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    Eucalyptus plantation in Congo by Takeshi Toma, CIFOR, Indonesia

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Large picture:

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Communities in flames: proceedings of an international conference on community involvement in fire management

Edited by

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Foreword

Decentralisation and devolution are dominant concepts in contemporary discussions on natural resource policy and management throughout the world. In forestry, decentralised governance and granting greater decision-making authority to local people has a long history. Recently, innovative and progressive policies and legislation have strengthened and formalised what in many locations were previously informal institutional arrangements for managing local forests.

There are several factors driving these trends toward increased participation of local stakeholders in forestry. In some cases, greater decentralisation and devolution is arising from a realization that central governments often lack the capacity to manage forests effectively. In many places, governments are themselves advocates of increased partnership with local people, recognising that their own forest management resources are inadequate. In other areas, local stakeholders are simply asserting their roles more aggressively than in the past. In nearly all instances, when local people are given a meaningful stake in forest management decision-making, there is a demonstrated improvement in the way forest resources are managed.

As global concern over the fate of the world's forests has grown generally, so too has specific concern over the frequency and intensity of forest fires, which have increased dramatically as a result of human activities in recent years. The major forest fires of 1997 and 1998 in Asia and elsewhere around the globe inflicted enormous ecological damage and human suffering. A positive result, however, has been an awakening of world attention to the challenges of fire management in the modern era. To some, the massive fires of the 1990s were viewed not just as a local emergency, but rather as a human-induced planetary disaster that should never to be allowed to occur again.

Since the widespread fires of the late 1990s, numerous agencies and organizations have supported various fire prevention, suppression and management initiatives. These efforts have indicated that no single actor, whether government or civil society, can independently solve the serious social, economic and ecological challenges associated with uncontrolled forest fires. Importantly, it is now increasingly recognized that, in many countries, local communities can play significant positive roles in fire management, particularly when working in close collaboration with formal forest and fire management authorities.

In developing appropriate community-based forest fire management systems, much can be learned from the lessons gained in decentralising and devolving forest management. Nevertheless, important differences between managing fires and managing forests exist, and care must be taken in adopting institutional arrangements, approaches, tools and methods designed for different purposes.

Information on involving communities in fire management is still scarce, widely scattered and only slowly emerging. The *Communities in flames* proceedings provides long-awaited and first-hand insights into community-based forest fire management. The strength of the publication lies in the diversity of the contributions and the recognition that the role that communities can play is not overstated. Other stakeholders, including the government and the private sector, must also play a substantial role in forest fire management.

We hope that this publication will prove useful to those responsible for formulating and implementing fire management policies and programs in better understanding the key issues and challenges of involving local people as effective partners in managing forest fires.

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Preface

Large-scale fires throughout the world in recent times have demonstrated the social, economic and ecological costs of uncontrolled fires and have received unprecedented coverage in the international media. To combat the negative impacts, national and international agencies have called for improvement in controlling forest fires.

Unfortunately, government responses to forest fires have tended to focus on suppression and costly technological solutions to fight fires. Contrary to alleviating forest fire problems, they have often increased the scale and magnitude of forest fires, and ignored the positive dimensions of fire including the social and ecological benefits of smaller, prescribed burns. These conventional measures are increasingly being questioned as the number of forest fires increases.

In addition, decreasing governmental budgets to sustain suppression management regimes have led many agencies to explore more proactive approaches in combating fires before they occur. Over the last decade, there have been calls to revisit traditional forest fire management regimes, which emphasise prescribed burning and prevention. These have been seen as more effective in tempering unwanted fires, more beneficial to local ecosystems and less costly in the long term.

In December 2000, Project FireFight South East Asia and the Regional Community Forestry Training Center (RECOFTC) organized a regional workshop on community-based fire management (CBFiM). The workshop concluded that successful CBFiM strategies and experiences should be shared with government agencies to combat the persistent paradigm that suppression and enforcement are the only effective ways to manage fires.

The *Communities in flames* conference was organized to serve that purpose. The objectives of conference were to:

♦ expose forestry departments/fire control agencies to alternative approaches to forest fire management, which promote the participation of local communities in planning, and managing their own forest fires regimes (within the context of past/traditional practices and their socio-economic needs of local communities);

♦ examine the approaches and elements for promoting these alternatives to civil society (including identifying fire research needs, forest policy amendments, legal and regulatory structures and appropriate strategies for socialising CBFiM); and

♦ collect examples of the approaches taken by communities worldwide to manage and use their fires as a resource, and to further clarify and analyse the potential to capture the opportunities which these alternatives have to offer.

These objectives were pursued through the presentation and discussion of high-quality case studies and analytical papers from around the world. The conference was targeted to present a synthesis of lessons learned from CBFiM and its benefits in mitigating fires. Among the 120 participants were individuals and representatives of organizations that have extensive knowledge and experience of CBFiM, including a strong local non-governmental organizational presence. Representatives from forestry departments and other governmental agencies involved with land-use planning, disaster management and fire control also participated in large numbers. Academics and researchers, directly or indirectly involved in fire management-related issues such as land-use planning, shifting cultivation and air quality, were also active participants.

Acknowledgements

Abbreviations

BMG	Badan Meteorologi dan Geofisika
BPS	Badan Pusat Statistik
CBFFM	Community-based Forest Fire Management
CBFiM	Community-based Fire Management
CIFOR	Center for International Forestry Research
CVA	Capacity and Vulnerability Analysis
DEPHUT	Departemen Kehutanan
DoF	Directorate of Forestry (Namibia)
ENSO	El Niño Southern Oscillation
FFPMP	Forest Fire Prevention Management Project
FMUs	Fire Management Units
FPAs	Fire Protection Associations
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Safe Council
GEF	Global Environment Facility
GFMC	Global Fire Monitoring Center
GGFP	Gambian-German Forestry Project
GIS	Geographic Information System
GPS	Geographic Positioning System
GTZ	German Agency for Technical Co-operation
HLS	Household livelihood security
HPH	Hak Penguasaan Hutan
HTI	Hutan Tanaman Industri
ICRAF	International Centre for Research in Agroforestry
IFM	Integrated Fire Management
IFFM	Integrated Forest Fire Management
IGB	Integrated green belt
ITCs	Information and Training Centres
IUCN	The World Conservation Union
JFM	Joint Forest Management
Kanitab	Kader Tani Menetap
KBDI	Keetch Byram Drought Index
KWNP	Kiang West National Park
MPTS	Multipurpose tree species
NFFP	Namibia-Finland Forestry Program
NFTs	Nitrogen-fixing tree species
NGOs	Non-governmental organizations
NOAA	National Oceanic Atmosphere Administration
NTFPs	Non-timber forest products
PCA	Participatory Communication Approaches
PLA	Participatory Learning and Action
PMDH	Pembangunan Masyarakat Desa Hutan

PULK	Pertanian Usaha Lahan Kering
R	Rand
RECOFTC	Regional Community Forestry Training Center
RFD	Royal Forest Department (Thailand)
RMT	Rangeland Management Team
Rp	Rupiah
RT	Rukun tetangga
SA	South Africa
SALT	Sloping Agricultural Land Technology
SOPs	Standard Operating Procedures
TAC	Technical Advisory Committee
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USFS	United States Department of Agriculture Forest Service
VFDs	Volunteer Fire Departments
VFFPC	Village Forest Fire Prevention Committee
WWF	World Wide Fund for Nature

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Living with fire: summary of *Communities in flames* international conference

David Ganz and Peter Moore

1. Introduction

Disturbance is present in all natural ecosystems, and management of forests must take into account the chance of natural disturbance by a variety of agents, including fire induced by humans. Fire is a ubiquitous disturbance factor in both space and time, and it cannot be ignored. However, not all fire is harmful. In some cases, fire is essential for forest regeneration; in others it destroys forests and has serious adverse social and economic consequences. It is important to differentiate between harmful and beneficial fires. At the same time, it is important to recognise that most fires are neither entirely good nor entirely bad.

Local communities are often blamed for harmful forest fires, whether they have started these fires or not. Consequently, fire and forest management institutions tend to perceive local communities as the problem rather than as part of the solution. Since local people have the most to lose in the event of a harmful fire, they should clearly be involved in mitigating unwanted forest fires. Papers presented at the recently convened international conference, *Communities in flames,* highlighted that local communities can and do manage fires in many situations and for many different reasons. The conference provided insights into what kinds of community-based fire management (CBFiM) are being practiced around the world. It also presented the challenges and opportunities for CBFiM, the potential catalysts for it to reach the ground, and the necessary next steps for promoting CBFiM on national and regional scales.

A major issue addressed during the conference was the importance of land/resource tenure security and incentives for successful CBFiM. The consensus was that incentives need to focus on people and organizational structures rather than on equipment or legal constructs. Another insight was that communities cannot provide the complete solution in dealing with harmful forest fires. Communities have a role to play, but should not shoulder the entire burden for fighting fires. Respect for communities and their involvement in fire management was identified as a crucial factor in establishing a balanced approach to forest fires.

Communities in flames was a first step in collecting examples of CBFiM and raising awareness of this issue. The attendance of over 120 people from 21 countries, and the discussion and contributions they provided, were strong endorsements of the view that communities can and do play an important role in the management of fires. There was significant diversity represented in the various community-based approaches presented. For CBFiM to progress, it must embrace this diversity and draw out similarities from the different community situations in which it is found. To better characterise CBFiM, it is clear that further understanding is needed. This paper summarises the reports presented at the international conference, provides an overview of CBFiM, and elaborates the key issues related to CBFiM.

2. Background

Recent large-scale fires throughout the world have demonstrated the high social, economic and ecological costs of uncontrolled fires. Unfortunately, government responses to forest fires have tended to focus on suppression and costly technological solutions to fight fires. Contrary to alleviating the problems, these solutions have often increased the scale and magnitude of forest fires. Furthermore, they have largely ignored the human dimensions of fire and the positive social and ecological benefits of smaller prescribed and managed fires. As the number of forest fires appeared to increase, conventional suppression measures have increasingly come under question. Thus, many agencies have started to explore more proactive approaches in combating fires, including more effective prevention activities. The search for improved approaches has led to calls for revisiting traditional forest fire management regimes that emphasise prescribed burning

and prevention. Many of these systems and approaches are seen to be more effective in tempering uncontrolled burns, more beneficial to local ecosystems and more cost efficient in the long term.

Analysis of the role of indigenous use of fire in forest management and conservation conducted in 1998 indicated that relevant, high quality information (published or unpublished) on community involvement in fire management was rare (Jackson and Moore, 1998). Moreover, the authors were surprised that many of the participants at an international workshop where the results were presented argued that communities did not have any role to play in managing forest fires, and were in fact considered only in negative terms as igniters of fires.

In response to these findings, Project FireFight South East Asia and the Regional Community Forestry Training Center (RECOFTC) sought to outline the information available and assess the interest in CBFiM. In December 2000, the two organizations began a dialogue on CBFiM by holding a regional workshop in Bangkok, Thailand. The workshop suggested two parallel strategies:

> First of all, it is still clear that more examples of successful CBFiM are needed
> from in and around the region to combat the dominant paradigm that suppression,
> prevention and enforcement are the only effective ways to manage fire. The
> second and parallel strategy is awareness raising that is necessary and critical to
> give CBFiM credibility in the eyes of scientists, development workers,
> government officers, policymakers and civil society (Ganz *et al*., 2001).

Due to the widespread interest in the Bangkok workshop and its report, Project FireFight and RECOFTC sought a larger audience to address these two parallel strategies. The result was *Communities in flames: an international conference on community involvement in fire management*, convened 25-28 July 2001, in Balikpapan, Indonesia. The conference was organized by Project FireFight in close collaboration with the Ministry of Forestry of Indonesia, the Food and Agriculture Organization of the United Nations (FAO), and the German Agency for Technical Co-operation (GTZ)-supported Integrated Forest Fire Management Project.

The *Community in flames* conference focused on highlighting successful CBFiM strategies, in part to combat the persistent perception that suppression and enforcement are the only effective ways to manage fire. To promote greater awareness of actual experiences, plenary and working groups were used to examine the approaches and elements of successful CBFiM (including identifying fire research needs, forest policy reforms, legal and regulatory restructuring and appropriate strategies for socialising CBFiM). The conference further sought to identify opportunities for further collaboration.

3. Key points from the conference

The development and implementation of fire management strategies need to include evaluation of how, when and why local communities use and manage forest fires. In this conference, examples of fire prevention and suppression were contrasted with beneficial uses of managed fires for controlling weeds, reducing the impact of pests and diseases, and generating income from non-timber forest products (NTFPs). The impacts of fires on forests, positive or negative, depend on the fire regime that is suitable for the ecology of the forest type under management. People who live in localities where fires burn will often know the local conditions and many of the components of this fire regime.

In the *Communities in flames* conference, examples were given of how local people can and do apply this traditional knowledge when they use and manage fires. The key points of the conference are summarised below to stimulate discussions on defining the context of communities, their role in fire management, and the mechanisms that will be needed to facilitate their inclusion in national fire management policies.

3.1. Communities have a role

Communities can play a significant role in fire management, especially in most parts of the world where human-based ignitions are the primary source of fires. Fire is not something that can be excluded from people's daily lives and in many cases not from the ecology of landscapes. Communities use fire to cultivate crops and NTFPs, hunt, create forage, and manage pests and diseases. They also play a significant role in preventing and suppressing harmful fires that have a detrimental impact on their lives. An example from Thailand (Box 1) is one of many in which local communities have taken action to protect resources not only within their vicinity but also resources valuable to their country. Many cases exist in remote locations where the government's fire control/suppression approaches would not be as successful in protecting the forest resource.

Box 1: Communal resource protection – an example from Thailand

Villagers from the Mae Khan watershed had been using fire in a traditional cultivation system. In the early 1990s, fire started to become a problem, spreading from one village to another and potentially into valuable forested catchment areas. Communities came together to form a collaborative fire protection network around their forested areas. Today the villages have a co-ordinated system to protect the Mae Khan watershed.

Communities cannot do everything, however. The activities and knowledge communities generally practice are primarily those associated with prevention. They include planning and supervision of activities, joint action for prescribed fire and fire monitoring and response, applying sanctions, and providing support to individuals to enhance their fire management tasks. It is not fair or feasible to expect communities to go far beyond their activities to be involved in large-scale fire suppression, for example. This task requires significant resources to be organized, often for substantial periods of time each year. Communities can be an important, perhaps pivotal, component, but should not be expected to shoulder the entire burden for fighting fires.

3.2. Sense of ownership

There are several different ways for communities to participate in fire management. This involvement can be started, stimulated and supported using a variety of social or economic incentives. *Communities in flames* identified many ways in which communities have taken action in forest fire management, ranging from simply providing labour to active decision-making. Although all such inputs are credible, truly sustainable community action depends on having a meaningful role in decision-making and priority setting.

A case from Indonesia described the use of monetary incentives for getting community members to extinguish coal fires threatening a protected area. This was an example of community involvement in managing fire in forests in which they have no "sense of ownership" and where they had not started the fires. It was unclear whether once the development project left, community action would continue. In contrast, a case from The Gambia presented self-initiated action for preventing and suppressing fires where there was a sense of ownership. Similarly, a case from Viet Nam demonstrated the effectiveness of the land allocation programme in reducing the number of fires. Both examples demonstrate the importance of land/resource tenure security and incentives. In general, when communities have this "sense of ownership", they are more inclined to take interest and action in the management of fire.

This "sense of ownership" was a key concept identified at the *Community in flames* conference. It stems from recognising that people have been "mobilised" where they had a *sense* of ownership. It is important to note that this *sense* does not automatically include legal or formal

ownership and does not only apply purely to land or tenure security. In some areas of the United States, Germany, New Zealand and Australia, land ownership and resource access rights do not directly result in a "sense of ownership" of the fire management issue. In one case from California, community concerns about fire management were ignored by state and federal government agencies until the community took collective action to demonstrate their "sense of ownership" of public lands. The comfort and ability to make decisions about fire and its management is often based in this concept of "sense of ownership". Conversely, the absence of this *sense* or the destruction of it through circumstance or third party action may eliminate local people's interest and motivation to be involved in fire management.

The existence of incentives is a factor that appears to be intimately associated with this "sense of ownership". The provision of some sort of benefit, formally or traditionally, appears to be a key element in the active participation of communities in management of fires. Some incentives are short term and costly, but necessary. Others may be longer term and lower cost, but also very worthwhile. A closer analysis of these incentives and their outputs is necessary. It was clear that incentives in Africa and Asia have some similarities in design, but are different in terms of outputs and relative levels of success.

In the past, cases of CBFiM have been assessed as successful by only a segment of society. "For whom is CBFiM successful?" is an important question that emerged during the keynote addresses (Box 2) and numerous other times at the conference. The benefits may also be short term in nature and highly specific. Benefits may accrue to only a segment of the community. Or, they may be beneficial to the community, but not to stakeholders outside the community. There is a clear need to be explicit about who benefits and how impacts accrue. In most cases, the users of fire benefit while others (e.g. urban dwellers, transport and tourism industry) perceive fire to be largely negative. It will be necessary to fully assess community needs and uses of fire as well as the appropriate conditions and strategies for CBFiM success. In these aspects, it is important to clearly understand what is meant by "community" and "community-based" approach.

Box 2: Keynote addresses

William Jackson (Global Co-ordinator, The World Conservation Union [IUCN]'s Forest Conservation Program) introduced the premise that community participation is not just labour supporting fire prevention and suppression but is rather local people managing fire in terms of their own needs.

Somsak Sukwong (Executive Director, RECOFTC) stated that the success of community-based fire management should be measured on the basis of its appropriateness for meeting the community's needs and management objectives.

3.3. Context of "community" and "community-based" within CBFiM

There is a large body of knowledge on, and examination of, the definition of communities and community-based approaches in other fields such as anthropology, community-based forest management and other disciplines of the social sciences. This material should be considered and incorporated in the evolution of an understanding of communities in the context of fire. Indeed, many of the lessons learned from community involvement in forest management are directly relevant to CBFiM and it would be wise for advocates to recognise this and avoid re-discovering and duplicating existing information and understanding. CBFiM proponents maintain that there are potential and important linkages among CBFiM, land-use planning, natural resource management and overall community development processes. CBFiM cannot function independently from these other processes.

The context of communities is central. Brazil, Indonesia and, to a lesser extent, the Congo Basin can be identified as "frontier" situations where rapid change and development are taking place and natural resources are being heavily used. In time, the change processes will slow down for various reasons and conditions should stabilise. At present, the rapid and profound change is a major influence. Conversely, the circumstances in Mongolia, parts of China and East Africa are characterised by low population densities and consequently a different context for community involvement with fire. Other countries have varying conditions and complex circumstances requiring careful assessment and comprehensive analysis.

The term "community" in the context of CBFiM could be taken broadly to include a household, a group of households, a settlement, or a group of settlements. Generally, a single household is not considered a community. For example, under the land allocation programme in Viet Nam, the household is an important functional unit for encouraging community forest - including fire - management. Within a well-defined community, sub-groups or other stakeholders may also have different interests in how fire is managed (Box 3). All of these sub-groups are stakeholders and their uses of fire should be considered when developing CBFiM.

Box 3: The importance of "community" - an example from East Kalimantan

The community living around Sungai Wain Protection Forest has 14 sub-groups. Each of these sub-groups will likely have varying knowledge and experience with fire management or perhaps none at all. Some have noted that new migrants to East Kalimantan are partially responsible for some of the harmful fires because they watched and mimicked neighbours clearing land with fire without an understanding of fire as a management tool in their new surroundings.

The term "community-based" in the context of CBFiM is much more than community labour in fighting fires. It is also important to recognise that community "involvement" covers a wide spectrum of situations, from potentially forced participation in an activity (coercion) to free and willing participation in actions developed by the actors themselves (empowerment). The emphasis of "community-based" is sometimes focused on community involvement alone; at other times, CBFiM has been recognised and supported by external agencies (governments, non-government organizations [NGOs], projects and others). This may include support to an existing indigenous system by formalising, modifying, or otherwise elaborating on it, or instituting new systems.

3.4. Indigenous knowledge - justified emphasis or overstated?

Investigations on communities and their interaction with their environment have often uncovered significant information, knowledge and wisdom on natural resource management. Fire management is no exception and the value of this community memory is enormous. There are, however, some caveats with respect to traditional knowledge. One critical understanding is that traditional knowledge is not always recognised as dynamic knowledge. The information and its application change through time, as do the conditions and circumstances in which it is used. Notably the traditional approaches may progressively be lost as the world moves through a period of change and communication unlike any other in history.

Traditional or local knowledge itself is insufficient to ensure sound, effective fire management. Institutional structures - both within and beyond the community - and the capacity to apply the knowledge are needed. While pertinent, timely and appropriate knowledge about fires is useful, it will be of little use without the community institution to organize and direct the application of the knowledge. Integration of traditional approaches into a fire management system will need a concerted effort by all stakeholders to build constructive partnerships that recognise the importance of attitudes towards fire, roles in decision-making and securing incentives for balanced fire management.

Varying emphasis has been placed on identifying indigenous practices for using fire as a management tool. The conference recognised that communities often possess much knowledge about fire. However, the context for fire on the landscape is dynamic, for the same reasons that ecosystems and social systems are dynamic. Fires are becoming a problem in parts of the world where historically they were never considered a problem. Shifting population, changing land-use patterns, globalisation and (potentially) global warming are just a few factors that are changing the demographics and ecological circumstances in which fires seem to be occurring more often. In addition to a greater frequency of events, fires have been reaching greater sizes than previously experienced. If CBFiM is to be culturally sensitive, sustainable and responsive to a community's socio-economic needs, then local-level information and experiences need to be examined and understood.

There are cases that demonstrate the use of fire can be sustainable in agricultural, pastoral or agro-pastoral systems. Many of these sustainable systems have depended on locally based knowledge being passed on from generation to generation. The erosion of fire-related community knowledge has taken place through the dislocation of people from their traditional settings and by younger generations disassociating themselves from the elders holding the knowledge. Increases in population, or in some cases relocation policies, can also change the sustainability of local fire management systems. In cases from India (Box 4), Indonesia and Thailand, traditional agricultural practices have been eroded by shifting demographics, both from the young moving to urban centres for work as well as from relocation policies intended, in part, to reduce population pressures on the resources. As a result, many sustainable fire management systems are being lost and there is an urgent need to document CBFiM approaches and their indigenous practices.

Box 4: The impact of changing demographics on traditional agricultural practices – an example from northeast India

Modern Mizo society has replaced the traditional practices of *jhumming* or shifting cultivation. In a typical village in which 50 percent now depend on the *jhumming*, its role has been weakened in the society and consequently undermined CBFiM approaches. In this part of India, there has been a gradual transfer of responsibility for fire to government agencies, and as a result of limited resources, fire has become a problem where once it was part of daily life and subsistence.

In contrast, some knowledge may be valid and highly useful but not traditional. Spontaneous and forced migrant communities may develop sound approaches in dealing with fire in their new settings. There are also examples where such communities have not adapted appropriately and fire becomes a problem for the local environment and landscape. In some cases, this misapplication has led to social conflict between groups. Clear examination of who holds the knowledge used in managing fire is necessary. This can be difficult to determine. In the case of the Sungai Wain Protection Forest (Box 3), less than 20 percent of the local population was originally from East Kalimantan and the community contained 14 different ethnic groups. Communities are also not static and traditional knowledge may not have originated in the locality where it is observed. Without careful identification of its origin, fire knowledge may also be associated with the wrong ethnic or sub-group. Transferring lessons between communities, in different provinces, nations or regions and establishing principles and common elements of CBFiM will be delayed and confused if the source of fire management knowledge is unclear.

4. The way forward

To transfer lessons between communities, in different provinces, nations, and regions, there is a need for improved education and training which recognise the technical and organizational capacity of communities in managing fire, historically and culturally. Integral to this education

and training is the need to evaluate the effectiveness of community-based approaches with consistency and rigor. It is especially necessary to enhance awareness of fire management issues and the effectiveness of CBFiM approaches to those external agencies that do not yet recognise and support it. A communications strategy has been suggested to facilitate this process.

4.1. Communications

Case studies are useful and many of those presented at the *Communities in flames* conference were well prepared. However, the concepts, ideas and principles should be widely shared through communications and advocacy to stimulate adoption and organizational change. The conference provided a stronger base of materials for convincing stakeholders about the role of CBFiM in balanced forest and natural resource management. There is sufficient information and understanding for communications and advocacy to commence. Proponents should not simply advocate CBFiM's merits to those already convinced of its value, but rather should aim at persuading non-believers to accept the role of CBFiM. A target audience accessible to many of the conference participants are those being trained at universities in forestry, natural resource management, rural planning and development. These disciplines needed to be exposed to the perspectives of the community on fire, both as a specific topic and as examples of how communities can be sensible stakeholders in natural resource planning and management.

The papers and case studies presented at the *Communities in flames* conference will offer a solid foundation for increased advocacy related to CBFiM. A fact sheet on CBFiM will also be prepared and widely circulated to provide a summary of the understanding and messages from the conference, and as an initial exposure to CBFiM for those who have not yet encountered it. The *Communities in flames* participants numbering more than 120 people from over 20 countries (from a wide range of donors, governments, government agencies, international and local NGOs, projects, academic institutions and the private sector) make up a formidable cadre of advocates for CBFiM. Many are already members of networks and fora that operate worldwide and encompass the full range of communities, natural resource management, forestry and development. The combination of the products of the conference and the scope of the participants' interests and professional contacts provides a strong opportunity for the key messages of the conference to be heard around the world at both field and policy-making levels.

As people clarify and contribute to the body of knowledge on communities and fire, the potential exists for identifying general models of CBFiM for others to experiment with and adapt. The starkly different contexts and the wide range of human, economic, political and ecological circumstances sound a warning of caution for transferring lessons. The "community" of local people, academics, government officials, project staff, individuals who work in donor agencies and NGOs has to clearly frame how to transfer lessons effectively. The challenge is to learn lessons and identify common principles from within the diversity of experiences and situations.

It is also valuable to identify the lessons inherent in failures. In many cases, efforts to build awareness and promote CBFiM actions have been difficult and the experiences negative. Why certain efforts fail, and the options for coping with failure, are potentially just as important as compilation of success stories.

4.2. A typology for CBFiM

Despite the efforts of the *Communities in flames* conference to document cases from around the world, there is still a clear need for further enhancement and documentation on the different levels of community participation in fire management.

At the conference, the need to develop a typology or characterisation of communities and their approaches to manage fire was identified (Box 5). The need to frame the concepts while at the same time remaining flexible creates a challenging tension. It is essential to ensure that any categories arising from such analysis and synthesis do not become "boxes" into which communities are placed, labelled and from which they have difficulty extracting themselves. A major emphasis emerging from the conference papers was one of diversity, unique circumstances

and varying context. The placement of elements into a typology that is flexible would enable clearer and more effective dissemination of the diverse approaches of CBFiM (where it exists, its strengths and the need for particular forms of incentives, support or motivation).

Box 5: The need for a typology

Cases from The Gambia and the Western United States demonstrate the need for a typology. These cases provide interesting similarities in the use of multi-stakeholder fora to discuss fire management systems but within very different socio-political and biophysical contexts. The Gambia, having adopted principles of community forestry, and the Western United States, with its strong private property rights regime, are dynamically different circumstances for CBFiM. A typology as a mechanism to systematically identify elements of difference and those held in common will support the effective transfer of lessons among communities and the development of principles for CBFiM.

The blending of understanding and information about elements that are important (successes, failures, and key factors) should be considered at the wider scale. To identify the "system" elements that enable (or prevent) CBFiM, the broader aspects at the system or programme level must be evaluated. These include the policies, laws, macro-economic intentions (and the institutions that represent them) and their implementation. A review of these elements from beyond the community level is needed to support the points for discussion, lobbying and advocacy with stakeholders at the system or programme level (e.g. government agencies, national governments, donors, NGOs). This improved understanding at the wider system scale should also create the opportunity to identify where, and perhaps how, communities can be connected to other levels of local, provincial and national governments and international actors.

5. Summary

Fire cannot be ignored as a factor in forestry, natural resource management and development activities. The *Communities in flames* conference underscored the fact that people around the world are concerned to different degrees about fire. Fire is not something that can be excluded from their daily lives and, in many cases, not from the ecology of landscapes. The connection between communities and fire is often based on economy (livelihoods, commercial activities and impacts) and in the longer term, also on public health. A clear examination of communities, their approaches to manage fire and the other stakeholders in fire issues is necessary to promote CBFiM at higher levels. This will serve as the basis for clarifying objectives for constructive dialogue between interested parties on how to manage fire in the landscape.

The dynamic nature of the world and its changing actors was evident during the conference. No single actor, whether government or civil society, can solve the serious social, economic and ecological threats from forest fires. It is essential that constructive partnerships are formed and stakeholders work together with NGOs, governments, the private sector and communities.

The *Communities in flames* conference was a first step in developing awareness of the role of communities in managing fire. It identified many ways in which communities have taken action in forest fire management and the need to give credibility to this role, but not to overstate it. In addition, the conference suggested possible approaches that might be necessary to move beyond isolated examples to broader implementation based on system elements. These system elements may be useful to local, provincial and national governments as well as international actors as they seek more cost-effective alternatives to managing fire in an increasingly fire prone-world.

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Community involvement in fire management: cases and recommendations for community-based fire management in Thailand

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Abstract

Fires are not new to the landscapes of Thailand. In general, wherever there are people, there are fires, as the two have been culturally linked for centuries. In rural areas, people have used fire as a land preparation tool, for promoting annual grasses for grazing livestock, to facilitate mushroom and bamboo cultivation, and to assist in hunting and land clearing. Such land management has generated benefits to some people and costs to others.

Fire management in Thailand is a community issue that needs to be addressed by a community-based approach. This paper reviews some of the local knowledge, experiences and lessons learned from those working with community-based fire management in Thailand to synthesise the current knowledge base and summarise some key points.

1. Introduction

> "In the old days during the dry season, community leaders would mobilise fire prevention activities by striking a gong three times a year; once in late January, once in late February and once in the middle of April. This gong signalled to the community to take collective action to manage the fuels in areas in and around the community to protect itself from forest fires. Today, collective action rarely occurs due to weak community leadership and the government's insistence that it has the sole responsibility to manage forest fires." (*Senior villager of Ban Pabong, Moo 1, Mae Hong Son Province.*)

People and fire have been culturally linked in Asia for centuries. Communities in Thailand have long been engaged in fire management. Fires in Thailand have many causes and impacts due to people's forest and land uses. They can spread from paddy fields to the forest, from the forest to the paddy fields, or from the paddy fields or forests into villages and vice versa.

Traditional knowledge of fire management is clearly manifested in Thailand. People have protected their communities from fire by digging fire lines around homes and temples. Backfires are also used to stop approaching fires. Villagers are aware of the potential fire damages and have controlled the spread of fire to minimise destruction of community assets.

In 1998, forest fires occurred across Thailand destroying thousands of hectares in Huay Kha Khaeng, Khao Yai, Dong Yai, Mae Wong, Phu Kradeung, Phu Rua and Phru To Daeng. These fires, coupled with the haze from other fires in the region, affected many people. The latest fire episode has caused major concerns at every level of society and changed people's view of rural people in Thailand from being victims of circumstances to being the cause of these fires.

The latest El Niño episode has triggered the preparation of many governmental and inter-governmental plans for regional programmes to prevent and control forest fires and haze in South East Asia. In Thailand, the results of these actions are confusing and often misinterpreted. The government has decided that farmers must inform the local authorities before burning crop residues in their paddy fields. Cabinet-level decisions were amended because burning for land clearing was identified as a potential cause of forest fires (Makarabhirom, 1998). In addition, a

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Royal Forest Department (RFD) official proposed that the drafted Community Forest Bill (currently being processed in the Parliament) should not be passed. He claimed that community forestry would perpetuate some of the causes of fires and, to prevent forest fires, no one should be permitted to stay in or around protected areas.

These arguments have led to hostile debates and increased conflicts between the government and villagers. Organizations supporting community-based natural resource management are concerned about the widespread misperceptions and misrepresentations. This paper reviews local knowledge, experience and lessons learned about community-based fire management (CBFiM) in Thailand. It synthesises the current knowledge base and clarifies some misrepresented and poorly understood issues.

2. Fire, rural life and misperceptions

Fire is a universal tool used in forest management, particularly in site preparation, control of pests and diseases, and the reduction of fuel loads. Such practices also represent a potential cause of large-scale forest fires. Poor villagers living in and around forests have little choice but to use fires for:

- land preparation for crop production;
- promotion of mushrooms such as hed poa (*Astraeus hygrometricus*);
- promotion of leaf growth of species like pak waan (*Melientha suavis*);
- cultivation and promotion of bamboo or grass shoots such as phai paa (*Bambusa arundinaceae*) and phai pek (*Arundinaria purilla*);
- promotion of seed germination of species such as teak (*Tectona grandis*);
- hunting wildlife such as wild pig (*Sus scrofa*), barking deer (*Muntiacus muntjak*), lan (*Varanus bengalensis*) and wild fowl;
- managing growth of a grass called yaa mai guard (*Thysanolaene maxima*) for the production of brooms (an activity undertaken by community groups in Nan Province); and
- promotion of yaa ka (*Imparata cylindrica*), which is commonly used for making thatched roofs.

Some 40 years ago, many Thai development policies identified rural communities as a cause of forest fires. Since that time, communities have been blamed for forest destruction and degradation. Yet, they are the ones affected most by the loss of the forest resources that they depend on. Over the decades, traditional and cultural practices have been replaced and eroded by economic development and the introduction of commercial farming. This has resulted in the loss of indigenous knowledge of and community responsibility for fire management, transferring the onus to the government instead. The consequence of this detachment is that fire is no longer regarded as a useful tool, but rather a danger to the communities.

Since many communities have adopted various unsustainable practices, fire has more harmful effects. In highland communities, these effects are more apparent due to higher fire intensities. At mid to high elevations, the fire risk is greater as high fuel loads, steep slopes and prevailing climatic conditions make fire behaviour unpredictable. Highland communities face intense fires in demanding terrain, thus requiring more elaborate fire management approaches.

The rapid expansion of agricultural development into previously forested highland areas has changed fire management from being a community concern to a nation-wide issue. The use of slash-and-burn cultivation to produce export crops is widely practised and has resulted in poorly managed fires. Since the introduction of "high-tech" intensive agricultural production systems, many highland villages have changed their tenurial systems from collective ownership to more individual arrangements, which have contributed significantly to regulatory problems. The abandonment of rotational shifting cultivation practices also makes fire management more difficult.

Traditional uses of fire and forest resources have changed considerably with altered land-use patterns and resource scarcity. In the past, some of the highland groups in Northern Thailand (e.g. Karen and Lua) practised rotational shifting cultivation. They had secure rights over the land that they

farmed, felt close to the land and the forests, and returned back to the same land after long fallow periods. Today, the government has assumed ownership, which in general has resulted in unclear land and resource security. When a fire breaks out, highland communities make no attempts to control it, as they have lost resource tenure and access. In addition, communities find it increasingly difficult to impose rules and regulations on outsiders because no tenure agreements with government counterparts are included in present regulations. This land tenure insecurity, and not the rotational shifting cultivation system *per se,* has increased forest fire problems in highland communities.

More uncontrolled fires are also occurring in Thailand due to climatic changes and fuel accumulation in dry dipterocarp forests. The villagers realize that uncontrolled fire destroys not only physical components of the ecosystem, but impacts also on social systems. Many community relationships disintegrate due to problems associated with fire events (Anan Duangkaewruan, 1999). For example, the social structure of the Mae Tha community in Chiang Mai Province broke down after a large fire that brought on drought and social problems, forcing the villagers to search for off-farm employment. In the Silalang Sub-district of Nan Province, permanent crop production and burning of the forest also led to drought and crop failures (Sathaporn, 1999).

The causes of forest fires continue to be debated. Some people argue that monocultures or inappropriate agricultural production is the main cause. Others point to poaching and recreational fires. All these activities cause forest fires and in looking for solutions the emphasis should not be on how fires start but what the underlying causes are and why fires are started.

The villagers' dependence on forest resources, particularly non-timber forest products (NTFPs), is the main reason for burning the forest. They believe that fires stimulate the growth of mushrooms and wild vegetables. Unsustainable development and government policies have perpetuated their forest dependence by changing land-use patterns and imposing restrictions without an adequate analysis of potential impacts on local livelihoods. Impacts of alternative fire management approaches should be analysed, and communities and the authorities should be informed of the costs and benefits of fire on forest resources and the appropriate ways to control fire (Nugen, 1999).

3. Community-based fire management: rationale and development

Many academics, policy makers and development workers are debating whether communities are capable of managing forest fire. The academic community has supported CBFiM by clearly stating that the community is the key to the survival of forests through integrating indigenous knowledge, conservation values and sustainable livelihoods. Managing the forest with the full involvement of community members is more effective for managing fire if it is an entrenched social responsibility in the first place (Chamarik and Santasombut, 1994; Wasee, 1996; Sukwong, 1998; Ganz *et al.*, 2001).

Many communities have strong traditions that help enhance forest richness – biological and cultural diversity – through innovative means of forest fire management and integrated forest management. After all, it is in their best interest to manage the forest and forest fires to meet their livelihood needs. They realize that short-term solutions like fire lines – if they are well maintained – can only provide protection against fire itself. They cannot stop people from setting fires. This implies that forest fire management requires the long-term commitment and co-operation not only of community members but also those of outsiders. One example of this broader approach is establishing networks of communities that share similar problems (Box 1).

Opportunities for CBFiM exist all over Thailand. At present the financial resources devoted to fire prevention and suppression are not spent effectively. Although the budget for governmental fire management and the number of Forest Protection Units have increased, forest fire occurrences have also escalated. If implemented on a large scale, CBFiM is likely to improve forest management and reduce costs to the government.

Box 1: The forest fire management network of Mae Khan Watershed

Villagers of Mae Khan Watershed have long been using indigenous knowledge to manage fire as part of their rotational shifting cultivation system. In the early 1990s, fires increasingly spread outside the village. In response, villagers developed a collaborative fire protection plan for the whole village. As time passed, fires began to encroach on the village. As a solution, the villagers approached neighbouring communities to set up a collaborative fire protection network around the forest areas. Now, the concerned villages co-ordinate their efforts in community-based forest fire management for protecting the watershed.

For CBFiM to be effective, three fundamental components need to be understood:

♦   ecology and forest fire behaviour, particularly forest fire regimes;

♦   the community, particularly its needs and the behaviour of its members; and

♦   the relationships between fire and the community.

A fundamental understanding of fire ecology is necessary as communities are managing fire – or ought to be managing fire – within a certain fire regime that is suitable for the ecology of the forest type under forest management. A situational analysis at the village level is necessary to consolidate critical information on opportunities for and constraints to implementing CBFiM. This analysis considers the natural, political and socio-economic environment. The integration of information about the fire regime, the variety of stakeholders and the situational analysis into an operational plan is the basic premise of decentralised fire management. The Thai government should take the leadership in CBFiM in the region and ensure that the modernisation of forest fire management in Thailand is based on sound knowledge.

4. Forest fire management: a call for collective planning

Fire management is part of forest management planning. This has been evident in the Mae Tha community of Chiang Mai, Na Pho Nue village of Ubon Ratchatani, Ka Lor community of Yala and Rom Pho Tong village of Chasoengsao (Box 2). Forest management requires a plan that considers and provides for community benefits. Similarly, proper fire management calls for a fire management plan that responds to community needs. For example, if the community relies on mushrooms or young grasses for its livestock, or has fruit trees that need to be protected, then annual prescribed burns should promote the growth of mushrooms or young grasses, while ensuring that the fruit trees are not destroyed.

Box 2: Collaborative fire management in Ban Rom Pho Tong, Eastern Region

Fire management planning and activities are part of Rom Pho Tong Village's community forest management plan. In 1995, a community forestry development programme was prepared, followed by a management plan in 1997. The villagers co-operated with the local Forest Fire Control Unit to train village forest fire volunteers. Forest fires still occur but are less likely to cause substantial damage.

In 1998, the Community Forestry committee started to extend its fire management network to the neighbouring communities of Ban Khao Klui Mai and Ban Sam Pran. A few months later, the network reached 20 villages around the eastern forest. During monthly network meetings, the forest fire situation in each village is discussed together with other development and conservation activities. A self-motivated forest fire network has been initiated as a result of the meetings and the collective action on forest fire management.

As several cases indicate, there are strong linkages between CBFiM and other development and conservation activities. CBFiM should be considered a component of land-use planning and natural resource management. Rather than taking on an independent identity, it should be an integral part of an overall community capacity-building process.

5. Promoting participation in fire management: a four-step process

Step 1. Agreeing on common objectives and a collaborative management plan

In fire management, clear objectives are necessary. They must address all actors with vested interests in the forest area with regard to:

♦ where to control fires;

♦ where to burn; and

♦ what methods to use.

Clear and agreed upon objectives avoid misunderstandings and frequent jurisdictional problems. If the villagers request that local organizations should take charge of fire management, then the Fire Control Units should provide information and training to all actors to raise awareness of the roles and responsibilities of each member of the community.

Step 2. Managing the budget by local authorities

Fire management costs money. Many problems and obstacles (e.g. the lack of equipment, budgets and personnel) restrict government agencies from collaborating with communities to manage fire effectively. To remedy this situation, communities must be informed about financial problems and ask for the support of local organizations such as sub-district councils and the local administration. Alternative and innovative funding mechanisms need to be sought at the local levels. Financial systems that will show how CBFiM can be effective while reducing costs should be encouraged.

