Rapport de mission d’appui :
Elaboration de plans de gestion de deux forêts de pin en vue de la gestion durable et de la protection contre les incendies

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Rapport final, January 2013
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Projet d’Appui au Développement Local dans le Nord du Liban
(ADELNORD)

Mission report:
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

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Final Report, January 2013
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<th>Description</th>
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<tbody>
<tr>
<td>ADELNORD</td>
<td>Project “Appui au développement local du Nord Liban”</td>
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<tr>
<td>ADL</td>
<td>Agent de développement local</td>
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<tr>
<td>CDR</td>
<td>Council for Development and Reconstruction</td>
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<tr>
<td>Dunum</td>
<td>Lebanese area measurement (1 dunum = 1,000 m²)</td>
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<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ELARD</td>
<td>Earth Link &amp; Advanced Resources Development s.a.r.l.</td>
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<td>EU</td>
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<td>EUR</td>
<td>Euro</td>
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<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
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<td>FD</td>
<td>Forestry Department</td>
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<td>GFA</td>
<td>GFA Consulting Group G.m.b.H.</td>
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<tr>
<td>LARI</td>
<td>Lebanon Agricultural Research Institute</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
</tr>
<tr>
<td>MoA</td>
<td>Ministry of Agriculture (of Lebanon)</td>
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<td>MoU</td>
<td>Memorandum of Understanding</td>
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<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<td>PCM</td>
<td>Project Cycle Management</td>
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<td>ToR</td>
<td>Terms of Reference</td>
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## Units and conversion factors

<table>
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<tr>
<td>°C</td>
<td>degree centigrade</td>
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<td>cm</td>
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<td>dunum</td>
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<td>ETo</td>
<td>reference evapotranspiration in mm</td>
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<td>hour</td>
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<td>km²</td>
<td>square kilometre</td>
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<td>LL</td>
<td>Livre libanais</td>
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<td>l/s</td>
<td>litre per second</td>
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<td>million cubic meters</td>
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<td>cubic meter per second</td>
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<td>s</td>
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<td>T</td>
<td>temperature in °C</td>
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<td>USD</td>
<td>United States Dollar</td>
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1 km² = 100 hectares  
1 m³ = 1,000 litres  
1 ha = 10,000 m³ = 10 dunum  
1 mm = 10 m³ per ha precipitation  
1 € = ~1,900 LL  
1 Mio = 10^8 = Million

Comma is used as thousand separator; the dot is used as decimal separator.
0 INTRODUCTION

The overall objective of the project ‘Support local development in North of Lebanon’ (ADELNORD) focuses on three main target areas:

- Contribute to national unity and to improve the living conditions of the Lebanese population by enhancing the development potential of the region that suffers from a development deficit
- Contribute to national policy planning
- Contribute to improve environmental protection

The specific objective of the program highlights the participatory interaction with local communities for the sustainable management of agricultural and natural resources. The project's philosophy thus underlines the sustainability of economic activities and guides local development projects in harmony with the natural environment.

The project acts in three components, namely:

- Development of local infrastructure
- Communal development
- Support to environmental protection

For the entire project, three results were formulated:

- Government, local authorities, private sector and civil society are mobilized around sustainable local development strategies
- Agriculture is diversified, its productivity and profitability have improved. The use of Good Agricultural Practice (GAP) is systematized and employment in agriculture are maintained and increased
- Mountain ecosystems are protected

The project requested the services of Rainer Koepsell, Michel Bassil and Jan-Eric Voss (the consultant team) to support the 3rd component ‘Environmental Protection’ by conducting and subsequently evaluating a natural, environmental and socio-economic inventory of target areas in Andqet Forest and Qornet el Hosn Mountain Forest for forest management.

The main objective of the assignment was:

- The “Elaboration of sustainable management plans for the Pine forests of Andqet Forest and Qornet el Hosn Mountain Forest for the purpose of fire protection"
The short term mission comprised of the following main tasks:

- Establishment of an inventory and diagnosis of prior activities in view of the protection of forests against fire, while taking into account the opinion of the stakeholders
- Analyse the data and assess the issues that influence forest management in Andqet Forest and Qornet el Hosn Mountain Forest with respect to protection against wildfires
- Deduce a strategy for prevention and intervention in order to protect these forests against fire risk and for enabling sustainable management of the forest resources

After the finalisation of the assignment, it is expected that:

- The forest owners covered by this study dispose of a comprehensive view of development and sustainable management of forests, including the reduction of the risk of forest fires.
- The forest owners covered by the study dispose of a plan for sustainable management, including a set of specifications to be approved by the forest service in order to begin management activities necessary for the maintenance and sustainability of the respective forest areas.

The field work of the assignment was carried out from 03 September to 02 October 2012. For the detailed Terms of Reference (ToR), please refer to Annex 1.

The consultant team would like to express its gratitude to the Project Director, as well as to all project staff for their helpful cooperation. Special thanks go to Council of Development and Reconstruction, Ministry of Agriculture, Municipalities of Andqet, Sfireh, Tirane and Btormaz, the Federation of Municipalities of Dannieh.
1 METHODOLOGY AND COURSE OF MISSION

At arrival of the consultant team in Beirut, a start-up meeting was held at CDR where the general methodology for the assignment was presented. In consideration of CDR’s recommendations, the methodology was adjusted and the schedule of the field work was planned and agreed upon.

During the following weeks, the consultant team was based near the ADELNORD project office in Abdeh, and remained in close contact and regular discussion with the project’s experts and staff members.

1.1 General Working Method

In general, the working method consisted of three parts in each of the two project areas:

1. Initial meeting with local authority
   - Introduction of involved persons
   - Discussing current situation of forest area
   - Presentation of methodology and fine-tuning of work plan
   - Selection of work groups for field check

2. Data Collection and Gathering
   - Document check at forestry offices
   - Initial field visit and collection of general data from local forestry staff
   - Interviews with local stakeholders
   - Field measurements in representative forest areas
   - Elaboration of intervention catalogue

3. Mid-term meeting with local authority
   - Presentation of results and discussion

4. Reporting
   - Mapping
   - Reporting

During the mission, a meeting in Beirut at the Minister’s office was held in order to present tentative results and to align the concept with the Ministry’s National forestry plan.
At the end of the assignment in Lebanon a final meeting was held in Beirut at CDR office in order to present a summary of findings and a tentative proposal for interventions to be included in the forest management plan.

The elaboration of the final forest management plans and completion of overall reporting took place during the last week of the assignment via home-office.

1.2 Sampling procedure, data collection & interviews

Based upon discussions with the local forestry staff, sighting of available maps, satellite images and aerial photographs, as well as an initial distant visual check of the respective forests, the consultant team selected a number of representative forest areas to be checked during the mission.

