



Republic of Lebanon
Ministry of Environment



Lebanon's National Forest Fire Management Strategy

Second Draft

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Development and review: (names listed in alphabetical order)

Association for Forests, Development and Conservation (AFDC):

Fady Asmar¹
Sawsan Bou Fakhreddine
George Mitri²

International Union for Conservation of Nature (IUCN):

Rami Bou Selman
Pedro Regato³
Timothy O'Connell⁴

Ministry of Environment:

George Aaki⁵
Nabil Assaf
Lara Samaha

Ministry of Agriculture:

Jean Stephan
Zeina Tamim

Ministry of Interior and Municipalities (Directorate of Civil Defence):

Ziad El Natour

Editor: George Mitri, Ph.D.

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¹ National responsible consultant

² Coordinator of the EU funded project MED/2008/149-389

³ Senior Programme Manager "Ecosystem Management and Development"

⁴ Intern consultant

⁵ Focal point of the EU funded project MED/2008/149-389

List of Acronyms

AFDC	Association for Forests, Development and Conservation
AWFS	Autonomous Early Warning System for Forest Fires
CBO	Community-Based Organization
CDR	Council of Development and Reconstruction
CEAM	Centro de Estudios Ambientales del Mediterráneo
CFU	Community Fire Unit
EFFIS	European Forest Fire Information System
EFIMED	European Forest Institute – Mediterranean
EU	European Union
FAO	Food and Agriculture Organization
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GIS	Geographic Information System
ICS	Incident Control System
INFOCA	Plan de Protección Civil y Atención de Emergencias por Incendios Forestales de la Junta de Andalucía
IUCN	International Union for Conservation of Nature
LARI	Lebanese Agriculture Research Institute
MoA	Ministry of Agriculture
MoD	Ministry of National Defence
MoE	Ministry of Environment
MoI	Ministry of Interior and Municipalities
MoJ	Ministry of Justice
NCSR	National Council for Scientific Research
NGO	Non-Governmental Organization
NPO	Non-profit Organization
OWL	Other Wooded Land
PA	Protected areas
SDATL	Schéma Directeur d'Aménagement du Territoire Libanais
SER	International Society for Ecological Restoration
ZIFs	Forest Intervention Zones

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Preface

Forests in Lebanon are a unique feature in the arid environment of the Eastern Mediterranean. Until June 2006, they, along with woodlands covered around 13.5% of the overall area of Lebanon. Lebanese citizens, especially in rural communities, have traditionally benefited from forest resources in various ways: forest flora is exploited for beekeeping, edible and medicinal plants, and pine trees are a valuable source of income, as are wood collection and charcoal.

Increasingly, Lebanon's forests, which include a variety of relic broadleaf and conifer forests that cover the Lebanese mountains in patches, are exposed to degradation as a result of repetitious fires, wars, neglect, improper management, outdated laws, poor policy enforcement, climate change, among others. Like other Euro-Mediterranean countries, forest fires have been especially damaging in Lebanon in recent years, representing one of the most important elements that destroy Lebanon's natural resources. Moreover, the absence of a National forest management strategy and the limited human, technical and financial resources contribute to the degradation of Lebanon's forests.

The effects of forest destruction have led to fragmentation and loss of the forest ecosystems, which in turn, has had a devastating impact on the livelihoods of local communities. The damages from recent fires were so immense that they reduced the forest cover to 13% in a relatively very short period of time and raised concern at the national and international levels that they could lead to total eradication of forests if radical steps were not taken to solve the problem.

To the end of the disastrous forest fires in 2007 which burned more than 2000 ha only in few days, the Prime Minister of Lebanon formed an inter-ministerial committee, and a National Executive and Technical Forest Fire Prevention and Forest Restoration Committee through the Decision No. 118/2007 to deal with the problem of forest fires. The National Executive and Technical committee groups representatives from the different institutions dealing with forest management and fires in an attempt to coordinate a response to the problem after the huge forest fires of October and November 2007. This committee was chaired by the Ministry of Environment and included representatives from the Ministry of Agriculture (MoA), the Ministry of National Defence (Lebanese Army), the Ministry of Interior and municipalities (the General Directorate of the Civil Defence and Internal Security Forces), the Higher Relief Council (HRC), the Council for Development and Reconstruction (CDR) in addition to the Association for Forests, Development and Conservation (AFDC). Later on, the IUCN Centre for Mediterranean Cooperation joined the Committee. Consequently, four working groups, working on different subjects, namely, fire fighting equipment, forest fire operations room, training, and national strategy for forest fire management emerged from this committee.

MoE and AFDC have been in charge by the Prime Minister of developing and implementing a recovery plan to restore the damaged forest areas and to put into action a forest fire management plan in cooperation with other ministries within the previously mentioned committee. A Memorandum of Understanding (MoU) approved by the Council of Ministers was signed between AFDC and the MoE on November 12th, 2007 to implement the recovery plan.

The collaboration between MoE and AFDC lead to developing and implementing in 2008 the EU funded project "Towards Developing and Implementing a National Strategy for Forest Fire Management in Lebanon". One of the main objectives of this project was to develop Lebanon's National forest fire management strategy. Such National strategy aims at reducing the risk of intense and frequent forest fires whilst allowing for fire regimes that are socially, economically and ecologically sustainable.

Since Lebanon has been lacking of a comprehensive National strategy for forest fire management, there was an urgent need to design and develop this strategy with the participation of local key players in forest fire management and with the involvement of the regional and international knowledge and expertise. As such, the National working group responsible for designing and developing this strategy focused his work on presenting a first draft strategy to be discussed and commented by major concerned ministries and institutions. Consequently, MoE and AFDC with the collaboration of the International Union for Conservation of Nature (IUCN) organized two National workshops on 7-9 May 2008 and on 30 and 31, October 2008 to discuss a first draft of the National Strategy.

Eventually, this presented strategy is a result of extensive work conducted at the national level and with the contribution of several local, regional and international collaborators, organizations, and institutions. It is hoped that this strategy, if appropriately implemented, would decrease significantly the number of devastating fires, and improve the odds for the conservation, rehabilitation, and restoration of Lebanon's forests.

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Ministry of Environment
Republic of Lebanon

Association for Forests, Development and Conservation

ABSTRACT

The aim of this National strategy is to reduce the risk of intense and frequent forest fires whilst allowing for fire regimes that are socially, economically and ecologically sustainable.

For the purpose of discussion, policies related to forest fire have been grouped into five categories: (1) Research, information and analysis; (2) Risk modification, including fire vulnerability reduction and prevention of harmful fires; (3) Readiness, covering all provisions intended to improve interventions and safety in the event of fire; (4) Response, including all means of intervention for fire suppression; and (5) Recovery, including the rehabilitation and ecological restoration of healthy forest conditions, and the support to individuals and communities in the short- and medium term aftermath of the fire.

Each one of the concerned parties, public or private, governmental or non-governmental, has a certain role to play in order to contribute to the suppression of forest fires, the reduction of their intensity and frequency and the rehabilitation of the affected regions after the fires. The attached table proposes an implementation framework for the forest fire strategy.

Needs and Limitations:

- Scattered responsibility and lack of a coordination mechanism among all concerned stakeholders by forest fires.
- A database on forest fires is still missing. When it exists, is scattered, non-homogenous and difficult to process.
- Collaboration with neighbouring countries and international assistance on forest fire issues is very limited.
- Research on forest fires is weak.
- The analysis of the actual direct and indirect effects of forest fires is at a very preliminary level, failing to identify and estimate the real burden posed on the economy and society from forest fires.
- An integrated approach is needed both in forest planning and management of forest fires.
- Forests are not viewed as a common good having vital links with the local economies. Communities do not feel part of forest management.
- Public awareness on the values of forest other than direct timber production is not adequately promoted.
- There is a lack of a management approach on forest fire issues. Forest fires are treated as a natural disaster only and analyzed (depending on the case) as either an effect of the development and management policies, an inherent part of the Mediterranean ecosystems, or a voluntary action aiming at destroying the natural heritage, and in some cases as a management tool for forests.

- Sectoral policies (agricultural policy, tourism development, urban development, etc.), contribute to a non-sustainable process, which in turn increases the distortions between communities and the forests.
- Forest policy is still missing, despite its importance for the forests.
- Fighting forest fires is in most cases seen as a reaction to a natural catastrophe, independently from the actual root causes and forest management policies and practice.
- Weak law enforcement to punish the responsible of fires...
- Lack of awareness at all levels (about fires, its causes and way of prevention...)
- The employment status of the fire brigade (Civil Defence) and other stakeholders concerned with fire suppression...
- Lack of human resources and administrative cadre in the concerned ministries

DRAFT

1. Problem Statement

The problem of forest fires in Lebanon is complex and should not be addressed on a sectoral level. It concerns all the aspects related to forest management, prevention, suppression, and post fire management. It is a problem of forest policy and legislation, as much as it is a problem of equipment and capacity building.

Despite the increased efforts, fire problems increasingly threaten forest ecosystems and economic development in Lebanon. Reports accuse increases in fire frequency and severity, thus affecting tree growth and survival, yield and quality of wood and non-wood forest products, wildlife habitat and the recreational, scenic, environmental and cultural value of forests. Serious fires can also cause human injuries and death in addition to losses in properties.

A shift is needed towards more holistic, inter-sectoral and participatory approaches to forest fire management in policy, implementation, rehabilitation and monitoring. This requires strengthening the capacity of the concerned authorities to address the different issues related to forest fires.

Lebanon is lacking the necessary policy measures and management capacities to address a number of forest protection measures related to fire management including monitoring, prediction (early warning), preparedness, prevention, suppression and restoration. The role of the local communities in the different steps related to fire management is far from being understood in its real dimension.

Experience has shown over a number of years that the reporting systems in Lebanon is weak and do not reflect the reality of the problems. This has serious repercussions on the policy development and implementation and on the identification of the needs to be addressed.

Although a basic forest strategy was developed a few years ago, it was never implemented and responsibilities were not defined.

Several initiatives, projects and activities were developed in the last decades, among which we cite the assistance provided by the French Government. This project has allowed the training of engineers from the Ministry of Agriculture in France, through several study tours, training and courses, on the different questions related to forest fire management and forest management. Assisted by the trained Lebanese engineers, French trainers provided a full training program to forest guards from the Ministry of Agriculture. The project has also assisted in the provision of equipment, cars, small and large trucks for immediate interventions and the identification of the most appropriate sites for look-out towers and water reservoirs. The implementation of the look-out towers and water reservoirs is still missing. More recently, emergency projects dealing with forest fire management have been implemented at the national level. Such projects include the Lebanese

Recovery Fund Project “Integrated forest fires management – forest fires prevention, forest fires fighting (control) and damaged forests assessment and rehabilitation”, which is managed by FAO and implemented by MoE and AFDC and the EU National scale funded project “Towards Developing and Implementing a National Strategy for Forest Fire Management in Lebanon”, which is implemented by AFDC in collaboration with MoE.

2. Objective of the Strategy

Reducing the risk of intense and frequent forest fires whilst allowing for fire regimes that are socially, economically and ecologically sustainable.

3. Fire Situation in Lebanon

A. Introduction

Fire is the main cause of the destruction of forests, other wooded lands and other lands in the countries of the Mediterranean Basin in general and in Lebanon in particular, causing enormous economic and ecological damage as well as loss of human life. A forest fire map that was produced by AFDC in 2007 shows that 28% of the total surface area of Lebanon is severely threatened by fires (Annex 3).

The forest fire situation in Lebanon is significantly determined by predominating climatic conditions with prolonged summers (extending from June to October and sometimes even longer), virtually no rain and average daytime temperatures well in excess of 30°C, reducing the moisture content of forest litter to below 5 percent. Under these conditions, even a small addition of heat (lightning, a spark, a match, a cigarette butt) can be enough to start a violent conflagration. The steep slopes and the summer and eastern dry autumn winds characterized by high speed and strong desiccating power aggravate the situation.