Step 3. Supporting information for fire management

Many villagers are interested in information on the effects of fire on the production of mushrooms and other NTFPs. Unfortunately current research on such issues is very weak. Credible research and the timely dissemination of appropriate technologies are needed to influence the adoption of improved practices.

Step 4. Shifting from protection and suppression to management

Forest fire management in Thailand has been centralised within one government department. Recent valuable experiences in CBFiM and collaborative fire management with other government projects are disregarded. Research potentially leading to improved fire management is ignored and community involvement in decision-making is difficult to promote. The following recommendations can help improve fire management:

♦ Increase community involvement in forest fire management

♦ Adjust existing laws and policies, as appropriate, to enhance community involvement in fire management

Policies and laws need to promote collaborative management and the co-operation between people and government agencies

♦ Search for alternative ecologically sound forest fire management

Improved forest management is required for managing forest fires, especially in watershed areas.

♦   Analyse forest fire management experiences to identify opportunities for improved community collaboration

Participatory analyses are necessary to investigate the forest fire situation, which will aid in collaborative planning and applying religious rites – such as forest ordinations – to raise people's awareness to conserve forests, and assist in enrichment tree planting, natural forest restoration and fire management activities.

♦   Provide technical knowledge on fire management

Technical knowledge on fire management should be extended to all actors. Training should be provided not only to highland but also to the foothill and lowland communities who also use fire in land-use practices.

♦   Conduct research to support management decision processes

Greater efforts should be placed on understanding the effects of fire on forest products. If alternatives are found to manage NTFPs that villagers depend on and information is adequately disseminated, then a reduction in the number of fires may follow.

♦   Develop local networks to support fire management

Encourage the establishment and development of local groups and organizations in each community for the planning and implementation of fire management. If these organizations (e.g. village committees or groups of teachers, youth and women) can work together with the officials at the community level, then fires will be managed efficiently.

These seven recommendations are based on the principle that "fire management is the joint duty of all people and organizations to plan." Therefore, it is necessary that the communities, officials and non-governmental organizations plan how to manage fire together. The co-operation of the communities is absolutely necessary as they can develop and implement fire protection methods faster and more effectively than outsiders (Sathaporn, 1998). Local communities have clear understanding of local conditions and circumstances important for successful fire management.

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Learning across borders: community-based fire management – Kalimantan to California

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Abstract

Communities in very different places are initiating participatory fire management planning processes. This paper raises questions about the effectiveness of transferring experiences from one place to another, based on recent examples from northern California, USA, and West Kalimantan, Indonesia. Reforming approaches to fire management is both politically and technically challenging. Vastly different political and administrative systems, and unequal technological capabilities make many apparently sensible approaches unworkable in the foreseeable future. Transferring some practices and assumptions may actually endanger ecosystems and people, demanding that planners "first, do no harm". Despite demands for caution, in Kalimantan and California there is a growing consensus that participatory and collaborative initiatives offer the most promising approaches to effective fire management.

1. What is at stake?

During the past decade, wildfires, more extensive and intense than any in historical memory, have devastated large areas of both Kalimantan and California. Fire has become one of the foremost concerns of rural communities in both locations, and to people alarmed about the future ecological integrity. Communities initiated new approaches to solving fire problems in Kalimantan and California, in response to their own local concerns, to ensure that their interests would be represented in the face of pressure and neglect from distant governments and commercial interests. Many of these efforts on opposite sides of the globe share common features. Yet, some of their issues also deviate sharply, due to differing causes and contexts of fires. Community-based fire management initiatives have developed local, regional and landscape-scale planning to prevent future wildfire catastrophes, locally appropriate rules for burning practices for "legitimate" purposes, procedures for containing or suppressing fires that are out of control and recommendations for broader policy changes to reflect local interests.

New approaches in fire management are often modelled on systems that appear to work elsewhere. Most people assume that they can learn useful lessons from experiences of communities in places far from our own. Yet, we must be cautious in transferring lessons or approaches from one location to another. Differences in fire ecology, politics and administration, technology, culture and other factors may invalidate our assumptions about fire management for that other place. How can we know which aspects of fire management systems developed elsewhere will work in our own contexts, and which will be ineffective, or even harmful? Few tools help us test the appropriateness of models for locations that they were not designed for.

This paper raises questions about the effectiveness of transferring experiences from one place to another. Recent examples of involving communities in fire management in northern California, USA, and West Kalimantan, Indonesia, provide interesting insights (Figure 1). The work in northern California draws mainly on experiences from Trinity County, associated with the efforts of the Trinity County Fire Safe Council, a consortium of local, state, and federal governmental agencies, and non-governmental citizens bodies. The work in West Kalimantan draws largely on work supported by the U.S. National Science Foundation, and in conjunction with a fire research project by the Center for International Forestry Research (CIFOR), the International Centre for Research on Agroforestry (ICRAF), the United Nations Educational, Scientific, and Cultural

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Organization (UNESCO), the United States Department of Agriculture Forest Service (USFS), the U.S. Agency for International Development, Yayasan Pancur Kasih and Yayasan Dian Tama.
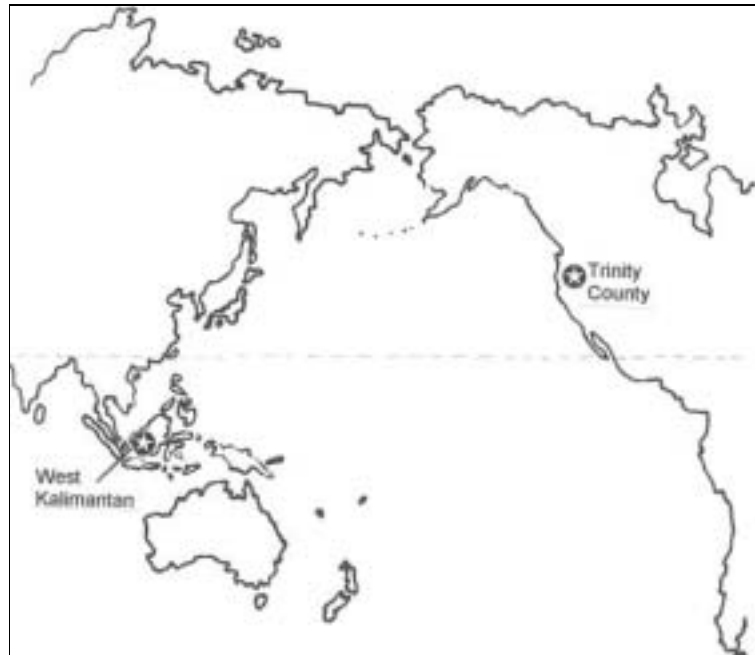
Figure 1: Location of study sites

This paper also highlights the potential of cross-regional lessons, and warns of dangers of transferring models or assumptions, with four areas of concerns:

- ♦ understanding fire causes and transferring fire management technologies from different ecological and social contexts to new locations;
- ♦ developing information for fire management based on local knowledge and appropriate science and technology;
- ♦ understanding and assessing diverse values at risk; and
- ♦ reviewing necessary administrative and political reforms to enable community-based fire management.

In comparing and applying lessons of and approaches to community involvement in fire management, it is necessary to consider:

- ♦ Stakes in fire management vary, depending on one's standpoint.
- ♦ Reforming approaches to fire management is both a political and a technical challenge.
- ♦ Transferring some practices and assumptions may increase damage to land, ecosystems and people.

Combining the four concerns with the three notes of caution generate a matrix that raises warning "flags" to indicate the appropriateness and limitations of transferring knowledge (Table 1).

Table 1: Matrix of warning "flags"

Concerns \ Warnings	Stakes in fire management vary depending on one's standpoint	Reforming fire management is both a political and technical challenge	Transferring practices and assumptions may increase damages to land, ecosystems and people
Understanding fire causes and transferring fire management technologies from different ecological and social contexts to new locations	Implications of differences in fire ecology, spatial scale, different and changing political and administrative contexts	In some cases, technical issues are more problematic; in others, political conditions are a greater concern	It may be difficult to know how best to apply the precautionary principle across dissimilar situations
Developing information for fire management based on local knowledge and appropriate science and technology	Information and technology readily accessible and well understood in one context may not be well-understood, equitably accessible, locally controlled, or credible in another context.	Government agencies accustomed to technocratic expertise may suspect or devalue local knowledge about fire and fire management	It may be difficult to know when to rely on local knowledge and on science and technical expertise
Understanding and assessing implications diverse values at risk	Members of local communities may have diverse assessments of values at risk, and these may differ from those of local, regional and national fire management officials	Even in collaborative processes, parties with more power often fail to acknowledge the validity of value systems different than their own	Appropriately prioritising values at risk must be based on local contexts, but may also need to consider values not fully represented in a local collaborative process
Reviewing necessary administrative and political reforms necessary to enable community-based fire management	Positions on reform may be related to other political and administrative concerns and positions	It may be difficult to distinguish political or administrative aspects from technical aspects in unfamiliar situations	Misestimating administrative or community capacity, or conflicting assessments of political reform, contribute to ineffective or dangerous decisions

In California, community members, exasperated by lack of attention or misguided approaches to fire management by state and federal government agencies, have initiated fire management planning efforts, and invited state and federal agencies to join them. While these government agencies recognise the value of participating in consultative local "Fire Safe Councils", the visions of some recent local initiatives go far beyond the degree of collaboration foreseen by the agencies. In California, expenses for community-based processes have been covered by state and federal government funds requested by the consortium of local government and non-governmental parties, under the umbrella of a local collaborative "Fire Safe Council."

In Kalimantan, indigenous communities have initiated fire management efforts in response to the perceived causes of many fires that adversely affected their community life and agroecosystems during the late 1990s. The efforts initially focused on improving co-operation within and between communities to reduce risks of wildfire from routine burns by smallholders. Together with regional non-governmental organizations (NGOs), they have also addressed fire threats in a broader political-economic context, to ensure that neighbouring plantation and timber concession holders manage their fire risks. In the wake of fires during the 1997/98 El Niño drought, international pressure and assistance have also prompted Indonesian government agencies to co-operate with enterprises and communities in developing new approaches to fire

management. In West Kalimantan, most initiatives have focused on emergency fire suppression, rather than tackling the underlying causes of fires (Dinas Kehutanan, 2000). Provincial plans appear to assume that recent Indonesian forest law reforms have adequately addressed these basic issues. The roles envisioned for local communities in most of West Kalimantan's officially supported initiatives have taken many cues from other countries' traditional firefighting systems, offering Indonesia a combination of technical, financial and institutional assistance.

2. Understanding fire causes and transferring fire management technologies

Most northern California forest fires are ignited by lightning. A few are bona fide human accidents, and a very small number are ignited by arsonists. Most fires of concern originate as natural consequences of an ecosystem adapted to periodic low-intensity fires that recycle nutrients, germinate seeds and generate ecosystems. Fire extent and intensity have been aggravated by a century of logging and fire suppression, creating volatile "fuel ladders" that turn ground fires into destructive crown fires.

Very few wildfires in northern California originate from deliberate burning. By contrast, virtually all West Kalimantan fires are set by people, and for purposes whose legitimacy is contested. In Kalimantan, burning slash is a defining feature of subsistence shifting cultivation and smallholder agroforestry. Yet, most fires of concern during the 1990s originated from land clearing for extensive government-licensed plantations (CIFOR *et al*., 2001), although such commercial burning was made illegal in 1995.

The fundamental differences in fire causes and contexts limit the potential of transferring fire management approaches. Improving fire suppression alone will not solve regional fire problems in either Kalimantan or California. However, effective fire management in northern California ultimately depends on improving vegetation management to restore more natural fire regimes and reduce the risks of catastrophic fire. In West Kalimantan, developing consensus about responsible and legitimate uses of fire, and collaborative approaches to controlling wildfires appear to be the best options for improving fire management.

3. Developing appropriate fire management information

In both Kalimantan and California, there is general agreement among the marginalised rural communities involved in forest management that local knowledge provides effective guidance in identifying and communicating their fire concerns, and in planning responses to address these concerns. Useful local knowledge adds to the understanding of specific dynamics of fire within a complex local landscape. It also enhances comprehension of how community members are able and motivated to manage fire for their own, and their neighbours', safety and well-being, for ecological integrity, and in response to broader concerns.

Comparable processes in Kalimantan and California include compiling narratives that explain causes, dynamics and impacts of past fires to local people, scientists, government agency representatives and business people. Community-based planning initiatives in both locations focus on how to reduce fire threats with the help of maps.

3.1. Fire narratives

In both Kalimantan and California, community-based fire management efforts have captured local knowledge by compiling knowledgeable community members' stories of past fire events. These may include details of locations and causes of fires, extent of damages, how fires spread through the landscape, successes and failures to contain or extinguish fires, changes to the local landscape, and impacts on community life. Such narratives indicate a range of local understandings of the ecological and social or institutional causes of fires, and generate discussions about specific measures that could prevent, contain, or suppress future fires.

In West Kalimantan, until recently, oral histories of fires often provide the only accounts of past fires affecting land to which the community has customary rights. In communities where customary rules for burning and sanctions for fire damage still apply, community leaders and customary law functionaries can recall fire events for a generation or more, including locations and seasons of wildfires, areas and directions to which fires spread, property and natural assets burned, who started the fires, local responses, sanctions applied for negligent burning, current uses and conditions of previously burnt lands, and whether fire-use behaviour changed as a result. Villagers can point to consequences of these fires in their community's landscape, and can mark many of these details on maps. In recent cases, some narratives have complemented sparse records kept by plantation and timber companies, and even sparser police reports of suspected arson. Some oral reports have also contradicted company records. The extent to which these records and memories do NOT intersect indicates that communities, companies and government may each see blank spots on their mental "fire maps" of areas beyond their immediate concern.

In California, state and federal government land management agencies and local fire departments have long kept detailed records of fire events. Knowledgeable people's detailed memories of fire events including ignition, movements through the landscape, weather and responses are essential for assessing future fire risks and planning for fire management. Equally important is information on rationales behind past pre-fire planning and landscape/vegetation treatments (e.g. shaded fuel breaks, firebreaks, prescribed burning, backburning, provision of water points, conditions of roads used for emergency access). This is particularly significant as many measures are effective only if they are maintained over long periods, and over extensive areas of the landscape. Many government staff responsible for fire suppression and prevention programmes are transferred to new assignments too frequently. This weakens institutional memory, and makes detailed local knowledge by long-term residents even more important.

3.2. Mapping

In both Kalimantan and California, one of the most effective tools for extracting and analysing information about fires, fire prevention and responses from personal narratives and official records is to present the information on thematic maps. Many types of information important for identifying and reducing fire risks are indicated on these maps (Table 2). In Kalimantan and California, recent community-based resource mapping, initiated by NGOs rather than state agencies, have helped to empower marginalised communities to improve management of the local natural resources. Community organizers have adopted mapping technologies previously monopolised by powerful central governments and resource corporations, to develop alternative maps that reflect local communities' understandings of their landscapes and resources (Alcorn and Royo, 2000). They have also used maps to have their rights to land and resources recognised.

In Kalimantan, mapping aimed at improving fire management has included information on fire history, community members' assessment of fire risks, priorities for fire protection based on current and projected land and resource uses and values, and proposed priorities for reducing fire hazards. Collaborating with NGOs and researchers in participatory mapping processes has also given communities access to technologies including geographic information systems (GIS) and global positioning system (GPS) to improve map quality and accelerate map production. Communities also benefit from information gathered through remote sensing imagery, including locations of "hot spots", vegetation changes, "burn scars" and other changes in their regional landscape. Community organizers and researchers hope that fire maps developed through participatory processes will help raise community members' awareness of fire hazards, and open up opportunities for constructive dialog and joint planning with government agencies, neighbouring communities, and plantation and timber corporations. If constructive dialogue fails, some community advocates hope that their greater access to legal remedies, anticipated with political reform in Indonesia, will help them press suit against companies that have negligently or illegally used fire to clear land, and support communities in their struggle for legal recognition of customary land and resource rights. Maps produced through participatory processes are crucial in supporting both processes.

Table 2: Information for fire management mapped in Trinity County, California and West Kalimantan, Indonesia

California	Kalimantan
Baseline maps used were developed from a combination of information from government agencies and NGO community resource mapping. Topographic, hydrologic, road, administrative boundary and other basic data were available in official maps (mostly in digital form)	*Baseline maps used were developed mainly by NGO-assisted community mapping process aimed at documenting and defending customary lands and resources. Community landscape-scale maps showed basic hydrologic data, roads and footpaths, administrative and customary boundaries. Very little usable information in official maps (none in digital form at a usable scale)*
Information for emergency response (1st set of meetings):	*Locations of past fires based on oral histories + narratives:*
Roads with limited access for emergency vehicles (too narrow; no exit; bridges cannot bear weight of heavy equipment); how to get keys to locked gates	Extent, sequence of events, causes, damages associated with all fires remembered by participants, or noted in oral histories from past generations
Water sources that could be developed (private and public land)	Responses to fires (including sanctions applied, if any)
Possible helicopter landing locations	Comparisons of narratives with remote sensing data (in a few cases, including hotspots and burn scars)
Participants' identification and ranking of values at risk from fire (2nd set of meetings):	*Participants' assessments of areas with high risk of future fires, based on landscape conditions, land uses, and resource tenure or conflicts*
Housing/buildings; recreation and resort sites	Fire-prone vegetation
Telecommunications towers	Activities with high risk of uncontrolled fires
Old-growth forest and specific groves	Locations of potential conflicts
Habitat for species of special concern	Comparing assessments from villagers, companies and officials
Locations of current and potential fuel management zones (3rd set of meetings):	*Assessment of gaps between current capacities for fire management and perceived needs*
Ridgelines; roads (especially within 1.5 miles of communities)	Community-based process focus on community needs
Public/private land interface	Basis for formalising fire control rules and negotiating joint responsibilities
Community drinking water supplies	

Mapping has also played an important role in California's community-based fire management efforts. As in Kalimantan, mapping for fire management draws on an infrastructure of community-based mapping and technology developed for broader resource management purposes. The community-based fire management efforts in Trinity County were spearheaded by NGOs, but brought under the umbrella of a new committee of the local county government.[2] The committee tries to bring together community organizations, volunteer fire departments and private landowners with county agencies, and fire management staff of state and federal land management agencies. Organizers designed mapping efforts to incorporate spatial data generated by all participating groups.

The maps indicate locations of past fire and fuel breaks of various types and degree of maintenance, detailed information about emergency vehicle and helicopter access and water sources for firefighting, a wide variety of ecological and property assets at risk, as well as

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[2] The Trinity County Fire Safe Council was established with strong support of the county's official Natural Resource Advisory Council.

jurisdictional and administrative boundaries. Maps also show participants' recommendations of priority projects and activities for fire prevention (especially vegetation treatments).

There are many significant differences in the ways that local knowledge is generated and used in fire management (Box 1). In California, many long-term residents of fire-prone rural regions have professional experience and training in fire management techniques, and are familiar with the way government agencies work to suppress and prevent fires, as staff or contractors for land management agencies, commercial loggers, landowners and members of local volunteer fire departments. Counting on this knowledge, participants in the Trinity County community-based fire planning process hope that by collaborating with state and federal agencies to develop coherent plans for fire management, these agencies that normally respond to fire emergencies would uphold local priorities even in emergency situations (TCRCD and WRTC, 2000).

Box 1: Questions to help define significant differences for information based on local knowledge

♦   What is considered to be legitimate "local knowledge"?

♦   Who has obtained it? How?

♦   Who initiates efforts to gather or generate information useful for fire management?

♦   Who controls this information, and how does this affect its use?

♦   Who uses it?

♦   For what specific purposes? For what purposes is it not used?

♦   Who respects it? Who disparages it?

♦   Who "owns" technology or records used to compile and interpret local knowledge?

♦   Who communicates information to whom? Through what means? When?

♦   Who "owns" the right to communicate information?

♦   Who decides which information will be communicated? Which will be withheld?

In contrast to California, few local community members in West Kalimantan are familiar with, and trusted by, government agencies or companies involved in fire management. Many government-supported fire management efforts tend to disparage indigenous experiences and knowledge of controlled burning for shifting cultivation under customary rules, and responses to escaped fire using simple local technologies. Even government-sponsored efforts to involve communities in fire management continue to portray long-standing indigenous communities and their agricultural practices either as fire risk factors (swidden fires, or arson against company assets), or as free or cheap labour to fight fires (Dinas Kehutanan, 2000). In some cases, officially supported participatory measures also see community monitoring as a source of reports of companies' illegal burning. However, less attention is paid to threats to community assets posed by corporate activities than threats to company assets or protected areas by smallholders.

Experienced staff, equipment, trained community members and local familiarity with uses of community-generated maps and plans formed a basis for fire mapping and planning efforts. In California, fire mapping could start with accurate, high-resolution topographic maps produced by the federal government. In West Kalimantan, on the other hand, government topographic maps of areas where NGO-assisted fire management mapping efforts focus are unreliable. Both topographic and land-use maps available to the public (as opposed to military maps) are at a scale too coarse to be useful. Base maps used in fire mapping had been produced by villagers with NGO help, and had been intended largely to defend customary lands and resource rights against expropriation for exploitation by government-licensed concession holders.

In both places, the processes of identifying significant past fire events, locating them on base maps, and linking them with as much data as could be collected about each fire were analogous. They both grew out of previous involvement with community-based resource mapping, and mistrust that distant and plodding official fire planning processes would accurately reflect community priorities and values. Yet, differences in their level of detail and variety of data on baseline maps were enormous. The sources of data were also dissimilar. Whereas government baseline maps and fire data were readily provided to the California process (much of it in digital form), in West Kalimantan regional government and forestry agencies both lacked useful data, and were suspicious of NGO-assisted community mapping.

4. Understanding and assessing diverse values at risk from fire

Community-based fire management processes consider threats to direct resource values, less tangible cultural values, commercial assets, various types of private and common property and numerous ecological functions. The California state government's approach is generally to identify these assets, acknowledge disagreements about the ranking of values among participants in the planning processes, and eventually address protection of a very wide range of values, from employment in logging and real estate to wildlife habitat, with priorities for specific projects and programmes. This statewide process had not yet been applied to Trinity County (CalCBF *et al.*, 1996) before the locally based participatory process began. The Trinity process was in part designed as a local alternative to the statewide "top-down" asset assessment approach. Local people were concerned that it would undervalue the remote forest region's fire protection needs, compared to those of more urban areas.

In California, identifying priority fire management programmes and projects early ensures that legally required environmental impact assessments and administrative approvals are completed in time, so that projects can proceed with a local workforce without delay as soon as funds become available. Yet, some critics insist that most purported fire management treatments, including thinning for fuel reduction, and "salvage logging" in previously burned or pest infested areas, are just excuses to continue logging where logging would otherwise be prohibited for environmental reasons.

Collaborative community-based resource planning in northern California emerged in the mid-1990s in the wake of the "timber wars", which had pitted environmentalists against loggers in a battle over values that would form the region's future landscape. A remarkable feature of the fire planning priority process developed in Trinity County is its incorporation of a wide range of values. Overcoming polarisation involves developing a consensual sense of a "community of place"[3] where economic prosperity and community welfare can be based on protecting and restoring "forest health". Vegetation treatment for fire management and ecosystem restoration may create jobs that are needed because of the declining logging industry.

In West Kalimantan, community efforts also try to balance conflicting values, although compared to California, indigenous communities embarking on fire management appear to be less polarised in terms of values, especially concerning their own interests relative to government policies on land rights, agroforestry practices and fire uses. The most serious rifts appear to be between indigenous communities and commercial plantations, logging and mining companies, and new settlements on customary lands. As communities organize themselves to reduce fire risks through consensual processes and mutual assistance, many village residents are annoyed that blame for the late 1990s fires is still so easily cast at shifting cultivators, despite evidence that the most serious of the West Kalimantan wildfires were associated with commercial land clearing (CIFOR *et al.*, 2001). Numerous villages have codified and reinforced customary sanctions aimed at reducing wildfire risks since the 1990s fires, with relatively little government support. Many

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[3] "Community of place" and "forest health" are terms often used in describing motivations underlying recent movements for increased community control of local natural resources in the United States, corresponding to widespread developments in "civic environmentalism".

call for the government to act decisively and stop illegal burning for plantation expansion rather than threaten to prohibit burning by indigenous shifting cultivators using traditional safeguards.

A conflict of values is also expressed in the implicit devaluation of the relatively fire-resistant landscapes that indigenous agroforestry is forming in the long term. Government-licensed plantations continue to expropriate customary village lands. Local governments have largely failed to enforce prohibitions imposed by executive order in 1995 against land clearing by commercial burning. As smallholders plant more perennial tree crops, land is withdrawn from shifting cultivation cycles, which reduces the need for burning. Through much of West Kalimantan today, smallholders have integrated indigenous shifting cultivation with relatively high-value agroforestry production. Both recently planted and generations-old forest gardens are the focus of many community efforts to protect customary territory from wildfire. Many villagers contributing to fire management initiatives believe that to protect their area from fire they have to defend their customary land rights and village customary territory against encroachment by commercial plantations! For the regional NGOs assisting villages in fire management, expanding from land rights advocacy to fire management is a strategic move.

When plantation and timber companies began working with the regional government to develop new systems and procedures to mobilise their capacities for firefighting, local communities were seen either as sources of fire risk or cheap labour for the companies' firefighting crews. Although the regional government and several aid projects have included villagers in firefighting training, and provincial fire suppression plans intend to provide training for farmers' groups, no provincial plans have provided for local communities' input to formulating fire policies. New provincial fire suppression institutions follow an extremely hierarchical model (Dinas Kehutanan, 2000). Whether such a model to mobilise firefighting capacity in a regional emergency is compatible with consensual village-level fire management initiatives has yet to be tested.

5. Reviewing necessary reforms to enable community-based fire management

Administrative and more fundamental political reforms would contribute to the potential success of emerging community-based fire management. Movements to gain political support for forest and watershed management regimes that are more responsive to local needs are taking place in Kalimantan and California.

Recognising that it is more cost-effective to prevent than to fight unwanted fires, it makes sense for governments to assist community-based fire management. Demonstrating the value of local knowledge for fire management provides a strong argument for governments to provide financial and technical resources, in a credible "political space" to support collaborative fire management. Successful community-based fire management calls for government recognition of local planning and values to guide emergency fire responses. Unfortunately, such government support is still rare in California and Kalimantan. Community-based initiatives occupy only a tenuous place in broader forest management, and are not yet integrated with government firefighting institutions and procedures.

Yet the differences in political and administrative contexts in California and Kalimantan make it problematic to compare political and administrative reforms much further. Since most of the land in California is managed by the national Forest Service, administrative reform to support community-based fire management would include taking ongoing collaborative processes more seriously, and prioritising resultant projects and programmes for government financial support. It would also mean eliminating the bias toward huge projects to enable small-scale local contractors to compete. Emergency fire crews mobilised by the USFS (to fight fires on federal land) and the California Department of Forestry and Fire Protection (to fight fires on private and state land) should become accustomed to consultative operations. Some of this change requires financial assistance; much of it calls for a change in attitudes.

In Kalimantan, a more open attitude from the government toward the capacities of local communities, recognition of indigenous land-use and forest management systems, and of local

decision-making institutions are priorities. It is just as important to incorporate local communities' fire management capacities into the newly implemented fire suppression action plans. Recent reforms of the Indonesian forestry law, which strengthen community positions relative to corporations and the state, would help support community-based fire and forest management. Other Indonesian reforms focusing on devolution of authority and revenue collection from the central to the provincial governments may facilitate broad-based fire management. However, devolution may also provide irresistible incentives for regional politicians to exploit every possible source of revenue for the short-term, rather than conserving natural resources for the long term. Funds for investment in a decentralised fire management system, calling for substantial early investment for benefits in an uncertain future, would be scarce in this case.

6. Problems in comparing and transferring practices

Community-based fire management initiatives in northern California and West Kalimantan share several similarities. Yet, the many differences seriously limit opportunities to transfer approaches directly without any adaptations. It is particularly important to increase our understanding of how various actors' stakes in fire management are likely to differ across contexts – not only between vastly different locations, but also across different spatial scales and institutional levels.

In assessing where and when approaches can be successfully transferred from one place to another, the following act as a guide:

♦ *Reforming approaches to fire management is both politically and technically challenging. Vastly different political and administrative systems, and unequal technological capabilities may make many apparently sensible approaches unworkable in the foreseeable future.*

In California and West Kalimantan, the similarities in approach to planning, using narratives, mapping and prioritising systems appear to be remarkable. However, the levels of technology and uses to which maps or other tools can be applied are limited by very different characteristics in the two locations. Although the processes may be congruent in some ways, it is misleading to assume that they will lead to the same kind of planning and implementation opportunities.

♦ *Transferring some practices and assumptions may endanger the land, ecosystems and people. In attempting to "transfer" practices from one place to another, how can the precautionary principle, "First, do no harm," be applied?*

There has been some controversy over whether it is more important to know the history of underlying causes of fires, or whether it may be enough to understand the more immediate causes of fires. If one assumes that a build-up of fuel loads will eventually result in a fire, then it is not particularly important to understand causes and contexts for specific ignition events. This rationale may make sense in California, where fire is a natural part of an ecological cycle, and fuel build-up through fire suppression set the scene for the almost inevitable fire. However, it would be dangerous to apply the same rationale to Kalimantan. Where fires are largely anthropogenic, understanding the circumstances of specific fire events is crucial, since if no fire is lit, no fire will burn. By overlooking fire origins in Kalimantan, opportunities to prevent fires by addressing the intentions of people starting fires will be lost. Asking "What do we gain by making a particular set of assumptions?" and "What do we lose by not making other assumptions?" may allow us to translate assumptions and approaches more carefully.

Processes of community-based fire management can create opportunities for improving understanding among local communities, land and resource management agencies and commercial enterprises. Successful community-based approaches are in the best interest of everyone hoping to eliminate unwanted fire. In both Kalimantan and California, there is a growing consensus, among people who believe that both people and valuable ecosystems are at risk from present courses of action, that the most promising approaches to sustainable forest and natural resource management lie in such joint management initiatives.

Acknowledgements

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Community-based fire management, land tenure and conflict: insights from Sumatra, Indonesia

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Abstract

A collaborative research project involving the Center for International Forestry Research (CIFOR), International Centre for Research in Agroforestry (ICRAF), United States Department of Agriculture Forest Service and the European Commission found that community-based fire management in parts of Indonesia can have both positive and negative impacts on the forest environment, and can lead to short- and long-term changes in income. This paper examines two examples from Lampung Province in southern Sumatra, Indonesia, where communities manage fire in different forest types to increase income generation, but without a conscious effort to maintain environmental services or achieve biodiversity conservation. In Sekincau, located in a national park, communities manage forest fire to facilitate the establishment of coffee gardens in the residual understorey or in open areas. Based on knowledge of fire behaviour, communities often encourage fire to escape from adjacent areas and burn in previously illegally logged forest. Fires are also managed to prevent damage to adjacent coffee gardens. This suggests that the community knows how to manage fire to meet specific objectives.

In Menggala in the vast swamps of east Lampung Province, the traditional communities use fire as a tool for burning organic matter to prepare the ground for "traditional swamp rice cultivation" (sonor) during extended dry periods. The fires burn large areas of swamp forest well beyond the boundaries required for rice production. The fires have facilitated the regeneration and expansion of areas of *Melaleuca cajuputi*, a fast-growing species that responds positively to disturbance. The regenerating forests are harvested for domestic consumption and supplementing income through the production and sale of charcoal, poles and sawn timber.

1. Introduction

Large-scale fires and associated smoke are an increasing problem in Indonesia and surrounding countries. Major fires occurring in the El Niño years 1982/83, 1987, 1991, 1994, and 1997/98 (Dennis, 1999) burned huge forest areas and caused significant economic losses, both in Indonesia where most fires occurred, and in neighbouring countries. The economic costs of the 1997/98 fires in Indonesia have been estimated to exceed US$9 billion, with carbon emissions high enough to elevate Indonesia to one of the largest polluters in the world (ADB and Bappenas, 1999; Barber and Schweithelm, 2000). There are several underlying causes for the fires. If they are not addressed, unwanted fires will continue to burn in many parts of Indonesia with the ensuing negative impacts on the forest environment. The fires also generate large amounts of emissions from the burning of peat soils and the resultant smoke and haze have led to cross border problems (Applegate *et al*., 2001; ADB and Bappenas, 1999).

As research on underlying causes of fire in Indonesia has indicated (Applegate *et al*., 2001), perverse policy and institutional incentives (e.g. inappropriate land-use allocation, lack of tenure security) and external forces (e.g. demographic changes) have influenced the communities' use of their knowledge of fire behaviour in sustaining their livelihoods. Therefore, it is understandable that community-based fire management is considered by many to be an important approach to address the problem of recurring fires and their related negative impacts. However, documented knowledge about the conditions under which this approach may work is limited (Ganz *et al*., 2001).

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This paper outlines two cases in Lampung Province of South Sumatra, Indonesia (Figure 1). The communities of Sekincau and Menggala manage fire in different forest types to meet similar goals of income generation. They also use it as a tool to gain access and control of resources In Sekincau, but without a conscious effort to maintain environmental services or conserve biodiversity of the burned forest and forestlands.

In the two examples, community-based fire management is defined as the conscious use of fire to meet a specific objective. The results of community fire management may not always be positive, which depends on whose perspective is adopted to judge the outcomes. The paper argues that communities' livelihood systems and their relationships with the wider socio-economic and institutional environment need to be understood to ascertain how community-based fire management may be used to improve local livelihoods while avoiding (or minimising) negative environmental impacts.

Figure 1: Location of study sites in Sumatra, Indonesia

2. Methodology

The methodology used to identify the extent of community-managed fire regimes involved the use of geographic information system (GIS) to integrate the results of socio-economic research with remote sensing analysis. Local people's narratives and sketch maps were incorporated with land cover change and burn scar maps derived from satellite images.

3. Sekincau: community-based fires and land tenure conflicts

The burn scar analysis from satellite imagery for this site identified three main zones of burning, characterised by a distinctive burn scar pattern. In Zone 1 (see Figure 2 and Table 1), burn scars are small (3 ha on average) and widely scattered, accounting for 1 percent of the area. Overlaying the 1997 burn scar map with the land cover maps for 1985 and 1994 shows that much of the forest area had already been converted to coffee gardens by 1985. Field observations confirmed that the forest was burned regularly to expand the coffee gardens (Suyanto *et al*., 2000a).

Burn scars in Zone 2 are large, with an average size of 28 ha, and account for as much as 21 percent of the zone. The majority of burn scars are located near or adjacent to primary forest. The analysis showed that much of the area covered by the 1997 burn scars was still natural forest in 1994.

Zone 3 exhibits very large burn scars. Although the number of burn scars is less than in other zones, the average size is much larger (87 ha) and accounts for 29 percent of the zone. Historical satellite data show that this area has burned repeatedly since 1994, and probably in earlier years. In 1985, much of this area was already cultivated and converted to coffee gardens. The site is located in a national park, and the burning of the forest by communities to prepare the land for coffee production has resulted in conflicts between local people and the Forestry Department over

tenure and use rights. Data on distribution of coffee areas by different tree age were used to estimate area and year of establishment. The burned areas in 1997/98 covered 310 ha. Approximately 77 percent of the total land was cleared by fire in 1997/98.
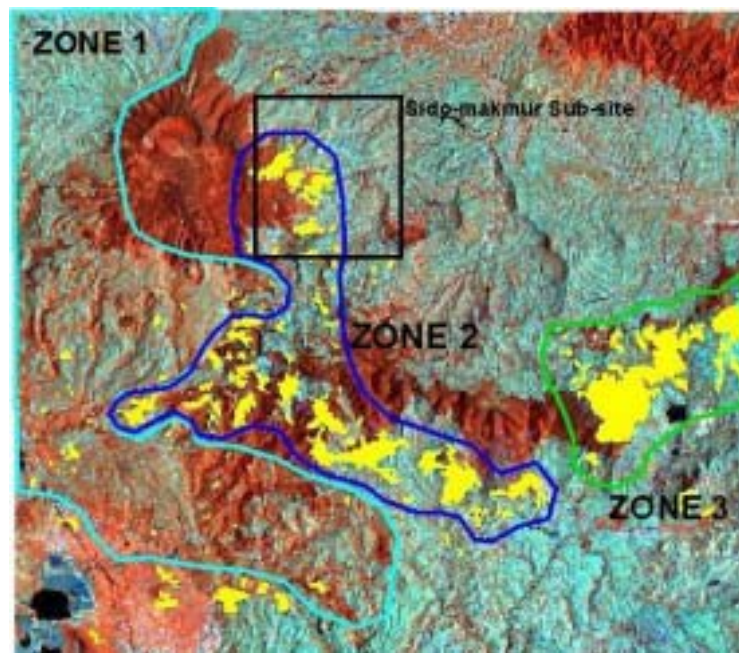
Figure 2: Burn scar patterns in Sekincau

Table 1: Statistics of burn scar patterns

Burn scar zone	1	2	3
Size of zone (ha)	13,371	6,548	3,286
Number of burn scars	48	48	11
Total area of burn scars (ha)	142	1,358	960
Area of burn scars in zone (%)	1	21	29
Average size of burn scar (ha)	3	28	87

In Sido-Makmur in Zone 2 (Figure 2), fires destroyed the forest in the national park. Based on research findings, the so-called "uncontrolled" fire that "escaped" from the farmers' fields burned the forest during El Niño years because the young coffee gardens are generally located near forests. On the other hand, interviews with local communities provided no evidence to show that fires spread to neighbouring farmers' coffee gardens. This suggests that farmers can manage fire effectively and prevent it from escaping into coffee gardens, but enable it to escape and burn forest areas to expand coffee gardens.

The traditional (adat) law has a system of penalties that are imposed on farmers who mismanage fires and destroy neighbours' fields. On the other hand, there is no incentive for communities or individuals to control the spread of fire into the natural forest, which in this case is a national park. On the contrary, communities and individuals stand to gain from forest fires in the park because the fire facilitates the establishment of coffee gardens in the area. While field investigations indicated the skills of local communities in the use fire on steep slopes by allowing

the prevailing winds to fan the fires into forest areas, many individuals denied that their land clearing activities were a cause of fires. Many insisted that they were very careful in managing fires when clearing the land. Most survey respondents blamed the forest fires on accidents from the campfires and discarded cigarette butts of illegal loggers.

The demographic composition in the study site is heavily influenced by migration from Java and Javanese communities from established settlements in Lampung. People moved to the area because of hardships and poor livelihood opportunities elsewhere. The positive initial evaluations from "pioneers" and increased family incomes from growing coffee have persuaded many families to relocate. Although land tenure is uncertain, because most of the coffee gardens are located inside the national park, "private" land tenure in the park is gradually becoming more secure. Farmers feel that the government will not take their land away because their community is established and developed with roads and other public services. The feeling of secure land tenure has increased during the "reformation" period (mid-1998 to the present). Confrontation with the authorities is less likely compared with the past when government authorities often tried to evict the coffee growers from the park.

The research results indicate a strong relationship between fire and deforestation. The establishment of coffee gardens using fire for site preparation is most active in areas where natural forest is still relatively abundant. Also, judging from the proximity of the burned forest areas and young coffee gardens, it is most likely that the fire spread during land preparation activities outside forest areas to the natural forest. The analyses therefore suggest that there may be two types of fires in this area: those that are managed and those that are allowed to burn uncontrolled. The managed fires come from the activities of smallholders for forest clearing, while uncontrolled fires can also occur in natural forest as a result of escaped fires from land clearing and illegal logging inside the national park.

4. Menggala: fire and traditional "sonor" rice cultivation

The second study site is located in the swamp areas in eastern Lampung Province. During the El Niño years of 1997/98, this area was characterised by burned swamps. The villagers of the Mesuji community are the main residents who manage fire for the production of swampland rice or "sonor". The Mesuji people came from South Sumatra to Lampung in the early 1900s, and brought with them the sonor technology. Over the last 10 years, farmers have practised the sonor system in each of the very dry years of 1987, 1991, 1994 and 1997. These years coincided with the El Niño phenomenon. According to the chief of the Mesuji people, thousands of hectares of swamp forest were burned and cultivated under the sonor system in 1997, with most households cultivating approximately 5 ha each (Suyanto *et al.*, 2000b).

The Mesuji people live along the rivers, which are dominant features in this area. Their main livelihood is fishing and sonor. They also harvest *gelam* trees (*Melaleuca* spp.) from the swamp forest for house construction and for sale. Under the sonor system, farmers plant rice only after a considerable drought, usually associated with an El Niño event. A 5- to 6-month dry period ensures that the water table is low enough for the successful burning of swamp forest. The fire removes the organic matter and provides an ash bed, which facilitates the early growth of the young rice seedlings. Characteristically, the Mesuji communities burn the swamp in September and October. Although land preparation requires relatively little labour inputs, shortage of labour for harvesting has been a problem. Therefore, many seasonal workers from transmigration areas are under contract to assist in the harvest. The traditional owners and labourers share the harvest equally. This generous payment highlights the severe labour shortages in the area, even to the point that some rice fields could not be harvested in 1997. Average yield per hectare under the sonor system is 4 metric tonnes of unhulled rice, which is almost double the yield of the non-sonor farming system.

