

COMMUNITY-BASED FIRE MANAGEMENT

A review



Cover photo:

Community-based fire management in Zimbabwe, P. Vuorinen, 2009

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A review

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Foreword

For more than 60 years, FAO has made dedicated efforts to strengthen the capacities of member countries in forest fire management. Over the years, many fire management projects have been implemented in member countries. Building on the experiences of FAO and others, two complementary approaches to fire management have been developed.

The first is an integrated approach. Integrated fire management combines science and fire management with socio-economic elements, at multiple levels. Environmental, cultural, social, economic and political interactions are considered. An integrated approach also looks at all types of vegetation fires, as fires do not stop at the border between one land-use or vegetation type and another. Integrated fire management requires a balance of many different fire-related activities; rather than being limited to actions involving fire suppression and provision of equipment, it extends to such activities as prevention, awareness-raising, preparedness and restoration. The integrated approach is reflected in the Fire Management Voluntary Guidelines published by FAO in 2006. Ideally, this approach would lead to integrated landscape fire management or integrated natural resource fire management.

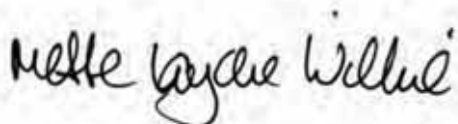
The second approach is a participatory approach known as community-based fire management. Globally, people cause most fires. Involving the population in all aspects of relevant policy development and fire management practices is, therefore, a logical approach. Rural communities, especially in developing countries, are often closest to and most affected by vegetation fires. Often they cannot call on distant national agencies to prevent or to fight fires. As a consequence, they have to deal with these fires themselves. Most fire management projects of FAO focus on this approach. Like integrated fire management, community-based fire management also promotes activities that extend beyond suppression and provision of equipment to emphasize prevention and preparedness in a landscape perspective.

Community-based fire management can take different forms. The present publication highlights the state of the art in community-based fire management and provides updated information that complements the approach published previously in the Fire Management Voluntary Guidelines.

The document redefines the concept, reviews some implementation and training case studies, reflects on related policy and legal frameworks and considers the climate change concept. It draws attention to limitations in: policy and law, capacity, training opportunities, incentives, concept promotion and funding. It concludes with current challenges for community-based fire management, such as:

- how to make the approach an integral component in natural resource and landscape management, and in rural development;
- the development of partnerships with communities, the private sector, NGOs, governments and their agencies to provide knowledge and resources necessary for effective implementation; and
- the need to direct existing information about this approach to resource managers and end users.

As a next step in community-based fire management, and based on this publication, the Forestry Department hopes to produce a tool for practitioners in this field. To this end we encourage you to provide us with feedback on this publication.



Mette Loyche-Wilkie

Principal Officer

Forest Assessment, Management and Conservation Division

FAO Forestry Department

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Acronyms

CBFiM	community-based fire management
CBFM	community-based forest management
CBNRM	community-based natural resource management
CLC	Central Land Council (Australia)
CONAFOR	National Forestry Commission (Mexico)
CONANP	National Protected Areas Commission (Mexico)
CWPP	Community Wildfire Protection Plan
FMCN	Mexican Conservation Fund
GFMC	Global Fire Monitoring Center
GHG	greenhouse gas
IFM	integrated fire management
IPA	Indigenous Protected Area (Australia)
NGO	non-governmental organization
NIFC	National Interagency Fire Center (United States of America)
NTFP	non-timber forest product
PRA	participatory rapid appraisal
REDD	reducing emissions from deforestation and forest degradation
TNC	The Nature Conservancy
VER	verified emission reductions
WUI	wildland urban interface

Executive summary

Fire is a natural disturbance event that has also been used by humans for millennia as a tool to manipulate their environment. Fire still plays an essential role in many societies today; however, fire is not always used appropriately and can often be damaging. The danger is exacerbated by issues such as changes in land use, increasing population in rural areas, inadequate or inappropriate policy, and climate change. Traditional fire management practices and contemporary approaches used in developed countries – and increasingly being adopted in developing countries – often do not adequately address the complex issues of fire management. Through its integrated approach, community-based fire management (CBFiM) has the potential to address many of these challenges effectively.

Numerous natural resource management projects are being implemented globally that directly involve or collaborate with communities. The majority of these projects include a forest-management component with a focus on procurement, conservation, rural livelihoods and, more recently, carbon sequestration and storage. There are examples, particularly in the tropics, where communities involved in natural resource management projects have traditionally used fire as a tool for a variety of livelihood activities such as clearing land, hunting and agriculture, and they continue to do so. Many community-based natural resource management (CBNRM) projects, in which fire has been identified as a threat, do not recognize the essential role that communities play in effective fire management. In many instances, these projects fail to include communities in the fire management process, resulting in less effective management of fire and increased risk of damaging fire events that threaten the long-term success of the project. An integrated approach to fire management that includes communities in decision-making and implementation, CBFiM is a positive, perhaps essential, element of project implementation where fire has been identified as a threat.

To implement CBFiM successfully, a number of pre-existing conditions need to be present. Good governance and relevant policy and legislation that support integrated fire management approaches are the minimum requirements for the sustainable implementation of CBFiM. To implement CBFiM, existing governance and policy in that location should be examined from an integrated fire management perspective to determine strengths and shortfalls and to formulate potential modifications that will enable a feasible and long-term CBFiM strategy to be developed and implemented.

CBFiM training workshops designed to increase the expertise of practitioners should be conducted at the national and sub-national levels and should be followed up with an adequate level of technical support.

It is often necessary to collect field data rapidly and efficiently to support CBFiM project design and implementation. There are a number of ways of doing this. A notable methodology used by natural resource professionals is known as

participatory rapid appraisal (PRA). A number of PRA tools have been adapted and adopted by CBFiM practitioners to identify the strengths and weaknesses of existing CBFiM programmes and, in some cases, to assess the feasibility of initial CBFiM implementation. A methodology based on the Fire Management Voluntary Guidelines (FAO, 2006) may be used to design or review fire management circumstances, action plans or policies, using a participatory approach that includes all stakeholders and that is a good fit for CBFiM.

With an increasing amount of attention being focused on anthropogenic fire and its linkages to climate change, CBFiM should be considered as a viable approach to both effective fire management and climate change mitigation. Specifically, CBFiM can be more frequently employed to reduce carbon emissions and the threat of fire to carbon sequestration through active community involvement in fire management. Carbon sequestration projects, including approaches based on reduced emissions from deforestation and forest degradation (REDD), need to recognize the importance of community involvement in fire management to ensure the long-term success of the project.

The effective implementation of CBFiM is not without its challenges. Some of these challenges include: lack of institutional support in terms of appropriate policy, limited capacity, minimal training opportunities, lack of incentives for locals to engage and lack of resources, including funding and technical support. It is important that each of these challenges be examined within its individual context and that solutions be developed to meet each unique situation. Tools and resources need to be developed that are culturally appropriate, that are easily accessible to CBFiM practitioners and other end users and that support the effective long-term implementation of CBFiM. CBFiM is not a “one size fits all” approach, but rather must be tailored to meet specific needs and circumstances to be an effective and sustainable approach to fire management.

Introduction

Agriculture practices such as slash and burn and/or shifting agriculture by local communities have long been implicated as one of the main cause of wildfires. However to be considered is that communities are also part of the solution as they often use fire positively to manage the landscape. The issue of fire was especially high-profile in 1997 and 1998 when damaging fires occurred on every continent and attracted global attention, generating a series of reports, donor interventions and regional strategies. Community engagement in fire management (in many cases continuing the already-existing management of fires by local people) was also an attempt to balance the interventions in response to large, damaging or high-profile fires, which were overwhelmingly focused on suppression (fire fighting).

FIRE MANAGEMENT – CONCEPTS, CONTEXT AND SYSTEM

The core and elements of fire management have been evolving and been clarified through adaptive approaches in recent decades. This process has been undertaken simultaneously in a number of nations and regions by a number of agencies and institutions at various levels, sometimes working in collaboration. The key ideas are set out here for reference and are dealt with in the guidelines prepared under the aegis of FAO (FAO Voluntary Fire Management Guidelines).

Dealing with fires, including the history of fire “management”, has often been focused on putting out fires or increasing the capacity to put out fires; yet consensus is that this approach is less effective than it could be. Often an oversimplified version of a complex situation is conveyed to decision-makers and the public:

- Forest fires are caused by extreme weather (not necessarily true).
- All forest fires are harmful (not true).
- All fires need to be prevented and extinguished (not true).
- Forest fires are periodic events best dealt with when they occur (definitely not true).

These overly simplistic explanations of forest fires tend to encourage decision-makers to conclude that fire fighting is the main solution to harmful forest fires, so they tend to react to short-term, recurring crises rather than focusing resources on long-term, sustainable solutions that integrate fire management. To date, inadequate attention has been paid to addressing underlying causes and to preventing a damaging pattern of recurrent fire and degradation in burnt areas.

Integrated approaches to fire management place greater emphasis on addressing underlying causes and seek long-term, sustainable solutions that incorporate the same five essential elements (the five Rs) that have been adopted globally in

dealing with disasters and their management:

RESEARCH – analysis of the fire issue and identification of options for positive change;

RISK REDUCTION – prevention, focusing resources on the underlying causes of fires;

READINESS – preparing to fight fires;

RESPONSE – ensuring appropriate responses to unwanted damaging fires; and

RECOVERY – community welfare, repairing infrastructure and restoration of fire-damaged landscapes.

Resources need to be redirected to support research that improves the understanding of the causes of fire, identifies existing management practices that encourage harmful fires and promotes management systems that take advantage of well-established fire use. Key stakeholders, especially local communities, need to be involved in fire management planning.

At present, analysis is often done only when a fire begins; it is then mainly influenced by political pressures created by dramatic fire images and by the immediate responses needed to protect people and assets or to respond to criticism. A better response would be to start analysis in fire-prone areas before a fire begins and consider rebalancing management, if required. Although understood in theory, this response is not often carried out for various reasons:

- In most cases there is no overall fire management framework available.
- The view that all fire is negative and fearsome leads, in turn, to the view that fires are a suppression challenge rather than a symptom of underlying management problems.
- The most dramatic part of fire management is response, or fire suppression. Fires are an obvious “enemy”, and clear consensus about addressing burning fires is more socially and politically expedient than addressing the complicated questions involved in long-term fire prevention and management. Sources of ignition and fuels are local; thus, the systems and frameworks of fire management are often best established at the provincial level, while monitoring and analysis are usually best dealt with at the national level. Yet discussion and debate often take place without reference to the appropriate scale of intervention.

To ensure that suppression occurs effectively at the local level, that is, that unwanted and undesirable fires are kept small, everything else in the fire management equation must occur at higher levels, including effective coordination and cooperation of all fire management agencies. To enable effective fire management, the key principles must be established at a landscape level to keep unwanted and untimely fire at the local level. The local level is where actions will be taken, but those actions must be considered at the landscape level to ensure consistency, effectiveness and clarity for fire managers, land managers, government agencies and civil society.

Local people and communities, therefore, play a pivotal role. This is particularly the case where the administration, agencies and other systems (communication and transportation, for example) are not able to fill the requirements for coordination of systems and frameworks necessary for routine, rigorous and effective fire management.

Community-based fire management (CBFiM)

The term *community-based fire management* (CBFiM) was coined by Sameer Karki at the Regional Community Forestry Training Centre (RECOFTC) in Bangkok in 2000. The lower case “i” is used in the acronym to distinguish it from community-based forest management (CBFM), which has been implemented as a form of CBNRM for some time. Since recognition began almost a decade ago, there have been a series of reports, analyses, case studies, training efforts and some peer-reviewed papers. Collectively, this body of written work serves as a reference for CBFiM practitioners and policy-makers alike. CBFiM began to be documented and recorded in the late 1990s. This review brings together the insights and understanding generated throughout the past decade to create a solid summary and a platform that will enable CBFiM to progress to realize its potential role in sustainable landscapes in a changing world.

In many countries around the world communities continue to use fire in a safe and effective manner to improve livelihoods and protect resources. These communities are quite familiar with fire and its uses for traditional livelihood activities such as clearing vegetation for agriculture, improving pastures for grazing, hunting and managing non-timber forest products (NTFPs). Where communities may not rely directly on local natural resources to sustain a living or use fire to manage those resources, it remains in their best interests to have a stake in how fire is being managed across the landscape with which they are associated.

Analysis of CBFiM and its effectiveness as a fire management approach began in the early 1990s in Africa and Southeast Asia, where recent decades have seen a significant increase in large-scale fires (IFFN, 2003). Information and lessons learned from those analyses have confirmed CBFiM as a potential component of efforts to manage sustainable landscapes. Examples of CBFiM can be found globally in developing, transitioning and industrialized nations. The success of these efforts varies depending upon a number of factors, including the existence of: supporting policy and legislation, land tenure, and institutional and community capacity. What remains consistent, however, is that fire, people and the ecosystems that they inhabit are inextricably linked. There always has been fire and, as a natural disturbance event, there always will be fire. For these reasons it is essential that contemporary fire management approaches, if they are to be effective, consider not only the technical aspects of fire management, but also the communities and the environments in which they live.

CBFiM has multiple manifestations in most nations across mixed cultural, social, economic and ecological circumstances. This diversity has led to a range

of explanations and definitions for the term to describe local people actively engaged in fire and its management. Based on structured fieldwork by subject matter experts (Ganz, Fisher and Moore, 2003), a working definition was put together. This definition was considered a refinement of CBFiM concepts pulled together for a substantive review document in 2004 (Moore, 2004). Generally, it is an approach to fire management in which local communities are actively engaged in the development, and in some instances the implementation, of fire management strategies designed to prevent, control or utilize fires in ways that will improve their livelihood, health and security.

WHAT IS IT?¹

CBFiM can be considered as a subset of CBNRM, which is not a new idea or approach to natural resource management. CBNRM is receiving increasing attention as the role of communities in the management of their resources is recognized as being an essential element in effective and sustainable resource management. The concept of CBNRM is linked to a variety of terms, including participatory, community, community-based and collaborative natural resource management (Treue and Nathan, 2007). In practice, CBNRM is mostly about ways in which the state or government can share rights and responsibilities regarding natural resources with local communities. A continuum for CBFiM has been identified, suggesting that in general terms it can be considered as having three nodes:

- Local-scale fire management in which traditional or indigenous knowledge plays the major role in informing and undertaking fire management, which is also planned, conducted and controlled by local people. Livelihoods and maintaining the landscape are key to this node of CBFiM. A community may have complete ownership and legally recognized tenure rights, including management of land and natural resources, completely community-based. The practices of Australian aborigines are an example of this node of CBFiM.
- Community involvement in fire management that involves a range of local actors, including agencies and non-governmental organizations (NGOs), that work on fire management. Livelihood dependence, some traditional practice and community institutions may be characteristics. Elements needing support may include: analysis of the fire problem, technical capacity, regulatory framework or logistical assistance.
- Volunteers from the community, perhaps with agency involvement, conduct fire management on behalf of the community across private and public lands. The development of Community Wildfire Protection Plans (CWPPs) in the United States of America and the Volunteer Bushfire Brigades in Australia are examples of this node of local management. There may be very little direct involvement of local people in the rural landscape, and livelihood dependence on lands or forests is low. Hence, community involvement may be limited to a role in which the community is informed of management decisions and designated roles and responsibilities by the government, with very limited

¹ This section includes material drawn from Moore (2004).

consultation. This node is, therefore, not really considered community-based.

Any situation in which CBFiM is practiced can be characterized on the basis of one of these nodes or a combination of them.

A common theme among the array of CBFiM definitions is that the community is actively involved in some aspect of fire management: either the development of fire management strategies or their subsequent implementation. This involvement includes activities associated with the management of fire-prone land, such as suppression, prevention and the use of fire. These fire management activities are typically associated with livelihood activities and occur with or without the assistance of groups or organizations outside of the community. However, the importance of entities external to communities in helping to achieve effective and sustainable CBFiM approaches has often been cited (Jackson and Moore, 1998).

A Strategic Paper written in 2003 similarly suggests that the emphasis on “community-based” relates not only to community involvement, but also to community capacity that has been recognized and supported by external agencies (governments, NGOs, projects and others) (IFFN, 2003).

Zhang *et al.* (2003) defined CBFiM as an approach in which villagers have shown a profound understanding of fire prevention and control and have participated voluntarily in fire management. A slightly more ambiguous definition of CBFiM included the conscious use of fire by communities to meet specific objectives (Suyanto, Applegate and Tacconi, 2002). In 2003, the Global Fire Monitoring Center (GFMC) updated the 1986 version of the online FAO Wildland Fire Management Terminology (FAO, 1986) and included the following definition of CBFiM:

[CBFiM] is a fire management approach based on the strategy to include local communities in the proper application of land-use fires (managed beneficial fires for controlling weeds, reducing the impact of pests and diseases, generating income from non-timber forest products, creating forage and hunting, etc.), wildfire prevention, and in preparedness and suppression of wildfires.

The term has been used to describe such a wide variety of different ways in which communities are involved in fire management, in parallel with the discussion of CBNRM, that it is difficult to make any systematic comparisons or generalizations. A definition should be precise enough to enable useful generalizations to be made about somewhat similar things, while being flexible enough to accommodate a variety of approaches; that is, it should be a definition based on essential features. The definition proposed by Ganz, Fisher and Moore (2003) is:

CBFiM is a type of land and forest management in which a locally resident community (with or without the collaboration of other stakeholders) has substantial involvement in deciding the objectives and practices involved in preventing, controlling or utilising fires.

This description defines CBFiM, without confusing it by incorporating a separate definition of fire management, with “fire management” taken to be any fire-prevention or fire-related practice. The essential feature of the definition is that it takes seriously the idea of fire management being *community-based*. It does not include situations in which people simply carry out paid work for a fire-control agency or another agency outside the community. Communities are in decision-making roles for the application and control of fire so that:

- They have sufficient tenure (formal and informal) to ensure that their rights are considered along with broader (e.g., national, provincial and district) production and environmental protection aims and objectives.
- They consider that involvement in land and fire management decision-making and activities will improve their livelihood, health and security (Abberger and Marbyanto, 2003).

This view is consistent with a trend in CBNRM (and various other similar approaches), which sees the essence of genuine community participation in terms of some element of community power over decision-making.