Among the factors that threaten the forests in Lebanon, fire constitutes the most dangerous factor and causes severe ecological, economic losses and, sometimes, human injuries. Within some hours fire destroys what has naturally grown over years and centuries. An increase of wildfire frequency is witnessed reaching a catastrophic dimension and serious action to reduce the negative impacts of fire should be taken. This was particularly true in October 2007, when more than 200 fires were declared in less than 24 hours, destroying thousands of hectares of forests and Other Wooded Lands (OWL).

It must be noted however, that the fire may not destroy the forest completely. Fires might have some positive roles if they occur at a very low frequency and intensity.

After fire, some forest species have the ability to regenerate. Therefore, the forest is not lost, but it is temporarily un-stocked. Natural regeneration, assisted regeneration or reforestation will enable the land to restore its role in the land use and land cover of the country.

B. Land-Use and Climate Change

A strongly human-influenced landscape was created by the severe human pressure and its resulting activities like burning, cutting and grazing on non-arable lands and clearing, terracing, cultivating, and later abandonment of arable portions. It is not possible to understand the current vegetation patterns in Lebanon without taking into account past and current anthropogenic activities and land uses. Human intervention has been so strong that it is still making a significant impact on current and future vegetation patterns.

The changes in fire occurrence during the last decades closely reflect the recent socio-economic changes underway in several countries. Changes in traditional land-use and lifestyles, depopulation of rural areas, increases in agricultural mechanization, decreases in grazing pressure and wood gathering and increases in the urbanization of rural areas leading to the recovery of vegetation and an increase in accumulated fuel. Land-use changes produced during the present century are parallel to the changes in the fire regime, from being few in number and affecting small areas, to becoming very numerous and affecting large extensions every year. This trend is not observed in countries/regions where traditional land uses remain the major socio-economic system.

Although the main reason for fire increase in the last decades is probably changes in land use, climatic factors should be considered as a contributing factor. Fires tend to be concentrated in summer when temperatures are high and air humidity and fuel moisture are low. The climate changes that are predicted to occur in the near future as a result of releasing greenhouse gases are likely to induce increased fire risk.

C. Forest Vegetation as Fuel

As a reflection of the prevailing climate and its long summer droughts, Lebanese forests and other wooded lands are characterized by plant species adapted to certain natural fire regime. Nevertheless, the complex inter-relationship between humans, fire and forests have modified natural forest fire dynamics, making it rather difficult to understand and/or characterise natural forest fire regimes nowadays. This explains why Mediterranean fire dynamics is the subject of countless studies and reports.

Fire acts with different frequencies and intensities depending upon the vegetation and topography involved. Climatic regimes determine the occurrence of fire. Thus, vegetation composition, biomass and structure depend on climate and on fire frequency and intensity, while fire frequency

and intensity depend in turn on vegetation biomass, structure, topography and climatic regimes.

For many Mediterranean species it is difficult to determine whether fire or any other natural or anthropogenic disturbance acted as the major selective force for their environmental adaptation. In the case of xeric pines, a “dual life strategy” may respond to both fire and to intense drought periods. A number of reproductive features are described as adaptation to fire and drought, from which “serotiny” ((the retention of mature seeds in a canopy-stored seed bank with synchronised cone opening and seed release with fire and extreme dry weather) must be highlighted. Certain species also tend to have a particularly high content of resin or essential oils, making them extremely flammable.

Other species, particularly the evergreen sclerophyll species have developed a morphological resistance to fire. Likewise, the presence of a large number of dormant buds ensures the production of shoots and sprouts if the aerial part of the plant is reduced by fire.

However, these adaptive traits do not provide permanent protection. The climate change exacerbation of the intensity and frequency of human-induced fires forest vegetation may cause sharp changes towards more xeric vegetation types with unpredictable ecological and socio-economic consequences.. Since the Neolithic times, there are registered cases of forest vegetation replacement by the rapid expansion of fire-prone tree and shrub vegetation (i.e. with the dehiscence of rockroses (*Cistus*), or other species that produce seeds with a thick isolating tegument or rhizomes or running roots), and significant reductions or extinctions of more temperate tree species.

To this processes must be added human-induced changes caused by attempts to restore the tree cover in areas where excessive fire or other uses such as overgrazing and fuelwood extraction have caused a high level of degradation. Reforestation is usually carried out using pioneer species, predominantly stone pines (*Pinus pinea*) established in monospecies stands. This in itself increases the risk of fire due to the continuity of fuels in closely spaced plantations as well as the concentration of fine, highly inflammable fuels.

There is still another important factor that increases the danger of fires. The socio-economic development and the changes that occurred on the livelihood systems have led to a generalized decrease in grazing and in the collection of wood and forest scrub for fuelwood and fodder. As a consequence there has been a build-up of highly flammable forest litter. This problem is much more serious in the regions where the rural population has abandoned the traditional lifestyles (managing large numbers of ruminants and gathering great quantities of fuelwood and other products from the forests for domestic use) than it is in the regions where grazing and other forms of forest related activities are still an integral part of the system.

Another cause of increases in forest fuels is the shift of population from the rural areas to the cities. As a result, large stretches of marginal farmland, especially in mountain areas, have been left uncultivated and have been colonized by bush and even natural pine groves.

The population drift does not imply the total elimination of activities in the forest area. Some of the remaining rural population use fire to eliminate stubble and renew pastures; the increase in tourism is a recent form of forest related activities that is increasing the risk of fires. However, the large accumulation of fuels often allows fires set for agricultural and tourism purposes to spread out of control and to develop unprecedented intensities and severities that are the major reason for the difficulty of control and the ecological impacts of the wildfires. Furthermore, the scarcity of forest dwellers makes fire suppression more difficult.

D. Causes of Fires

Lack of data on forest fires and their causes are a major obstacle in understanding the nature of forest fires. Information is needed to describe the magnitude and urgency of the problem to decision makers and to make them prioritize the necessary measures. Information is also essential to draw the most appropriate strategies and policies.

Statistics on the causes of forest fire are far from being complete, but it is evident that people set the majority of fires. Natural agents such as lightning do indeed cause forest fires. However, the climatic conditions in Lebanon are not favourable for such fires, as thunder storms occur in winter when the vegetation is no longer susceptible to fire. The most common causes of fire are the following:

- Farmers who use fire to eliminate crop stubble, and to push back the forest to make room for agricultural expansion. In spite of the obvious risks, farmers might set fire to agricultural residues even when large out-of-control fires are burning in the same area.
- Careless smokers and excursionists who throw lit cigarettes on the forest litter or along the roads and light cooking fires without taking the necessary precautions to extinguish them properly.
- Burning solid wastes (municipal wastes and those left by tourists and recreational users), the disposal of garbage by burning being often carried out in conditions of high fire risk without taking the necessary precautions
- Fixed installations such as high voltage power lines that are implemented above forest areas
- Arsons that set fires for destruction, vengeance, conflicts, and changes in land-use classification...
- Fireworks (pyrotechnics)

4. A Strategic Approach to Control Policies and Programmes

There is widespread acceptance among fire management agencies that decisions about fire management are best made within a risk-management framework, known as the 5Rs (IUCN, 2007): (1) Research, information and analysis; (2) Risk modification, including fire vulnerability reduction and prevention of harmful fires; (3) Readiness, covering all provisions intended to improve interventions and safety in the event of fire; (4) Response, including all means of intervention for fire suppression; and (5) Recovery, including the rehabilitation and ecological restoration of healthy forest conditions, and the support to individuals and communities in the short- and medium term aftermath of the fire.

A. Research, Information and Analysis

Strategic Objective:

To support and promote the improvement, know-how sharing, monitoring and dissemination of knowledge on fire ecology, fire management and post-fire vegetation dynamics among all relevant actors (science/research, policy makers, land managers, grassroots' groups), bridging science and traditional knowledge.

Authorities and bodies in charge:

- Ministries: Agriculture, Environment, Interior and Municipalities (including Fire Brigade and Internal Security Forces), and National Defence
- NGOs, CBOs, Municipalities, Research Institutions
- Operations room (the forest fire coordination room at the Civil Defence)
Weather stations (Beirut International Airport and other stations)

Time Frame:

All year round; full time monitoring during high fire risk periods

Activities should be undertaken in close collaboration between all concerned stakeholders:

- Reinforce the existing organisations and institutions/programmes working on fire related issues (in capacity building, human and financial resources).
- Set-up specific forest curricula in universities/research institutions where forest fire experts should be prepared and undertake research work.
- Support Lebanese organisations/institutions to join existing networks researching on fire issues in the region.
- Develop exchanges with “nodes of expertise” on fire issues.

- Develop effective monitoring systems (indicators to be measured, methodologies, databases) and set up systems for the collection of relevant data (qualitative and quantitative).
- Implementation of an early detection system consisting mainly of lookout towers all over the territory, an automated infrared system and ground patrols.
- Building the capacity of local inhabitants and raising their awareness to better detect emerging fires
- Developing daily danger indices based on weather conditions, vegetation types and prevailing activities; developing a comprehensive danger-rating system
- Developing fire behaviour models and/or combustibility models to allow the fire fighting brigades to better predict the fires and better manage them
- Development and implementation of a data base on forest fires
- Monitoring fires after suppression to avoid re-ignition
- Archiving and reporting data and information use to simulate forest dynamics and trends and to monitor and detect fires
- Development of objectively verifiable indicators which can evaluate the success or failure of the National Forest Fire strategy and the adoption of fire risk reduction means in all concerned sectoral policies.

Overview:

The natural forest fire regimes in the region are poorly known due to the ancient alteration of the natural vegetation by people. Moreover, fire regimes are nowadays ruled by complex and often badly known root-causes driven by socio-economic conflicts and insane human behaviours. A number of regional networks, mainly linking Mediterranean countries from the European Union, were established in the last years to exchange and improve know-how for understanding the root-causes of fires, the dynamics of different fire regimes, and the ecology of fire of the different Mediterranean forest ecosystems and related uses. It is necessary to reinforce the existing organisations and institutions/programmes working on fire related issues in Lebanon, supporting them to set-up specific forest fires curricula and research work, to join existing networks researching on fire ecology issues in the region and to develop exchanges with “nodes of expertise” on fire ecology issues.

National detection and monitoring networks based on fixed and mobile stations are established in several countries. In some cases, these operations are being automated with the use of infrared sensors and remote television monitors, sometimes powered by photovoltaic cells. The high cost of aerial monitoring places serious constraints on its wide use. In any case, hi-tech systems cannot replace ground-level technicians with a good working knowledge of the terrain. The experienced person is still and will continue to be a basic cog in the detection wheel.

Monitoring from look-out towers is a very widespread technique that is used in several countries. This activity is usually supplemented by ground patrols made up of foresters with a good knowledge of the area. In some cases, visual assessment could be complemented by automated infrared systems. Interestingly, fires are often first reported by local inhabitants.

Danger-rating systems are another essential element of fire control. This requires close cooperation with the national meteorological services, and the development of fire behaviour models and indices. Relevant and adequate meteorological data should be made available in order to develop daily danger indices based on local weather forecasts, calculated over several years.

Improving knowledge on fire related issues requires effective monitoring systems (indicators to be measured, methodologies and databases) for the collection and analysis of relevant data (qualitative and quantitative) over time. By doing so, it will be important to bridge innovative fire management knowledge with traditional management practices. A good monitoring system will also allow evaluating the implementation and effectiveness of the National Fire Strategy.

B. Risk Modification (Fire Vulnerability Reduction and Prevention of Harmful Fires)

Strategic Objective:

To develop effective measures intending to reduce fire vulnerability, to increase ecological and social resilience to fire, and preventing the occurrence of harmful fires and unsustainable fire regimes.