The sampling method applied during the survey inside the forest areas was line sampling with circular sample plots of size 100 m², in difficult terrain, square samples of 25 m² where used (e.g. in very steep areas). When site conditions were homogenous, less sample plots were established and the consultant team instead checked the area visually during a walk over. Where site conditions were inhomogeneous, or the area was split up in smaller parts, more sample plots were established and/or deviations from the line sampling were made, e.g. in case of steep slope.

Figure 1: Evaluation of natural regeneration after forest fire and of age and growth

The collected data covered information about the existing vegetation, including distribution of ground flora, natural regeneration, tree species name, tree height, tree diameter at breast height, tree quality as well as occurring diseases. Furthermore, the evaluation included investigations on soil
condition, forest fire, snow-damage, grazing impact, conducted harvesting activities and non-wood forest product collection.

Figure 2: Evaluation standing volumes

Besides technical issues, the assessment also included interviews with local authorities, forest technicians, forest guards, NGOs, farmers and private businesses regarding their participation in existing forest protection and/or utilization activities. Records and technical reports at forestry centres were checked regarding harvesting licenses, forest violations as well as occurrence of forest fires.

Figure 3: Stakeholder interviewing
2 APPRAISAL OF RELEVANT FORESTRY PARAMETERS

2.1 General overview

According to MoA/FAO (2005), forests in Lebanon cover about 13.5% (ca. 135,000 ha) of the country's total surface area (10,452 km²), another 10.1% are covered by other wooded land (OWL). The main tree species growing in Lebanon's forests are Quercus sp., Juniperus sp., Cedrus libani, Abies cilicica, Pinus pinea, Pinus brutia, Pinus halepensis and Cupressus sempervirens.

Some twenty percent (equivalent to approximately 27,000 ha) of Lebanon's forest area consist of pine forest. Approximately 46% of these forests are stocked with Pinus pinea, also called stone pine, which is known for its edible fruits. The remaining 54% (~14,500 ha) are covered by two other native pine species, namely Pinus brutia and to some extent Pinus halepensis, which are simply called other pine or wild pine. Their fruits are not used for human consumption in Lebanon.

Figure 4: Spatial distribution of forests [ha] in Lebanon

Regarding the distribution of Pinus brutia and P. halepensis, the caza of Akkar accounts for more than a quarter (3,900 ha) of the total Pinus brutia and P. halepensis forests of Lebanon (14,500 ha), out of which Andqet Forest covers 1,200 ha (about 31%) and one sixth (2,600 ha) of Lebanon’s Pinus brutia and P. halepensis forests are found in the North Lebanon region with – among others - 381 ha (about 15%) being in the Qornet el Hosn Mountain Forest.
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 5: Spatial distribution of Pinus brutia + P. halepensis [ha]

2.2 Andqet forest

Figure 6: Andqet forest / Overview of location
Andqet Forest is spread on the western mountainous chain in the North of Lebanon. It is located 30 km far from the Mediterranean Sea and about 1.5 km east of Andqet’s village centre. The forest adjoins to a transition area of agricultural and other forested land. Residential areas do not exist within the forest, only one house seems to be situated close to the forest boundary.

Currently, there is no complete cadastre available for the Andqet Forest area, but it is expected to be accomplished in the following months. Nevertheless, it can already be as sumed that the biggest part of the forest in the area is owned by the municipality of Andqet. Especially, the eastern boundary of Andqet Forest is rather clear as it extends right on the mountain ridge in north-south direction. However, the boundaries of the other sides are not really known because of the interface between private and municipal lands.

**Figure 7: Andqet municipality / Land use**
In order to prepare the forest management plan the consultant team has taken aerial photos (2003) as basis to draw a map of the forested area. This map shows that the forested area amounts to 1,247 hectares. Yet, it must be considered that the map does not identify the exact boundaries of private and public land. Therefore, the map should be updated as soon as the cadastre is completed for the area of the public forest.

It is well known that Andqet Forest is a natural forest. Still, it is difficult to trace back the exact history of the area since no specific files were found in the Forestry Department. However, it is known that during the 1940s, the pine trees in Andqet Forest were harvested to build the railway. In addition, local people used to depend on the forest for fuel wood and medicinal plants collection, for hunting and extraction of logs for house construction.

As no technical forest management plan was drawn in the past the extracted annual amount of fuel wood and other products is not known. However, data about the occurrence of forest fires is available for the time period 1996 until today.

**Figure 8 : Andqet forest / History of forest fires**
The main part of Andqet Forest extends over the eastern side of the Oudine valley, for about 9 km length in north-south direction and about 1.4 km width in east-west direction, covering about 1,247 ha. A smaller part of the forest is located on the western side of the valley, it covers around 180 ha. The forest area is located between 500 and 1,100 m above sea level. It consists of several narrow valleys oriented east-west in both valley sides. Steep slopes are mainly found in the southern part and in some places in the northern part of the main valley.

A small river separates these two parts of the forest. It is fed by several natural water springs found within the forest, Nabaa el Charqui (the eastern spring) being the most important one.

There is only one official access to the forest area through a tarmac road which leads southwards from the centre of Andqet village through Oudine valley. Two further tracks cross the valley to provide access to agricultural lands that are situated between the small river and the lower parts of the forested area on both valley sides. In some places, these tracks are extended to facilitate wood collection from the forest areas. Consequently, only the lower part of the forest close to the river is accessible by vehicles. Some foot tracks are found in the higher altitudes, being mainly used by hikers, hunters and wood collectors.

The soil of Andqet Forest is almost homogenous and classified as red soil which developed on compact limestone. It is composed of decalcified residues of clay, which sometimes turns to brown forest soil. In some areas, basaltic soil is found. The depth of the soil is variable and can reach up to 45 – 50 cm mainly in the central part and lower altitudes of the forest. The northern and southern parts of the forest are characterized by quite shallow soils. In the eastern part, especially at high altitude, rocky outcrops exist and limit the growth of trees.

Recently, a weather station was installed in Andqet by the Lebanese Agricultural Research Institute. For the last two years, this station recorded annual precipitation rates ranging from 800 to 900 mm. The rainfall is distributed between 4 and 5 month with an extended dry period lasting from March to October. The average annual temperature is about 15 degrees Celsius. It might reach freezing temperatures in winter and 35 °C in a short period of the hot season. During winter, the snow might cover the higher parts of the forest for about one month.

