

## **DISASTROUS FOREST FIRES IN KENYA: NATIONAL ROUND TABLE AS A PANACEA TO COMMUNITY-BASED FIRE MANAGEMENT IN THE COUNTRY?**

**\*Festus M. Mutiso<sup>1</sup>, Mware J Mugo<sup>2</sup>, Joshua Cheboiwo<sup>3</sup>, Francis Sang<sup>2</sup>, George K. Tarus<sup>4</sup>, Gideon K. Chemitei<sup>5</sup> and Wasike B. Simiyu<sup>5</sup>**

### **\*Corresponding author**

1. South Eastern University College (SEUCO), P.O. Box 170-90200, Kitui
2. Department of Forestry and Wood Science, Moi University, P.O. Box 1125, Eldoret
3. Kenya Forestry Research Institute, P.O. Box 8, Londiani
4. Better Globe Forestry Ltd, P.O. Box 823-00606, Nairobi
5. Kenya Forest Service, P.O. Box 30513-00100, Nairobi

*\*Festus M. Mutiso.*

Ass. Lecturer, South Eastern University College (SEUCO)  
P.O. Box 170-90200, Kitui

Cell phone: 0723769694, Email: [mutifestox@yahoo.com](mailto:mutifestox@yahoo.com)

*George K. Tarus*

*Forester, Better Globe Forestry, P.O. Box, Nairobi*

Cell phone: 0721287634, Email: [kkipkorir81@yahoo.com](mailto:kkipkorir81@yahoo.com)

*Prof. Francis K. Sang*

*Associate Professor, Department of Forestry and Wood Science, Moi University  
P.O. Box 1125, Eldoret*

Tel. (0321) 63257, Cell: 0722792088, Email: [fsang2007@yahoo.com](mailto:fsang2007@yahoo.com)

*Mugo J. Mware*

*Lecturer, Department of Forestry and Wood Science, Moi University*

*P.O. Box 1125, Eldoret*

Tel. (0321) 63257, Cell: 0722792088, Email: [jmware@gmail.com](mailto:jmware@gmail.com)

*Joshua Kiplongi Cheboiwo*

*Centre Director Kenya Forestry Research Institute, P.O. Box 8, Londiani*

Tel 052-64082, 0202172567, Cell: 0722464469, Email: [jkchemangare@yahoo.com](mailto:jkchemangare@yahoo.com)

*Gideon K. Chemitei*

*Kenya Forest Service, P.O. Box 30513-00100, Nairobi*

Cell phone: 0723119815, Email: [giddyplimo@gmail.com](mailto:giddyplimo@gmail.com)

*Wasike B. Simiyu*

*Deputy Director, Kenya Forest Service, P.O. Box 30513-00100, Nairobi*

Cell phone: 0721906121, Email: [cabonsimiyu@yahoo.com](mailto:cabonsimiyu@yahoo.com)

## **ABSTRACT**

Though fires degrade forests quickly, the recovery process takes long. Rehabilitated forests will not have enough time to grow and become forests of economical and ecological value and all silvicultural treatments will be useless in absence of a fire management strategy. Most forest fires are started by humans. As such, it is worth to encourage communities to assume control and ‘ownership’ over fire management. Community Based Forest Fire Management (CBFFM) helps to integrate fire and people into land-use and vegetation management systems. We carried out a study between February-May 2009 on the escalating forest fires with the aim of evaluating whether National Round Table on fire management can be a forerunner to CBFFM in Kenya. We subjectively chose Kiptunga, Koibatek and Maji Mazuri forests to represent two high fire risk zones; Mau complex and Koibatek District. Ten sub-compartments were chosen in each forest and fire incidences in plantations recorded. Fire occurrence was assessed in categorized distances of <0.5, 0.5-1 and >1km from the settled reserves. We evaluated fire prevalence across three plantation species: pines, cypress and eucalyptus and across three age cohorts: <5, 5-10 and >10years. Incidences of fires were high in plantations near settled reserves, <0.5 and 0.5-1km, compared to those far (>1km) and in cypress plantations compared to pines and eucalyptus in all studied sites. Significant differences in occurrences in respect to distances ( $P = 0.027$ ) and across the species ( $P = 0.012$ ) were observed. A strong negative correlation (Spearman,  $r_s = -0.97$ ,  $P < 0.05$ ,  $n = 3$ ) existed between frequency of fires and the distance from settled reserves in all studied sites though a weak positive relationship ( $r_s = 0.32$ ,  $P = 0.04$ ,  $n = 3$ ) was evident across age cohorts. All fire incidences in sampled sites were human-induced. Use of fire as a tool in land preparation under the PELIS was largely blamed though we could not rule out arsonist. Community empowerment and participation in fire fighting was largely lacking. Study areas burn on yearly basis hence silvicultural treatments will be useless unless bold intervention measures are put in place to fight the escalating fire menace. We propose an array of consultative bottom-up and top-down approaches in consensus building process. The process should entail National Round Table on fire management with full participation of stakeholders in the forest sector. It is expedient for the KFS to capitalize on the already institutionalized and legislatively backed CFAs to build consensus for possible formation of a CBFFM. Piecemeal episodic interventions will not solve the current fire crisis but we recommend a bold policy intervention coupled with resolute political commitment. Successful CBFFM will require legislative and policy reforms strongly backed by institutional and financial support as well as a thorough explanation of the pluriformity of the legal context to the locals. Sanctions for starting uncontrolled fires should be put in place. Sanctions and incentives should go together for effective fire management. Fire fighting crews from the KFS and the community, should have adequate logistical support. This was largely lacking in the 2009 fire season. Before National Round Table is convened, we strongly recommend an in-depth research on various policies governing community forest resource use and ownership rights. A cost-benefit analysis should, also, precede National Round Table and subsequent formation of CBFFM.