As the nature of the implementation of CBFiM is dynamic, so should its definition be dynamic until the concept matures, and the breadth of work on and experience in CBFiM enables a static, certain definition to be developed.

The identification and analysis of CBFiM to date has been in the context of developing and emerging nations. There are some key differences between their circumstances and those of developed nations. In developing countries the roles of government and the types of land-use activities differ from those in developed countries. The definition of “community” (“living in a particular locality” or a “community of interest”) is essentially different in developed countries. In developing countries, land-use activities are more often tied to personal livelihood and existence, with no other choices available.

Recent examples of community engagement in developed countries could be seen as an element of CBFiM, as the community is increasingly invited to participate in fire management decision-making, and the importance of local knowledge is being recognized and valued. However, there is little evidence that community engagement ensures community empowerment in the context of land-use management. In fact, there is no clear, common understanding of community engagement. Of note, in developed countries, if CBFiM requires government involvement, it will require considerable resources and training within the organizations and communities involved for effective implementation.

COMMUNITY

The identification of “C”BFiM will rest in part on the definition or description of “communities” as an entity. Some advocates of community management have assumed that communities are small spatial units with an homogenous social structure in which members share common values and objectives. In fact, this homogeneity is rarely the case. Communities are characterized by dynamic relations consisting of: multiple and often conflicting interests; a variety of actors

attempting to influence decision-making; and internal as well as external parties shaping decision-making processes (Agrawal and Gibson, 1999). This view differs slightly from a more recent one formulated by MacQueen *et al.* (2001) in which a community is defined as a group of people with diverse characteristics who are linked by social ties, share common perspectives and engage in joint action in geographical locations or settings. A community, then, may contain individuals who do not always share common interests or perspectives; and further, both internal (community) and external (other) interests often inform decision-making processes at the community level. A number of examples and models exist of effective inclusion of communities in the management of their forests and non-forested landscapes. Success, in many cases, is linked to a participatory approach that engages indigenous skills and knowledge and combines them with appropriate outside expertise and experience (Jackson and Moore, 1998). CBFiM is one such approach.

INTEGRATED FIRE MANAGEMENT

The term CBFiM is often confused with the comprehensive approach to fire management known as integrated fire management (IFM). They are, however, not the same thing. Broadly defined, IFM includes the integration of science and fire management approaches with socio-economic elements at multiple levels. As such, it implies a holistic approach to addressing fire issues that considers biological, environmental, cultural, social, economic and political interactions (Myers, 2006).

Fire Paradox, funded by the European Union, was a joint research project on forest fires with a strong focus on fire use – “integrating” into “fire management”. The primary objective of the project was to prevent the disastrous social, economic and environmental consequences of wildfire in the Mediterranean environments of Europe. The research was used to provide the scientific and technical building blocks necessary to improve the management of wildfire through the “wise use” of fire.²

The integrated approach to fire management is set out comprehensively in the Fire Management Voluntary Guidelines (FAO, 2006), and involves:

- integrating all activities related to fire management, such as prevention, preparedness, suppression and restoration, into one coordinated process of fire management policy, planning and implementation;
- integrating the use of fire as a land-management tool and the management of devastating wildfires into one process, which involves the acceptance of fire use in certain situations;
- integrating all actors and sectors involved into the same process; and
- integrating all actors involved in fire suppression, through the use of the Incident Command System (ICS), in the case of wildfires.³

² For more information on the Fire Paradox project, see www.fireparadox.org.

³ See www.fao.org/forestry/firemanagement.

In many cases, CBFiM includes one or more of the components typically identified with IFM, such as fire management, fire sciences and socio-economic factors. CBFiM is often stimulated by a socio-economic dimension at the community level, which may have elements of livelihood enhancement and rural development activities and lead to community-level policy development. CBFiM also often includes traditional and contemporary approaches to fire management, such as prevention, suppression and fire use. Anecdotal or indigenous knowledge of local fire ecology and fire behaviour is also often a component of CBFiM. While CBFiM may not always be a required element of IFM, it does involve the application of management and science and is often driven or underpinned by socio-economic elements, so it can be said to be integrated.

CBFiM in practice

Indigenous communities have been using fire in varying degrees to manage and shape the landscapes they inhabit for millennia. Community involvement in the management of traditional lands and natural resources, therefore, is not a new concept. Many of the Native American tribes who inhabited the Great Plains of North America historically used fire to manage their landscape. Prairie fires occurred frequently in the spring and fall, and two primary causes were lightning and the use of fire as a land-management tool (Caitlin, 1848; Komarek 1964, 1966; and Anderson, 1972). Globally, native groups have a history of managing the forests and grasslands essential to their livelihood, health and security, in many cases through the use of fire.

Communities continue to use fire to improve livelihoods and protect resources, being quite familiar with fire in terms of its use for traditional livelihood activities such as clearing vegetation for agriculture, improving pastures for grazing, hunting and stimulating the growth of non-timber forest products (NTFPs).

In developing countries, communities that use fire are subject to fire-management policies that often conflict with their traditional fire-use practices. The result is often that fire is poorly managed and used inappropriately, which can lead to damaged ecosystems and altered fire regimes if too little, too much or the wrong kind of fire is applied. Demographic processes also contribute to increasing wildland fires. In developed countries, the number of wildland fires that threaten communities directly is increasing along with the development spurred by continuing population growth in those parts of landscapes in which structures and other human development meet or intermingle with undeveloped wildland.

In 2005, FAO reported that, globally, more than 350 million hectares (865 million acres) of land area were burned in 2000, 95 percent of which because of human activity. The report goes on to list some of the factors that contribute to the increasing global occurrence of wildland fire. These include: the continued expansion of agriculture and other forms of land conversion activities in developing countries; the increased use of forests for recreational purposes and tourism in both developed and developing countries; and the continued expansion of cities and suburbs in almost all countries (FAO, 2005). The increase in catastrophic wildfires has also been linked to climate change. Longer, warmer summers and reduced precipitation in forested ecosystems in many parts of the world create conditions ideal for large-scale fires.

CBFiM can support more effective fire management in the face of these land-management challenges. Analysis of CBFiM and its effectiveness began in Africa and Southeast Asia in the early 1990s. Information and lessons learned from this analysis have resulted in the increasing consideration of CBFiM as

a component of fire management efforts in those regions and in other parts of the world. CBFiM shares important links with many elements of CBNRM and cannot be implemented successfully in the absence of these existing frameworks (FAO, 2003).

Examples of CBFiM can be found globally in developing, transitioning and developed nations. The success of these efforts varies depending upon a number of factors, including the existence of: supporting policy and legislation, land tenure, and institutional and community capacity. It is essential that contemporary fire management approaches, if they are to be effective, consider not only the technical aspects of fire management, but also the communities and the environments in which they live.

Examples of CBFiM applied in Africa, Latin America, North America and Australia are presented in brief in this section and then in detail in the annexes to this publication. These case studies illustrate a variety of CBFiM strategies being used to achieve specific objectives for the communities engaged. The examples highlight, among others, hazardous fuel reduction in the wildland–urban interface (WUI) in the United States of America, fire and traditional livelihood activities such as agriculture in Namibia, the use of fire in Mexico for such objectives of sustainable forest management as conservation of biodiversity, and the combination of traditional and contemporary fire knowledge to facilitate effective fire management by indigenous groups in Australia. The case studies represent developing and developed countries. The who, what, when, where, how and why of CBFiM are demonstrated within the different developmental contexts.

The Caprivi Integrated Fire Management programme (Annex 1) in Namibia provides an example of CBFiM within a developmental context. The Caprivi programme has been implemented in approximately 10 000 km² of semi-arid tropical savannah in sub-Saharan Africa. The people that inhabit this region live a predominantly rural existence in which subsistence farming and direct dependence on the natural resources are important sources of livelihoods. Traditional use of fire includes slash and burn agriculture, management of livestock grazing, management of natural product harvesting, hunting, pest control, protection from wildlife and honey collection. National fire management policy focused primarily on fire prevention and suppression was consolidated in 1996–2001 through the East Caprivi Integrated Forest Fire Management Project. This project was effective at curbing the widespread application of many traditional uses of fire, however, every household employs slash and burn techniques to clear fields for planting between August and October. Coinciding with the late dry season uncontrolled crop field fires lead to extensive wildfires negatively impacting community livelihoods through loss of natural resources, property and life. In 2006 the Caprivi programme, by developing and implementing a fire management policy that takes into account the environment, community, current land use, capacity and available resources, has significantly changed the timing, distribution and effects of fire on the landscape. The use of controlled burning as a legitimate land-management tool and the decentralization of fire management to the community level are the key elements in the effectiveness of the Caprivi

programme. This goal was achieved through a pilot CBFiM policy implemented through a burning permit system regulated by the Directorate of Forestry.

The High Knob community in the state of Virginia in the eastern United States of America provides an example of CBFiM implementation in an industrialized or developed nation (Annex 2). The community of High Knob is a gated subdivision consisting of approximately 400 homes located on a mountainside with surrounding vegetation, which consists of dense hardwoods with scattered conifers. In addition, there is a large amount of downed fuel and heavy undergrowth in some areas. High Knob represents an example of a community that exists where human development interfaces with undeveloped wildland and where the consequences of wildfire are potentially catastrophic. The primary objective of the community is thus the protection of their homes and property from wildfire.

The process of establishing a CWPP by the community results not only in meeting the community's primary objective, but also in increasing collaboration with partners both within and outside of the community. Cooperation can include the sharing of resources ranging from scientific and traditional knowledge to contemporary strategies for fire management and conflict resolution. Increased collaboration and the increased understanding that collaboration brings can also lead to the development of policy approaches that make sense and are relevant to a particular community.

Another case study involves two *ejidos* (communal lands managed by rural villages) within the buffer zone of the La Sepultura Biosphere Reserve in Chiapas, Mexico (Annex 3). The La Sepultura project is one of the few examples that goes beyond local prevention efforts and community-run suppression brigades to include fire use (prescribed burning) to restore and maintain native fire-dependent ecosystems. It also illustrates that success at the community level requires that the broader (national and regional) scientific, technical, social and political issues related to fire be addressed simultaneously. The primary interests of the communities were focused on burning to improve the forage quality of understory grasses for their livestock and also to reduce fuels to limit fires damaging to the forest and their property. They were also concerned about a noted lack of pine regeneration, which is needed to sustain the forest in the long term. Concurrent with this project, fire management in Mexico took a huge step forward with the approval, in 2006, of a National Strategy for Fire Protection and Fire Management, which recognized the important ecological role that fire plays in fire-dependent ecosystems and the important economic role that it plays in agriculture and rural communities. These policy and rule changes that recognize the ecological role and importance of fire were the direct results of the efforts of many of the people involved in funding, promoting and guiding the community-based fire project at La Sepultura Biosphere Reserve.

Another case study looks at the Aboriginal people of the Tanami Desert in Central Australia, who have applied fire to their land to serve a myriad of purposes for millennia (Annex 4). Through this practice, a central strand of

the culture and connection with “country” are maintained.⁴ Whereas fire has always been a part of life in desert communities, it is also gaining recognition in mainstream Australia as a critical tool for the maintenance and protection of biological and cultural assets. Over the past twelve years, the Central Land Council (CLC) has actively encouraged and supported Aboriginal peoples’ involvement in CBFiM in the Tanami region. To an increasing degree over the past five years, this programme has had, at its core, an evolving participatory process that involves traditional owners of the region and that combines traditional and contemporary fire knowledge, practices and technologies in annual cycles of planning, implementation, monitoring and review.

Each of these four case studies illustrates differing strategies and approaches in the implementation of effective CBFiM to achieve specific fire management objectives. However, similarities exist between the approaches applied. The existence of sound policy and legislation that promote community involvement in fire management is a key element in effective fire management in locations where people use fire or are directly impacted by it. Further, in each of the examples, increased community involvement in fire management has provided an environment for improved collaboration among communities, government agencies, the private sector and other stakeholders at the local level.

As a result, resources are shared more effectively, traditional and contemporary knowledge is more easily transferred, and mutually beneficial fire management objectives can be developed that are more likely to be achieved.

These case studies, as well as the Sofala Community Carbon project case (Annex 5), illustrate the key characteristic of CBFiM: the active engagement of the community in the development and implementation of fire management strategies. Each community has substantial involvement in decision-making. The cases also demonstrate enabling policy and laws; access and use rights to land and institutional and community capacity; or at least enough of these key elements for CBFiM to be a viable option.

It is notable that in each case there has been an external influence, as an actor, catalyst, convenor or circuit-breaker. These external inputs have been stimulated by interests from outside that include the testing of policy implementation (Namibia); self-protection (High Knob); the restoration of the ecological balance (La Sepultura) and cultural re-engagement (Tanami Desert). The motivations may vary; however, the common theme of external intervention suggests an important role for third parties in triggering the steps towards CBFiM.

The requirement of open engagement, ensuring the consideration of both the full context and the complete suite of actors, is clear. This engagement can be supported by applying or adapting tools, checklists and other approaches as described later in this review. Critically, the engagement of external actors, as in any case, should be sensitive, appropriate and transparent. Effective implementation could usefully benefit from further consideration and development of guidance for the assessment, evaluation and engagement of CBFiM.

⁴ The term “country” has a richer meaning in the Aboriginal language than is implied by its English definition. It indicates spiritual, physical, emotional and cultural connection to land and its functionality, stewardship and use.

FAO training workshops

Four international CBFiM training workshops were held in South Africa, Belize, Indonesia and China, respectively, between 2004 and 2009 (Figure 1). These workshops were organized by FAO and a number of its partners. The workshops sought out participation from natural resource management professionals with expertise in developing participatory fire management policies, legislation, strategies, guidelines and work plans for community participation. Workshop participants in South Africa and Belize had been trained as CBFiM trainers and placed in positions as facilitators and sources of knowledge and information in their existing daily duties. This intention, however, was not embedded in national programmes or approaches, and there was no opportunity for follow-up or support for the participants. Consequently there is no certainty that the exposure and skills delivered by the training were then passed on. For CBFiM trainers to be able to train others they would need to be accredited trainers of trainers themselves and to operate in an environment where the opportunities and resources for training were made available.

LEARNING OBJECTIVES

The objectives of the workshops hosted in Indonesia and China differed slightly; their focus placed more emphasis on raising participant awareness about CBFiM and fire use. With the relatively low recognition and identification of CBFiM outside projects, case studies and interested actors, these workshops provided a strong introduction to the topic as a step towards increasing the scope of awareness and the body of interest. Through an increased understanding of community-based natural resource management approaches, it is anticipated that participants at the four workshops will contribute to the improved environmental management of resources in their home countries.

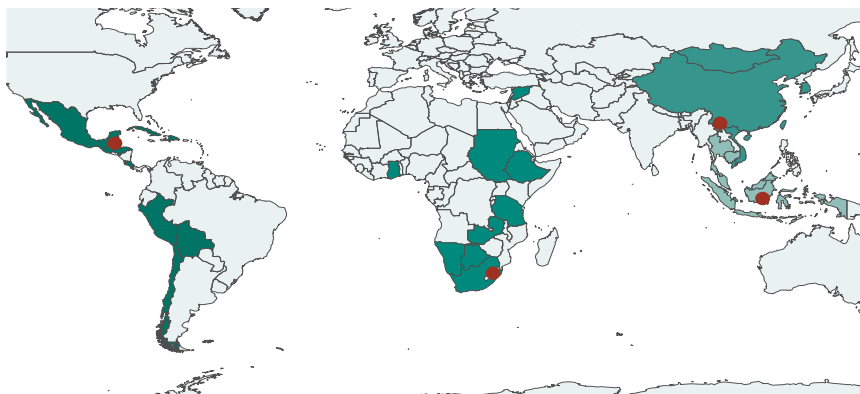


Figure 1

Locations of the four international FAO-sponsored CBFiM training workshops (2005–2009)
The shading indicates those countries represented at each workshop

To achieve these objectives the CBFiM training workshops were designed to deal with concepts at several levels of the learning continuum using a Taxonomy of Learning Objectives as a guideline.⁵ The taxonomy identifies levels of cognitive learning and is useful in setting up workshops to match the requirements of different groups and combinations of people.

Level 1. Knowledge

At the first level of the continuum, workshop participants are exposed to information that includes concepts in fire management, fire science and ecology and, more specifically, CBFiM. This information is disseminated either through a series of presentations or field-based activities.

Level 2. Comprehension

In order to attain comprehension, each participant is assigned to a small working group for the duration of the workshop. Within these groups participants are periodically required to discuss the various workshop presentations and reading materials and to complete assignments relevant to those materials. This approach is designed to promote collaboration, teamwork and increased comprehension of workshop educational materials.

Level 3. Application

The third level of learning employed in the workshops focuses on application. Each working group is required to prepare assigned materials for presentation to the other workshop participants. Individual groups are expected to present the assigned materials using one of a variety of methods, including but not limited to, role-playing, formal presentations (such as slide shows, posters and flip charts) and puppet shows.

The primary focus of each CBFiM training workshop was to:

- provide a forum on CBFiM within the workshop region;
- prepare mechanisms for the exchange of information and resources regarding fire management in forests and other wildlands within the region, including the establishment of partnerships for joint activities in fire research, training and policy development; and
- enable the preparation of proposals to governments and international organizations within the region to establish mechanisms for sharing resources in fire management and in large fire emergencies, in accordance with existing international procedures.

The general approach taken and the objectives outlined for each of the four training workshops were similar. However, the workshops hosted in Indonesia and China were shorter, as they did not include extensive practical “hands-on” training in the application of prescribed fire (as existing national policies severely restrict the use of fire in those countries). Brief summaries of the workshops follow.

⁵ Mike Jurvélius is a training expert who developed the Taxonomy in 1986 as a means of comparing the level of learning among workshop participants.

SOUTH AFRICA (2004)

The Training Course for Instructors in CBFiM was held in Nelspruit, South Africa, from 20 October to 12 November 2004. Organizers for the training course included FAO and GFMC through the United Nations International Strategy for Disaster Reduction (UNISDR) Regional Sub-Saharan Wildland Fire Network (AfriFireNet) and the GFMC Wildland Fire Training Center Africa (WFTCA). The primary objective of this training course was to collate information about CBFiM in the region and analyse the experiences gained since the first landscape-level projects were started in 1996. The countries represented at this workshop included Botswana, Ethiopia, Ghana, Namibia, South Africa, Sudan, Syrian Arab Republic, United Republic of Tanzania and Zimbabwe.