Due to the existing relief, the forest is mostly protected from direct western wind. However, it is exposed to the humid south-west and the cold northern winds. The wind speed and snow sometimes negatively affect the development of the trees by causing damages to tree tops with subsequent attacks by insects and diseases.
One of the main characteristics of Andqet Forest is the existence of perennial water resources. The main river, called Naher el Mwaqid in the north and Naher Oudine in the south, crosses the forest in South-North direction. Further, the hydrological map of the site shows more than fifteen other streams that flow through the forest towards the main river. In addition, several water sources rise inside the forest. The two main water springs are known as Nabaa el Charqi and Nabaa el Gharbi, the Eastern and Western springs, which traverse the eastern and western part of the forest. There are no studies available on the water flow of these sources and springs, but it seems the Eastern Spring is the richest among all of them and its water is canalised for irrigation purposes. So, the main part of the watershed area is covered by Andqet Forest.

Figure 9: Points of interest in Andqet forest
The main tree species growing in Andqet Forest is *Pinus brutia*. In the forest side exposed to west, *Quercus calliprinos* is growing as a second tree layer all over this part of the forest. *Arbutus sp.* is also found, it is relatively abundant in the humid valleys associated with *Asplenium* species. *Arbutus* seems to find good conditions for development and regeneration. *Phylleria media, Rhamnus punctata, Pistacia sp.* and *Ceratonia siliqua* are found at the lower parts of the forest. On the western side of the river (exposed to the east), *Quercus calliprinos* shows a dominant growth and is associated with *Cupressus sempervirens* in some places. The *Cupressus* trees are characterized by their straight stem shape. Close to the river, riparian trees are growing such as *Platanus sp.* However, this part of the forest was not studied in detail since it is private land and mostly used for agricultural purposes.

The main shrub species found in almost all the forest areas are *Calycotome villosa, Poterium spinosum, Ruscus aculeatus*.

In general, the ground flora of Andqet Forest is characteristic for the Eu-Mediterranean vegetation level (B. Abi Saleh and S. Safi). Obviously, it was not possible to conduct a comprehensive inventory of this flora during three weeks at the end of summer season. However, at that time the consultant team noticed some important species, such as *Urginea maritimum* which is growing in the open areas located between agricultural and forest lands, and *Origanum libanoticum* which is also found in the lower part of the forest. Other species detected are *Origanum syriacum, Slavia sp., Phlomis sp.*

Due to its large and coherent area as well as location in the high and often steep mountains, Andqet Forest serves as habitat for several species of wild animals, amongst others fox, hyena, wolf, hedgehog, porcupine, wild boar, and several species of reptiles.

**Figure 10 : Cranium of a wild boar found in Andqet forest**
In addition to the abovementioned animals, Andqet Forest is also a roosting place for migrating birds, such as bee-eaters, buzzards and swallows.

In previous years, Andqet Forest received benefits from a number of projects which were implemented mainly by AFDC. Various donors supported environmental and forest fire protection activities, e.g. the Italian cooperation agency, FAO through the Lebanon Recovery Fund, and others.

A forest centre managed by AFDC was built on the western part of Oudine valley. This centre is used by AFDC for the conduct of training courses. It was planned to already receive people, but it still needs additional furniture. A forest nursery has also been established and is being maintained by AFDC. The seedlings raised in this nursery are sold at low prices to encourage people to assist in the plantation.

**Figure 11 : Andqet forestry training center and nursery**

A water pond was built close to the forest to provide water for aerial fire-fighting measures. At the same time, a landing site was established in the western part of the valley to be used by helicopter for landing, maintenance and fuel re-filling during the fire-fighting.

**Figure 12 : Fire protection pond, Andqet**
Lebanon Recovery Fund has also provided a fire fighting vehicle through a FAO project. This vehicle was provided to the municipality of Andqet and it is used by AFDC volunteers.

Two water outlets compatible with the civil defence hoses have been installed, one in the northern part and the second in the central part of the forest.

During last three years period also some forest fire prevention activities were implemented in Andqet Forest. They targeted the road sides and the interface areas between agricultural and forested lands.

People in Andqet used to depend and partly still depend on the forest especially regarding fuel wood provision to heat the houses during the cold season and to provide traditional bakeries with small fuel wood for their ovens. Nowadays, the households' demand for fuel wood is increasing due to the high fuel prices. However, only one bakery is left in Andqet which is running its business close to the forest. It is mostly using the small wood that was harvested during fire prevention activities. In the past, especially the small sized fuel wood was requested in larger amounts by a number of households for different uses such as heating water for cooking, washing, and baking.

**Figure 13 : Fuel wood for domestic and bakery use**

The people also used to graze animals and collect medicinal and aromatic plants, such as Thymus and Salvia. The collection of edible mushrooms is not practised or known by most of the people.
Recently, the urban plan of Andqet village classified its forest as a Green Area where almost no construction is allowed.

2.3 Qornet el Hosn Mountain Forest

Qornet el Hosn Mountain Forest is located in the Casa of Tripoli/Dannieh, about 30 km east from Tripoli city in the North Lebanon region. It spreads out on the slopes of an isolated mountain and is considered as the environmental lung of the area. The forest is mostly surrounded by urban and agriculture areas.

Unlike Andqet Forest, the ownership of Qornet el Hosn Mountain Forest and its limits are well known. It is a state forest distributed to the official territory of three villages (Sfire, Btermaz and Tirane). An interface among forest and agriculture land is observed mainly near the northern boundary of the state forest.
The federation of municipalities of Dannieh provided the project with a map showing the limits of the state forest where no land use conversion and no law violation are observed. According to this map, the state forest covers an area of 385 ha. This map was used as base for the elaboration of the forest management plan.
Elaboration of management plans of two pine forests
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Similarly to Andqet Forest, it is difficult to understand the exact development of Qornet el Hosn Mountain Forest in the past due to the lack of available information about previous uses and management interventions. In general, it is known that the forest used to be exploited mainly for fuel wood. According to the local population, the last large-scale harvesting goes back to the forties of the twentieth century when the British army used the timber for the construction of the railway. After that, heavy pressure on the forest was observed during the Lebanese war when efficient control by the responsible institutions and persons could not be provided. Finally, the laws prohibiting cutting of conifers at the end of the war helped in the protection and regeneration of the forest. However, the increase of biomass and the lack of professional management augmented fire hazards in the forest area.
Qornet el Hosn Mountain Forest extends on a mountainous area between the villages of Sfire, Tirane and Btormaz. The altitude varies from 550 m up to 1,348 m at the highest peak, named Qornet el Hosn, on the south east side of the forest. From this point, the high mountains of Dannieh and the coastal part of north Lebanon can be seen. Cliffs surround the forest from the eastern and southern side. Steep slopes are found mainly on the southwestern and northeastern edges of the forest. Two big valleys oriented southeast - northwest direction cross the forest, named Ouadi el Ghamiq and Ouadi el Jisr. These valleys are winter streams and collect water from the forest to disgorge it in the Naher El Bared. There are no official roads leading inside the forest. However, some trails link the three villages, which are placed around the mountain, to the forest. These tracks are much-frequented by hunters and hikers.