**Authors’ Keywords: Forest Fires, Community Based Forest Fire Management, Forest Fire Control, Fire Management**

## **BACKGROUND INFORMATION**

Large-scale wildfires during severe droughts are a major challenge to forest rehabilitation efforts (Toma *et al.*, 2009). Two of the world's largest fires occurred in East Kalimantan within a 15- year record (Goldammer *et al.*, 1996). The two that occurred in 1982-1983 and 1997-1998 were related to an unusually prolonged and severe drought linked to a strong EL Nino Southern Oscillation (ENSO). Toma 1999 and Mori, 2000, states that the two fires destroyed huge areas of rain forest in East Kalimantan. The semi-natural forests were damaged more severely by the 1997-1998 fires than they had been by the 1982-1983 fires, since they had had not recovered their previous health in the intervening period (Goldammer, 1999; Mori 2000; Toma *et al.*, 2000b). Further, Toma *et al.* (2009) document that in the rehabilitated forests, the planted trees had not grown enough to survive the fire, so they were heavily damaged. Though fires degrade forests quickly, the recovery process takes long. As such, rehabilitation efforts will be useless unless measures are put in place to manage fires. Semi-natural and exotic plantations cannot adequately withstand fire stress. Mutiso (2007) and Fashing (2003) states that 60-80 years is not even enough time for a forest to recover from such stress and retain its original integrity. Kumar (2001) cautions that if such stress is beyond certain critical limits, the forest can “flip” off to an alternative state to the detriment of all the biota in habitation.

Most of the forest fires are human-induced. Most of the wildfires in East Kalimantan are caused by human activities. All fires in Kenya are started by people (World bank, 1999). Of these fires, 40% are classified as arson, 20% are caused by negligence and carelessness and 40% are due to unknown causes. Kenya faces an average of 78 fires annually. Rehabilitated forests and plantations are the most damaged by these fires. During severe droughts, fires ignited by human activity spread out to become wildfires (Toma *et al.*, 2008). Such fires are used as a tool for land preparation in Taungya system or *set alight* intentionally to kill or drive out pests, hunting and to stimulate succulent herbaceous regrowth for livestock (UNO, 1994). Intentional fires are used as a weapon in social conflicts (Tomich *et al.*, 1998; Gouyon, 1999). In East Kalimantan, like people everywhere, typically act in the belief that what they are doing satisfies their best interest, and much of their forest destroying or land degrading behaviour is profitable to them (Toma *et al.*, 2006).

The role of communities in forest fires has led to a paradigm shift in fire management. The consequences of increasing application of fire in land-use practices and land use change and subsequent outbreaks of the 1980s and 1990s have led to the development of several fire management programmes in Asia and Africa (Goldammer, 2006). This has led to integrated forest fire management (IFFM) which is based on the assumptions that communities can successfully incorporate fire usage into sustainable land use and vegetation management systems. The concept of round tables on fire management has been used to define the participatory approach in fire management. The underlying concept of integrated fire management (IFFM) also referred to as Community-Based Integrated Fire Management (CBFFM), is to better integrate fire and people into land-use and vegetation management systems (Toma *et al.*, 2006). Complex configuration of local, cultural, social, economic, political and environmental conditions determines the definition and design of the CBFFM (Kammaing, 2001; Goldammer, 2006; Johann *et al.*, 2009). While

land tenure is a critical factor for community participation in fire management activities, the selected fire control techniques must be appropriate for the specific land-use system. Formation of CBFFM requires consultative consensus building characterized by bottom-up and top-bottom approaches (Ing, 2000; ISDR, 2000) coupled with strong legislative and policy reforms and thorough explanation of the pluriformity of the legal context to the locals. As the country underwent through one among the worst forest fires disaster in history, we decided to embark on a study on the actual situation with the aim of coming up with a conceptional framework upon which to pivot future mitigation measures. Between January-May 2009 we carried out a study on forest fires in three major forest ecosystems; Kiptunga, Koibatek and Maji Mazuri. Apparently, the study forests not only fall under the country forest fire hotspots but are partially part of the Mau ecosystem; a critical water tower in the country. Our study was also based on the understanding that land tenure and resource use and ownership rights are critical in Kenya (Mutiso *et al*, 2009) and elsewhere in the world (Dogra, 2009; Ghosh *et al*, 2006). All fire incidences recorded were caused by human activities. In our search for mitigation measures, we could not separate fire management from the local communities. As such, to combat the escalating fire disasters in the country and save our water towers, wildlife, tourism and agriculture, in this paper, we discuss a comprehensive community-based fire management strategy applicable in the country.

## **MATERIALS AND METHODS**

### **Study Sites Selection**

Our study sites were chosen subjectively to capture high fire risk areas. Koibatek and Nakuru districts are high fire risk areas. As such Kiptunga (part of the Mau ecosystem), Koibatek and Maji Mazuri forests were selected to represent the two. Apart from falling in high fire risk areas, a study site had to have a minimum of ten plantation sub-compartments to qualify for the study.

### **Materials**

The study made use of: Plantation UTM Maps, Rotring Rule, GPS Receiver, Suunto Compass, Digital Camera, Pen/Pencil, Notebook and Field Forms

### **Procedure**

In each forest ecosystem, ten sub-compartments were systematically selected from the settled reserves towards the interior of the forest. On the UTM maps and using a rotring rule, the selected sub-compartments were subdivided into three categories: >0.5, 0.5-1, and 1km from the settled reserves. In each category, ten plantations were selected using random numbers. Our study was only restricted to three plantation species: pines, cypress and eucalyptus and assessment was further narrowed to three age cohorts: <5, 5-10 and >10 years. From the UTM maps, we documented the species and age cohorts of the selected ten plantations in each distance category.

### **Assessment of Fire Incidences**

Using a rotring rule, we measured the UTM coordinates from the Maps for each of the plantation under assessment. The coordinates were then transferred to the GPS receiver. Using the GPS, compass and the UTM map, we accessed all the selected plantations. Then we ascertained the species and age cohorts for conformity with what was reflected on the maps. Incidences of fire were assessed per plantation. A set threshold limit was used where for a case to qualify as a fire incidence, it should have affected  $\geq 0.1$ ha.

