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




Food and Agriculture Organization of the United Nations
Regional Office for Asia and the Pacific
Bangkok, Thailand
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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.

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Project FireFight South East Asia, a global initiative of the World Conservation Union (IUCN) and the World Wide Fund for Nature (WWF), was the lead organizer of the *Communities in flames* international conference. In all aspects of planning, organizing and conducting the conference, the Project worked closely with the Regional Community Forestry Training Center (RECOFTC) and the Food and Agriculture Organization of the United Nations (FAO). Essential support for planning and undertaking the conference and field trips came from local communities and non-governmental organizations in collaboration with the German Agency for Technical Co-operation (GTZ)'s Integrated Forest Fire Management Project, the Provincial Government of East Kalimantan and the District Government of Balikpapan, which hosted the event. The Ministry of Forestry of the Government of Indonesia, the FAO, the European Union and the United States Department of Agriculture Forest Service provided financial resources and other support.

The efforts of the many individuals were co-ordinated and channelled by three committees, whose contributions were essential to the conference's success and are gratefully acknowledged:

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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 Royal Forest

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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.

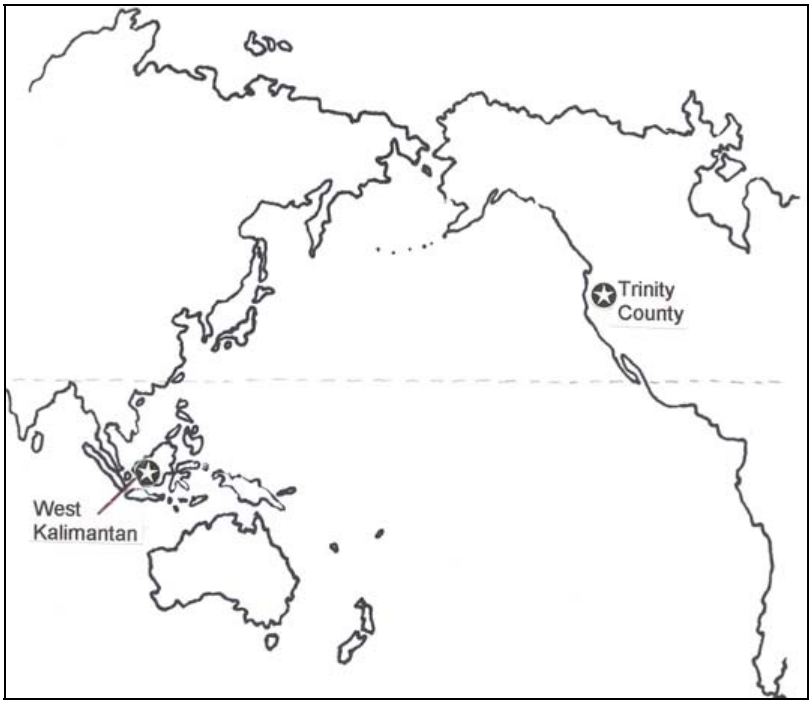

Figure 1: Location of study sites

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"

Warnings Concerns	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): 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 Water sources that could be developed (private and public land) Possible helicopter landing locations	*Locations of past fires based on oral histories + narratives:* Extent, sequence of events, causes, damages associated with all fires remembered by participants, or noted in oral histories from past generations Responses to fires (including sanctions applied, if any) 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): Housing/buildings; recreation and resort sites Telecommunications towers Old-growth forest and specific groves Habitat for species of special concern	*Participants' assessments of areas with high risk of future fires, based on landscape conditions, land uses, and resource tenure or conflicts* Fire-prone vegetation Activities with high risk of uncontrolled fires Locations of potential conflicts Comparing assessments from villagers, companies and officials
Locations of current and potential fuel management zones (3rd set of meetings): Ridgelines; roads (especially within 1.5 miles of communities) Public/private land interface Community drinking water supplies	*Assessment of gaps between current capacities for fire management and perceived needs* Community-based process focus on community needs Basis for formalising fire control rules and negotiating joint responsibilities

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.[1] 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

[1] 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"[1] 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 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.

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[1] "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".

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.

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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.

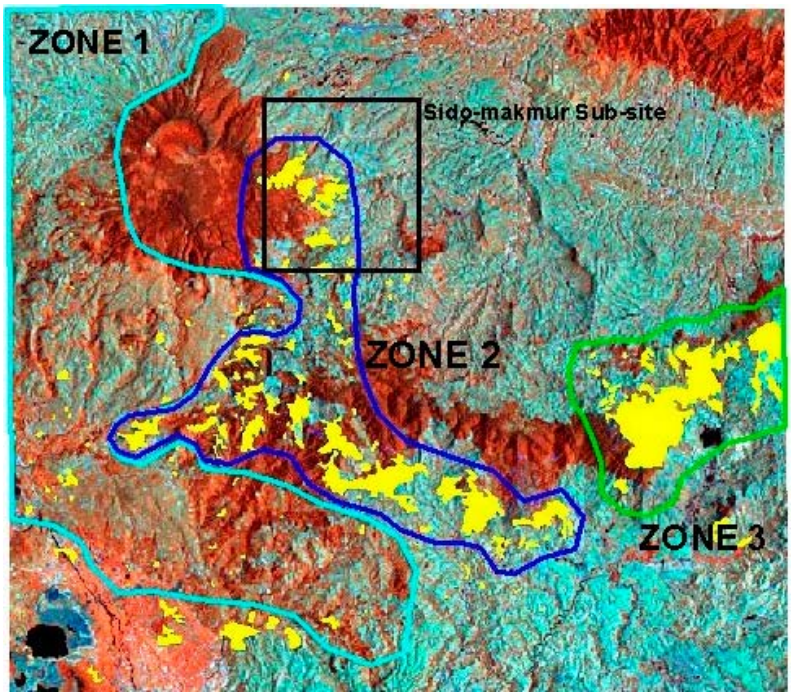

Figure 2: Burn scar patterns in Sekincau

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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