Nearly half of the global area affected by fires each year is in sub-Saharan Africa, comprising approximately 170 million hectares. While some of this burning is both sound and useful, ecologically, a large share of it is harmful and damaging to the environment. There is a need to reduce the area affected by unnecessary or harmful burning, to develop proactive fire management approaches and to better understand the underlying causes of these fires.

Land-management professionals in this region need to look for solutions beyond conventional fire management approaches, which at present are mainly effective only in private plantations. The sustainable management of fires in areas outside plantation forests requires the identification of other solutions. Potential solutions could concentrate on facilitating the transfer of fire management responsibility to local communities, NGOs and women's groups, or recognizing the potential to apply an ecosystem approach wherein all fires, regardless of their purpose (for agriculture, land clearing, beekeeping, hunting, cooking or heating), could be managed by the local people.

BELIZE (2005)

The Training Course for Instructors in CBFiM organized by FAO, Asociación Vivamos Mejor Guatemala, Programme for Belize and The Nature Conservancy was held in the Rio Bravo conservation area in Belize from 7 to 18 November 2005. The objectives of this training course were: to obtain and synthesize existing data and experiences in the Mesoamerica region on the handling of fire at the community level; to identify the obstacles found in this process; and to stimulate the development of fire-use programmes at the community level in locations where the excessive or unsuitable use of fire is problematic. A key element of the course was to address existing government policies that discourage community-level fire management. The training course outlined the necessary reforms that would allow the controlled use of fire. The workshop included participants from Belize, Chile, Costa Rica, Cuba, the Dominican Republic, Guatemala, Honduras, Mexico, Peru and the Plurinational State of Bolivia.

Many ecosystems in Mesoamerica undergo wildfires every year. Some of these

fires are acceptable; however, a significant number of them are not ecologically appropriate and have the potential to damage the environment and impact local communities. In Mesoamerica, it has become a priority to manage the amount of forested area affected by both beneficial and detrimental fires. The objectives of this strategy are to protect forested areas from fire and to promote the sustainable use of forests. A key element in this approach is the promotion of safe and effective management of beneficial fires by local communities.

The workshop participants considered it important to identify the underlying causes of these fires rather than simply to increase the capacity to extinguish fires or to create and impose restrictive laws for burning. At the time of the workshop the conventional approach to solving the problem of undesirable fires was to implement fire-control programmes designed to detect and fight fires when and where they occurred. For many reasons, the majority of these programmes were failing. In response, a number of NGOs began to focus their efforts on the management of fire at the local or community level where rural populations benefit directly from fire and its appropriate uses. The CBFiM training course helped to facilitate those efforts.

INDONESIA (2007)

The Training Course for Instructors in CBFiM organized by FAO and The Nature Conservancy was held in Balikpapan, East Kalimantan, Indonesia, from 28 October to 4 November 2007. The aims of this training course were to collate regional information about CBFiM, to analyse the experiences gained, and to increase local capacity to create proactive fire management approaches and national strategies in the appropriate use of fire as a management tool. The workshop was regional in scope and included participants from Cambodia, China, Indonesia, Malaysia and Thailand.

Over the past thirty years, the frequency and intensity of fires in South Asia has increased. From 1997 to 1998, nearly 10 million hectares were burned in Indonesia, resulting in damages estimated at nearly US\$ 9 billion. The ecological, human and economic impacts of fire are further exacerbated during El Niño years. More than one-third of terrestrial habitats in Southeast Asia are considered fire sensitive; they suffer from too much fire primarily as a result of ecologically damaging fire use for agriculture or clearing for rural and urban development. While some of the burning activity in this region is ecologically sound and useful, much of it is harmful and damaging to the environment. Many communities in countries located in this region are quite familiar with the uses of fire in traditional livelihood activities, such as clearing vegetation for agriculture, hunting and management of NTFPs. Communities have played a significant role historically in the management of fire in many areas of the region, but changes in land-use patterns, and top-down fire-related policy and legislation often conflict with traditional fire-use practices.

CHINA (2009)

The Workshop on CBFiM in the North Asian Region organized by FAO, The Nature Conservancy (TNC) and the China State Forestry Administration was held in Xishuangbanna, Yunnan, China, from 9 to 14 March 2009. The primary objective of this training course was to collate information about CBFiM in the northeast Asian region, analyse the experiences gained and increase the local capacity in creating proactive fire management approaches and national strategies in the appropriate use of fire as a management tool. Countries represented at the workshop included China, Mongolia, Republic of Korea and Viet Nam.

This workshop was hosted in the northeast Asia region to address the need to highlight the existing legislative and policy constraints on involving and transferring fire management responsibilities from government to local communities. Issues include the need to present positive solutions to legislative constraints by highlighting experiences both within China and in its neighbouring countries.

In China most occurrences of forest fires are concentrated in a small number of regions. The highest number and largest sizes of forest fires occur in five provinces: Heilongjiang, Inner Mongolia, Yunnan, Guangxi and Guizhou. These regions tend to have the majority of forest cover; are exposed to more climatic extremes, including extreme wind events; and are remote, with limited access and fire management (prevention and control) facilities. Specific fire-related threats include lightning and uncontrolled accidental fires in forests, savannahs and grasslands. With the exception of the northeastern forest regions in China, where many fires are the result of lightning strikes, 95 percent of all fires in China and other countries in the region are caused by human activities.

ANALYSIS

Feedback collected from participants in the four FAO-supported international CBFiM training workshops revealed that the geographic scale at which training workshops are implemented is an important consideration. The FAO training workshops that were hosted in South Africa, Belize, Indonesia and China between 2004 and 2009 were all regional in scope. However, many of the participants indicated that training workshops of this nature should have more of a focus on national or sub-national fire management issues. A lack of technical support following training was also identified by some participants as being an obstacle to the successful long-term implementation of CBFiM. Both of these issues – the geographic focus of CBFiM training and the availability of technical support following training – should be given more attention in the design, resourcing and implementation of subsequent CBFiM training workshop planning efforts. CBFiM training workshops designed to increase the expertise of practitioners should be conducted at an appropriate scale and should be followed up with an adequate level of technical support.



Governance, policy and legislation

Governments provide the legal and policy frameworks that are necessary for successful and sustainable natural resource and landscape management programmes. Community-based approaches can only be effective if the institutional setting in a given location has in place policies, laws, regulations and fire management agencies that provide a contextual framework for participatory approaches, rights and benefits. The successful implementation of any programme, including CBFiM, often requires changes to the supporting policy, rules and regulations at three distinct levels of administration: the national level, the local/district level and the intermediate/provincial level.

At the national level, policies and supporting legislation need to create an environment that enables CBFiM and makes it attractive to local communities. At the provincial level a model of decentralized natural resource management needs to be promoted that is most likely to work under the relevant political circumstances (Treue and Nathan, 2007). In Cambodia, for example, government policy, laws and regulations all influence villagers regarding their use of fire. According to the Cambodia Forest Sector Review (2004), government field staff, specifically cantonment (district) offices of the national Forestry Administration (FA) often enforce specific laws at the district and commune levels. As a result, the government and its policies are seen to be explicitly linked to traditional fire use and, in broader terms, to the socio-economic situation in many rural villages. Community involvement in natural resource management is also a priority in Mozambique's existing policy on forestry and wildlife resources. This focus is reflected in the government's efforts to manage natural resources in partnership with rural communities and the private sector. This approach represents a policy shift both in Mozambique's agricultural and natural resource sectors, which results in the potential for significant impact in economic development (Nhantumbo, Dent and Kowero, 2001).

The development and the eventual implementation of relevant policy and supporting legislation require, at a minimum, good governance. The term "governance" is used extensively and in many contexts, but is difficult to capture in a simple definition. In a natural resource context, governance is used to refer to the body of formal and informal policies, and the arrangements developed between relevant stakeholders, to manage and to make decisions about a particular resource. Governance provides the framework by which groups, such as communities, define their interests, rights, responsibilities and the ways in which they will interact with each other and with institutions of authority to manage

a particular resource (Government of India, 2002; and Blomley, 2009). Good governance typically has eight major characteristics (UNESCAP, 2007). It is:

1. participatory;
2. consensus oriented;
3. accountable;
4. transparent;
5. responsive;
6. effective and efficient;
7. equitable and inclusive; and
8. it follows the rule of law.

Inadequate governance, or the absence of clearly defined processes, roles and responsibilities for decision-making, is often at the root of many problems that impede effective CBFiM. Effective CBNRM initiatives are dependant on good governance, which may be measured, in part, by the extent and quality of enabling policy and legislation (Mayers, Bass and Macqueen, 2002).

Adequate policy and legislation are directly related to the successful implementation of CBFiM. Legislation may, for example, empower communities by promoting their involvement in fire management; it thus provides for the establishment or recognition of community committees and decision groups and allows community members to participate actively in a variety of fire management activities, including the development of local fire management plans. To encourage community involvement, legislation should also provide adequate incentives for members of those communities involved in fire management activities and should compensate those individuals both for their efforts and for any personal injury or damage to property that results from fire. Increased involvement in fire management by communities often results in those communities being better informed and more likely to use fire in a judicious manner and to adhere to local policy and legal regulations relating to fire management (FAO, 2009b). Legislation that supports participation will allow progress towards sensible fire management and may be appropriate, depending upon national circumstances.

Legislation may include provisions that permit the use of fire by communities for certain activities under specific requirements and regulations. This approach not only encourages the responsible use of fire, but also addresses the fact that prohibition on fire use is, in many instances, ineffective and may even be counterproductive. In many countries fire is a cheap and effective tool, readily available to rural communities for a variety of livelihood activities, which means that these communities are likely to use fire whether or not it is permitted. Establishing appropriate legal guidelines can be an effective way to allow traditional fire-use practices under certain circumstances and to promote the sharing of that knowledge with contemporary land and fire managers.

If tenure is poorly defined, there may be no incentive for those using fire to manage it safely and responsibly. Where there is no clear ownership of land, people are less likely to care if it burns or is managed poorly. Overlapping tenure rights, or other issues that make ownership rights unclear, can also lead to conflicts

between individuals or groups that simultaneously claim an area as their own. This situation is exacerbated when local people's uses and needs are not considered in the development of legal and regulatory systems that relate to industrial, sectoral or national interests (Murdiyarso and Adiningsih, 2006). The resulting social conflict has often been recognized as an indirect cause of fires. Similarly, lack of recognition of local people's property rights in management and planning can lead to conflicts in which stakeholders may resort to the use of fire as a weapon to claim lands (Tomich *et al.*, 1998).

If people have formal and legally recognized ownership of resources, and can see long-term benefits from the land that they are managing, they will tend to be concerned with the protection and sustainable management of those resources and the land that supports them. Clearly defined land tenure that provides legal ownership, clear boundaries and security, in the form of enforceable rights, is most likely to provide the necessary incentives for communities to manage fire judiciously both in the short term and the long term. Similar incentives and shared approaches are necessary in order to gain the involvement and support of communities in managing wildfires that have their origins outside of their traditional or legal boundaries.

The development of appropriate policy and legislation, combined with education and training, can result in a situation in which communities are engaged and have a strong sense of ownership, and in which fires, both beneficial and detrimental, are likely to be more effectively managed. This, in turn, can lead to an increase in the opportunity for collaboration between communities, commercial interests and governments and, in many instances, to the sustainable management of resources.⁶

Under a participatory approach, different stakeholders should each have an opportunity to be informed of the legal issues related to forest fires and to contribute to identifying the most appropriate legal solutions, on the basis of their knowledge, interests and concerns. Legislation should provide a clear basis for this kind of approach. For example, the law could:

- require responsible authorities to inform the public adequately regarding monitoring activities and other aspects of forest fire management;
- envisage the creation of local committees or groups that could undertake certain forest-management responsibilities on the basis of specific agreements, following the provision of adequate information and training;
- envisage agreements with concerned land and forest owners that set out their respective rights and obligations regarding measures to prevent fires or other forest-management aspects;
- require consultation with local communities and concerned land and forest owners in the process of the adoption or revision of plans for forest fire management and of forest fire legislation;
- require the public to inform the authorities of relevant facts;

6 The FAO publication *Forest fires and the law: a guide for national drafters based on the Fire Management Voluntary Guidelines* (FAO, 2009b, also available at www.fao.org/docrep/011/i0488e/i0488e00.htm) provides additional information on the linkages between sound legislation and fire management.

- foresee rewards or other incentives for persons or teams who have successfully completed certain activities, e.g. fire suppression; and
- clarify the conditions and procedures for the authorized use of fire, such as prior notification, inspections, permits to burn, supervision, agreements, the submission of plans, or a combination of any of these tools to allow managed fire (FAO, 2009b).

Also important for CBFiM is the legislation regarding the use of fire. Although legislation traditionally tended to foresee blanket prohibitions on the use of fire, various laws have now begun to allow certain planned uses of fire, as there is general awareness that fire may be a useful land- and forest-management tool (FAO, 2009b).

In 2003, a workshop was held to examine the current state of fire-related laws and collectively to identify best practice for fire-related legislation and regulation (Simorangkir *et al.*, 2003). The workshop report works through and outlines the legal aspects and agency requirements for fire management, which are key aspects of “governance”. The review is not restricted to CBFiM, though that is a focus. In point form the elements were set out below under the major headings that follow.

- Framework law:
 - The ideal approach for legally regulating fire management would be to consolidate all existing laws and regulations into one national level “umbrella” framework law.
 - In addition, the framework law should establish responsibilities for carrying out other activities related to fire management, including information management, public awareness, training, and education.
 - Within the framework provided by the law, there should be flexibility for provincial, district, and village level authorities and communities to implement the basic obligations of the law, taking ecological and social needs and local circumstances into account. Operational details for implementing the law should be set out in one comprehensive regulation.
- Harmonization of existing laws and regulations should be reviewed to find out if:
 - they contain all of the elements needed; and
 - they contain provisions that conflict with each other or with other laws and regulations related to fire management.
- Core principles to be followed are broadly applicable to most laws and include such considerations as:
 - sovereignty;
 - precaution;
 - cooperation;
 - sustainable development; and
 - all fire is managed.

- Operational elements include:
 - general elements, such as:
 - comprehensive coverage;
 - powers and responsibilities;
 - coordination mechanisms; and
 - cooperation.
 - fire-related technical elements, such as:
 - research and analysis;
 - risk reduction (fire prevention);
 - readiness (preparedness to fight fires);
 - response (fire suppression); and
 - recovery (restoration of built and natural assets).
 - additional operational elements, such as:
 - public awareness;
 - resourcing;
 - incentives and disincentives; and
 - enforcement.

If the legal and regulatory situation in a country systematically addressed all or most of the segments identified above, then the requirements of both sustainable landscapes and of community roles and responsibilities in fire management, that is, CBFiM, would be likely to have been well addressed by law.

The FAO Fire Management Voluntary Guidelines (FAO, 2006) provide a framework of legally non-binding principles and internationally accepted strategic actions. The intent of the guidelines is to address comprehensively the cultural, social, environmental and economic aspects of fire management and to encompass the full range of fire management activities. These activities range from prevention and the appropriate use of fire in maintaining ecological processes and ecosystems to the use of fire to reduce the accumulation of fuel and residues below hazardous levels. One of the primary objectives of the guidelines is to publicize and encourage the contribution of effective CBFiM. Significant emphasis is given to social and community values and to the importance of engaging communities in fire management planning and implementation. As such, the Voluntary Guidelines can be a useful tool in assessing the viability of new and existing CBFiM efforts.



Rapid assessment tools

Fire management professionals require reliable and accurate field-level information in order to plan and to be effective in their work. In addition to the information that they have from their technical backgrounds, training, and professional experiences, it is essential that they receive information about: the areas where they are working, the local conditions, the culture, and the social and economic circumstances of the people who are affected by their actions (FAO, 1996). For CBFiM to succeed, gaining a solid understanding of the community context is critical.

There are a number of approaches that have been developed to enable the collection of information at the field level. Some examples of field-collection methods are described below, though it should be noted that the existing studies of CBFiM have not applied a common method and that there is no single accepted method.

PARTICIPATORY RAPID APPRAISAL

A well-known and widely used approach is Participatory Rapid Appraisal (PRA). PRA is a family of methods that enable individuals to share and assess their local knowledge, thereby allowing them to plan and to act (Chambers, 1994), with outsiders facilitating rather than controlling the process (World Bank, 1994). Tools developed and used in this process facilitate the collection and analysis of information by and for community members, with an emphasis on local knowledge. PRA methods provide information to both outsiders who wish to understand how the community uses and manages its resources and to the communities themselves, enabling them to evaluate resource management practices. Both are valuable inputs to resource management and to CBFiM in particular. The information collection process, if applied correctly, also provides a forum for informal and unbiased dialogues with the community members and with a variety of stakeholders, including representatives from local government divisions. This information-gathering through dialogue allows for an in-depth examination of existing practices, problems, conflicts, and opportunities regarding the use of resources, thus providing a basis for developing more sustainable and productive management systems (Asia Forest Network, 2002).

RANKING, SCORING AND MATRICES

Matrices are used to assess the relative prioritization of the elements of a single issue, in this case fire use, by individual groups (Table 1). This technique can be used to identify constraints or opportunities as well as to explore preferences and to attempt to develop an understanding of the basis on which choices and decisions are made (Jones, 1995).

TABLE 1
A ranking and scoring matrix used in Participatory Rapid Appraisal

Fire use	Month used	Value (importance)	Comments
Rice paddy preparation	January	1	Fire is now very intense and burns very hot.
Land clearing	October	5	Fire has become difficult to control and to keep in designated areas.
Mushroom collection	March	3	Fire used in the forest is a tool to grow mushrooms.
Honey collection	September	6	We are often not allowed to use smoke to collect honey because of the danger from fire.
Traditional medicines	November	4	Most medicinal plants do not like fire.
Hunting	July	2	Fire is used to hunt for animals; however, a lot of animals disappeared when the forest was cut down.