The communities only set out to burn as much swamp forest as they require for the sonor production, but make no conscious effort to control the fires, which burn beyond the designated area. The desirable characteristic of the sonor system is its extremely low labour demand. Following the burning of the swamps and the sowing of the rice seeds, the farmers usually return to the field only after the harvest 6 months later. By this time, the water table has risen to levels

where it is necessary to travel through the fields by boat. Following the harvest, the forest areas are fallowed for 3 to 4 years (depending on the dry season cycles). During this period, the swamp forests, often dominated by gelam trees, regenerate and occupy the site.

The sonor practice is a community-based fire management approach that uses fire to prepare land, rather than one that aims to control the spread of fires. One of the side benefits of the sonor system is the development of *Melaleuca* spp., a fast growing, light-demanding species with a wide range of end uses. Preliminary investigations suggest that the vast swamp ecosystem south of the Musi River, an area including the study site, have been largely converted from primary swamp forests to grasslands and *Melaleuca*-dominated forests following logging and transmigration site developments. The repeated fires over a short time span of less than 25 years have altered the forest resource, which is now dominated in many places by *Melaleuca cajuputi*.

This "new" forest provides the raw materials for pole, sawn timber and charcoal industries operated informally by local people and migrants. The operations appear to extend over a vast area and sustain the livelihoods of many people. Observations suggest that the *Melaleuca* spp. regeneration is perhaps largely a feature of disturbed freshwater swamp forests. The issue of modified peat swamps therefore needs to be examined more closely. With the potential of generating new income from the resource, research will be undertaken to determine the social and biophysical aspects of community-based forest management of this resource and the judicious use of fire by the communities to promote regeneration and sustained productivity.

5. Conclusions

Community-based fire management is defined in the paper as the conscious use of fire to meet a specific objective. From the perspective of a community, or an individual, the objective could be the maintenance of livelihoods. This may involve clearing forest to plant coffee or rice, or to secure rights to the land, which may have negative impacts on the environment. Whether local communities consider such impacts as negative depends to a large extent on the effects on their livelihoods. Environmental changes that have global, but not local-level, impacts are unlikely to mean much to local communities. The ignorance of local communities about localised environmental changes that may affect their livelihoods needs also to be addressed. If in specific cases the use of fire has these unrecognised effects, it could be possible to reduce the occurrence and/or the extent and intensity of the fires while benefiting local communities.

For organizations promoting the use of community-based fire management, the objective of fire management could be the reduction of the negative impacts of fires on the local and global environment. These organizations need to recognise that their definition of negative impacts may differ from the communities' perspectives.

It is obvious that introducing community-based fire management demands detailed knowledge of environmental impacts, communities' livelihood systems and their relationships with the wider socio-economic and institutional environment. This requires research on existing livelihood systems (e.g. environmental sustainability, economic opportunities) and ways of improving them, the policy and institutional environments affecting livelihoods and environmental management, and the relationships between rural livelihoods and the corporate sector.

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Community participation in integrated forest fire management: experiences from Africa, Asia and Europe

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Abstract

The consequences of increasing application of fire in land-use practices and land-use change and the subsequent outbreaks of large wildfires in the tropics and neighbouring regions during the 1980s and 1990s have led to the development of several fire management programmes in Asia and Africa. The "Integrated Forest Fire Management" (IFFM) projects are based on the assumption that communities can successfully incorporate fire usage into sustainable land use and vegetation management systems. The IFFM concept was first applied in Indonesia and Namibia. Other countries such as Mongolia, Ethiopia and Guatemala are also interested in building IFFM capacities. The Fire Ecology Research Group/Global Fire Monitoring Center (GFMC) has supported the design of IFFM projects, especially using the concept of Round Tables on Fire Management for defining the participatory approach in fire management. The GFMC in association with the UN International Strategy for Disaster Reduction (ISDR) is promoting community participation as a measure for prevention of fire disasters.

1. Introduction

The majority of wildfires in developing countries of the tropics and subtropics, and in temperate-boreal countries in transition, are caused by human activities usually associated with land-use practices and changes. Many land-use systems in these regions are vulnerable to wildfires. The property, health and welfare of people in these areas are negatively affected by direct and indirect consequences of fire and air pollution. Active involvement of the local people has therefore been recognised as a condition for the successful implementation of fire management programmes, especially at the interfaces between wildlands, managed systems and residential areas.

During the 1980s and 1990s, several technical co-operation projects were implemented in developing countries, funded bilaterally or supported by international organizations (e.g. the Food and Agriculture Organization of the United Nations (FAO) and the World Bank). Many projects were implemented in partnership with national institutions responsible for the prevention and control of forest fires, often designated as "Forest Fire Control" or "Forest Fire Prevention and Control" projects, with a purely technical approach to reduce fire hazard and improve fire suppression capabilities. This resulted predominantly in working with and through government agencies. Local people, who use fire in land-use systems and/or are major agents of wildfires, and who are also directly and adversely affected by wildfires, were not involved in project activities. There was little or no recognition of local people as important actors and stakeholders.

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The underlying concept of Integrated Forest Fire Management (IFFM), also referred to as Community-based Forest Fire Management (CBFFM), is to better integrate fire and people into land-use and vegetation management systems. The approach is based on the following considerations:

♦ Reasons: fire is a spatially and temporally disperse phenomenon. It is difficult to have a centralised control system, particularly in developing countries. Responsibility for fire management must be brought closer to those who benefit both from the use of fire and from having more control.

♦ Objectives: rational, ecologically compatible, sustainable and safe use of fire is very important. With few exceptions, complete disuse of fire is undesirable.

♦ Impediments: defining responsibility (or "the community"), the need for complementary policy and legislative changes, identifying and supplying technical and other support needed to enable communities assume a central role in fire management are some of the difficulties encountered.

♦ Entry points: possibilities include definition of mechanisms, methods and policy instruments (e.g. incentives) to encourage communities to assume control and "ownership" over fire management.

Definition and design of IFFM approaches clearly depend on the complex configuration of local cultural, social, economic, political and environmental conditions. However, a dialogue and negotiation process among all stakeholders, from local to national levels, must first be established. IFFM objectives can be successfully realized only if all stakeholders involved in fire management agree on a distribution of responsibilities, decision-making power and resources. The process of negotiation and consensus building requires careful consideration of different perspectives and also the pluriformity of the legal context. Existing rules are often of different and sometimes contradictory origins (e.g. laws and administration rules governed by centralised legislation, traditional rules that may not be legally recognised, or weakening influence of traditional structures due to increasing cultural intermix (migration) or other impacts of globalisation).

To overcome possible conflicts and deadlocks, a combination of bottom-up and top-down approaches in defining the appropriate integrated fire management strategy seems to be most effective to build consensus among stakeholder groups at different levels. In the past decade the Fire Ecology Research Group[2] and the Global Fire Monitoring Center (GFMC) have chosen both approaches to support the development of national IFFM programmes. Several "National Round Tables on Fire Management" were held in co-operation with the German Agency for Technical Co-operation (GTZ) and international partners, including:

♦ In the aftermath of the extended fire and haze episodes of the 1980s, the first national long-term strategic fire management plan was prepared in Indonesia at the International Workshop on Long-term Integrated Forest Fire Management in Indonesia (Bappenas, 1992; Goldammer, 1993). This first national round table involved most stakeholders in fire management and the international donor community. It resulted in a concerted approach in building fire management capabilities in the country, leading to the IFFM project by the GTZ in co-operation with the Fire Ecology Research Group, the largest-ever international co-operative fire management project.[3]

♦ In 1999, the Namibia-Finland Forestry Program (NFFP) also convened a national round table on fire management, which recommended a multi-stakeholder approach in fire management with particular emphasis on the involvement of regional stakeholders and local communities. The IFFM approach of NFFP, its successes and limitations, as well as the results of the round table are discussed further in this paper.

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[2] Based at the Max Planck Institute for Chemistry, c/o Freiburg University, Germany.
[3] For the community component of project, see Abberger *et al.* in this publication.

♦ After the large forest fires in Ethiopia in 2000 and the successful international response to the emergency (Goldammer, 2000), the government called for a National Round Table on Fire Management in September 2000. It was recognised that Ethiopia, currently a country without any fire management capacities, would build its future programme on the basis of community involvement (Ministry of Agriculture, 2001).

In other countries no formal national round tables have been held prior to launching an IFFM programme. However, in these cases in-depth investigations at the community level were conducted to define the role of community participation in fire management, for example:

♦ In Mongolia, a survey was conducted to investigate the underlying causes of increased occurrence of wildfires in the steppe and forest ecosystems.

♦ In Guatemala, a local IFFM forum was convened in 2001 to address community involvement in the lowland rainforests of Petén. Experience gained in the Guatemala forum and in the four pilot communities is to be discussed at the national level in 2002.

2. Fire management in Africa

The organizational arrangements and procedures of national and local fire management systems vary from country to country. In the following sections examples are given from Namibia, Zambia, Côte d'Ivoire and South Africa. General recommendations for fire management in Africa are also available from various publications (FAO, 1999; Goldammer and de Ronde, 2001).

2.1. Namibia

In 1996, the Forestry Department of the Ministry of Environment and Tourism selected East Caprivi Region (north-eastern Namibia) as the pilot area for the NFFP to develop a model for community-based forest fire control (Jurvélius, 1999; Kamminga, 2001). The pilot area consists of 1.2 million ha of Namibia's best forest resources and belongs to the sub-tropical region. Most of the area is communal land, but a significant part is state forest, national park and wildlife conservation area. Although the pilot area falls within the Kalahari sand zone, the forests are moderately productive because of the relatively high rainfall (700 mm). Prior to the beginning of the project, 70-80 percent of woodlands in the pilot region used to burn each year and almost all fires were anthropogenic in nature.

NFFP was launched on basis of the 1996 Namibia Forestry Strategic Plan. The first phase was implemented from 1997 to 2001. The fire component, "Pilot Project for Forest Fire Control", was modified to IFFM in 1998 to emphasise that fire is a suitable land management tool, if carefully timed and used (Goldammer, 2001).

One objective of the IFFM was to assist the government in formulating a national fire policy and regional fire management plan for East Caprivi. The main objective according to the project document, however, was "the implementation of an applicable model for integrated forest fire management, implemented by Namibians". The major outputs included:

♦ Improved efficiency and effectiveness of the Directorate of Forestry (DoF) and other agencies and stakeholders implementing applicable IFFM activities in the field.

♦ Development of national guidelines and forest fire policy.

♦ Changed attitudes and behaviour of general public towards the use of fire and burning, and its detrimental effects to the environment in Caprivi.

IFFM adopted the following strategies:

♦ Support for public relations and extension activities for forest fire prevention within the government.

♦ At the community level, training and mobilisation of community members towards improved fire control and subsidised cutline construction and maintenance.

♦ Organization of a massive fire awareness and public education campaign through schools and local organizations in the area, involving all stakeholders. This included the production and use of written materials, posters, billboards, drama, radio programmes and videos (Figure 1).

An interim evaluation in 1998 concluded that the results of creating a model for controlling fires in communal lands in Caprivi were encouraging (Table 1).

Table 1: Performance indicators of activities in East Caprivi between 1995 and 1998*

Output areas	Conventional government-run forest fire control	Implementation of IFFM		
	1995	**1996**	**1997**	**1998**
Total area burned (ha)	838,000	790,000	558,000	390,000
Area burned (%)	99	91	67	47
Reduction in burned area (%)	0.2	6.0	24.0	54.0
Area under forest fire management (ha)	10,000	115,000	396,000	636,000
Area covered by fire management (%)	2	14	48	76
Area protected from fire by DoF (ha)	2,000	-	-	-
Area protected from fire by local communities (ha)	0	50,000	202,000	450,000
Effectiveness of fire prevention in managed areas (%)	20	44	51	71
Number of communities/ stakeholders	0	7 + 2 DBC** + 13	23 + 6 DBC + 42	28 + 2 DBC + 24 +64***
Fire lines or fuel breaks built (cutline) (km)	150	487	1,217	1,812
Number of people involved in fire control activities	30	300	525	1,000
Number of fires observed	>10,000	6,000-8,000	4,000-6,000	3,000-4,000
Number of people trained in forest fire control	0	7,500	13,000	33,500
Total area burned in Namibia including prescribed burning in national parks (ha)	3-5 million	3-5 million	2.1 million	2.0 million (estimate)

* The programme began only in April 1996.
** DBC = Development Brigade Corporation
*** Number of stakeholders involved in assisting the DoF in forest fire prevention activities during 1998 were: 28 local communities (16 contracted), 2DBC camps with ex-combatants of the independence movement, 24 handicraft producer villages (under the Caprivi Arts and Cultural Association (CACA) and 64 schools

The programme has involved many local people, their participation varying from attending drama shows, learning how to fight fires, determining the locations of cutlines, to being employees constructing or maintaining cutlines. These efforts saw a 54 percent reduction of burned areas annually in the area and also a decrease of fire incidences by 70 percent.

Figure 1: Examples of fire prevention posters in Namibia

During the high-risk fire season (April-November) in 1999, about 1,500 villagers were engaged in controlling wildfires in northeastern Namibia. In addition, some 1,000 teachers and 30,000 students received basic fire education.

In 1998, a survey examining local people's experiences in controlling fires in their communities showed that the positive effects of better fire control on the natural resource base were widely recognised (Virtanen, 1998), as can be affirmed by:

♦ improved condition of plants and trees;

♦ more forest products (e.g. fruits, nuts) as food supplements;

♦ increased numbers of wildlife;

♦ increased availability of grasses, thatch and other building materials;

♦ more fodder for livestock;

♦ less diseases among livestock;

♦ absence of livestock or crops destroyed by fire in the pilot villages; and

♦ increased income from sales of grasses, animals, and other products.

The survey also concluded that the government should transfer the responsibility and authority for fire protection to local people. The Namibian administration has forbidden the use of fire and this is still the situation today. The new Draft Forest Bill, however, delegates fire management responsibilities and authority to the traditional authorities. This will hopefully empower the local communities to assume ownership over fire control and management, a crucial factor for the sustainability of IFFM activities.

A recent assessment of the IFFM programme in terms of its impact on rural livelihoods in East Caprivi showed that the negative effects or "costs" of wildfires and the benefits of improved fire control on local people's livelihoods are difficult to quantify (Kamminga, 2001). Costs and benefits vary among different segments of the population and are also site specific. They depend on the general natural resource situation (e.g. alternative resources when certain areas are burned), local access rules (tenure), intensity of the land-use system, and other options available to individual households.

This complex relationship between the costs and benefits of IFFM activities is one reason why mobilising local volunteers to maintain cutlines has proven to be difficult, especially when areas are utilised for collective grazing. Land tenure is a crucial factor for community participation in fire management activities. In addition, the selected fire control techniques must be appropriate for the specific land-use system. The woodlands of East Caprivi are used for grazing. Labour intensive techniques such as firebreaks are not economically justified from the farmers' perspective and subsidies will always be necessary (Kamminga, 2001). Some lessons learned from implementing the IFFM model are:

♦ IFFM's concept of community participation differs from that of the local people. For example, IFFM relies on the community to volunteer partially for the cutline work. The pay is relatively low in comparison to the food-for-work system. However, the cutline workers expect commercial wages. This discrepancy endangers future social and economic sustainability of the firebreaks. A clear understanding and agreement about the work and payment among all parties must be clarified right from the beginning.

♦ Providing employment in an isolated and remote area saddled with political instability, considerable unemployment, and one of the highest HIV/AIDS infection rates in the country is very effective in alleviating poverty. This should be considered an objective in itself. Proper wages should be paid.

♦ Pressure on local IFFM staff to provide employment is high. Nevertheless, cutlines should only be constructed in communities with high risks of wildfires. Resources should therefore be allocated according to priorities based on objective, verifiable and transparent criteria. Strict supervision is necessary.

- ♦ Recruitment of labourers should favour the poorest categories of people, in particular female heads of households and married males, to help meet the basic needs of their families. Women should be allowed to work on cutlines closest to the village, while men can work further away in the bush.

- ♦ Recruitment of young male school leavers for subsidised cutline work can help to occupy the otherwise idle boys and also provide them with work experience, discipline, technical skills, etc. Emphasis must be on recruiting youngsters from the poorest households.

- ♦ To reduce competition with other household labour demands, cutline work should not coincide with the agricultural season.

- ♦ More frequent and timely payment of cutline work is crucial for optimising benefits to the target groups. Poor women, in particular, need immediate, or at least regular, income (Kamminga, 2001).

2.1.1. National Guidelines on Forest Fire Management in Namibia

After an earlier proposal to call a National Round Table on Fire Management (Goldammer, 1998) and in accordance with the recommendations of the Round Table in 1999 (Goldammer, 2001), the IFFM assisted the government to prepare the *National Guidelines on Forest Fire Management in Namibia* (Jurvélius, 2001). The guidelines strongly encouraged community participation in forest fire protection programmes.

2.2. Zambia

Widespread and uncontrolled burning is common during the dry season in the Western Province of Zambia, destroying large areas of rangelands, woodlands and forests. Some fires are started deliberately by livestock owners seeking to promote a green flush for their animals, by rodent hunters clearing vegetation to catch their prey more easily, by people creating firebreaks around their homesteads or seeking to improve visibility, or by individuals playing with fire. The fires are also ignited by people clearing land for cultivation, smoking out beehives, making charcoal, cooking or trying to keep warm. The uncontrolled fires can spread accidentally from their sources into the surrounding bush where they usually burn themselves out some distance away, often crossing into a different vegetation type (Frost, 1992a).

Whereas the lowlands seem to be able to sustain regular burning, many of the woodlands are beginning to show signs of damage from too frequent and intense fires. This is exacerbated by timber extraction, which is opening up the woodland canopy and allowing more light to reach the herbaceous layer, thereby promoting increased production of grass and fire-resistant shrubs that fuel the fires. Fires kill the more fire-sensitive trees and suppress the regrowth of the more resistant species. This is preventing the re-establishment of the woodland canopy, which would suppress herbaceous production and reduce fuel loads, fire frequency and intensity (Gambiza *et al*., 2000).

Besides being illegal, the widespread and uncontrolled use of fire poses a number of potential problems for resource managers. For example, shortages of fodder for livestock towards the end of the dry season may more than offset any benefits derived from having access to smaller amounts of higher quality forage. Progressive declines in woodland cover and productivity, destruction of timber, fuelwood, thatching grass and other resources on which many people of the Western Province depend are other issues to be considered (Jeanes and Baars, 1991; Frost, 1992b).

Researchers and agricultural extension workers seeking to enhance cattle production in the Western Province recognised the benefits of burning to produce a green flush of grass for cattle. They also acknowledged that frequent and extensive burning was reducing the amount of forage for cattle in the late dry season. Consequently, the Rangeland Management Team (RMT) of the Livestock Development Programme, a joint Dutch-Zambian initiative, commissioned a review of the existing information and insights on savannah burning, to provide a framework for the development and implementation of a revised policy on burning, if one was needed. The review considered the following aspects (Frost, 1992b):

♦ fire regimes of the Western Province;

♦ ecological aspects of fire in southern African savannah ecosystems, including beneficial and adverse effects;

♦ fire behaviour and the factors affecting the behaviour;

♦ the use of fire in rangeland and woodland management;

♦ legal provisions for burning; and

♦ a synthesis outlining the framework for an enhanced fire policy in the Western Province.

The review was followed by a draft policy for fire management (Frost, 1992a), which was subsequently adopted and implemented at the provincial level.

2.2.1. Fire management policy

A proposed policy of planned and controlled burning of selected rangelands in the Western Province sought to trade-off the need for an adequate supply of suitable fodder throughout the dry season and the needs of other users to derive benefits from the natural resources (Frost, 1992a). The policy also implicitly recognised that the current use of fire followed traditional practices, and that it would be impossible to ban its use completely, as shown by the failure of the policy at that time. The revised policy therefore aims to maximise the benefits and minimise the drawbacks associated with the use of fire.

People generally use fire as a tool to manage natural resources. To satisfy divergent needs, conflicting objectives have to be considered (e.g. burning may improve fodder quality but is also likely to diminish the availability of thatch grass and timber). Any attempt to institute controlled burning within a community needs to be broad-based and address the reasons why people use fire, the benefits to be gained through its use and the consequences of changing the pattern of use. In short, a strategy for prescribed burning had to be developed within a broader land-use and resource-management programme.

Prescribed burning requires decisions on where, when and how to burn, what preparations are needed to control the fire, and co-ordinated actions to control the spread of the fire. Co-operative management of the post-fire regrowth is equally important. Burning for the production of high quality fodder should be confined to vegetation types, mostly the lowland moist grasslands, where sustained dry season regrowth of the grasses could be expected, even when grazed. In contrast, late dry season fires in the upland woodlands should be avoided by planning burns early in the dry season when they do not conflict with the interests of other forest users (Frost, 1992a).

To ensure success of controlled burning, community members must be party to decisions on the need for burning and its control. They must be responsible for determining which areas can be burned, when, how, and by whom. They must also be able to delegate these responsibilities. The essential role of technical assistance is to facilitate decision-making by the community, not to dictate the decisions.

An implementation strategy was therefore proposed to involve the community in the planning and implementation, and to integrate controlled burning into an overall land-use and resource management programme. The strategy addresses the following questions:

♦ What level of control is required to achieve the expected benefits and to restrict potential detrimental effects of burning?

♦ Who should be responsible for exercising control?

♦ How can responsibility be instituted?

♦ How much and what kind of technical advice is required to support controlled burning?

♦ What is the most appropriate framework for promoting the implementation strategy?

The RMT initiated a series of district-level workshops between December 1993 and June 1994 to promote the revised policy and to recommend an action plan. Workshops were held in five of the six districts of the province (Sesheke, Senanga, Kaoma, Lukulu and Kalabo).[4]

Although the workshops were initiated by the RMT, the meetings were officially held under the auspices of the local district council and chaired by the council chairman. Workshop participants included district councillors, members and representatives of the Barotse Royal Establishment, farmers, local officials of government departments, and other interested parties.

There was general agreement at the workshops that current burning practices were not beneficial because vegetation was destroyed, resulting in the loss of natural resources and exposed soil that is prone to erosion. These negative effects were blamed on uncontrolled and uncoordinated burning, coupled with the fire users' lack of technical knowledge.

All the workshops strongly recommended greater community involvement through their traditional leaders, together with government officials such as Natural Resources and Forestry Officers, in decisions on the use and control of fire. Responsibility for controlling burning used to be vested in traditional leaders (e.g. chiefs, indunas, and headmen). Violators of the local laws were prosecuted in traditional courts. Current legislation makes no direct provision for community control. Other suggestions on improving current burning practices included educating villagers on the responsible use of fire, introducing financial incentives and improving fire control.

Resource management entails considerable costs that may become onerous for poor rural people. In general, they only invest in natural resource management if they expect a clear improvement in their livelihoods or if it will reverse a situation that threatens their livelihoods. Experience elsewhere in southern Africa suggests that for community-based natural resource management institutions to be both functional and robust, they need to fulfil most of the following criteria (Murphree, 1991):

- Those who manage the resources must have a vested interest in the outcome. This means that the resource managers must be the landholders and primary beneficiaries.
- There must be a close and proportional link between management inputs and benefits.
- The benefits must be tangible and immediate.
- There should be local autonomy in decision-making, both in regard to management and the distribution of benefits.
- The resource user group should be small enough to be cohesive and to lower transaction costs, but not so small that it becomes exclusive and wholly self-serving.
- The leadership must be accountable, transparent and broadly representative of the community it serves.
- Responsibility at different scales should be nested to give effect to the principle of subsidiarity.
- The boundaries of the management units should be distinct and exclusive (although this requirement may be difficult to implement because there is often considerable overlap between adjacent communities in the areas from which they obtain common-pool resources).
- Political and administrative boundaries of these management units should coincide broadly with the biophysical ones.

2.3. Côte d'Ivoire

After the El Niño of 1982/83 and the extended wildfires of 1983, forest and bush fire control became an important priority of the environmental protection policy of the government of Côte d'Ivoire (Anon, 1996). In 1986, a National Committee of Forest Protection and Bush Fire Control

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[4] The Mongu District Council declined hosting a workshop, and it would be necessary to identify and address the source of its reservations.

was formed. Personnel of the Forest Service filled the positions of the General Secretariat and the Presidency of the National Committee. These bodies co-ordinated the participation of 14 ministries involved in national programmes. The task of the committee was to raise the awareness of the damage caused by fires, the need for fire prevention and techniques for extinguishing fires. In total, 1,500 village committees, 57 local committees and 32 regional committees were created to decentralise the task of fire control during the last ten years. These committees, consisting of elected members, a secretary and a president, raised consciousness of fire threats and informed the public about fire prevention. The office of the Secretary General and the regional divisions provided advice and monitored the forest fire situation at the national level. The committees receive monthly payments during the four months of the dry season. The remuneration is inversely proportional to the size of the area affected by fire as shown below (Oura, 1999):

- ♦ F CFA 500,000 (US$1,000) per month per committee for 0 ha burned;
- ♦ F CFA 400,000 (US$800) per month for less than 5 ha burned;
- ♦ F CFA 200,000 (US$500) per month for less than 10 ha burned; and
- ♦ F CFA 50,000 (US$100) per month for less than 20 ha burned.

The average annual cost of surveillance is about F CFA 3,000 (US$7) per ha per year for forest plantations and F CFA 1,000 (US$2) per ha for natural vegetation.

2.4. South Africa: Ukuvuka: Operation Firestop Campaign

Crisis can lead to dramatic reactions, encouraging people to co-operate in new and creative ways. As shocked residents of the Western Cape Province, South Africa, watched their mountains burn in January 2000, the thought in every mind was that something urgent had to be done to prevent such devastation from occurring again (Figure 2). Their response was speedy, dynamic and powerful. People shared a vision of maximum fire protection and restored ecological integrity, giving their time willingly to translate this vision into a business plan that would find resources and co-ordinate how various authorities would act (Kruger, 2001). The aptly named "Ukuvuka: Operation Firestop Campaign" (*Ukuvuka* is a Xhosa word meaning "to wake up") brings together representatives of government, private enterprise and the media in a partnership unprecedented in South Africa.

Figure 2: A community in South Africa damaged by spreading wildland fire

Public sector members of the initiative include Working for Water Programme representing the national government, the Western Cape Government, South Africa (SA) National Parks, the South Peninsula Municipality, the City of Cape Town and the Cape Metropolitan Council that has committed Rand (R) 30 million to the Campaign. Other public sector organizations are contributing staff support and expertise.

Major private sector funds have come from Santam (with R20 million, believed to be the largest single donation ever made to a South African environmental project), Cape Argus (R5.5 million), Nedbank (R5 million) and Total (R4 million). In addition, local companies and the World Wide Fund for Nature (WWF) South Africa have offered free services, ranging from the production of advertising materials to legal assistance.

The Campaign's activities are governed by a Board, managed by a steering committee and overseen by independent trustees of the Ukuvuka Trust Fund. The Campaign does not carry out ecological restoration work itself but co-ordinates and funds projects under the control of SA National Parks or the local authority, the City of Cape Town.

The Campaign aims to significantly reduce the risk of damage and danger from wildfires in the Cape Peninsula. The first key objectives are to:

♦   control invasive alien plants; and
♦   rehabilitate fire-damaged areas.

Secondary key objectives are to:
♦   create employment, training and poverty relief for disadvantaged people;
♦   protect the most vulnerable communities from fire; and
♦   promote co-operation and social cohesion among communities.

Thirdly, institutions will be assisted to:
♦   implement integrated fire management plans; and
♦   manage the urban edge.

The Campaign has a four-year mandate, started in February 2000, to achieve its goals. It places great emphasis on an effective communication and education programme, and an accountable administration. The Campaign hopes to be a role model for similar projects elsewhere in the country by passing on lessons learned.

2.4.1. Working with the land and its plants

Since early 2000, the focus is on clearing alien plants and rehabilitating public land. After the fires, emergency measures to stabilise burned slopes are top priorities. The spectre of post-fire flooding and mudslides is a major concern after similar events in Glencairn and Fish Hoek the previous year. The City of Cape Town identified 34 high-risk sites, and by the end of June 2000 numerous anti-erosion structures, including silt curtains, sandbags and stone gabions, had been constructed.

Helped by a below average rainfall, this operation was a resounding success. Now, the Campaign is developing community-based nurseries to produce indigenous species.

The long term, and more substantial, problem is the presence of invasive alien vegetation. To date, some 750 tree and 8,000 other plant species have been imported to South Africa for use as crops, timber, firewood, barriers, or for ornamental purposes. Most cause no harm, but 198 species have been declared weeds and invasive species. Uncontrolled, these aggressive plants tend to reproduce rapidly and consume billions of litres of water each year. Urbanisation, agriculture and forestry have already occupied almost one third of the 90,000 km^2 Cape Floral Kingdom, and what remains (mostly in mountainous areas) is threatened by invasive alien plants. Indeed, these plants are the single greatest threat to the floral kingdom.

The City of Cape Town has a long history of destroying invasive alien plants. Currently the Cape Peninsula National Park commits more than R10 million annually on an eradication programme. Water conservation is justification enough for a war against weeds, but reducing fuel loads in the event of a fire is another important factor. The intensity of uncontrolled wildfires increases substantially when fire-prone aliens take root among the indigenous plants. The fuel load increases and densely invaded areas become impenetrable to firefighters, multiplying the risk of disaster.

Since March 2000, more than 1,000 ha of alien plants have been cleared with Campaign funds, and a firebreak is being created along the 200 km boundary of the Cape Peninsula National Park.

What this means for landowners

Existing regulations require landowners to get rid of invasive alien plants, and the laws are becoming much tougher. It is in everyone's interests to deal with these plants as quickly as possible: the longer they are ignored, the more invasive they become and the more costly to eradicate. The Campaign's extension officers are available to identify invasive trees and plants, help find suitable contractors and oversee the clearing operation.

Some stands of alien trees have special appeal because of their historical or cultural significance, or their recreational use. They will be spared, or phased out gradually. Forestry, responsible for a sizeable percentage of alien infestation, will continue in the Peninsula, but plantations will be managed accordingly. Nevertheless, some carefully controlled woodlots of alien species may be grown to provide firewood to poor communities.

It is important to remember that not all alien plants are undesirable – only those deemed to be a problem. The Campaign is trying to explain the threat to the rich indigenous vegetation and the increased fire risk to the public and private landowners.

2.4.2. Working with communities and individuals

Employment and training

One Campaign key objective is to create jobs for as many disadvantaged people as possible. Fortunately, eradicating alien invasive vegetation is very labour intensive, and cutting down trees is only the first step. The job is not complete until all the unwanted plants have been removed or burned, and careful follow-up clearing done to prevent regrowth – usually over several years. One person from each household is on contract at any one time in this activity, to ensure income to as many families as possible. Once people have acquired skills, they can gain further employment in the private sector.

Protecting the most vulnerable social groups from fire

Part of the Campaign's mission is to empower disadvantaged people to protect their families and communities. Residents of informal settlements may not be affected by a mountain blaze, but they are always at risk from fire. Their shacks are often built of highly combustible materials and are usually clustered close together. When fire strikes one of these densely populated communities, it is often impossible to contain the resulting inferno and hundreds can lose their homes.

The Campaign's target area includes five disadvantaged, fire-prone communities: Imizamo Yethu, Hout Bay fishing village, Ocean View, Masiphumelele and Red Hill. Two vulnerable satellite areas on the Cape Flats, Joe Slovo and Silver City, will also receive help. In 2000, 30 percent of reported fire incidents in informal settlements in the Cape Town municipal area and 60 percent of all dwellings destroyed occurred in Joe Slovo. Working in partnership with disaster management and community volunteers, the Campaign has distributed 4,800 buckets, whistles and informative posters in Joe Slovo. The effectiveness of a swift response to an alarm whistle to control a fire, using buckets of sand and water were also demonstrated.

In each of these vulnerable areas, training in firefighting techniques, interventions to provide fire hydrants and hardened tracks that can be used as access roads and firebreaks are underway or

being investigated. Youth groups have been established to act as information officers. Fire and access breaks between homes are still needed in some areas – a step that calls for sensitive negotiation as, inevitably, some homes will have to be relocated to create the necessary space.

Promoting co-operation between communities

The Campaign has also conducted a study to identify private properties at risk, and it is working with the local authority to advise property owners about how best to fireproof their homes. Affluent people usually have fire insurance and the means to either fight a blaze or flee by vehicles. In these cases, the Campaign encourages landowners to manage their properties responsibly, join forces to reduce the risk of fire and flooding, and contribute financially to projects in the public interest. Informal settlement dwellers, on the other hand, generally have fewer choices, no insurance and very little control over their environment. Assistance from the Campaign can help to organize them, improve their fire protection capacities and enhance their responsiveness to neighbouring communities in need.

2.4.3. Working with institutions

Fire management plans

An integrated fire management plan is vital if the various authorities are to co-ordinate and streamline their firefighting activities. The Veld and Forest Fires Act (1998) has provision for Fire Protection Associations (FPAs). The Ukuvuka: Operation Firestop Campaign is funding the appointment of a facilitator to establish an FPA in the Peninsula. Its primary tasks will be to help maintain firebreaks and to supervise volunteer firefighting groups and a rapid response system. While the FPA directs the practical operations, the Campaign's input will focus on education, firefighting training, disaster planning and the provision of equipment.

Living on the edge

People who choose to live on the mountain slopes, enjoying the beauty and advantages of the adjoining natural environment, are vulnerable to fires. They must accept responsibility for protecting their immediate surroundings. There is a need for firebreaks, erosion control and fireproofing of properties along the urban fringe. The Campaign is supporting the efforts of hack groups and nature clubs with planning, mapping, training, equipment and plants. As public awareness grows, it is hoped that landowners, apart from clearing alien plants and replacing them with indigenous species (many of which have fire-repellent properties), will participate in these efforts.

2.4.4. Communication

To help the Campaign achieve its objectives, there must be awareness, environmental education, community enthusiasm and goodwill, pressure from insurance companies and banks, and (where necessary) legal enforcement by authorities. Campaign activities are already being widely publicised in the media. School children will soon be exposed to an educational programme that will increase their knowledge about invasive alien plants and their link to fire and its consequences. Already, Campaign workers and partners sport eye-catching T-shirts, and publicity initiatives include banners, bumper stickers and advertisements to inform the public of the Ukuvuka: Operation Firestop Campaign drive.

The Campaign is a huge undertaking, but fortunately it has the enthusiastic support of various authorities, generous funding from the private sector, and a high level of co-operation and commitment from landowners. It is also a campaign that aims to facilitate a fundamental shift in the mindset of Capetonians; a shift that will ultimately be apparent throughout South Africa as the success of this ambitious project is duplicated elsewhere in the country.

Lessons have been learned, and although the Ukuvuka: Operation Firestop Campaign was born out of devastation and despair, its legacy will be immensely rich: rehabilitated and protected natural assets, and safer, more empowered communities.

3. Fire management in Asia

3.1. India

In India, Joint Forest Management (JFM) committees have been established at the village level to involve people in forest protection and conservation. At present there are 36,165 JFM committees throughout the country, covering an area of more than 10.24 million ha (Bahuguna and Singh, 2001; Kumar, 2001). The committees also have been given responsibilities to protect the forests from fires. For this purpose, the Modern Forest Fire Control plan is being revised and JFM is being made an integral component of the forest fire prevention strategy. Use of aircraft and helicopters has not been cost effective in the fire management programme and the Air Operation Wing is being closed down. For emergency purposes, however, a provision for hiring aircraft for transporting crews and water is being maintained. The Government of India has issued national forest fire prevention and control guidelines. Salient features of the guidelines include identification of vulnerable areas on maps, creation of a data bank on forest fires, establishment of a fire forecasting system, provisions for a crisis management group, involvement of JFM committees, and efficient enforcement of legal provisions.

3.2. Philippines

The Mountain Province in the Cordillera of Luzón, Philippines, is a fire-prone area. The dipterocarp stands are located along creeks and rivers mostly in the eastern part of the province, particularly in the municipality of Paracelis and Natonin. Pine forests are the major forest vegetation covering 53,767 ha, while the mossy forest covers about 37,200 ha. The pine forest with its open crown and grassy understorey provides high fuel loads during the dry season. A region-wide Forest Fire Management project, implemented from 1987 to 1989 has determined that 99 percent of forest fires are caused by human activities, such as slash-and-burn agriculture (kaingin), debris and garbage burning, arson, and other indiscriminate use of fire. This situation gave rise to the "No Fire Bonus Plan", which intends to involve local people in fire prevention (Pogeyed, 1998).

To motivate and encourage participation in the implementation of forest conservation/protection measures against fires, the programme's goals are to:

♦   organize and strengthen community members to enable them to work towards a common endeavour;

♦   strengthen the political will of the community and the Local Government Units towards the conservation/protection of the forest resource; and

♦   incorporate forest conservation/protection initiatives into development efforts at the community level.

To achieve these goals, the specific objectives are set as follows:

♦   limit/prevent, if not totally eradicate, the occurrence of forest wildfires in every community (barangay) of the province;

♦   regulate the use of fire by farmers through the issuance of permits to burn;

♦   monitor and record the occurrences of fire in each barangay regularly; and

♦   continuously investigate the causes of fires and recommend policies to concerned agencies for implementation.

Part of the implementation strategy is to mobilise all barangay communities to participate in the No Fire Bonus Plan. The provincial government of Mountain Province will establish a committee to select barangays for the plan and to facilitate the awarding of projects to winning barangays.

Participating barangays that have not incurred any forest fire during the dry season or other forest destruction, such as illegal logging and occupation in forestlands, shall be awarded development projects worth 200,000 pesos (about US$4,000). The programme shall adopt a community-based approach in identification, planning and implementation projects. The projects

shall include, but not be limited to, environment-related activities such as garbage disposal, water impounding schemes and erosion control. A total of 124 barangays from the municipalities of Barlig, Bauko, Besao, Bontoc, Sabangan, Sadanga, Sagada and Tadian have been proposed as the beneficiaries of this programme (Pogeyed, 1998).

3.3. Mongolia

Forests and grasslands play an important role in Mongolia's economic development. Forests cover around 12.5 million ha or 8.1 percent of the Mongolia's total land area, consisting mostly of larch (*Larix sibirica*), pine (*Pinus sylvestris*), birch (*Betula platyphylla)*, cedar (*Pinus sibirica*), spruce (*Picea* spp.) and saxaul (*Haloxylon ammodendron*). Grasslands cover 70 percent of the country. It is assumed that most of today's steppe vegetation is on former forest sites that have been degraded by fire. Forest fire statistics from 1963 to 1997 reveal that the majority of fires occurred within the central and eastern parts of the forested area. This can be attributed to the predominance of fire susceptible pine and larch stands. Moreover, economic activity is much higher here than in other parts of the country. Extreme fire seasons are caused by long droughts and fires are common from April to July under such conditions. The average fire season usually has two peaks: one from March to mid-June accounting for 80 percent of all fires, the other is during September and October and accounts for 5 to 8 percent of all fires. In summer, fires are rare (only 2 to 5 percent) because of heavy rains (Valendik *et al.*, 1998).

The increase in the number of wildfires since the mid-1990s corresponds to changes in social conditions. Current unemployment rates in rural areas can be as high as 80 to 90 percent. The loss of income has forced many people to resort to logging, fuelwood collection, haymaking, hunting and fishing, and, most importantly, the collection of non-timber forest products (deer antlers, pine nuts, berries, herbs and grasses). Use of natural resources for both personal consumption and sale is often seen as the only option for survival (Ing, 1999a, 1999b, 2000).

The urban population is also dependent on natural resources, dramatically increasing pressures on the environment and protected areas. Accentuating such pressures on natural areas is intensified migration as people move about looking for alternatives. The return to traditional livestock herding, as a preference to unemployment, is a major reason for rural migration. A direct result of these pressures is the increasing potential for anthropogenic wildfire occurrences through intensive natural resource utilisation and rangeland preparation. The inexperience and carelessness of urban dwellers might also inadvertently have started wildfires.

An average of 50-60 forest fires and 80-100 steppe fires occur annually in Mongolia, and about 95 percent of such fires are caused by human activities. The winters and springs from 1996 to 1998 were extremely dry and without snow in most areas. From late February to early June of these years, Mongolia witnessed large-scale forest and steppe fires that devastated large areas. Twenty-nine people died, 82 were injured and 11,700 livestock were killed. Also, 218 family houses, 1,066 communication facilities, 750 fences and 26.3 million ha of pasture and forest burned (Wingard and Erdenesaikhan, 1998; Wingard and Moody, 2000).

3.3.1. A decentralised fire management approach

Until recently, the Civil Defence, a branch of the military, was responsible for fire-related activities in Mongolia. It maintained all training, equipment and personnel with virtually no support to local communities. With the downfall of the communist regime in the 1990s and the stagnating economy, the centralised firefighting system collapsed. Perhaps the single most important contributor to the increase in fire spread was the grounding of the Aerial Patrol Service.

In 1969 the Mongolian Fire Protection and Aerial Patrol Service was established to provide early detection and rapid initial attack on fires, based on a Soviet-style aerial detection and airborne firefighting programme. The Service was staffed by 200 to 300 smokejumpers and helicopter rappellers, including a fleet of helicopters for helitack and tactical aerial support. The aerial forces operated out of seven bases distributed throughout the fire-prone regions of northern Mongolia. Smokejumpers on routine aerial patrols detected a high percentage of the fires and

handled approximately 90 percent of the suppression workload. In the early 1990s, when the communist government and Soviet financial support abruptly disappeared, the Mongolian aerial programme sharply declined. At present, the country cannot afford to maintain and fly their aerial patrol aircraft. The decline of the aerial programme through the mid-1990s resulted in a "fire suppression void" and greatly contributed to the horrendous losses experienced in the 1996 and 1997 fires.