Figure 17 : Qornet el Hosn forest / Land use
The soil in Qornet el Hosn Mountain Forest is mainly classified as red soil on compact limestone. It is sometimes interrupted by mixed marl/clay beds. The clay is decalcified and turns into brown forest soil. The depth of the soil reaches up to 50 cm in some sites, especially in the northern part of the forest. On the ridge between the two valleys, shallow soil is observed and sometimes the rocks are well seen. In some places, thick humus is found. It is characterized by low decomposition due to the high share of coniferous tree species whose leaf litter provide a less favourable habitat for soil organisms than leave litter from broadleaved tree species.

Qornet el Hosn Mountain Forest has a typical Mediterranean climate with a rainy and cold season extending from November until April. It has long dry and hot season which reaches seven months or more depending on the years. During the cold season, the higher part of the forest is covered with snow. The forest receives an average precipitation between 1,000 to 1,100 mm. The annual average temperatures vary from 8° to 11°C.

Due to the relief, the forest is exposed to the humid western and to the cold northern winds. Both, strong wind and snow impact sometimes cause damage to the top of the trees.

Although Qornet el Hosn Mountain Forest receives a high amount of precipitation during the rainy season, no permanent water sources exist inside the forest. However, two water sources are found close to the eastern boundary of the forest, named Ain el Haour and Ain El MAqtouaa. An additional water source, called Ain Eddarji, rises near the north east side of the forest. This is why Qornet el Hosn Mountain Forest plays an important role in water conservation in Dannieh area. In addition, some seasonal streams are found during winter, which provide additional water to Naher El Bared.

Due to its location and prevailing climatic conditions, a wide range of flora is found in Qornet el Hosn Mountain Forest. *Pinus brutia* is the dominant tree species in the forest. In the lower forest layer, *Quercus calliprinos*, *Ceratonia siliqua* and *Phylleria media* are also found, especially at low altitude. Here, also *Cupressus sempervirens* finds suitable conditions to grow, mainly in the south western part. In the middle part of the forest, *Juniperus oxycedrus* reaches three meters height; it is abundant in western exposition. *Acer Syriacum*, *Arbutus sp.*, *Malus trilobata*, *Cercis siliquastrum* are growing in the humid places mainly close to the Ouadi el Ghamiq. *Crataegus sp.*, and *Quercus cerris* are growing at medium and high altitude.

The shrub layer is rich with regard to some specific plants found in this forest such as *Poterium spinosum* L., *Satureia thymbra* L. et *Thymbra spicata* L.. *Calycotome villosa* (Vahl) Link, *Centaurea sp.* *Linum sp.*, *Cistus sp.* and some bulb plant such as *Iris sp.*
The location of Qornet el Hosn Mountain Forest at medium altitude also benefits different fauna species. Most of these species such as fox and hyena leave the higher mountain forests of the surrounding during the cold season to spend the time in Qornet el Hosn Mountain Forest. Hedgehog and porcupine live here throughout the year. Also wolves and wild boars seem to occur, as wild boars are reported to cause damages to the orchards in the neighbourhood of the forest. A number of reptiles (lizards, etc.) and bird species can be found as well.

The Qornet el Hosn Mountain Forest has also been prone to forest fires in the past. The following map illustrates the sites, its extension and the year of occurrence of these fires.

**Figure 18 : Qornet el Hosn forest / History of forest fires**

Qornet el Hosn Mountain Forest has not been the goal of any forest project for years. In general, no activities related to forestry or silviculture were
implemented previously, also not by the forestry department. However, the North Horizon Forest Trail project implemented by German International Cooperation and the Federation of Municipalities of Dannieh aims at the elaboration of a Protected Area in Dannieh, but Qornet el Hosh Mountain Forest was excluded from this project since it is too far away from the main area and composes predominantly of *Pinus brutia* trees, only.

Yet, the forest seems to get additional value for tourists due to the new road of Mrah el Sraj-Tiran-Sir and Brissa dam which made it easier to reach.

As most of the state forests in Lebanon, also Qornet el Hosh Mountain Forest was affected by unregulated extraction of forest products during the period of lacking control. In addition, some forest areas were converted to urban or agricultural land.

Today, Qornet el Hosh Mountain Forest is not too much affected by fuel wood collection of the local population. This situation is not only caused by the fact that the state has the ownership, but also due to the difficult access to the forest. Still, the removal of small fuel wood is observed and the forest is also used to collect non wood forest products. The fuel wood is mainly extracted from the northern area close to private properties. The neighbouring owners limit the access to themselves which decreases the pressure on the forest.

Hunting is also practiced in the forest and some old trails providing access to the forest area are quite well maintained. The forest was also used for grazing, but currently the remaining shepherds go to the high mountains during summer and to the low altitude oak forest in winter in the greater surrounding of Dannieh.

## 2.4 Threats / Risks

Qornet el Hosh Mountain Forest and Andqet Forest are exposed to different types of threats, the main important ones are described in the following.

### 2.4.1 Forest fire threat

After disastrous forest fires destroyed large forest areas in Lebanon during the last years and especially in late 2007, several actions were taken to decrease the risk of forest fires throughout the country as well as in the forests of North Lebanon in particular. Amongst others, this includes the elaboration of “Lebanon’s National Strategy for Forest Fire Management” (2009) and a forest fire fighting field assessment for the respective forest area of Andqet municipality. Therefore, the following paragraphs will not reiterate the facts and figures already presented in the aforementioned documents. They will incorporate, however, the main recommendations where applicable and tailor
them to the scenario prevailing in the target areas of Andqet Forest and Qornet el Hosn Mountain Forest.

Figure 19: Forest fires traces

2.4.1.1 General Fire Management Considerations

Fire management is the process of effectively minimizing the negative impacts of fires on the environment, human health, and valuable investments, such as homes, crops, forest plantations and other improvements, and the use of prescribed fire to meet management objectives. Three major components for managing the fire threat are:

- Fire prevention through education and awareness programs and enforcement of regulations.
- Fire detection, safe/effective initial fire suppression response, and mobilization/logistical support for large fire incidents.
- Fuels management to meet ecological and human needs.

An effective fire management system is characterized by:
• An officially designated organization lead by a single official that is responsible for preventing and suppressing fires. This organization can be replicated at various levels and each level can be delegated varying degrees of responsibility based on capabilities and needs.

• Prompt detection and reporting of fires.

• Well-organized, equipped and trained fire suppression crews.

• Prompt initial-response to reported fires.