Authorities and bodies in charge:

- Ministries: Agriculture, Environment, Interior and Municipalities (including Fire Brigade), Education, Justice, Information, Social affairs, Finance,
- CDR (SDATL)
- Municipalities
- NGOs, CBOs
- Media (Press, TV and Radio stations...)
- Private sector,
- Religious land committees (waqf)
- Political parties

Time Frame:

All year round

Activities should be undertaken in close collaboration between all concerned stakeholders

- Develop Fire Danger Rating System and risk mapping at national and municipality level.
- Develop a participatory planning process to design landscape pattern (type of uses and its territorial distribution) resilience to fire. These would need to be developed and designed with consultation with local landholders and it can be a way to break up the landscape, and reduce fuel available
- Identify opportunities and needs to allow land owners/users adopt the identified fire resilient land uses.
- Develop and explore opportunities (i.e. innovative management systems, economic incentives, etc) to help adopt fire resilient land uses and landscape pattern. Modify risk through a number of means (i.e. traditional farming practices with some controlled and enforced livestock grazing in forests; encouragement of sustainable fuel wood collection; Incentives for farmers/herders not to burn crop residue and pastures during 'fire danger times'; encouragement of Non-Wood Forest Products which can play a role at reducing risk; encouragement

of 'green fuel breaks' across the landscape; Incentives for farmers to have ploughed fuel breaks around the perimeter of fields)

- Creation of farming cooperatives where resources can be pooled by local farmers
- Preventive silviculture and fuel management aiming at reducing the highly flammable biomass and management of the forests to increase their resistance to fires (or reduce their susceptibility to fires); this includes but is not limited to grubbing and pruning, tree thinning, brushwood crushing, prescribed burning, controlled grazing and species selection.
- Territorial analysis of fires' distribution according to their causes.
- Inventory (mapping) of dangerous infrastructures (i.e. power lines) within the territory.
- Improve research methodologies to minimise the % of unknown causes.
- Analyse the probability of intervention (depending on causes and social groups) to modify habits (behaviour) and change dangerous uses.
- Develop ad hoc intervention measures for each social group/cause
- Include a course on civil defence in scholar and academic curricula
- Private sector fund raising in order to finance awareness campaign
- Awareness raising at all levels of population; awareness varies with population types (urban and rural; schools; universities, decision makers...). Involve aware individuals from the same target groups (i.e. farmers, shepherds) to whom awareness raising and surveillance campaigns are addressed, in the awareness, education and surveillance actions.
- Publicity campaign targeting professionals
- Provisions for prevention of fires associated with installations (clearing under high voltage lines, and equipping the lines with visibility balls; rubbish dumps; road sides; picnic and camping sites...)
- Legislations, including revision of current legislation, drawing new laws, empowerment of law enforcement authorities: forest law, land zoning and classification law and land tenure law)
- Higher involvement of municipalities in all levels of forest management, including incentives and income generating activities
- Involvement of religious authorities and political parties
- Legal framework related to land tenure system
- Implementation of the SDATL

Overview:

Minimising the risk of fire and preventing harmful fires has four main elements:

1. Spatial planning processes to ensure that natural and built assets are identified in relation to fire risk and to agree on landscapes with more resilient types of land uses and spatial distribution of uses and infrastructures within territorial units.

2. The adoption of management practices within the landscape to help minimising the risk of damage to life, the natural environment and built assets.
3. The establishment of policies and economic instruments to support land owners, users and managers in the adoption of risk reduction management practices and land uses
4. Reducing the frequency of ignitions that result from arson and carelessness.

Land owners, users and managers have a major role in fire risk reduction. Participatory spatial planning processes, in large territorial units where large-scale disturbances such as harmful fires occur, are being adopted by some Mediterranean countries where fires have caused enormous damages in the last years. Participatory spatial planning has the objective to get the active involvement of all concerned stakeholders in the identification/mapping of:

- High fire risk areas.
- Resilient land use types and landscape patterns with the spatial distribution of uses and infrastructures which result more efficient to reduce the risk of fire.

Although participatory planning processes help raise awareness of local actors about fire risk reduction options, trade off mechanisms (i.e. economic compensations and incentives) will be needed to get the buy-in of individuals and communities and empower them to adopt resilient uses and management practices. The implementation of trade off mechanisms requires the revision of all sectoral policies concerned by fire risk reduction and the establishment of flexible legal frameworks supporting the adoption of resilient land uses and management practices.

Prevention activities can be divided into two broad areas: those aimed at mitigating the flammability of the vegetation, and those directed at the primary cause of fire, which in most of cases is due to negligence or arson. Knowledge of the causes of forest fire is a precondition for the implementation of suitable solutions.

Mitigating the flammability of the vegetation implies the adoption of adequate forestry and land management practices which help reduce dry biomass and fuel continuity in the landscape. It requires modelling and testing innovative options adapted to the ecological and socio-economic context of the Lebanese rural areas and to the climate change predictions for the region. Fuel management involves such highly diverse techniques as grubbing and pruning, tree thinning, brushwood crushing, prescribed burning, controlled grazing and species selection.

Protective techniques need to be integrated into overall silvicultural practices, which have generally concentrated on regeneration and production. Selection of specific techniques must be determined by the prevailing physical, economic and social conditions. For example, in areas where there are forest-grazing conflicts, controlled grazing should be encouraged rather than

prohibited. If properly timed and controlled, grazing enables fine fuel accumulation to be reduced and involves pastoralists in forest management.

The major problems in applying efficient preventive silviculture are the extent of the area to be treated and the cost of the labour required. Broad-based policies encouraging reforestation operations and care of existing stands are necessary. These policies may need to be supported by credits and other incentives, especially in the case of privately held forest areas.

Prescribed or controlled burning is still not used in Lebanon, despite the advantages of this low cost land management technique. However it must be noted that this technique is highly dependent on the climatic conditions and requires very well trained personnel. Different intervention methods must therefore be combined and adapted to specific situations.

Almost all Mediterranean countries have adopted measures to increase public awareness of forest fires, and the focus is nearly always on accidentally caused fires. The target is the adult public - residents or tourists - located in areas of risk. School children are also the target of specific programmes.

The situation regarding the rural population, however, requires a different approach. In fact, campaigns developed for urban populations may even be counterproductive with a rural public. Generally, rural dwellers have a good basic knowledge of the positive influence of forests on the microclimate and of their effect in reducing erosion, and of the potentially negative effects of fire. The rural population needs to be involved in forest economics. People need to be clearly informed about the damage wildfire causes to the long-term potential of their farming and livestock operations. It is also necessary to give precise information on who is, in fact, affected by fires, with a concentration on the effect on both public and private lands.

Provisions for the prevention of accidental fires associated with installations (railways, rubbish dumps, power lines, etc.) do not exist in Lebanon. The prevention is generally poorly considered in the list of available policy and administrative measures.

Preventive efforts must be supported by legislation clearly establishing the setting of incendiary fire as a crime and penalizing offenders in proportion to the damage caused. However, this component should never be the main element of prevention efforts. In some parts of the world, it has been observed, that the heavier the punishments provided by the law, the more difficult it is to prove arson and the more the courts hesitate to condemn arsonists.

Among the legal provisions that could be implemented, three merit special consideration:

- Punishments brought on the parties at fault in the case of fire. Legal instruments developed to punish the guilty parties responsible for setting a fire, either deliberately or not.

- Regulations restricting the right to light fires. Prohibiting the use of fire (including smoking) in forests and near their boundaries during the period regarded as high risk, including on privately owned land.
- Regulations obliging the clearing of the undergrowth. Some countries have adopted provisions in their forestry laws aiming at obliging forest owners to clear the undergrowth around the houses, and along roads and/or railways. Undergrowth clearance can be interpreted as much as a measure of prevention (aimed at preventing ignition) as a measure of pre-suppression (aimed at making roads safe).

Summer time is also the season of weddings and celebrations; fireworks frequently associated with such events are one of the main causes of fires. The legislation should also take into consideration the regulations of such activities.

C. Readiness or Pre-suppression

Strategic Objective:

To undertake all possible provisions by individuals, communities and fire and land management agencies to be prepared before a fire event occurs, and improve interventions and safety in monitoring the probability of fire and detecting the event of fire

Authorities and bodies in charge:

- Ministries: Agriculture, Environment, Interior and Municipalities (including Fire Brigade), Public works (including Land-use planning authority), National Defence (Geographical affairs, Engineering, Demining), Office of Meteorology
- NGOs, CBOs, Municipalities, private sector

Time Frame:

All year round; prescribed (controlled) burning should only be undertaken in winter and fall

Activities should be undertaken in close collaboration between all concerned stakeholders

- Weather forecast
- The development of methodologies to optimize the distribution of infrastructure.
- Landscape distribution of fire-fighting infrastructures: conduct an inventory of current fire fighting resources which are available and desired future resources (aerial and ground infrastructure): Fire lookout towers; Water reservoirs; Forest tracks and road network in general; Forest strips with low tree density and low shrub cover; Fire break

- areas of first and second level; Forest tracks with fire break lines along them; Protection perimeters in urbanised areas; Fire fighting units
- The conciliation of interests regarding fire-fighting infrastructures, which may also benefit the local population, and may reduce the maintenance costs: (i.e. Green fire breaks for grazing activities too; Water reservoirs in order to increase the water availability in all the forest areas
 - Forest roads and tracks allowing the access of the fire suppression teams to all the forests (setting criteria; identification of needs)
 - Clearing under high voltage lines and using red balloons on the electric wires (to alert helicopters).
 - Setting up means to increase the awareness and incorporate land users into fire management.
 - The promotion of cooperative surveillance programs (incorporating community and forestry department) including neighbourhood watch programs and patrols in high risk areas during severe fire weather conditions.
 - Setting up a mechanism to educate and target the various land users groups of how to respond to a fire. (An option exists which has been implemented in many other countries and regions throughout the world with success is the establishment of 'Community Fire Units' (CFU's) with well trained members of the village/town/community prepared with necessary equipment with the role to act as the first to suppress the fire, whilst waiting for further back up depending upon the size of the fire. They can also play an important role in preventative actions and within their communities of education and awareness raising.
 - Development of a protocol for establishing 'community fire units', firstly trialling community fire units/volunteers at a smaller scale to see if they can be effective within a Lebanese setting.
 - Establish a clear mechanism for clarifying the roles of each agency in fire management.
 - Detail clearly the roles and authority of each agency in decision making and communications of fire incidents and the role of decentralised units.

Overview:

The establishment of fire-fighting infrastructures for the early detection and fighting of fires is carried out in a very similar way throughout the Mediterranean basin. It is based on the creation of tracks, observation towers, firebreaks and water reserves. This work is often designed within the framework of traditional management projects. The adequate distribution, sufficient numbers and good maintenance of these infrastructures is an important issue. New GIS systems help better plan and distribute fire-fighting infrastructures in the territory. These infrastructures, should take into account the recent technical developments such as the advent of large water carriers or air-tanker helicopters. The creation of additional tracks is however controversial, as these tracks may open the way for arsons, fire setters, campers and picnickers; they can also open the way for new settlements and urban sprawl. If they are to be opened, they should be controlled and subject to a very specific regulation.

The weather forecast is used to mobilize means of suppression in advance. A considerable effort to establish weather stations that record temperature, humidity, and wind speed and direction should be made.

Raising awareness and know-how of land users, which may rapidly detect and inform about fires, effectively react in the very early stages help increase rapid response. Moreover, the maintenance of rural people and uses in high fire risk areas, and the incorporation of preventive measures in their management practices (i.e. reducing fuel through grazing in high fire risk areas) facilitate early interventions and reduce the probability of harmful fires.

Be prepared for a fire before it occurs also requires the establishment a clear mechanism for clarifying and defining clearly the roles and authority of each agency in decision making and communications of fire incidents and the role of decentralised units. This requires clarify current coordination between the various stakeholder agencies and define effective organisational structure and coordination systems.

Setting up a mechanism to educate and target the various land users groups of how to respond to a fire. (An option exists which has been implemented in many other countries and regions throughout the world with success is the establishment of 'Community Fire Units' (CFU's) with well trained members of the village/town/community prepared with necessary equipment with the role to act as the first to suppress the fire, whilst waiting for further back up depending upon the size of the fire. They can also play an important role in preventative actions and within their communities of education and awareness raising.

All people involved in fire fighting activities should be well trained and equipped. Annual training activities should be organised for the different social groups; Training activities involving at the same time different stakeholders who may act in the same fire-fighting activities and may need coordination among them is needed. Training for the right use of equipment is required.

