



ROYAL GOVERNMENT OF BHUTAN
MINISTRY OF AGRICULTURE AND FORESTS
THIMPHU BHUTAN

FOREST FIRE MANAGEMENT STRATEGY FOR BHUTAN



2013

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FOREWORD BY THE MINISTER

Every year a significant area of valuable forests is being ravaged by forest fire leading to huge loss of biodiversity and revenue for the Government. Most of these fires are human-induced which normally stemmed from agricultural debris burnings, land clearing activities, activities directed towards inducing fresh flush of grass for livestock management, extraction of non-wood forest products, industrial development, and negligence of the people, communities and sometimes arsons.

Research has shown that forest fires have both beneficial as well as harmful effects on the forest ecosystem and livelihood of the people. In a forest where no fire has occurred for several years the fuel load get accumulated on the forest floor and when a fire breaks out in such forests it will burn with very high heat intensity and also dangerously. The number of fires continues to increase in such forests getting larger and gaining in intensity. In future this condition will become increasingly dangerous as urban and sub-urban areas are continuously encroaching on forested spaces.

Fire also has important effects on the abiotic components of an ecosystem, particularly the soil. Fire can affect the soil by direct contact with it and by its effects on the plant community associated with it. During the forest fire, if the overhead vegetation is completely burnt it can lead to increased solar radiation on the soil surface during day time resulting in greater warming, and to greater cooling through the loss of radiative heat at night. This condition is seen to help aggravate in increasing soil as well as atmospheric temperature leading to warming effect.

Because of the socio-economic situation and physiographic conditions of the country, harmful effects of forest fire have been greatly out-weighting the beneficial effects. Whenever fire starts burning the forests the loss inflicted to the country and society is colossal and in many instances causing irreversible damage to the ecosystems, environment and wildlife habitats.

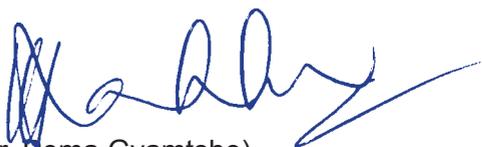
However, in Bhutan, fire has been used as land management tool by the rural communities since time immemorial and it is still being used widely in almost all parts of the country. It has not been possible to totally ban the use of fire

or do away with it. As such appropriate options need to be formulated so that use of fire as land management tool is continued by the rural communities at the same time the forests are also protected from fire.

Therefore it is very important to develop a very sound and scientific forest fire management strategy so that the valuable forests including the fragile environment are saved and helps Bhutan remain carbon neutral as declared during UNFCCC COP 16 in Copenhagen.

It is very heartening to note that the Forest Fire Management Strategy developed by the Department of Forests and Park Services has incorporated both the (a) beneficial as well as the (b) harmful effects of fire to the ecosystem (c) use of fire as an important land management tool and recommended community based management of fire by involving the local communities, volunteers and religious leaders.

It is expected that the paradigm shift in managing forest fire, through local communities, would help the Department to keep a check on the occurrence of forest fires in the country and also allow the rural communities to use fire as land management tool.



(Dr. Pema Gyamtsho)
MINISTER

FOREWORD BY THE SECRETARY

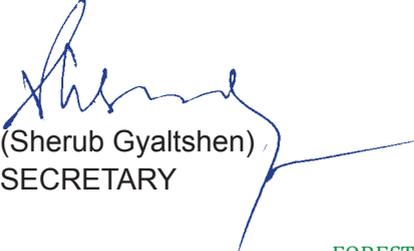
Scientific management of forest fire, in the country, has been a challenging task for the Royal Government. Thousands of acres of forest are being destroyed by fires every year leading to huge loss of revenue and biodiversity in the country. At the same time valuable time of forestry staff is also lost, during the fire season, in fighting forest fires. Often even lives and properties of the people are lost.