### **Data Analysis**

Field data was organized using Ms Excel. The same was used to generate charts. To detect and isolate significant statistical differences in prevalence of fire in respect to distance from settled reserves and across the study species and age cohorts, results were subjected to Duncan Multiple Range Test (DMRT) using SPSS version 13. We also carried out a Spearman and Pearson correlation analysis to detect any relationship between frequency of fires and the distance from settled reserves and between age cohorts within the studied sites respectively.

## RESULTS

### Forest Fire Incidences in Respect to Plantation Distance from Settled Reserves

Significant differences ( $P = 0.027$ ) existed in the incidences of forest fires within the study sites and across the categorized distances of sampled plantations from the settled areas. Though incidences of fires were high in plantations near settled reserves,  $<0.5$  and  $0.5-1\text{km}$ , compared to those far ( $>1\text{km}$ ) in all studied sites, Kiptunga recorded low frequencies (fig. 1) of fires (15.6%) compared to Koibatek (31.1%) and Maji Mazuri (53.3%). Fires were intentionally lit by herders and farmers as a tool in land preparation (fig. 2). A strong negative correlation (Spearman,  $r_s = -0.97$ ,  $P < 0.05$ ,  $n = 3$ ) existed between frequency of fires and the distance from settled reserves in all studied sites.

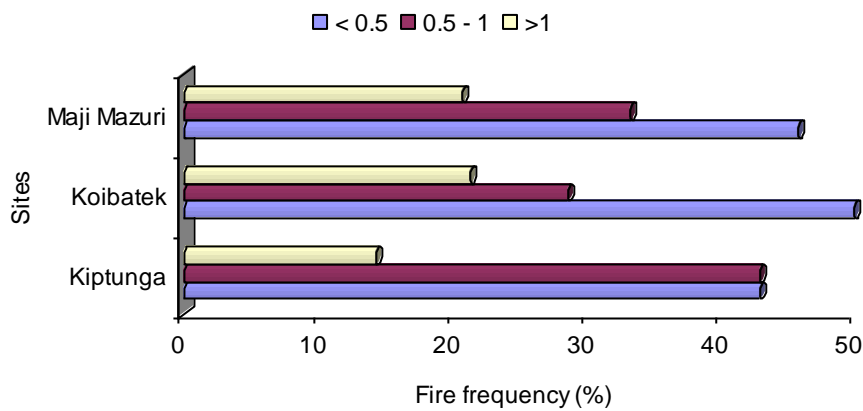


Figure 1: Forest fire frequency (%) in respect to plantation distance from settled reserves in sampled sites in 2009



Figure 2: Grazing activities and fire incidences in *P. radiata* stand near the settled reserves (A) and use of fire in land preparation under PELIS (B) in sampled sites in 2009

### Prevalence of Fires across Species in Studied Sites

We observed significant statistical differences ( $P = 0.012$ ) in the occurrence of fires across the three major species studied. This was further reflected within the sampled areas. In the study sites, cypress had the highest incidences of fires (fig. 3 and 4) followed by pines while eucalyptus were the least affected. We however, found out that in Kiptunga, cypress covered 80% of the plantation area while pines and *Eucalyptus* covered 14.3% and 5.7%



respectively. This trend was different in Koibatek where cypress covered 41% with pines and *Eucalyptus* covering 36% and 23% respectively. Maji Mazuri reflected a different scenario where cypress covered 53.2% of the plantation area while pines and *Eucalyptus* covered 31.2 and 15.6% respectively.

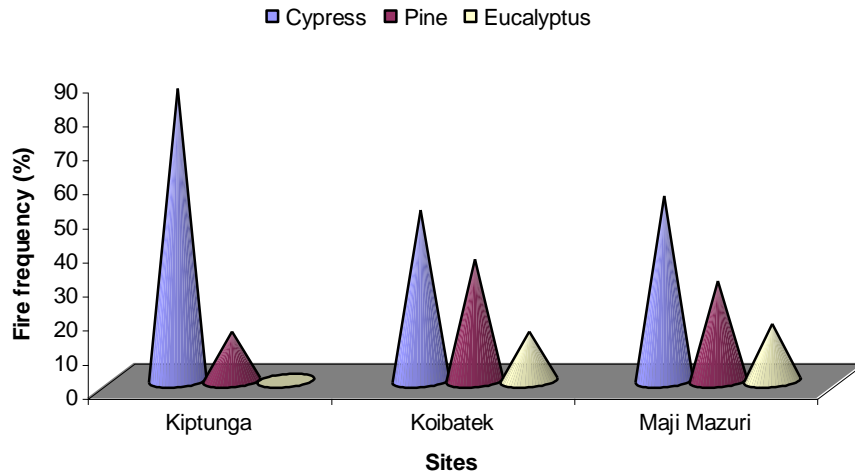


Figure 3: Frequency of fires across species in studied sites in 2009



Figure 4: Fire initially lite to prepare land for cultivation runs out of control and burns a Cypress plantation

### Fire Incidences across Different Age Cohorts in Sampled Areas

By subjecting affected plantations to a correlation analysis based on their age cohorts revealed a weak relationship (Pearson,  $r_s = 0.32$ ,  $P = 0.04$ ,  $n = 3$ ) but significant differences existed within the studied sites. Severity of burn different significantly across studied plantations (fig. 6). In Kiptunga, all affected plantations (100%) were under the >10 years age cohort (fig. 5). However, in Koibatek, plantations under age cohorts <5 years and >10 years were the most affected (42.9). In Maji Mazuri, plantations under >10 years age cohort were the most affected (54.2%). We however, noted that in Kiptunga, plantations under the age cohort of <5 years formed 3.3% of plantation area while 5-10 and >10 years covered 10 and 86.7% respectively. Age cohorts were however, distributed in Koibatek with 31.6%

under <5 years and 19.3% and 49.1% under 5-10 and >10 years respectively. The same distribution was also observed in Maji Mazuri where 21.5% were under >5years, 29.1% under 5-10 years and 49.4% in the >10 years age cohort.