Immediately following the 1996 fires, Mongolia received assistance from international organizations. The German government initiated an Emergency Fire Aid project in the northern and eastern parts of the country between October and December 1996. The Mongolian government has since been working to find long-term solutions to improve fire management. In a first step, the parliament passed a law designed to organize and improve firefighting efforts at all levels.

In February of 1998, the German and Mongolian governments signed an agreement to start an Integrated Fire Management (IFM) Project to be implemented over three years (1997-2000). A primary task of the project was the establishment of a fire management plan compatible with the protected area goals and the responsibilities of the local communities. Fire Management Units (FMUs) in the local communities received professional training and hand tools suitable for the regional conditions. Information and Training Centres (ITCs) provided the necessary infrastructure for fire prevention activities, management information, training, dispatch and field organization.

IFM, like other community-based programmes, focuses on flexible, pragmatic approaches designed to support local people's role in resource management. Specifically it entails the application of modern wildland fire technologies and practices at the community level. The IFM project strengthened local capacities to effectively address fire prevention, pre-suppression and suppression by helping to organize co-operative efforts between protected area staff and local and national administrations responsible for fire management, and by including all stakeholders in the planning and implementation of fire management activities. Additional goals include establishing the necessary infrastructure, providing in-country and overseas training.

In the summer of 1998, the IFM project began pilot activities in the buffer zone communities surrounding the Khan Khentii Special Protected Area – one of the more seriously affected areas by the 1996 fires. Specifically targeted were the potential multipliers including ITC extension officers, educators, protected area rangers and key community persons. This co-operative effort resulted in the development of the following educational materials:

- ◆ a fire prevention curriculum for school children;
- ◆ fire prevention videos;
- ◆ ranger's handbooks to be used as an outreach tool in remote areas;
- ◆ colouring books for small children; and
- ◆ a fire mascot to deliver the prevention message.

The central focus of pre-suppression work has been the drafting of a fire management plan for the protected area administration and local communities. Suppression goals include:

- ◆ establishment of fire management crews;
- ◆ provision of equipment; and
- ◆ development of a locally run "Fire Training Programme" adapted to Mongolian conditions of fuels, fire behaviour and available suppression resources and logistics.

In the spring of 1998, six soum (district) governors in the protected area buffer zone formed for each soum a 15-person FMU (or suppression crews). Each crew consists of a crew boss, assistant crew boss and thirteen volunteers. The crew is jointly managed through a Memorandum of Understanding between the local community and the protected area administration. The project also identified equipment to match the fuel conditions. Starting in March 1999, the IFM project

assisted Mongolian fire specialists in developing a series of training materials. The training programmes were adapted from existing Mongolian training schemes and the basic courses used to train American wildland firefighters. Approximately one half of the course was conducted in the field, including "practice fires" for mop-up and a live-fire exercise.

4. Germany: integrated fire and landscape management

Page and Goldammer (2000) investigated how prescribed burning by local communities can maintain the traditional open meadow vegetation structures on slopes that are threatened by secondary succession in Germany.

The history of wine cultivation in the Kaiserstuhl area, located in the Rhine valley in the State of Baden-Württemberg, dates back to the 8th Century. Farmers grew wine on terraces built on the hilly terrain. Although bushes and trees dominated the natural vegetation cover in the area, vineyard slopes have distinct meadow-like grassland. Until World War II, these ecosystems were maintained by mowing and occasional burning to retain the openness of the landscape, particularly to prevent shading of vineyards and to produce hay for cattle. After the war, wine growing became a major economic activity, while animal husbandry decreased in importance. As the farmers no longer needed hay to feed their cattle, they began to burn the slopes in the winter to suppress the growth of bush and tree species.

In 1975, following the Federal German nature conservation law, Baden-Württemberg imposed a ban of open burning (broadcast burning) of vegetation. Since then the slopes were cultivated only under certain circumstances. This led to secondary succession with an increasing invasion and expansion of bush and trees into these areas. Habitats for many plants and animal species that favour open grasslands were lost because of ecosystem changes.

The slopes in the old historical vineyards were only up to 8 m long. With the consolidation and restructuring of farmland property in the 1960s and 1970s, slopes of up to 40 m long and with over 100 percent inclination were constructed. Except for the initial establishment of grass on the slopes, no human intervention has taken place in the area. Today, both the new and the historical slopes serve to let secondary succession run its course. Given the size of the area (4 km^2 only in the central part of Kaiserstuhl), a major investment of time and money is required to maintain the traditional grass-dominated open structures by cutting and/or mowing, or by prescribed burning as an alternative.

4.1. Objectives of the prescribed burning project

A research project was initiated to determine whether prescribed burning of small plots in late winter could be used to maintain and promote the traditional open vegetation structure, the habitats and occurrences of typical and characteristic animal and plant species in Kaiserstuhl. A survey of the attitudes and possible involvement of the local farmers was part of the research (Page *et al*., 2000; Weiher *et al*., 2000).

Discussions with different groups involved in agriculture, viticulture and landscape management in the region (farmers, municipality, governmental and non-governmental nature conservation organizations) revealed conflicting views on the potential application of prescribed burning. While farmers and local municipalities unanimously supported the use of prescribed fire as a tool to suppress succession, the governmental and non-governmental nature conservation bodies were concerned about the negative impact of burning on the environment. To create a common discussion platform to address conflicting views and to develop a mutually acceptable and harmonised management strategy, a "Round Table on Slope Management in the Kaiserstuhl Area" was held.

A strategic paper, "Model for the future development of the vineyard slopes in the Kaiserstuhl area" was produced, recommending that existing open vegetation structures should be maintained by using different management practices including prescribed burning. For the first time in Central Europe, prescribed burning as a tool for landscape management was accepted as a valid practice. Details on how fire should be (re-)introduced in the future include:

♦ Prescribed burning will be restricted to the winter season (between November and February) under specifically defined weather conditions.

♦ Areas to be burned have to be small – not more than half a slope on one section of land (often, but not necessarily, under the same ownership; the absolute maximum width is 50 m on an individual slope) – and cannot be adjacent to each other. A mosaic of burned and unburned plots is a vital prerequisite for re-colonising threatened or endangered fauna, particularly arthropods.

♦ The owner of the slope is responsible for the management of the burns. Anyone can obtain a permit for prescribed fires, but participation in an information and training programme is mandatory.

During the winter of 2000/2001, a prescribed burning programme was implemented in one municipality (Figure 3). Based on the positive results and experience gained in community participation, the programme shall be extended to include the whole Kaiserstuhl from the winter of 2001/2002.

After a six-year test period, an efficiency control project will be carried out to validate whether prescribed burning under the responsibility of local communities can accomplish the desired goals.

Figure 3: Prescribed burning in Germany

5. Conclusions and outlook

A number of projects representing a broad range of social, economic and environmental conditions have been reviewed in this paper to introduce IFFM/CBFFM projects or approaches. In some countries, the involvement of communities in fire management is well established. In others, recent project proposals have defined approaches that are specifically designed to meet local conditions. Clearly, there are many forms and degrees of community involvement.

Despite many socio-cultural differences, it seems that the basic principles of community participation are rather similar throughout the various regions. Most importantly, however, is the question whether theoretical concepts of participatory approaches in fire management and successfully established pilot projects or "show cases" have led to sustainable improvement of livelihoods of local populations and to improved ecosystem stability and productivity.

When participation consists mainly of providing paid labour, the sustainability of such systems is fully dependent on continuous external funds. This is a problem for many countries. IFFM/CBFFM approaches that build upon existing social structures and involve traditional leadership may be less dependent on such financial support and therefore are likely to be more socially and economically sustainable. However, creating an enabling environment (e.g. appropriate changes in legislation) and awareness raising and extension support will always be required.

Despite the experiences in IFFM/CBFFM, further understanding of the concept of community participation and inter-cultural exchanges of experience and practices are necessary. The process of international co-operation in IFFM/CBFFM will hopefully help to stimulate this development.

To promote the IFFM/CBFFM approach, the GFMC jointly with the UN International Strategy for Disaster Reduction (ISDR) prepared the UN 2000 World Disaster Reduction Campaign that addressed community participation in fire management (ISDR, 2000). An international concerted programme in conjunction with IUCN/WWF Firefight and an earlier Global Environment Facility (GEF) proposal by the GFMC that will consequently follow up the concept of fire disaster reduction through community involvement is highly recommended.

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The development of a community-based approach for an integrated forest fire management system in East Kalimantan, Indonesia

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Abstract

Every 3-5 years, El Niño-driven severe forest and land fires have occurred in East Kalimantan, Indonesia. In 1997/98, approximately 5.2 million ha were burned, affecting 25 percent of the entire province. During the last 20 years, fire prevention and suppression efforts have been limited and ineffective. Since 1994, the Integrated Forest Fire Management (IFFM) project has been supporting the provincial forestry department in developing a comprehensive fire management approach that includes prevention, information and suppression. An important aspect of this approach is the co-operation among agencies, the private sector and local communities. This paper focuses on the basic strategy and contents of a community-based fire management (CBFiM) system at the village level. Extension, training and technical support for village fire crews are planned to benefit the entire community. In addition, environmental education programmes are designed to increase public awareness of the negative impacts of wildfires. The Fire Information Unit supports CBFiM by providing information on fire occurrence, fire danger criteria and fire risk maps, while the Fire Operation Unit trains village fire crews. The provincial and district fire centres are the hubs of a governmental fire management organization. The role of these fire centres in promoting CBFiM is discussed.

1. Introduction

Every 3-5 years since the early 1980s, severe vegetation fires driven by El Niño Southern Oscillation (ENSO) have been reported in East Kalimantan, Indonesia (Goldammer *et al.*, 1996; Barber and Schweithelm, 2000). The worst ever-recorded wildfire occurred in 1997/98, which threatened the health of thousands of people in the province, partly interrupted sea and airborne transportation, and caused huge economic and ecological damage. Many reports have studied the impacts of vegetation fires in East Kalimantan and other Indonesian provinces (Goldammer *et al.*, 1996; Hinrichs, 2000; Mayer, 1989; Schindele *et al.*, 1989; Bappenas, 1999; Barber and Schweithelm, 2000; Schweithelm, 1999; State Ministry for Environment of the Republic of Indonesia and UNDP, 1998).

Most fires in East Kalimantan are human-induced. Only in very limited areas, burning coal seams, mostly ignited by previous fires, have some significance in causing wildfires. A large number of fires are the result of forest conversion for industrial plantations and escaped small-scale agricultural fires. Fire is the least expensive land-clearing method, and for most of the smallholders the only one available. Many local people are upland farmers who use fire to clear their land, but they have also experienced damage and losses due to wildfires.[2]

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[2] Assumptions are derived from interviews with villagers in fire-affected areas (unpublished), and also from Mayer (1989).

The Integrated Forest Fire Management Project (IFFM), jointly implemented by the provincial forestry service, Dinas Kehutanan, under the Departemen Kehutanan (DEPHUT - Department of Forestry of the Indonesian Ministry of Forestry) and the German Agency for Technical Co-operation (GTZ), is developing fire management capacities in East Kalimantan. The participation of local communities is fundamental to fire management concepts. Past experiences have shown that fire management can only be implemented successfully in a vast province like East Kalimantan, with limited access and infrastructure, if local communities participate. At the same time, this approach is directed towards community development, with a self-help focus.

2. The fires in East Kalimantan

2.1. Past and recent fire events

Lowland tropical rainforests are normally thought to be free of natural fire because of their moist environment. However, carbon dating of soil charcoal in East Kalimantan indicates that ancient fires occurred between 350 and 17,500 years ago (Goldammer and Seibert, 1990). This generally corresponds with the possible development of a more arid climate in the area between 15,000 and 18,000 years ago. These ancient fires are thought to be ignited when lightning struck exposed coals seams and through anthropogenic fire use. However, since the present wet, rainforest climate stabilised about 7,000 to 10,000 years ago, fires of the past 350 to 1,280 years may be attributed to the combined effects of periodic droughts and human activities (Goldammer *et al*., 1996).

The large wildfires in the past 20-30 years are attributed to extreme drought (coinciding with ENSO) and numerous escaped fires originating from slash-and-burn land-clearing activities such as swidden agriculture and forest conversion. The first comprehensively recorded and evaluated large-scale forest fires in East Kalimantan were those in 1982/83, which affected an area of 3.2 million ha, of which 2.7 million ha were tropical rainforests (Schindele *et al*., 1989). Significant fire events also occurred in 1987, 1991/92, 1993/94 and 1997/98 coinciding with prolonged droughts triggered by the ENSO phenomenon.

In 1997/98, the 12-month drought in East Kalimantan provided prime conditions for large-scale wildfires. At the peak of the event, National Oceanic Atmosphere Administration (NOAA) satellites recorded more than 2,000 "hot spots" in the province. [3] Despite international support, the situation was uncontrollable and far beyond the existing firefighting capacity in the province. Approximately 5.2 million ha of natural forests, plantations, agricultural land, bush- and grassland were burned, affecting a quarter of the entire province (Hoffmann *et al*., 1999; Siegert *et al*., 2001).

2.2. Fire causes

While most of the fires in the province are anthropogenic, glowing coal layers near the surface are also a potential wildfire source. Personal observations and interviews with villagers suggest that human-caused fires sweeping through the area often ignite such coal seams. Once lighted, these seams increase future fire risks by smouldering for a long time in an already degraded environment.

Until the mid-1990s, local communities were believed to be the main cause of wildfires in the province. Satellite observations and field reports during the 1997/98 fires helped to change this perception. In many cases, fires were used to clear land for large-scale oil palm plantations (Barber and Schweithelm, 2000). In addition, recent research indicates that shifting cultivation by

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[3] Satellites operated by NOAA's National Environmental Satellite, Data and Information Service (NESDIS). The prime customer for the satellite data is NOAA's National Weather Service, which uses the data to forecast weather for television, radio and advisory services. For fire detection, two infrared channels of the Advanced Very High Resolution Radiometer (AVHRR) sensor onboard of the NOAA satellites are used. Reference: www.noaa.gov/satellites.html.

traditional Dayak communities is not a significant cause of wildfires.[4] Long traditions, customs and extensive knowledge normally prevent the irresponsible or uncontrolled use of fire in such communities (Aspiannur *et al*., 1997; Colfer, 2001; Colfer and Dudley, 1993; Vayda, 1999). Nevertheless, information gathered from several villages in the Samarinda-Balikpapan and middle-Mahakam areas revealed that some accidental wildfires are caused by escaped shifting cultivation fires mainly started by farmers from non-indigenous ethnic groups (Abberger and Beebe, 1999; Aspiannur and Baraq, 1999; Colfer, 2001).

In addition, fires are sometimes lit to reduce land values. Obviously, land is assessed at lower values if covering trees or plants are destroyed (Vayda, 1999; Gönner, 1999).

Arson was a frequent cause of fires in 1997/98. In some areas, fire was used as a weapon in land-use conflicts between communities and concession or plantation companies (Abberger and Beebe, 1999; Nicolas, 1999). In other areas, people living within or adjacent to protected areas burned the forest in retaliation for being denied access and use of the forests (Aspiannur and Baraq, 1999). Gönner (1999) also reported disputes between families within a single community, which might have led to arson. Further examples of intentionally set fires were for hunting turtles in the swamp forests in the middle Mahakam area (Hoffmann *et al*., 1999; Jepson *et al*., 1998; Vayda, 1999) and fires lit to mask illegal logging (Vayda, 1999). Other wildfire causes reported by locals and concession staff include abandoned cooking fires in the forest, discarded cigarettes and burning garbage.

3. The IFFM fire management approach in East Kalimantan: an introduction

Established in 1994, the IFFM project works to develop and strengthen provincial and local fire management capacities in East Kalimantan. The project consists of the three technical sections – Fire Information, Fire Prevention and Fire Operations – which elaborate concepts, modules and training aimed at institutionalising fire management at provincial and district levels.

The provincial fire management organization in Samarinda, located at Dinas Kehutanan, is currently being inaugurated. It is designed to support fire management activities in East Kalimantan by identifying "hot spot" locations; producing fire danger-rating indices, fire risk maps and materials for prevention campaigns; supporting training and fire-suppression methods to all involved agencies and institutions. In addition, the provincial organization provides training, co-ordination and advice to develop local fire centres in the districts.

Local fire centres at 10 district forest offices as well as Kutai and Kayan Mentarang National Parks are currently being established and equipped with a wide variety of firefighting equipment including pumps, hand tools, vehicles, personal safety equipment, computers and office items. The centres are the core of a fire management organization at the district level. They are designed to establish and provide co-operative assistance, guidance and services in fire prevention, operations and information. They are to co-ordinate and directly support fire management efforts in the field, partly with their own firefighting crews, but also in co-operation with local communities and concession holders. The participation of local communities is essential for the success of fire management in East Kalimantan. Local fire centres provide information, materials, training and techniques to protect community land (homes, gardens, fields, forests) from fire. Local fire centre staff assists village leaders and/or extension workers in identifying and acquiring appropriate firefighting equipment and advise on techniques of proper fire use and control. At the same time, it is hoped that local communities will support the fire centres and concessions in preventing and fighting forest fires.

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[4] The term *Dayak* is a collective name for traditional (indigenous) communities in Indonesian and Malaysian Borneo. In East Kalimantan, they consist of 9 major groups - Kenyah, Punan, Bahau, Benuaq, Bentian, Tunjung, Lundayeh, Penehing and Dayak Pasir - and make up 20 percent of the province's population.

4. Community-based fire management approach in East Kalimantan

4.1. Selection of villages and rapid rural appraisal

Most of the 1,264 villages (BPS, 1999) in East Kalimantan are concentrated in the eastern lowland areas and along rivers. Due to the 1997/98 fires, many gardens and fields in the villages were damaged, resulting in crop reduction or failures. In anticipation of future droughts, these villages need to develop fire management capacities to protect their land from fires.

Approximately 70 villages are currently included in the IFFM programme. Villages are prioritised according to their location in relation to areas of high fire risk. A fire risk map that distinguishes five different risk classes, based on previous fire events, vegetation classifications and land-use information, is available at the province and district levels (Figure 1). It serves as the primary reference in selecting up to 15 priority high-risk villages in each district. Field workers visit these villages to discuss with formal and informal leaders the wildfire problem and identify necessary support. The major concern of villagers has been to improve their fire protection capabilities. All villages in the programme have suffered damage from previous wildfires. Village leaders often complain about the absence of governmental support for protecting their villages from fire, citing the lack of co-ordinated efforts and effective strategies as well as unsuitable or non-existent firefighting equipment.

IFFM offers a support programme to address these issues including modules for institutional development, fire management training, equipment use and maintenance.
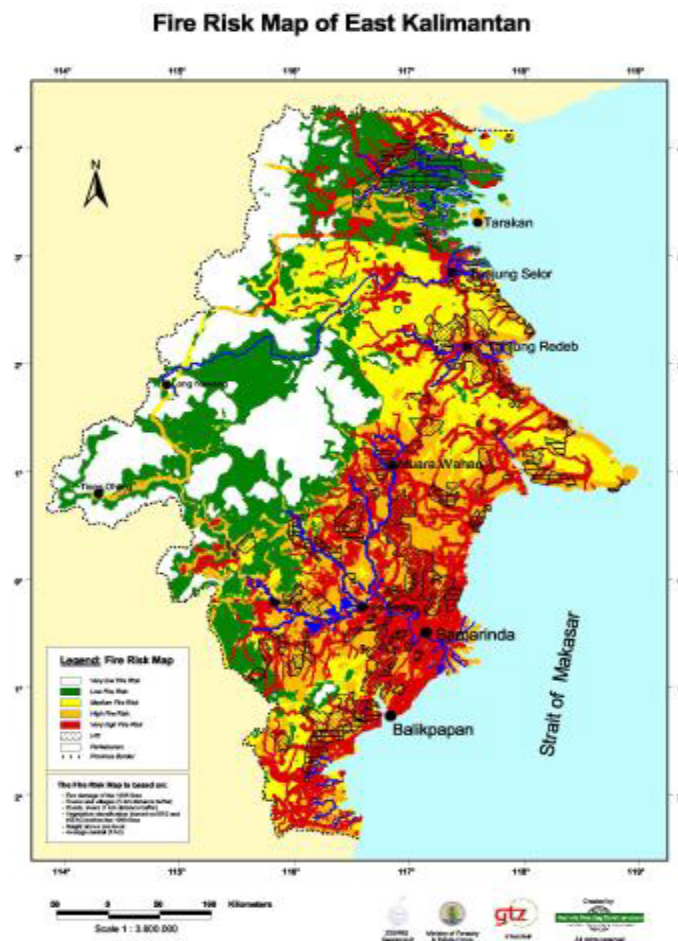

Figure 1: Fire risk map of East Kalimantan

4.2. Institutional development

IFFM's training module addresses the institutional aspect of fire management at the village level. In a two-day training workshop, strategies to protect village areas from future fires are discussed with participants from selected villages. The purpose of the workshop is to encourage villagers to organize themselves and discuss different aspects of village fire management. This training workshop has been successfully carried out at two locations, with participants from 11 villages (Figure 2).

The development of fire (management) crews – or volunteer village fire brigades – is a decisive step towards institutionalising village fire management. The major task of such crews is to prevent and suppress wildfires in the village and to promote safe burning practices in slash-and-burn agriculture in co-ordination and co-operation with the village and district authorities. Crews develop their own Standard Operating Procedures (SOPs) and require a regular budget from the village administration. These SOPs need to be simple and based on local conditions, knowledge and experience. Standard methods for hand tool maintenance and patrolling plans should also be included. Furthermore, the elaboration of an early warning system is needed to alert village fire crews of the increased risks of burning during extended dry periods.

The elaboration of SOPs is an initial step in developing co-operation and co-ordination among village fire crews and the district government, local fire centres, other land management agencies, and private forest and plantation management companies. Once co-operation agreements are prepared, government authorities can monitor and evaluate village fire prevention and suppression efforts more easily.

Establishing co-operation among neighbouring villages is another essential aspect of community-based fire management (CBFiM). IFFM helps to facilitate meetings among different villages to discuss experiences and solutions in fire management and identify common interests in fire prevention and suppression. Important aspects include communication among villages, prevention campaigns, patrolling and firefighting. Such efforts should result in formal village co-operation agreements and need to be included in the SOPs of village fire crews.

Figure 2: Village training exercise

4.3. Fire prevention and suppression training

Since the start of IFFM, more than 60 villages have received basic fire management training. In the first phase of the project, it mainly focused on fire suppression. The programme later evolved to provide a mix of theory and field practice, and give greater consideration to local conditions, knowledge and experience of the participants. A participatory approach is used to facilitate discussions, role-playing and other activities. The curriculum includes fire prevention, environmental education, institutional issues, the role, functions and responsibilities of fire crews, the use and maintenance of simple equipment and also firefighting strategies and techniques. A comprehensive training manual will be published in 2002.

A five-day "Training of Trainers" approach has been designed for extension workers, forestry staff, crew bosses and community leaders, who have already passed the basic fire management training. Two training sessions have been carried out successfully in 2001. Supporting training manuals and materials are being prepared.

4.4. Firefighting equipment at the community level

Equipment traditionally used to fight fires consists of simple hand tools like machetes, wooden rakes and small bamboo hand-pumps. When nothing else is available, banana leaves or a bundle of wooden sticks are used to fight fires. Generally, such equipment is effective in fighting grass fires or safeguarding small "slash-and-burn" fires, but it is unsuitable for "hot" wildfires like those in 1997/98.

To elaborate a standard for firefighting at the community level, hand tools have been introduced and evaluated during training. Hand tools have to be suitable for local conditions. They have to be light and their dimensions have to fit the people who use them. The backpack pump, the Pulaski (two-function hoe) and the McLeod (two-function rake) are the most favoured tools. Additionally, the fire swatter, useful to fight grass fires, is well accepted. IFFM has assembled "tool boxes" to support village fire crews of 15 to 20 members. More than 100 hand toolboxes are being handed over to communities in close co-operation with the district forestry services and the local governments on condition that the villages have officially established fire crews and drafted SOPs. In addition, suitable storage rooms have to be provided, which can also serve as village fire (management) posts. In the future, one task assigned to local fire centre staff will be the support of village crews in maintaining and repairing their firefighting hand tools.

4.5. Further incentives to support CBFiM

The provision of training and hand tools by IFFM are initial incentives to support villages in building their capacities in wildfire prevention. To further develop CBFiM and eventually enhance the sustainability of such efforts, continuous support by the government is needed. Once a village develops a fire management organization, the village fire crew needs official recognition by the district and provincial governments to receive administrative, financial, organizational, educational and legal support. Apart from these basic steps, further incentives are necessary. For example, successful wildfire prevention and suppression might be rewarded with village infrastructure and income-generating programmes.

5. Fire information – potential benefits for local communities and their necessary contribution

The IFFM supports the Fire Information Unit of the provincial fire management organization by providing fire danger-rating information through drought index calculation, weather forecasts including El Niño predictions, satellite-based hot spot data and fire risk mapping (Figure 3). Such information is the foundation of fire management planning and has been made available at the national, provincial and district levels. It remains, however, unclear how this information can reach villages in fire risk areas and be translated into essential details for fire prevention or suppression in the field.

5.1. Early warning system

The Keetch Byram Drought Index (KBDI), introduced and applied by IFFM and calculated by the governmental meteorological service – Badan Meteorologi dan Geofisika (BMG) – for the province, is the basic tool for an early warning system for fire.[5] The index is input into a fire danger-rating matrix that describes four fire danger classes as low, moderate, high and extreme.

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[5] IFFM adapted the KBDI, used in some states in the US, to East Kalimantan conditions. See Deeming (1995) and Weidemann (2002).

The SOPs for fire prevention and suppression depend on the current and expected fire danger rating, in combination with other factors such as El Niño predictions, and local weather forecasts and conditions. Village fire crews elaborating SOPs have to combine drought index information with their knowledge of local conditions, and a seasonal calendar for land preparation, planting and harvesting. The fire danger-rating information has to reach the village fire crew regularly. This can be accomplished by establishing communication links among villages, the local government, and concession and plantation companies.
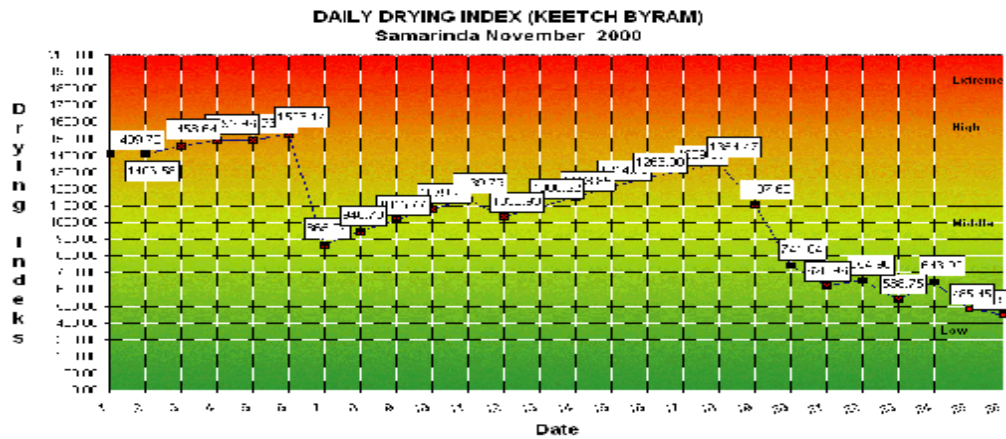

Figure 3: Example of the fire danger-rating information used in East Kalimantan

5.2. Communication system

Communication technology is still limited in the interior of East Kalimantan. Although telephones are available in almost all the smaller towns in the province, most villages remain unconnected. The only communication lines available in such areas are satellite telephones and short-range radio systems, used mainly by concession and plantation staff.

In many villages, simple battery-powered stations are used to communicate with neighbouring villages and towns, reaching sometimes as far as 40-50 km. In addition, most of the government sub-district offices have radio communication stations that allow them to contact the district administration and villages. Early warning messages can be relayed to villages through direct communication between local fire centres and villages within the communication range of the centre. However, very often such information might reach villages through governmental communication links and should be reported from village to village following a fixed sequence. The participation of concession and plantation companies in transmitting early warning will be important to fill the gaps. Additionally, field workers of the Forestry and the Agricultural Service can broadcast messages, especially during high or extreme fire danger in certain areas.

With the support of IFFM, the provincial forestry service plans to develop a radio communication system for fire management in East Kalimantan. Once this system has been established at each local fire centre, fire danger index, hot spot and other relevant information can be provided to district government agencies, concession and plantation owners, and villages. Likewise, all field observations can be reported to the local fire centres. The system has to allow access to the villagers apart from concession and plantation staff.

5.3. Village fire risk sketch-mapping

One of the tasks of a village fire crew is to sketch-map fire hazards and determine fire risk areas based on previous fires and the knowledge of local conditions in relation to existing vegetation types and land use. A sketch-map is an elementary instrument for the elaboration of SOPs in combination with determining the village fire crew's response area for firefighting. Additional information such as village posts, water reservoirs and equipment locations should be included.

Village fire risk sketch-maps can become a valuable information source for the provincial and district fire centres by adding more specific details from such maps into district fire risk maps, digitally produced by the provincial fire centres. They will also support the provincial fire centre in setting up a database of fire relevant information such as available firefighting resources in the province, which includes village fire management efforts.

5.4. Hot spot information and early detection

Hot spot data might be useful as early fire detection information and therefore can support initial response efforts, assuming that they reach government or concession fire crews in time. The usefulness of hot spot data for village fire crews, however, is questionable. Villagers may have already spotted a fire before hot spot data are available. In addition, hot spot data or co-ordinates are useful for village fire crews only if they are translated into descriptions of estimated fire locations, since Geographic Positioning System (GPS) tools are not easily available. The parties that potentially benefit most from hot spot data might be concession/plantation companies and government agencies. Normally, the provincial fire centre would evaluate hot spots in combination with land-use information, based on government land-use maps, and send daily reports to local fire centres, which then inform companies and district government agencies about fires in their respective areas.

6. Environmental education as part of CBFiM

From the beginning, IFFM has been continuously designing fire prevention materials and carrying out campaigns in various forms together with government agencies, non-governmental organizations (NGOs) and other institutions to directly or indirectly support CBFiM in East Kalimantan. Dozens of campaigns – with hundreds of participating villagers – were carried out in the past years within the framework of village extension work to raise awareness on the negative impacts of uncontrolled fires and the importance of CBFiM (Table 1). Additionally, IFFM has disseminating information on fire prevention to teachers, government extension workers, NGOs, university students and others, and distributed thousands of leaflets, posters, stickers, and fire prevention comics at seminars, workshops and training events. Such activities are aimed at supporting and encouraging potential "community agents" to help spread the fire prevention message to as many people as possible.

Most households in East Kalimantan have access to radio transmissions and to a large extent also to television and newspapers. Consequently, the co-operation with the mass media has been intense from an early stage of the project. It resulted in numerous newspaper campaigns, interviews, television talk shows, and television and radio coverage of fire prevention campaigns. A future goal will be to integrate early warning information into the daily weather news for the province, particularly in high and extreme fire danger situations. IFFM also has been co-operating with an Indonesian television star (Kak Seto) to promote the Indonesian fire prevention mascot "Si Pongi" (Figure 4). Together, various marketable Si Pongi items have been produced, a theatre show for children designed and carried out, and a music cassette produced. Recently, Si Pongi has become a regular attraction in a national children's television show that is watched by millions of children all over Indonesia.

Figure 4: "Si Pongi", the Indonesian fire prevention mascot, attracts children at a shopping centre in Samarinda

7. Framework for the success of CBFiM in East Kalimantan

The participation of communities is crucial for a successful fire management system in East Kalimantan. However, an important question remains: why should communities fight wildfires if they do not have access to the areas or draw immediate benefits from the areas where the fires occur?

The misuse of fires to resolve land-use conflicts, as well as the uncertainty of land tenure, and unclear or conflicting land-use allocation need political solutions, whereas using fire as a tool in shifting cultivation or accidental fires can be addressed by educational and training programmes that are supported by government institutions. The Indonesian government must formulate and implement policies to deal with the underlying causes of wildfires that occur almost every year and become most severe during El Niño years. Special attention has to be given to land allocation and tenure rights. Very often, rights granted to concessionaires or in connection with transmigration contradict or challenge traditional rights of local communities. A just and transparent legal system and procedures to resolve emerging conflicts must be developed and implemented, taking into account the traditional and social aspects of the communities affected by government policies and actions. To implement and enforce such policies and legal concepts, the capacities of government institutions and other stakeholders have to be increased strengthened. A dialog among all stakeholders to tackle these political issues is urgently needed, as is a system of incentives for local communities that fight fires. The provincial fire management system and the district fire centres will have to help implement the political means that promote the rights and involvement of local communities in an overall fire management system, in which all stakeholders from all levels have to take part.

Table 1: IFFM fire prevention efforts in East Kalimantan

Prevention activity	Details	Comments
Extension work in villages	Around 40 prevention campaigns have been carried out in different villages, attended by an average of 50–100 villagers. In a three-hour event, fire prevention was discussed, videos shown and materials distributed.	A high and costly input, long-term impact is questionable without follow-up training and institutional development.
Training and seminars with school teachers	Fire prevention was discussed and materials distributed.	Representatives of the Education Department approach IFFM regularly to obtain support (materials and information) for school events in the province.
Support of an Environmental Education Network together with several local NGOs	Regular meetings and two provincial workshops were carried out, with fire prevention included as one important item on the agenda.	Progress is slow due to limited funding. The network has set up a secretariat; the network's Internet address is used for discussions among members; more interested parties are getting involved.
Drawing competitions on environmental topics	IFFM supported dozens of such events in major cities and several villages in East Kalimantan.	Often, a Si Pongi costume has been used to attract children; various fire prevention materials were distributed.
Competitions among different villages engaged in CBFiM	Competitions among village fire crews presenting their skills in firefighting or general sports competitions; IFFM has been partly facilitating and sponsoring such events.	Help to motivate village fire crews and support them in their role as a village organization. Huge audiences are ideal for distributing fire prevention materials.
Promotion of the Indonesian fire prevention mascot, "Si Pongi"	In close co-operation with Kak Seto (Mutiara Indonesia Foundation), various prevention materials have been produced, a TV and radio show conducted.	Currently, Kak Seto is running his new TV programme and regularly integrates Si Pongi into the show.
Roadside campaigns	During high fire danger periods, IFFM together with the government conducted several road campaigns in protected forest areas and distributed fire prevention materials.	Proved to be an effective way to reach thousands of people in one day.
Signboards and banners with fire prevention messages	IFFM has been setting up dozens of signboards and banners with fire prevention messages in the most fire-prone areas.	Currently, new signboards and banners are being designed; more than 100 will be installed in 2002.
Fire prevention video clips for TV	Two video clips were produced and aired locally, and partly nationally.	A new video clip to promote "Si Pongi music" is being produced.
Fire prevention information in local newspapers, radio and TV	Letters and comics in local newspapers; TV and radio interviews, talk shows, etc., are being produced.	Regular coverage during "fire seasons"; fire danger-rating index is not published regularly yet.
Display of fire prevention materials and relevant information	IFFM regularly participates in exhibitions in the province (2-3 times per year) and sets up counters displaying prevention materials and fire information.	Proved to be quite efficient by reaching thousands of people; particularly school children can be easily attracted (by Si Pongi!) and provided with information.

8. Conclusions

CBFiM is still in an early stage of implementation in East Kalimantan, although components such as extension and training have been part of fire management involving village communities since the beginning of IFFM. The programme aims at integrating village communities into wildfire prevention and suppression efforts. Its success very much depends on two crucial issues. Firstly, CBFiM has to be part of community development processes that benefit local communities. Secondly, provincial and district governments have to support such community efforts.

The community's interest in protecting their land from fire is the basic entry point for the development of CBFiM in East Kalimantan. Providing training and equipment, and facilitating efforts to establish a village organization strengthen the capacities of village communities in fire prevention and suppression, and therefore, are directed at communities' self-help approach. Various long-term educational measures and campaigns have to accompany and support CBFiM processes as early as possible. CBFiM will commence only after a village organization has been established.

Whether CBFiM can support fire management beyond the protection of community land in the future, i.e. by suppressing fires in concessions or protected forests, will very much depend on the necessary support given to village fire crews from the provincial and district governments, and the private sector. Thus, the co-operation among these three key players will be crucial to prevent large-scale wildfires in the future. It is, however, inappropriate if local communities are only regarded as a source of forest firefighting workers. The success of CBFiM will depend on how the government tries to address the underlying causes of fire such as land disputes that are partly triggered by the national government's neglect of traditional community forest rights in the first place.

Another important aspect is the development of suitable regulations limiting the (mis-)use of fire. Large-scale forest conversion with the use of fire has to be prohibited, while on the other hand, small-scale forest conversion by shifting cultivators should be permitted, i.e. by the introduction of burning permits. Such regulations are part of CBFiM's framework and must be enforced by the government. In turn, village fire crews together with their village administration can introduce a reporting system for fire use in their respective villages, through which they would implement existing government regulations.

CBFiM in East Kalimantan has to build on the willingness and motivation of village communities to contribute to fire prevention and suppression. The approach has already shown some promising results in certain areas. It is hoped that CBFiM might become the key to prevent and suppress wildfires more successfully in East Kalimantan in the future.

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Experiences in community forest fire control in Viet Nam

Ha Thi Linh

Abstract

This paper focuses on the policy to allocate forestlands to communities as the most effective measure for forest protection and fire control in Viet Nam. Forestland is assigned to organizations, households or individuals, for sustainable forest management. This policy has decreased substantially the area of forests burned annually. Steps to execute community forest fire control include making plans based on data that span at least the previous five years, followed by implementing technical measures, such as organizing forest fire control crews who are trained and provided with proper equipment. A forest fire forecasting grading system was also developed, which defines five degrees of fire risks. Recommendations for more effective forest management, protection and development as well as forest fire control are presented.

1. Community forest fire control in Viet Nam

Viet Nam's total land area in 1999 was 32.9 million ha, of which 10.9 ha are forests (9.4 million ha natural and 1.5 million ha plantation forests). As part of its national economic development, the government of Viet Nam has decided to improve forest management and protection by allocating forestlands to organizations, households and individuals for long-term sustainable forest uses. Considered one of the most effective measures, this policy has resulted in a remarkable development of forest sources, forest fire prevention and control, and increased rural welfare, especially in mountainous areas.

The policy directly or indirectly affects about 25 million people living in or adjacent to forests. At present, there are about 50,000 villages in around 9,000 communes with forestlands that can be allocated, apart from their traditional community forests. Management of these forests usually incorporates forest preservation and forest plantation development. In the past few years, villagers' efforts to prevent logging, grazing, land clearance by burning and other damaging activities in forested areas have benefited communities tremendously.

2. Progress and performance of allocating forestlands

The impact of forestland allocation and protection on areas of forests burned can be seen in Table 1. The percentage of area burned in relation to total forest areas has decreased substantially since the policy has been implemented.

Table 1: Allocation of forestland and forest protection on area of forest burned

Year	Allocated forestlands (ha)	Forestlands assigned for protection (ha)	Burned forest areas (ha)	Burned forests/ total forestlands (%)
1998	298,435	367,872	19,712	0.18
1999	631,544	490,580	7,019	0.06
2000	124,567	222,400	1,517	0.01

Source: Annual reports of the Forest Protection Department, Ministry of Agriculture and Rural Development

The allocation of forests has motivated villagers to keep their commitments to forest protection and community development. They actively try to reduce fuel loads and practise sustainable agriculture. As a result, forests have regenerated rapidly, even on steep lands. Forest

cover also increased, forest products have multiplied, watersheds are protected, soil erosion is reduced, the natural environment has improved, and in particular, incidences of forest fires have decreased. All these outcomes have helped satisfied the objectives of Viet Nam's 5 Million Hectare Reforestation Programme.

Community-based forest protection has partially met villagers' subsistence demands for forest product (e.g. firewood, timber, bamboo for construction, fruits, medicine and fodder). Villagers could even derive income from forest products, and did not have to rely on payments from the government, thus saving the state an average of VND 50,000/ha/per year in forest protection fees.

The government is concerned about forest fires. Important legislation has been enacted to facilitate forest fire control activities in Viet Nam. Community forest fire control is carried out according to the steps outlined below:

Step 1: Forest fire control plans are made based on fire data from at least the previous five years. The data are analysed according to:

♦   Causes of the fire.

♦   Timing of the fire (is it influenced by climate and time of day?)

♦   Location of the fire (marked on maps.)

The plans should include:

♦   objectives;

♦   relevant legislation;

♦   maps showing forest fire location and vulnerable areas;

♦   warning schedules;

♦   charts summarising forest control programmes;

♦   human resources for forest fire control (e.g. communities, forest rangers, army, police); and

♦   development of community education programmes on forest fire control.

Some measures for minimising forest fire risks include asking households to sign on for forest protection, and compiling feedback from the field.

Step 2: Implement technical measures:

a. Organize and prepare forest fire control crews, including local forest rangers, to help People's Committees at all levels plan and set up Forest Fire Control Steering Committees to be chaired by the Chairperson or Vice Chairperson of People's Committees. Representatives from other relevant agencies are members of the Steering Committees. These Committees help authorities at all levels direct, supervise and monitor forest fire control activities, especially in fire-prone areas, during the dry seasons.