Bhutan's commitment to remain carbon neutral has also been seriously challenged by frequent occurrence of forest fires *vis a vis* large tract of forest being burnt every year. Different ecosystems, specific wildlife habitats and regeneration of seedlings are damaged leading to degradation of forests specifically in the conifer belts.

Use of legal provisions alone is not effective in managing forest fires in Bhutan because traditionally use of fire is linked to land management and farming system activities in rural areas. Community participation in fire management is crucial to ensure sustainability of rural livelihood and social responsibility. The Department of Forests and Park Services alone would not be able to cope up in prevention as well as suppression of forest fire because the extent of fire occurrence is throughout the country and mostly in difficult terrain.

It is very heartening to note that the Department of Forests and Park Services has developed the Forest Fire Management Strategy incorporating various options like community based management system, involvement of forest fire fighting volunteers, religious leaders for dissemination of fire prevention information, and taking on board the school students and designing incentives for accumulation of carbon credits under individual's name which could be used to obtain rebate for electricity energy and water used by the individual.

It is hoped that this innovative Strategy incorporating all possible tactical options would be useful in managing forest fire in the country so that our valuable forest, lives and properties of the people, important ecosystems are protected as well as the rural communities can still avail the opportunity to use fire for their land management activities in the rural areas.



(Sherub Gyaltshen)
SECRETARY

FOREWORD BY THE DIRECTOR GENERAL

Forests, in Bhutan, had been experiencing forest fires since time immemorial. Every year large tracts of valuable forests are burnt leading to destruction and degradation of specific wildlife habitats and important ecosystems.

Every year the Royal Government is spending huge amount of money on forest fire related activities like fire line clearance, fire prevention and fire suppression activities. Despite tremendous efforts made by the Royal Government for scientific management of forest fire, no significant difference could be made on number of fire occurrence and area burnt. Fire keeps on ravaging the valuable forests every year threatening lives and properties of the people living in the vicinity. Forests are degraded, fire sensitive ecosystems destroyed and huge amount of Government budget and many man-months are lost while suppressing forest fires in the country.

To enhance holistic management of forest fires in the country, the Department embarked on the development of a strategy that is socially acceptable, economically viable and environmentally feasible. The Department alone cannot ensure protecting of vast stretches of forest from fires and thus seeks collaboration from all stakeholder and citizens in this daunting task.

The Strategy, therefore, strongly proposes introducing community based management of forest fire, enrolment of forest fire fighting volunteers from all sections of the society, introduction of incentives like accumulating carbon credit and availing opportunity for getting rebate on electric energy and water consumption.

It is hoped that with the implementation of the Strategy, the Department would be able to reduce the number of forest fires in the country and save many acres of valuable forests in future.



(Chencho Norbu)
DIRECTOR GENERAL

FOREST FIRE MANAGEMENT STRATEGY FOR BHUTAN

1. Context

- i. Occurrence of forest fires in the country, during dry winter months, is a common phenomenon. The rugged terrain coupled with huge volume of fuel-load on the ground, erratic and strong wind further aggravates the occurrences and spread the fire very fast especially in the conifer forests.
- ii. Records maintained by the Department shows that thousands of acres of valuable forests are destroyed every year threatening wildlife habitats and biodiversity resulting in loss of revenue in million of Ngultrums. This situation is creating difficulties in safeguarding the Constitutional requirement of maintaining 60% of the land under forest covers for all times to come. It is observed that forest fires, in Bhutan, commonly occur below 2,500 metres altitude with higher burning intensity in dry zone during winter months
- iii. During the winter months, people start preparing land for agricultural and horticultural purposes. People employ fire as a cheapest tool to burn agricultural refuse and debris. The unmanaged use of fire in or adjacent to the forest occurs frequently and when such fires escape to the forest accidentally. Huge tracts of forest is burnt making large expense of forest vulnerable to pests and diseases attack thereby causing degradation of the forest. In some cases, fires are set deliberately by the cattle herders to obtain flush of green grasses for their cattle.
- iv. It is, in this context, a sound fire management strategy is needed so that fire as a land management tool is to be used by the farmers and while at the same time the unwanted and hazardous forest fires are also prevented.