D. Response

Strategic Objective:

Suppress the fires within the first 20 minutes after they start and limit the extension of fires through the development of methods and techniques coupled with appropriate material and very well trained personnel

Authorities and bodies in charge:

- Ministries: Agriculture, Interior and Municipalities (including Fire Brigade and ISF), National Defence (Military airbase), Justice
- NGOs, CBOs
- Municipalities
- Private sector

Time Frame:

During periods of fire; highest levels of preparedness during high fire risk periods

Activities should be undertaken in close collaboration between all concerned stakeholders

- Empowering and building the capacities of the fire brigade to fight forest fires
- Training other stakeholders on fire suppression to assist the fire brigades or to interfere at the early stages of the fire, thus avoiding the expansion of the fires; organizing common training activities
- Aircrafts and helicopters should only be seen as a support and not as the main actors in fire suppression. Under Lebanese conditions helicopters equipped with belly tanks are the ideal solution; aircrafts (Canadair) would only be acquired after all other means have been properly implemented
- Developing an appropriate legal framework and empowering the law enforcement agencies to better punish those in charge of the voluntary or non-voluntary (accidental) fires
- Developing the appropriate legal framework to implement a forest-fire coordination room or head-quarters that would insure the coordination of fire suppression activities; and to implement the most appropriate coordination mechanism among all concerned stakeholders; training on coordination mechanism among all concerned stakeholders
- Providing the fire fighting personnel, including NGOs and CBOs with the most adapted and most appropriate equipment, based on the level of intervention of each stakeholder
- Monitoring fires after suppression to prevent restarting
- Conducting common trainings between all the concerned stakeholders to enhance coordination
- Evaluation of the suppression activities and the coordination mechanisms

Overview:

In ideal conditions, the fire should be suppressed within the first 20 minutes after it starts, after what it becomes a wildland fire, very difficult to control.

Having trained personnel available in sufficient numbers is a basic condition for successful suppression work. The organizational scheme providing the best level of protection is one consisting of a general, permanent fire service which is reinforced with additional resources and personnel during critical periods. The dimensions of the basic service will be determined by the overall risk of fire. The correct functioning of such a system requires a suitable legal framework in which jurisdictions and responsibilities (who has the authority to mobilize forces, for example) are clearly delimited.

The efforts of land-based suppression forces are reinforced in many Mediterranean countries by fleets of aircraft (mostly amphibious) and helicopters. The use of helicopters is assuming increasing importance, particularly in the transport of fire crews to difficult locations.

Helicopters equipped with water belly-tanks are the most adapted for the conditions in Lebanon. Their built in submersible water pump and their smooth mobility give them the capacity to fill their tanks from any existing water reservoir, truck equipped with a reservoir, forest based water reservoirs or even private swimming pools. As their engines do not need to be warmed up before the flight, they have the capacity to fly immediately after the alert is given; aircrafts require some warming up time before they are able to fly, which retards their intervention capacity.

Airborne suppression activities must not be viewed as a substitute for land-based efforts, particularly in view of the high costs involved. If land-based forces are not sufficient, the introduction of additional airborne forces will not improve overall efficiency, and may even retard future development as resources which could have been better invested in the formation of land-based brigades are diverted. Apart from their direct costs, airborne forces require an additional infrastructure of personnel and facilities.

It should be noted that fire brigades are usually trained to combat fires in urban areas and in cities, but cannot necessarily fight forest fires. If fire brigades should combat forest fires, they should be trained and their capacities built accordingly.

Legal frameworks should be implemented at the country levels in order to improve the coordination among the different actors concerned by forest fires. The example of Cyprus is worth mentioning as the forestry service is in charge of all forest fires and all fires that could affect the forests, while the mandate of the fire brigade is to protect people and properties in urbanized areas.

E. Recovery, Post-fire Management and Rehabilitation

Strategic Objective:

Provide support for individuals and communities in the immediate aftermath of the fire and in the medium and longer term efforts of community and economic renewal, and restore healthy ecological conditions of burned forest land to facilitate the natural recovery of vegetation and increase forest resilience against future fires

Authorities and bodies in charge:

- Ministries: Agriculture, Environment, Justice
- CDR (SDATL)
- NGOs, CBOs,
- Municipalities

- Research institutions
- International organisations

Time Frame:

After fire; activities should best be undertaken in winter time, before the natural regeneration occurs

Activities should be undertaken in close collaboration between all concerned stakeholders

- Analyse the post-fire emergency needs of individuals and communities and established a 'Solidarity Fund' which gives adequate support to them
- Assessment/mapping of fire affected areas.
- Assessment of fire impacts on different vegetation types.
- Pilot research experiences in different forest ecosystems to test and define adequate post-fire snags and woody debris management.
- Prohibition of grazing in burned forests (forest law prohibits grazing for the 10 year following a destructive forest fire)
- Implementing activities aiming at the reduction of soil erosion when the winter starts; erosion is one of the most severe fire consequences.
- Developing post-fire active restoration/rehabilitation protocols and activities (forest landscape restoration).
- Facilitate natural forest regeneration and undertaking reforestation activities in areas where regeneration is not possible.
- Support ecological restoration actions where the forest services decide to recover resilient vegetation types to reduce fire risk or where resilient land uses are supported; assisting the natural regeneration or protecting the forest to allow for the natural regeneration if the existing vegetation type is to be maintained.
- Develop post-fire snags and woody debris management guidelines for the Lebanese forest ecosystems and forest areas, and modifying the existing legislation that prohibits the removal of burned trees accordingly.
- Developing a national reporting system, based on statistics and post-fire questionnaires; developing a national data base on forest fires, their occurrence, the ecosystems where they emerge, the exact climatic conditions at the time of emergence... This would substantively contribute to better manage the forest fires in the future. The questionnaire prepared by some concerned stakeholders could serve as a basis for these statistics; some statistics are available in some ministries and organizations.
- Involving the local communities in the different activities related to post-fire management identifying socio-economic opportunities to link forest restoration and local development (i.e. local tree nurseries for the production and marketing of aromatic/medicinal native plant species).
- Analysis of fire causes and spreading mechanisms and development of learning systems to transfer lessons.

- Undertaking research related to the effect of fire on the wildlife.

Overview:

The development of a strategy to help local communities recover from the social and economic damages after fire is necessary. The revision and improvement of current policies should well determine the needs of individuals and communities which may range from temporary emergency housing to financial support mechanisms. An example of support is from the European Union which has established the EU 'Solidarity Fund' which gives support directly after major disasters. Consultations with various stakeholders for this process would be necessary and may include Ministry of Environment, Ministry of Agriculture, Forestry Department, AFDC, community, farmers, rural residents, aid agencies, rural development agencies, Interior Ministry and other agencies within the Lebanon government who have social and economic welfare mandates.

The restoration and rehabilitation of the forests after fires, or the post-fire management, is one of the issues that are not properly addressed in Lebanon. While suppression and other aspects of fire management may not necessarily be undertaken by the national forest services, post-fire management should essentially be undertaken by foresters, land owners, land users and NGOs.

The development of capacity within the forestry/agricultural department to map fire affected areas is necessary. It is important to learn from existing methodologies developed and applied in the Mediterranean countries using satellite imagery to estimate the damage to forest and other land cover types.

The actions to be undertaken vary with the vegetation composition and with the type of fire and its intensity. Active restoration procedures need to be established as part of the strategy. Consideration should be given to the following:

- Soil erosion protection;
- Pre-disturbance ecosystem
- Post fire salvage logging (positive/negative impacts)
- Use of Nurse shrubs
- Native trees, shrubs and herbs Nursery considerations and establishment

The development of a restoration action plan may be based on the Forest Landscape Restoration principles developed by IUCN and the Society of Ecological Restoration guidelines. A number of general principles should be taken into consideration in all post-fire restoration projects:

- The importance to increase mixed character of forests and tree crops (higher % of drought-tolerant species), especially in ecotonal zones.

- The importance to restore habitats' diversity in forest landscapes (heterogeneity of the landscape) and to break the monotony of artificial, disturbed and/or abandoned landscapes (i.e. large territories with homogeneous scrublands, tree plantations, etc).
- The value of combining different life strategies to increase resilience (i.e. favouring re-sprouting species like *Quercus* spp, *Arbutus* spp, etc.; favouring fruit trees which will attract seed dispersal fauna; favouring nitrogen fixing shrubs; etc)
- The value of restoring riparian vegetation (fire break role).

Overview:

Decisions should be taken regarding post-fire snags and woody debris management. Several options are: a) keep all it in the land as it was after the fire; b) keep part of it standing and cut part of it which may remain laying down on the soil; c) cut all and keep it laying down on the soil; d) Remove part of it; e) Remove all. One single good option may not exist and may depend on the site conditions, type of fire, etc. The first measures to be taken involve an evaluation of the survival chances of remaining trees. Many specialists recommend that trees weakened by the flames be abundantly sprinkled immediately after the fire.

Decisions to be taken may not only be based on the ecological effects on forest regeneration and soil stabilization, but also on socio-economic factors (i.e. social opposition to standing post-fire snags due to aesthetical problems; social demand for the economic use of snags and woody debris; etc). It is recommended that the Lebanese organisations/institutions join existing networks researching on fire ecology issues in the region to help adopt the best options. Nevertheless, testing different options may be necessary and desirable, with the objective to understand which scenario provides better conditions in terms of:

- High soil nutrient incorporation
- High seed dispersal and regeneration
- High protection against herbivores
- Microclimatic improvement
- Lower management costs
- Social demands (When a fire is located near urban areas, the aim is to eliminate the black trunks visible from the inhabited areas)
- Security (Burnt trees are more easily wind-thrown and therefore represent a serious safety hazard when they are near to people)

Efforts to control erosion are a high priority. Lebanon is characterized by steeply sloping terrain and strong autumn rains. When the forest canopy has been damaged or eliminated by fire, there is an elevated risk of erosion or mudflows. The cutting of burnt woods and their disposal along the level lines makes it possible to retain the soil and the stones on slopes.

Once urgent works are completed, there is the question of the future of damaged areas. Reforestation or assisted regeneration is employed under certain conditions:

- Insuring soil stability and avoiding land degradation or desertification.
- Insuring water balance in forest ecosystems, preventing forest stagnation and water stresses which may increase dry biomass (i.e. dieback events) and fire risk.
- Assisting the reestablishment of healthy forest conditions, restoring the ecosystem as a whole and not only the trees.
- The enrichment of the forest composition to make it more resilient to fire.

In order to improve the harmonization of burned area data and statistics, a forest fire assessment system could be put in place. A map of burned areas could be derived from the classification of satellite images acquired at the end of each fire season (November of every year). This area map could further be used in conjunction with land cover database to estimate the damage to forest and other land cover types. This assessment could bring a consistent support to the decision makers on all issues to be addressed after the fire.

5. Responsibilities and Roles

Different countries have different ways of organizing their fight against forest fires. There is no critical description of the weaknesses and advantages of the systems applied. This approach would be very useful for planning future activities and changes.

The philosophy of forest fire prevention is based on the creation of tracks, firebreaks and water reserves. This work is often designed within the framework of traditional management projects. Maintenance of these networks is an important issue.

Two general trends can be described, as far as protection from forest fires is concerned:

- A system where the Forest Service is responsible for forest fire prevention and control,
- A mixed system, where the Forest Service is responsible of forest fire prevention and post-fire management while the Fire Brigade takes over suppression and pre-suppression activities. This system may be more complex with local and national authorities and local community groups or NGOs being involved in the activities.

The advantages of the mixed fire protection system are:

- Improvement of the effectiveness of detection and rapid response,
- Well trained personnel in fire suppression (not in all cases), and

- Ability to use more personnel, expensive tools and high technology facilities.

The main disadvantages of the mixed forest fire system are:

- Coordination between the agencies is an absolute prerequisite for the effectiveness of the system and this is not easily the case due to the differences in mentality, training and background,
- Different players usually represent different policies and a common forest fire policy is not applied - or existing,
- Forest fire management is a complex issue that needs feedback among all stages and cannot be separated in pieces.

In all cases, suppression mechanisms should act complementary to the specific prevention and management measures, within the framework of a solid policy for forest fire protection. What counts most is the policy under which the players operate and their coordination.