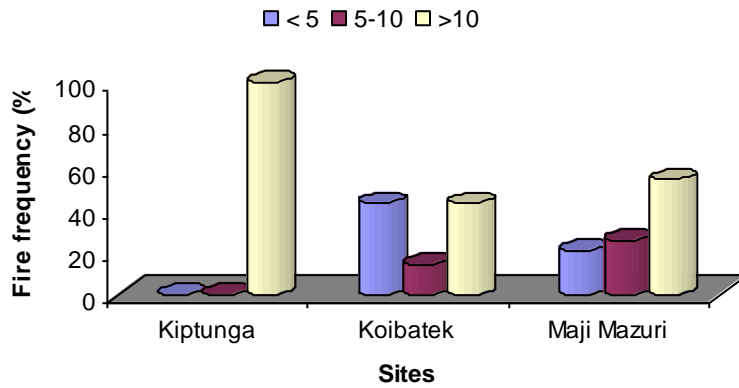


Figure 5: Fire frequency (%) across different age cohorts in sampled areas in 2009



Figure 6: Plantation partially burnt (A) and fallen dead logs after a severe burn (B) in sampled areas in 2009



## **DISCUSSIONS**

### **Incidences of Forest Fires in Relation to Distance from the Settled Reserves**

The high frequency of forest fires in plantations near the settled reserves compared to those in the interior can be greatly attributed to human activities. Use of fires in land preparation in settled reserves as well as in the plantation under Plantation Establishment Livelihood Improvement Scheme (PELIS) was widely prevalent. Further, high human activities in and out of the plantation areas with a fore to land preparation and grazing was widely prevalent especially in Maji Mazuri followed by Koibatek then Kiptunga. We attributed the high prevalence of human activities in Maji Mazuri to the presence of the Maji Mazuri village whose inhabitants are former peasant farmers and saw mill employees before the Non-residential cultivation and logging were banned in late 1990s. Though these activities were banned, the inhabitants, who live in a more or less slum setting, depend on the forest for their livelihoods. The correlation in fire incidences in respect to plantation distances from settled reserves was due to human activities that varied significantly as one moved deep into the forest.

Elsewhere, Mutiso *et al* (2009), in a different study in the expansive Mt Kenya and Aberdare ecosystems, documented the high dependence on forest by peasant farmers who depended on non-residential cultivation and logging for their livelihoods before they were banned. He proposes an array of cross cutting measures on land policies by the government in addressing the plight of the forest communities. It is however, worth to note that the forest community activities pose a major threat to forest. Land preparation and grazing in and outside the plantations are characterized by frequent use of fires. Such a practice is supported by UNO (1994) which states that fires are used as a tool to clear land for cultivation as well as management of grassland for grazing. Further, this study found cases where fire was lit literally by those looking after livestock in the forest especially during cold seasons. All these human-induced fires in most cases were poorly managed and became wild thus consuming large plantation and indigenous forest areas.

Our findings are further supported by World Bank (1999) which records that all fires in Kenya are started by people. Of these fires, 40% are classified as arson, 20% are caused by negligence and carelessness and 40% are due to unknown causes. Also, Toma *et al* (2008) in their study in East Kalimantan concluded that most of the wild fires were caused by human activities. We find the place and role of the community critical in handling the fire menace in the country. This calls for consensus building coupled with bold policy interventions to bolster and explain to the locals the benefits and hazards of forest fires. Though Toma *et al* (2008) state that building consensus is a complex and time consuming process compared to merely planting trees, they caution that unless such a move is undertaken, the planted areas will never have enough time to grow and become a forest in absence of a fire management strategy.

### **Community Participation in Fire Management**

We backed our findings with thorough literature review with the aim of developing a conceptual framework upon which we can pivot community-based method of managing fire regimes in the country. From our findings, the revenue lost to forest fires in sampled areas, especially in the last fire season, runs into millions of shillings. Piecemeal episodic interventions may not be a viable solution to the disaster but a stable method that actively involves the

autochthons in dealing with the historical fires in the country may offer a long-term solution. An array of crosscutting measures explored in this study coupled with bottom-up and top-down approaches in dealing with fires can be the way forward in dealing with the crisis. Based on this, we suggest community involvement in managing fires. National Round Table on fire management should precede formulation of such strategy. Goldammer *et al* (2008) state that round tables is a concept on fire management for defining the participatory approach on fires. The integrated forest fire management (IFFM) is based on the assumption that communities can successfully incorporate fire usage into sustainable land use and vegetation management systems (Goldammer, 2000).

Elsewhere, Ministry of agriculture (2001), Ethiopia documents that active involvement of the local people has therefore been recognized as a condition for the successful implementation of fire management programmes, especially at the interfaces between wildlands, managed systems and residential areas. Our study sites were characterized by these wildlands, managed systems and residential areas hence the observed high frequencies of fires. In search of entry point to community participation in Kenya, we isolated the already institutionalized Community Forest Associations (CFAs) as a suitable entry point for a possible formation of a community-based forest fire management (CBFFM). Under the new forest act in the country, the CFAs are not only mandated to have a stake in decision-making but also in the overall management of forests. To us, since the CFAs are in place, the consensus building may not be complex and time consuming in the country and as a result, the Kenya Forest Service can use the CFAs as a platform to bolster and explain to the local communities the effects of forest fires. Note that Goldammer *et al* (2008) asserts that consensus building is not only complex but also time consuming. With active involvement of the CFAs, National Round Table can be convened and fire management schemes developed through consultative bottom-up and top-down approaches backed by strong legislative and policy reforms on resource use and land tenure. Goldammer *et al* (2008), record that the underlying concept of CBFFM is to better integrate fire and people into land-use and vegetation management systems.