Source: Johnson (2006)

ANALYSIS TABLES

Tables have been designed, theoretically and subject to preliminary trial, to gather information about fire that is related to the community quickly and effectively. The CBFiM Analytical Table (Table 2) is designed to capture information related to a particular group's or community's use of fire. The Fire Impacts Table (Table 3) is a more detailed perspective on the impact of fire and provides the opportunity to sort and describe those impacts. As part of an FAO North Asian regional training workshop on CBFiM in 2009, during a one-day field trip to a rural village in Yunnan province, participants conducted two-hour, semi-structured interviews with several different groups, including a women's group, an elders' group, a community leaders' group, a men's group and a group consisting of park staff. The tables, and the information they contain, are provided as examples.

TABLE 2
CBFIM analytical table (Data collected from Mangun village, Xishuangbanna prefecture)

Types of fire being assessed within a community perspective						
1 Prescribed fire (agricultural)						
2 Wildfire						
Point of origin		Impact (+/-)		Ability to change	Intent to change	Shared objectives
Insider	Outsider	Insider	Outsider			
Rice paddy fields	Neighbouring villages	(+) minimizes harmful forest insects		Where and when to burn	Comply with policy	Use of prescribed burning
Sugar cane fields	Nature reserve	(+) improves grazing for livestock wild animals		Policy	Adapt fire management practices to minimize conflict with nature reserve	Develop ways to decrease accidental fire events
Grasslands (grazing)	Nature reserve staff apply fire on reserve boundary	(+) controls grass minimizing competition with seedlings		No ability for community to change reserve burning practices	Fire is the custom, is part of the local culture and is needed for agriculture	Reduce fuel loads on the reserve and the community
Forested hillsides	where fuel loads are heavy and risk of fire is high.	(+) fertilizes agricultural fields		Classify the reason for a prescribed burn	Fires to be lit after 18.30 hours when fire danger is low	Increase fertility of the soil
Celebrations (festivals)		(+) reduces hazardous fuels regeneration		Prepare burn plans	The community does not intend to change reserve burning practices that they perceive to be positive and beneficial to the community (protect the community from large fires)	Possible to create some shared objectives in the nature reserve buffer zone
		(-) potential of escaped fires into nature reserve			May occur in November each year at the prefecture permit stage	
		(+) stop large fires				
		(+) improved wildlife habitat				
		(-) soil erosion				
		(-) water quality				
		(-) wildlife loss				
		(-) tree mortality				

Source: FAO (2009a)

TABLE 3
Fire Impacts Table (Data collected from Mangun village, Xishuangbanna prefecture)

Fire type				
1 Prescribed fire (agricultural)				
2 Wildfire				
Impacts	Inside		Outside	
	Positive	Negative	Positive	Negative
Ecological	Increased fertility of land Regeneration of pine and oaks Control pests (mice, etc.)	Destroys forest	Regeneration of pine and oaks Control pests (mice, etc.)	Destroys forest
Environmental		Smoke/haze Reduced water quality		Smoke/haze Reduced water quality
Social	Makes the community happy Social harmony		Experience in how to prevent agricultural fires burning into the natural reserve Social harmony	
Safety	Protects the community	Injuries/accidents Property damage	Avoid fires escaping into the nature reserve forest Promote the skills of the nature reserve staff	Injuries/accidents
Health		Smoke/haze Reduced water quality		Smoke/haze
Economics (subsistence and livelihoods)	Increased agricultural products Increased household incomes Increased NTFPs (mushrooms)	Economic loss		Economic loss Costs of conducting burns (labour, fuel, etc.)
Political	Harmonious society		Harmonious society	

Source: FAO (2009a)

CBFiM and climate change

The Intergovernmental Panel on Climate Change, established by the World Meteorological Organization and the United Nations Environment Programme, defines climate change as “any change in climate over time, whether due to natural variability or as a result of human activity”. Wildfire contributes to significant levels of deforestation, degradation and atmospheric emissions in many parts of the world. An increased number of wildfires in the last two decades has been attributed, in part, to a changing climate (Westerling *et al.*, 2006); specifically, warmer temperatures and reduced precipitation are some of the factors that may be resulting in this global increase.

Fire is a significant threat to the ecological health and subsequent sequestration ability of many tropical forests. Fire-sensitive ecosystems typically have not evolved along with fire as a significant recurring process. Species in these areas lack the adaptations necessary to respond to fire, and mortality is high even when fire intensity is very low. Unmanaged or poorly managed fire is a key component in the process of deforestation and degradation for many of these fire-sensitive ecosystems and can often result in significant greenhouse gas (GHG) emissions. Fires in densely forested ecosystems can produce emissions of up to 113 tonnes/ha (Bonnicksen, 2008). Indonesia has experienced levels of deforestation and peatland degradation that has resulted, in part, from forest fires and that, according to some assessments, has put it among the top three largest emitters of GHGs in the world. Emissions resulting from deforestation and forest fires in Indonesia are almost five times as high as those resulting from non-forestry emissions, which illustrates the magnitude of this problem (PEACE, 2007). This situation is not unique to Indonesia. Fires, wherever they occur, in addition to their potential negative effects to ecosystem health, may contribute to global warming via significant emissions of GHGs (Shlisky *et al.*, 2007).

The global pattern of fire occurrence, fire as a contributor to GHG emissions, and fire’s contribution to forest degradation and destruction, all underscore the need for the development and implementation of more effective fire management approaches. To be effective, fire management strategies must recognize the integral role that fire plays in shaping ecosystems and its links with the inhabitants of those systems. Fire may be better managed by employing approaches that support and recognize the legitimacy of fire use by communities and rural populations. This awareness, in turn, can result in a significant reduction in GHG emissions.

In addition to reduced emissions, forests that are not burned can also continue to act as valuable carbon stocks. A number of projects have been implemented in recent years that place an emphasis on reducing emissions from deforestation and forest degradation (REDD). The majority of these projects seek to trade carbon on the voluntary carbon markets as opposed to the regulatory or compliance markets.

One example of a carbon-related project that contains an element of fire management is the Sofala Community Carbon Project in Gorongosa National Park (Annex 5). Envirotrade is a Mauritius-based company that operates projects involving the sale of carbon offsets to support the conservation and management of existing forests and the planting of new ones. It is piloting a poverty alleviation model in the buffer zone of the Gorongosa National Park in central Mozambique on land owned and managed by the communities around the park. A focus on land-use change in the buffer zone of the protected area has resulted in reduced pressure on threatened natural resources within the park.

The project works closely with communities to rehabilitate the forests on their land and to introduce new, sustainable farming practices. Verified Emission Reductions (VERs) produced for sale to date is 1 106 044 tonnes of carbon dioxide equivalent (tCO₂e). Fire management is a component of the project.

Annual burning of the bush by communities was one of the significant threats to the forest resources in the project area. Communities in and around the park continue to use fire to achieve a number of objectives. These objectives include: using fire to reduce hazardous fuels that build up over the course of the growing season; traditional bee keeping; herding wild animals as a hunting tactic; and burning grass to improve grazing for domesticated animals, such as goats, and to attract game. Fire is most commonly used to clear semi-permanent farmland plots.

Envirotrade has supported Natural Resource Management Committees, which develop and coordinate fire management training for local community members. This training includes both the preparation of a prescribed-burning plan and readiness for fire suppression activities in the project area. Locals often need very little fire management training because of their experience and comprehensive understanding of fire behaviour in the Miombo woodland ecosystem. Fire and its management is integral to the communities that have traditionally inhabited the landscape and is therefore a factor in project-management activities. Incentives for responsible fire use by local community members include well-established and officially documented land ownership based on traditional tribal boundaries and the receipt of payments for carbon credits, with a set of indicators in place that if breached result in carbon credits not being issued to the project.

The threat of fire may not have been addressed sufficiently in the planning or implementation of some REDD projects and activities. Over 90 percent of fires are caused by humans, and large fires, such as those in Indonesia in 1997 and 1998, have the potential to wipe out all the gains achieved through REDD globally. Many REDD projects are located in areas of the world where fire plays a significant role as both a land-management tool and as a primary agent of forest loss. In these instances, fire is an important risk factor that should be addressed in the development of an effective REDD mechanism. Without appropriate and effective fire management consideration that also addresses community involvement in planning and implementation, this objective may be significantly compromised.

CBFiM – in sum

CBFiM has been implemented and practised in its various iterations for the better part of two decades. Examples of CBFiM can be found globally from Asia to Latin America (Kurtulmuslu and Yazici, 2000; Alvarado, Rosales and Aguilar, 2001; Dampha, 2001; Goldammer and Abberger, 2001; Zhang *et al.*, 2003; FAO, 2003; FAO, 2011; London, 2001; Nanda and Sutar, 2001). However, the sheer number of CBFiM applications does not necessarily equate to the successful long-term implementation of this approach. More work is needed to promote CBFiM as a viable approach to fire management, particularly in those places where communities, fire, natural resource management and conservation efforts coexist. There is also a need to advocate for the inclusion of CBFiM, and fire management in general, in the broader field of landscape and natural resource management and rural development. Attention needs to be placed on creating favorable environments in which CBFiM can thrive. Capacity and resources need to be bolstered to ensure the sustainability of CBFiM following implementation. In order for any of these issues to be addressed properly, the major factors limiting the effective and sustainable implementation of CBFiM should first be identified. Only then can appropriate strategies be designed to strengthen, expand and modify CBFiM approaches.

LIMITING FACTORS

There has now been more than a decade of focused effort on CBFiM; the subject has been the topic for an international conference, specific training and a number of case studies, and has been promoted and facilitated by FAO. Despite the effort, the materials and the logic of engaging communities in the management of fire in their local environment, progress has stalled. How can CBFiM become more of an integral component in natural resource management? Why has it not done so in the last decade? There is no easy solution or response to these questions given the many challenges in terms of implementing effective and sustainable CBFiM approaches. To be properly addressed, these limitations are best examined and evaluated within the individual contexts in which they occur. Some of the current known limitations on CBFiM include the following:

Lack of policy and law – In many instances adequate and appropriate fire-related policy and law do not exist. In the face of changing land use and an increasing population, policy that will address, realistically, the needs of communities that use fire is required. It is a complex issue for governments to endorse deliberate fire use when the regulatory framework, the planning and operational capacity, and the operational resources of its agencies are limited in various ways.

Lack of capacity – Communities often lack the analysis, planning, training and equipment necessary to manage fire effectively. In many instances the same constraints are faced by government fire management agencies, which may also lack skills, training, equipment, data and processes for analysis themselves.

Lack of localized training opportunities – CBFiM-related and -focused training programmes that are designed to address the needs and circumstances of participants at national to local scales are not always available. Some of the skills needed are related not only to fire, but may also include record-keeping, meeting facilitation and other abilities involved in bringing people together to work collaboratively.

Lack of incentives – Incentives need to be in place in order for CBFiM to be effective and sustainable. Communities need clear land access and use rights, government representatives need to receive adequate compensation, and communities have to be able to see clear benefits from their participation in responsible landscape and fire-management. Care should be taken that incentives do not distort performance by unbalancing responses or stimulating activity that is not consistent with a holistic approach to the landscape.

Poor promotion of CBFiM concepts and approaches – CBFiM needs to be promoted as a viable approach and solution to effective fire management in those instances where anthropogenic fire adversely impacts project goals and objectives. Information regarding CBFiM applications and approaches, particularly scientific research, needs to be transferred to field managers and other end users effectively. Such effective transfer requires that information be clear, concise and in a format that land managers and practitioners can easily access, understand and implement.

Lack of funding to implement CBFiM – A lack of adequate funding will always be a constraint in the long-term implementation of natural resource projects. CBFiM capacity-building using a national, as opposed to a regional, focus could be a starting point for developing materials to assist participants in identifying and securing potential sources of funding.

Consideration needs to be given to each of these challenges in order to develop appropriate and effective strategies for increasing the promotion of CBFiM as a viable approach to fire management. Each implementation of CBFiM will have its own specific challenges that will require unique approaches and solutions. That each implementation will be unique further underscores the significance of scale-sensitive approaches in CBFiM training, capacity-building and implementation efforts.

PARTNERS AND COLLABORATION

CBFiM requires collaboration, and that collaboration is essential for the development of strong and effective partnerships both within and outside the community. Collaborative partnerships with communities, the private sector,

NGOs, governments and their affiliated agencies can provide the knowledge, resources and other inputs that are necessary for successful CBFiM implementation. These local partnerships can, in turn, be effective mechanisms for linking to national and even regional partnerships, allowing for increased technical support and a potential increase in other necessary resources.

TOOLS AND RESOURCES

A continued effort needs to be made in the development of tools and resources designed to assist CBFiM practitioners to implement CBFiM effectively in the long term. Any materials developed should be tailored as necessary to meet the needs of practitioners in a multitude of contexts and situations. There exists a significant body of information that describes CBFiM. To date, however, this information has not been conveyed effectively to resource managers and end users with the express purpose of increasing awareness and helping to create environments suitable for the sustainable implementation of CBFiM. The success of CBFiM as an effective fire-management approach cannot be measured only by how many projects are funded or by how many research papers are generated, but must also be measured by how critical information from research efforts is conveyed successfully to resource managers and end users with the express purpose of improving fire management decisions. The focus should be on developing materials applicable to, and understood by, a wide range of audiences, including community members (elders, men, women and children), NGOs, the private sector and government at all levels.



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Annexes – CBFiM case studies



Annex 1

CBFiM in Namibia: the Caprivi Integrated Fire Management programme

Robin Beatty, Integrated Rural Development and Nature Conservation, Namibia

EXECUTIVE SUMMARY

The Integrated Fire Management (IFM) programme in the Caprivi region was begun in 2006 to support community, national parks and forestry in the region. Caprivi is a 300 km finger-like projection of semi-arid tropical savannah in northeast Namibia. The majority of the region (71 percent) is communal land, and the population of 100 000 live a predominantly rural existence. Traditional use of fire includes slash and burn agriculture, management of grazing lands, natural product harvesting, hunting, pest control and honey collection.

National fire management policy focuses on fire prevention and suppression, and implementation consists of discouraging burning through public awareness campaigns, firebreak networks and community wildfire suppression. In Caprivi, this policy was consolidated in 1996 through the Namibia–Finland Forestry Programme (NFFP). A strong CBFiM component facilitated the extension of national policy to the local level. Since the withdrawal of Finnish support in 2001, the nature of implementation has changed in that it relies upon legislation and negative reinforcement, such as threat of punishment, to discourage burning. As a result of widespread use of slash and burn agriculture, uncontrolled fires affect more than 50 percent of Caprivi every year. These fires impact community livelihoods through the loss of natural resources, property and life. Current national policy provides communities minimal opportunity to resolve this problem.

The Caprivi programme implements a pilot CBFiM policy to establish fire management that complements the environment, land use, resources and capacity of communities. It is implemented through a fire management strategy based on controlled burning, decentralized community fire management decision-making and integrating CBFiM into regional fire management.

Implementation of the pilot CBFiM policy in Caprivi has established fire management in communal land that has brought tangible livelihood benefits to communities through improved land use, reduction of uncontrolled fires and improved environmental management. Community ownership and the ability of individual community members to control fire management are essential to

achieving effective implementation over 10 000 km² without costly machinery and resources.

The achievements of the pilot CBFiM policy in Caprivi have led to its adoption into national fire management policy; its principles could also be applied to other southern African nations.

INTRODUCTION

The Caprivi Integrated Fire Management programme was begun in 2006 to support CBNRM, national parks and forestry in the region. The government, NGOs, community and private stakeholders developed the Caprivi Integrated Fire management Strategy (2007–11), which is currently implemented over 10 000 km² of land. The majority of Caprivi is communal land (71 percent), and a pilot CBFiM policy is central to the strategy. The CBFiM policy aims to establish fire management that complements the natural environment, land use, resources and capacity of the community. The policy involves:

- developing a fire management strategy based on controlled burning as an effective tool in managing wildfires, land use and the environment;
- decentralization of fire management decision-making and implementation to the community; and
- integrating CBFiM into regional fire management.

The Directorate of Forestry of the Ministry of Agriculture, Water and Forestry regulates the implementation of CBFiM policy with funding and technical assistance from the support agencies Integrated Rural Development and Nature Conservation and Community Forestry Namibia and the German Development Service.

BACKGROUND

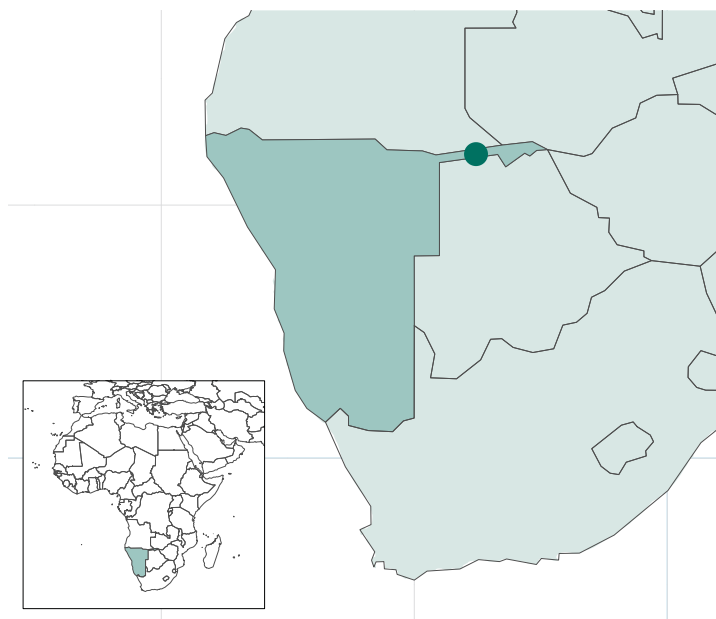
Caprivi region

Caprivi is a 300 km finger-like projection of semi-arid tropical savannah of northeast Namibia in sub-Saharan Africa (Figure, next page). Annual rainfall is highly variable, with an annual average of 600–700 mm and distinct wet and dry seasons. Permanent rivers (Chobe, Kavango, Kwando and Zambezi) supporting riverine woodlands and floodplains traverse thick deposits of Kalahari sands dominated by savannah woodlands.