6. Fire Research

With a few exceptions, there are no major studies and research undertaken in Lebanon on the forest fires, fire ecology, fire behaviour, post-fire regeneration or any topic related to our field of interest. This makes very strategic for Lebanon to support the participation of concerned organisations and institutions in existing regional research networks (i.e. the different projects/programmes supported by the EU) on forest fire issues. Moreover, exchange programmes with “nodes of excellence” on fire related issues may facilitate the dissemination of know-how and the sharing of results from research work.

7. Collaboration

International agencies and unions have developed policies and strategies to promote the protection of the Mediterranean countries from forest fires. Their role is in most cases theoretical. Treaties and agreements for cooperation exist, but only a few measures are taken on the ground. Most agreements concerning forest fires are part of broader forestry policies, strategies for civil protection and environmental declarations. The issue of trans-boundary cooperation and collaboration remains a crucial aspect to be emphasized.

An effective Mediterranean forest fire initiative does not exist in any international organization, besides some meetings and research projects without any application. The Mediterranean has its own specific characteristics that define the way forest fires should be controlled and cannot simply be a sub-unit of a larger international policy. However, the activities of *Silva Mediterranea* with its role as a regional network within the Global Wildland Fire Network is a promising arrangement that may be instrumental for intra- and inter-regional cooperation in forest fire management.

8. Community involvement

Local populations have a low level of awareness concerning their attitude to forest fire protection. They often burn forests by mistake, using fire as a tool in the wrong time and at the wrong place. People also burn forests on purpose in order to replace it with other land uses that may bring short-term profit. This indicates that people are not aware of the long-term value of forests and the services they provide. They cannot connect the forest with their own quality of life. While the link between forest fires, poverty and land-uses should be properly addressed, community participation is crucial at all levels of forest fire management.

Some community based organizations and active NGOs are playing a very important role in fire prevention and suppression in Lebanon. Such organizations should be encouraged and supported by the Government and by international organizations, bi-lateral and multi-lateral partners.

9. Needs and Limitations

From the analysis of forest fires the following needs and limitations can be drawn:

- Scattered responsibility and lack of a coordination mechanism among all concerned stakeholders by forest fires
- A database on forest fires is still missing. Data, when it exists, is scattered, non-homogenous and difficult to process.
- Collaboration with neighbouring countries and international assistance on forest fire issues is very limited.
- Research on forest fires is weak.
- The analysis of the actual direct and indirect effects of forest fires is at a very preliminary level, failing to identify and estimate the real burden posed on the economy and society from forest fires.
- An integrated approach is needed both in forest planning and management of forest fires.
- Forests are not viewed as a common good having vital links with the local economies. Communities do not feel part of forest management.
- Public awareness on the values of forest other than direct timber production is not adequately promoted.
- There is a lack of a management approach on forest fires issues. Forest fires are treated as a natural disaster only and analyzed (depending on the case) as either an effect of the development and management policies, an inherent part of the Mediterranean ecosystems, or a voluntary action aiming at destroying the natural heritage, and in some cases as a management tool for forests.

- Sectoral policies (agricultural policy, tourism development, urban development, etc.), contribute to a non-sustainable process, which in turn increases the distortions between communities and the forests.
- Forest policy is still missing, despite its importance for the forests.
- Fighting forest fires is in most cases seen as a reaction to a natural catastrophe, independently from the actual root causes and forest management policies and practice.
- Weak law enforcement to punish the responsible of fires...
- Lack of awareness at all levels (about fires, its causes and way of prevention...)
- The employment status of the fire brigade (Civil Defence) and other stakeholders concerned with fire suppression...
- Lack of human resources and administrative cadre in the concerned ministries
- The major needs in terms of forest fires management and control are the following:
 - Institutional building
 - Vocational training
 - Early warning systems and preparedness plans
 - Evaluation of the vulnerability of stands
 - Critical seasons (olive/pine related activities...)
- The needs could be answered through:
 - The establishment of a training center
 - Community participation (training and implementation)
 - Capacity building programmes involving all concerned actors
 - Early warning system (providing links with EU system)
 - Policy and forest law review
 - Networking on issues like prevention and post-fire

10. Suggested Implementation Framework

Different potential projects that are suggested to be designed, developed and implemented in line of this strategy. Such projects are:

- Awareness raising campaigns
- Biomass management; prescribed burning...
- Forest related activities (charcoal production; wood harvesting...)
- Controlled grazing
- Forest based equipment (water reservoirs, lock-out towers...)
- Fire suppression equipment (trucks, helicopters, hand tools...)
- Capacity building, education and training
- Monitoring and early detection
- Legal framework
- Post-fire management

Finally, a comprehensive framework (following table) is suggested for the implementation of the National Strategy for Forest Fire Management.

11. References

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- **FAO** - “Forest fires in the Mediterranean area” by D. Alexandrian, F. Esnault and G. Calabri;
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Annexes

DRAFT

Annex 1. Suggested Implementation Framework

Policy	Objective	Themes	Activities	Target Group	Authority
1. Research, information and analysis	Support and promote the improvement, know-how sharing and dissemination of knowledge on fire ecology, fire management and post-fire vegetation dynamics among all relevant actors (science/research, policy makers, land managers, grassroots' groups), bridging science and traditional knowledge	<ul style="list-style-type: none"> Improve knowledge, develop effective monitoring systems and become members of regional networks about fire ecology, natural ecosystems resilience to fire and post-fire dynamics 	<ul style="list-style-type: none"> Reinforce the existing organisations and institutions/programmes working on fire related issues (in capacity building, human and financial resources). Set-up specific forest curricula in universities/research institutions where forest fire experts should be prepared and undertake research work. <ul style="list-style-type: none"> Develop effective monitoring systems (indicators to be measured, methodologies, databases) and set up systems for the collection of relevant data (qualitative and quantitative). Support Lebanese organisations/institutions to join existing networks researching on fire ecology issues in the region (EU Project EUFIRELAB). Develop exchanges with "nodes of expertise" on fire ecology issues. 	<ul style="list-style-type: none"> LARI Universities NCSR Policy makers NGO's Land managers Rural people 	<ul style="list-style-type: none"> Ministry of Education MoA MoE Mol Municipalities
		<ul style="list-style-type: none"> Bridge innovative fire management knowledge with traditional management practices, develop effective monitoring systems and become members of regional networks on the issue 	<ul style="list-style-type: none"> Collate further data to include in the strategy which has a purpose to create an understanding of the historical and the existing fire situation in Lebanon. <ul style="list-style-type: none"> Assess land uses against fire risk and identify fire resilient traditional management practices. Develop effective monitoring systems (Simple indicators will facilitate implementation and participation). Support Lebanese organisations/institutions to join existing networks researching on fire management in the region (EU Project FIRE PARADOX). Develop exchanges with "nodes of expertise" on fire management issues. 	<ul style="list-style-type: none"> LARI Universities NCSR Policy makers NGO's Land managers Rural people 	<ul style="list-style-type: none"> MoA MoE Ministry of Education

		<ul style="list-style-type: none"> Support the exchange of know-how and the application of good technologies for predicting fire potential or risk 	<ul style="list-style-type: none"> Support the use and application of appropriate technologies for predicting fire danger <ul style="list-style-type: none"> Make use of existing expertise within Lebanon with GIS mapping through CRNS/AFDC which have used remote sensing technologies. Develop a fire induction danger rating systems based on other good examples, such as Develop exchanges with good examples (i.e. Canadian, Australian or European Union EFFIS systems; Andalusia Plan INFOCA). 	<ul style="list-style-type: none"> Mediterranean universities and research institutions Policy makers NGO's Land managers Rural people 	<ul style="list-style-type: none"> MoA MoE Ministry of Education International organizations MoD NSRC AFDC Meteorological Service
		<ul style="list-style-type: none"> Support the use of appropriate technologies for detection, monitoring and assessment of fire and its impacts 	<ul style="list-style-type: none"> Consult technical staff to ascertain the viability of Early warning systems (i.e. The Autonomous Early Warning System for Forest Fires, AWFS) in Lebanon forest fire situation. Perhaps conduct a small trial before fully implementing this expensive technology. The establishment of information databases or further develop existing databases including all relevant information. 	<ul style="list-style-type: none"> Mediterranean universities and research institutions NGO's Land managers 	<ul style="list-style-type: none"> MoA MoE Ministry of Education Universities AFDC
		<ul style="list-style-type: none"> To develop indicators for evaluating the implementation and effectiveness of the National strategy 	<ul style="list-style-type: none"> The development of objectively verifiable indicators which can evaluate the success or failure of the strategy/policy may be another important development of the overall strategy. Essentially indicators can and should be able evaluate each facet of the strategy. Indicators can serve as a method of evaluating whether the strategy in place is effective in achieving the stated goals and objectives. It helps managers track progress towards objectives. 	<ul style="list-style-type: none"> Universities and research institutions Policy makers NGO's Land managers Rural people 	<ul style="list-style-type: none"> MoA MoE Ministry of Education MoI Municipalities MoD AFDC
Policy	Objective	Themes	Activities	Target Group	Authority
2. Risk modification	Develop effective measures intending to	<ul style="list-style-type: none"> Identification/mapping of 	<ul style="list-style-type: none"> Develop Fire Danger Rating System based on other good examples. 	<ul style="list-style-type: none"> Universities and research 	<ul style="list-style-type: none"> MoA MoE

(Fire Vulnerability Reduction and Prevention of Harmful Fires)	reduce fire vulnerability, to increase ecological and social resilience to fire, and to prevent the occurrence of harmful fires and unsustainable fire regimes	high fire risk areas	<ul style="list-style-type: none"> ▪ Develop risk mapping at national and municipality level. Consult with NCRS regards developing the latest mapping for the strategy, targeting high risk areas. ▪ Develop training programmes (GIS software technicians within the Forestry Department/Agriculture Department, NGOs) involving NCRS and technical staff from the EU program 'EFFIS' in developing mapping capabilities. ▪ Develop an assets register. Need for spatial planning may be important to ensure natural and built assets in relation to fire risk (mapping of built, natural and cultural assets and their distribution amongst the wider landscape). This can be useful during the response phase of fire fighting and supporting decision making. 	<p>institutions from Lebanon and EU</p> <ul style="list-style-type: none"> • NGO's • Land managers 	<ul style="list-style-type: none"> • Ministry of Education • MoD • MoI • Municipalities • NSRC
		<ul style="list-style-type: none"> • Participatory spatial planning process to agree on landscapes with more resilient types of land uses and spatial distribution of uses and infrastructures within territorial units 	<ul style="list-style-type: none"> ▪ Identify fire resilient land uses and landscape patterns. ▪ Define landscape/territorial units for participatory planning fire risk reduction (i.e. the "Forest Intervention Zones, ZIFs" of the new Portuguese Forest Strategy). ▪ Identify all relevant stakeholders (i.e. municipalities, local associations, land managers, extension agents, etc) from the established territorial unit. ▪ Develop a participatory planning process to design landscape pattern (type of uses and its territorial distribution) resilience to fire. These would need to be developed and designed with consultation with local landholders and it can be a way to break up the landscape, and reduce fuel available ▪ Identify opportunities and needs to allow land owners/users adopt the identified fire resilient land uses. 	<ul style="list-style-type: none"> • Universities and research institutions • NGO's • Municipalities • Land managers (agriculture agents, rangers, etc) • Land owners • Land users 	<ul style="list-style-type: none"> • MoA • MoE • MoA • MoE • CDR • MoI • Municipalities • Urban Planing
		<ul style="list-style-type: none"> • Develop trade off 	<ul style="list-style-type: none"> ▪ Develop and explore opportunities (i.e. 	<ul style="list-style-type: none"> • Municipalities 	<ul style="list-style-type: none"> • MoA