During high fire risk period and in fire-prone areas, the following teams should be set up:

♦   Forest fire control teams of two or three members who are forest protection staff (forest rangers); and

♦   Voluntary forest protection teams at the local level comprising 15-30 people mobilised from the armed and police forces, and workers of agroforestry enterprises. The teams are equipped with firefighting equipment and trained in appropriate techniques. Together with forest rangers, they patrol and safeguard forest areas regularly.

Communities living near the forests protect forests in accordance with community customs and traditions. In some places, they have initiated a common village fund for forest protection (e.g. Yen Bai Province). In others, social organizations and households work together to develop community forests and organize forest protection (e.g. Cao Bang Province).

b. Annually, the District Forest Protection Departments assist forest owners in forest fire prevention and control during the dry seasons. A forest-fire forecasting grading system was developed and posted on large signboards at key fire-prone areas as follows:

- Grade 1: Safe, conditions not likely to start a fire.
- Grade 2: Fair, conditions likely to start a fire.
- Grade 3: Alert, dry weather conditions likely to start a fire.
- Grade 4: Dangerous, lengthy dry weather conditions very likely to start a fire.
- Grade 5: Extremely dangerous, lengthy dry weather conditions extremely likely to start and spread a fire quickly.

In addition to involving communities in fire prevention and control, Viet Nam has also created firebreaks, including green belts.

3. Recommendations

To strengthen forest management, protection and development as well as forest fire management, further attention should be paid to the following issues:

- Develop policies to encourage community involvement in forest protection and management. This is a key strategy for forest protection in general and for forest fire control in particular. As long as people understand and see the benefits, they will have a sense of ownership and take more responsibility for forest and fire management.
- Empower communities to manage, utilise and protect forests.
- Allocate forestland, especially customary land used and managed by communities and forests with no clear ownership.
- Alleviate poverty and hunger, improve knowledge of people in rural and mountainous areas, and invest in infrastructure (electricity, roads, schools, health clinics, potable water and irrigation in mountainous areas) in collaboration with other development programmes.
- Develop policies on investment, tax, food security and human resource development.
- Develop models of forest management and protection at communal and village levels, carry out the signing of inter-household, inter-village commitments to forest protection, especially during the dry seasons when the risk of forest fire is extremely high.
- Increase dissemination of information and invest in education to improve the awareness of local people living in forests, establish forest fire control teams and provide appropriate equipment and tools.
- Strengthen management capacity to direct the enforcement of the Law on Forest Protection and Management at various levels.
- Set up a mechanism to notify communities about forest fires and mobilise firefighting teams and tools.
- During high risk periods, Steering Committees and Management Boards of forest fire control have to establish guidelines on:
  ⇒ on-site directives;
  ⇒ on-site fire control teams;
  ⇒ on-site tools and equipment; and
  ⇒ on-site logistics.
- Increase co-operation among agencies, and provide guidelines and directives on zoning for permanent agriculture to minimise slash-and-burn practices, a major cause of forest fire.

Forest and fire suppression in East Kalimantan, Indonesia

Chandradewana Boer[1]

Abstract

The 1982/83 fire in East Kalimantan destroyed about 3.5 million ha of forest. Forest fires occur almost every year, however each event is specific in intensity and extent. The 1997/98 fire was declared a national disaster, since it affected more than 5 million ha of forest in East Kalimantan alone. Intensive logging activities also increased the susceptibility of the forest.

Indigenous knowledge can help protect tropical forest. To minimise the negative impact of fire and to develop fire prevention techniques, it is important to make use of indigenous knowledge and combine it with scientific knowledge of fire behaviour and fire management technologies.

1. Introduction

Intensive logging activities in East Kalimantan have turned its forests into a fire hazard, and forest fires are occurring more frequently. From 1982/83 to 1997/98, fires have decreased not only East Kalimantan's forest cover but also the quality of the forest. This affects the environmental functions of the forest and casts great impacts on the economy, culture and health of society.

Forest protection has become very important to the future of forest resources. In particular, the decentralisation of power and responsibility has made it possible for local people to exhaust natural resources more easily. Such exploitation interrupts the process of secondary succession and prevents the tropical forests of Kalimantan to reach its climax condition.

People living at the forest margins rely on traditional local knowledge and skills to protect the forest against fire. Their success depends on the community's attachment to the forest. The question remains whether traditional knowledge and skills alone are sufficient to manage the forest today.

2. Forest protection
2.1. Forest protection from fire

In 1982/83, fires destroyed about 3.5 million ha of tropical forests in East Kalimantan. Eighty percent were logged-over areas (Lennertz and Panzer, 1983). After the forest fires in 1982/83, 1991/92 and 1993/94, an El Niño event that lasted 12 months exacerbated major fires in 1997/98, burning approximately 5 million ha or 25 percent of the forests in the province. Almost 2.3 million ha of Hak Penguasaan Hutan (HPH – forest concession) areas (56 HPH and ex-HPH), 0.4 million ha in forest reserves, 0.9 million ha in Hutan Tanaman Industri (HTI – industrial timber plantation) areas (30 HTI) and 0.7 million ha in other plantation areas burned. Of the 27 ex-HPH concessionaires, only 7 were not burned. Two ex-HPH areas – P.T. Alas Kusuma (5,863 ha) and ex-HPH P.T. Astrini (11,669 ha) – were completely destroyed.

The smoke and haze from the forest fires affected the health of people nationally and regionally, and lead to serious criticism of Indonesia by neighbouring countries. This caused tension and disturbed international relationships. The fires also destroyed the habitats of wild animals, and forced some species (e.g. the orangutans (*Pongo pygmaeus*)), to move into the plantation areas (Ngatimna, 2001). Many mangrove forests, as the original habitat of endemic fauna such as bekantan (*Nasalis larvatus*), were also damaged. Moreover, underground coal seams pose an additional threat should they catch fire.

Efforts to protect plantation forests have been undertaken, although they were not very successful judging from the recurring fires. Table 1 shows examples of efforts to prevent and control forest fires in the HPH or HTI areas.

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Table 1. Types of activity and purpose for protection against forest fire

Activity	Purpose/target	Comment
Forest security procurement (personnel and training)	Increase the quality and quantity of the forest security	Not optimal yet, although personnel has increased in number and were trained
Material procurement and establishment of firefighting team (security post, watch tower, patrol car, and communication devices)	Support prevention	Not all HPH have firefighting team
Field prevention (firebreak, buffer strip, pools, warning signs)	Prevent the spread of fire	Forest paths are usually used as firebreaks
Clearing and cleaning of cultivation areas	Reduce inflammable materials	Hardly done
Counselling to the community	Community's awareness	Insufficient
Undertaking village establishment programme	Increase community welfare	No real effects
Establishing forest patrol	Security	More theoretical than reality
Making maps of fire hazard areas	Prevention and socialisation	Not all HPH have comparable maps

In East Kalimantan, 1.5 million ha of plantations are expected to be developed to produce 15 million m^3 per year. The success of the reforestation efforts relies heavily on fire-free conditions. Additional efforts are needed to prevent fires from starting and to minimise the size of those that do occur.

2.2. Protection against illegal logging and forest conversion

The degree of fire damage depends to a considerable extent on forest conditions. Logged-over areas are more susceptible to fire than primary forests, and newly logged areas even more so. Illegal logging and forest conversion are major problems that lead to forest degradation. To protect the forest from fire, it is necessary to stop such destructive actions.

Nonetheless, illegal logging and forest conversion occur extensively all over Indonesia. The perpetrators are rarely arrested, and bribery and collusion are common. Local communities appear to be well aware of illegal logging, and in fact some are buyers of illegal timber. The government and private companies have tried to curb the extent of timber theft by taking some measures (Table 2).

3. Reinforcement of local knowledge in forest management

Fighting forest fires is not an easy task because it means mastering not only fire prevention and control techniques, but also overcoming problems of poor infrastructure and access, large concession areas, and limited and untrained human resources.

The overlap between forestland and community land for agricultural production means that assigning responsibility for forest protection, especially against fire, is a sensitive and difficult issue. A careful inventory of the biophysical features of the forest would be useful to identify open areas and determine the carrying capacity of the areas for human activities. This exercise could also reveal potential sites for delivery of stolen timber.

Traditional local knowledge of forest management appears to be ineffective because governmental and private company interests generally take priority over community needs. Furthermore, such knowledge and skills alone are not sufficient to protect the forest under extreme drought conditions (Sarjono, 1990; Devung, 1999; Widjono, 1989; Abberger, 1996; and Gunawan, 1998). To keep a synergistic co-operation between the forest manager and the community, the government could urge companies to incorporate better-tailored community development programmes into their forest management plans.

Table 2. Types of activity and purpose for protection against illegal logging and forest clearing

Types of Activity	Purpose/target	Comment
Confiscation of illegally felled trees	Law enforcement	Not effective
Confiscation of chainsaws	Law enforcement	Not effective and tends to create conflicts
Safeguarding forest protection team operation	Law enforcement	Efficient enough
Inventory and monitoring of the activities of illegal cultivators	Data collection	Hardly done
Providing information (about the advantages of forest, law, socialisation of border regulation)	Socialisation	Impact yet to be felt
PMDH* village establishment and community forest	Welfare improvement	Needs to be continued and monitored
Generating employment	Community involvement	Limited job opportunities
Stationing forest security patrols	Security	Operational difficulties
Co-ordination with relevant security and enforcement departments and institutions	Co-ordination	Sometimes disappointing
Use of signboards prohibiting illegal logging and cultivation	Prevention	No impact yet

* PMDH = Pembangunan Masyarakat Desa Hutan (Village Community Development Programme)

Another important factor that threatens the forests is the low incomes of rural communities in East Kalimantan. Poor farmers are found in all provinces. Almost 90 percent of them, both indigenous and migrant, settle in forested areas and depend on the surrounding natural resources for their daily needs. This has contributed to forest degradation. Moreover, the forest will continue to be exploited when illegal brokers continue to buy timber and other forest products. Unless this great disparity between the poor and powerful is resolved, forest degradation will continue.

Efforts to control shifting cultivation include transmigration policies, dryland cultivation (Pertanian Usaha Lahan Kering – PULK), permanent cultivator cadres (Kader Tani Menetap – Kanitab), resettlement of isolated tribes and HPH for forest village establishment. However, these efforts have not achieved the desired results – shifting cultivation and forest conversion persist. In addition, communities have settled in ex-HPH or conservation areas, such as the Kutai National Park.

4. Community forestry as a strategy for forest and land protection

The forests in East Kalimantan consist mainly of secondary logged-over and fire-affected areas. Without community participation in forest management and fire prevention, deforestation and forest degradation will continue with negative impacts on forest dwellings and forest margin communities.

Therefore, those involved in forest protection should be knowledgeable of the area to be protected, despite constraints such as poor accessibility and inconsistent monitoring of fire risks especially during droughts. The following factors need to be considered in planning forest protection.

4.1. Dividing the forest area into smaller units for more effective forest protection

Protecting the extensive forests of East Kalimantan is a classic problem for Indonesian forestry. Dividing the forests into more manageable units is in line with the Decree of Director General of Forest Cultivation No. 220/1997. According to this decree, a system can be established with an Administrator who controls 40,000-50,000 ha, Administrator Assistants who oversee 4,000-5,000 ha each, and Heads of Forest Resort who are responsible for 1,000-2,500 ha. Smaller areas enable the participation of local people in protecting that area from fire. Since a major problem that led to communal conflicts is poorly demarcated boundaries, clear and well-defined administration of smaller units will significantly improve fire prevention.

4.2. Sharing forest products in consultation with local communities

Forest management tends to exclude the local population from, and deprive them of, forest resources. By applying a profit sharing system, the community's reliance on the forest can be gradually reduced. This can be integrated with other activities such as establishing forest village communities, increasing the role of the community in protecting the territory and developing community awareness. In this way, the community will feel more attached to the forest and be willing participants of fire prevention activities.

4.3. Implementing integration programmes for newcomers to the community

Another common problem is the conflicts between indigenous communities and migrants. Transmigrants usually have few skills or knowledge of their new environment, and may use fire inappropriately. Unless well-planned integration arrangements are implemented, long-time residents will not accept newcomers. The conflicts are in fact the results of a misguided rural development programme.

4.4. Enforcing the law at all levels of society

Weak law enforcement is a sensitive issue that has to be overcome slowly. If not implemented appropriately, the community will resent the forestry department and will not co-operate in any of its programmes. Incentive systems may more appropriately be substituted for sanctions that are sometimes illegally practised today. The intentional destruction of forest resources by communities is a good indicator of their dissatisfaction and animosity.

4.5. Establishing policy and raising awareness of the community's role in conserving tropical forest

There are still forest inhabitants whose daily lives depend on traditional knowledge, and their skills should not be ignored. The transfer of local knowledge from one generation to the next is uncertain. Therefore, local traditional knowledge should be integrated with contemporary techniques for forest management in East Kalimantan. Research and analyses on how this knowledge can be applied in conserving tropical forest is needed.

4.6. Securing sufficient funds for forest protection

Putting out small fires is easier than extinguishing big ones, and preventing forest fires in the first place is preferable to suppression. However, funding for these activities is limited. Therefore, sufficient financial resources should be sourced and set aside to deal with forest fires before they become unmanageable.

4.7. Rehabilitating burned forest areas through natural succession process

Large-scale reforestation programmes are usually attempted to rehabilitate burned forest areas. Their success, however, depends on how well the plants grow. The situation is even more precarious if salvage cutting is carried out, as is commonly practiced. Allowing the burned forests to regenerate on their own and letting natural succession follow its course is an alternative that should be considered.

5. Conclusions

Indigenous knowledge has a long history of forest management. Community-based fire management therefore should incorporate indigenous knowledge. Combining local knowledge and skills with modern firefighting technologies is an optimum solution for forest fire prevention and suppression.

Institutional strengthening at the local level is essential. Qualified and trained people are needed to integrate contemporary knowledge and traditional skills. Local communities should be involved in maintaining and managing forest resources. They should also be given the opportunity to participate in forest protection. Without their involvement and knowledge, it will be difficult to ensure the success of fire management.

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Extinguishing the 1998 forest fires and subsequent coal fires in the Sungai Wain Protection Forest, East Kalimantan, Indonesia

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Abstract

During the 1997/98 El Niño drought, the Sungai Wain Protection Forest in East Kalimantan, Indonesia, caught fire in early March 1998. Fires entered the 10,000 ha primary forest reserve from the neighbouring INHUTANI I logging concession and subsequently from agricultural areas in or around the reserve. The Sungai Wain Protection Forest (Hutan Lindung) is the last patch of primary forest between Balikpapan and Samarinda with a large number of rare and endangered wildlife species. The area was established as a reserve in 1934. Since 1992 the forest has been used as an orangutan reintroduction site and various long-term research projects have been carried out in the reserve. It has also served as a water catchment for the oil industry in Balikpapan, the second largest refinery in Indonesia, since 1947.

In theory, responsibility for forest fire management of a protection forest falls under the regional forestry department. In reality, however, firefighting is not a high priority for the department's staff. When the fires broke out in the reserve, other research and project staff in the area recruited up to 80 local people per day for two months to construct firebreaks and extinguish the fires. Villagers were paid daily wages and provided with food and other essentials. About 40 percent of the reserve was saved.

Seventy-three coal fires were further located in approximately 5,000 ha of burned forest. Again, local villagers were recruited. Two and a half years later, 61 coal fires had been put out, 8 had gone out by themselves and 4 still need to be extinguished. In addition, a firebreak was made around the whole reserve during the 1999 dry season.

1. Introduction

The rapid disappearance of natural forests due to conversion to agricultural land, poor management practices, illegal logging and a lack of law enforcement in East Kalimantan (Rijksen and Meijaard, 1999), underlines the importance of protecting the few remaining pristine forest areas. The Sungai Wain Protection Forest is the last primary forest area remaining between Balikpapan and Samarinda, the two major cities in the province. Established as a reserve in 1934 by the Sultan of Kutai, it contains a large number of rare and endangered species and has been a reintroduction site for orangutans from the Wanariset Orangutan Reintroduction Project since 1992. The area has served as a water catchment for Balikpapan and the oil industry since 1947, and extensive research has been carried out in the reserve over the last 10 years (Fredriksson and de Kam, 1999).

2. The fires of 1998

During the 1997/98 El Niño drought, the Sungai Wain Protection Forest caught fire in early March 1998. The fires originated in the adjacent INHUTANI I logging concession and spread to surrounding areas (Figure 1). Despite existing communication services, the fires were not reported, and subsequent fires entered the reserve from neighbouring agricultural areas.

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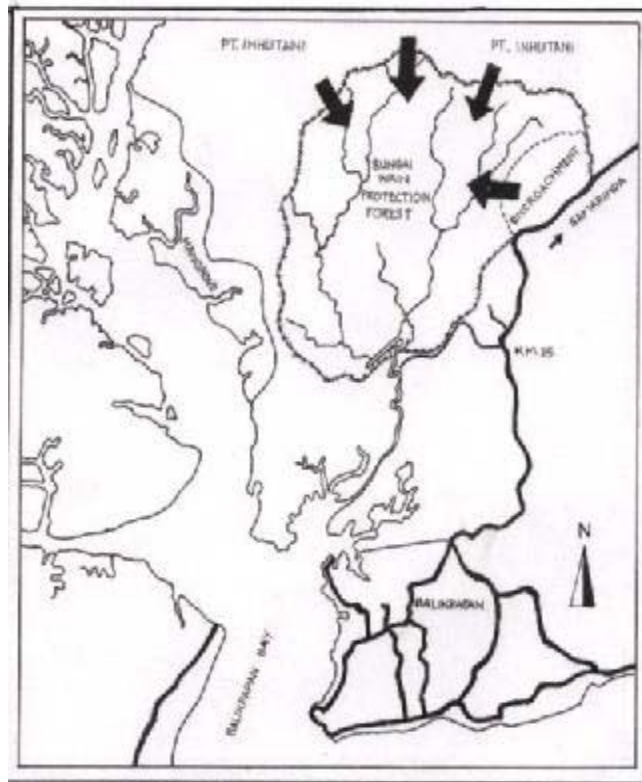
Figure 1: Location of the Sungai Wain Protection Forest and the 1998 fires that entered the forest reserve

Although responsibility for forest fire management in a protection forest theoretically falls under the regional forestry department (PP 62/1998), in reality departmental personnel are unlikely to be active firefighters in the field. Their main task is to control the logging concessions under their jurisdiction. Managing protection forests is an added assignment of low priority mainly because of the lack of financial incentives that can be tapped from protection forests aside from payments extracted from illegal loggers. Due to the low awareness and concern for forest conservation in Kalimantan, pressure from the central government or the public on the forest department to patrol or fight fires is minimal.

Hence, when fires broke out in the reserve, other research and project staff in the area initiated emergency measures by employing local residents to counter the fires. However, no one was willing to work for the normal daily wages (about Rp10,000 per day, the equivalent of approximately US$1.50 at that time) and a 150 percent increase in wages to Rp25,000 was agreed upon due to the urgent situation. Food and cigarettes were additionally supplied. Funds for the firefighting efforts were provided by the Orangutan Reintroduction Project (Balikpapan Orangutan Survival Foundation).

The local firefighters were divided into groups of 5-10 people with one "leader" (usually a research assistant from the projects). Each group would spend up to a week in an area, with three members cutting down the larger vegetation with hand machetes within a 2-metre strip, and the rest of the group clearing away the debris with palm fronds, until they reached the firebreak of an adjacent group. Each group would construct a firebreak of approximately 2-3 km per day. The firebreaks were usually made as close as possible to the fire front, sometimes only a few metres away, hence covering a large distance due to the irregular front line of the fire. Occasionally, when there were fewer people in an area, the firebreak would be made in a straight line further

away from the fire front, and back fires would be lit to burn the vegetation between the firebre ak and fire front. Eventually a continuous firebreak was made, surrounding the unburned forest core in the reserve. Each group was equipped with basic firefighting equipment (machete, brooms made from palm leaves, entrenching tools or cangkul), cooking and camping equipment, food (rice and noodles) and other essentials. The leaders were each given a compass and a communication radio (ICOM V-68), on loan from the research projects. Work continued throughout the day and night until the fires were under control. Another two weeks were spent checking the firebreaks and ensuring that no remaining embers caused a new fire.

Workers from the oil refineries and PERTAMINA provided no assistance to the firefighting efforts even though the forest reserve has been a wate r catchment area for the oil industry for the last 54 years. PERTAMINA is the biggest state-owned oil company in Indonesia and has freely operated in the field with virtually no payments to the local governments for environmental services (e.g. the supply of fresh water). The impacts of forest fires on the catchment area and the consequent environmental damages are not well understood or recognised, and responsibilities are not shared among the various institutions that might have an interest in the forest.

3. Coal seam fires

Shortly after the forest fires had been extinguished, a burning coal seam was discovered in the burned forest. Having expended so much effort to put out the surface fires, the firefighting teams decided that the coal seam fire must also be extinguished. Funds from the Orangutan Reintroduction Project and USAID project collaborating with the Ministry of Mines, focussing on the coal fire problems in Indonesia (Sumatra and Kalimantan), were secured to continue the activity.

More burning coal seams were detected, until a total of 73 were identified in 5,000 ha of burned forest. (Figure 2). All coal fires started near small streams where coal layers are found at the soil surface. From there the fires spread underground depending on thickness of the coal layer, depth and available oxygen. Some coal fires had moved more than 300 m during the course of two years, leaving behind large areas devoid of trees, which had all died due to the heat damaging the root systems. The remaining seams that are still burning are relatively large in size (up to 1,000 m^2).
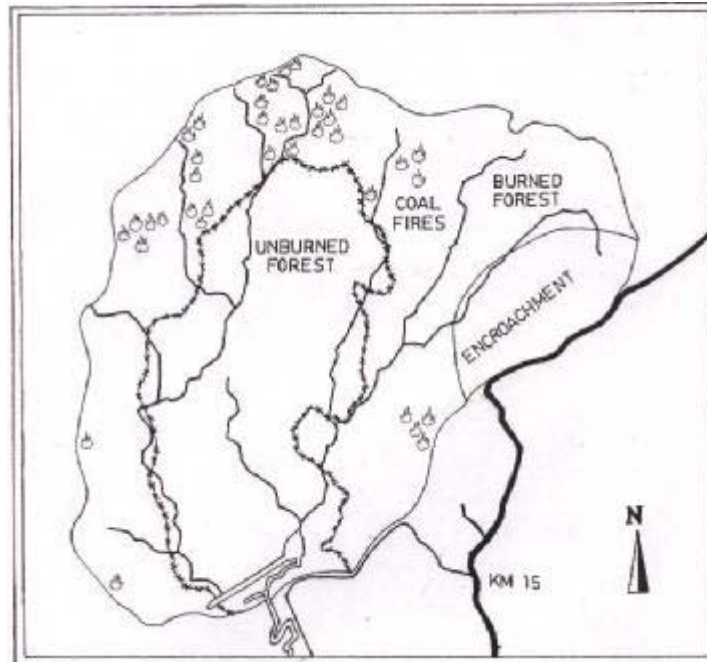
Figure 2: Burned and unburned forest and location of coal seams

Again the local communities were hired to extinguish the coal fires. Initially, a group of about 20 people received daily wages, but eventually was given a "lumpsum" payment for working on a certain number of coal seams identified earlier. The number of people soon decreased to eight. A contract was signed by the leader who was appointed by the group, and all remaining financial and logistical matters were arranged among the group members.

Pumps, hoses and other small equipment were provided. Manual labour was used to put out the coal fires with the assistance of water pumps (Wajax) and hoses borrowed from the German Agency for Technical Co-operation (GTZ)'s Integrated Forest Fire Management (IFFM) project in Samarinda. First, the coal seam at the front line would be dug out and isolated from the coal layer. Occasionally this would mean digging 8 m into the soil. The burning coal embers would be hosed down and excess soil would be washed away. Then, the burning middle section of the coal seam would be extinguished by digging out the remaining burning coal layers. The biggest problem encountered was a shortage of water or a water source that were too distant.

The effort to extinguish the coal fires is ongoing. A total of 61 coal fires have been put out, 8 went out by themselves, and 4 still need to be extinguished. A separate independent team has verified that the burning coal seams have been adequately extinguished.

4. Fire prevention: experience from 1999

In August and September 1999, during the height of the dry season, a firebreak was made around the entire reserve boundary to prevent the entry of fires. Again about 30 people from surrounding villages were employed and divided into small groups (7-10 people). People were paid the "normal" daily wages (then about Rp15,000 per day or US$2). Each group was equipped with a handheld communication radio, food and camping supplies.

5. Discussion of firefighting/control activities

5.1. Community involvement

The forest fires were put out after six weeks of firefighting. Another two weeks were spent checking on the remaining embers and firebreaks. Villagers considered firefighting in a protection forest to be the responsibility of the local forestry department, and hence were not willing to help fight fires without being paid higher wages.

According to the ethnic composition of the communities living close to the Sungai Wain Protection Forest, and assuming that Dayaks, Pasirese and Banjarese are native inhabitants of Kalimantan, less than 20 percent of the people are from East Kalimantan. Since most inhabitants are migrants from other islands, it is likely that they have little sense of ownership of the forests. Especially when they are not allowed to collect wood or other forest products (although they continue to do so at the risk of being caught), the economic impact of a fire in the reserve, is less significant to them. Another explanation for their disinterest in fire suppression or prevention is the poor understanding about the direct and indirect consequences of forest fires.

5.2. Ministry of Forestry (non) involvement

The local forestry department is under little pressure to promote forest conservation practices, partially because these are low priority issues to the regional constituency and the higher echelons at the Ministry of Forestry. There is also an enormous lack of awareness of the negative environmental impacts of forest loss, whether due to over-harvesting or forest fires.

The local forestry department seems to be sufficiently equipped and staffed, at least in the small Balikpapan municipality, for firefighting activities. Large numbers of firefighting tools and additional equipment (e.g. pumps and vehicles) have been distributed to the local forestry departments by the IFFM-GTZ project in East Kalimantan. It is, however, quite probable that the central government did not allocate sufficient funds to the provincial forestry department (TK I) and even less to the regional forestry department (TK II) for fighting forest fires for extended periods of time.

5.3. PERTAMINA (non) involvement

The PERTAMINA refineries in Balikpapan have been using water from the Sungai Wain Protection Forest since 1947. One reason the company provided no assistance during the firefighting activities could perhaps be traced to an ignorance of environmental functions and processes. Water pumped from the reserve is stored in a lake at the edge of the forest. PERTAMINA might be unaware of the impact of forest fires on the catchment area and the water supply to the lake, and thus was not concerned enough to take action. Secondly, the company denies responsibility for the entire catchment area, claiming to be responsible for only 3 ha covering the lake and its immediate surroundings.

5.4. INHUTANI involvement

The fires originated from the INHUTANI I logging concession bordering the reserve. The cause of the fires in INHUTANI I (and also other concession/plantation areas) could not be determined due to the absence of hard evidence. Arson to destroy proof of embezzlement of funds has been suggested as one possibility. These fires then spread beyond the intended boundaries due the severity of the drought, compounded by inadequate preparation of firebreaks.

No logging concessionaires and plantation owners have been made accountable for the fires that spread from their concession areas, making it very difficult to tackle the underlying causes of the 1997/98 fires in East Kalimantan. In 2001, a new government regulation (PP 4/2001) stated that any person responsible for commercial activities that can affect the environment (e.g. concessionaires or plantation owners) will be responsible for the occurrence of forest and land wildfires in that site and shall be obliged to conduct mitigation. Although the effectiveness of this regulation in punishing offenders has yet to be tested, at least it provides an avenue for victims who seek compensation.

6. Coal seam fires

Extinguishing coal seam fires is a demanding task that lasted more than 3 years. Various schemes of organization and payment were tested. Paying daily wages and supplying food and equipment resulted in poor performances. Agreeing on a "lumpsum" payment for a number of seams seemed to improve productivity, although this only seems to work if there is sufficient respect between the leaders and workers, and among the workers themselves.

7. Firebreaks during the 1999 dry season

During the 1999 dry season, local villagers were employed to assist in making a firebreak around the reserve in August and September at a time when people were burning their swiddens next to the reserve. These areas were highly flammable, as they were damaged by the 1998 fires and contained high fuel loads.

Although there was a high fire risk in 1999, the firebreak effectively prevented fires from entering the reserve, even in high-risk encroachment areas. Making the firebreaks also paved the way for outreach programmes towards the local communities to help reduce the risk of fires and raise awareness of the effects of fires and danger posed by uncontrolled burning. Farmers were also asked to report burning of their swiddens so that people making the firebreaks could prevent the fires from spreading.

8. Cost estimate

The total direct costs of putting out the fires, extinguishing coal fires and making a firebreak in 1999 was about US$33,700 (Table 1).

Table 1: Costs of firefighting activities in the Sungai Wain Forest Reserve

Activity	Cost in US$ (US$1 = Rp10,000)
Firefighting	9,002.50
Fighting coal seam fires	21,337.75
Making firebreaks	3,376.50
Total	33,716.75

9. Conclusions

The main problem of the fires in the Sungai Wain Forest Reserve was the unwillingness by any government organization to take responsibility for forest fire management. The lack of co-ordination or collaboration among the various organizations during the emergency also hampered the efforts. Other problems were mainly logistical and relatively easy to solve. Sometimes, travelling to the fires required an 8-hour walk from the village but people were quite willing to spend a month sleeping in the forest, eating only rice and noodles if they were being paid and cigarettes were available, as long as everybody received the same treatment.

Key factors for the successful firefighting efforts in Sungai Wain in 1998 were:

♦ commitment and desire of a few individuals working in the reserve to control and put out fires;

♦ sufficient funds to pay people to work under arduous conditions for extended periods of time;

♦ clear, strong leadership and co-ordination;

♦ ability of the co-ordinator to motivate people; and

♦ availability of communication equipment from the research projects in the reserve, making co-ordination of firefighting efforts more efficient.

It is also far more cost effective to actively prevent fires from entering the forest than putting out fires or subsequent coal fires. Another positive aspect of making a firebreak during the height of the dry season was raising the awareness among farmers to ensure that fires do not spread from their burning fields.

The firefighting activities in the Sungai Wain reserve during the 1998 fires depended heavily on the commitment of a few individuals and their ability to secure funds. To overcome these weaknesses in the future, a large effort has been made to establish a multi-stakeholder management unit for the reserve, with an "independent" executive committee, responsible for the management of the reserve, including firefighting. Government and donor funds will be channelled directly to the management unit to carry out all necessary activities. Clear action plans will be prepared for emergencies, with a main focus on fire prevention.

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Acknowledgements

Community-based disaster management: a response to increased risks to disaster with emphasis on forest fires

Johan Kieft[1] and Aspian Nur[2]

Abstract

East Kalimantan has become increasingly vulnerable to forest fires in the last two decades. Most of the burning is caused by human activities aggravated by the El Niño Southern Oscillation (ENSO). The forest fires have seriously affected the livelihoods of people relying on the forests and many households are now less secure after the 1997/98 forest fires.

In response, CARE has developed a humanitarian approach to community forest fire management based on disaster management concepts. Disaster management incorporates community development with disaster/emergency responses. CARE's programme consists of six clusters of activities, i.e. participatory action and learning, training in disaster management, building local emergency response capacity, improving land-use mapping, organizing stakeholder planning workshops and establishing stakeholder forums on disaster management at the sub-district level.

Initial assessments highlighted the communities' fatalistic attitudes about their situation. CARE's attempts to engage the communities in designing and implementing activities have proven to be a successful start of the project. Training in disaster management was effective in developing initial links between communities and other stakeholders, as well as establishing a common vision about disaster management.

Disaster management has great potential in dealing with increased vulnerability to forest fires. One of its strong points is the flexibility of the programme that allows communities to adapt activities to suit their socio-cultural traditions and needs, and to integrate them into village development plans. It is equally important to expose stakeholders to existing international standards of entitlements to emergency assistance.

1. Introduction

Over the last two decades, East Kalimantan has become increasingly vulnerable to forest fires. Although forest fires are common occurrences in Kalimantan since pre-historic times (Brookfield *et al*., 1995), the impact of recent fires is much worse and widespread than those recorded at the beginning of the colonial period. The 1997/98 forest fires were among the most destructive. They damaged 9.8 million ha of forests, of which 5.2 million ha were located in East Kalimantan.

According to Goldammer (1997) and the World Bank (2001), almost all the burning was related to human activities aggravated by the El Niño Southern Oscillation (ENSO). The World Bank estimated that only 1 percent of forest fires was due to natural causes while large-scale land clearance was responsible for 34 percent, shifting and permanent agriculture for 17 percent, arson for 14 percent and transmigration for 1 percent of the occurrences. The fires in 1997 caused a total loss of US$9.3 billion for Indonesia, including US$7.9 billion of socio-economic costs and US$1.4 billion for carbon emissions and environmental damages.

CARE's assessments (2001a and 2001b) show that most of the affected communities are still trying to recover from the disasters. Many farmers are reporting repeated crop failures since 1997. The forest fires and drought were obvious reasons for the losses in 1997, but since 1998, plagues and floods, among others, are the main cause of the failures. More than 81 percent of the farmers lost at least some perennial crops, one of their most important assets, and the degree of damage can be seen in Table 1.

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Table 1: Damage to perennial crops caused by disasters since 1997 in target villages (CARE, 2001a and 2001b)

Degree of damage	Pepper (%)	Coconuts (%)	Rubber (%)	Fruits (%)
0%	29	49	15	45
1-50%		7	38	11
51-100%	71	44	47	44

The widespread destruction of the ecosystems in East Kalimantan has forced farmers to look for alternative livelihoods. Since 1997, more than 35 percent of the farming community are involved in illegal logging, petty trade, and occasional work, while others rely on coconut farming. Figure 1 shows the alternative income generating activities in Marang Kayu sub-district, one of the seriously affected areas. Logging is not included in this case mainly because there is no forest left in the area.
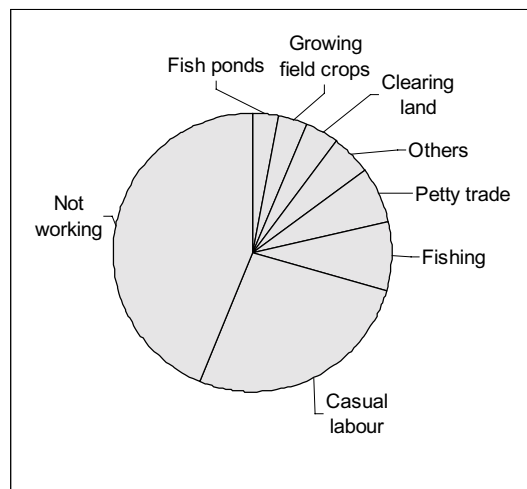
Figure 1: Common livelihood strategies adopted by farmers in Marang Kayu

The impacts of the 1983 and 1997/98 fires on forestry and natural resources have been documented in several reports (Von Gemmingen, 2001; Yeager, 1999). On the other hand, the impact on the livelihoods of forest-dependent communities has received less attention and is still not adequately assessed. Nevertheless, especially from the 1997/98 forest fires, indicators for food security, such as nutritional status for children, have given rise to grave concern for the affected communities. In 1998, CARE found 13.1 percent of children less than 5 years old to be moderately malnourished, and 3.1 percent were severely under-nourished, while in 2001 the figures were 12.6 and 5.3 percent, respectively (United Nations threshold standard for emergency interventions is 10 percent) (CARE, 1998). These data highlight the social impacts of the forest fires, making local communities more vulnerable to subsequent disasters in the long term.

2. A need for a humanitarian approach to disaster management

So far, the international community and Indonesian government have tried to deal with the forest fires by concentrating mainly on natural resource management issues. Indeed, this is a logical approach given the costs involved. However, the high incidences of malnutrition also points out that other issues are at stake and an alternative strategy is needed to address the immediate needs of vulnerable communities.

In response to this urgency, CARE is developing a household livelihood security (HLS)-based approach to disaster management in East Kalimantan. The project aims to facilitate the establishment of integrated and functional structures for disaster preparedness and the adoption of local-level disaster mitigation measures, including the adoption of environmentally sustainable land-use management techniques. A prerequisite for the success of the project is to actively involve all stakeholders and raise their awareness. Therefore, CARE networks with local communities, the private sector (e.g. concessionaires, mining and other resource extraction companies, plantation companies), governments (especially at village and sub-district levels) and local non-governmental organizations (NGOs). It also assists communities to improve or establish effective linkages with these organizations and companies.

3. A theoretical framework for disaster management

Many humanitarian agencies have a dichotomous approach to emergency recovery and development efforts. They have emergency staff who respond specifically to disasters and development staff who step in once the crisis is under control. However, in the 1980s, experiences of major relief and development agencies have convinced them that emergency and development programmes are intertwined.

A second factor that plays a role in changing perceptions of effective assistance is the increasing emphasis on livelihood security for households affected by disasters. Calamities are the main threat to this security and reducing the communities' vulnerability to such hardships is a crucial response.

Based on these insights and through intensive discussions, disaster management has evolved to merge rescue and development plans, and several sophisticated approaches have been formulated. Within the context of disaster management, development is defined as a process that reduces vulnerabilities and increases capacities. For further clarity, vulnerabilities are generally defined as long-term factors that affect the ability of a community to respond to events or make it susceptible to calamities. They contribute to a disaster's severity, impede effective responses, are present before disaster strikes and remain long after the event is over. In this respect, vulnerabilities differ from needs, which arise from the crisis and are often short term in nature (e.g. the need for relief food supplies immediately after a forest fire). Vulnerabilities to forest fires, however, are more enduring and have intensified in recent years because of increased conflicts, a lack of law enforcement, and poor natural resource management.

Nonetheless, their vulnerabilities, most communities still have capacities to rebuild their lives. From a disaster management's point of view, capacities are strengths on which future development can be built.

During disasters, the community's vulnerabilities are more pronounced than their capacities. Recognising the vulnerabilities and capacities of the affected population is essential for designing and implementing an effective disaster response. To identify these capacities and vulnerabilities, a Capacity and Vulnerability Analysis (CVA) matrix (Table 2) can be used to examine three aspects of information:

♦ Physical factors: what productive resources, skills and hazards (e.g. land, environment, health, skills and labour, infrastructure, food, housing, capital and technologies) are available?

♦ Social organization: what are the relationships among and organization of the communities (e.g. formal political structures and informal systems such as decision making, establishing leadership or organizing various socio-economic activities)? When prejudice or conflict is present in a community, social and organizational vulnerabilities are inevitable.

♦ Attitudes: how does the community view its ability to adapt to changes? Strengths and weaknesses can make a significant difference in the communities' ability to rebuild and improve their material base and social institutions. A community is psychologically more vulnerable when its people feel victimised, fatalistic and dependent.

Table 2: Capacity and vulnerability analysis matrix

	Vulnerabilities	Capacities
Physical factors	Geographical calamities (floods, earthquake) Economic misfortunes (drought) Poverty (insufficient resources) Lack of infrastructure Poor health	Skills to be productive Access to productive resources (land, forest, sea, capital, etc.) Technologies (agro-forestry/sustainable land management) Adequate infrastructure Good health
Social organization	Division according to religion, ethnicity, language, class or caste Prejudice Conflict Ineffective community organization	Social coping mechanism: family, group, community and/or area wide organizations
Attitudes	Superstition Fatalism (feeling that nobody supports them). Dependence on external support	Fighting spirit Religion* Sense of purpose

*Religion can have a positive impact on attitudes, but can also divide the community and create conflict.

In general there are two different disaster management models:

♦   The cyclic model in which emergency, recovery, development (preparedness, mitigation) and early warning are executed progressively, with each phase having its own particular approach(es).

♦   Expand and contract model in which all aspects of disaster management are addressed simultaneously, albeit with varying degrees of emphasis. For example, during the onset of a disaster, emphasis would be on emergency management and early warning but recovery and mitigation are taken into account as well.

CARE has adopted the "expand and contract" model for its disaster management programmes.

4. Disaster management for forest fires: the CARE DISPRE (DISaster PREparedness) approach

CARE has implemented the project in East Kalimantan for one year and has received positive feedback from local communities and other stakeholders. Although the project targets fire-prone forest communities, it does not focus on forest fires *per se*. Instead, it seeks to reduce vulnerabilities of communities to disasters in general, as the recurrence of other disasters (e.g. rat infestation, floods) poses a higher risk to these communities in comparison to forest fires.

CARE's approach is based on the following principles:

♦   Involving local stakeholders:

Involvement of a full range of local stakeholders is essential to reduce vulnerability. The private sector is still the main land users in the most affected areas. The private companies are an important factor in forest fires as well as major providers of relief assistance to affected communities. Improved planning in both development and relief is only possible if these stakeholders are involved.

♦ Integrating disaster management and development:

The project facilitates the integration of disaster mitigation and preparedness into the community's development processes, in line with the Indonesian government's village development plans.

♦ Strengthening the community's capacity:

The project aims to re-establish and strengthen existing social and organizational capacities within the communities. Increasing the confidence of people to overcome their vulnerability is a major focus.

♦ Utilising an integrated media approach:

An integrated media approach comprises communication avenues such as participatory communication approaches (PCA), participatory workshops, community leaders' training, posters, and radio talk shows.

The CARE disaster management approach consists of the following activities (Figure 2):

♦ Participatory learning and action (PLA) is the core strategy to facilitate the integration of disaster management into village development plans and to infuse in the villagers a sense of ownership of the process. Participants set their own targets and indicators for each activity they implement. The initial PLA-derived findings then serve as a baseline that allows communities to monitor their progress. PLA has proven to be effective in re-establishing social structures that have been under pressure as a result of the disasters. PLA activities linked to natural resource management, such as constructing firebreaks, planting trees and converting wasteland into arable land, reinforce existing social structures and increase community self-confidence.