Caprivi has a population of approximately 100 000 comprising the Bayeyi, Khwe (San), Mafwe, Mbukushu and Subiya ethnic minority groups (Central Statistical Office, 2001). They have a predominantly rural existence in which subsistence farming and natural resources are important sources of livelihoods. Natural resources include grazing for livestock, building materials (timber and thatching grass), firewood, medicinal plants, wild fruits and honey. CBNRM projects supplement income from government salaries or pensions and small-scale farming enterprises.

Traditional use of fire includes slash and burn agriculture, management of livestock grazing, management of natural product harvesting management, hunting, pest control, protection from wildlife and honey collection.

FIGURE
Location of the Caprivi IFFM



National fire management policy

Namibia has maintained a fire-prevention and suppression fire management policy since colonial administrations revoked local burning practices and control by traditional authorities 30–50 years ago. The Directorate of Forestry regulates fire management through the Forest Act of 2001 (Government of Republic of Namibia, 2001), which is mainly concerned with: prohibiting fires within forest reserves, declaring fire hazard areas and specifying landowner liability for fire damage. The lighting of fire on communal land is illegal without authorization from the Directorate of Forestry.

The formalization of national policy to strengthen the coordination of fire prevention and suppression among government, private and community stakeholders occurred only recently, through the Draft National Forest and Veld Fire Management Policy (Directorate of Forestry, 2005). Implementation consists of discouraging burning through: education and awareness campaigns, firebreak networks and community training in wildfire suppression. Controlled burning, although recognized as a fire management tool, is rarely implemented.

National fire management policy in the Caprivi region

National policy implementation in Caprivi was consolidated in 1996 through the NFFP. The Pilot Project for Forest Fire Control aimed to reduce fires in East Caprivi to improve the environment and living standards of local people. A strong community participation component extended national policy through fire-prevention education and awareness, community firebreak maintenance contracts and wildfire suppression training and mobilization. It was modified in 1998, as the East Caprivi Integrated Forest Fire Management Project, to emphasize

that fire is a suitable land-management tool, if carefully timed and used (Goldammer, 2001).

Implementation was comprehensive while Finland was providing funding (€3 million) and technical support. However, it is unclear how effective the programme has been in improving rural livelihoods in East Caprivi, as the impacts of wildfires and the benefits of improved fire control are difficult to quantify (Kamminga, 2001). Implementation has been less comprehensive since the withdrawal of Finnish support in 2001, and the Directorate of Forestry now relies largely upon legislation and the threat of punishment to discourage the lighting of fires.

The widespread use of slash and burn agriculture to prepare land for crops continues in Caprivi. Coinciding with the late dry season, when weather conditions and fuel characteristics cause intense fires, uncontrolled crop-field fires lead to extensive wildfires. Uncontrolled fires between August and October affect more than 50 percent of Caprivi every year, and this pattern has not changed over the past 17 years (National Remote Sensing Centre, 2002; Integrated Rural Development and Nature Conservation, 2006). These fires negatively impact community livelihoods through the loss of natural resources, property and life.

Current national policy provides communities with minimal capacity, resources and opportunity to resolve this problem. Communities have recommended both restoring their rights to practise controlled burning and community decision-making to achieve effective fire management on communal land in Caprivi.

CAPRIVI PILOT CBFiM POLICY

The pilot CBFiM policy aims to establish fire management on communal land that complements the environment, land-use, resources and capacity of communities. The policy is based on integrating existing community skills, knowledge and institutional structures with sustainable fire management strategies and ecological requirements. The CBFiM policy is implemented through a fire management strategy based on: controlled burning; fire management decision-making and implementation that has been decentralized to the community; and CBFiM that is integrated into regional fire management.

Fire as a resource

The CBFiM policy employs a fire management strategy centred on controlled burning to manage wildfires, land use and the environment. Based on holistic management principles, the strategy integrates traditional burning practices, contemporary land use and environmental requirements. Managing fire as a resource focuses on the benefits of fire as opposed to its negative impacts, which is the case in existing national policy implementation.

Land-use productivity and sustainability is enhanced through the use of controlled burning to improve grazing, natural product harvesting and agriculture. The timing, intensity and frequency of burning is prescribed to specific land-use objectives in specific areas. This approach creates an extensive mosaic burn pattern that minimizes the occurrence and extent of wildfires by reducing and fragmenting

fuel loads. Infrastructure and sensitive resource areas are protected by strategic reduction of fuel loads around these assets. The environment is enhanced through both the reduction of fire intensity and the diversification of fire regimes to enhance habitat and biological diversity.

By controlling when, where and how fires occur, communities can minimize their negative effects and maximize the benefits of fire without costly machinery or resources. Using fire behaviour, local knowledge of the area and strategic implementation, safe and efficient controlled burning is achieved with minimal equipment (such as matches, drip torch, fire beater etc.). Firebreaks are limited to implement controlled-burning around the infrastructure. Firebreak networks are no longer required, as existing roads and tracks provide sufficient access for the implementation of controlled burning.

Decentralization of fire management to the community

The CBFiM policy decentralizes decision-making and implementation through fire management programmes that are specific to the individual community. The programmes enable communities to acquire the rights and responsibilities of fire management in their areas of authority. A development and implementation process based on the Forest Act of 2001 and regulated by the Directorate of Forestry guides the coordination of fire management within communities.

Communities register a fire management area that encompasses their area of authority. Each community elects a fire management committee: a functional group of between four and six community members that develops and implements a fire management programme on the community's behalf. The committees are trained in the process of implementing a fire management programme with an emphasis on managing people as much as managing fire. The traditional authority administers the committee and arbitrates fire-related disputes within the community.

CBFiM programme planning involves comprehensive community coordination, liaison and awareness. Stakeholder meetings, 'door to door' consultation and field surveys are used to identify land-use requirements, priority resource areas, infrastructure, fire history and hazards. A strategic fire management plan that is centred on the objectives of community land use details the timing, location and methodology of operational activities. The plan is submitted to the Directorate of Forestry as an application for a permit to burn.

CBFiM implementation is coordinated within the community through continual liaison and awareness by the committee. Conveying individual roles and responsibilities in community fire management and notification of programme activities are priorities. Community participation in operational activities of the committee is encouraged to extend fire management skills and knowledge to the community.

Controlled burning is implemented in the early dry season when weather conditions and fuel characteristics lead to low intensity fires of limited extent. Implementation includes: firebreak maintenance, infrastructure and resource protection burning, controlled land use and mosaic burning, and wildfire management.

Integrating into regional fire management

CBFiM programmes are integrated into regional fire management through structured collaboration and coordination with neighbouring communities, national parks and gazetted forests. Community committees develop collaborative strategies with fire managers in areas that share a common boundary with their fire management area. The alignment of fire management objectives, and shared resources and workloads, all facilitate effective fire management with the least effort and resources. Importantly, boundary firebreaks, requiring considerable resources to construct and maintain, are no longer necessary using this approach.

CONCLUSIONS

Implementation of the pilot CBFiM policy in Caprivi has established fire management in communal land that has brought tangible livelihood benefits to communities through improved land use, has reduced uncontrolled fires and improved environmental management. Strategies centred on controlled burning, capacity-building of the community and collaborative fire management between neighbours enable these benefits to be achieved effectively over 10 000 km² without costly machinery and resources.

Integrating traditional institutional structures and knowledge with existing community skills into the CBFiM policy is essential in developing community fire management ownership. Programmes specific to the community further contribute to a sense of ownership through the recognition of cultural diversity and community value in regional fire management. Community ownership facilitates responsibility at leadership, committee and wider community levels.

Effective CBFiM programmes are driven by the ability of individual community members to control fire management and to improve their livelihood through enhanced land use. By basing implementation of fire management on existing skills, knowledge and institutional structures within the community, programmes are accessible and controllable by individual community members. Their committees possess the necessary skills, knowledge and equipment independently to plan and implement fire management safely and efficiently. Individuals control fire management by directing the committee's activities within their resource areas. Settlement of fire-related disputes is commensurate with individual resources and is arbitrated locally through a process accessible and open to individual contribution.

Effective and sustainable CBFiM programmes require a long-term development process to build fire management skills, as well as knowledge and collective fire management responsibility in communities. The operational relationship between committees and the community evolved primarily through personal experience. Benefits of controlled burning were demonstrated in the first year through tangible livelihood improvements. Widespread reliance on committees was experienced in the second year with uncoordinated use of fire ceasing. Wildfires from uncontrolled slash and burn agriculture remain a challenge to the programmes. In an effort to build collective fire management responsibility throughout the community, committees do not suppress uncontrolled fires from these sources.

Land-use improvements following three years of implementation stimulated the proactive participation of the wider community in operational activities. CBFiM programme sustainability relies upon the extension of fire management skills, knowledge and responsibility to the wider community, thus enabling independent fire management in the future.

Integration of CBFiM into regional fire management through the collaboration and coordination of neighbours establishes effective fire management over large areas of differing land tenure and use. Regional fire management is composed of programmes specific to property; these are coordinated as an adaptable and robust programme driven by grassroots level decision-making and implementation.

The achievements of the pilot CBFiM policy in Caprivi have initiated its adoption into national fire management policy. Its principles could also be applied in other southern African nations with comparable fire management scenarios including Angola, Botswana, Mozambique, Zambia and Zimbabwe.

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Annex 2

CBFiM in the United States of America: the High Knob community wildfire protection plan

Darren Johnson, Forest Ecosystem Services LLC, Hinesburg, Vermont, United States of America

Rachel F. Brummel, University of Minnesota, Saint Paul, Minnesota, United States of America

PREFACE

CBFiM is often regarded as an approach exclusively for developing countries or as one that involves only those communities that rely directly on their land and the resources it provides to sustain their livelihoods. However, communities in developed countries are also actively involved in the development or implementation of the fire management approaches that affect them. These communities may not always rely directly on local natural resources to sustain their living, but it is often still in their best interests to have a stake in how fire is being managed in and around their area of interest.

In the United States of America nearly a century of effective fire suppression has resulted in altered fire regimes and significant increases in hazardous fuels. There has been an increase in the number and size of catastrophic wildfires, and between 2001 and 2008 wildland fires in the United States of America burned close to 19.5 million hectares (48 million acres), with 85 percent of those fires being caused by humans and 15 percent by lightning (NIFC, 2008). An increasing number of wildland fires are occurring in areas where human developments interface with undeveloped wildland or vegetative fuels such as forests, shrublands and grasslands. These areas of interface are typically referred to as the wildland-urban interface (WUI); such development grows as populations increase and expand outward from major urban centres. This increase creates significant strains on fire-management resources, which can be overwhelmed by wildfires.

As a result, individual communities and homeowners must be willing to accept a high degree of responsibility for protecting their homes from wildfire. Initiatives such as the development and implementation of CWPPs have been successful in achieving this goal (United States Fire Administration/National Fire Data Center, 2002).

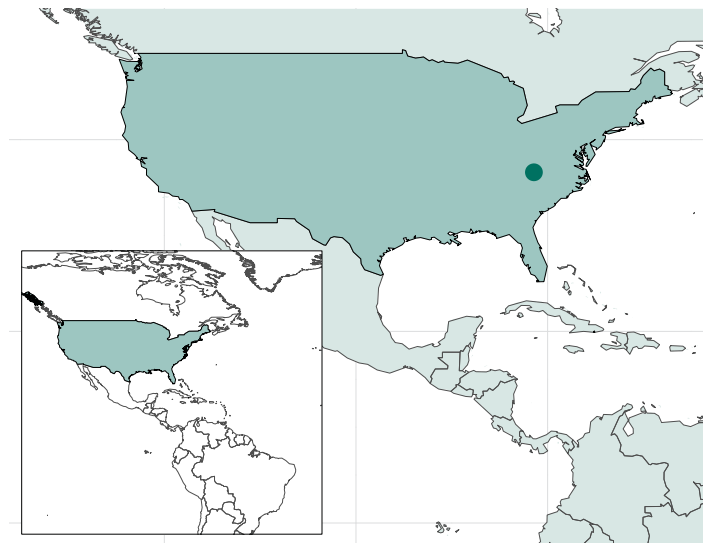
The CWPP enables a community to plan how it will reduce the risk of wildfire. Each CWPP meets the specific needs of the community developing it and is therefore unique to that community. Specifically, the plan identifies strategic sites and methods for hazardous fuel reduction projects designed to protect the community and to reduce the likelihood of structures burning. A CWPP can help a community to clarify and refine its priorities for safety, property and critical infrastructure within the WUI.

In 2006, the community of High Knob, located in the state of Virginia in the eastern United States of America, worked in collaboration with the state's Department of Forestry to develop a CWPP. The active participation by the local residents in the development and eventual implementation of the plan is a good example of CBFiM in a developed nation. High Knob is situated on the side slope of a mountain surrounded by an abundance of flammable vegetation. The CWPP developed by the community outlined strategies to reduce and remove hazardous fuels and to improve access in and out of the community.

INTRODUCTION

The community of High Knob is a gated subdivision consisting of approximately 400 homes on the outskirts of Front Royal in Warren County, Virginia, in the eastern United States of America. High Knob is a gateway community for the Shenandoah National Forest and is located approximately 65 miles west of Washington, DC. Because of its proximity to the capital, many of its seasonal and permanent residents commute to work in DC on a daily basis (JFSP, 2006). The community is located on a mountainside with surrounding vegetation consisting of dense hardwoods with scattered conifers.

FIGURE
Location of the High Knob community



In addition, there is a large amount of downed fuel and heavy undergrowth in some areas. High Knob represents an example of a community that exists where human development interfaces with undeveloped wildland and where the consequences of wildfire are potentially catastrophic.

Prior to the development of the High Knob CWPP, a mitigation specialist from the Virginia Department of Forestry conducted a community-wide wildfire assessment. The assessment revealed that the community would be at significant risk in the event of a wildfire. This risk was the result, in part, of the community's location in the WUI and the local topography that results in the placement of homes on a steep gradient up the mountainside. The area around High Knob has a relatively low frequency of wildfire occurrence, but the assessment determined that the hazardous buildup of fuels on private property places the community at significant risk. The assessment also raised major concerns regarding access in and out of the subdivision for emergency response vehicles. The roads in the High Knob subdivision are winding and tend to be steep, with insufficient turnaround areas. The mitigation specialist from the Department of Forestry presented the findings from this initial assessment to an organization within the community known as the High Knob Home Owners Association (HOA). The establishment of homeowners associations by communities and their subsequent involvement in the development of CWPPs is a requirement of the Department of Forestry in Virginia. In the case of High Knob, the HOA, and its Board of Directors, functions as a governing body within the community. Based upon the findings of the wildfire assessment, the High Knob HOA board approved official engagement with the Virginia Department of Forestry to reduce wildfire risk; they began developing a CWPP specific to their community, using an existing template as guidance. The HOA business manager acted as the lead in the community's involvement and was the primary liaison between the community and the Department of Forestry's mitigation specialist.

OBJECTIVES

High Knob is an example of active community participation in the planning and implementation of a specific type of fire management plan known as a CWPP. The community's location in the WUI also provides an example of community-based fire prevention on private land in the form of several effective hazardous-fuel mitigation strategies.

The primary objectives of the CWPP for High Knob were the community-wide reduction and cleanup of hazardous fuels and improved access for emergency vehicles in and out of the community. These activities focused specifically on private land within the subdivision boundaries. Fire is not used by the community to achieve these objectives; rather, they use a variety of mechanical fuel removal techniques, such as the mechanical chipping of woody debris.

BACKGROUND

The Virginia Department of Forestry assumes the primary responsibility for wildland fire suppression and response in Virginia's 15.8 million acres of forestland, with the exception of federally-managed lands such as the Shenandoah National Park (Gramley, 2005). In federally-managed lands in the United States of America, fire management is the responsibility of whichever agency – either the Forest Service, the Bureau of Land Management, or the National Park Service – has jurisdiction. The Virginia Department of Forestry is organized into six administrative regions within the state which receive oversight and support from a central headquarters facility. Government-owned forests make up 14.2 percent of the forestland in Virginia with the remaining 6.8 and 79 percent being owned by forest industry and private non-industrial owners, respectively. In Virginia there is a significant amount of collaboration and partnership between the Department of Forestry and local fire departments. Volunteer fire departments provide a significant source of labor with respect to fire fighting in the state, and they can be the first responders to a wildfire.

The homeowners of the High Knob subdivision have attempted to mitigate the potentially adverse effects of wildfire to their community by developing and implementing a CWPP in collaboration with the Virginia Department of Forestry. According to objectives set out by the Healthy Forest Restoration Act (HFRA), the CWPP is designed to minimize the threat of wildfire to homes and critical infrastructure within the subdivision. This goal has been achieved in part by creating defensible space around structures and removing hazardous fuels in strategic locations throughout the subdivision. Improved road access in and out of the community and improved signage (with reflective numbers) on the homes are also focuses of the plan, to facilitate travel safety and efficiency within the community during a wildland fire event.

The High Knob CWPP was funded through a federal grant provided by the National Fire Plan. The US\$ 100 000 grant was administered at the state level by the Virginia Department of Forestry. A requirement of the grant was that communities be engaged in the CWPP process and match 20 percent of the grant amount 'in kind' through labor provided by community members.

CASE STUDY SUMMARY

The residents of High Knob are involved in managing fire risk through planning and mechanical fuel treatments, rather than through the use of prescribed fire or active suppression. The community provided significant input into the development of both the initial and final CWPPs via the HOA board and a steering committee. The plan developed by local residents outlines an approach for community-wide reduction and cleanup of hazardous fuels; this approach includes improved access into and out of the subdivision. Members of the community have been active in implementation by organizing and carrying out various activities related to hazardous fuel reduction and road improvement within the subdivision. As a result, the community is less vulnerable in the event of a wildfire, and emergency vehicles can move more efficiently and safely throughout the subdivision.

Community involvement in planning and implementation

A necessary element of CBFiM is the inclusion of community members in the development and implementation of some sort of fire management planning that has direct implications for the community. In the High Knob community a steering committee was formed following official agreement by the HOA to work with the Department of Forestry in the development of a CWPP. In addition to the Department of Forestry, the High Knob CWPP steering committee is composed of a few key homeowners including some of the HOA staff and its business manager. The steering committee's role was to develop the initial plan, write grants and prioritize steps in reducing fuels and improving access within the community.