• Availability and use of proper equipment suitable for the terrain, fuels and expected fire behaviour.

• Cooperation between government agencies, institutions, communities, NGOs, and small landowners whose assistance is needed in large fire, emergency situations.

• Written cooperative agreements (and/or regulations) with adjoining fire organizations for assistance and aide that are established well in advance of a fire event.

• Written strategic and operational (tactical) fire management plans that provide direction, assign responsibility, and define budget parameters.

Fire management planning is tiered (directly linked) to overall forest and land management plans, policies, and objectives and identifies fire hazards/risks, strategies, values to be protected, and agencies responsible for implementation. The overall goal is to facilitate the coordinated effort to protect life, property, other valuable assets, and meet the direction of overall land management objectives.

Forest fire management preparedness and fuels management activities are essentially an insurance policy that is used to protect and minimize damages to valuable forest resources. Consistent financial support is needed to ensure the training, equipment, personnel, and standard operating procedures are constantly applied and prepared for implementation at a moment’s notice. Fuels management activities must also be regularly applied to maintain fuel loadings in a non-hazardous condition. The benefits of preparations and investments in fire management may be difficult to realize in the short-term during periods of little or no fire activity, however the ability of the organization to effectively respond to wildfires during severe dry periods will be optimized.

2.4.1.2 Existing Fire Management Conditions

Forest fires have occurred on a quite regular basis in both forest areas in the past, causing considerable damages to existing forest resources and the surrounding environment. For Andqet Forest, 24 fires have been recorded.
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

during the last 17 years. Out of these, eight fires were classified as small fires which burnt less than 300 m² each. However, three fires in 2002, 2004, and 2007 burnt forest areas of approximately 80 ha, 50 ha, and 130 ha, respectively. The Qornet el Hosn Mountain Forest is also vulnerable to fire, yet at a lower frequency than in Andqet Forest. Only eight fires have been registered since 2001, out of which three reached a size of more than one hectare. However, especially in Qornet el Hosn Mountain Forest the fires did not only affect the forest resources, but also the nearby populated area.

Fire risk is defined as a fire causative agent broadly defined by two categories, either natural or human-caused. Natural ignitions from lightning do not appear in Lebanon as the thunder storms occur during winter when the vegetation is no longer susceptible to fire. Human-caused ignitions are the primary reason for fires to ignite in the respective forest areas. In 2008, Bouzza and Chnais already listed several fire risks for Andqet Forest in their report, of which some were also detected during the recent assessment. Lebanon’s National Strategy for Forest Fire Management (2009) also provides a list of main causes for forest fires, which greatly coincides with the findings of the consultant team’s assessment as well. The following activities can be regarded as major risk factors for forest fires:

- Land tenure/ownership uncertainty adjacent and sometimes inside the forest areas of Andqet Forest and Qornet el Hosn Mountain Forest causes problems. The boundaries between private and public land are only roughly known in some cases. This interface urges or might urge people to burn existing forest to enlarge their lands.
- Further, local people explained that high prices for fuel have triggered intentional burning of forests in several cases. Normally, it is forbidden to cut any trees without a specific permission by the Ministry. However, it is a common procedure to cut burnt trees as fuel wood subsequently to a forest fire.
- Fires which got out of control, started by
  - farmers cleaning remnants of their agricultural lands/pruned trees,
  - campers/hunters/hikers during their visit to the forest,
  - careless smokers/playing youths/fire works

During the last months and years, forest fire fighting activities in the forests of Andqet Forest and Qornet el Hosn Mountain Forest have been intensified. Especially for Andqet Forest, the municipality of Andqet and the Association of Forest Development and Conservation (AFDC) undertook several forest fire prevention and protection activities. As suggested also by Bouzza and Chnais (2008) this included regular cleaning of the forest bush-layer and floor from
dead twigs and plant material near the edges of roads with a focus on the most frequented roads. Further activities encompassed the creation and cleaning of buffer zones around agricultural land, the installation of water outlets and a water pond and landing area to support fire fighting by helicopter. Andqet Forest has also been provided with a Toyota LandCruiser HZJ-79 fire tender. Its capacity is 400 litres and it is well equipped to be used for first fire fighting interventions. The vehicle is stationed and maintained at the local AFDC unit in Andqet.

However, the organization of regular patrols during the fire season through forest service, forest guards and local dwellers has proven to be crucial for the early detection of the fire and fast intervention, both in Andqet Forest and Qornet el Hosn Mountain Forest. The patrols together with awareness-raising among the villagers have reduced the number of fires during the last three years, especially in Andqet.

2.4.1.3 Reduction of forest fire risk through professional forest management

The survey of the consultant team revealed that despite above mentioned indispensable activities, which were mostly accomplished within the administrations as well as near the boundaries of the forests, the risk of fire still exists, especially within the forest areas. Following the concept as explained in “Lebanon’s National Strategy for Forest Fire Management”, the forest management plans at hand therefore focus on the so-called ‘risk modification’ as described under the second component in the strategy paper. It is stated in the strategy to “develop effective measures intending to reduce fire vulnerability, to increase ecological and social resilience to fire, and to prevent the occurrence of harmful fires and unsustainable fire regimes”.

The current situation of fire risk inside the forests can be explained by the dry climatic conditions, the dominance of a single, fire vulnerable tree species growing inside both forests (Pinus brutia), and particularly the lack of regular professional thinning of the forest stands according to sustainable silvicultural standards during the past decades. The latter has been intensified by the national felling ban which was geared towards the protection of the forest resources. However, as result the pine trees regenerated in high numbers and created extremely dense forests stands. As the pine trees grew up, the high density caused and is still causing intensive competition among the trees. Due to that the forest stands face natural die-offs of numerous trees and by that an accumulation of flammable dead wood material inside the forests.

Consequently, the activities related to active forest management should predominantly aim at the reduction of large amounts of highly flammable
vegetation material inside the forests. Correspondingly, the appropriate steps included in the forest management plan should aim at

- the reduction of flammable material inside dense forest stands through a consequent, sustainable thinning regime;
- the development of mixed species forest stands that are less susceptible to fire by strictly protecting and enhancing the natural regeneration of broadleaved tree species;
- support of ongoing activities, such as patrolling fire guards, by providing better access to forest stands;
- Support of clearing forest sites near roads and paths from flammable vegetation material.

The described approach is integrated in the respective forest management plans as presented in the following chapters.

2.4.2 Other threats

The main risk affecting the forests is the interface between private and public land and the absence of complete cadastres which makes the forest boundaries unclear in certain areas. As a result, some farmers try to enlarge their properties by cutting trees, laying out of terraces and planting agricultural crops. In a few cases, farmers are regarded as being responsible for the fires occurring in the forest, either accidentally or intentionally.