The communities are able to adjust the PLA programmes to suit their own socio-cultural environment. This is important in East Kalimantan given that the project involves seven villages with four different ethnic groups (Dayak, Bugis, Javanese and Kutai). Each group has its own traditional way of farming. Most of the Bugis rely on coconut trees, the Dayak and Kutai are mainly rice swamp farmers with some perennial crops, and the Javanese are transmigrants growing rubber trees in a former nucleus estate scheme. Hence, the needs of each ethnic group can differ significantly.

♦ Training in disaster management aims to develop common knowledge among the different stakeholders. The training methodology attempts to link disaster management concepts with the participants' local experiences and focuses on increasing understanding of the different aspects of disaster management, such as:

➢ Different models of disaster management.

➢ Terminology used in disaster management. Most participants are unfamiliar with the terminology, such as vulnerability, capacity, hazard and risk.

➢ Different phases of disaster management including preparedness, mitigation, early warning, emergency management and recovery.

➢ Conflict resolution as a tool in disaster mitigation.

➢ Emergency management in line with the SPHERE international humanitarian standards (SPHERE, 1998). These standards are currently acknowledged as basic rights for those in need of assistance. During training, the standards are explained and participants explore how they can be integrated into community-level initiatives.

➢ CVA as a tool to integrate disaster management into village development plans. Participants develop their own disaster management strategy based on CVA.

♦ Development of local capacity in emergency response involves training in fire repression, establishment of granaries to mitigate food shortages during emergencies (a very successful effort in Dayak villages) and indigenous rainwater storage techniques to avoid flood-related contamination in flood-prone areas.

- ♦ Vision mapping of the villages is used to facilitate village-level integration of disaster management into village development planning. It is also used to develop links between communities and other stakeholders, and as a planning tool for communities to effectively develop land-use plans to reduce the risk of forest fires for the next five years.

- ♦ After the vision mapping has been finalised, workshops are organized to prepare disaster management plans that include:
  - ➤ Development of local mechanisms to integrate disaster management into existing village and sub-district development plans.
  - ➤ Assessment of locally available capacity and ways to strengthen it.
  - ➤ Incorporation of SPHERE (1998) standards into local emergency response mechanisms.
  - ➤ Establishment of functional fora that bring together major stakeholders.

- ♦ Stakeholder fora at the sub-district level focus on broader issues other than forest fires as experience has shown that the destruction caused by forest fires significantly increases other hazards such as flooding and rat infestation of crops.

5. Initial experiences

During the first year, the project has focussed on strengthening the existing social structures in the villages. It has re-established farmer groups through PLA programmes. Some resultant activities were not directly linked to disaster management but allowed the communities to begin building up the necessary capacity to underpin effective disaster management.

5.1. PLA

Many of the participating communities were fatalistic at the start of the project. They had basically abandoned their agricultural activities and were relying on alternative incomes and illegal logging. The project initiated the PLA process to motivate them to take a more positive approach in overcoming their misfortunes. Activities currently assisted by the project include:

- ♦ Banana relay-planting with rubber cultivation:

  From their experiences in fighting forest fires, the farmers found that planting banana trees as firebreaks in rubber plantations was effective in stopping the fires and provided them with extra income. Based on their recommendations, the project assists the communities to develop this technology.

- ♦ Formulating contracts for leasing land:

  Contracts for lease of land facilitate better land-use planning between the more established settlers and recent (spontaneous) migrants. In the Dayak villages, land has traditionally been viewed as a common good with certain limited user rights after the land was first cleared. However, recent socio-economic changes have significantly decreased land availability. The more established Dayak groups claimed ownership to all the land they cultivated in the past. As a result, new Dayak migrants have access only to smaller plots. Land is left fallow and jealousy has led to increasing incidents of arson. The project introduced the concept of leasing land that allows the original claimants to retain their rights but also enables new arrivals to grow perennials such as rubber and fruit trees. The trees belong to the claimants but the harvests are shared by both parties.

- ♦ Cultivating productive firebreaks:

  Another attempt is to establish permanent firebreaks around the villages, rubber plantations and homegardens with crops producing minimum biomass, such as onions. This can help to protect recently established perennials from fire outbreaks, especially from the alang-alang (*Imperata cylindrica*) areas.

♦ Organizing forest fire brigades:

In some communities, villagers are interested in organizing fire brigades based on existing social organizations (e.g. farmer associations). The project facilitates training and assists communities to extend the brigades' responsibilities to include early warning efforts.

♦ Establishing paddy fields on burned peat swamps:

The area was previously under coconut cultivation following traditional Buginese land clearance and water management systems. Drought and subsequent peat fires have destroyed the coconut plantations. Growing paddy will help to prevent further burning and re-establish livelihoods of affected villagers.

5.2. Disaster management training

The disaster management training curriculum is based on experiences from other countries as Indonesia focuses mainly on internally displaced people and complex disasters, and not on disaster management. The curriculum aims to provide tools to participants to help them analyse and learn from their experiences. This has proved to be a successful strategy. Activities initiated by the training include:

♦ Assisting communities to deal with other stakeholders:

One example is a mining company that wants to dig a flood control channel but lacks the capacity to plan with the affected communities. Another is an oil palm plantation that intends to reduce fire vulnerability by supporting neighbouring communities to improve their land-use practices. CARE assists these communities in collaborating and co-operating with such companies to avoid negative impacts and reduce risks.

♦ Supporting local NGOs interested in developing disaster management programmes:

All interested and active local NGOs are invited to the training sessions and CARE helps them to develop programmes with communities in disaster management.

♦ Promoting conflict resolution:

Conflict occurs at different levels, both horizontally and vertically. Examples are conflicts over resources within a community, among communities and between communities and other stakeholders. During stakeholder sessions, participants are asked to explore different options for collaboration (e.g. partnerships, co-operatives) that should address the root causes of the forest fires as well as enhance local capacity to sustainably manage their resources.

6. Preliminary conclusions

Many lessons can be learned and preliminary conclusions drawn from the project even though it has been operating for just over a year, for example:

♦ In East Kalimantan more attention needs to be paid to the impact of disasters on HLS.

♦ The private sector, especially major companies that compete with the local communities for natural resources, exerts considerable impact – positive and negative – on the livelihoods of these communities in East Kalimantan. CARE tries to involve the private sector in community disaster management activities whenever feasible, and to assist the communities in advocating their interests to these companies. Training exposes the companies' community development staff to disaster management concepts and facilitates communication in a neutral setting. Such training sessions enable the incorporation of local communities' needs into the company plans and the integration of disaster management, including conflict management, into their development activities.

Communities

Stakeholders
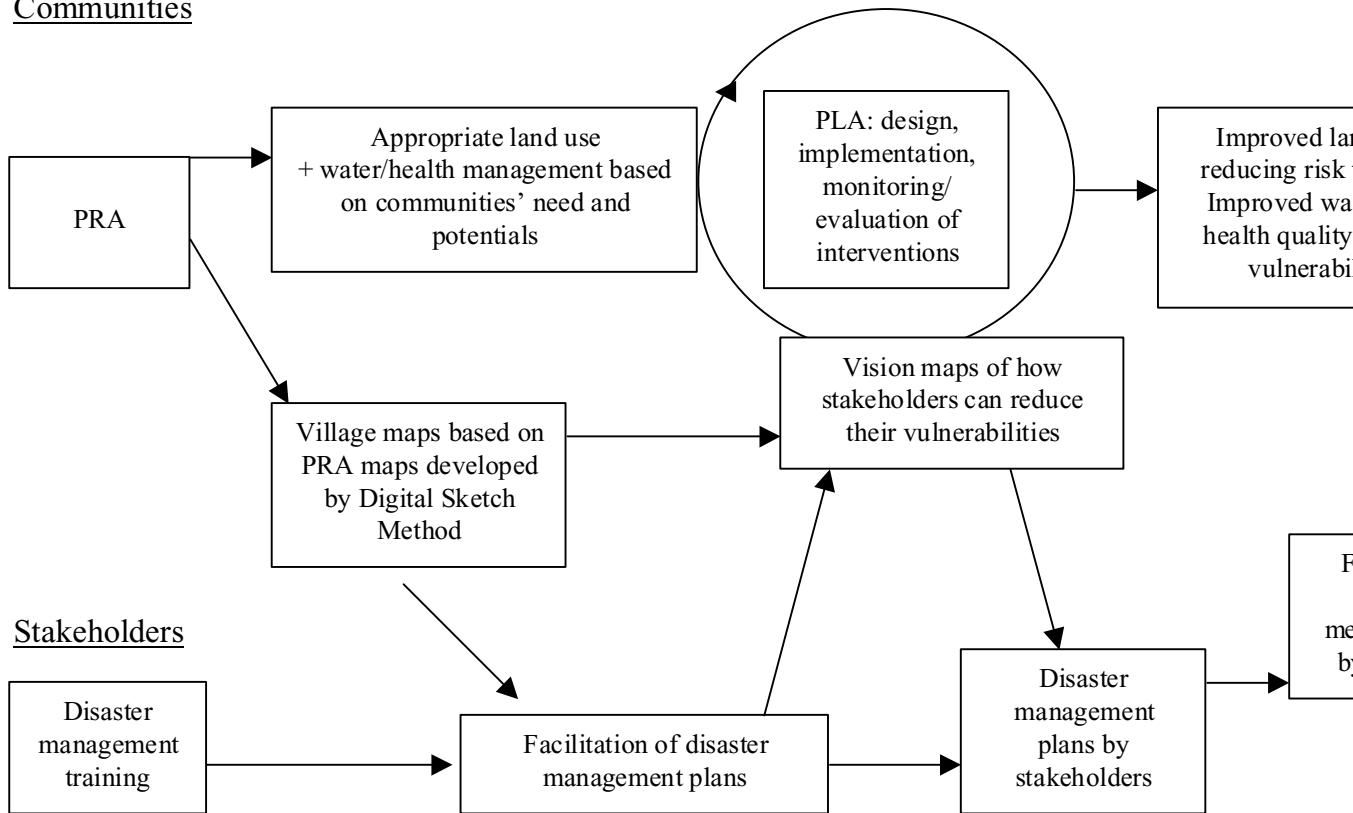
The process is strengthened by a media campaign that focuses on different aspects of the approach.

Figure 2: CARE's disaster management programme

♦ The fatalistic attitudes of communities in disaster-prone areas are often not taken into account, yet they are a major vulnerability. To be successful in disaster management, building up the confidence of the communities cannot be overlooked.

♦ Disaster management initiatives need to be integrated into community development activities to be effective. In fact, disaster management should be a thread running through community development planning in disaster-prone areas.

♦ Socio-cultural differences create divergent perceptions of land tenure and agricultural practices. This needs to be considered in disaster management. Activities have to enable the various ethnic groups to strengthen their capacities and reduce their vulnerabilities within their unique cultural frameworks.

♦ Training on humanitarian standards, such as the SPHERE standards, has been found to increase community members' understanding of their entitlements for emergency assistance. This helps the communities to better understand their rights and request for assistance especially when they no longer are able to cope on their own.

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Acknowledgements

Review of the participatory forest fire prevention programmes in Jambi and West Kalimantan, Indonesia

Masahiro Otsuka[1], Sumantri, Kuspriyadi and Syaharuddin[2]

Abstract

The participatory forest fire prevention programmes of the Forest Fire Prevention Management Project (FFPMP) have been implemented with farmer groups using different models in Jambi and West Kalimantan. Both programmes aim at intensive fuel load management and fire control by cultivating green belts on community land around the forests and promoting permanent agriculture. The FFPMP will follow up with monitoring and technical assistance during the proposed second phase to increase farmers' participation in its fire prevention programmes.

At the Jambi site, the integrated green belt (IGB) incorporates a wire fence, a ditch, rows of various tree species and inner agricultural land. Farmers fenced approximately 15 km of the area and dug a ditch 9 km in length. Tree rows reached more than 10 km in length and 5-30 m in width. Perennial crops such as areca nut, albizia, rambutan, durian, citrus and coconut were planted. Wire fences were effective to keep out wild boars, boost productivity and reduce fuel loads on their fenced land. However, the farmers' knowledge of seedling production, land preparation without burning, crop planting and protection are limited. Alternative fencing technologies to replace the costly wire fences have to be considered.

At the West Kalimantan site, alley cropping or sloping agricultural land technology (SALT) is tested with nitrogen-fixing trees (NFTs), other trees and annual crops. A small number of farmers planted alleys and hedgerows with NFTs, but could not weed and prune according to schedule due to labour shortages.

1. Introduction

The Forest Fire Prevention Management Project (FFPMP) has initiated participatory programmes in Jambi and West Kalimantan Provinces, Indonesia. The programmes aim to achieve long-term forest fire prevention based on local communities' active participation in planning, implementation and evaluation. Most of the wildfires are caused by human activities in and around forests.

This paper reviews the implementation of the participatory programmes, outputs and constraints, and offers recommendations for future fire prevention activities.

2. Jambi site

2.1. Site condition

A pilot programme for community-based forest fire prevention is implemented at Rantau Rasau Desa and Sungai Rambut Villages, Rantau Rasau Sub-district, Tanjung Jabung District, Jambi Province (Figure 1). Both villages are situated along the boundary of Berbak National Park that protects one of the most important lowland swamp forests in Indonesia. Inhabitants consist of local Malay migrants (mainly at Sungai Rambut), and Javanese and Buginese migrants (mainly at Rantau Rasau Desa). The riverside has been settled mainly by the Malays since the end of the nineteenth century, and the inland by the Javanese and Buginese since the 1960s. The settlements are well organized with canals and ditches in most areas, divided into administrative units called neighbourhood associations (rukun tetangga - RT).

By and large, the Malay live on rice farming and freshwater fisheries, while the other ethnic groups depend on subsistence and cash crop agriculture. Many people have exploited the forests for timber, fish and wildlife to supplement their incomes. An elementary school was built, but public

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utilities, such as water supply, electricity, telephone and gas are still unavailable. The government has provided credit to both communities through its Presidential Funds for Under-developed Villages programme.
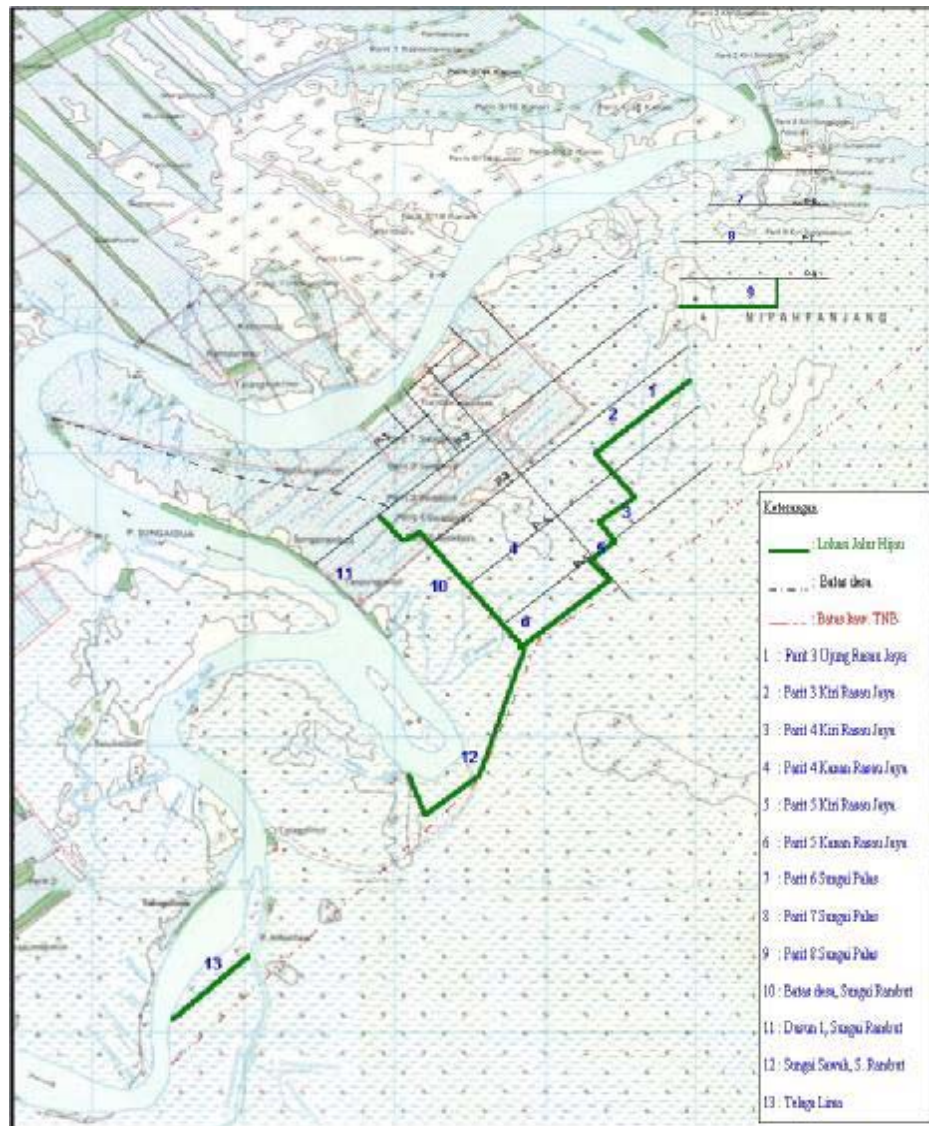

Figure 1: Project site in Jambi

2.2. Concept of participatory Integrated Green Belt

The integrated green belt (IGB) aims to protect the forests of the national parks from wildfires and agricultural land from wild boars by encouraging farmers to intensify land management. The IGB is established along the boundaries of existing agricultural fields close to the park boundaries with farmers' participation. The IGB basically consists of a wire fence, a ditch, tree rows and agricultural land (Figure 2). The wire fence is effective in keeping out wild boars, while the ditch stops ground fires and secures water for initial fire suppression. Tree rows are expected to control surface fires and obstruct the passage of wild boars, besides increasing agricultural productivity.

Suitable tree species need to be selected for effective fire prevention in terms of fuel load control and fire resistance, and to provide farmers with non-timber products. The selected species should grow easily on the wet and peat soils. Therefore, in the initial green belt design, the FFPMP restricted tree species selection to two criteria, i.e. for fire prevention and easy growth. Through community consultations, three of the farmers' preferred species that met the project's initial needs were selected – areca nut (*Areca catechu L.*), albizia (*Paraserianthes falcataria*) and lamtoro (*Leucaena leucocephala*). Areca nut is planted along the wire fence for support after existing wooden props have decayed. Albizia yields valuable timber in a short period while effectively forming hedgerows. Lamtoro is preferred by some farmers for its multipurpose functions, including soil improvement and fodder production.

At the second stage, other promising species, based on farmers' requests and report recommendations, were tested for their effectiveness in preventing fire. Fruit trees and multipurpose tree species (MPTS) were planted inside the fence, such as durian (*Durio zibethinus*), rambutan (*Nephelium lappaceum*) and melinjo (*Gnetum gnemon*). On the farmers' own initiative, demonstration plots were established to test these new tree crops within the fenced community land. The green belt is being expanded at both sides of the fence with the selected tree species.

The fire resistance of these tree crops needs to be tested during the trials. The farmers noticed that the bark of the trunk of the areca nut is thick enough to help the tree withstand fire. The long branches of the albizia can effectively inhibit the growth of ground cover, outweighing the vulnerability of its trunks to fires. Lamtoro is quite similar to albizia, but its trunk is more resistant to fire. Durian, rambutan and melinjo are generally resistant to fire because of their long branches and high moisture content in their trunks.

The immediate benefit of the IGB is its effective protection of community land and forest from wildfires. However, the farmers also expect the IGB to reduce inflammable undergrowth and enable the cultivation of annual and perennial crops. The FFPMP provides materials and encourages farmers to participate actively in green-belt activities.

During the course of the project, the farmers found that it was difficult to adhere to the original concept of planting in rigid lines to align the green belt with the fence. In response, the programme was modified and farmers were encouraged to cultivate according to topography and soil conditions (Figure 3).

2.3. Inputs for the establishment of the IGB

To motivate farmers to participate in the FFPMP, a number of incentives were provided. The FFPMP procured wire netting and some props, which the farmers used to construct fences in the designated areas. In total, 16.1 ton, or 15.3 km, of wire netting and 7,480 props were required (Table 1). The total cost of the wire fence amounted to approximately Rp9,000 per metre. More wire and props were needed at Sungai Rambut because of the inexperience of the local farmers in constructing wire fences. Migrant farmers extended the existing 4 km ditch at Rantau Rasau themselves, but some farmers at Sungai Rambut requested hired help because they were untrained in such construction work. In total, a 9 km ditch was dug (Table 1).

The FFPMP also distributed seedlings (half of which were purchased in Jambi) to participating farmers to speed up the establishment of the IGB (Tables 2 and 3). The cost of providing the seedlings was about Rp1,600 per tree. Areca nut (38 percent) was the farmers' most preferred tree species, followed by coconut (11 percent), rubber (7 percent), albizia (7 percent), citrus (6 percent), melinjo (4 percent), rambutan (3 percent) and durian (2 percent). Areca nut was most popular because of its ability to yield higher profits, easier cultivation even on wet soils, and good fire resistance. Coconut and rubber are common commercial crops at the site. Although they are vulnerable to fire, the farmers are expected to protect them from fire. Albizia is a lucrative source of timber and firewood. Some farmers are fond of citrus and other fruit trees even though they require special care.

Initially, the FFPMP produced seedlings of areca nut, albizia and lamtoro at a nursery in each village. However, the farmers were unable to manage the nurseries and skilled labourers had to be hired. The FFPMP has also supplied construction materials for a base camp and tower, and fertilizers for fruit trees and other tree crops.
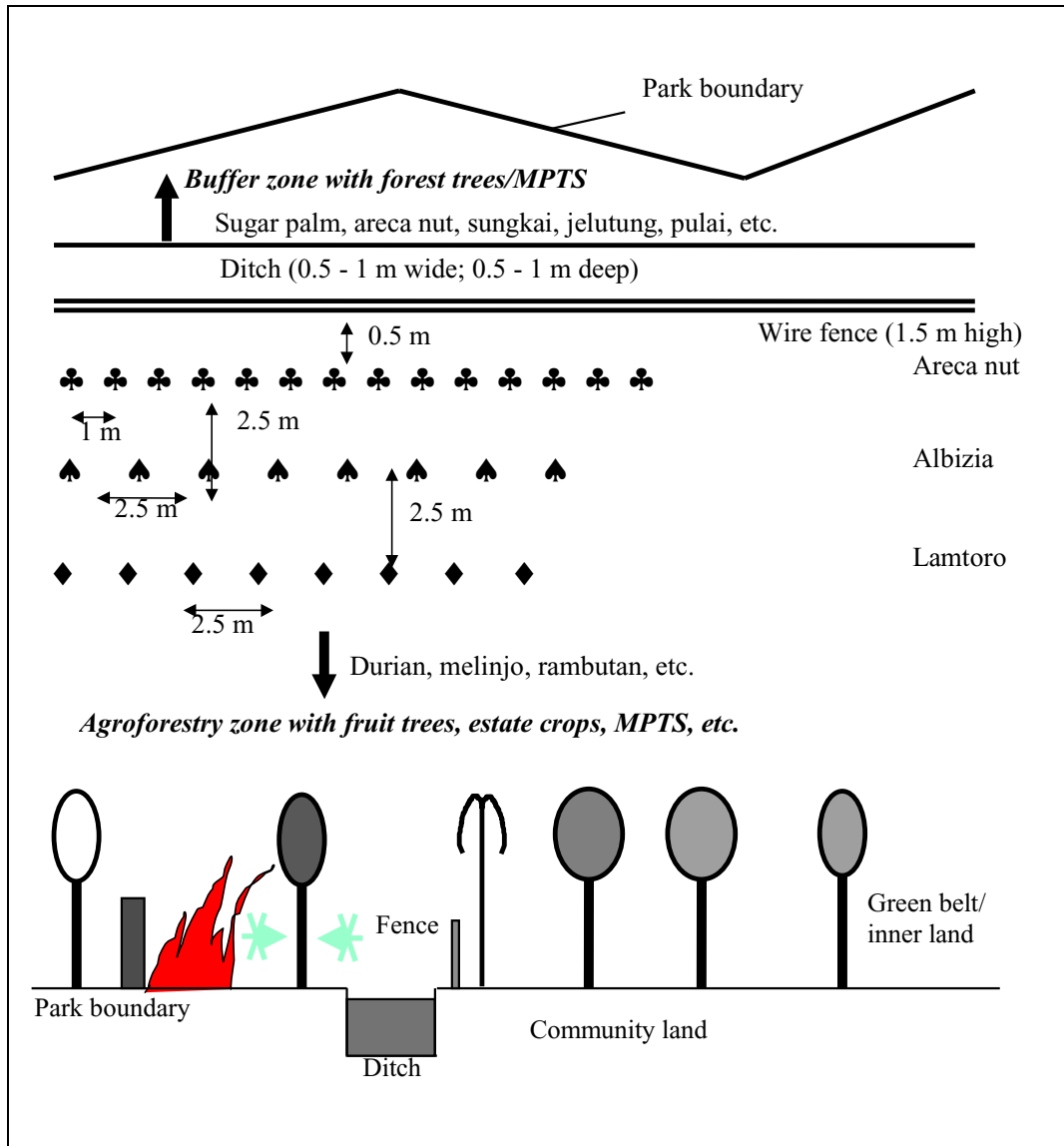
Figure 2: Model of the IGB

Table 1: Materials provided by FFPMP for wire fences and ditches

Village	Wire (t)	Prop (pieces)	Wire fence (km)	Ditch (km)
Rantau Rasau	10.2	5,150	11.9	6.6 (2.0)*
Sungai Rambut	5.9	2,330	3.4	2.4 (1.4)
Total	16.1	7,480	15.3	9.0 (5.6)

* Figures in brackets denote distance dug by paid labourers.

Pattern 1

Pattern 2
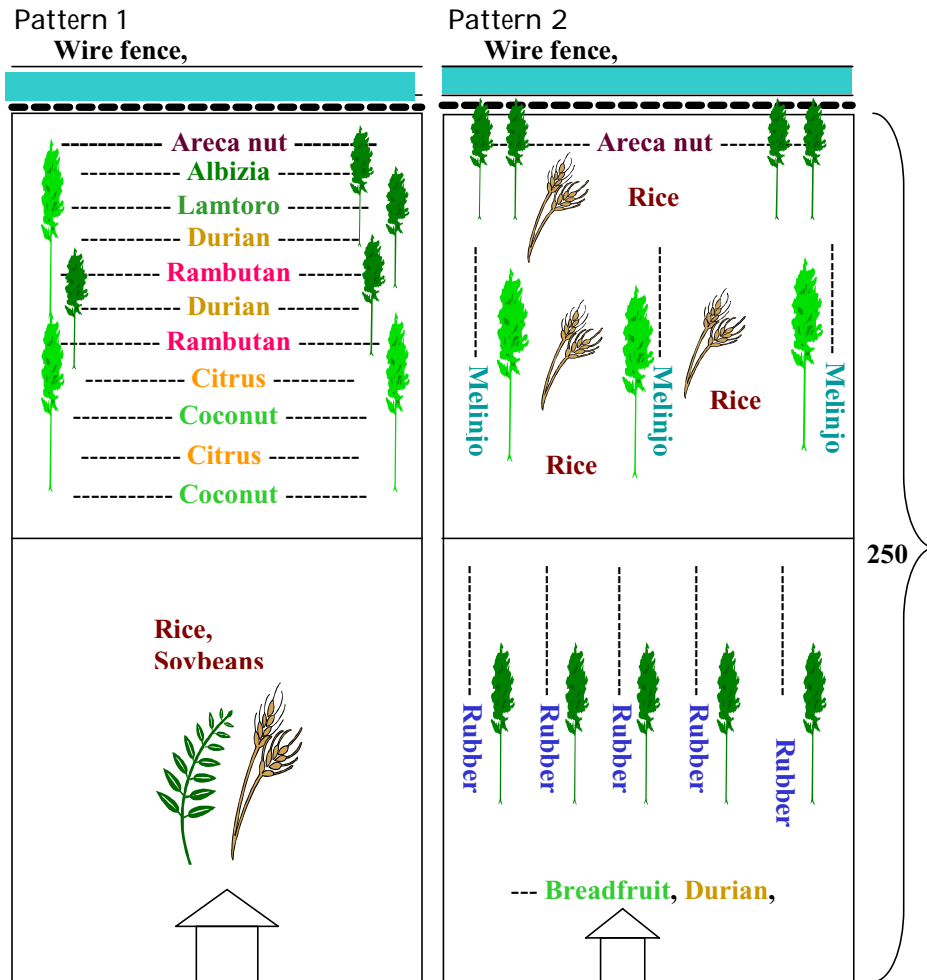
Wire fence,

Wire fence,

Figure 3: Modification of planting patterns of the IGB

Table 2: Number of seedlings provided by FFPMP

Village	1997	1998	1999	2000	Total
R. Rasau	8,711	56,691	20,303	44,098	129,803
S. Rambut	2,989	49,369	13,018	19,149	84,525
Total	11,700	106,060	33,321	63,247	214,328
Target area (ha)	15	72	50	88	225

Table 3: Number of seedlings produced by the nursery and provided by FFPMP

Village	Production	Provision
Rantau Rasau	61,000	53,000
Sungai Rambut	54,000	46,000
Total	115,000	109,000

2.4. Outputs of green belt activities

Up to now, 336 farmers were encouraged to participate in the green belt activities in Jambi. They were divided into 10 groups consisting of a total of 216 farmers at Rantau Rasau and 4 groups of 120 farmers at Sungai Rambut. Tree rows reached more than 10 km in length and 5-30 m in width by line-planting along the fence and broader planting on the higher elevations inside the fence. The survival rate ranged from 50 to 80 percent.

There were four different planting patterns (Figure 4). The first pattern is most common and planted with areca nut, durian, rambutan, citrus, coconut and other tree crops. Tree spacing is dependent on each species, but the land will ultimately be converted into tree gardens. Rice and other food crops are intercropped with trees. The second pattern is similar, but species composition is simpler, mainly with coconut, melinjo and food crops. Rice is still an important component. The third pattern maintains rice fields on the inner area, accompanied by some tree crops (e.g. areca nut, rubber, albizia, coconut) along the fence and on the homestead. In the fourth pattern, farmers cultivate only part of the land around their homesteads, while the more distant land along the fence is left untouched and covered with undergrowth.

It is assumed that the first and second patterns are more effective in preventing fire because of the farmers' careful cultivation of the whole land, while the wild vegetation of the fourth pattern harbours a greater fire risk. The success of the third pattern depends on the intensity of land management and fire behaviour.
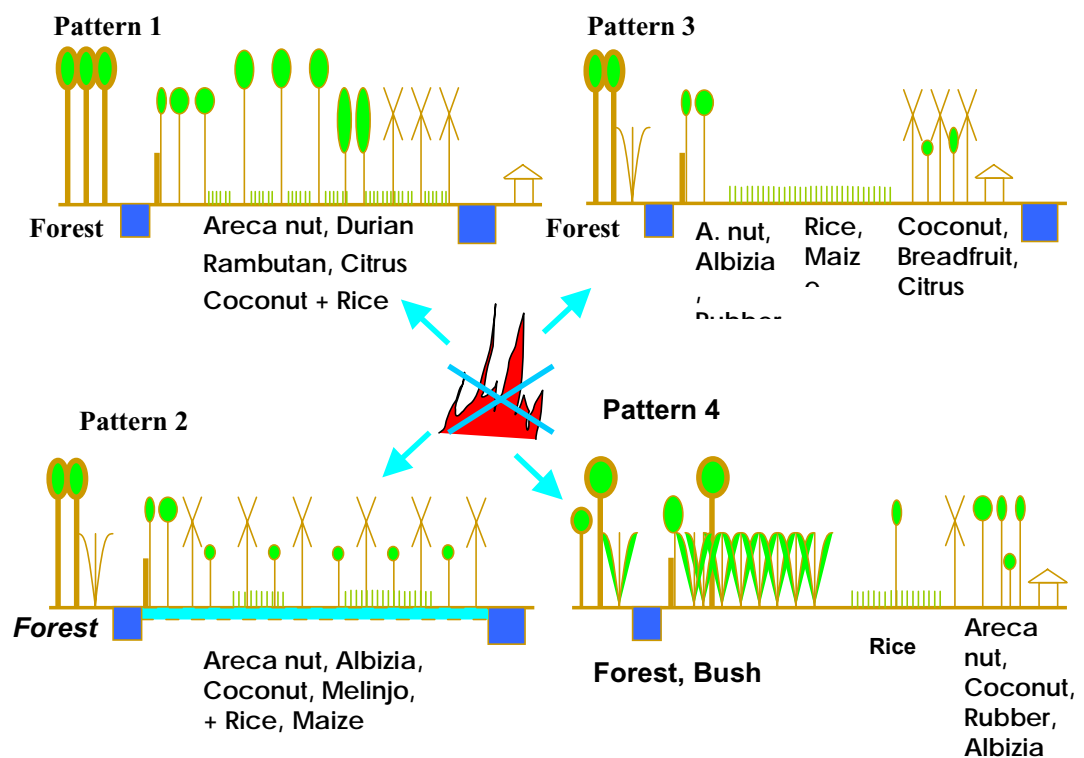

Figure 4: Planting patterns in the IGB

Major impacts of the IGB have been a decrease of wild boar damage (from 28.6 times per month in 1995 to 15.0 times per month in 1999) and a reduction in the use of fire for clearing land. However, more farmers resorted to herbicides for the land preparation and weeding (Table 4). Alternative land management technologies have to be sought to avoid their heavy reliance on herbicides. However, the farmers' capabilities in land improvement and crop protection (e.g. mounding, terracing, manual weeding and fertilization) are seriously limited.

Many farmers search for alternative employment. Their land is left fallow and overgrown with weeds, which often impede the growth of newly planted trees. Moreover, frequent flooding, caused by accelerating deforestation in upland areas and illegal logging in the vicinity, has severely damaged the tree crops. The farmers have noted the presence of acid water and soils in flooded areas.

Despite the farmers' growing interest in tree crops labour shortage and environmental factors have affected the growth of the tree crops.

Table 4: Changes in land preparation practices

Land preparation practices	1995		1999	
	Farmers (%)	Frequency/year	Farmers (%)	Frequency/year
Burning	8	13	0	0
Herbicides	45	85	73	135

Basic structure of the IGB

Areca nut

Extension of the IGB

Transport of seedlings

Examples of green belt establishment in Jambi

3. West Kalimantan site

The participatory fire prevention programme at the West Kalimantan site applies alley cropping or sloping agricultural land technology (SALT) to establish permanent farming systems on shifting cultivation areas. It is also implementing long-term fire prevention and control, which are new concepts to the pilot site and other parts of Kalimantan.

3.1. Site condition

The pilot site is located in a hilly area adjacent to a protection forest at Landau Beringin Sub-village, Nanga Pintas Village, Nanga Pinoh Sub-district, Sintang District in West Kalimantan Province. The inhabitants are local Dayak who have close community bonds, although modern cash economy is gradually penetrating the area. Shifting cultivation with short bush-fallow rotations (3-7 years) is still a common practice. The vegetation is burned, and the land planted with upland rice, with maize, peanuts and other food crops. After the rice harvest, the land is fallowed to allow growth of new vegetation. Cultivating degraded fallow land is difficult where only *Imperata* spp. can grow. Consequently, more farmers have started to encroach on protection forests for crop production.

In recent years, farmers have become more interested in permanent farming around their settlements to provide a more stable environment for the family, and enable their children to go to school. Some community members participate in government-sponsored semi-irrigated rice farming on the lower floodplains. Although trials indicated that double cropping of rice is possible, experiments are still at an early stage. There is still a great demand for improved dryland farming to raise crop yields and overcome resource degradation from short-fallow shifting cultivation.

3.2. Green belt model in West Kalimantan

The green belt in this site is modelled after SALT or contour cropping of nitrogen-fixing tree species (NFTs) (Figure 5). Hedgerows of leguminous shrubs are established at intervals of 4-5 m along contour lines on the sloping land. The most promising species are kemelandingan (*Leucaena leucocephala*), gamal (*Gliricidia sepium*), turi (*Sesbania grandiflora*) and *Flemingia congesta*. Gamal has been observed to be resistant to fires in the plantations of Perum Perhutani (State Forest Corporation) in Central Java. Kemelandingan may be less fire-resistant and more susceptible to psyllid pests. The spacing of the shrubs should be about 25 cm to form live fences for soil improvement. Taller NFTs are introduced to the surrounding dryland, such as calliandra (*Calliandra calothyrsus*), lamtoro merah (*Acacia villosa*), johar (*Cassia siamea*) and secang (*Caesalpinia sappan*), together with MPTS such as candlenut (*Aleurites moluccana*) under various planting arrangements.

The FFPMP decided to introduce a wide variety of tree species to reduce the risk of failure. Farmers are encouraged to grow upland rice and secondary food crops (*palawija*) continuously between the hedgerows of NFTs. Several cover crops can be planted on the fallow land after the harvest to restore soil fertility and limit growth of inflammable vegetation.

NFTs can be easily propagated from seeds. They can survive in poor-quality soil without fertilizers, but require pruning after the first year to reduce the negative effect of shading on agricultural crops. Farmers are requested to prune older plants up to 25-50 cm in height and mulch the alleys to control soil erosion and provide organic matter to the soil. NFTs capable of providing firewood and fodder are favoured.

3.3. Inputs by the project

Eight species of NFTs and some cover crops were distributed by the FFPMP to the participating farmers. The farmers also received 3,800 tree seedlings as an initial incentive for participation, including areca nut, banana and rubber, together with food crops such as soybeans, peanuts, corn and ginger. At the nursery, about 138,000 seedlings of calliandra, kemelandingan, gamal, turi and johar were produced to replace dead trees on the pilot dryland. Some farming tools were made available, including shears and saws, to ease pruning at the initial stage. The FFPMP also constructed a community hall – managed by the community – as a base camp for consultations and fieldwork.
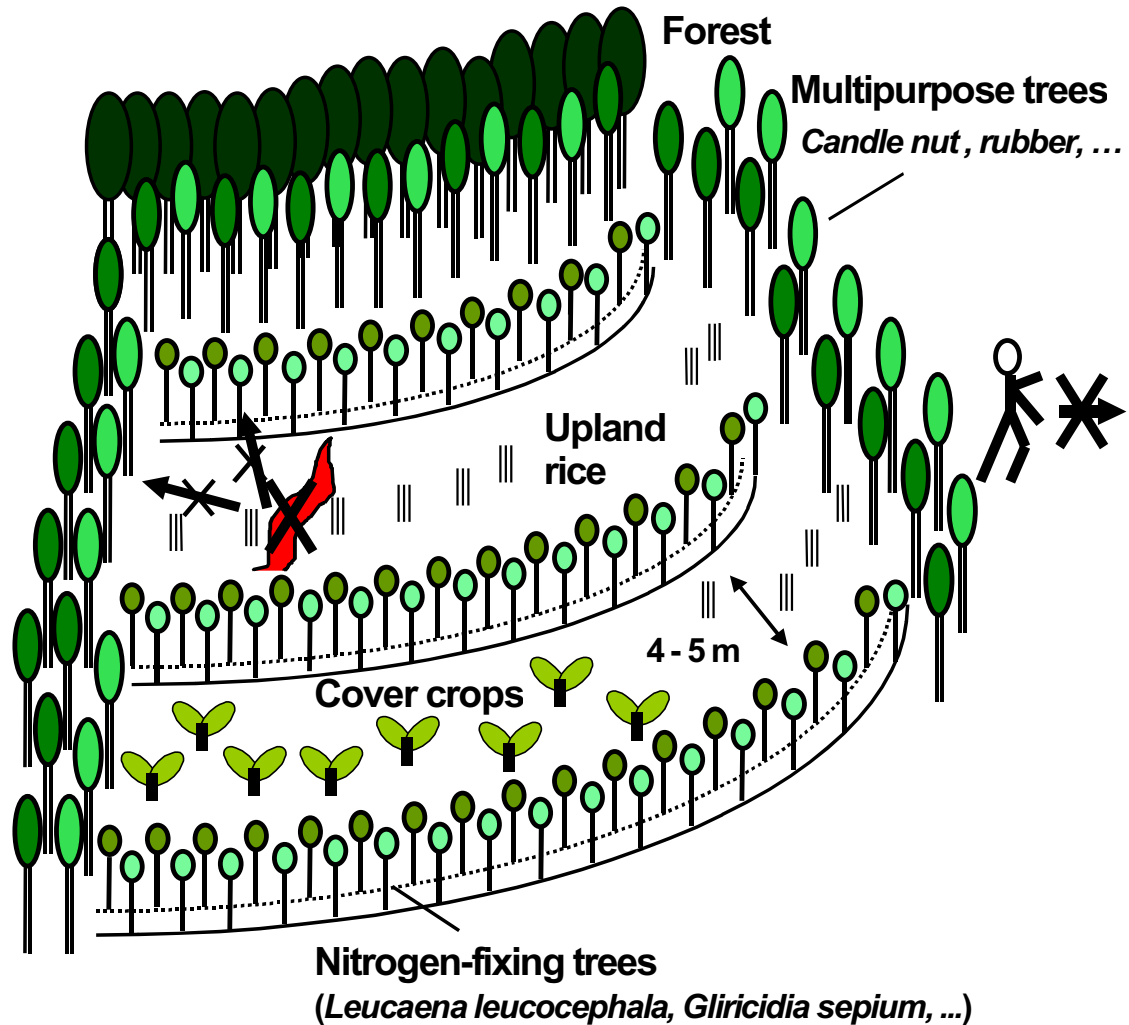
Figure 5: Green belt model for West Kalimantan site

3.4. Outputs: orientation and progress

Prior to implementation of the programme, project staff distributed technical manuals on alley cropping to government staff, local leaders and others. After conducting planting trials of NFTs around the site, the FFPMP helped to prepare the land and sow NFT seeds on selected plots located on sloping land along the village road to facilitate crop management and enhance the demonstration effect. By October 1999, two plots of approximately 7.5 ha had been planted with kemelandingan, gamal and turi in 26 hedgerows, amounting to 1.9 km in length.