### **National Round Table as a Panacea to CBFFM**

CBFFM approaches clearly depend on the complex configuration of local cultural, social, economic, political and environmental conditions (Goldammer *et al*, 2008). This explains why this study not only advocates for community participation but also calls for bold policy interventions coupled with resolute political commitment to deal with the ‘thorny’ issue of resource use rights and land tenure. Mutiso *et al* (2009) quote conflict of interest in resource use and land ownership rights in the country especially among forest communities and peasant farmers entirely depended on forest for their livelihoods. Elsewhere, Dogra (2009) documents the same resource use conflict. Goldammer *et al* (2008), however, state that, to overcome these, a dialogue and negotiation process among all stakeholders, from local to national levels, must first be established for a successful CBFFM. Objectives of CBFFM can be successfully realized only if all stakeholders involved in fire management agree on a distribution of responsibilities, decision-making process and resources. In this context, we consider the CFAs as a bold platform for consensus building because they not only have strong backing from the forest Act and Kenya Forest Service but also have a good will

from the community. The process of negotiation and consensus building requires careful consideration of different perspectives and also the pluriformity of the legal context. Resource use and ownership rights are subjects that require further legal interpretation prior to formation of CBFFM. This is further supported by Mutiso *et al* (2009) and Goldammer *et al* (2008) who found that existing rules are often of different and sometimes contradictory origins (e.g laws and administration rules governed by centralized legislation, traditional rules that may not be legally recognized, or weakening influence of traditional structure due to increasing cultural intermix (migration) or other impacts of globalization). We suggest a combination of bottom-up and top-down approaches in defining the appropriate CBFFM strategy to overcome possible conflicts and deadlocks. Such a strategy seems to be the most effective in building consensus among stakeholder groups at different levels.

As case studies, we isolated several national Round Tables on fire management previously held in co-operation with the German Agency for Technical Co-operation (GTZ) and international partners:

- ✓ In the aftermath of the extended fire and haze episodes of the 1980s, the first National long-term strategic fire management plan was prepared in Indonesia at the international workshop on long-term integrated forest fire management in Indonesia. This first National Round Table involved most stakeholders in fire management and the international donor community. It resulted in a concerted approach in building fire management capabilities in the country, leading to the IFFM project by the GTZ in co-operation with the Fire Ecology Research Group; the longest-ever international co-operative fire management project;
- ✓ In 1999, the Namibia-Finland Forestry Program (NFFP) also convened a National Round Table on fire management, which recommended a multi-stakeholder approach in fire management with particular emphasis on the involvement of regional stakeholders and local communities;
- ✓ After the largest forest fire in Ethiopia in 2000 and the successful international response to the emergency, the government called for a National Round Table on fire management in September 2000. It was recognized that Ethiopia, currently a country without any fire management capacities, would build its future programme on the basis of community involvement (Ministry of agriculture, 2001)

Following the catastrophic forest fires that occurred in Kenya in the 2009 fire season, this study suggests orchestrated efforts to be redirected to the fire disasters. We strongly believe that a strong institutional support from the Kenya Forest Service coupled with in-depth research on the concept of CBFFM with the necessary financial backing and a strong political will can form a benchmark upon which to pivot future fire intervention measures. The mentioned National Round Tables enriched by a range of crosscutting measures highlighted in this study can act as a basis of implementing a CBFFM in Kenya.

### **Conceptual Approaches in Formation of CBFFM in Kenya**

Findings in this study coupled with the suggested array of crosscutting measures and backed by strong literature predict a successful National Round Table and subsequent formation of a CBFFM in Kenya. Complexity of forest communities and pluriformity of the legal context on land tenure and resource use rights have challenged Consensus

building in many cases. To overcome these, the state or forest custodian must win the community participation. This study has earmarked CFAs as a solution to this. Currently, the CFAs are not only institutionalized but are backed by strong legislation. As such, the Kenya Forest Service can move with speed and convene National Round Table and form CBFFM to tame the escalating fire disasters threatening our ecosystems. We do not overlook the complexity that may befall the consensus building process as well as time to be devoted as pointed out by Goldammer *et al* (2008) but the benefits that may accrue from a well institutionalized and policy backed CBFFM strategy overrides all these. Further, we also understand that the CFAs, though institutionalized, they are still evolving into full pledged institutions with the capacity to manage forests. It is however, worth to note that the fire menace is of urgent concern since our exotic and natural ecosystems are threatened and game sanctuaries severely affected by fires. At stake, here, are future revenues for Kenya Forest Service, wildlife, tourism, water sector and not to mention the overall impact on climate change. Though Goldammer *et al* (2008) point out that consensus building is not only complex but also time consuming compared to mere planting of trees, he is quick to caution that unless fire management strategies are in place, trees in rehabilitated ecosystems will never have time to grow and become forest in presence of fires.

Elsewhere, Fashing (2003) states that 60-80 years is not even enough time for a forest subjected to these anthropogenic disturbances to recover and retain its ecological integrity. Fashing's findings are further supported by Mutiso (2007 and 2008) who cautions that major ecosystems in Kenya (Kakamega and Mt Elgon) are still recovering from anthropogenic disturbances of 1940s and 1990s respectively. Further, Kumar (2001) states that if these stresses are beyond a certain critical limit, the ecosystem can 'flip' off to an alternative state to the detriment of all the biota in habitation. We, therefore, propose a strong conceptional framework to be put in place with the mandate of reviewing a possible National Round Table and subsequent formation of CBFFM. Such a framework should be guided by a resolute political will, financial and institutional support, ecological and humanitarian considerations. Further, the approach should be based on the following considerations:

- ✓ Reasons: fire is a spatially and temporally disperse phenomenon. It is difficult to have a centralized control system, particularly in developing countries. Responsibility for fire management must be brought closer to those who benefit both from the use of fire and from having more control;
- ✓ Objectives: rational, ecologically compatible, sustainable and safe use of fires is very important. With few exceptions, complete disuse of fire is undesirable;
- ✓ Impediments: defining responsibility or 'the community', the need for complementary policy and legislative changes, identifying and supplying technical and other support needed to enable communities assume a central role in fire management are some of the difficulties encountered; and
- ✓ Entry points: possibilities include definition of mechanisms, methods and policy instruments (e.g. incentives) to encourage communities to assume control and 'ownership' over fire management.