For the successful implementation of a management plan, the boundaries of the forest must be clear. In Andqet Forest, cadastral work is going on to identify the exact limits of the forest, but it is not yet completed. The situation is different in Qornet el Hosn Mountain Forest where ownership is well known and the boundaries are clear between private and state land. However, a couple of neighbouring owners used to consider the forest of the state as their own property and entered it to extract fuel wood and other products.

In the northern part of Qornet el Hosn Mountain Forest, a number of houses or agricultural land might have been constructed on state property, due to the lack of control in the last decades.

During the field work and data collection phase, symptoms of several diseases and insects affecting tree health were noticed. Yet, the short period of the mission in a given season did not allow identifying all occurring types. However, some forest pests were clearly recognized and are listed in the following:
• **Melampsora pinitorqua** - Pine twisting rust
  
  This is a type of fungus which causes orange lesions on the current year shoots of young trees reaching a height of 2 to 3 meters. It causes cankers on the twig and distortion of the leader shoot. On adult trees, it causes the development of non-straight stems, thus bad shape and bad quality of timber.

• **Ryacionia duplana** – Pine shoot moth – Elgin shoot moth
  
  This insect causes a yellow red discolouration of the needles at the tips of juvenile shoots. The new shoots become crooked, red and dry. Damages occur on young plants, they are noticed through a distortion in the new shoots causing branched and bushy plants. Therefore, the growth is affected and quality of timber is worthless. This insect causes the death of the plant in case of repeated attacks.

• **Thaumetopoea pityocampa** – Pine processionary moth
  
  Almost all pine species are potential hosts of this insect, it was identified in Lebanon during the late sixties. The larvae of this Lepidoptera insect feed on the pine needles. It causes yellow brown needles at the end of the summer season and weaves silky nests at the end of the branches during winter causing total defoliation of the twigs. So, a loss of radial growth is noticed and young trees might be killed after repetitive attacks.

**Figure 20 : Pine diseases**
In conclusion it must be said that Lebanese forests, especially Andqet Forest and Qornet el Hosn Mountain Forest, should receive additional investigations on the present occurrences of insects and diseases in order to prevent further damage of the forest resources.

The impact of storms and snow is very well seen inside both forests. The storm causes uprooting of some trees. The weight of snow often breaks the top of trees. Eventually, these injured trees are often attacked by fungi or insects as it can be observed throughout the forests.

In the absence of a professional forest management concept, many people living nearby Andqet Forest and Qornet el Hosn Mountain Forest have not developed a clear awareness of the high quality products their forests could actually provide. In fact, a large part of the population connects forest with conservation and protection aspects, only. However, another part of the local populations depended and still depends on the collection of a number of forest products, including fuel wood, medicinal and aromatic plants. Hence, to a certain extent non professional cutting has always occurred and is still ongoing. For example, clear cutting of small sized trees has been observed by the consultant team in a wide area and sometimes larger trees were removed, destroying the smaller ones around them during that process. It remained unclear on what basis the trees were cut or thinned. Unfortunately, those persons who are engaged in this activity are not used to apply proper silvicultural practices. Hence, the cutting occurs in an anarchic way, i.e. without selecting future crop trees or mother trees, and without sufficient protection of natural regeneration. Furthermore, the method used for harvesting the trees is often causing damages to the remaining trees. As result, the uncontrolled and harmful utilization exposes the trees to several fungus and insect attacks which is leading to the propagation of these parasites and to a bad quality of wood or even die-off of the trees.

Consequently, this way of treatment will not serve the sustainability of the forest. As result, in several sites the trees are already sick and develop crooked stems. In other places, forest stands are too dense and not well structured. In this case, a high competition among the trees is observed, leading to low increment rates reflected by thin stems. By this, the stability of the trees is reduced, and the trees might be easily broken by the impact of snow and storms.

In addition, pruning of trees was observed to obtain fuel wood for a local bakery. Unfortunately, also the pruning is not practiced according to correct technical methods, which results in severe injuries of the trees. This again leaves the trees exposed to several insects and fungi attacks.

There are no active quarries within the main part of the forests, but some old ones can be found nearby both forests. The partly unclear boundary of the
forest does not allow identifying whether these quarries are actually within the respective forest areas or outside. It is obvious that quarries destroy the forest ecosystem in an irreversible way, so it is important to keep such activities away from the forest.

Hunting is a widespread activity in both forests. Professional hunters and young people are shooting birds, even those which are not edible. In fact, hunting is practiced most of the time as pleasure and sport rather than as a possibility to obtain food resources. Shooting all types of birds is also affecting the health of the forest ecosystem in a negative way as predators of certain insects get eliminated by this behaviour. As consequence, the ecological equilibrium gets out of balance which supports outbreaks of forest pests.

Interestingly, the wild boar is not yet considered as a goal for hunters even though this species has a high rate of reproduction which can be used as resource without negative impacts as long as it is done sustainably. As the wild boars are also causing damages to agricultural land and or chards in some places, a professionally organized hunting management could also have a positive impact in this respect.

In Andqet Forest, only one shepherd is grazing his herd for about six months during summer season. He uses the lower parts of the forest for young animals and the higher altitudes for the adult animals. A few other shepherds occasionally enter the forest from neighbouring municipalities on the southern side. The assessment revealed that when the grazing is practiced in a recently burnt area, the natural regeneration is damaged and the forest is exposed to degradation. However, grazing is useful in some areas such as next to frequented roads and paths, it helps decreasing the fuel load of the forest in the grass and shrub layer and thus assists in fire prevention.

In Qornet el Hosn Mountain Forest, the situation is different as the natural cliffs surrounding the forest make the access difficult. However, two or three
herds graze occasionally in the forest. They come from the northern side where there is an interface with agriculture and residential areas.

During the assessment, erosion was detected on areas with rocky soils and steep slopes where grazing took place. Unprofessional cutting of trees and bushes in steep slopes also exposes the soil to erosion. In Andqet Forest, erosion is mainly localized in the upper (eastern) part of the forest where several areas without forest cover can be found.

Erosion in Qornet el Hosn Mountain Forest is observed in limited areas only, but there is a risk this will become more intense in the valleys and in the southern and eastern boundaries of the forest if those areas are not strictly protected. The eroded land and the vulnerable land for erosion should be protected for the following years to allow the rehabilitation of the ecosystem.
3 STRUCTURE OF FOREST MANAGEMENT PLAN

Following the ToR, management plans have to be elaborated for sustainable management of the pine forests in Andqet Forest and Qornet el Hosn Mountain Forest. In general, a forest management plan consists of three parts:

- The first part covers inventory and assessment,
- the second focuses on planning issues
- and the third one considers financial aspects.