2. Causes and season of forest fires

- i. In order to develop effective and appropriate strategy measures it is important to understand the causes of forest fires in the country. As per the record, about 60% of the forest fires are caused while burning agricultural debris by the villagers, and intentional burning of lemon grass areas in the chir pine forests and also deliberate setting of fires in *tsamdos* for grasses by the cattle grazers. Another 20% are caused by children playing with ignition materials, roadside workers, picnickers, camp fires etc and about 15% are caused accidentally and another 5% is through unknown sources. Most of the above-mentioned causes are anthropogenic in nature and are related to livelihood and land management activities.
- ii. Besides the above-mentioned causes the following sources of fire also need careful study and devise appropriate strategy measures to manage them. (a) Fire left un-extinguished by the cattle herders (b) fire started by labourers working in the roads for heat and melting bitumen and (c) electrical short circuits.
- iii. The duration and fire occurrences, in Bhutan, depend on geographical locations and climatic condition like length of dry season, rainfall pattern and fuel-load on the forest floor. In general it is observed that fire season starts from November and lasts till May of the following year. In the eastern part of the country the peak season is between February to March intensifying during the month of March whereas in the western region the peak season is January to May heightening the burning intensity during the month of January. The risk factors in both these regions are very high because the total annual rainfall is less than 1000 mm. The risk factor in central and southern regions is medium to low with total annual rainfall more than 1000 mm and in many areas above 2000 mm.

3. The Strategy Development Process

- i. The Strategy has been developed by a task force of senior forest officers who were appointed to draft the document. Many rounds of in-house discussion and consultations were held within and outside the Department. Feed-backs and comments were also sought from all relevant stakeholders.

- ii. After incorporation of all relevant comments and feedbacks the document was uploaded in MOA websites for public reading and further comments.
- iii. Finally, the draft, after incorporation of feedbacks and making relevant changes was submitted to the Ministry of Agriculture and Forests for approval.

4. Objectives

To implement the strategy the following objectives shall be pursued:

- i. Develop and strengthen necessary policy measures, legislation and institution for forest fire management;
- ii. Mobilize local communities, fire volunteers, De-Suups, Armed Forces, Civil Society Organizations, government and non government organizations for prevention and control of forest fire;
- iii. Develop communication and information management system for forest fire management and disaster mitigation;
- iv. Develop guidelines for wise use of fire for ecosystem management and for livelihood of the local communities.
- v. Develop clear roles and responsibilities for various institutions and organizations so that unwanted fire is prevented and controlled.
- vi. Create enabling environment for national and international co-operation to address the problems arising from uncontrolled national and trans-boundary fire disaster.

5. The Strategies

- i. The strategy focuses mainly on the preventive aspect of forest fire management through environment education, awareness raising, and community involvement. Emphasis has also been made to establish forest fire volunteers for prevention, suppression and post fire management.
- ii. Capacity building of forestry staff, fire volunteers, communities, De-Suups and Armed Forces through trainings and visits need to be

given high priority. Further where fire is to be used as a tool for land management related activities it is recommended to use safely and effectively under the guidance of local forest officials with permit.

- iii. Operational guidelines, for management of forest fire, should be developed based on this strategy that should clearly outline operational responsibilities of all stakeholders, organizational structures, standard operating procedures and actions with regard to forest fires.
- iv. Concurrently the Forest Fire Section under DOFPS should develop and promulgate the necessary administrative instruments required to give effect to the strategy and guidelines across all agencies and at all levels from local communities to the national agency.
- v. Therefore based on the objectives outlined above, the following strategy measures shall be followed for effective and scientific management of forest fire in Bhutan.