### **Prevalence of Fires across Species in Studied Sites**

While we attribute observed differences in fire incidences to differences in species susceptibility to fires, we greatly associate it to species distribution in the study sites. We isolate the case of Kiptunga where cypress formed 80% of the plantation area. As such, we expect such a species to depict high incidences of fires as opposed to Koibatek and Maji Mazuri where species were fairly distributed. It is also worth to note that species respond to fires at varying degrees. While species with high coppicing ability can recover from the effects in the longrun, others such as cypress and pines are poorly adapted and rarely recovers. UNO (1994) further documents that some forest trees are poorly adapted to withstanding burning. They have a thin bark and negligible ability to produce vigorous epicormic shoots or root suckers after a fire has passed. Some contribute little or nothing to soil seed banks thus posing a threat to forest recovery.

Recurrence of the fires is the main threat to the recovery of forests. Even in species that are adapted to fires, such a recovery may not be of economic importance in the long-run as long as the fires recurs in the preceding years. We isolate the case of Menengai forest. In the recent years, the forest lost 270Ha of forest to fires. During a recent survey on the forest, under the on-going National Plantation Inventory, we found that the greater part of the forest is under *eucalyptus* species. However, such plantations, despite the strong coppicing ability of eucalyptus, never grows beyond pole size. The forest burns on yearly basis leaving no time for recovery. These findings are echoed by [Toma \*et al\* \(2009\)](#) who cautions that all silvicultural techniques are useless in forest rehabilitation unless they include fire prevention. The prevention and management of fires are vital to allow forest recovery and rehabilitation to proceed.

This study was restricted to the notoriously fire prone areas in the country. In the recent years, Koibatek forest lost 1000ha, Maji Mazuri 300ha, Esageri 100ha, Kiptunget 2900ha, Chemususu 100ha, Dundori 440ha, Logoman 350ha, Sururu 548ha, Baraget 105ha, Nessuit 300ha, Eburu 1100ha, Central Ontulili 200ha, Ontulili 500ha among others. With the Kenya Forest Service less prepared to counter such disasters coupled with escalating severe droughts in the country, the situation may probably worsen in coming years. In the 2009 fire season, Nessuit forest was almost wiped out by forest fires. As we were called to reinforce fire-fighting crew in Nessuit, Koibatek, Kiptunget and other forests that burned severely in the 2009 fire season, we learnt a different trend. In as much as these fires having been started by humans, the community played a minor role in countering the menace. Despite the fires burning a few metres from the settled reserves, community members watched from a distance as hundreds of hectares went up in flames. Sensitizing the community on the impact of forest fires as well as empowering them to ‘own’ and take control of fires can meaningfully reduce the magnitude of the fire disasters.

### **Community Involvement and Empowerment in Managing Fires**

In this paper, we proposed the formation of CBFFM through the use of the current CFAs. We, hereby, elaborate on the crosscutting issues that are pertinent to a successful community participation in fire management. The following should be thoroughly investigated before community participation can be involved:

- Local ecology e.g. what is the likely ‘natural’ role of fire for the indigenous ecological regime (e.g. tropical rainforest, woodlands, grasslands, tall closed canopy);
- History of the community’s use of fire;
- History of the area, including both ecological and socio-economical changes; and
- Inter-relationships among people, fire and ecology that have contributed to the current situations and options for future interactions.

The objective of fire management must be clearly understood by all stakeholders. Where fires are to be managed by the local with vested interests such as agriculture, it will be necessary to change undesirable practices by providing incentives and supporting alternative livelihoods (Gauld, 2000, Gounner, 2000; IFEJ, 2006). This study propose the following incentives for forest fire management:

- ◆ Providing external support from governments, international organizations to initiate and finance work by community ‘volunteer’ and to build fire breaks and firelines;
- ◆ Improving community skills in fire management such as training communities to use simple tools for fighting fires;
- ◆ Offering alternative livelihood strategies; and
- ◆ Increasing tenure security through the lease of the forestland.

Further, as a way forward in fire management, community awareness, skills and techniques, especially where PELIS is being practiced, should be promoted through:

- Establishing firebreaks, buffer strips and firelines;
- Preventing fires from spreading by piling trash in the middle of the field, burning only in early morning or evening of the dry season and against the wind and back burning;
- Protecting valuable trees by removing underbrush;
- Relying on experienced villagers to manage fires;
- Fore warning all households in the community about the fire to be set so they can take precautions and announcing fire outbreaks over village meetings or loud speaker;
- Implementing a monitoring system for patrolling fire prone areas during the dry season and building watch towers; and
- Encouraging the community involvement in fire fighting.

We further suggest that resources should be availed to the community to manage fires. Careful planning is needed to ensure that the rural poor are not overburdened especially where tangible benefits cannot be isolated in the near future. We therefore put forward the following options:

- ✓ Ad hoc community involvement or more organized community volunteers requiring only limited financial inputs;
- ✓ Development of alternative livelihood strategies such as animal husbandry; and
- ✓ External support from government, international and local organizations and institutions



Such support will promote inter-community co-operation and strengthen the community's technical skills for fire management. Empowering community to manage fires should also ensure sanctions are put in place for starting uncontrolled fires. We suggest that where government legislation is lacking, community-enforced fines and other penalties can work better. Nevertheless, in as much as the community may impose fines, the government of the day should rise to the occasion and prevent uncontrolled fires especially where offenders are not members of the community. We advocate for bold policy and legislative reforms on fire management coupled with thorough explanation of the pluriformity of the legal context to the local community who eke out their living from the forest.