Eleven out of 82 households participated in the initial stage. Community leaders assisted and supervised the daily activities, supported by regular technical assistance in cropping technologies from the FFPMP. Using the "A-frame" – a simple field instrument to lay out contour lines – farmers made holes about 25 cm apart and 4-5 cm deep along the contours, and put 4 or 5 seeds of a predetermined species into each hole.

Three of the farmers have developed more than 30 rows (2,200 m) in three pilot plots (9 ha) in one block, planted with kemelandingan, gamal, *Flemingia*, johar, calliandra, turi and lamtoro merah. Johar, calliandra and turi were highly resistant to weeds during their early stages of growth and grew very well, whereas kemelandingan and gamal did poorly because they suffer more from weed competition.

These farmers replanted over 10,000 seedlings and sowed 15 kg of alternative seeds on their land. The NFTs should have been pruned before they reached 3 m in height. However, pruning was delayed due to labour shortages. The alleys should be weeded before pruning the NFTs for effective mulching, which is also time consuming. Initially, the FFPMP provided farmers with food crops as an incentive to carry out the weeding.

Alley with *Cassia siamea*

4. Conclusions and recommendations

At the Jambi site, farmers actively participated in IGB activities hoping to prevent fires on their land and forest in the long term. Despite witnessing the advantages and benefits of IGB, the farmers are still unable to adopt IGB's land management and crop protection strategies because of a shortage of financial resources. Small-scale farmers or forest product gatherers cannot afford the lengthy wait for benefits to materialize. Long-term forest fire prevention through afforestation was a primary objective of the FFPMP, while the farmers expected quick cash returns or other financial incentives from participating in the project. The FFPMP tried to balance both needs through the IGP programme. However, there is still a gap between the short-term needs of the farmers and the long-term objective of the project.

Participatory forestry is expected to achieve successful afforestation and rural development. Still, farmers frequently participate in project activities only if direct incentives are provided because of the high labour inputs and long gestation periods. In addition, the farmers' living conditions, land-use systems and limited capacities are often overlooked during project planning.

To increase adoption rates of sound and effective firebreaks on community land, approaches will have to become more flexible and incorporate more bottom-up and self-reliant planning. Other economic activities that capitalize on the farmers' experiences should also be integrated (e.g. agriculture, fisheries and other land-related occupation). However, low-input technologies, particularly for land preparation and crop protection, must be pursued to sustain these activities. Alternative fencing methods (e.g. hedgerows with fast-growing trees) are essential to replace the costly wire fences.

Resource gatherers may be more agreeable to tree planting and forest restoration, but communities are not allowed to utilize park forests for personal uses because park authorities are concerned about further forest degradation. Agroforestry systems can be developed for agricultural lands if appropriate technical assistance, particularly for seedling production and tree protection, is provided to participating farmers. To ensure success of the programme, farmers have to be better organized, and ethnic and gender issues should receive more attention.

In the West Kalimantan site, the new alley-cropping trial has high potential for long-term fire prevention and permanent agriculture, but continuous support is still needed to improve the activities. Recommendations for future implementation include the following:

- ♦ Schedule and carry out land preparation, NFT sowing, weeding and pruning, properly to ensure optimal growth of NFTs.
- ♦ Ensure steady supplies of NFT seeds or seedlings within the village by allowing some of the trees to mature.
- ♦ Regulate alleys and land uses for effective soil protection.
- ♦ Promote the programme to other farmers through the experience and success of pioneer farmers.

Field staff and facilitators are indispensable for participatory evaluation and follow-up activities. The FFPMP will continue to monitor the alley-cropping trials and offer technical assistance to farmers through participatory research during the second phase. Other farmers are still reluctant to take on the laborious tasks of alley cropping. They are not convinced by the success of the trials, and continue to practise shifting cultivation. Nevertheless, they are envious of the three active farmers who are expected to facilitate technology transfer to other farmers, based on their experience.

Acknowledgments

Why don't they come and discuss together? Community-initiated stakeholder co-ordination on forest fire management in rural Gambia

Kebba Sonko, Saikou Samateh, Kanimang Camara and Clemens Beck[1]

Abstract

This paper examines the approaches of a rural Gambian community to forest fire management. Community forestry has given local communities the opportunities, but also the responsibility, of managing forests and protecting them from forest fires. The community described has been successful in implementing various fire prevention strategies. It has protected not only their forest, but also adjacent forestlands from ravaging fires. However, these achievements have been threatened by the lack of fire management in Kiang West National Park that borders the community forest of the village. The community's Forest Committee has now approached villages surrounding the National Park and invited authorities of Forestry and the National Park to a round-table meeting with the objective of involving all concerned stakeholders in local forest fire management.

1. Introduction

The Gambia is the smallest country in continental Africa (Figure 1) with an area of approximately 11,000 km^2, a population of more than 1.4 million and a population growth rate of about 3 percent per annum. With more than 120 inhabitants per km^2, The Gambia is one of the most densely populated African countries. About 50 percent of the population above 15 years old are literate.

With an annual per capita income of about US$300, the country is one of the least developed in the world (FAO, 2000 estimates; CIA, 2001). The climate is of the Sudano-Sahelian type with a rainy season from June to October and a dry season from November to May. The average annual rainfall is between 800 and 1,000 mm. Situated in the dry savannah region of sub-tropical Africa, the country is prone to bushfires.

The most important causes of bush and forest fires in The Gambia are hunting, wild honey collection, land preparation, creation of new settlements and firewood collection. Other causes include oyster processing, palm wine tapping, and cooking in the open (Dampha *et al.,* 2000).

2. The study area: Batelling in Kiang West District

Batelling is a comparatively small village of 27 compounds (households) with 366 inhabitants. It is located in Kiang West District in the Lower River Division, about 150 km from Banjul. Batelling's traditional lands are bordered by the 11,000 ha Kiang West National Park (KWNP) to the north and west, and by the 360 ha Brikama Forest Park in the south (Figure 2).

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Figure 1: Map of The Gambia and neighbouring countries
Source: www.lib.utexas.edu/Libs/PCL/Map_collection/africa.html

Most inhabitants of Batelling are Mandinka by ethnic origin. There is only one Fula compound with seven people. The Fulas are the herders of the community with about 70 cattle. The predominant economic activity in the village is growing groundnut as a cash crop. Sorghum, rice, maize and cassava cultivation is mainly for domestic consumption.[2]

In addition to farming, 14 villagers earn some income from crafts (carpentry, masonry) or employment in the public sector. In the 1990s, seven inhabitants worked in the KWNP and four in the Forest Station at Dumbutu. Roughly one-third – 9 women and 55 men between 15 and 60 years old – of Batelling's population can be recruited for community activities.

Batelling's origins can be traced back 650 years, when the ancestors of the present inhabitants came from the empire of Mali, the origin of all Mandinkas. Despite its small size, Batelling used to be the capital of the Lower River Division, hosting its colonial administrators, the commissioners and, up to The Gambia's independence in 1965, the district heads (chiefs).

The traditional structure of the village has remained virtually unchanged to this day. The most important social units are the 4 kabilos (clans), which comprise families of the same lineage. The social structure is closely knit, with most compounds being interrelated by marriage or kinship (Figure 3). All the villagers are Muslims, guided by the Imam, a religious leader who plays an important role in the community.

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[2] Village-related information comes from the Community Forest files at the Dumbutu Forest Station.

The main decision-maker in the village is the kebba kafoo (Council of Elders with the Imam and the village head or alkalo). As in other Gambian communities in the last 20 years, the co-ordinating body for communal work and development activities is the Village Development Committee.[3]
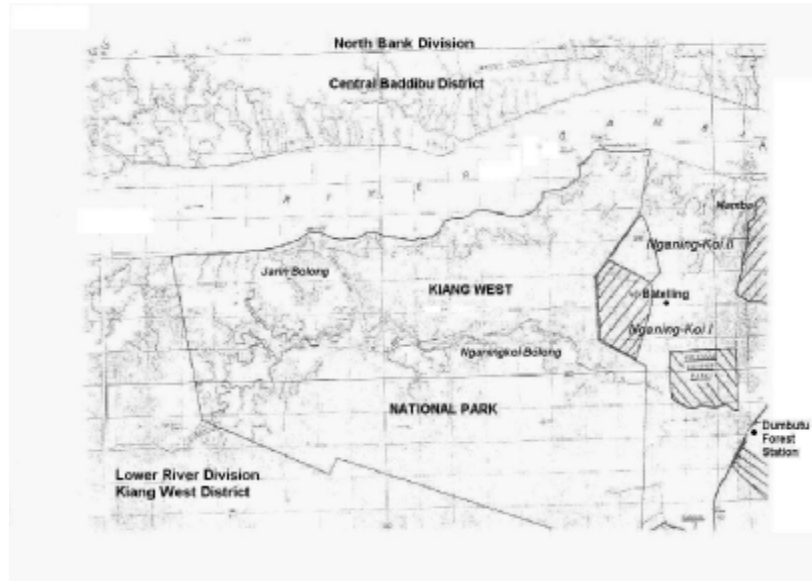
Figure 2: Map of Batelling and surroundings
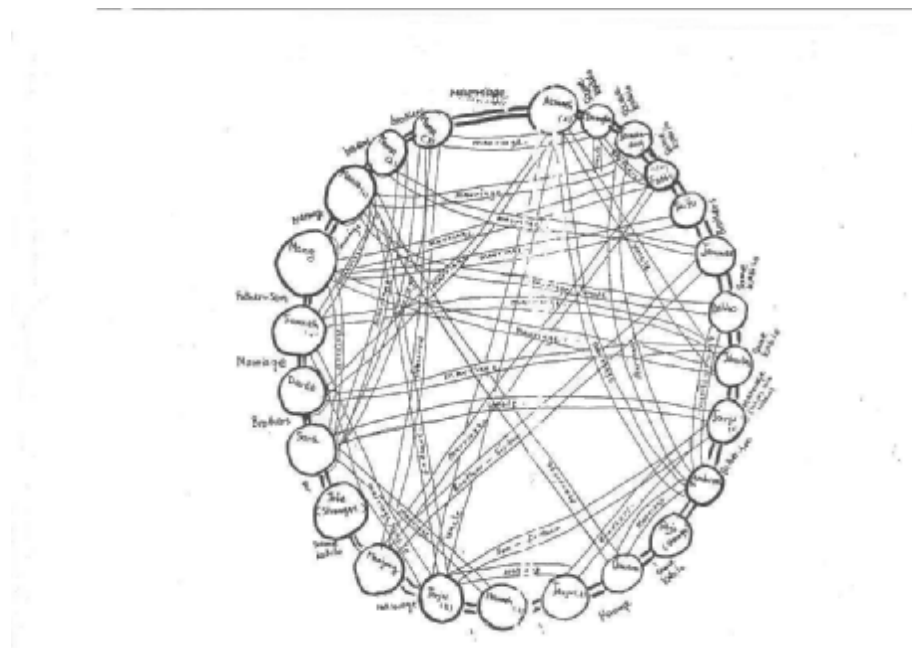
Figure 3: Sociogram of kinship in Batelling
Source: Bernecker and Fekade, 1994

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[3] Village history of Batelling, Community Forest files, Dumbutu Forest Station (undated).

3. Batelling's involvement in community forestry

3.1. Concept of community forestry in The Gambia

In The Gambia, the Forestry Department with the assistance of several Gambian-German forestry projects developed and implemented a community forestry concept since 1991. The approach attempts to give the local population full responsibility in the management of their local forest by vesting them with legal ownership over land and trees. Up to the present, community forestry is implemented in an area of 25,000 ha and involves more than 500 communities throughout the country.

The transfer of ownership to the participating communities proceeds in three phases:

♦   Start-up phase:

Communities that declare interest to the Forestry Department receive training in community forestry procedures. They identify a suitable forest area and form a Forest Committee representing the community.

♦   Preliminary phase:

Forestry staff and villagers develop a management plan under which the community is to demonstrate its ability to manage the forest and protect it from fire and illegal exploitation during a 3-year period with the advice and assistance of the local forestry staff.

♦   Final phase:

If the preliminary phase is successfully concluded, full ownership is awarded for the sustainable and exclusive forest use according to yearly village planning.

3.2. Community forestry in Batelling

When community forestry was introduced to the Lower River Division communities in August 1994, Batelling was the first village to send a letter of interest to the forestry officers, indicating its willingness to participate in the programme. The villagers were keen to gain ownership of the local forest after encountering restrictions laid down by the Department of Parks and Wildlife outlined in the KWNP management plans. Similarly, in fencing off the Brikama Forest Park in 1983, the Gambian-German Forestry Project (GGFP), in co-operation with the Department of Forestry, effectively banned the neighbouring communities from collecting firewood and grazing cattle (Schindele, 1986). Project and forestry staff recorded the villagers' point of view in the first village appraisal:

> "After having explained that the KWNP [authorities] took their forest, they continued: 'the GGFP ... came and took Brikama [Forest Park]. We are afraid that outsiders are taking our forest .… So we proposed the site for community forestry before it is taken away.…'" (Bernecker and Fekade, 1994).

Just one month after the introduction of the concept, a Forest Committee of 20 village representatives was formed to co-ordinate the establishment and management of the community forest. The committee included youth and women representatives, with the alkalo and Imam as advisors. The structure of the committee has remained virtually unchanged to this day (Figure 4). The community selected a site of almost 500 ha adjacent to the farmland southeast of the village, extending up to the boundary of KWNP (see Figure 2). The community forest, named Nganing-Koi after a local tree species (*Acacia seyal*), was demarcated in November 1994.

The community obtained provisional ownership in January 1995. After a positive evaluation of the management of Nganing-Koi in December 1997, the Forestry Department awarded full ownership over the forest to Batelling in December 1999.

In May 1998, the community applied for an extension of more than 300 ha to the north. With this extension (Nganing-Koi II, see Figure 2),[4] Batelling now has the second largest community forest in the country and the largest managed by a single village. Compared to the country's most extensive

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[4] The area first demarcated in 1994 is now referred to as *Nganing-Koi I*.

community forest (≈ 1,300 ha), which is jointly managed by six villages, each similar in size to Batelling, the management capacity and aspirations of this small community are to be marvelled.

Forest fire prevention and suppression play an important role in the development and management of Batelling's community forest. According to the villagers, "to stand against fires is the primary objective" of all their management activities in Nganing-Koi.[5] The ongoing forest fire protection programme has been a prerequisite for receiving full ownership to the community according to the 1998 community forest regulations. On the other hand, to be empowered as legal owners of "their" community forest and endowed with exclusive use rights are strong incentives for the community to protect and develop the Nganing-Koi in the long term.

4. Community-based fire management in Batelling

4.1. Traditional fire management

Attempts to minimise the adverse effects of forest and bush fires have had some tradition at the community level. "We have inherited protection from our forefathers" is a comment elicited during interviews with the Forest Committee. Even before their adoption of community forestry practices, the villagers of Batelling had relied on traditional fire management methods to protect the forest areas they were using. In particular, they maintained firebreaks around forest patches covered with elephant grass (*Andropogon* spp.) to stop fire intrusion. Villagers also scheduled prescribed burns at the beginning of the dry season, "early in the year when the grass was not very dry," with some people to control the burn and others who followed to put out all unwanted fires.
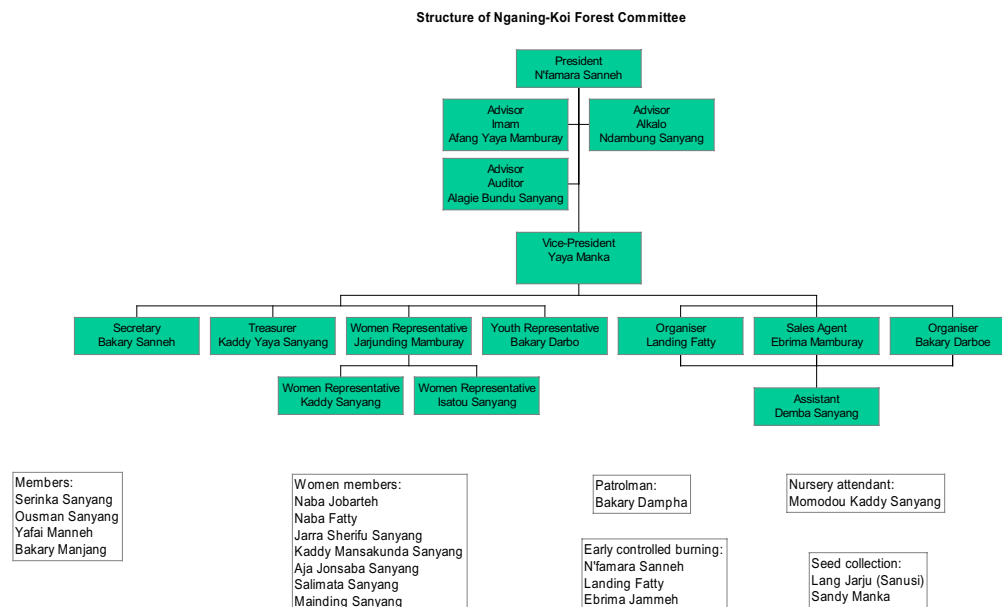
Figure 4: Structure of Nganing-Koi Forest Committee

Still, fighting fires to save the forest was not a main objective of traditional fire management: "We used not to mind, we only put it out when it came close to the fields."[6] Nevertheless, when given the responsibility for managing their community forest, the villagers could draw on their traditional knowledge and experience for fire suppression. Furthermore, fire management

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[5] Comment from a Forest Committee member during an interview.
[6] Comment from villagers during interviews.

techniques developed by the Forestry Department and adapted for community forest management help to booster their capabilities.

4.2. Fire management of Nganing-Koi community forest

Fire management is an integral part of community forestry. Without protecting the forests from annual fires, the rural population would not be able to derive sustained environmental and economic services from these forests. Therefore, active participation in community fire management is one of the decisive criteria for awarding them full ownership of the forest.

Fire prevention starts during the provisional phase of the transfer of ownership with the establishment of firebreaks on fire-prone sites. Priorities and details of these measures, such as timing, preparation, site selection and allocation of responsibilities, are determined in the management plan that is prepared by the Forest Committee with the assistance of forestry extension staff.

After five years of continuous collective village work, Nganing-Koi is entirely protected against incoming fires on its eastern boundary, previously the most vulnerable location. Live firebreaks and belts are the most important forms of protection. Live firebreaks are established by line planting of fast-growing species such as gumbar trees (*Gmelina arborea*). During the rainy season, their dense foliage inhibits understorey growth and creates a corridor with minimal fuel loads, thereby reducing chances of fire outbreaks during the dry season. Meanwhile, fire belts can be created by clearing a 5-m strip along the periphery of the community forest followed by a second strip running parallel at a distance of about 100 m, and then burning the vegetation – mostly grasses – between the two strips. This process has to be repeated annually at the beginning of each fire season to maintain the belts. Since Nganing-Koi II was established in 1999, annual controlled burns have protected its eastern boundary (Figure 5).
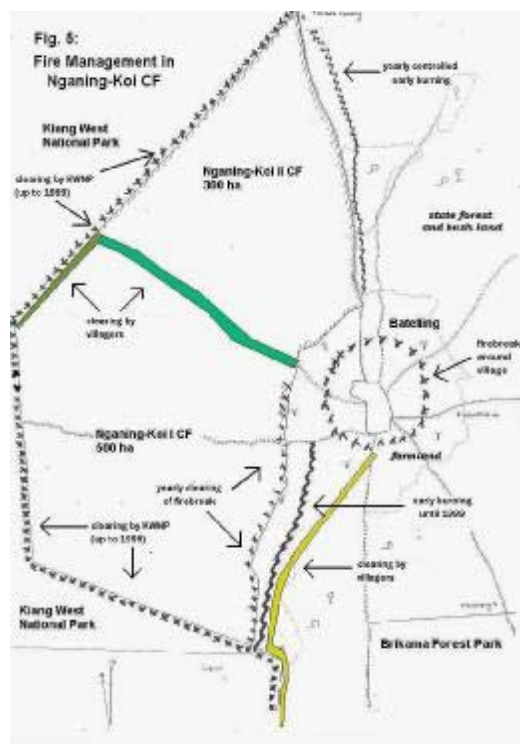

Figure 5: Fire management in Nganing-Koi community forest

Apart from the technical approaches, by-laws enforced by the Forest Committee regulate community forest management and fire prevention. Participation of able men and women in forest management is mandatory. The use of fire in the community forest is prohibited, with the exception of controlled burning. Culprits are to be reported to the alkalo, who in turn is to inform the Forestry Department and the district chief. The latter will take punitive action according to the 1998 Forest Act. The by-laws also set out the procedures for punishment at the village level. The Forest Committee is authorised to fine each guilty offender 300 Dalasis (about US$20) and withdraw his or her use rights to the community forest. For offenders under 17 years old, the Forest Committee will determine non-monetary forms of punishment, but there is no precedent yet.

Fire fighting to protect the community forest is mandatory under the existing by-laws: "Residents of Batelling have to participate actively in fire fighting. Offenders will be reported to the alkalo to be fined by him."[7] The villagers also maintain "prevention is better than cure. Before it comes, we already have the area controlled burned."[8]

The by-laws sanction the Forest Committee to raise awareness about the causes and consequences of fires in local schools and among other communities along the River Gambia where fires are often started by fishermen. The Forest Committee is also responsible for enforcing the laws. Four volunteers patrol the area to detect fires and other illegal forest activities such as felling of live trees and poaching.

The success of Batelling's forest management, particularly their fire prevention activities, clinched them two prestigious prizes: in 1997, the first divisional prize from the National Environment Agency, and in 1999, the national award of CILSS (Permanent Inter-State Committee for Drought Control in the Sahel[9]). The prize money amounted to 20,000 Dalasis (about US$1,300).

4.3. Achievements of fire management

Statistics of fire incidences in the Lower River Division, and the Kiang West District in particular, point out that up to 90 percent of the local forests burn annually. This applies even to managed forest parks (Herbort, 1989) and many of the community forests in the area (Dampha *et al.*, 2000). In comparison, since the Batelling community assumed responsibility for the management of Nganing-Koi community forest, only three major fires broke out in the area, namely in 1997, 2000 and 2001, burning most of the community forest. These fires were related to the following incidents:

◆ An attempt to set fire to a python's lair in a dead tree went out of control (1997).

◆ Arson in a neighbouring community forest, which succeeded after two thwarted attempts (2000).

◆ A campfire, allegedly started by fishermen, in an uninhabited area along the riverbank in the KWNP led to a major fire that burned for two days through the length of the park and entered Nganing-Koi community forest from the west (2001).

Three minor fires were detected early and suppressed through the spontaneous collective action of the villagers. Even the more severe fires were fought collectively by the villagers with the help of neighbouring communities and staff from the Departments of Parks and Wildlife, and Forestry.

5. Co-ordination of local stakeholders in fire management

The KWNP is far bigger than other forest parks of The Gambia (up to 2,600 ha). Public access and use of its natural resources are prohibited. The villagers of Batelling perceived this as a "breach of agreement" since the Park had been set up with the assistance of an internationally

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[7] *Nganing-Koi* by-laws of 1995, Community Forestry files, Dumbutu Station.
[8] Comment from a Forest Committee member in an interview.
[9] The CILSS comprises member countries Senegal, The Gambia, Mali, Niger, Chad, Burkina Faso, Guinea-Bissau, Mauritania and Cape Verde.

funded project with the promise that neighbouring villages could use its resources. Subsequently, the communities resorted to "mass illegal exploitation"[10] in the Park that once was accessible to them (Bernecker and Fekade, 1994).

The National Park, although a "protected area" according to the Wildlife Act 1977, is affected severely by annual forest fires (Gilbert *et al.*, 1992). Except for Jarin Bolong, a tributary of the River Gambia, the Park lacks any natural and artificial firebreaks and its road system is underdeveloped, which makes it difficult to access many sites.

According to a project-planning document, the firebreak system of the National Park is concentrated in the south and southeast of its peripheries. In 1990, villagers from Batelling and neighbouring communities were contracted by "food-for-work" programmes to clear firebreaks near their villages. When funding for these programmes ended, villagers' participation declined (Gilbert *et al.*, 1992). However, in recent years, villagers from Batelling were again contracted to clear firebreaks to be used as access roads by the KWNP staff.

A firebreak on the border between the KWNP and Nganing-Koi community forest used to be cleared until 1999, when funds were no longer available. The severe fire of 2001 entered the Nganing-Koi community forest through this overgrown area and destroyed Nganing-Koi I and II almost completely despite the community's fire fighting attempts. The villagers of Batelling were frustrated about their inability to protect their resources after having invested so much effort. The Imam, advisor to the Forest Committee, contended: "We inherited this forest from our ancestors. Now that we have attained ownership, there is a sabotaging factor that hinders the whole system. If the efforts we are doing are in vain, demotivation might be the result."

Theoretically, mechanisms are in place to integrate the satellite villages of KWNP in its management, the most important being a Technical Advisory Committee (TAC) that was set up in 1992. The main purpose of the TAC is "to discuss the issues they see as critical to life in a rural community" (Gilbert *et al.*, 1992). The influence of TAC on the management of the Park seems to be limited, as evident from the Imam's statement.

In fact, some community members alleged that arson by people dissatisfied with the current set-up of KWNP could be the cause of some fires. In the meanwhile, according to the villagers interviewed in Batelling, the lack of trust between the communities and the management of KWNP makes it difficult to trace the culprit(s).

To end this stalemate, the Forest Committee of Batelling called a meeting of all concerned stakeholders in the area – the management of KWNP, Forestry Department and the villages around the Park "as far as where the fire came from" – to discuss a common approach in fire management. Meanwhile, the villagers wondered why it was up to them to take the initiative: "Why don't the heads of Forestry and Wildlife come and sit together and discuss strategies before the communities initiate these things?"[11]

While the call for this meeting was well received by the other concerned villages "because this is a headache for everybody," the people of Batelling were cautious in their expectations from the representatives of the Departments of Forestry, and Parks and Wildlife.

6. The local forum on the control of bushfires

The communities were determined to use the proposed meeting as an opportunity to communicate their concerns to the relevant government agencies. The organizers from the Nganing-Koi Forest Committee therefore did everything to ensure the participation of officers from the Departments of Parks and Wildlife, and Forestry. However, the scheduled meeting was cancelled when Department representatives were not going to be present. The forum was finally held two months after the initial invitation, with the participation of 33 members of five satellite villages and staff of the two departments. Unfortunately, the villagers were unable to meet the Directors of both departments.

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[10] Quoted from a forest committee member.
[11] Comment from a forest committee member.

At the forum, participants voiced their views on the causes of the forest fires and responsibilities for controlling them as well as suggested solutions. The devastating effects of the latest fires in the KWNP were also disclosed. New houses in the village could not be roofed since grasses in Nganing-Koi had been burned. Many speakers, on behalf of the TAC and Forest Committee from satellite villages, were convinced that Park personnel have the capacity to play a more significant role in fire management. The management was urged to identify the origins of fires in the Park as a basis for prevention plans.

Likewise, the manager of KWNP explained the difficulties faced by the Park administration since funding for community involvement and salaries had been phased out prematurely. He envisaged future projects and called upon the support of the communities.

TAC members stressed the need for "people to be aware that they have to carry on even without projects." The villagers "should be encouraged to understand that the Park is theirs to take care of."

Forestry extension staff conducted a participatory appraisal on the results of the meeting. The following actions and stakeholders who are to be responsible for these actions were identified (Table 1).

Table 1: Proposed actions and stakeholders to be responsible

Proposed action	Stakeholders to be responsible
Form a local association to combat fires	Forest Committees, TACs
Improve participation in fire fighting from the satellite villages and KWNP staff	Forest Committees, KWNP
Sensitise the fishermen from Kiang, Baddibu (North Bank Division), Senegal and Mali who operate around Tubabkollon Point from November to June	KWNP environmental education group, forestry field staff, Forest Committees
Maintain continuous patrolling	Forest Committees, KWNP, Forestry Department
Clear fire entry points at appropriate times to be determined jointly	Forest Committees, TACs
Determine place and time for controlled burns based on previous experiences	Forest Committees, TACs, support of forestry field staff
Improve reporting of culprits and violators of the by-laws	Forest Committees, forestry field staff, communities
Enforce the Forest Act	District authorities and forestry field staff
Establish effective collaboration between the Departments of Parks and Wildlife, and Forestry in terms of fire management at the directorate level	Forestry Department, Parks and Wildlife Department

7. Conclusions

The case of Nganing-Koi demonstrates both the potentials and the limitations of community-based fire management. While the community of Batelling had traditionally employed fire management measures such as early burning to protect their assets, community forestry has laid the basis for sustained and co-ordinated fire prevention measures. It has also incorporated the advice and assistance of forestry extension staff, such as the construction of an extensive firebreak system and early burning.

The success of fire protection in Nganing-Koi shows that community forestry can have a high impact when it draws on appropriate local organization and traditional knowledge. Forestry

extension officials should give high priority to these aspects in their village appraisals and consider them in the work plans with the villagers.

Ownership over Nganing-Koi has created a strong incentive for the community of Batelling to protect and develop their forest. The relationship with the Forestry Department has improved to the extent that the community now even takes responsibility for fighting fires in forest areas beyond their own boundary. This change of attitude has overcome former pitfalls of forest management such as fencing off the adjacent National Park.

However, the example of KWNP also serves as a strong reminder that responsibilities for fire management cannot simply be passed down to communities. A single fire that had crossed into the National Park, burning uncontrolled for several days, had rapidly destroyed the achievements of years of fire prevention in Nganing-Koi.

The KWNP is a huge and in effect unmanaged zone in terms of fire control, lacking mechanisms to incorporate the stakes of neighbouring communities. The relationship of the park management with satellite villages has been limited to contract labour and paid employment. Envy among communities has been generated by the uneven and seemingly arbitrary recruitment of paid labourers from different satellite villages. This relationship deteriorated further when financial support for communal workers' salaries was withdrawn without prior notification. Villagers felt they were cheated out of their payments. It is therefore not surprising that communal work for maintaining the firebreaks of KWNP came to a halt.

The villagers thought they should be paid for their work because of the lost rights over the Park and its natural resources. This is not entirely correct since they are allowed to collect grass for domestic purposes. However, as it was revealed during the local forum, satellite communities were not told of this right by the park management, which leads to further misunderstandings.

The KWNP is a case in point for other nature parks and reserves that have restricted access by the local population, offering (at best) financial compensation to them for being deprived of any benefits. This is especially grave in a case like Batelling where subsistence livelihoods depend on the supply of local natural products and where inefficient (yet exclusive) management of these "protected" areas by state agencies can lead to detrimental events – such as forest fires – and severe hardship for the community.

The constructive outcome of the stakeholders' meeting should not obscure the difficulties facing communities like Batelling in holding the relevant administrations responsible. The Departments of Forestry, and Parks and Wildlife did not show enough interest in addressing the problem directly. To the villagers of Batelling, the stakeholders' meeting was less a manifesto of self-empowerment or grassroots politics, but rather an act of despair to deal with the threat to their natural assets. Attending the meeting was more a goodwill gesture from the two departments with no commitment on their part to solve the problems.

On the other hand, for the forum to have taken place at all is remarkable. It has brought relevant stakeholders together, identified others such as seasonal fishermen, and developed key points of action. The proposal to commit the key groups in a regional association seems to be particularly promising, corresponding in fact with a revision currently being foreseen in the Gambian forest policy. The new approach calls for a broader perspective on fire management planning at the local level, rather than at the regional scale which necessitates new planning procedures and new models of collective action (The Republic of The Gambia, 2001; Schindele, 2001).

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Acknowledgements

Forest fire in the context of territorial rights in northern Thailand

Atchara Rakyutidharm[1]

Abstract

Territorial rights are important for establishing the roles of those who should protect natural resources. Different property rights regimes may affect the characteristics of fires. This paper compares fires on land managed under a common property regime with fires on land owned and managed by the state. According to the definition of the Royal Forest Department (RFD), fire that occurs on communal land is not a forest fire because it is under "systematic" control, through traditional wisdom and knowledge, by the members of each community. The local people use fire for their daily household activities and to manage local ecosystems. Fires that occur on state land are classified as forest fires because they are assumed to be out of control and unwanted. The law claims all natural resources for the state, but in practice they are openly accessible to everyone. Thai people are barred from participating in forest management. As a result, they have no sense of resource ownership and may use fire carelessly. Limited staff and budget are major constraints of the RFD's forest fire control efforts. One way to improve fire management is to grant management rights to local communities. Through legislation, the conflicts between the legal and traditional systems can be resolved, and co-operation between the state and the community improved to develop sustainable and equitable resource management systems.

1. Property regimes and the forest fire management

Property rights are a key factor that determines resource use and influences behaviour of resource users. Property rights are also the main incentive for resource management (Libecap, 1989, cited in Suthawan Sathirawan, 1996).

Different property rights regimes may affect the characteristics of fires. This paper compares fires on land managed under a common property regime with fires on land owned and managed by the state.

2. Fire management on common property

Communal land is an area controlled and managed through community institutions. The Royal Forest Department (RFD, 1996) defines forest fire as *a fire that occurs [on forestland] for any reason and in the absence of any control*. So, a fire on communal land is not a "forest fire" under this definition since it is under "systematic" control by the community. Local people use fire for their daily household activities and to manage local ecosystems even if the land is *de jure* state or public land. The RFD regards fires as "forest fires" when they occur on public land. This perception is misleading and based on a disregard for local knowledge and local management of resources.

2.1. Fire management in community forests

A community forest is used and managed by a community according to community rules and regulations. It can be classified into conservation forest and production forest. In northern Thailand, the conservation forest is evergreen, dense and moist throughout the year. It is usually a watershed area and conserved. Sometimes it is also protected for religious and traditional beliefs.

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The production forest is usually a dipterocarp and mixed deciduous forest. Local people use these forests as a source of food, firewood, fodder and for other purposes. They may light fires in these forests for several purposes (e.g. to accelerate the germination of mushrooms, bamboo shoots and other edible forest plants). Smoke and heat are also used to force animals from their hideouts so that they can easily be hunted. The burning of ground cover accelerates the growth of tender new shoots and grasses as fodder for domestic animals.

Local people practise "early" or "prescribed" burning by setting fire to dry leaves and grasses in the forest to reduce the fuel load and thus the severity of dry season fires. The heat of the fire also assists the germination of thick-skinned seeds and helps to eradicate pests. Such uses of fire are valued by local people (Atchara, 2001).

Local fire patrols and firebreaks are also established in areas where fire would have a negative impact, particularly on the conservation forests. If a forest fire breaks out in this area, the villagers will extinguish the fire or construct a firebreak to stop the fire from spreading.

Many forest fire management techniques are employed by local communities who combine a number of methods to suit the diversity of ecosystems in their forests.

Box 1: From firebreaks to early burning: fire management in Mae Tha Sub-district, Chiang Mai Province

Mae Tha Sub-district in Chiang Mai Province is composed of 7 villages and 1,235 people. Located 500 m above sea level, it is surrounded by dipterocarp forest at higher elevations, mixed deciduous forest with teak and bamboo as the dominant species, and dry evergreen forest in the vicinity of water sources in the valley bottoms.

Farming is the main source of livelihood with one wet rice cultivation per year, along with orchards, cash crops and cattle. Some villagers also work in the Lamphun Industrial Estate.

Severe drought and forest fires in 1993 spurred the villagers to initiate a forest conservation plan. Logging from 1901 to 1908 and 1937 to 1964 had degraded the forests considerably. Since 1995, the villagers have implemented a natural resource management plan, dividing the communal land into three sections: 34,000 rai of conservation forest, 17,000 rai of production forest and 21,000 rai for agriculture.[2] Committees manage the community forests at the village level and the sub-district level for all seven villages.

Every February, the villagers construct firebreaks around their villages and community forests to prevent fires from entering the Mae Tha forest and to mark the boundaries of their forests. Between March and April, volunteer fire patrols are organized.

The forests are recovering and forest fires over the past few years were minor. Villagers have started to burn the dry leaves during January and March to reduce the severity of potential fires. According to Phoa Luang Suk Macham of Mae Tha (Atchara, 2001):

The burning method starts from the mountain ridge down to the plain. This way, fire moves slowly. By nightfall, the fire will have died away. If we do the burning in January, by February new leaves and new branches are coming out of the trees. Both big and small trees survive. Compared to firebreaks, which prevent fire over a period of two years, fire that happens after that period will be severe and lead to the death of many large trees.

The management of forest fire in Mae Tha is an integrated initiative and a learning process for the local people to manage their resources sustainably. Although most community forests have been managed by local communities, the forests are formally classified as National Forest Reserves, National Parks and Wildlife Sanctuaries and belong to the state. Communities have formulated regulations that lay down penalties for burning the forest.

Source: Surin Onthon, 2000

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[2] 6.25 rai = 1 ha

2.2. Fire management in agricultural fields

Most agricultural fields belong to individual households. However, households remain bound to traditional rules and community management (e.g. rules of kinship and community irrigation management organization). Hence the village organization continues to be the ultimate decision-making unit concerning land management.

People living in the forest have used fire to prepare agricultural land for thousands of years. Farmers usually burn at mid-day when winds are lighter to reduce the risk of fires spreading. In orchards, farmers burn grass in piles to avoid damaging the fruit trees. The heat from the fire destroys seeds of weeds, insects and diseases. Burning breaks down the organic matter and enables planted crops and indigenous plants to establish themselves in the burned areas.

Alternatives to fire use are not readily available due to the limited resources and skills. Instead, local knowledge of appropriate fire use achieves the same objectives, as shown by the Mae Pon Village, a Karen community in Chiang Mai Province.

Box 2: Local knowledge of appropriate fire use in rotational shifting cultivation in Mae Pon Village, Chiang Mai Province

Mae Pon Village, Ban Luang Sub-district, Chom Tong District, Chiang Mai Province, is a Pakagayaw (Karen) community. It is situated between 600 and 1,000 m above sea level and comprises 74 households. The village is divided into four communities: Ban Mae Pon Nawk, Ban Huey Wak, Ban San Din Daeng and Ban Glang. Village members in Ban Mae Pon Nawk plant terraced wet rice fields while the rest relies on rotational slash-and-burn farming. All four villages have orchards, practice livestock husbandry and work as labourers.

The Pakagayaw clear their fields in February. They cut only the branches of the large trees and fell smaller trees at waist level. They leave the vegetation to dry for 1-2 weeks and then burn them. The people who burn the fields must have knowledge of wind direction, slope, weather, environment and landscape. Households with adjacent fields usually help each other to build firebreaks and burn the fields together. Burning starts at the outer boundary and moves towards the centre of the fields, and from upland to lowland areas.

The Pakagayaw manage fire through traditional knowledge and wisdom. When the paddy in the field is about 30 cm tall, they carry out ceremonial offerings to the spirits and show respect and gratitude to Dtah Lu Me, the fire spirit. The Pakagayaw believe that all resources belong to the spirits, and as part of the natural world, humans are allowed to use these resources, but they must only take what they need, or the spirits will punish them.

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3. Management of fire in the state common property regime

According to the law, all natural resources are owned by the state. However, in practice, they are openly accessible to everyone. The state is not capable of managing and maintaining all the natural resources, while local people are officially barred from participating in the management processes, which contributes to resource degradation.

All fires that occur on state land are "forest fires" because they are assumed to be out of control and unwanted. Fires in the forest may be caused by agricultural practices as burning for hunting and gathering purposes. The root cause of forest fires is the absence of a feeling of ownership over the resources. As a result, people are careless about how they treat the environment. This contrasts with the use of fire in community forests, where fire is used carefully to avoid damage to communal property. In the latter case, community members know each other well and are able to find the culprit responsible for the fire more easily.

A basic problem is a conflict over the interpretation of "fire". The local people consider fire as a tool, controlled by traditional techniques, for managing resources. However, the provincial governor considers all these fires to be "forest fires" that spread and destroy ecological systems.

The state rejects local knowledge and management techniques. Being confident of the legality of its actions, it maintains that knowledge of appropriate fire use lies within its hands only.

The villagers' interpretation of the causes of forest fires can be markedly different:

> *"The local RFD unit sets the fires themselves because if fire occurs they will get a larger budget." - Gam Nan Anan Duang Gaiyo Ruen, Mae Tah Sub-district, Mae On District, Chiang Mai Province.*

> *"Every year, fires spread from the RFD plantations. I think the staff do it themselves because in the years that they do not have fire they get little money, but in the years they do have fire they get a lot of money." - Duang Gaiyo Salee, Ban Mae Yah Noi, Ban Luang Sub-district, Chom Tawng District, Chiang Mai Province.*

RFD officials explained that the people mix up prescribed burning with wildfires. It is difficult to confirm accusations. Since the state monopolises control over resources, the public is unable to evaluate or monitor what is happening. Forest fires on state-owned land are also caused by villagers' malicious actions designed to anger officials. This is due to the general dissatisfaction with the way RFD staff uses power to control resources and reflects the conflict between government and the community.