5.1 Develop and strengthen policy measures, Legal Instruments and Institutions

- i. The National Forest Policy of Bhutan 2011 has adequate provisions for prevention, suppression and control forest fires in fire sensitive ecosystems. The Policy also has provision to use fire as tool for improving the ecosystem health. Therefore there is acceptable Policy support for implementing the strategy.
- ii. The Forest and Nature Conservation Act of 1995 has provision prohibiting setting of fire or leaving camp fires burning in such manner that might destroy, damage or endanger trees, or any forest produce or wildlife. It also has provision requiring every village head to organize fire watchers and team to put out fire fires and also to identify the culprits who have caused the forest fire. The provisions contained in the Forest and Nature Conservation Act 1995 is not sufficient. The Act need to have provisions for using fire as tool for managing different ecosystems and also to support livelihood issues of the local communities using fire as management tool. Since rural communities use fire to support livelihood and land management activities therefore it is necessary to have sufficient legal provisions that support the above-mentioned activity. Therefore the Act needs be revised to

include provisions that will support the use of fire as a tool to manage sensitive ecosystem and livelihood activities. The Forest Fire Rules of Bhutan 2012 should also be reviewed based on Forest Policy, Act and forest fire management strategy.

- iii. Institutions including resources, Policy and legal support are very important for effective implementation of the strategy. Therefore strengthening the existing Institutions is required for proper coordinating the forest fire management activity in the country. DOFPS has a Section, at the HQ level, to deal with forest fire management and control but since the activities pertaining to forest fire management are implemented at the Dzongkhag level as such each Division/Park should have Forest Fire Management responsibility. However since the activity is time bound and seasonal it is recommended that the activity should be managed by multi-tasking using the existing staff of the Division/Park. The Forest Fire Management Section of the DOFPS shall be responsible for co-ordinating all activities related to fire management and suppression at the field level. It should also have the mandates of keeping all relevant information and data pertaining to forest fire management. The Section should be headed by a trained forest fire management professional.
- iv. The Forest Fire Management Section of the DOFPS should be organized so that (a) fire prevention (b) fire suppression (c) post fire rehabilitation and (d) safety of public and fire fighters are addressed properly. The present organization is not adequate to cater to the need of above-mentioned activities. Therefore proper Terms of Reference should be developed for the Section.
- v. Proper fire suppression mechanism needs to be established under each territorial Division/Park level so that the fire suppression related activities could be immediately put in place in the event the fire escapes into the forest. Incident Command System (ICS) is very effective for suppression of forest fires therefore this system should be established as a methodology for command and control of fires and other emergencies with properly defined chain of command, resources mobilizing authority, transportation of forest fire fighters, villagers and volunteers. Similar facilities and organization need to be established in fire prone Dzongkhags, territorial Divisions and Parks. The important aspect of the incident management team is that personnels should be

appointed to the team based on their capacity to undertake the role rather than on their seniority.

- vi. During the course of fighting forest fires if people are injured there should be provisions for addressing activities like rescue, relief and rehabilitation. Safety of the local people including volunteers and staff of the Department should be given high priority. Adequate provisions should be kept at each Division/Park level. The Incharge of the Fire Section at DOFPS should co-ordinate and make sure that adequate budgetary provisions are kept in all Divisions/Parks. Special attention would be required for those Divisions/Parks that are located in high fire risk Dzongkhags.

5.2 Education, creating awareness, and technology development

- i. Raising awareness through education would be very important component of the forest fire management strategy. DOFPS should target both the rural communities as well as people living in urban areas. They should be made aware of the ill effects of fire on the environment, live and properties of the citizens and the associated natural resources including wildlife. Awareness programme should be carried out at different levels of the society including the school children and teachers. The basis of effective community education should be to develop clear messages that suit the key target audiences. In the case of forest fire prevention, the messages should be directed at those people most likely to be able to take action to prevent forest fires. A frequent source of forest fires is agricultural and horticultural debris burning which subsequently escapes to the forest and the other is intentionally setting fire in the lemon grass areas. Therefore the forest fire prevention messages should be targeted to these audiences.
- ii. Effective prevention can be achieved by developing community education messages targeting those people who light fire for burning agricultural debris, lemon grass forests and to ensure that they are aware of appropriate means of preventing the fire escaping.
- iii. Forest protection and environment conservation groups or NGOs would be very powerful motivators for fire prevention as well as suppression provided the Department supports them with resources to reach the target audiences with appropriate messages. It is recommended that