### **Fire Incidences across Different Age Cohorts in Sampled Areas**

The observed weak correlation can be attributed to differences in age class distribution which differed greatly in each of the studied sites. It is worth to note that age cohorts for different plantation areas are mainly determined by the prevailing harvesting and replanting regimes. In Kiptunga, most of the plantations were mature. Though during the time of this study, exploitation by Raiply and Comply companies were on-going, it is highly probable that harvesting and replanting programmes have not been harmonized. This is in contrast to Koibatek and Maji Mazuri where harvesting was characterized by replanting programmes hence plantations of different age cohorts. Many young plantations burnt in Maji Mazuri compared to the other sites. Though this study could not authoritatively point out the reason behind this, community negligence played a key role in this. We isolated the case of a young *Pinus patula* plantation adjacent the Maji Mazuri village. Despite the village housing over a thousand households of the former forest employees and other forest depended communities, the plantation was completely destroyed by fire. Several other plantations adjacent the village and of different age cohorts had also severely burnt in 2009 fire season. We also isolated a different case where peasant farmer had let fire to run wild in his bid to clear land for cultivation under the PELIS. It was a scene of utmost negligence since the land under clearance was between a mature *P. patula* and *C. lusitanica* plantations that had completely burnt the previous week. A few metres from this, livestock keepers had left smoldering fire points scattered in an expansive *P. radiata* plantation.

This study suggest that where PELIS and grazing are on-going, rehabilitation efforts will always be frustrated by conflict of interest unless the locals 'own' and take control of fire management. We do assume that these people are aware of the consequences of uncontrolled fires as also supported by Gauld (2000). As such, it is expedient to capitalize on this awareness to promote action on the ground. While we strongly support formation of CBFFM and their facilitation through institutional and financial backing, sanctions against community members who intentionally start fires should be put in place. Schemes that can stand the test of the time, and developed through consultative bottom-up and top-down approaches should be put in place to deal with human negligence in use of fire. Gauld (2000) single out the case of Lao PDR's Kalaum district, Sekong province, where some people have even been jailed for indiscriminate burning. At this stage, the study finds, coercive measures against menfolk burning our forests will not in the longrun solve the fire muddle in the country, neither will piecemeal episodic interventions help in solving the historical fire problems but a bold policy intervention strongly backed by the government and the forest communities.

Such a policy should narrow down to National Round Tables on fire management and subsequent formation of CBFFM.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

- ✓ All fire incidences in sampled sites were human-induced. Use of fire as a tool in land preparation under the PELIS as well as by herders during cold seasons were largely blamed for the fire incidences. This study could not rule out arsonist in the fire incidences but could not authoritatively establish this;
- ✓ Most of the fire incidences were restricted in plantations near settled reserves. Community empowerment and participation in fire fighting was largely lacking. The Kenya Forest Service fire fighting crews were not only less prepared to deal with the disaster but were ill-equipped and facilitated; and
- ✓ We further concluded that Nakuru and Koibatek districts as well as the Mau complex are high fire risk areas historically. As such, the recurring fire incidences annually, will continuously burn the forests in the coming years. Burnt and later rehabilitated forest areas will never grow to become mature forests of any economic or ecological value. Therefore, all silvicultural treatments will be useless unless bold intervention measures are put in place to fight the escalating fire menace.

### **Recommendations**

#### **Management**

- We strongly recommend community-based approach in dealing with the fire disasters in the country. We propose consultative bottom-up and top-down approaches in consensus building process. The process should entail National Round Table on fire management with full participation of the autochthons who eke out their livelihoods from the forest and other stakeholders in the forest sector. We have earmarked the current CFAs as a platform on which consensus building can be anchored. The National Round Table should culminate in the formation of Community-Based Forest Fire Management (CBFFM);
- The study further recommends that it is expedient for the Kenya Forest Service to capitalize on the already institutionalized and legislatively backed CFAs to build consensus for possible formation of a CBFFM;
- Piecemeal episodic interventions will not solve the current fire crisis but we recommend a bold policy intervention coupled with resolute political commitment. Successful CBFFM will require legislative and policy reforms strongly backed by institutional and financial support as well as thorough explanation of the pluriformity of the legal context to the locals;
- Sanctions for starting uncontrolled fires should be put in place. Policies that guide use of fires and forest resources should be used to reduce the menace. To us, CFAs or community-enforced fines and other penalties can work better than government legislation in discouraging people from breaking fire rules; and

- Sanctions and incentives should go together for effective fire management. Fire fighting crews from the Kenya Forest Service and the community should have adequate logistical support. Transport, equipment and allowances should be availed to the disaster respond teams. This was largely lacking in the 2009 fire season.

### **Research**

- Before National Round Table is convened, we strongly recommend an in-depth research on various policies governing community forest resource use and ownership rights. To avoid conflict of interest, community land and resource tenure should be clearly understood by all. This may call for a paradigm shift in some of the land policies in the country; and
- A cost-benefit analysis should precede National Round Table and subsequent formation of CBFFM. This will entail formulation of a conceptional framework for investigating community forest fire management, including socio-economic and technical aspects.

### **Acknowledgement**

Donation awarded by the World Bank and the Government of Kenya to Kenya Forest Service in support of Forest Plantation Inventory Component of the National Resource Management Project, facilitated most of the logistics involved in the study. The field crew in the Kenya Forest Service, who thoroughly traversed the study ecosystems during data collection, is highly recognised. You did a wonderful job and God Bless you. Professionals in forestry and Range Management from Moi University, thank you for your review and insights of the paper.