After the initial CWPP was developed by the steering committee, the majority of participants involved in implementing High Knob's CWPP were the homeowners themselves. Over the course of several months, the steering committee held discussions and meetings with community members and other stakeholders, modifying the initial CWPP to create the final signed version. The community required the administrative support of the HOA in this process; however, the HOA did not have an integral role in planning or decision-making.

In the case of High Knob, CWPP planning and implementation were essentially simultaneous. Local residents were engaged in most activities to varying degrees. Coordinating these efforts on behalf of the community was a local resident and business manager for the HOA. The HOA business manager was instrumental in catalysing the community and liaising with state and federal partners throughout the process. Another resident serving on the steering committee provided much-needed expertise in grant writing. Several successful grant proposals were written that helped to fund the development and implementation of the plan. As a result of the CWPP, the High Knob community was divided into sections to facilitate the efficient removal of hazardous fuels across the entire subdivision by teams of homeowners.

The plan included the identification of roads within the community that needed widening or that required that vegetation be trimmed back to allow access for emergency vehicles, such as fire trucks and ambulances. Each road identified for treatment was then assigned to a resident road captain. The road captain's specific role was to visit homes on his or her road, communicate the objectives of the project, and develop the interest of community members in private property fuels management. Another local resident with critical local landscape knowledge acted as the field services manager, supervising the implementation of various projects and hiring contractors to assist in the completion of those projects.

Community involvement in this process has resulted in many beneficial outcomes that are not all related to fire management. Possibly the most significant outcome of the CWPP process was a marked improvement in communication between homeowners. Effective communication between local residents was recognized as being vital to the overall success of community-based effort. The primary forms of communication employed by local residents during the development and implementation of the CWPP included email, telephone and

word of mouth, as well as the creation of a community newsletter, flyers and bulletin boards. Community events and celebrations were also important for communication and sharing. The successful removal of hazardous fuels and the resulting improvement in the protection and safety of the community was and will continue to be an important outcome generated by this process. In addition, there has been a marked improvement in the local community's awareness regarding wildfire and what individual homeowners can do to mitigate the risk to their own property. This increased understanding of fire and fire management has led to an improved relationship between the community and the local volunteer fire department.

Keys to implementation

Some of the biggest challenges with regard to the implementation effort were how to increase community involvement, how to maintain that participation and how to track overall progress. To overcome some of these challenges, a community member was identified early on who possessed effective leadership skills and who had the time to manage the process on an almost full-time basis. Being respectful of people's time and schedules was also essential to the process. For example, to maximize and sustain community participation, meetings and events were planned around individual schedules in order to accommodate as many residents as possible. Increasing community awareness was also seen as an important element in sustaining and increasing involvement. To address this need, a fire management education component was developed that also included examples of similar CWPP efforts in other communities. Lastly, the plan has to be 'owned' by the community and therefore developed by the community at a pace and in a way that is comfortable for them. To achieve necessary levels of community involvement, the process cannot be enforced by outside parties.

Continued funding is essential to sustaining this effort and therefore government grants are being sought as an important element in the future success of the programme and in sustained community involvement. Members of the community indicated that the CWPP process has resulted in a more cohesive community. Thus, the likelihood of future collaboration, including an increase in the overall number of community organizations and in participation in fire-management activities, has significantly increased. Community-building was seen by many as a key outcome of the CWPP.

CONCLUSIONS

Development of effective CWPPs is a dynamic process and one that is unique to each community. Ultimately, success depends upon the level of involvement and commitment from key community members. These individuals tend to act as 'sparkplugs', motivating community members and producing tangible results. On a small scale such as High Knob, the ability to organize and mobilize community members may be more important than their initial knowledge of fire and fire management.

Scale is an important consideration when developing and implementing a community-based approach such as a CWPP. In High Knob, initiating the plan on a small scale resulted in more rapid implementation of fuel-reduction efforts. A CBFiM approach such as the CWPP can create community integration and cooperation that are beneficial to other community efforts that are not necessarily fire-related.

The benefit that many communities in industrialized nations can derive from adopting a CBFiM approach such as the development and implementation of CWPPs, is an increase in collaboration within the community and with partners outside of the community. This collaboration can include the sharing of resources ranging from scientific and traditional knowledge to contemporary fire management strategies and conflict resolution. Increased collaboration and the increased understanding that it brings can also lead to the development of approaches (such as policy) that make sense and are relevant to a particular community. Thus, a comprehensive approach to fire management that includes a strong, community-based component is a critical element in establishing effective fire management programmes in the United States of America and other industrialized nations.

ACKNOWLEDGEMENTS

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Annex 3

CBFiM in Mexico: La Sepultura Biosphere Reserve in Chiapas

Ronald L. Myers, Grupo Caras del Fuego, Baton Rouge, Louisiana, United States of America

EXECUTIVE SUMMARY

CBFiM at the La Sepultura Biosphere Reserve exemplifies a number of projects throughout Latin America that are enabling rural communities to take responsibility for managing the fire problems that affect them directly. The La Sepultura project is one of the few examples that go beyond local prevention efforts and community-run suppression brigades to include fire use (prescribed burning) to restore and maintain native fire-dependent ecosystems. It also illustrates that success at the community level requires that broader (national and regional) issues related to fire – including scientific, technical, social and political issues – be addressed simultaneously.

INTRODUCTION

The El Niño year of 1998 caused unprecedented wildfires in southern Mexico (Figure 1) where the number of fires and area burned increased nearly fourfold

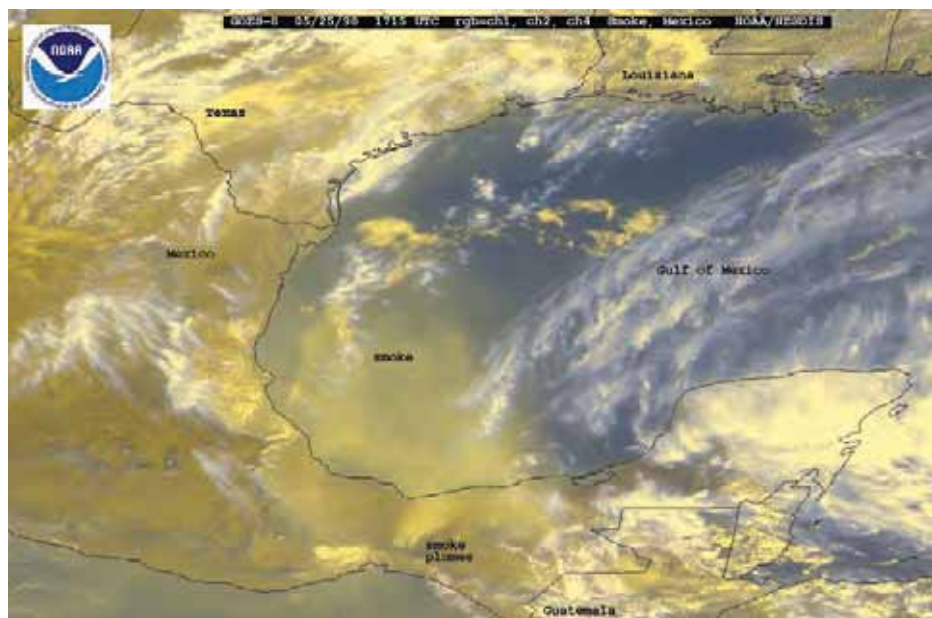


FIGURE 1
Fires in southern Mexico during the 1998 fire season

over the annual average (CONAFOR, 2006). Tropical moist forests and montane cloud forests, which are normally resistant to severe fire damage, were adversely affected by a number of large persistent fires. The southern state of Chiapas was particularly impacted by these fires. There were equally problematic fires in the adjacent northern Guatemalan province of Petén. After the initial suppression response to these fires, and the arrival of the rainy season that finally extinguished them, the Mexican government, research institutes, multilateral agencies, and NGOs evaluated the underlying causes of the fires and focused their attention on improving early warning systems, suppression capacity, and prevention programmes. Because many of the fires originated in the agricultural sector, the Mexican Conservation Fund (FMCN) focused its attention on developing CBFiM programmes in the areas that were most severely impacted by the fires. The Nature Conservancy (TNC) contributed to these efforts by developing an integrated fire management strategy, which was aimed at changing the way that both the Mexican conservation agencies (the National Protected Areas Commission (CONANP) and the National Forestry Commission (CONAFOR)) and rural communities think about and approach fire management issues in and around conservation areas (Myers, 2006; Pantoja-Campa, 2008).

Critical to this paradigm shift was the recognition that some ecosystems, like pine forests and savannahs, depend on fire to maintain their character and biodiversity – values that had led to their protection and inclusion in protected natural areas in the first place – and that fire plays both positive and negative roles in nature and society.

The case study presented here involves two *ejidos* (communal lands managed by rural villages) that are within the buffer zone of the La Sepultura Biosphere Reserve, Chiapas, Mexico (Figure 2). La Sepultura Biosphere Reserve is one of the most diverse forest reserves in Mexico and the world. It covers 162 700

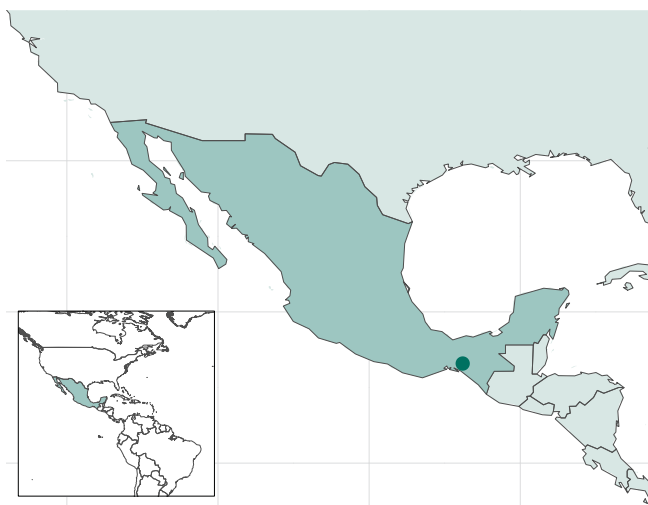


FIGURE 2
Location of La Sepultura Biosphere Reserve

hectares (approximately 413 253 acres) and protects 10 of the 19 vegetation types in Chiapas, including cloud forest, tropical forest and pine-oak forest. In 1998, fires that originated in agricultural lands and the tropical pine forest within the reserve's buffer zone severely damaged adjacent fire-sensitive cloud forest vegetation located within the core conservation area of the reserve. Beyond the biodiversity value of cloud forests, this ecosystem provides important ecosystem services, particularly the maintenance of water quality and appropriate water discharge rates for lowland rural communities and urban areas, as well as for the agricultural sector throughout the region. The two communities, Corazón del Valle and Valle de Corzo, were selected as pilot communities because of the fire problems that originated in their communal forests in 1998, and because there had been a long history of traditional fire use by people living in the pine forest where these communities are located. The communities are only two of 45 *ejidos* located within the biosphere reserve. The total population within the reserve is 25 000. Communal lands and private property comprise 95 percent of the reserve, making it important that land owners and communities are actively engaged in the reserve's management.

The pine forests in the region are dominated by *Pinus oocarpa* (known locally as *ocote*), the most widely distributed pine in Mesoamerica, ranging from central Mexico to northern Nicaragua (Photo). The pines are highly fire-adapted. Larger trees have thick protective bark and high, open canopies that allow for the dissipation of heat. Seedlings require bare mineral soil and direct sunlight: conditions that are created by fire. Saplings have the ability to resprout from the root collar if the main stem is top-killed by fire, providing an "advance regeneration" that can respond rapidly to fire-free periods. The pine forest frequently has a subcanopy of scattered fire-tolerant oaks (*Quercus*) and a diverse, flammable ground cover dominated by bunch grasses. The fire regime



RON MYERS

Pinus oocarpa forest in the La Sepultura Biosphere Reserve that is maintained through the use of fire

that maintains the ecosystem can be described as frequent, low-intensity surface fires that remove pine needle litter and above-ground portions of the grasses while doing limited damage to trees that are over one to two metres in height, as long as the fires are of low-intensity.

Steep slopes and strong prevailing winds create high-intensity flareups that kill some overstory trees and create canopy gaps that permit pine regeneration. The mean fire return interval is probably three to five years. In some portions of its range, however, the forests are fired annually, limiting the establishment of regeneration (Myers and Rodríguez-Trejo, 2009).

The rural populations throughout the range of *ocote* pine forests use fire to prepare agricultural plots, improve forage for cattle, ease travel, control pests like ticks and snakes, and facilitate hunting. These traditional uses have probably been in place for centuries, if not millennia, and they may be responsible for the characteristic structure and areal extent of the forests.

In Chiapas, a common burning practice was known as *quemadas de cuchillo*, which literally means using fire to “cut” firebreaks, usually on a ridge top. These burned strips were used to contain other fires that were set or occurred accidentally. Throughout Mexico, prior to the 1998 fires, and through 2004, the government policy and message was fire prevention and aggressive suppression, although in many areas the capacity and resources to deal with fire effectively were limited. As a consequence, fires have still been relatively common in the Chiapas pine forests, although prevention and suppression campaigns were having some impact in limiting the number of fires and the size of fires. The rural populations were also beginning to lose their traditional fire knowledge, as government fire prevention messages began to take hold.

OBJECTIVES

The La Sepultura site was selected because it is an example of a site where government land managers (CONANP) were at the forefront nationally in recognizing the important positive role that fire could play in maintaining native pine forests. At the same time, it was recognized that wildfires originating in the pine forest were adversely impacting the montane cloud forests, particularly during droughts resulting from El Niño, and that these El Niño events were expected to become more frequent and severe. Reserve staff also realized that prescribed fire could be an important tool in managing fires in the reserve, but that it would be unlikely that they would have the capacity and resources to implement a prescribed-fire regime effectively within the reserve anytime in the near future.

These circumstances led to discussions of the possibility of using the traditional fire knowledge of the *ejidos* to address fire management needs of the reserve while meeting some of the socio-economic needs of the communities.

Although the communal pine forests within the reserve buffer zone are owned by the communities, the use of forest resources is restricted because the forests are included in the reserve buffer zone. Having the communities develop and implement a fire management plan could provide a basis for sustainable forestry

and possibly ecosystem service payments that would benefit both the communities and the reserve. The project Integrated & Participatory Fire Management in Rural Communities in the La Sepultura Biosphere Reserve was funded by TNC's Global Fire Initiative and the FMCN. The project was administrated by CONANP and the NGO Espacios Naturales y Desarrollo Sostenible, AC.

The objectives of the project were to:

1. document traditional fire uses in the two target communities;
2. develop a conceptual fire-regime model illustrating the role of fire in maintaining desired ecosystem states and conditions;
3. have the two communities develop fire management objectives for their communal pine forests that would meet both their economic needs and the biodiversity objectives of the biosphere reserve;
4. have the two communities develop a fire management plan that would be implemented by the communities with assistance from government agencies (CONANP and CONAFOR);
5. monitor the ecological outcomes through the participation of university researchers;
6. stimulate interest in similar projects throughout southern Mexico; and
7. provide a practical example of appropriate fire use that would help change national and state fire management policies and approaches.

BACKGROUND

This case study is a practical demonstration of appropriate fire use in a political and scientific environment that was resistant, but becoming more receptive, to novel approaches in dealing with fire problems. Beyond the specific community-based effort, there were a broad array of other fire management activities that were occurring simultaneously in the form of scientific studies, technical evaluations, forums, workshops and training courses throughout Mexico and Mesoamerica. These activities, which made the La Sepultura demonstration project timely, included the FAO-sponsored Training Course for Instructors in CBFiM for Latin America that was held in Belize in 2005; forums, workshops, training courses and study tours sponsored by TNC; and the many CBFiM projects sponsored by the FMCN.

Prior to this project, fire use and prescribed burning had not been included in any community fire projects in the region. Although prescribed fire was not specifically prohibited by Mexican law or policy (as it is in many Latin American countries), there were no policies or legislation that specifically allowed, let alone promoted, it. The La Sepultura project provided the catalyst for a review of existing laws and policies, and stimulated similar projects and reviews not only in Mexico, but also in Guatemala and Honduras.

CASE STUDY SUMMARY

In 2004, CONANP personnel responsible for the La Sepultura Biosphere Reserve and its partners initiated the CBFiM project in the two pilot *ejidos* after they had

completed a reserve fire management diagnostic and plan (CONANP, 2004). The first year, technical meetings were held to ensure that a fire-use project was acceptable to state and federal entities who had fire management responsibilities in the area. These meetings were followed by a series of community meetings and workshops, first to engage the communities, and then to have them develop a conceptual framework and to establish objectives acceptable to both the communities and the reserve. Their participation led to the development of a community fire management plan (Photo).

The process also reinforced the community's efforts to prevent unwanted fires, particularly those that may originate in other *ejidos*, and to combat those fires when they occur.

The primary interests of the communities were in burning to improve the forage quality of understory grasses for their livestock and in reducing fuels to limit fires damaging to the forest and to their property. They were also concerned about a notable lack of the pine regeneration that is needed to sustain the forest in the long term. This lack of regeneration may be the result of excessively frequent burning that prevents the establishment of pine seedlings, but it also may be that burns tend to lack the intensity or flareups needed to create regeneration gaps in the canopy. The primary interest of the reserve staff was to implement a fire regime that would maintain the biodiversity of the pine forest, while preventing damaging fires from entering adjacent broadleaved forests.

An important component concomitant with the activities of the two communities was the assurance that reserve staff and technicians had the capacity to understand fire ecology and fire effects, and could implement safe and effective prescribed burns. Thus, a series of prescribed-fire training courses was initiated, coordinated by TNC, that were held in Mexico, Belize, Guatemala and Honduras; some key technical staff were sent to prescribed-fire training courses in the United



JOSE DOMINGO CRUZ-LOPEZ

Community members from Corazón de Valle prepare vegetation, fuel and burn-unit maps for their communal forest

States of America; and a study tour was coordinated for La Sepultura reserve staff to the pine-oak forests of Arkansas, United States of America, to observe the long-term positive effects of prescribed fire.

To ensure documentation of the project, TNC and the FMCN provided funds to a doctoral student from Colorado State University, United States of America. The student was hired to document local fire practices and the fire-related perceptions held by the two *ejidos* and the reserve managers, and to monitor fire effects, particularly the role of fire in stimulating pine regeneration (Huffman, 2010).