Although the state claims ownership over all natural resources, in practice it has limited staff and budget to implement proper management. For instance, in Doi Luang National Park, the number of forest fires increased after the RFD relocated people from their forest village.

> *"The outsiders always start fire for hunting at the base of the hill and it then rises to the top. The RFD staff cannot take care of all of them. When the villagers were there, the outsiders were wary of the villagers. If the villagers saw a fire starting anywhere they would help to put it out immediately. In the past, villagers brought the cattle to graze in the forest and this also reduced the risk of fire from dry grass on the forest floor." - Su Rueng Sa Forng, Ban Mae Tom, Wang Nueha District, Lampang Province.*

> *"After the villagers were moved out, the officials did not have enough labour to suppress the fires. We have just nine people per unit and have only nine units. In 1988, forest fires happened a lot and destroyed large areas of forest." - An official of Mae Hom Watershed Management Unit in Doi Luang National Park (Benja Silarak, 1998).*

The RFD spends a huge budget on public relations to encourage local people to share in protecting the forest. This will not solve the problem because the state only assigns people the duty to take care of the forest but grants them no rights. As a result, local people feel they have no stake in the land and are not motivated to conserve the forest. As Somsak Sukwong (2000), the Director of the Regional Community Forestry Training Center (RECOFTC), commented:

> *"If we want the villagers to grow the forest and protect it from forest fire it is not hard to do – simply allow the village members to manage the forest themselves. We do not utilise 100 percent of the forest community potential. If the villagers manage the forest, they will utilise the full potential themselves."*

4. Conclusions

Secure rights to natural resources are necessary conditions for establishing rules and responsibilities in resource management. Presently, the law does not recognise community the traditional rights of local communities. They have their own community forestry management systems, including a forest fire management plan that works in harmony with the local ecology and local traditions. The state must enact legislation that acknowledges these community rights, in accordance with the Constitution. Through legislation, the conflicts between the legal and traditional systems can be resolved, and co-operation between the state and communities improved to develop sustainable and equitable resource management systems.

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Fire in miombo woodlands: a case study of Bukombe District Shinyanga, Tanzania

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Abstract

Concern about the environmental impact of forest fires in the Bukombe District in Tanzania has been growing in the last two decades. Most in the district are caused by human activities. The protection of the miombo woodlands is hampered by a lack of fire management policies and legal instruments to support fire prevention and suppression. Trained human resources are also limited. Local communities have their own management system and forest fire management that complement local ecology and traditions. It is therefore expedient to involve them in forest management. The HASHI (Soil Conservation and Afforestation) Project together with the Forest and Beekeeping Division have organized joint forest management in selected locations where the villagers are granted use rights to forest resources. The creation of local ownership has been a key to the success of fire management.

1. Introduction

The Bukombe District is located in northern Tanzania, with an area of about 10,500 km^2. During the last two decades, concern about the environmental impact of forest fires in the district has been growing. The main natural vegetation in the district is composed of woodland and thick forest. More than 90 percent of all fires are caused by human activities such as:

- agriculture, especially farm preparation and shifting cultivation;
- logging;
- charcoal burning;
- hunting and collection of honey (smoke is used to drive animals from their hideouts and bees from their hives);
- arson; and
- traditional tribal fire uses.

Forest fire in the miombo woodland has resulted in significant damage to property and many lives have been lost. Even though fire is important for the regeneration and growth of the miombo woodlands, the uses of fire will always be controversial.

The major problems facing forest fire protection are age-old traditional attitudes, socio-economic activities and, to some extent, past national forest policies that dissociated the local communities from their traditional access and utilisation of the forests. The government used to be the custodian of such forests while local communities were barred from the resources. For example, the local villagers were not allowed to collect even firewood from the forest. Such alienation induces local communities to be detached and indifferent to their environment. Hence they do not care too much about the forest.

Efforts to combat forest fires in Tanzania, in general, are hindered by a lack of fire management policies and legal instruments to support fire prevention and suppression. Furthermore, technical and professional human resources are also inadequate at all levels. It is for that reason that a collective effort involving local communities in fire management should be encouraged.

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The local communities have their own management systems and forest fire management that complement local ecology and traditions. For example, the Sukuma people traditionally construct a Ngitili (a Sukuma term meaning "enclosure"). This area within the village is closed off at the beginning of the wet season and opened during the dry season for grazing cattle. This traditional practise has protected many areas from fires. Therefore, joint forest management (JFM) efforts and strategies need to be implemented, considering that the government does not have sufficient resources to combat forest fires alone.

Due to inadequate funds and staff resources to protect the forests, the HASHI (Soil Conservation and Afforestation) Project and the Forest and Beekeeping Division have established JFM in selected villages where local communities are granted use rights. This provides villagers an incentive to manage and protect the forest against encroachment, illegal harvesting and fires.

2. Methodology

In trying to involve local communities in forest fire management, the project focuses on:

♦ Education and publicity through interactive video shows, mobile extension teams, brochures, posters, calendars and radio programmes, to sensitise and empower the communities to prevent fires.

♦ Seminars, workshops and meetings at different levels to disseminate information.

♦ Formulation of by-laws on fire protection.

♦ Collaboration with village committees in management, planning, monitoring and extension services.

3. Conclusions

The creation of local ownership at the village level has been a key to the success of fire management. To a large extent, JFM has changed the attitudes and behaviour of villagers regarding land use and fire management considerably. The number of forest fires is slowly decreasing with time.

The new forest policy encourages private ownership of land and forests through JFM and community-based fire management that increase land tenure security. It is hoped that this will significantly decrease the incidence of wildfires in the miombo woodlands and improve forest and fire management.

Traditional community-based fire management among the Mizo shifting cultivators of Mizoram in northeast India

V.T. Darlong[1]

Abstract

The tribes of northeast India practicing shifting cultivation or "*jhumming*" have unique and varied community-based fire management traditions. The Mizos, living in Mizoram, have developed effective and well-organized community-based fire management practices that revolve around shifting cultivation.

The foundation of this practice is the Village Council, a system of village community governance. While the traditional fire management tools and techniques are simple, the strategies rely on timely community response and participation. There are four categories of measures, i.e. regulatory, activity-oriented, preventive and punitive. The community regulates the period of *jhum* burning, defines roles for each of its members, prescribes preparation of fire lines in the *jhum* fields, and imposes penalties for causing forest fires.

Constrained by the dilemma of a society in transition and influenced by various factors, the effectiveness of the Mizos' fire management practices appears to have weakened in recent years. Increased incidences of forest fire have prompted government intervention and schemes aimed at preventing and controlling forest fire. This shift from community-based to government-initiated programmes highlights the erosion of "*tlawmngaihna*" – a community spirit that puts the common good above personal gains. Rather than seeking to replace such management practices, the government should enhance the effectiveness of the traditional systems, supplement community efforts and encourage maximum community involvement.

1. Introduction

India's northeastern region, commonly known as the "land of seven sisters", is a land of diverse ethnic groups, tribes and culture. Shifting cultivation, locally known as "*jhum*" or "*jhumming*", has been and continues to be a way of life for many of these tribes since time immemorial. Consequently, the tribes appreciate the role of fire and its uses in their traditional shifting cultivation system. However, since the period for slash and burn generally coincides with the dry and windy months of the year, incidences of fires spreading beyond the boundaries of designated plots into the adjoining forests are not uncommon. In extreme cases, such fires may even destroy entire villages or hamlets.

Years of experiences by different communities have led to the evolution of community-based fire management practices that are rather specific to each tribe in northeast India. This paper discusses the traditional community-based fire management system of the Mizo shifting cultivators in Mizoram. The role of state and central governments in fire management is briefly discussed to highlight the linkages and importance of forest fire management.
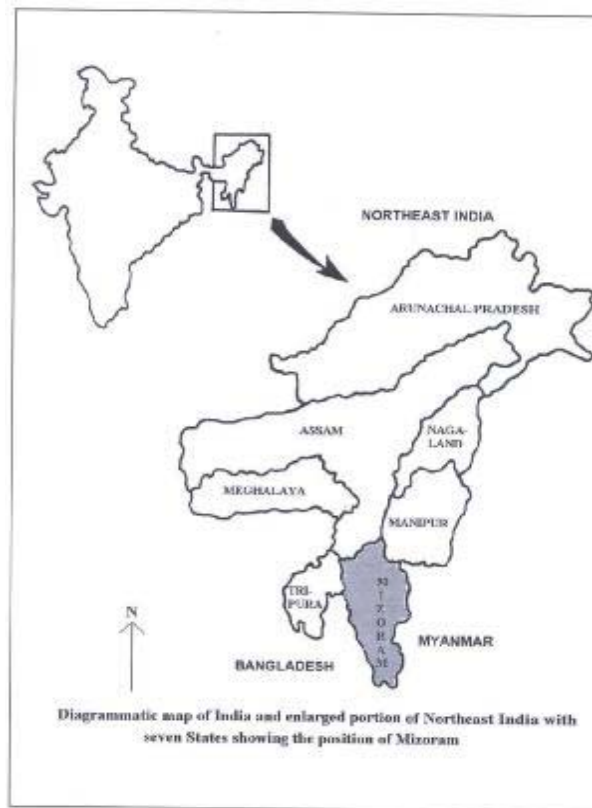
2. Mizoram: the land and its people

Mizoram, the "land of highlanders", is one of the seven states of northeast India, with an area of 21,081 km^2. It shares a boundary with Myanmar in the southeast and Bangladesh in the west (Figure 1). More than 98 percent of Mizoram is hilly and mountainous. The state enjoys a monsoon climate with an average rainfall of 2,640-3,900 mm annually.

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The people of Mizoram are known as the "Mizos", a Mongoloid race that had migrated from Myanmar and settled in the area since the 7th century. The Mizos live in villages that used to be governed by village chiefs (or "*lal*"), but are now replaced by elected village councils. The Mizos number approximately 0.69 million and are a close-knit society. The Mizo code of ethics, or "tlawmngaihna", espouses a moral of self-sacrifice for the common good. Agriculture is the main occupation and shifting cultivation continues to be the predominant practice, affecting as much as 6,000 km^2 or about 28 percent of the state. However, the Forest Survey of India estimated the area affected by shifting cultivation in the state between 1987 and 1997 to be 0.38 million ha (Anon, 2000a) or about 18 percent of the state.

Diagrammatic map of India and enlarged portion of Northeast India with seven States showing the position of Mizoram

Figure 1: Location of Mizoram

3. Causes and extent of forest fires in Mizoram

Natural causes of forest fires (e.g. lightning strikes) are rare. Forest fires are usually related to human activities, such as:

- ◆ *jhum* where highly inflammable bamboo flakes and kindling charcoal are blown to adjoining areas, setting dry grasses and leaf litter on fire;
- ◆ not clearing firebreaks around the *jhum* land before starting the burning;
- ◆ annual roadside clearing and burning (usually in February and March, the driest period of the year);
- ◆ burning of dry grasslands and forest floors by cattle grazers during the dry season to destroy unwanted vegetation and facilitate growth of new shoots for grazing;
- ◆ burning of forest floors to improve visibility for hunting wild animals;

♦ careless prescribed burning and fire line layout and construction;

♦ charcoal-making in the forests; and

♦ cooking and camping by woodcutters and other forest users.

Preliminary results of recent surveys show that the extent of forest fire in Mizoram is significant, though the areas affected fluctuate from year to year (Table 1).

Table I. Extent of forest fires in different forest divisions of Mizoram

Forest division	Area affected (ha)			
	1995/96	1996/97	1997/98	1998/99
Aizawl	1	42	0	0
Champhai	13,040	5,715	0	3,458
Chhimtuipui	56	0	6	0
Darlawn	0	0	0	0
Kawrtha	142	0	0	0
Kolasib	50	3	2	0
Lunglei	708	84	41	95
Mamit	101	0	0	0
North Vanlaiphai	800	2	0	0
Thenzawl	7	0	0	0
Tlabung	0	0	0	0
Total	14,965	5,986	49	3,547

Source: Anon, 2000b

4. Traditional village institutions: precursor to community-based fire management

Control and management of forest and *jhum* fire are joint responsibilities of individuals and the entire village. As *jhumming* has been an entrenched practice for the Mizos, the community has evolved its fire management around this tradition. Whenever a forest fire is reported, the Village Council President will immediately order the Village Crier (a village messenger or announcer) to alert the community, and anyone who hears the announcement is duty-bound to immediately proceed to the site to fight the fire. Labour is also divided across age and gender for *jhum* burning.

5. Traditional tools employed for community-based fire management

A Mizo prepared for fighting a forest fire will generally carry only a moderately long knife (chem or dao) and a bottle of drinking water in his cloth bag. He prefers to travel lightly, barefoot and clad in simple cotton clothing, so that he can move swiftly and climb trees to cut off branches for suppressing fires. He may even use drinking water to put out burning logs.

Fire extinguishers, buckets and spades are not suitable for the hilly terrain. They are not preferred by the local communities, except for extinguishing fires along roads or when houses are on fire. Occasionally, spades are also used to cover fires with soil cover as water is not always easily available in hilly areas. Household containers, such as buckets and pots, are filled with water for extinguishing any kindling falling on rooftops and around the village compounds. Modern firefighting equipment is used only by the Fire Service Department.

6. Techniques and strategies of community-based fire management

The four categories of techniques and strategies for community-based fire management are regulatory, activity-oriented, preventive and punitive measures.

6.1. Regulatory measures

The community as a whole determines the timing of *jhum* burning. Under the Mizoram (Prevention & Control of Fire in the Village Ram) Rules 1983, *jhum* burning can only be carried out between 15 February and 15 March each year. Fires are generally in the late morning or early afternoon so that burning can be completed at the latest by early evening.

6.2. Activity-oriented measures

This refers to the roles assigned to individual family members on the day of *jhum* burning and the activities of the entire village during a large-scale forest fire.

6.2.1. Roles of individual family members on the day of jhum burning

♦ Role of male members: notify village authorities, immediate neighbours and those having adjoining *jhum* fields about the date and likely time of burning. The male members will go to the field and start the fire, remain in the field until the burning is completed, and stay watchful for any forest fire in the vicinity of their field.

♦ Role of female members: store water for ready use in the event of fire in the vicinity of dwellings and remain watchful for wind-borne kindling falling on the thatch roofs.

♦ Role of younger members: stay alert on the thatch rooftops with water to douse off fire caused by wind-borne kindling from the burning *jhum*, and alert elders if they see a fire.

6.2.2. Community roles and actions during a forest fire

Jhum burning is always a busy period in a typical Mizo village. Traditionally, the entire community is involved, and every able-bodied member is expected to be available. All members of the village will prepare for the different responsibilities assigned to them. This may include speedy preparation of fire lines in strategic locations. Nowadays, the community also seeks the help of the local government Fire Fighting Authority to control forest fires. Subsequently, the Village Fire Fighting Authority and the government may conduct an enquiry to determine the causes of fires and try to identify the culprits, if any.

6.2.3. Village Forest Fire Prevention Committee

Since the introduction of the Mizoram (Prevention & Control of Fire in the Village Ram) Rules, every village must set up a Village Forest Fire Prevention Committee (VFFPC). The Committee nominates volunteers from amongst its members to be "Fire Watchers" who remain active particularly during the period of *jhum* burning.

6.3. Preventive measures

♦ At the time of slashing the vegetation, a cleared corridor about 8-10 m wide is maintained between the slashed vegetation and the adjoining forests. This creates fire lines in the *jhum* field itself, thereby preventing the spread of fire to adjoining forest areas.

♦ The villages are generally encouraged to maintain leafy trees and bushes, whose branches could be used quickly for extinguishing fires, at the fringes of *jhum* fields and adjoining forest areas.

♦ A day or so prior to burning, an individual landowner, or a group of landowners with adjacent *jhum* fields, generally undertakes a careful "field excursion" to inspect the fire lines, assess vulnerable points, and plan strategies for action in the event a fire escapes.

♦ Penalties are generally imposed on individuals, or collectively on the entire community, for deliberately or accidentally causing forest fires.

➢ The Village Council imposes stiff penalties on individuals who cause a forest fire. The amount may vary according to the findings of the Village Fire Fighting Authority or confessions of such individuals. For example, the penalty for a deliberate misdemeanour is Rs5,000 (approximately US$100), while an accident may cost the offender half the amount. The money collected is channelled to the Village Welfare Fund.

➢ The penalty imposed on the community can be as high as Rs50,000 (US$1,000), but generally this amount varies depending on the cause of the fire, villagers' collective efforts in controlling the fire, level of damages, and other variables.

7. Recent interventions by the government and its role in fire management

7.1. Role and programmes of the state government

Increasing incidence of *jhum*-related forest fires has prompted the Mizoram government to introduce the Mizoram (Prevention & Control of Fire in the Village Ram) Rules 1983 for effective prevention and control of forest fires. It has set up fire prevention committees at the village (headed by the Village Council President), district (headed by the Deputy Commissioner) and state (headed by the Chief Minister) levels, each with distinct duties and functions. While the village-level committees are to mobilise volunteers for fire watching and firefighting in each village, the committees at the district and state levels mainly have advisory, supportive and co-ordinating functions. The state-level committee acts as the apex body for all the other committees and also interacts with the central government on the matter.

In addition, there is the Fire Crisis Cell in the State Environment & Forest Department headed by the Principal Chief Conservator of Forests. The Forest Department is the technical and nodal department that implements the "Fire Control Project" with funds from the central government.

The present fire protection and control scheme of the state government includes programmes for fire prevention, fire detection, fire suppression, awareness raising, incentives and rewards to non-governmental organizations and village councils working in fire management, training in modern fire management, research and development, and compensation for accidental death of any individual during the course of a firefighting operation.

7.2. Role of the central government

The central government, represented by the Ministry of Environment & Forests, provides funds to the state government to undertake fire management programmes. The activities include controlled burning, preparation of firebreaks, removal of fire hazards along roads and around plantation areas, and awareness/sensitisation programmes for fire management through meetings, seminars, poster campaigns, print media and electronic media. The central government also provides funds for firefighting equipment, special clothing for firefighters, vehicles, wireless communication equipment, and training.

8. Concluding remarks

Today's Mizo society is increasingly experiencing two major challenges in their fire management efforts. Its traditional community-based fire management system is weakening. At the same time, there is a perceptible increase in the incidence and intensity of forest fires, which in turn is having direct impacts on the local environment.

The gradual degeneration of community-based fire management is influenced by a variety of factors. The modern Mizo society is in transition. Taking advantage of modern education and adoption of alternative sustainable land-use practices, many Mizo families no longer depend on *jhumming*. In a typical village, only about 50 percent of the families fully depend on shifting

cultivation. The result of this transformation is that the community-based fire management system can no longer attract the services of many adult members of the village.

The traditional practices have also weakened because of increasing dependency on government-initiated fire management programmes. It is the perception of the people that the government Village Forest Fire Management Committees and the government-appointed Fire Watchers are now responsible for fire control. The shift from community-based to government-initiated programmes also indicates the erosion of the community spirit of "*tlawmngaihna*", particularly in important issues like forest fire management.

The other constraint to Mizo's community-based fire management relates to the current system of unregulated selection of sites for *jhumming*. Traditionally, areas for *jhum* plots were selected in blocks, whereby the community could easily watch over and control any spread of fire to adjoining areas collectively. Today, due to reduced land availability, plots are prepared wherever possible and in smaller parcels. This increases fire risks, and creates more problems for managing fires. Moreover, the majority of the shifting cultivation plots are bamboo forests, which calls for extreme caution, when burning *jhum* during the driest period of the season, to prevent fire from escaping into the adjoining dried bamboo forests.

There is an urgent need to continue and intensify traditional community-based fire management systems among the Mizo society. Rather than substituting traditional systems, the government should enhance the effectiveness of traditional practices, supplement community efforts and encourage maximum community involvement.

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Acknowledgements

Community participation in fire management planning: a case from California, USA

Yvonne Everett[1]

Abstract

The ecological, social and economic costs of wildfires are escalating in the United States. While lightning-caused wildfires are a common phenomenon in much of the western United States, increasing population density at the wildland-urban interface has led to more anthropogenic causes of fires. Several decades of fire suppression have resulted in high fuel loads, especially in the forests. Multiple land management jurisdictions add to the complexity of developing co-ordinated approaches to fire management. The catastrophic fires in the summer of 2000 highlighted the resulting vulnerability of communities and forests very clearly.

Residents of fire-prone communities are an under-utilised resource in efforts to address complex problems in fire control and management. Local volunteer firefighters are often the first to respond to wildfires. They possess valuable knowledge of place, fire history and fuel loading. Residents also have the most to gain from participating in community-level education, co-ordination, fuel-load reduction and other fire management efforts. This paper discusses a participatory research process developed to capture and prioritise residents' recommendations for fire management as part of a county-wide community based fire planning effort in Trinity County, Northern California, USA. The process, in co-ordination with California state-level efforts to promote local "Fire Safe Councils", has enabled Trinity County to begin systematic fire management planning and implementation across jurisdictional boundaries. The experience gained may be of interest to other communities involved in landscape-scale fire management planning. The project is funded by the United States Forest Service Pacific Southwest Research Station and the California State Water Resources Control Board.

1. Introduction

In November 2000, the Trinity County Fire Safe Council in Northern California completed the first phase in an ongoing effort to collaborate with government agencies and local citizens in developing and implementing a landscape-scale fire management plan. This paper describes the process beginning with a brief introduction of wildfire and fire management concerns in the western United States. Wildfire management is discussed as a cross-boundary phenomenon that requires co-ordination among a range of actors. The limited role of private citizens in fire management to date is highlighted. The effort increases this role through the participatory research process undertaken by the Fire Safe Council in Trinity County.

2. Wildland fire in the western United States

In much of the western United States, including California, fire is a natural disturbance regime. Many ecosystems are adapted to periodic recurrence of wildfires that recycle nutrients and renew system functions. From a fire management standpoint, these fires reduce fuel loads. In the past, such wildfires were typically initiated by dry season lightning storms. Today, with growing human populations that have moved into wildland-urban interface areas, an increasing number of fires are anthropogenic, inadvertently caused for example, by discarded cigarettes or unattended campfires. Sometimes, wildfires are also caused by prescribed burns that get out of control, or by arsonists. From an ecological perspective, these fires occur at random and do not fit within a previous fire regime, to which flora and fauna have adapted. Instead, they serve to increase fire

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frequency. In addition, the economic impacts of wildfire are escalating as homes, vehicles and other assets at the wildland-urban interface are destroyed. Compounding the problem is the success of several decades of forest fire suppression policies that were intended to protect timber values and rural communities from fire. Widespread para-military scale efforts to put out every fire as quickly as possible have led to unprecedented volumes of fuel so that many forested areas are tinderboxes waiting for a spark. The mix of these factors has resulted in an increase in catastrophic wildfires of a scale and intensity beyond the range of historic variability (Biswell, 1989; Agee, 1993; Weatherspoon and Skinner, 1996).

Fire is a function of temperature, wind and fuels. Since people cannot control climate, reducing fuel loads through pre-fire treatments is the most promising method to influence wildfire behaviour (Agee *et al*., 2000). In the 11 western states of the United States, 55 percent of the land is federally owned and managed by one of several national land management agencies including the Bureau of Land Management, the United States Forest Service (USFS), the United States Fish and Wildlife Service, and the National Park Service (Loomis, 1993). One of the underlying challenges of reducing fuels is bringing together land managers – often a mix of private owners and public agencies with different mandates – and affected communities to decide which treatments to apply and where.

The scale of the fires across the United States during the summer of 2000 - captured national attention and triggered new investments and interest - in fire management. Along with continued support for fire suppression efforts, there is a significant new focus on pre-fire fuel reduction. As managers rush to implement programmes, one important source of information, expertise and ground-level support that could be drawn upon more than in the past are local communities, the people who live in the fire zone.

3. Community involvement in fire management planning across jurisdictions

In the United States, for the most part, public lands are the property of the people, managed by government agencies. Although the role of the general public in decision making for public land management has been growing since the passage of major legislation that required public comment, such as the National Environmental Policy Act (1970) and the National Forest Management Act (1976), most public land management efforts are hardly participatory or responsive to public input. Usually, federal and state-level government agencies involve the public in new forms of decision-making processes only because they are required to by law. Sometimes agency staff hope that by involving people in some steps of planning, opposition will be voiced early enough to allow for adjustments in proposed activities, and law suits filed by citizens can be avoided. The motivation in such cases is political exigency rather than recognition of the potential value of local experience, expertise and collaboration. Yet in many arenas of public land management, the people who live in the vicinities of these lands are potentially significant actors. Consider the case of wildfire management.

Local citizens are not normally involved in fire suppression planning or pre-fire decision-making processes. The suppression of large wildfires incurs enormous costs, often in the tens of millions of dollars. On public lands, firefighting agencies go into a para-military attack mode. When a fire reaches a certain size and rate of spread, or goes beyond local capacity for suppression, national strike teams are brought in from outside the area. While local line officers, e.g. USFS District Rangers, are still in charge, in effect the "superior expertise" of the strike teams takes over the "command centre" of the fire suppression activities. As rapid decisions are made regarding back-burning, bulldozing and other suppression activities, local citizens' knowledge, expertise and opinion are not typically factored into decisions. Yet, if site-specific information known to local residents (e.g. about unstable bridges, narrow roads, locked gates and water sources on private land) were readily available, some fires might not escalate and resources could be saved. Volunteer Fire Departments (VFDs) are the first to respond in emergencies, including fire, in many rural areas. It is in the interest of public land managers to have well-trained and equipped VFDs and to maintain good communication. Local site-specific knowledge

of and experience with the terrain, past fire behaviour and locations for emergency fire lines, could save lives, time and money during emergencies.

In the event of a fire, local residents may gain lucrative short-term employment as firefighters, or work as support staff providing food and facilities for the fire base camps. However, most would prefer to forego the opportunity for such additional income and support fire managers who advocate pre-fire vegetation treatments.

The potential value of involving people in pre-fire management has been neglected. Fire is oblivious to property and jurisdictional boundaries. It is up to private landowners to carry out fuel reduction around their homes and on forest parcels neighbouring public lands. Otherwise, the risk to public resources increases. Industrial forestland owners carry out a range of fuel management and fire planning activities, sometimes, but not always, in co-ordination with neighbouring land management agencies. When a fire starts, whether on public or private land, it can quickly spread to land with different ownerships.

4. The Trinity County Fire Safe Council, California

Trinity County, California (Figure 1) is a rural county at the northern end of the state. It extends over two million mountainous acres and, with 14,000 people, has a population density of less than four people per square mile. Over 75 percent of the land is managed by the federal government, largely in the Shasta-Trinity and Six Rivers National Forests. The vegetation is predominantly mixed conifer forest and oak woodland (Sawyer and Keeler-Wolf, 1995) with fire as the dominant disturbance regime.
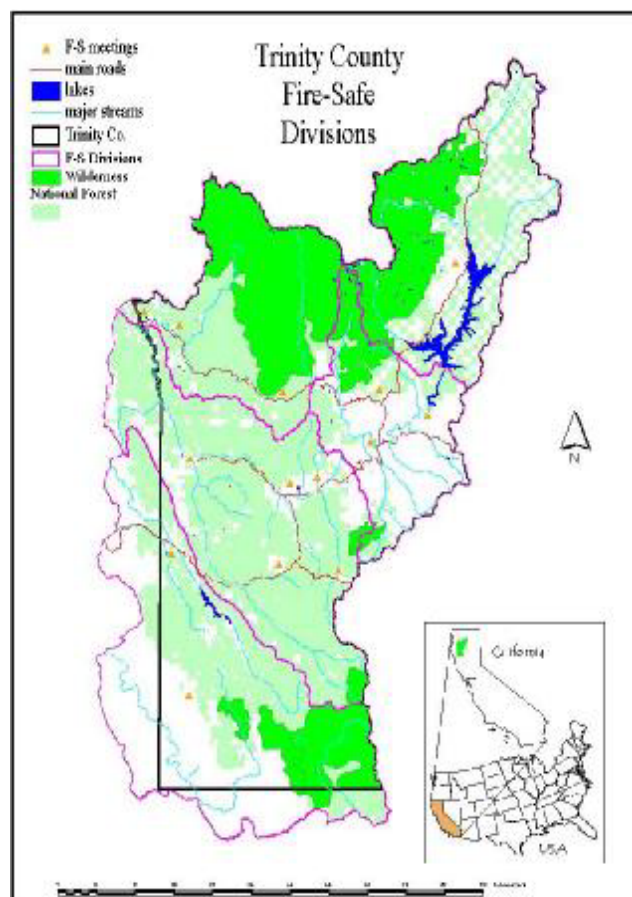
Figure 1: Map of Trinity County, California Fire Safe Divisions
(by P. Towle and K. Sheen)

During the last two decades, the impact of wildfires has increased in the area. In 1987, fires burned 91,000 acres (36,827 ha)[2] of the Trinity National Forest. The 1999 Big Bar Complex fire in Humboldt and Trinity Counties burned 125,000 acres (50,587 ha) of National Forest, Hoopa Valley Indian Reservation and private lands in 91 days. During that time air quality was so poor that the people living in the town of Hoopa had to be evacuated. Suppression costs were estimated at US$110 million (U.S. Forest Service, 2000).

In the county, fear of catastrophic fire that could repeat or be worse than these conflagrations is growing. In mid-1998, the Trinity County Board of Supervisors' Natural Resources Advisory Council appointed a sub-committee to address the issue of fire. This initiated the Trinity County Fire Safe Council (FSC) that includes representatives from local VFDs, non-governmental organizations (NGOs), the county, state and federal land and fire management agencies and others who have signed a Memorandum of Understanding (MOU) to co-operate on fire management planning (MOU, 1998).

The FSC has embarked on a landscape analysis and strategic planning process for fire management in the county. The first steps taken in 1999 and 2000 were to increase local involvement and interest in fire management planning. The objective was to capture local and regional knowledge and expertise in fire management as effectively and efficiently as possible. Participatory research and community mapping methods were adapted to achieve this goal. Two local NGOs – the Trinity County Resource Conservation District and the Watershed Research and Training Center – provided the team that led the effort, with funding from the USFS Pacific Southwest Research Station and the California State Water Resources Control Board.

5. Community mapping and participatory research

The FSC team proceeded to work with community members to:

♦ gather and develop a geographic information system (GIS) with available spatial data for the county that were pertinent to fire;

♦ identify local knowledge and spatial data relevant for emergency response;

♦ involve local residents and professionals to design a process for collecting community recommendations about fire management; and

♦ implement that process including gathering residents' perception of values at risk, collating their recommendations for pre-fire treatments to protect these values, and helping participants systematically prioritise proposed activities.

5.1. Developing the GIS

Data layers pertinent to fire management including topography, roads, hydrography, vegetation and past fire starts, were collated from sources such as the USFS, the Bureau of Land Management, and the California Department of Forestry and Fire Protection. There had been no previous effort on this scale to integrate spatial data for the county. Once the data were compiled, useful base maps for information gathering with community members and for future fire management modelling could be generated.

5.2. Identifying local knowledge and mapping emergency response data

From November 1999 on, a series of 13 widely publicised community meetings were held in VFD halls throughout the county to discuss the Fire Safe process and raise the local level of awareness about fire management issues ranging from needs of local VFDs to county, state and federal efforts. Furthermore, the FSC team wanted to identify local expertise in fire management that could be called upon later, and to gather site-specific information not found in the GIS. To ensure comparability between meetings, the basic format for all meetings was the same with two or more members of the FSC team participating in each. At every meeting, the FSC team members

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[2] 2.471 acre = 1 ha

presented an overview of the Fire Safe effort and gathered participants around maps of the local terrain generated by the GIS. A computer with the GIS database was brought to each meeting so that additional information could be accessed upon request. Participants added missing information by marking reference points on the maps and explaining issues of concern, which were subsequently noted. These data, of particular interest for local emergency responses, included water sources, unsafe bridges and roads, locked gates and other similar information. After each meeting, the FSC team entered the new data into the GIS database. Maps with the new input were sent back to participants to verify that the information was accurate. Updated hard copies of the maps were left with the VFD in each participating community so that new information might be added and included in database updates regularly. The GIS was shared with local land management agencies and emergency respondents. The number of community participants in the meetings varied, but even where the turnout was low, it included a high proportion of VFD members and others with an active interest in fire management issues.
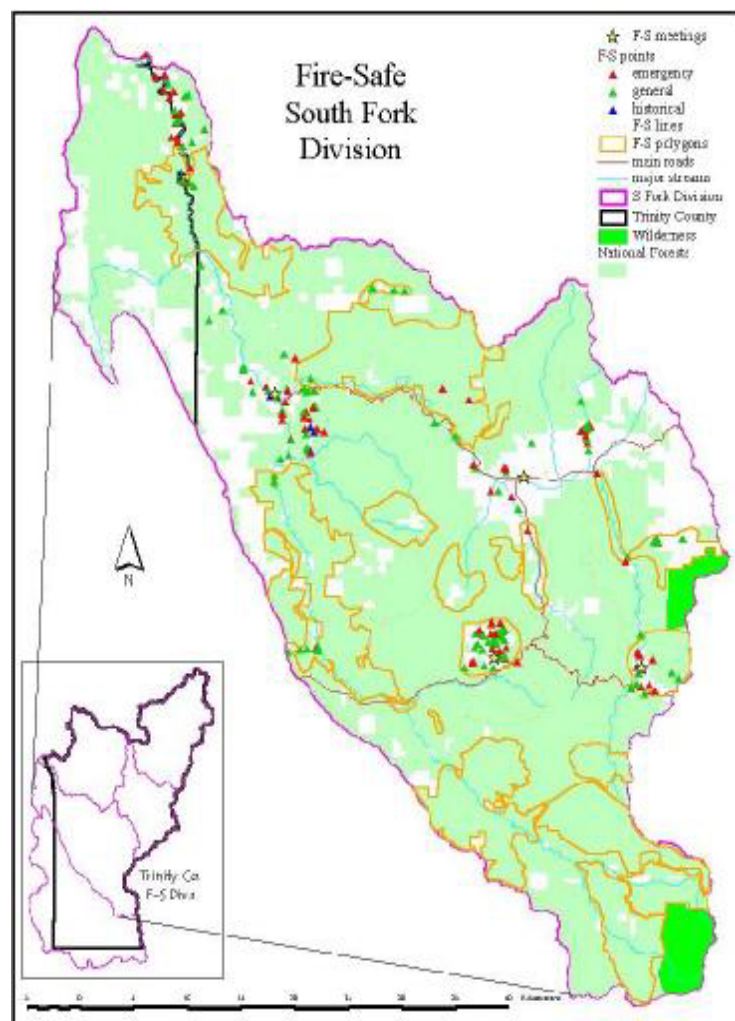
Figure 2: Emergency response data for the South Fork Division

(by P. Towle and K. Sheen)

5.3. Working with local residents and professionals to design a process for gathering community recommendations about fire management

A two-day planning meeting involving representatives of agencies and groups participating in the FSC was held in April 2000 to develop an appropriate process for gathering community input across the county. The FSC team hoped that by bringing together locally and regionally recognised experts to contribute their ideas to the process, a credible process for all concerned could be established.

At the meeting, it was decided that in addition to the GIS and local emergency response data gathered during previous meetings, the most important input from residents would be to identify and prioritise key values at risk from wildfires in the local areas, and their recommendations for protection of these values. Values at risk identified included homes, water supplies, power and communications lines, rare or endangered species habitat, and prime recreation sites.[3] Recommendations might include identifying locations for treating vegetation to reduce fire risk and hazard.

To make the best use of localised knowledge and staffing capability for meeting purposes, the county was divided into five sections. Evening and daytime meetings to maximise local attendance were held in central locations in each of these five areas, and discussion focused on the specific area in question.

Figure 3: Participants gathered around maps at the North Lake Meeting, May 16, 2000 *(photos by Carol Fall)*

5.4. Organizing community meetings to identify values at risk and to prioritise pre-fire treatments

An evening and a day-time community-mapping meeting were held in each of the five divisions of Trinity County in May 2000. Publicity to encourage broad participation was crucial. Everyone who had attended earlier community meetings or who had been identified in the April meeting received a written invitation and many people were contacted directly by phone. In addition, the meetings were publicised in the local newspaper and several press releases about the fire planning process were published.

At the meetings, people gathered around maps of their locality to discuss ideas. As in the emergency response meetings, initial input on values at risk was captured on maps and in notes taken during the meetings as well as through on-location editing of the GIS data. In each case, there were several community members, often long-term residents, who were immediately able to

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[3] Note this process varies somewhat from the approach taken by California Department of Forestry and Fire Protection (CDF) in the California Fire Plan where values at risk are pre-identified and ranked by CDF staff and community meetings are held to evaluate these proposals (CFP, 1996: p 24).

contribute ideas. The FSC team typically would reconvene the following day with a smaller group of participants (often retired firemen, USFS staff or VFD members) to review and consolidate the data gathered earlier.

Once participants had identified which values were at risk from fire and where they were located, they were asked to make recommendations for landscape vegetation treatments to protect these values. Recommendations included creating 30-100 ft perimeters of defensible space around homes on private land, and thinning from below and constructing shaded fuel breaks on public lands.

Finally participants worked together to prioritise projects. In an approach adapted from similar participatory prioritisation methodologies (e.g. Margoluis and Salafsky, 1998), criteria to evaluate proposals were defined and then ranked using a matrix approach. At each meeting, several criteria to evaluate the importance or relative priority of proposed activities were presented and modified according to participants' recommendations (Table 1). Each criterion was discussed and thoroughly defined to ensure that all participants had a similar understanding of the valuation process. The resulting "scores" in the matrix were treated as indicative of relative values among proposals. To avoid a false sense of quantitative valuation, all categories were weighted equally. The resulting prioritisation matrices for each meeting were presented with a detailed description of the process applied and CD ROMs with the GIS data sets in a draft final report to the FSC in January 2001 (Trinity County Fire Safe Council, 1999).

6. Results

A number of additional recommendations emerged from the community involvement process. Federal land managers were strongly encouraged to co-ordinate across jurisdictional boundaries on fire and road management policy. Trinity County was encouraged to identify community safety zones and escape routes in case of a catastrophic fire and to keep water tenders and other equipment locally available. Strong support for VFDs was advocated. All fire managers were encouraged to take a landscape-scale view of fire hazards and to co-ordinate treatments accordingly while identifying and focusing attention on critically important habitats for wildlife and on protecting old growth forests. The agreed goal is to protect key values from catastrophic fires, reintroduce low intensity fires, and reduce fuel loads – which incidentally will provide a continuous source of employment for the county workforce (Trinity County Fire Safe Council, 1999).

7. Conclusions

The recommendations have provided a basis for Trinity County NGOs and VFDs seeking funds for carrying out more fuel reduction activities. A number of recommendations are due to be implemented in 2001 (Baldwin, 2000). Co-ordinated planning meetings between FSC members and the USFS were also held. Other FSC efforts are emerging in neighbouring counties. The report has been distributed widely and has been a topic of discussion at national fire plan development meetings. The Trinity County FSC is currently involved in developing an overall strategic plan for fire management in which community recommendations will play a significant guiding role.

Table 1: Criteria used by participants to rank recommended projects (high, medium, low)

Community - areas most highly valued by community members ♦ *High value* - community, housing development or grouping of several residences, telecommunications translator, community water supply, key travel corridors; ♦ *Low value* - no residences or infrastructure issues ♦ **Public safety** - a * was added to highlight urgent projects
Fuel hazard - areas with high fuel loads, flammable vegetation ♦ *High hazard* - dense, flammable vegetation, e.g. thickets of second growth, untreated plantations, brush fields ♦ *Low hazard* - open ground, areas previously thinned, no ladder fuel
Fire risk - areas with a high probability of fire starting ♦ *High risk* - high slope position and southwest aspect, past history of lightning strikes or high concentrations of human activity e.g. hunting camps ♦ *Low risk* - low slope position, little human activity, little past history of lightening strikes or fire
Ecological value - a measure of known ecological concerns in the landscape ♦ *High value* - known habitat of threatened, endangered species or species for which USFS survey and manage protocols apply; notable stands of old growth vegetation, known nesting habitats of rare species ♦ *Low value* <u>do not indicate lack of ecological value</u> but rather no outstanding concern for the particular area in question
Economic value – a measure of known economic value of area resources ♦ *High value* - areas with private property values, power lines and/or plantations or other investments/resources at risk ♦ *Low value* – no particular infrastructure or resource value
Readiness – ability of landowners and managers to respond quickly ♦ *High value* - ability of both private landowners and the USFS to act immediately with community buy in on public or private land ♦ *Low value* - significant administrative work needed (e.g environmental assessment required by the National Environmental Policy Act (NEPA)) before activities could take place
Cost of project – referred to overall economic cost of doing the work ♦ *High cost* - due to inaccessible or steep terrain or large-scale project ♦ *Low cost* - clearing defensible space around a residence, some types of controlled burn
Recreation value/viewshed ♦ *High value* - scenic highway designation; high recreational use area ♦ *Low value* – no particular value noted
Land allocation USFS land allocations were included in the matrix to give a quick view of likely treatment opportunities and constraints on public lands as defined in the Northwest Forest Plan to protect the Northern Spotted Owl (e.g. late succession reserve, adaptive management area, wilderness, matrix).

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