the Department engages such groups to disseminate fire prevention and suppression messages. Further it is also important to examine that the messages conveyed by such an approach are correctly balanced to ensure consistency with the strategy on forest fire management. Under this strategy unwanted fires should be differentiated from those that are used as tools for land management to support livelihood activity.

- iv. Effective forest fire management programme should entail appraisal of the high fire risk period and the common causes of fires in that particular region. Different extension tools or materials should be used to communicate with the different target audiences like rural communities, orchard owners, cow herders, forest workers, road labourers, people living in urban areas etc. The extension materials and media used should suit different target groups.
- v. The media used for disseminating forest fire prevention messages should be (a) television and radio (b) bill boards and posters (c) fire danger warning signs (d) environmental education programmes in schools and colleges (e) exhibitions (f) installation of fire mascot in appropriate places that conveys the fire prevention messages understandable by the local people.
- vi. DOFPS should develop a national mascot and encourage formation of forest fire protection movement to solicit community support for forest fire prevention especially among young people. The village volunteers would be willing to assist in such endeavor provided they are given guidance and support by the Department. Such a movement would form an important element in disseminating the fire prevention message.
- vii. Remote sensing and GIS based fire detection and monitoring technology need to be developed and installed. The technology should be installed in DOFPS HQ level but the information obtained through this technology should be communicated or passed on to all the Dzongkahgs, territorial DFOs, Park Managers and community leaders especially the Gups.

5.3 Promote participatory approaches for managing forest fire

5.3.1 Community based fire management

- i. Forest fire management programme should be community based management. Based on some preliminary findings it is known that most land use activities in the rural areas are tied to livelihood of the local people. There are no alternatives or choices with the communities to totally do away or switch over to other options. It is therefore very important to understand the requirement of the people and accordingly appropriate options are designed so that communities can still use fire as tool for (a) agriculture debris burning (b) burning grasslands (c) burning lemon grass areas for getting fresh flush of grasses and at the same time unwanted forest fire are prevented.
- ii. In eastern part of the country earning from lemon grass activity constitute sizeable percentage of household income therefore use of fire, by the communities, as land use tool, will continue as such the strategy envisages forming local community based forest fire management Committee at the Chiwog level. The Committee shall be responsible for management of fire in that Chiwog. The local Dzongkhag Forest Officer in consultation with the local government should provide (a) training to the local communities (b) assist in the formation of fire management committee (c) provide technical backstopping for suppressing the fire when fire escapes to the forest. In the community forest, the community forest management group should take the responsibility of managing the fire in their forest. The concerned Chiwog Tshogpa shall act as Chairman of the fire management committee.
- iii. The frontline responsibility for fire detection, prevention and suppression should rests with local village communities. The Chiwog Tshogpa or the nearest forest office should be authorized to issue permits and manage the controlled use of fire within their area. The role of DOFPS should be to initiate, support and guide the process through training, provision of legislative support; formation of community based fire management groups, and provides co-ordination and backup in the event the fire threatens to involve more than one village or community.
- iv. When there is fire out-break the Misups/Risups should inform the Chipon/Gup and simultaneously also inform the villagers and mobilize

the village volunteers for combating the fire. The information should also go the Incident Commander (IC) of the Dzongkhags and it shall be their responsibility to further mobilize additional manpower, equipment and other required resources and logistics upon receiving the information from the Misups/Risups. Effort should be made to control the fire before it gets out of control. The Head of Department shall be responsible for appointing Incident Commander for each Dzongkhag.