3.1 Inventory

The goal of the inventory is to identify basic site conditions, e.g. geographical and cadastral situation, and to survey relevant parameters to assess and analyze the main factors influencing growth, volume, density, stability, and value of the forest.

In spite of an intensive mixture of different aged stands throughout the pine forests of Andqet Forest and Qornet el Hosn Mountain Forest, some main structures of occurring forest types could be identified. As result, the forest management plan distinguishes young pine stands, medium-aged pine stands and old pine stands. Furthermore an oak dominated forest stand represents an additional forest type.

For the defined pine forest types representative data was collected from existing documents and other resources or derived from direct measurements. Significant inventory data includes tree age, density of stands, the increment of wood or biomass as well as the number of trees and standing volume of wood per ha. This classification of the status of a forest is the foundation for the planning process.

3.2 Planning

Based upon collected and analyzed inventory data, the chapter planning develops strategies and instructions for practical activities which may be implemented in the field later on. The planning interval for forest management plans normally comprises 10 years for operational measures. In general, further prospective objectives (> 10 years) can be listed, but cannot yet be specified within the forest management plans. Towards the end of the first ten year cycle, the management plans will have to be reviewed and a more detailed planning for the following ten years needs to be conducted.
The proposed management plans aim for the conversion of the respective forests from the current situation towards a more productive, diverse and stable forest ecosystem. This conversion will require more time than the management plan's life span (10 years), mainly due to the absence of professional management during the past decades. For the protection and sustainable use of the forests it is of utmost importance to follow the proposed management plans one-on-one and to conduct the review after ten years.

In order to subdivide the forest in economic oriented units, the planning process as well as the inventory partitions of the forest will have to be distinguished into three categories. Within the management plan individual activities are to be allocated towards those categories. In the pine forests of Andqet Forest and Qornet el Hosn Mountain Forest, three different categories have been defined and divided into zones.

Category I puts the main focus on protection, only a few measures have to be implemented here. Category II includes forests in the development stage and the aim is to improve the forest stands under this category by selected activities. Forests associated under category III are in a status, which allow immediate management in the ordinary way of forestry, combing protection, quality improvement and production measures.

The management plans describe detailed activities and measures to implement the ecological and economical goals in the planning period.

3.3 **Budgeting**

Based on the specifications of the management plan, an overall working schedule, required labour input, inserted material and the amount of harvested wood, mainly fuel wood, can be calculated. As result, a detailed comparison of the supplies of the forests and demands of people can be made.

As soon as the management plan is fully developed, costs and benefits can be allocated to the respective intervention activities, measures and outputs from the forestry. Being integrated into an economical and financial statement, this survey can be used as a decision tool and as support for raising funds.
4 PROPOSED MANAGEMENT PLAN OF ANDQET FOREST

4.1 Summary

4.1.1 The current situation of the forests

The forest stands of Andqet Forest vary considerably in their appearance. Some stands are growing under favourable conditions, showing a productive growth performance and a good shape. However, a significant percentage of the Brutia pine forest stands have been degraded (category I). These parts of the forest must be managed very carefully. Rehabilitation measures should be the main objective in order to improve their multiple ecological functions and environmental contributions (positive impact on hydrological balance, protection of biodiversity of flora and fauna, protection against soil erosion, recreational values, etc.).

The other forest stands (category II, III) should be managed in a way to improve stand stability and to increase productivity. Particularly, used measures must target at the improvement of the average quality of the pine forests and at securing the fuel wood supply to local households. Furthermore, there is a need to consider new developments regarding legal, silvicultural, or technical issues, and to adapt the management of the forests accordingly (preservation, sustainability, promotion of natural regeneration, multiple use of forests, tourism, etc.).

4.1.2 Silvicultural treatment and marking rules

The silvicultural treatment of the forest stands has to be integrated into a few operational management activities. Forest opening, forest fire prevention, thinning and the enhancement of the natural regeneration of pine are the main important activities. All these activities have to be prepared, first theoretically during the planning process and then practically in the forests, the latter by marking future crop trees and competitor trees prior to the thinning. It is important that tree marking is exclusively conducted by experienced foresters or very well trained forest guards. Only they dispose over the necessary understanding of the silvicultural concept and can make the right decisions adapted to the prevailing conditions in the respective forest stands. In general, they are in charge to control all ongoing as well as finalized operations inside the forest, especially felling activities.
4.1.3 The management and inventory system

Up to the present, forestry as practised in Andqet Forest does not have the character of a sustainable management system. The need of modification in order to be more detailed and to consider the implementation of criteria and indicators for sustainable management should be fulfilled by the new management plan. This change is a first beginning and it requires improvements in the inventory system as well as continuous research for significant issues related to the management including regeneration, silvicultural treatment and its impact on the functioning and on the output of the forest ecosystems. In the future, a continuous forest inventory based on permanent sampling plots would be a very useful tool for forest monitoring. It should incorporate some additional parameters such as the age, site quality, and other parameters of ecological interest. There is also a need for more detailed mapping with regard to the species composition and the structure of stands.

4.1.4 The prospective situation of the forests

This first management plan for Andqet Forest includes the basic data for a sustainable management of the forests in the future. The practical planning horizon is ten years, but the plan initiates the forest development also beyond this era.

Pursuing the plan by opening the forest area, prevention of forest fires, directed improvement of quality and health conditions of the pine stands through professional thinning activities, will help that the situation of the forests is steadily becoming better. Increase of the yield of wood, raising quality, more stability, protected biodiversity and a higher amount of standing volume of trees will be the result.

Professional cutting of trees will not lead to a depletion of the forest resources. This selective thinning combines timber harvest with improvement and progression of yield. With the amount of harvested wood a part of the local demand for fuel wood of Andqet Forest can be supplied. In the future even timber needs can be met to a certain extent.

With an increased health and higher productivity, the forest will also more easily fulfil ecological issues and multipurpose functions.

4.2 Inventory / Rapid forest survey

For a more detailed appraisal of the Andqet forest parameters please refer to chapter 2 “Appraisal of relevant forestry parameters”, paragraph 2.2.
The survey of the forest area of Andqet Municipality included measurements of various forest parameters and intensive discussions with local stakeholders. It revealed that in order to ensure and improve the health and productivity of the forest ecosystem in the future, a combination of protection and maintenance activities within the forests will have to be applied.

The forested area (1,250 ha) represents some 46 % of the municipal area (2,716 ha) of Andqet.