## REFERENCES

- Dogra, B (2009)** ENVIRONMENT-INDIA: Forest People Take War on Evictions to the Cities. IPS, New Dheli, India
- Fashing, P.J., Forrestel, A.; Scully, C. and Cords, M. (2003)** Long-Term Tree Population Dynamics and their Implications for the Conservation of the Kakamega Forest, Kenya. *Biodiversity and Conservation* 00: 1-0, 2003.
- Johann, G., Goldammer, Peter, G., Mike, J., Kamminga, E., Kruger, T., Ing, S. Pogeyed, M( 2009)** Community Participation in Integrated Fire Management: Experiences from Africa, Asia and Europe.
- Goldammer, J., Seibert, B., Schindele, W (1996)** Fire in Dipterocarp Forests. In: Schulte, A., Schone, D (Eds.) *Dipterocarp Forest Ecosystems: Towards Sustainable Management*, 155-185. World Scientific Publishing, Singapore.
- Goldammer, J (1999)** Forests on Fire. *Science* 284:1782-1783
- Gauld, R (2000)** Maintaining Centralised Control in Community-Based Forestry: Policy Construction in the Philippines. *Ij Development and Change, Vol. 31*, Blackwells
- Gonner, C., (2000)** Causes and Impacts of Forest Fires: A Case Study from East Kalimantan, Indonesia. *IFFN No. 22* – April 2000. University of Freiburg.
- Gouyon, A., (1999)** Fire in the Rubber Jungle: Fire Prevention and Sustainable Tree Crop Development in South Sumatra. *IFFN No. 21* –September 1999, 48-56pp
- Ghosh, S., Bijoy, C (2006)** Campaign for Survival and Dignity, National Forum of Forest People and Forest Workers. IPS, New Dheli, India
- IFEJ (International Federation of Environmental Journalists (2006)** Gap between Policy and Research in Southeast Asia. Workshop Held On 31<sup>st</sup> May – 2 June 1999, in Chiang Mai University, Chiang Mai, Thailand. Edited By Tomich, T., Thomas, D., Van Noordwijk M. ASB – Indonesia *Report Number 10*. Bogor, Indonesia.
- Ing, S (2000)** Community-Based Wildfire Management in Mongolia. *International Forest Fire News No. 23: 57-60.*
- ISDR (International Strategy for Disaster Reduction) (2009)** Disaster Prevention, Education and Youth. The Specific Case of Wildfires. UN 2000 World Disaster Reduction Campaign. Educational Kit Produced By UN ISDR, Geneva – San Jose.
- Kamminga, E (2001)** Impact of the Integrated Forest Fire Management Program on Rural Livelihoods in East Caprivi, Region, Namibia. Namibia-Finland Forestry Program, March 2001. Also Published in *International Forest Fire News No. 25: 39-57.*
- Kumar, C (2001)** Community Involvement in Forest Fire Prevention and Control: Lessons from Joint Forest Management (JFM), India. *International Forest Fire News No. 26:28-31.*
- Mori, T (2000)** Effects of Droughts and Forest Fires on Dipterocarp Forest in East Kalimantan. In: Guhardja, E., Fatawi, M., Sutisna, M., Mori, T., Ohta, S (Eds.) *Rain Forest Ecosystem of East Kalimantan. El Nino, Drought, Fire and Human Impacts 29-45.* Ecological Studies, 140. Springer.
- Mutiso, F (2007)** Applicability of Selected Sampling Designs to Forest Health Assessment: The Case of Kakamega Moist Tropical and Mt Elgon Montane Forests. M.Phil Thesis, Department of Forestry and Wood Science, Moi University, Eldoret November 1, 2007.
- Mutiso, F., Sang, F., Tarus, G., Chemitei, G., Simiyu, W (2009)** The Role of the Stinging Nettle in the Diet Base and Medicinal World among the Rural and Urban Livelihoods: The Case of Aberdare and Mt Kenya Regions. Unpublished Research Paper.
- Mutiso, F., Tarus, G., Chemitei, G., Sang, F., Simiyu, W (2009)** The Sacrifices made to Save Water Towers; Mt Kenya and Aberdare Ecosystems: A Panacea to Saving the Mau complex? (Unpublished Research Paper).
- Ministry of Agriculture (Ethiopia) with GTZ and GFMC (Eds.) (2001)** Proceedings, Round Table Conference on Integrated Forest Fire Management in Ethiopia, 19-20 September 2000, Addis Ababa, Ethiopia. Ministry of Agriculture, Ethiopia.
- Toma, T., Oka, T., Mnnjenah, M., Fatawi, M., Mori T (2009)** Forest Rehabilitation Requires Fire Prevention and Community Involvement. Tropical Rain Forest Research Center (PUSREHUT), Mulawaman University, Samarinda, East Kalimantan, Indonesia.
- Toma, T., Matius, P., Hastaniah, Kiyono, Y., Watanabe, R., Okimori, Y (2000b)** Dynamics of Burned Dipterocarp Forest Stands in Bukit Soeharto, East Kalimantan. In: Guhardja, E., Fatawi, M., Sutisna, M., Mori, T., and Ohta, S(Eds.) Rain Forests of East Kalimantan: El Nino , Drought, Fire and Human Impacts, 107-119. Ecological Studies, 140. Springer.

**Tomich, T., Van Noordwijk, M., Budidarsono, S., Gillison, A., Kusumanto, T., Murdiyarso, D., Stolle, F., And Fagi A (Eds) (1998)** Alternatives to Slash and Burn in Indonesia. Summary Report and Synthesis of Phase Ii. ICRAF, South Asia, Bogor, Indonesia

**UNO (United Nations Organization) (1994)** Conservation and Management of Closed Forest: A Manual of Field Techniques for Students and Trainees. UNO/RAF/006/GEF. E,A. Forest Field Workshop, April – May 1994, Uganda.

**World Bank/Government of Kenya (1999)** Implementation and Completion Report (Kenya Forestry Development Project). Credit 2198-KE January 1999. Report No. 18805.