- v. After the fire has been controlled, the remnants of the fire in the tree trunks, fallen logs and sometimes below the surface of the forest floor, with thick humus, should be extinguished thoroughly. The threat of fire does not cease after the flames have been extinguished, as smoldering heavy fuels may continue to burn unnoticed for days after flaming.
- vi. Forest Fire Section of DOFPS should develop local operational plans that determine operational responsibilities, local strategies, local organizational structures and actions to be taken by key players, stakeholders and collaborators at the various levels of the Communities, Dzongkhags, Department and other relevant agencies having the responsibility for suppression of forest fires.
- vii. The Department should explore to impose total ban on use of fire during extreme weather condition. Such ban needs to be backed by legally enforceable sanctions and must be introduced through an intensive community education programme. During the ban season, where the weather forecast predicts extreme fire danger for a particular Dzongkhag or locality, lighting of fires in the open, in those areas, should be totally banned. This information must be made known to the communities in a timely manner through national television and radio and also backed up by use of roadside signs. Any person detected lighting fire on a day of total fire ban would be subject to an appropriate legal action. Concerned Gups should be made an important collaborator of such activity and action taken should be supported by him also.
- viii. The Department shall explore to involve religious leaders and organizations in forest fire messages dissemination programme. A large number of such religious leaders and organizations exist in the country and many of them may be willing to participate in programs to protect the environment and improve the living condition of the communities. The involvement of such religious figures would be

especially important because of the influence that these people have within the community. They would provide an alternative channel for dissemination of fire prevention messages and therefore should be explored further.

5.3.2 Government Organizations, Civil Society Organizations and Individual Volunteers

- i. Since every individual citizen should be concerned about the state of country's forests and environment as enshrined in the Constitution therefore the DOFPS should endeavor to solicit participation of all civil servants working in the Dzongkhags to come forward and register as forest fire fighting volunteers.
- ii. Civil Society Organizations can play very important role therefore DOFPS should encourage these organizations to join as volunteer for fighting forest fire and support the Department in community organization in the villages and also in the urban areas.
- iii. Fighting forest fire is very strenuous and manpower intensive activity. Staff of the DOFPS alone would not be able to cope with such huge task therefore DOFPS should solicit support from all sections of the society. Volunteerism has worked wonder in many countries and since initiative has already been taken for establishing forest fire fighting volunteers in Thimphu it would be worthwhile to institute such volunteer programme in all Dzongkhags. Anyone who is interested and concern about the environment in general and forest in particular should be allowed to enroll in the programme. Fighting forest fires involves certain level of physical efforts therefore ideally forest fire volunteers should be physically fit for carrying out this arduous work. However age should not be the limiting factor as several types of skills would be required ranging from physically fighting the fire in the forests to monitoring from strategic or vantage points or delivering refreshment to the fighters. Therefore individuals of all ages should be encouraged to join the forest fire volunteer programme.
- iv. Traditionally the communities were responsible for protection of forest against fire. Misups were appointed for detecting and reporting forest fire cases to the nearest forest office. They were also responsible for mobilizing fire fighters in the case of forest fire incidences. In addition

to the Misups, the DOFPS should appoint Risups as village forest guards on consolidated wage system. The Risups should be given basic forest fire fighting trainings and should report to the concerned Divisional Forestry Office.