After the first year of the project (2005), both communities had a community integrated fire management plan that outlined their specific visions regarding the traditional use of fire needed to maintain their livelihoods, while it also incorporated the role of fire in maintaining the natural dynamics of the pine forests. These plans included outlines for specific prescribed burns to be conducted during the second and third years of the project.

The prescribed burns incorporated both traditional methods known to the older members of the community and modern prescribed-fire techniques. The Nature Conservancy donated equipment such as drip torches, back pack pumps, hand tools and safety clothing.

The communities also used prescribed-fire planning forms that were being established as the standard in Mexico, under a new draft forest-management law, and prescribed-fire rules (Norma Oficial Mexicana NOM 015) that were being developed during this period. These forms and processes were officially formalized in 2009.

In May 2006, the communities completed their first planned prescribed burns (Photo). The burns were conducted by the *ejido* members. They were assisted by personnel from CONANP, CONAFOR and the municipality of Cintalapa. The objectives of the burns were to: reduce hazardous fuels, remove vegetation to favor pine regeneration, improve the forage quality of grasses and train younger



Community members from Corazón del Valle set a backing fire during their first prescribed burn

community members in the use of prescribed fire. The day following the burns, community members assisted researchers in evaluating fire effects.

These prescribed burns were the first planned and conducted by rural communities in Mexico that had both economic livelihood and ecological objectives. They provided a valuable demonstration that set the stage for applying the planning and implementation process to other communities with pine forests or other flammable vegetation types that could be burned to prevent the spread of fire into sensitive vegetation types. In May 2007 and 2008, the communities successfully planned and implemented the prescribed burns outlined in their plans.

One of the limitations of this project was the lack of specific financial incentives for the communities to maintain the fire management programme over time, and to help pay for equipment and training. An alternative would have been to initiate the project with clear incentives related to sustainable forest use, or payments for ecosystem services or carbon sequestration. CONANP is currently in discussion with the communities about developing an incentive programme.

CONANP will continue to provide support and guidance to these two communities, but they are also applying the concepts and process to other communities in other protected natural areas in southern Mexico. The publicity that Valle del Corzo and Corazón del Valle received during the project stimulated a number of other communities to request assistance in developing their own fire-management project. Some of these communities have pine forest situations similar to La Sepultura, while others simply have problems with escaped agricultural fires that negatively impact tropical forests. The local NGO, Ambio has started a programme to provide rural farmers with the training they need to conduct safe and secure agricultural burns. As escaped fires are reduced, rural farmers receive payments as part of a carbon sequestration project.

The popularity and success of the La Sepultura project led reserve staff to produce a guide to developing CBFiM projects (Negrete-Paz, Vásquez-Vásquez, and Cruz-López, 2008), along with a brochure and poster (Figure 3), and to publicize the results through a variety of forums (Pantoja-Campa *et al.*, 2008).

Concurrent with this project, fire management in Mexico took a great step forward with the approval in 2006 of a National Strategy for Fire Protection and Fire Management. It recognized the important ecological role that fire plays in fire-dependent ecosystems and the important economic role that it plays in agriculture and rural communities. The strategy was followed in 2009 by approval of new rules (NOM 015) for the use of prescribed fire in forested ecosystems. For the first time the rules established that:

1. prescribed fire is an accepted method of managing forests, and controlled burning is accepted for agricultural purposes;
2. the federal government has the obligation to identify and produce maps of vegetation according to its response to fire, e.g. fire-dependent, fire-sensitive, and fire-independent;
3. the Ministry of the Environment (SEMARNAT) and the Ministry of Agriculture (SAGARPA) are obligated to establish a national programme to promote the new rules; and



FIGURE 3

Poster produced by the La Sepultura Project to promote CBFiM

4. appropriate agencies are obligated to develop capacity in fire use.

These policy and rule changes that recognize the ecological role and importance of fire were the direct result of the efforts of many of the people involved in funding, promoting and guiding the project at La Sepultura Biosphere Reserve. The entire process illustrates the need to address fire management problems and issues at a number of levels simultaneously in order for any one of them to be effective in the long term.

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Annex 4

CBFiM in the Tanami Desert region of central Australia

Gina Broun, Central Land Council, Alice Springs, Northern Territory, Australia
Grant Allan, Bushfires NT, Alice Springs, Northern Territory, Australia

EXECUTIVE SUMMARY

For millennia, Aboriginal people have applied fire to their country to serve a myriad of purposes. Today the indigenous people of the Tanami Desert in Central Australia continue the practice of applying fire to their land systematically and, in so doing, maintain a central strand of their culture and connection with their traditional country. While fire is a part of daily life in desert communities, in mainstream Australia it is gaining recognition as a critical tool for the maintenance and protection of biological and cultural assets.

Over the last twelve years, the Central Land Council (CLC)¹ has actively encouraged and supported Aboriginal peoples' involvement in CBFiM in the Tanami region. For the last five years, this programme has had at its core an evolving participatory process with traditional owners of the region that combines traditional and contemporary fire knowledge, practices and technologies in annual cycles of planning, implementation, monitoring and review.

INTRODUCTION

Aboriginal oral history recorded in songs and stories passed down from generation to generation over thousands of years suggests that fire was applied deliberately, systematically and broadly across much of the Australian continent prior to European colonization. This evidence is supported by the records of nineteenth-century European explorers who routinely recorded fires burning in the landscape (Jones, 1969; Griffin, 1992).

It is thought that over tens of thousands of years the biota of the Australian arid interior was modified by its inhabitants, who effectively farmed the country with fire (Latz, 2007). This "firestick farming" (Jones, 1969) has created a patchwork mosaic of postfire ages in spinifex-dominated landscapes (Burrows and Christensen, 1991), which has induced a higher level of biodiversity and

¹ The Central Land Council was established under the Aboriginal Land Rights (Northern Territory) Act 1976 with, among other functions, statutory responsibilities for Aboriginal land acquisition and land management for an area of approximately 780 000 km² in the southern half of the Northern Territory. The Council comprises 90 Aboriginal people elected from across its vast region, representing some 24 000 Aboriginal people from 15 language groups.

productivity than would otherwise have occurred. It has also protected the many areas of significant biological and cultural value from the harsh and destructive effects of intense summer wildfires, particularly along travel routes where burning activity was focused (Griffin, 1992).

Mirroring a continent-wide pattern after European colonization, however, the Aboriginal people of Central Australia were dispossessed of their traditional lands and resettled in communities run by the government or by missions. The absence of people from their lands caused a significant change in precontact fire regimes and consequently had a deleterious impact on landscape health and biodiversity.

In more recent history, Aboriginal people were discouraged from burning land returned to them, in an effort to prevent potential unintended damage to neighbouring pastoral properties and infrastructure. This attitude, which persisted for many decades and was advocated by pastoralists themselves, and by missionaries and government officials on their behalf, contributed to a further reduction of traditional burning practices among Aboriginal people who still retained traditional fire knowledge.

Belatedly today, the mainstream scientific and land-management communities have recognized the wildfire prevention and biodiversity values of traditional burning practices. Current practices aim to emulate the pre-European state of widespread fire application both to maintain connection to country and to protect the significant biological values of Central Australia. This case study describes how this goal is being achieved by Aboriginal people of the Tanami Desert, the many challenges involved in doing so successfully and the multiple benefits provided.

BACKGROUND

The Tanami Desert stretches across 260 000 km² of central Australia, 88 percent of which is within the Northern Territory (Thackway and Cresswell, 1995). It has a semi-arid climate with a northerly monsoonal influence and a highly irregular rainfall pattern. Annual precipitation is described as occurring over a north-south gradient of between 500 mm and 300 mm. This irregular rainfall pattern is mimicked in the boom and bust cycle of the Tanami's flora and fauna, which respond in dramatic fashion to large rainfall events. Fire management in the Tanami must take into account these pulses of extraordinary growth that occur in the years following above-average rainfall (Edwards *et al.*, 2008).

Vegetation in the Tanami is dominated by spinifex grasslands with a variable overstorey on infertile soils, interspersed with wooded corridors along drainage lines. Although much of the vegetation appears to be biologically homogenous, it sustains a surprisingly rich diversity of native animals. The arid and semi-arid grasslands, for example, support the world's richest variety of desert reptile fauna (Griffin, Morton and Allan, 1993). It also contains many smaller features of high biological and cultural value, which must be managed for fire, specifically.

The Tanami Desert is recognized nationally for its areas of high biodiversity and its cultural value to Aboriginal people. In this region, nine species of fauna and one of flora are currently listed as threatened at the Northern Territory or

Australian national level (Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2008). In 2007, the Northern Tanami Indigenous Protected Area (IPA)² was declared to be part of the Australian National Reserve System. The southern Tanami is currently being assessed for the same purpose, with the participation of its Aboriginal owners.

Under the legislative regime of land rights in the Northern Territory over recent decades, large areas of country were returned to Aboriginal people as Aboriginal freehold title. With the strengths inherent in this title, they are now at liberty to apply fire freely, in accordance with customary law, to serve a variety of environmental, cultural, spiritual and livelihood purposes. They also continue to use fire in their traditional economy (Vaarzon-Morel and Gabrys, 2008); a practice that remains relevant in contemporary society. Both men and women use fire on country in specific ways with specialized knowledge and skills. Fire and the absence of fire are used specifically to flush out game species or to attract them to areas of green pick. It is also used to proliferate, harvest and treat a variety of plant species which are utilized for food, medicine, tools, art, ceremonial or commercial purposes.

Until very recently, this burning has been constrained largely by the extent and condition of access tracks radiating out from communities and outstations. Given this constraint, fire management across large tracts of the Tanami Desert has continued to be characterized by frequent, uncontrolled and large wildfires.

During 2007, for example, a wildfire which burned over an eight-week period consumed a total of 80 000 km², or 38 percent of the region (Figure 1, next page), damaging important cultural, natural and infrastructure assets.

Three individual fires were started in separate areas of the Tanami Desert in 2007; over the subsequent eight-week period the fires coalesced and burned nearly 80 000km². Suppression efforts restricted the spread of the fire onto pastoral lands on the northern perimeter of the fire extent. The background map shows the pattern of the three primary land uses in the regions, with Aboriginal lands in yellow, pastoral lands in green and conservation areas in pink. The map inset indicates the area of responsibility of the Warlu Committee in the Tanami Desert of Australia.

OBJECTIVES

In response to these issues, a programme of CBFiM has been developed by the CLC together with IPA management committees, traditional owners and Aboriginal ranger groups, with support from the Northern Territory government body responsible for fire control, Bushfires NT.

The objective of this programme in the Tanami region is to emulate previous periods of active fire management progressively over extensive areas, in a way

² An IPA is an area of indigenous-owned land or sea where traditional Aboriginal owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation. In return, the government agrees to give some support to the traditional owners to carry out the land-management work required to conserve the land's ecological and cultural value.

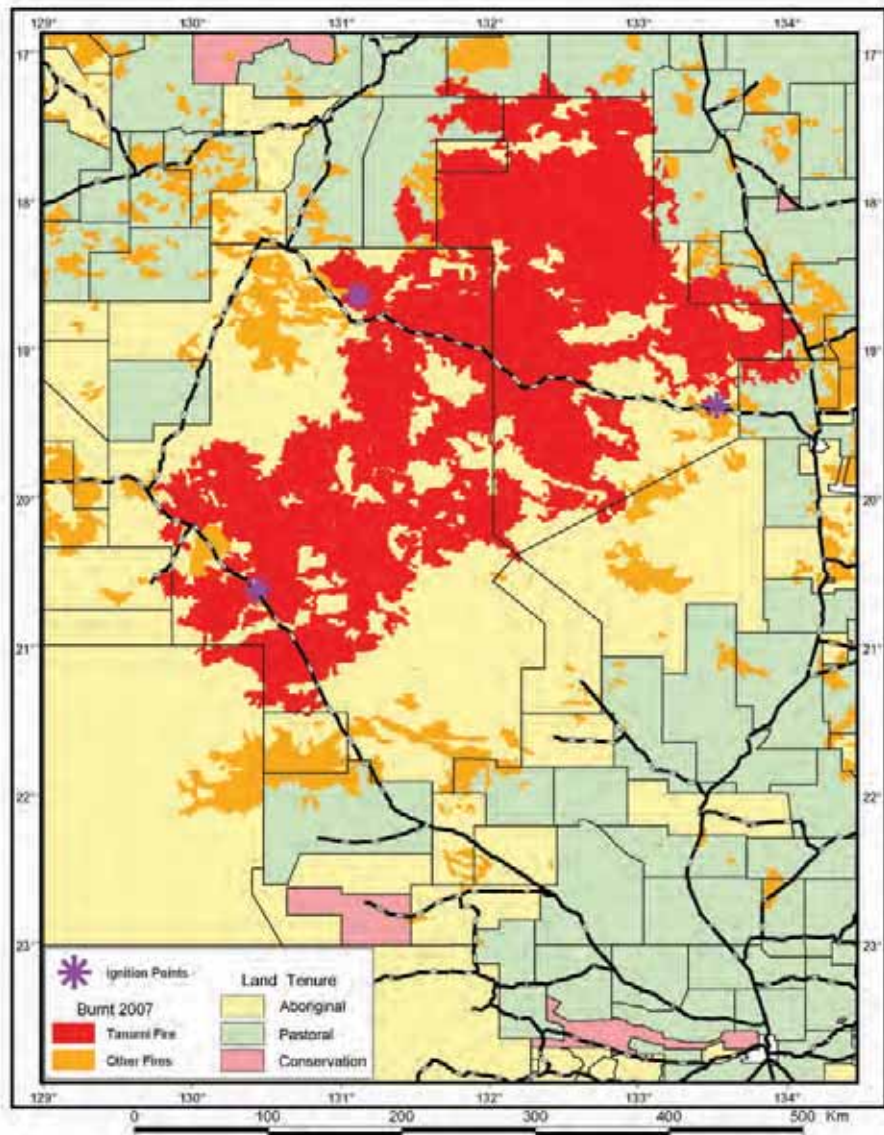


FIGURE 1
Location of Tanami Desert fires in 2007

that shifts the seasonality of fires back to a pre-European balance³ (Figure 2). It aims to make the best use of contemporary fire management tools and techniques, community governance structures and a depth of traditional knowledge, all to facilitate effective fire management by remote indigenous peoples across their lands.

The largest areas burnt per month occurred over the August to November

³ This objective has been achieved in northern Australia through the West Arnhem Land Fire Abatement project, which is funded by Conoco Phillips under a voluntary carbon market instrument (Russell-Smith, Whitehead and Cooke, 2009).

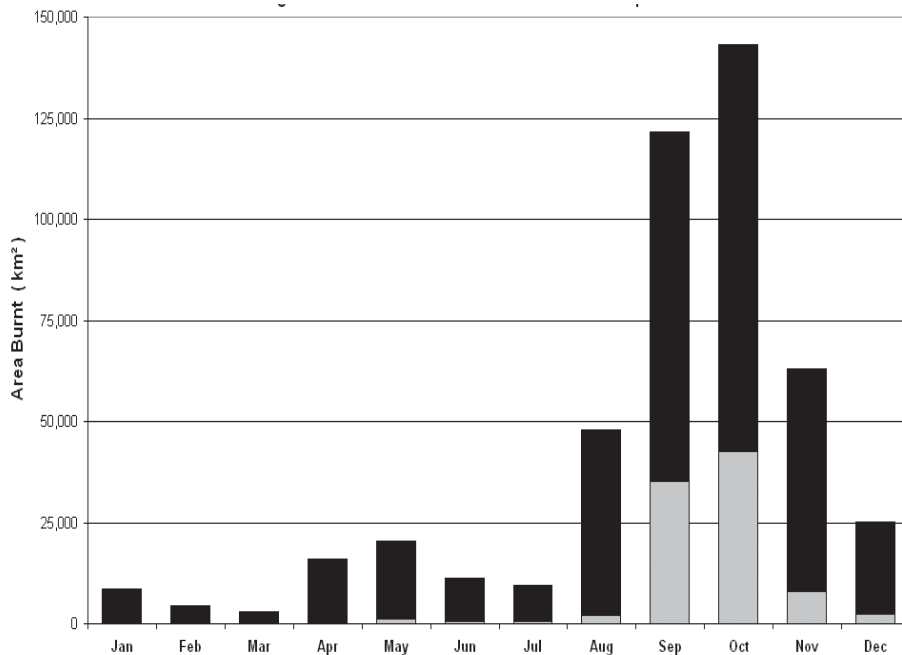


FIGURE 2.
**Total area burnt, by month, in the Warlu Committee region
 during the period of 1997 to 2009 (Derived from AVHRR satellite images)**

period; the period with the highest Fire Danger Indices. The extent of area burnt by fires in 2007 is shown in grey.

The programme promotes local ownership of fire management activities and provides an important mechanism for maintaining connection to country and culture, aspects of which are known to have tangible social and health benefits for Aboriginal people (Burgess *et al.*, 2004).

THE CBFIM APPROACH

In order to support the many components of remote fire management by Aboriginal landholders in the Tanami, a structured process of planning, implementation, monitoring and review has evolved over the last four years. This adaptive management model is integrated with IPA programmes and Aboriginal ranger group work plans to take advantage of existing governance structures, personnel and resources.

Five factors have been critical to its success:

1. the establishment and enhanced capacity of Aboriginal ranger groups in the region supported under the Working on Country programme of the former DEWHA;
2. the development of two IPAs in the northern and southern portions of the Tanami, with DEWHA funding support;
3. the establishment and resourcing of a dedicated fire management position within the Central Land Council;

4. the development of a peak Tanami Aboriginal regional fire management body, the Warlu Committee⁴, through research supported by the Natural Resource Management (NRM) Board (NT); and
5. the strong partnership approach taken by the CLC and Aboriginal traditional owners, together with the Northern Territory Government, and with Bushfires NT, in particular.

The Warlu Committee consists of two elected representatives from seven key Aboriginal communities and one or more Aboriginal rangers from each. This group provides the strategic direction for fire management on Aboriginal land across the broader Tanami region. Members also sit on IPA management committees and regional fire-planning groups, thus forming a strong link between regional and local planning processes.