		<p>mechanisms (i.e. compensations and incentives) to get community buy-in and empowering local communities to adopt fire resilient land uses and management practices</p>	<p>innovative management systems, economic incentives, etc) to help adopt fire resilient land uses and landscape pattern. Modify risk through a number of means:</p> <ol style="list-style-type: none"> i. traditional farming practices with some controlled and enforced livestock grazing in forests ii. encouragement of sustainable fuel wood collection iii. Incentives for farmers/herders not to burn crop residue and pastures during 'fire danger times' (fire danger index). iv. The encouragement of Non-Wood Forest Products which can play a role at reducing risk v. Encouragement of 'green fuel breaks' across the landscape vi. Incentives for farmers to have ploughed fuel breaks around the perimeter of fields vii. Creation of farming cooperatives where resources can be pooled by local farmers 	<ul style="list-style-type: none"> • Land managers (agriculture agents, rangers, etc) • NGO's • Land owners • Land users • Universities and research institutions 	<ul style="list-style-type: none"> • MoE • MoEconomy • International organizations • NGOs, CBOs
		<ul style="list-style-type: none"> • Improve legislation with provide flexible legal frameworks for the adoption of fire resilient land uses and landscape planning 	<ul style="list-style-type: none"> ▪ Revise European Union current policies encouraging resilient land uses and landscapes through compensations and incentives. ▪ Investment from the Lebanese government to encourage rural development which aims to reduce fire risk. ▪ Support Lebanese NGO active on rural development programmes beneficial for local forest communities with a fire risk modification approach 	<ul style="list-style-type: none"> • Universities and research institutions • NGO's • Municipalities • Regional development offices (agriculture forestry) • Ministerial departments 	<ul style="list-style-type: none"> • MoA • MoE
		<ul style="list-style-type: none"> • Break fuel continuity in the landscape through modelling, testing and adoption of preventive 	<ul style="list-style-type: none"> ▪ Develop competencies by land managers in Lebanon (forestry service, Agricultural department) to undertake fuel management actions (i.e. grubbing, tree thinning and 	<ul style="list-style-type: none"> • Universities and research institutions • Land managers 	<ul style="list-style-type: none"> • MoA • MoE • MoIM

		silviculture and land management practices	<p>pruning, brushwood crushing, prescribed burning, and controlled grazing).</p> <ul style="list-style-type: none"> ▪ Develop funding mechanisms for the implementation of preventive silviculture/land management works. ▪ Exchange information with and join relevant regional networks and institutions (i.e. the EU 'FireParadox' project; EFIMED) aiming at creating collaboration amongst countries and institutions regards the use of fire to manage the landscape. ▪ Exchange information with and join relevant regional networks and institutions (i.e. PLAN INFOCA in Andalucía Region/SP; CEAM in Valencia region/Spain) who are currently trialling the effectiveness of grazing in reducing fuel loading. ▪ Establishing 'cooperatives' for farmers who usually practice the burning of stubble to help them pool some resources and employ a contractor to undertake this work through livestock grazing, manually or with tractor appliances at a reduced and affordable price. Consult with FAO experts their experience on soil management practices ▪ Reduce the stagnation of forest stands and accelerate tree growing in fire-prone ecosystems (i.e. Aleppo pine forests) through thinning and pruning. ▪ Reduce tree density, especially in tree plantations and post-fire pine regeneration to minimise tree competition for soil water, dieback processes and dry biomass, and speed up tree growth and break continuity between forest layers ▪ Break landscape homogeneity (i.e. large scrubland territories after agriculture land abandonment) in fire-prone landscapes and facilitate ecological succession processes (Shrub clearance and crushing). 	<p>(agriculture agents, rangers, etc)</p> <ul style="list-style-type: none"> • NGO's • Municipalities • Land owners • Land users 	
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			<ul style="list-style-type: none"> ▪ Support the creation a framework for the creation of 'green fuel breaks/shaded fuel breaks' at a landscape level as a way to manage the landscape aimed at reducing fuel availability and in turn limiting the spread of fires. Incorporated within these shaded fire breaks can be activities which can be economically viable for rural people. (i.e. grazing, fuel wood collection, truffle growing). This land-use also has an advantage in that it is not so aesthetically displeasing when compared to the traditional fuel breaks which have no vegetation. 		
		<ul style="list-style-type: none"> • Adequacy and maintenance of forest infrastructures and installations 	<ul style="list-style-type: none"> ▪ The concerned administration should equip forest land with leisure activities with the necessary infrastructure and assure its maintenance. ▪ The concerned administration and/or companies should secure adequate installation/construction and maintenance of infrastructure making use of forest land (Rubbish dumps, picnic areas and camping sites, roads, power/telephone lines, etc). 	<ul style="list-style-type: none"> • Private enterprises • Municipalities • Land managers 	<ul style="list-style-type: none"> • MoI • MoPower • MoE • MoA
		<ul style="list-style-type: none"> • Reduction of fire ignition events both as a result of regulations from local/regional authorities or agreements between concerned parties 	<ul style="list-style-type: none"> ▪ Territorial analysis of fires' distribution according to their causes. ▪ Inventory (mapping) of dangerous infrastructures (i.e. power lines) within the territory. ▪ Improve research methodologies to minimise the percentage of unknown causes. ▪ Analyse the probability of intervention (depending on causes and social groups) to modify habits (behaviour) and change dangerous uses. ▪ Develop ad hoc intervention measures for each social group/cause 	<ul style="list-style-type: none"> • Residents and tourists in areas of risk • NGO's • Universities • School children • Rural people • Private enterprises • Land managers • Civil works managers 	<ul style="list-style-type: none"> • MoE • MoA • MoInterior

			<ul style="list-style-type: none"> ▪ Involve aware individuals from the same target groups (i.e. farmers, shepherds) to whom awareness raising and surveillance campaigns are addressed, in the awareness/education/surveillance actions. ▪ Build the capacity of users about good practices on fire management (in case they are allowed) based on the existing regulations. ▪ Develop agreements with companies/administration/privates responsible of dangerous infrastructures on the necessary investments and periodic works for their maintenance to reduce ignition risk. ▪ Identify and apply new technologies (i.e. GIS) for managing fire risk in relation to the territorial infrastructures networks (i.e. roads, power lines, railways, etc). 		
		<ul style="list-style-type: none"> • Build capacity of all concerned actors 	<ul style="list-style-type: none"> ▪ All people involved in fire prevention activities should be well trained and equipped. ▪ Annual training activities should be organised for the different social groups; Training activities involving at the same time different stakeholders who may act in the same prevention activities and may need coordination among them is needed. ▪ Training for the right use of equipment is required. 	<ul style="list-style-type: none"> • Residents and tourists in areas of risk • NGO's • Universities • Rural people • Land managers • Local authorities 	<ul style="list-style-type: none"> • MoEducation • MoE • MoA
		<ul style="list-style-type: none"> • Develop programmes on awareness raising and education 	<ul style="list-style-type: none"> ▪ Implement at local, regional and national levels a wide set of means: educational workshops with rural people; workshops with urban/university/school people; flyers; radio and television; media/press releases; internet website and online publications improving the Ministerial websites; door to door knocks throughout at risk communities by 'volunteer' fire fighters raising awareness 	<ul style="list-style-type: none"> • Residents and tourists in areas of risk • NGO's • Universities • School children • Rural people 	<ul style="list-style-type: none"> • MoEducation • MoE • MoA

			<p>and potentially increasing participation in fire management issues.</p> <ul style="list-style-type: none"> ▪ Develop awareness campaigns about the fundamental role that the rural population plays in preventing dangerous fires. ▪ Design specific awareness campaigns ▪ Raising awareness to general public by Posters and signposts, which warn the public about the danger of forest fires (and show the forest fire danger index for that day) which are placed at conspicuous places of roads, picnic and camping sites and villages. ▪ Notification of fire danger rating through the media – radio, television, newspapers, websites. ▪ Production and distribution to elementary and secondary schools of special materials including documentary videos showing consequences of fire from the Mediterranean region 		
		<ul style="list-style-type: none"> • Development of prevention Plans for all protected areas and “Forest Intervention Zones” 	<ul style="list-style-type: none"> ▪ All preventive measures affecting Forest Intervention Zones and Protected Areas should be part of a prevention plan which will be prepared in a participatory way, involving all concerned stakeholder groups, and reviewed periodically according to results. 	<ul style="list-style-type: none"> • Local population • Municipalities • Land owners • Land managers • NGOs • Regional/Local governmental institutions 	<ul style="list-style-type: none"> • MoA • MoE • MoPublic Works
	Developing and enforcing the legal framework	<ul style="list-style-type: none"> • Safety norms for the execution of works/activities in forest land and surroundings 	<ul style="list-style-type: none"> ▪ The concerned administration should develop safety norms for all works happening in forest land and surroundings (i.e. the use of machinery, engines, the use of fire by workers for cooking and smoking, electric systems, explosives, waste disposal and wood piling) which may represent a fire risk. ▪ The concerned administration should 	<ul style="list-style-type: none"> ▪ Local population ▪ Tourists ▪ Municipalities ▪ Land owners ▪ Land managers ▪ NGOs ▪ Regional/Local 	<ul style="list-style-type: none"> • MoA • MoE • MoJ

			benefit the local population, can have an important awareness raising role, as well as getting the buy-in of local actors to participate in fire prevention actions.		
		<ul style="list-style-type: none"> Land users awareness and know-how (incorporation of preventive measures in their management practices) which may increase rapid response 	<ul style="list-style-type: none"> Setting up means to increase the awareness and incorporate land users into fire management. The promotion of cooperative surveillance programs (incorporating community and forestry department) including neighbourhood watch programs and patrols in high risk areas during severe fire weather conditions. Setting up a mechanism to educate and target the various land users groups of how to respond to a fire. An option exists which has been implemented in many other countries and regions throughout the world with success is the establishment of 'Community Fire Units' (CFU's) with well trained members of the village/town/community prepared with necessary equipment with the role to act as the first to suppress the fire, whilst waiting for further back up depending upon the size of the fire. They can also play an important role in preventative actions and within their communities of education and awareness raising Development of a protocol for establishing 'community fire units', firstly trialling community fire units/volunteers at a smaller scale to see if they can be effective within a Lebanese setting should be encouraged. 	<ul style="list-style-type: none"> Local population groups Non-local land users (i.e. hunters' associations, Tourists) Municipalities NGOs Forest rangers 	<ul style="list-style-type: none"> MoA MoI MoE
		<ul style="list-style-type: none"> Organization systems/entities at the landscape level 	<ul style="list-style-type: none"> Establish a clear mechanism for clarifying the roles of each agency in fire management Detail clearly the roles and authority of each agency in decision making and 	<ul style="list-style-type: none"> NGOs Fire brigades Forest rangers Volunteers and Local 	<ul style="list-style-type: none"> MoE MoA Civil Defence MoInterior

			communications of fire incidents and the role of decentralised units	population fire units	
		<ul style="list-style-type: none"> Build capacity of all concerned actors 	<ul style="list-style-type: none"> All people involved in fire fighting activities should be well trained and equipped. Annual training activities should be organised for the different social groups; Training activities involving at the same time different stakeholders who may act in the same fire-fighting activities and may need coordination among them is needed. Training for the right use of equipment is required. 	<ul style="list-style-type: none"> Municipalities NGOs Fire brigades Forest rangers Volunteers and Local population fire units Municipalities 	<ul style="list-style-type: none"> MoE MoA MoEducation Civil Defence
		<ul style="list-style-type: none"> Landscape distribution of fire-fighting units 	<ul style="list-style-type: none"> Development of methodology to optimize the distribution of fire fighting units is necessary. Consultation with appropriate fire fighting agencies (i.e. Plan INFOCA Andalusia region/SP) An inventory of current fire fighting resources which are available and desired future resources (aerial and ground resources) Mobile fire-fighting units developed in a way to help a rapid transfer to the field decentralised decision making units Obtain further fire fighting equipment suitable for Lebanon (i.e.: small 4 by 4 vehicles such as Land Rover equipped with pumps, pipes and a water reservoir with a volume of 1 cubic meter). Development of fire fighting units with the potential to be on standby in strategic areas/high risk areas during extreme periods. 	<ul style="list-style-type: none"> Municipalities Private Owners Private public works enterprises Forest rangers Regional/local governmental departments 	<ul style="list-style-type: none"> MoE MoA Civil Defence
		<ul style="list-style-type: none"> Develop and effective coordination system 	<ul style="list-style-type: none"> Understand the needs and develop effective organisational structure and coordination system. Clarify current coordination between the various stakeholder agencies and define 	<ul style="list-style-type: none"> Decision makers from all relevant governmental departments 	<ul style="list-style-type: none"> MoA MoE Civil Defence Mol