- v. DOFPS should develop detailed guidelines for registrations of the volunteers, both as organization and individuals. Before the volunteers are ready for going to the field they should be fully oriented and basic trainings should be imparted on forest fire fighting techniques.
- vi. DOFPS should also provide vital safety gears like helmets, gloves, safety glasses, face mask and first aid kits to the volunteers and foresters.
- vii. For facilitating procurement of standard forest fire fighting equipment a national procurement guidelines of such equipment should be developed by the Department so that adequate and standard equipment are purchased and distributed to all concerned collaborators based fire risk assessment.
- viii. Transportation of forest fire fighters to the site is very important activity and should be taken care by the concerned authority. If transport is arranged immediately the response time would be shortened and the fire can be controlled much faster. DOFPS should procure enough medium duty vehicles and kept ready during the fire season. Dzongkhags should also be provided with such vehicles for transporting forest fire fighting volunteers to the fire sight.
- ix. DOFPS should devise modalities for providing incentives for the registered volunteers. This will further motivate them to come to fire sight immediately. The incentives should be in the form of accumulation of carbon credits. The account should be maintained by the concerned territorial Divisions/Parks. Upon accumulation of certain number of credits DOFPS should consider providing rebate on electricity energy or water consumed by the volunteer in that particular month. The detail modality and tariffs should be worked out in consultation with Bhutan Power Corporation Limited and concerned Thromdey/Dzongkhags and appropriate guidelines prepared for implementing the incentives.

5.4 Promote co-ordination, collaboration and networking

- i. It is very important to develop co-ordination amongst different stakeholders and collaborators. Most important collaborators in forest fire management works are the Armed Forces (RBA, RBG and RBP), Schools, local communities, forest fire volunteers, De-Suups and some relevant government institutions. At present the co-ordination and collaboration, amongst the stakeholders, is reasonable in many Dzongkhags but in some it is weak. The Fire Section of DOFPS should devise mechanism to improve the situation further and more vigilance need to be put in place especially in those high fire risk Dzongkhags. It would be advisable to appoint focal point for each organization so that information could be passed or collected through these focal points.
- ii. Linkages, through networking, should be established by the Forest Fire Section of the DOFPS. All important and concerned collaborators and stakeholders should be brought under forest fire network. The information gathered, after analysis, should be shared through the network. It is very important to establish good understanding and working relation among the lead agencies and other concerned collaborators in all stages of planning, implementation and overall management of forest fire.

5.5 Establish communication and information management system

- i. No nationwide forest fire communications network exists at the moment. Much of the basic communication function is currently provided through mobile phones and walkie-talkies. This system is quite useful given the extensive coverage, but cannot be relied upon in times of emergency or when the network fails. There is a need to develop comprehensive and integrated communication systems for forest fire suppression. DOFPS should, therefore, prepare guidelines and standards for appropriate and adequate communication systems based on local operational requirements. The guidelines should also address equipment procurement, distribution and maintenance including planned replacement.
- ii. The information on fire occurrences should be collected regularly and analyzed. Annual report should be prepared and distributed to all concerned stakeholders and collaborators. The information

management system (FIMS) of the Department should be upgraded to accommodate forest fire information.

5.6 Training and capacity building

- i. The ability to detect forest fire incidences and respond with all necessary resources, trained personnel in the earliest possible time frame needs to be developed for all fire prone Dzongkhags. Containment and extinguishment of the fire must be achieved with the minimum impact in lives, property and the environment.
- ii. Capacity building at all level would be very important and the DOFPS should give very high priority for this activity. At the Dzongkhag level forest fire management would be community led assisted by the Department, NGOs, Armed Forces and Dzongkhag Administration. Therefore capacity building at this level, through trainings, should be given due importance.
- iii. The five year plans prepared by the DOFPS should have the provision for trainings on forest fire management at all levels focusing on (a) prevention management (b) suppression and incident management.
- iv. Under current system, most fire fighters use tree branches to swat fires. This is both exhausting and inefficient practice and under slightly higher fire intensity it is also dangerous because of the threat of burns and heat exhaustion.