Regional fire planning occurs in five key communities, where groups of 30 to 40 people meet annually to plan and prioritize fire management activities for the coming fire season. The activities under consideration are in addition to traditional burning undertaken by family groups throughout the year on their more accessible country. The ethos behind these planning meetings has been to provide the best available contemporary knowledge, tools and technology to each group, so that they can combine these assets with their traditional knowledge and skills to enable them to make informed fire management decisions. In places where IPA committees operate, fire-planning workshops are held as part of the larger IPA pre-fire-season planning meetings.

These annual planning workshops identify a selection of prescribed burning and wildfire mitigation activities that are required during the year. These activities, which may include both ground-based and aerial burning, are incorporated into the work programmes of Aboriginal ranger groups, members of which receive training by staff of the CLC and Bushfires NT. Operational costs are met primarily by the CLC, which accesses project-based grant funding from a variety of sources.

Prescribed burning and wildfire mitigation activities are undertaken as part of the larger body of work for that country, often in combined ‘country’ (cultural) fire trips. The benefits of pooling resources and combining burning activities with cultural maintenance have become very important for effective and strategic fire management practices, providing a familiar framework for traditional owners to re-engage with the broad-scale management of their country.

Similarly, land-management activities such as these are important opportunities to facilitate the intergenerational transfer of indigenous knowledge and skills on country. The older generation of Aboriginal people in this area hold the most knowledge about the impacts of fire on the landscape, about how to use it safely and about the physical barriers used to stop its unwanted spread; many of them acquired this knowledge through walking through country with their parents and grandparents. They understand how best to use fire to keep their land and people

4 “Warlu” means “fire” in Warlpiri, the largest language group of the Tanami.

BOX

Cultural value of the Tanami Desert

"The cultural importance to Aboriginal People of the (Tanami) stems from the inherent connection that exists between the physical landscape and Aboriginal culture. This connection can be thought of in two ways. Firstly, the land is of cultural significance because of the traditional activities that continue to be carried out on it such as gathering bush tucker, hunting, and practicing ceremony. However the primary cultural import stems from the belief that all of the land is imbued with cultural significance through the actions of the dreamtime ancestors. Aboriginal people in the region refer to this period as Jukurrpa, or 'the dreamtime' or 'dreamings'

Jukurrpa is a term that refers to the creative period when Spirit Ancestors travelled the country. These Spirit Ancestors, often called dreamings, were creative beings who rose up from the earth or travelled from distant places, and created and/or changed geographical features and placed different plants and animals on the earth. At some point in time, most of the Spirit Ancestors changed into a number of forms. Some became life forms or phenomena, such as certain species of plants and animals, celestial bodies, winds and rain. Others transformed themselves into rocks, trees and water courses, and their power became localised at certain sites. These sites are the "sacred sites" that are scattered throughout the Tanami.



Traditional owner Henry Cook visiting his family's sacred sites in the northern Tanami as part of the fire management programme

In addition to the localities which mark places where Spirit Ancestors ended their journeys or left items of importance, all land is criss-crossed with the tracks or paths of Spirit Ancestors. These tracks are marked with places where the Spirit Ancestors danced, ate, fought, slept... and so on. Regarded as repositories of power and the consciousness of the Spirit Ancestors, these places are also referred to as sacred sites... . Examples of some of the more extensive dreaming tracks are Ngapa (rain) and Wampana (hare wallaby).

Thus the country... while being a physical landscape is also a cultural landscape or a network of meaning. It is through interaction with this cultural landscape that (Aboriginal people)... derive cultural significance."

Extract from DRAFT Northern Tanami Indigenous Protected Area Plan of Management

Source: Central Land Council Land Management Section (2006)



Traditional owner Myra Nungarrayi Herbert burning around significant wetland areas on her country

healthy. They value the opportunities with which land management presents them to be on country with their young people, to teach them about fire and to impart other important cultural knowledge.

In recent years, Aboriginal people of the Tanami have also assumed an additional measure of responsibility in caring for specific populations of animals and plants of considerable cultural significance to them, which have become seriously threatened since European colonization. As part of their regular burning activities, Aboriginal rangers throughout the Tanami undertake protective burning around remnant populations of species such as the Greater Bilby (*Macrotis lagotis*) and Great Desert Skink (*Egernia kintorei*) to ensure their survival and local prosperity.

Protecting remote infrastructure has also become a focus of fire management activities. There are a number of very remote family-based living areas within the Tanami (known as “outstations”) constructed with basic services to enable the occupation of remote lands by family groups with traditional responsibilities for those areas. These basic facilities are highly valued by Aboriginal people and so become a focus of annual fire-prevention activities.

However, ground-based burning activities alone have not been sufficient to reach the scale of prescribed burning necessary to induce the desired patchwork mosaic of fuel types. In a sparsely-populated region with few access tracks, aerial burning offers one of the very few means of managing natural and cultural assets at the landscape scale. Proposals from the government for aerial burning of Aboriginal land were generally opposed by traditional owners in many areas throughout the 1980s and 1990s, particularly in the prevailing circumstances of the

time when they were not supported participants, and sites of cultural significance were considered to be at risk. Many senior Aboriginal people whose land had been returned to them recently also sought the opportunity that ground-based burning provided to access remote areas from which they had long been absent. However, through increased participation in aerial surveillance and the use of helicopters for remote placement on country, aerial burning has received greater acceptance by traditional owners in recent years and is rapidly gaining recognition within Central Australia as a critical factor in efforts to slow biodiversity decline.

In 2009, Myra Nungarrayi Herbert, a traditional owner in the central Tanami, directed the first aerial-burning activity on Aboriginal land by Aboriginal people in Central Australia (Photo). Since then, this technique has been tried by traditional owners on inaccessible lands in the southern, northern and eastern Tanami. It has been well received, and traditional owners have requested that aerial burning be used on their country on an ongoing basis.

With increased burning activity comes increased risk to neighbouring tenures, so risk-management strategies now form part of standard fire management in the Tanami. Through self-determined governance structures established by IPAs and Aboriginal ranger groups, cooperative fire management initiatives between Aboriginal people and their neighbours are developing to minimize the risk of fire causing damage across tenure borders.

The results of burning activities are monitored through the acquisition and interpretation of satellite images as the burning season progresses, by the use of 'hotspot' fire-tracking websites, and through repeat visitations to burnt country. Satellite imagery is used to identify fire scars and areas of high fuel loads, and this information is then used to refine subsequent burning activities. Also, websites such as the North Australian Fire Information service⁵ prove invaluable in monitoring the active spread of fires in remote areas.

After the burning season has ended, the results of the year's activity are reviewed at an annual post-fire-season meeting of the Warlu Committee. At the annual meeting, Aboriginal rangers and members from across the Tanami discuss the fire-related work they have done throughout the year, where they have had successes and where challenges need to be resolved. The committee provides these groups with feedback and guidance on the following year's strategies and on how the different groups can work together most strategically.

This system of planning, implementation, monitoring and review enjoys a high level of participation because it provides Aboriginal people with the opportunity to make decisions about their lands and to work on their own country. More importantly, by using a participatory approach Aboriginal people are able to influence the future of their culture and their children (Walsh and Mitchell, 2002).

In the past, fire management programmes have met with only limited success in Central Australia, in large part because of the area's vastness, a poor level of engagement with indigenous landholders by relevant authorities and a scarcity of resources available to implement management on this scale (Griffin, 1992).

5 The North Australian Fire Information service is available at www.firenorth.org.au/nafi2/.

However, this new programme has a greater potential for success as a result of new partnerships based on: mutual recognition of the role of fire in maintaining biodiversity and its cultural significance to Aboriginal people; the ability to leverage limited funding; and the level of community ownership and participation. To ensure longevity, there remains an ongoing need to continue the development of capacity among local people to take more prominent roles in facilitating the fire management programme across the country in which they live.

Other challenges occur at a policy level where the discord between indigenous and mainstream fire management practices continues to be evident (Vaarzon-Morel and Gabrys, 2008). Government policies that encourage traditional burning (Bird, Bird and Parker, 2003) and that recognize the nationally significant environmental service it provides would help to reconcile this situation, as would formal recognition of the role of groups such as the Warlu Committee.

Another significant issue for this programme is the need to resource its operational aspects adequately, in particular, the costly activities of aerial burning and access track construction. These techniques are required both to meet the threshold needed to return fire regimes to a broad-scale traditional patchwork mosaic and to minimize risk. In the future, a GHG market, or a market based on other green and social services, may provide an economy that will fund fire jobs on country and will meet the operational costs of CBFiM in the Tanami Desert.

There is also a need to fund and support research on the specific long-term biological impacts and benefits of changed fire regimes on different ecotypes in knowledge-poor bioregions. The first and most basic aspect is for fine-scale fire history and vegetation mapping across Central Australia.

Similarly, programme participants are still learning how to apply fire on a broad scale to a highly flammable landscape that houses vulnerable 'islands' of ecological and cultural significance in contemporary Australia. The ability to manage the risks associated with applying fire at this scale will require increased collaboration with neighbours and so will provide more opportunities and benefits extending well beyond fire management.

Another challenge involves tailoring the format of review and planning workshops, as well as the language of fire, tools and techniques, to suit the several dominant indigenous language groups in the region. As programme facilitators, we aim to understand better and further benefit from the wealth of traditional fire and country knowledge held by traditional owners. In return, contemporary burning activities themselves will seek to serve better the aspirations of traditional owners for their country and their families, in particular, by making a significant contribution to the transfer of traditional knowledge to future generations of indigenous managers of the Tanami landscape.

CONCLUSIONS

The evolving model of CBFiM in the Tanami Desert has seen tangible benefits to the country and its people. Key benefits seen so far include:

- well-resourced and informed ranger groups involved in all aspects of the programme;
- increasing levels of active participation and ownership by traditional owners;
- improved relationships with neighbours of Aboriginal Land Trusts;
- protection of cultural and environmental values, and value of assets such as buildings;
- reinvigorated connection of people with their remote country;
- increased opportunities for intergenerational knowledge transfer;
- improved relationships between traditional owners and government fire authorities; and
- improved access by Aboriginal people to technical expertise.

While there are significant challenges to ensuring the programme's longevity, not the least of which is the security of operational funding, the system that has been developed is well-integrated, well-supported and, most importantly, is beneficial to the lives of its participants.

As the Tanami model develops, it will need to be evaluated and refined continually to ensure that it delivers optimal cultural, social and environmental benefits. If this approach continues to be successful and builds momentum and support, Aboriginal people in other parts of central Australia may well move to adopt a similar model in the future.

ACKNOWLEDGEMENTS

Aboriginal people from the Tanami are the true owners, drivers and participants of this programme. Their feedback and encouragement is integral to its success and longevity.

Without the support of many individuals from the CLC staff, in particular, the Wulain, Muru-Warinyi Ankuul and Warlpiri Aboriginal ranger groups and the IPA staff and committees, none of this would be possible.

We are indebted to Mr. Peter Latz for his depth of knowledge, his encouragement and his infallible zest to improve fire management in Central Australia.

We wish to thank the indigenous people of the Tanami who have taught us about fire in the desert and the ways of their culture.

In particular, our heartfelt appreciation goes out to the men and women of the Warlu Committee who continue to guide CLC's fire management programme as we learn new ways together.

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Annex 5

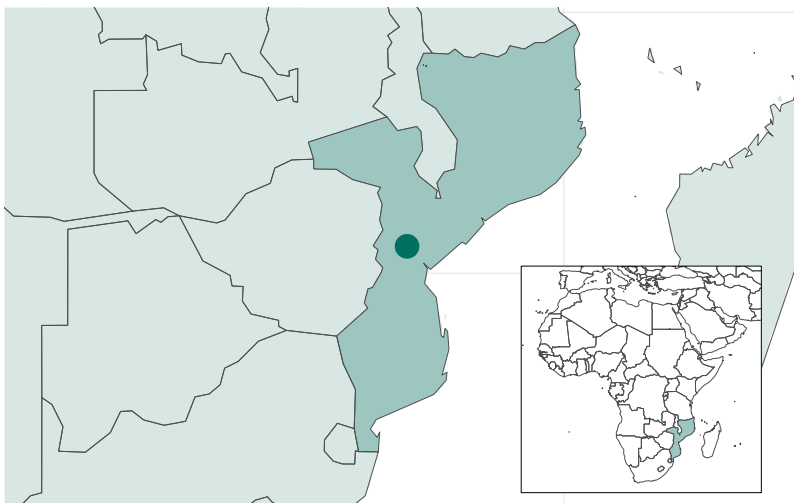
The Sofala Community Carbon Project – Gorongosa National Park

Darren Johnson, Forest Ecosystem Services LLC, Hinesburg, Vermont, United States of America

Casey Ryan, University of Edinburgh, United Kingdom

Lucy Goodman, Envirotrade, United Kingdom

Envirotrade is a company based in the United Kingdom that joined with the European Commission, the University of Edinburgh and the Edinburgh Centre for Carbon Management to pilot a poverty alleviation model in the buffer zone of the Gorongosa National Park in central Mozambique. The buffer zone is not on park land, but is owned and managed by the communities around the park. The project is managed with technical support from the University of Edinburgh, using the Plan Vivo methodology for developing and managing community-based land-use projects with long-term carbon, livelihood and ecosystem benefits developed by the non-profit organization BioClimate Research and Development. Plan Vivo is a set of standards, processes and tools that is used to develop and register payments for projects in developing countries; it allows for income generation via carbon credits of land use, land-use change and forestry activities implemented by local farmers or communities.



FIGURE

Location of the Sofala Community Carbon Project in central Mozambique.

A focus on land-use change in the buffer zone of the protected area has resulted in reduced pressure on threatened natural resources within the park. The project works closely with communities to rehabilitate the forests on their land and to introduce new, sustainable farming practices, such as agroforestry and the planting of nitrogen-fixing crops. These new practices have had a dramatic effect on the yields of cash crops such as cashews and fruits, and have begun to provide healthy livelihoods for close to 1 700 farmers. To date, the project has enabled the rehabilitation and management of approximately 10 000 hectares of community forest.

Verified Emission Reductions produced for sale to date is 1 106 044 tonnes of carbon dioxide equivalent (tCO₂e). Of this amount, 310 039 tCO₂e are from agroforestry (calculated *ex ante*) and 796 005 tCO₂e from forestry, resulting in revenues of over US\$ 1 million. In order to maintain compliance and transparency, all carbon transactions have been conducted to Plan Vivo standards, with inspections and audits carried out by third parties. The trust fund is audited by a local auditor, and finances relating to the European Union (EU) involvement have been audited independently by the University of Edinburgh's auditors. Sales revenues from carbon credits are returned to the local community through payment for ecosystem services, inputs into the trust fund or generation of local employment. Additional funding was provided originally by the EU and by one of the company's founders for the project's start-up costs.

Fire management is a component of the project. Annual burning of the bush by communities was one of the significant threats to the forest resources in the project area. There appears to be a long history of burning by local inhabitants of the Miombo woodlands that dominate the buffer zones surrounding and adjacent to Gorongosa National Park. These woodlands are generally characterized by an open canopy with an understory of grasses, making this area a potentially fire-prone ecosystem. Communities in and around the park continue to use fire to achieve a number of objectives. These objectives include: the use of fire to reduce hazardous fuels that build up over the course of the growing season; traditional beekeeping; the herding of wild animals as a hunting tactic; and the burning of grass for improved grazing for domesticated animals, such as goats, and to attract game. Fire is most commonly used to clear semi-permanent farmland plots. These small plots, or *mashambas*, are generally between one and two hectares and are typically farmed for up to 15 years before being allowed to go fallow. The crop stubble in these plots is burned after each harvest in preparation for the planting of the next crop. The burning of stubble is an effective means of reducing insect infestation and providing short term soil nutrient inputs.

Fire is typically used by communities during the early part of the winter's dry season (April through June). Through generations of experience, the community members have determined that this time of year is safest for burning. Later in the winter (July through October), it is drier and there are more fuels available, increasing the likelihood of escaped fires. Early patchy burning is used to maximize ecosystem services, to avoid potentially destructive late-season fires and

to stimulate natural regeneration. Reforestation through natural regeneration is thereby promoted.

Incentives for responsible fire use by local community members include well-established and officially documented land ownership based on traditional tribal boundaries. As well, payments are made for carbon credits, with a set of indicators in place. If the indicators are breached, the result in carbon credits are not issued to the project.

Envirotrade has supported NRM Committees that develop and coordinate fire management training for local community members. The training includes the preparation of a prescribed-burning plan and readiness for fire-suppression activities in the project area. Locals often need very little fire management training because of their experience and comprehensive understanding of fire behaviour in the Miombo woodland ecosystem. Fire and its management are closely tied to the communities that have traditionally inhabited the landscape and therefore are considered in the project activities. The fire management approach taken by the project includes fire-awareness education and training for project personnel, community members and firefighters; and providing fire-fighting equipment. In particular, fire education is recognized as being an effective way to increase the involvement of community members in fire management planning, plan implementation and awareness-raising of existing fire-related laws and policies. Prefire season training is required every year for those groups directly involved in fire management activities. Individuals are selected from the among the project workforce and community land managers to receive more advanced fire training, in addition to the annual prefire season training.

The forest management plan includes a detailed fire management component. The plan was developed along with input from members of two communities (Chicale and Mucombeze) located within the Gorongosa project site. The plan, developed through participatory approaches, is based on local needs and capabilities. To underpin effective fire management within the project sites, several studies have been conducted on the impact of fire on the Miombo woodlands that dominate the park buffer zones.

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COMMUNITY-BASED FIRE MANAGEMENT

A review

This publication is based on the experiences of FAO and partners in community-based fire management (CBFiM). The concept of CBFiM emphasizes the importance of local communities in policy development and fire management practices.

Several case studies from Australia, Mexico and the United States of America highlight the importance of community access to land and natural resources, particularly in relation to fire-management decision-making. The publication emphasizes the need to include CBFiM in the planning and implementation of projects for Reducing Emissions from Deforestation and Forest Degradation (REDD). A case study from Mozambique shows how CBFiM can generate income via carbon credits.

The publication defines current limiting factors of implementation while underlining the importance of effective partnerships within and outside the communities. It concludes with a call to continue the development of tools and resources to assist CBFiM practitioners with their implementation of CBFiM.

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