			adequate roles and competencies of each agency clearly (i.e. the Cyprus system).	<ul style="list-style-type: none"> • Fire brigades • Forest rangers • Fire volunteers • Municipalities • NGOs 	
		<ul style="list-style-type: none"> • Making use of the weather forecasting stations to increase the preparedness 	<ul style="list-style-type: none"> ▪ Mobilize means of suppression 	<ul style="list-style-type: none"> • Weather stations (Beirut Airport, LARI) • Civil Defence (Fire Brigade) 	<ul style="list-style-type: none"> • MoI • MoA • MoE • Civil Defence
Policy	Objective	Themes	Activities	Target Group	Authority
4. Response	Suppress the fires within the first 20 minutes after they start and limit the extension of fires through the development of methods and techniques coupled with appropriate material and very well trained personnel	<ul style="list-style-type: none"> • Develop a national network and system aiming at the detection and early warning 	<ul style="list-style-type: none"> ▪ Develop Danger-rating systems and daily danger indices. ▪ Develop fire behaviour models. 	<ul style="list-style-type: none"> • Research institutions (Universities; NCSR) • NGOs • Forest services 	<ul style="list-style-type: none"> • MoEducation • MoE • MoA
		<ul style="list-style-type: none"> • Develop effective Coordination systems (Operational unified command structure that link all; decentralised intervention units, etc) 	<ul style="list-style-type: none"> ▪ The defining of a clear command structure with the roles and responsibilities of each fire fighting agency clearly defined is necessary. ▪ The establishment of a Central Command Unit (i.e. Cyprus example of coordination). ▪ Implement an Incident Control System (ICS) by the fire fighting agencies (i.e. Australia example), which is a structure of delegation to ensure that all fire ground management and information functions are carried out. It is divided into four functional areas: Control - the management of the incident. The overall direction of response activities at a fire/incident. The Incident Controller is designated by the agency/service and is responsible for the overall management of the 	<ul style="list-style-type: none"> • Decision makers from all relevant governmental departments • Fire brigades • Forest rangers • Fire volunteers • Municipalities • NGOs 	<ul style="list-style-type: none"> • MoA • MoE • Civil Defence • MoI

			<p>fire/incident.</p> <p>Operations - the collection and analysis of incident information and planning of response activities The Operations function is to combat the fire/incident</p> <p>Planning - the direction of resources in combating the incident. The Planning function is to support activities at the fire/incident by: Collecting and analysing information at the fire/incident; Predicting fire/incident behaviour; Keeping track of resources; Preparing strategies to control the fire/incident over time</p> <p>Logistics - The Logistics function is to support activities at the fire/incident by providing:</p> <ul style="list-style-type: none"> ○ the provision of facilities, ○ services and ○ materials required to combat the incident <ul style="list-style-type: none"> ▪ Exercise the Command and Control functions of the ICS in an operational sequence known as R.R.A.P.I.D: 1) Reaction; 2) Reconnaissance; 3) Appreciation; 4) Plan; 5) Issue of Orders; 6) Deployment ▪ Establish effective communications (i.e. telephone, paging and radio networks, which call fire fighters to incidents and help them coordinate activities and strategies at the incident). There needs to be a platform for both strategic and tactical communications systems, which are used to communicate with airborne appliances to coordinate reconnaissance, water-bombing, crew transport and other tasks. ▪ The creation of a GIS mapping assets register to enable effective decision making and coordination during a fire event should 		
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			be established as part of Readiness phase, but used during the Response phase. Assets include social, natural, cultural and other.		
		<ul style="list-style-type: none"> Organization systems/fire-fighting entities 	<ul style="list-style-type: none"> This facet of the strategy should include the current fire fighting systems and agencies which are responsible for fires in Lebanon and their capabilities and limitations. Also the future direction of fire fighting needs to be decided, whether it continues to be a multi agency responsibility and the clear definition of each agencies roles and responsibilities. Fire fighting ability may be enhanced through training programs from other countries with expertise, from Spain Plan INFACO for example. 	<ul style="list-style-type: none"> Decision makers from all relevant governmental departments Fire brigades Forest rangers Fire volunteers Municipalities NGOs 	<ul style="list-style-type: none"> MoA MoE Civil Defence MoI
		<ul style="list-style-type: none"> Developing and enforcing the legal framework 	<ul style="list-style-type: none"> Improve coordination mechanisms; Define team leaders during fires 	<ul style="list-style-type: none"> Decision makers from all relevant governmental departments NGOs 	<ul style="list-style-type: none"> MoA MoE MoIM MoD
		<ul style="list-style-type: none"> Provide the necessary equipment, training and working conditions 	<ul style="list-style-type: none"> The development of an inventory of current equipment used for fire fighting and future desired equipment is necessary. Further consultation with other fire fighting agencies may be necessary to learn about new equipment and upgrade older equipment according to needs. Many countries (Spain, Italy, Cyprus) could provide useful knowledge regards effective equipment (i.e. fire fighting aircraft and helicopters suitable to Lebanese conditions; Lookout towers; Ground patrols; Forest-based equipment; Water reservoirs and water outlets; Hand tools and equipment; 	<ul style="list-style-type: none"> Local inhabitants NGOs Fight-fighters Forest rangers Civil Defence staff Fire Brigades 	<ul style="list-style-type: none"> MoA MoI MoD

			<p>Machinery; New technology including automated infrared systems)</p> <ul style="list-style-type: none"> ▪ Permanent fire service reinforced with additional resources during critical periods ▪ Financial incentives ▪ Training and raising awareness to involve local inhabitants, municipalities, NGOs and CBOs in early warning and detection ▪ Empowering and training the land-based forces: Status improved in terms of salary, insurance, retirement plans, etc 		
		<ul style="list-style-type: none"> • Adequacy and maintenance of the equipment 	<ul style="list-style-type: none"> ▪ The concerned administration and/or civil society organisations should be aware of innovations regarding fire-fighting equipment and renew it. ▪ The concerned administration and/or civil society organisations should secure adequate use and maintenance of fire-fighting equipment. 	<ul style="list-style-type: none"> • Fire brigades • Forest rangers • NGOs • Local community fire units • Volunteers • Civil defence staff 	<ul style="list-style-type: none"> • MoA • MoI
		<ul style="list-style-type: none"> • The use of local knowledge through volunteers 	<ul style="list-style-type: none"> ▪ The use of volunteers is potentially worth exploring as an important tool for the response phase of the strategy. ▪ Small trials in different regions about the effectiveness and willingness of volunteers being used in response to fire should be evaluated. ▪ The possibility of developing 'Community Fire Units' (i.e. in Turkey/Australia and to some extent Spain) should be explored, depending upon a community's interest in the forest (financial/social/ cultural/other). Their immediate role can be to act as the first to suppress the fire, whilst waiting for further back up depending upon the size of the fire. 	<ul style="list-style-type: none"> • Local communities • Forest rangers • NGOs 	<ul style="list-style-type: none"> • MoA • MoE • Civil Defence

			<ul style="list-style-type: none"> ▪ The development of a protocol for establishing 'community fire units', firstly trialling community fire units/volunteers at a smaller scale to see if they can be effective within a Lebanese setting should be encouraged. 		
		<ul style="list-style-type: none"> • Number and distribution of fire-fighting units 	<ul style="list-style-type: none"> ▪ The strategy should detail the number and spatial distribution of fire fighting units currently in Lebanon to set the context. ▪ The future needs should also be established. ▪ The current capabilities of the various agencies which conduct fire suppression needs to be evaluated, which may include: 1) Lebanese Army; 2) Civil Guard; 3) Forest Service; 4) Internal Security Forces; 5) Community volunteers ▪ Determining if exchanges of expertise are required with other fire fighting agencies is also required. ▪ The distribution of all fire fighting units needs to be evaluated to obtain the optimal spread of resources to meet the objectives of fire suppression. 	<ul style="list-style-type: none"> • Forest rangers • Municipalities • Local/regional governmental departments • NGOs 	<ul style="list-style-type: none"> • MoA • MoIM
Policy	Objective	Themes	Activities	Target Group	Authority
5. Recovery (Rehabilitation)	Provide support for individuals and communities in the immediate aftermath of the fire and in the medium and longer term efforts of community and economic renewal, and restore healthy ecological conditions of burned forest land to facilitate the natural recovery of vegetation and increase forest	<ul style="list-style-type: none"> • Support for individuals and communities in the immediate aftermath of the fire 	<ul style="list-style-type: none"> ▪ The development of a strategy to support communities post fire is necessary. ▪ Current policies may be in place, and these should be cited within the strategy. Review and modify these policies for adequacy. ▪ The needs of individuals and communities should be determined and may range from temporary emergency housing to financial support mechanisms. ▪ An example of support is from the European Union which has established the EU 'Solidarity Fund' which gives support directly after major disasters which was implemented for Greece (however not 	<ul style="list-style-type: none"> • Local communities • Municipalities • NGOs 	<ul style="list-style-type: none"> • MoInterior • Civil Defence

	resilience against future fires		<ul style="list-style-type: none"> ▪ possible for Lebanon). ▪ Consultations with various stakeholders for this process would be necessary and may include Ministry of Environment, Ministry of Agriculture, Forestry Department, ADFC, community, farmers, rural residents, aid agencies, rural development agencies, Interior Ministry and other agencies within the Lebanon government who have social and economic welfare mandates. 		
		<ul style="list-style-type: none"> • Supporting the medium and longer term efforts of community and economic renewal 	<ul style="list-style-type: none"> ▪ The development of a strategy to support communities at the long term after fire is necessary. ▪ Current policies may be in place, and these should be cited within the strategy. Review and modify these policies for adequacy. ▪ Develop support mechanisms. ▪ Investigate the possibility of payments for carbon sequestration services/other environmental services and if this is viable on a small scale trial first. 	<ul style="list-style-type: none"> • Local communities • Municipalities • NGOs 	<ul style="list-style-type: none"> • MoEconomy • MoA • MoE
		<ul style="list-style-type: none"> • Assessment (mapping of fire affected areas) 	<ul style="list-style-type: none"> ▪ The development of capacity within the forestry/agricultural department to map fire affected areas is necessary (i.e. through AFDC, NCSR, and the Ministry of Environment). ▪ At a European Union level the use of satellite imagery creates mapping in conjunction with EU-CORINE land cover database to estimate the damage to forest and other land cover types – EFFIS database shows mapping. 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation
		<ul style="list-style-type: none"> • Assessment of fire impacts on different vegetation types 	<ul style="list-style-type: none"> ▪ Support (or promote) research institutions/programmes to improve knowledge about fire ecology, natural ecosystems resilience to fire and post-fire dynamics ▪ Join existing networks researching on these issues in the region and/or develop 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers • Land and PAs managers 	<ul style="list-style-type: none"> • MoA • MoE

			<p>exchanges with “nodes of expertise” on these issues (University of Granada, Spain could be a potential institution to exchange expertise for fire ecology)</p> <ul style="list-style-type: none"> ▪ Consultation of previous research literature as a large amount of literature exists for some Mediterranean species response to fire ▪ Develop appropriate ‘fire regimes’ based on science which can be used as a measure to reduce fuel loadings and at the same time ensure survival of fire dependant species. 		
		<ul style="list-style-type: none"> • Developing post-fire active restoration protocols 	<ul style="list-style-type: none"> ▪ Active restoration procedures need to be established as part of the strategy ▪ Consideration should be given to the following: <ul style="list-style-type: none"> ○ Soil erosion protection ○ Pre-disturbance ecosystem ○ Post fire salvage logging (positive/negative impacts) ○ Use of Nurse shrubs ○ Native trees, shrubs and herbs ○ Nursery considerations and establishment ○ Other considerations in restoration works ▪ Consultation with the forestry and agricultural departments is necessary. ▪ Development of a restoration action plan which could be based on the Forest Landscape Restoration principles (IUCN/WWF) and the Society of Ecological Restoration guidelines. 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers • Land and PAs managers • Local communities • Municipalities 	<ul style="list-style-type: none"> • MoA • MoE
		<ul style="list-style-type: none"> • Post-fire snags and woody debris management 	<ul style="list-style-type: none"> ▪ Decisions should be taken regarding post-fire snags and woody debris management. Several options are: a) keep all it in the land as it was after the fire; b) keep part of it standing and cut part of it which may remain laying down on the soil; c) cut all 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers • Land owners 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation

			<p>and keep it laying down on the soil; d) Remove part of it; e) Remove all.</p> <ul style="list-style-type: none"> ▪ One single good option may not exist and may depend on the site conditions, type of fire, etc. ▪ Decisions to be taken may not only be based on the ecological effects on forest regeneration and soil stabilization, but also on socio-economic factors (i.e. social opposition to standing post-fire snags due to aesthetical problems; social demand for the economic use of snags and woody debris; etc). ▪ Support Lebanese organisations/institutions to join existing networks researching on fire ecology issues in the region and/or to establish exchange programmes with “nodes of expertise” (I.e. University of Granada, Spain) is recommended to help adopt the best options. Nevertheless, testing different options may be necessary and desirable, with the objective to understand which scenario provides better conditions in terms of: <ul style="list-style-type: none"> ○ High soil nutrient incorporation ○ High seed dispersal and regeneration ○ High protection against herbivores ○ Microclimatic improvement ○ Lower management costs 	<ul style="list-style-type: none"> • Land managers & users 	
		<ul style="list-style-type: none"> • Increasing fire resilience in vegetation structure and composition at the stand and landscape level 	<ul style="list-style-type: none"> ▪ The means to achieve fire resilience may be through joining existing networks researching on fire ecology issues in the region and/or to establish exchange programmes with “nodes of expertise” in the Mediterranean region. ▪ A number of general principles should be taken into consideration in all post-fire restoration projects: <ul style="list-style-type: none"> ○ The importance to increase mixed 	<ul style="list-style-type: none"> • Regional Universities and Research institutions • NGOs • Forest rangers • Land owners • Land managers & users 	<ul style="list-style-type: none"> • MoA • MoE • High Recovery Commission

			<p>character of forests and tree crops (higher % of drought-tolerant species), especially in ecotonal zones.</p> <ul style="list-style-type: none"> ○ The importance to restore habitats' diversity in forest landscapes (heterogeneity of the landscape) and to break the monotony of artificial, disturbed and/or abandoned landscapes (i.e. large territories with homogeneous scrublands, tree plantations, etc). ○ The value of combining different life strategies to increase resilience (i.e. favouring re-sprouting species like <i>Quercus</i> spp, <i>Arbutus</i> spp, etc.; favouring fruit trees which will attract seed dispersal fauna; favouring nitrogen fixing shrubs; etc). ○ The value of restoring riparian vegetation (fire break role). 		
		<ul style="list-style-type: none"> • Build capacity of all concerned actors for rehabilitation issues 	<ul style="list-style-type: none"> ▪ All people involved in post-fire restoration activities should be well trained about the agreed restoration protocols (i.e. the IUCN/WWF forest landscape restoration principles, methodologies, etc; The SER (International Society for Ecological Restoration) principles). ▪ Periodical training activities should be organised for the different social groups; Training activities involving at the same time different stakeholders who may act in the same restoration activities and may need coordination among them is needed. ▪ The concerned administration or civil society organisations should guarantee the necessary equipment and plant material for the restoration work. 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers • Land owners • Land managers & users 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation

			<ul style="list-style-type: none"> ▪ A network of tree nurseries for native plant species production (involving not only trees but also herbs and shrubs) should be created to guarantee (quality and quantity of all relevant native species) the necessary production for all annual restoration work. Tree nurseries may be created in forest protected areas, and respond to a multiple role (post-fire restoration; rare species conservation programmes; local communities aromatic/medicinal plant production & marketing; etc). ▪ The availability of high quality plants from all relevant species and the development of ad hoc restoration methods adapted to the environmental and social context is a must for succeeding in forest restoration work. 		
		<ul style="list-style-type: none"> • Community involvement in post-fire restoration work: socio-economic opportunities to link forest restoration and local development 	<ul style="list-style-type: none"> ▪ Develop raising awareness programmes about the social and economic value of recovering healthy forest systems. ▪ Build local capacity about post-fire restoration methods, with special emphasis on the creation of community tree nurseries. ▪ Develop participatory processes to identify post-fire restoration options and socio-economic values and uses of different native species/habitats. ▪ Help establish community restoration programmes with environmental, social and economic objectives and build capacity in all related themes (technical issues; business plans; institutional development; etc). 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers • Land owners • Land managers & users 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation • MoEconomy
		<ul style="list-style-type: none"> • Analysis of fire causes and spreading mechanisms 	<ul style="list-style-type: none"> ▪ Support Internal security forces to gain competencies in the analysis of fire causes ▪ Mechanisms to improve the competencies within the forestry department need to be supported specifically related to analysis of 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs • Forest rangers 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation

			<ul style="list-style-type: none"> spreading mechanisms. ▪ Exchange with expertise will be essential in this component. ▪ EU FIRELAB can provide useful information regarding fire spreading mechanisms and opportunities should be explored with this organisation. ▪ Potential exchanges of expertise for investigating and analysing fire causes is with the Italian State Forest Corps. ▪ They investigate every fire to attribute the fire event to one of five likely causes (natural, accidental, negligence, arson, doubtful) and the identification of a reason for each cause. Working with Italy State Forest Corps would be beneficial should forest fire laws be passed including legislation regards arson and negligence. 	<ul style="list-style-type: none"> • Land managers 	
		<ul style="list-style-type: none"> • Learning system to transfer lessons learned from the experiences of each fire event, and from other emergencies, to decision makers, practitioners, users, etc. 	<ul style="list-style-type: none"> ▪ The development of systems to transfer lessons learned is essential. ▪ Opportunities to learn from fire events needs to be established possibly through databases, sharing information at a regional, national and international level. ▪ Further research should be encouraged in this phase of the strategy, including research into fire causes and spreading mechanisms, fire ecology, deeper reasoning behind human induced ignitions and many other forest fire related topics. ▪ Current useful databases include: <ul style="list-style-type: none"> ➢ A number of European databases in which fire information can be collated and shared with relevant people, this serves as a transfer system and as a way to enhance to efficiency of international reporting (for example data for Lebanon was not included in the 2005 Global Forest Fire 	<ul style="list-style-type: none"> • Universities and Research institutions • NGOs 	<ul style="list-style-type: none"> • MoA • MoE • MoEducation

			<p>Assessment)</p> <ul style="list-style-type: none"> ➤ At a national level NCSR and AFDC has developed a data base for forest fires for input into GIS. ➤ Further data bases should be developed to include: Personnel used in fire suppression; Activities during suppression and pre suppression that were conducted well/poorly; estimated environmental/economic/social impact both positive and negative; GIS mapping with spatial and temporal information (fire size, fire intensity, fire frequency, history of fires in Lebanon). <ul style="list-style-type: none"> ▪ The establishment of a review system after each fire is necessary, which details the lessons to be learnt from each fire experience. Data should also be collated in a format that is compatible with the 'Global Wildland Fire Statistics Database' which has been developed through FAO and University of Freiburg. 		
		<ul style="list-style-type: none"> • Developing and enforcing the legal framework 	<ul style="list-style-type: none"> ▪ Revising and modifying the laws to allow all forest restoration requirements under the forest landscape restoration and ecological restoration principles 	<ul style="list-style-type: none"> • NGOs • Research institutions and Universities • Municipalities • Land managers 	<ul style="list-style-type: none"> • MoA • MoE • MoJ

Annex 2: List of Participants to the National Workshops⁶

Name	Title	Organization	Telephone	Fax	e-mail
Chadi Adwan	Environmental Fund for Lebanon	GTZ	03-513038	01-981252	cadwan@cdr.gov.lb
Charbel Hanna	Project Assistant	AFDC		01-752670	charbel_hanna179@hotmail.com
Fadi Bou Ali	Programme Coordinator	AFDC		01-752670	fadi@afdc.org.lb
George Akl	Engineer	Ministry of Environment	01-976555 / ext: 452	01-976530	g.akl@moe.gov.lb
George Mitri	Project Coordinator	AFDC	03-330695	01-752670	gmitri@afdc.org.lb
Ghazi Kassar	Engineer	Ministry of Agriculture	03-347216	06-433754	ghkassar@hotmail.com
Hassan Boushrouh	Colonel	Lebanese Army Forces	03-644742	05-951033/4	h.bouchrouh@hotmail.com
Hisham Selman	Programme Coordinator	AFDC		01-752670	hisham@afdc.org.lb
Houssam Dahrooj		Civil Defence	03-771395		
Jacopo Monzini	Environment Sector Manager	Italian Cooperation	70-163043		
Jawad Bou Ghanem	Project Coordinator	AFDC		01-752670	jawad@afdc.org.lb
Jawdat Abou Jawdeh	Senior Architect	CDR	03-346890		jawdate@cdr.gov.lb
Jean Stephan	Head of Forestry Dpt. Mount Lebanon	Ministry of Agriculture	03-814109		jeanstephan@hotmail.com
Khaldoun Al Omari	PA's officer	IUCN	00962 7778883444		khaldoun.alomari@iucn.org
Khalil Ibrahim	General	Lebanese Army Forces	03-353465	01-289228/7	
Lamia Mansour	Environmental Fund for Lebanon	GTZ	03-777134	01-981252	lmansour@cdr.gov.lb
Lara Samaha	Head of department	Ministry of Environment	01-976555 / ext: 417	01-976530	l.samaha@moe.gov.lb
Layal Fayyad	Project Assistant	AFDC		01-752670	layal@afdc.org.lb

⁶ Workshops held on 7-8-9 May 2008 and on 30-31 October 2008 at MFDCL, Ramliyah, Lebanon for the "Discussion of the first draft of the Lebanese National Strategy on forest fire management"

Marco Pagliani	International Consultant		0034-650908625		mpagliani@yahoo.es
Marcos Valderrabano		TRAGSA	03-186835		mvalderr6@yahoo.es
Michel Bassil		FAO	03-270576 / 05-924005/6/7 ext: 206		michel.bassil@fao.org
Moussa Karnib	Major	Internal Security Forces	03-734918	01-426996	moussa.karnib@i.s.f.gov.lb
Nada Beainy	Programme Officer	Italian Cooperation	05-451494	05-451483	nada.beainy.est@esteri.it
Nancy Awad	National Resources Specialist	Ministry of Environment	01-976555 / ext: 442	01-976530	n.awad@moe.gov.lb
Nazih Hedari	Colonel	Lebanese Army Forces	03-972717		
Nizar Hani	Scientific Coordinator	Al-Shouf Cedar Reserve	03-515845	05-502230	nizar@shoufcedar.org
Pascale Dib	Master Environmental Negotiations	LFPC	03-896840		pascale_eldib@live.fr
Pedro Regato	Senior Programme Manager	IUCN Mediterranean	0034-645810097	0034-952028145	Pedro.regato@iucn.org
Rafael Gómez					
Raghd Assi	Programme Advisor	UNDP	03-969799		raghdassi@gmail.com
Rami Abou Salman	Head of Programme	IUCN Mediterranean	0034 615441409	0034-952028145	rami.salman@iucn.org
Ramzi Fanoos	Statistician	Ministry of Environment	01-976555 / ext: 459	01-976530	r.fanous@moe.gov.lb
Rana El Hajj	Project Coordinator	AFDC	03-404625	01-752670	rana@afdc.org.lb
Rasha Kanj	Environmental Specialist	Ministry of Environment	01-976555 / ext: 398	01-976513	r.kanj@moe.gov.lb
Roger Akl		LFPC grp YASA	03-202076		roger_akl@hotmail.com
Roger Sleiman		Civil Defence	03-226724		
Samer Khawand		Ministry of Agriculture	03-905648		samerkhawand@hotmail.com
Sawsan Bou Fakhreddine	General Director	AFDC		01-752670	sawsan@afdc.org.lb
Viviane Sassine	Environmental Specialist	Ministry of Environment	01-976555 / ext: 499	01-976530	v.sassine@moe.gov.lb
Wissam Bou Daher	Awareness Coordinator	Al-Shouf Cedar Reserve	03-505205	05-502230	wissam@shoufcedar.org

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Annex 3 Fire Risk Map 2007