5.7 Research

- i. The causes and effects of fire in the forest ecosystem and on livelihood of the communities are poorly understood. There are concerns that forest fires destroy the forest ecosystems, wildlife and their habitats and reduce the forest cover, releases carbon dioxide in the atmosphere and threaten lives and properties of the people. These concerns need to be authenticated and backed by research findings. Therefore the RNR-RDCs should include research on forest fire management in their annual work plan.
- ii. Based on the statistics maintained by DOFPS, it is observed that almost 95% of the forest fires are anthropogenic in origin and are strongly

linked to livelihood related activities like inducing good growth of lemon grass in the chir pine forests, green grasses for cattle after the dry winter months etc. Therefore it would be apt to consider conducting research on such issues and recommend suitable measures for consideration of the implementing agencies.

- iii. Research on forest fire management has been conducted in the past and there are many useful research findings on this topic therefore it is important that research on forest fire management is continued and taken up on priority basis. Such research not only builds credibility in policies that uses it, but also allows the development of a professional forest fire management system within the Department. It is noted with concern that forest fire management does not have a prominent place in the curriculum in forestry training institute as such the RNR-RDCs should assist in addressing this issue. Research is needed not only to determine the causes of forest fires but also to ascertain most appropriate messages that would be needed for effective prevention and suppression of forest fires.

5.8 Regional and International co-operation

Regional and International co-operations are required for addressing the following issues:

- i. Sharing information on forest fires as well as to acquire technologies that are available for detection of fires, fire risk mapping and monitoring fire burnt areas. It would also be useful for availing trainings, support in fire-fighting equipment. Research results and information sharing would also be very important component of effective forest fire management.
- ii. Forest fire also has certain common issues and trans-boundary effects. Near-ground smoke pollution adversely affects human health and security at local and regional level. Emissions from forest fires determine the composition and functioning of the atmosphere. Further the secondary disasters triggered by excessive forest fires also often cross national borders. These include destabilization of ecosystem functioning at landscape level, floods, loss of biodiversity, and even desertification. Thus, forest fire can have impacts on multiple nations and even the global community.
- iii. Quantification of impacts of forest fire at global level is needed in order

to understand the role of forest fire in regional change processes. Accurate and timely information is needed on the number of fires, area burned and phytomass consumed annually at national, regional and global scales, and on the social, economic and environmental costs. Only then can a harmonized policy be developed that considers the multi-directional effects of forest fires.

5.9 Roles and Responsibilities of relevant Stakeholders and Collaborators

- i. It is important that all stakeholders and collaborators who are responsible for implementing this strategy should have clear roles and responsibilities. This will help them to respond at a short notice.
- ii. The Fire Section of the Department should consult with all stakeholders and develop the Terms of References for implementation. The Section should also have the facility of receiving and transmitting fire alert alarm through short message services (SMS).

5.10 Reporting fire incidences, monitoring and evaluation

- i. Proper systems and methods should be developed for reporting forest fire incidences. It would also be required for contingency planning and forecasting the probability of fire starting in the future. At present fire incidences are reported in the form of progress report or sometimes verbally or through telephone communication. There is no standard format or procedure for reporting fire incidences. The information collected verbally or through telephone are not useful for making any meaningful management decision.
- ii. The Forest Fire Management Section under DOFPS should develop proper and scientific method of reporting fire incidences from field offices and the data should be interpreted and analyzed. The analyzed information should be shared amongst all concerned field offices for making proper management decision.
- iii. The Fire Section of DOFPS and territorial Divisions/Parks and Dzongkhags Forestry Sector should constantly monitor the forest fire control programme in their jurisdiction. The information gathered would be useful for preparing reports. Such reports would be useful in

developing plan of actions for forest fire management. Based on the monitoring, an overall evaluation report should be produced at five years interval.

- iv. It is essential that Forest Fires Section of DOFPS should acquire human resource expertise to monitor and evaluate national and Dzongkhag level forest fire management plans. The analysis should be able to identify shortcomings in Dzongkhags plans as well as provide support in plan preparation and development.
- v. The Forest Fire Section of DOFPS should become a crucial player in the iterative process of plan development. Such a role would require DOFPS to re-establish its expertise and experience in forest fire management at all levels.