**Figure 22 : Andqet municipality / forested area**

Accordingly, a classification of existing forest resources and a number of measures are recommended in the following which should be implemented during the next years. In spite of an intensive mixture of different aged stands in the pine forest of Andqet, common structures were identified and classified as **different forest types** as described in the following.
Young pine stands

Young stands of *Pinus brutia* are defined to include trees reaching the age between 0 up to 25 years. They originated from natural regeneration after forest fires. Often these stands are quite dense with more than 4,000 trees per ha. Some of them show crown damages caused by the weight of snow, negative effects of different fungi and the impact of grazing animals.

Figure 23 : Forest type T1: Young pine stands

Medium aged pine stands

Medium-aged stands of *Pinus brutia* are defined to consist of trees at the range between 25 and 50 years of age. Their origin is also from natural regeneration after forest fires. In and after their youth phase the stand density had been reduced by diseases, cuttings and die-offs during the natural selection process.

Figure 24 : Forest type T2: Medium aged pine stands

Old pine stands

Old stands of *Pinus brutia* are defined to reach an age of >50 years. Also large parts of these stands originated from natural regeneration after forest fires. Yet, some stands also developed from natural regeneration without any impact by fire. In the past, the stands included under this forest type have been reduced in density by diseases, cuttings and the natural selection process.
Other forest stands

Other forest stands are oak dominated stands mixed with cypress and some pine. They are mainly found on a slope southbound of the South of Andqet Forest and some other localized places.

Figure 25: Forest type T3: Old pine stands

Figure 26: Forest type T4: Other forest stands

Figure 27: Main characteristics of forest types T1 to T4

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<tr>
<td>Possible sustainable activities</td>
<td>- Opening</td>
<td>- Opening</td>
<td>- Opening</td>
<td>- Opening</td>
</tr>
<tr>
<td></td>
<td>- Fire prevention</td>
<td>- Fire prevention</td>
<td>- Fire prevention</td>
<td>- Grazing</td>
</tr>
<tr>
<td></td>
<td>- Thinning</td>
<td>- Thinning</td>
<td>- Thinning</td>
<td>-</td>
</tr>
<tr>
<td>Standing volume</td>
<td>[m³/ ha]</td>
<td>depending on age</td>
<td>depending on age</td>
<td>depending on age</td>
</tr>
<tr>
<td></td>
<td>0 - 50</td>
<td>20 - 70</td>
<td>20 - 150</td>
<td>5 - 25</td>
</tr>
<tr>
<td>Average yield</td>
<td>[m³/ year]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - 5</td>
<td>2 - 5</td>
<td>0.5 - 1</td>
<td>0.5 - 1</td>
</tr>
<tr>
<td>Expected extraction</td>
<td>Fuel wood</td>
<td>Fuel wood</td>
<td>Fuel wood</td>
<td>Fuel wood</td>
</tr>
<tr>
<td>Work input per ha</td>
<td>[hrs./10 years]</td>
<td>40</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Cut volume per ha</td>
<td>[m³/10 years]</td>
<td>6</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Expected revenue</td>
<td>[$/ha]</td>
<td>800 S/ha</td>
<td>4,000 S/ha</td>
<td>3,500 S/ha</td>
</tr>
<tr>
<td>Assumption</td>
<td>1 m³ = 0.9 t</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 Planning / Management activities

4.3.1 Forest management categories

In order to enable an effective management, the area of Andqet Forest should be divided into three distinct categories:

Forest management category I (red)
Forest stands growing on poor sites, shallow soil, rocky stands and steep slope facing unfavourable growth conditions, being not or hardly reachable.

Forest management category II (blue)
Forest stands growing on medium to good sites, being generally difficult to access, but need to be developed. These stands have the prospective potential to develop good quality products in the medium term.

Forest management category III (green)
Forest stands growing on medium to good sites, which are mainly within easy reach and should be managed immediately.

For category I protection and preservation are the main targets and must be considered during future management of these forest areas. The management should predominantly focus on controlling activities, such as fire and pest control, protection against overgrazing as well as other damages. Consequently, the main investment measures would be the opening of the respective forest areas by the construction and maintenance of a small scale network consisting mainly of control paths and some working trails. Furthermore, reliable control systems are desirable and should be installed and operated continuously.

Category II and III forests need to be managed differently and more intensively than category I. In order to secure the health and stability of the forests as well as to improve their productive function it is necessary to provide access to the stands and to apply suitable maintenance measures on a regular basis. In Andqet Forest, this management concept could be implemented as in the category I without costly investments, but starting soon. To reach this target, it is of great importance to plan and set up a basic infrastructure system. Such system would mainly consist of extended footpaths and skidding lines with a width of ca. 1.5 m. This would enable forest guards and workers to access the partly remote and very dense forest sites for control and maintenance work.
For **category II** some investments, notably to reach remote stands, are necessary. But maintenance as in the category II is not very urgent and may not be started until ten to fifteen years from today, at the earliest.

**Figure 28**: Spatial distribution of forest management categories in Andqet forest


4.3.2 Maintenance of forests

Maintenance of existing forest stands would focus on improving health conditions and the growing process of the existing pine (*Pinus brutia*) forest stands, which in turn will increase the stability of the forests and thereby reduce the vulnerability towards natural disasters and other risks. After having improved the access to the forest stands, selective activities can be implemented successfully, including thinning of forest stands, selection of potential future crop trees and the regulation of the existing species composition in favour of valuable local broadleaved tree species. As a result, it would be possible to specifically improve the condition of the forests in terms of quality, resistance to damages and diversity of products. For that purpose it is necessary to apply regular professional silvicultural measures, such as opening, fire prevention, pruning, disease prevention and selective cutting as described in the subsequent paragraphs.

4.3.2.1 Opening

First of all, it is essential to open the forest area by installing a site-adapted control and working path network including logging lines for reasons of better clarity and accessibility. Priority of all interventions must be the enhancement of forest protection, especially regarding forest fire, damage by insects and fungal infestation.

Maintenance activities in pine stands growing on sites of forest category III, later II, should start early. During a first step, control paths and logging lines as basic infrastructure are needed to be laid out and cleared from vegetation. On the hillside, systematic spacing of paths (200 m apart from each other in vertical direction, generally following contour lines) and skidding lines (every ca. 100 m or following ridges) is suggested. As a second step, thinning and (rarely) pruning may be started within the opened forest area.

The construction of paths is comparably easy and could be done by local workers that have received a short training beforehand. The accumulated vegetation material (branches, small and bad shaped trees) resulting from the clearing should be collected and could be provided as fuel wood to the local market. In case there should be no funds available for the local workers, the collected material could also be distributed to them as compensation in kind.

Technically, the clearing of paths can be done using simple tools such as handsaws and axes. If available, small chain-saws or trimmers could be used as well. The cut off vegetation material from the paths shall be removed from the forest and brought to nearby roads where it can be picked up by small trucks. The removal itself could be done either by the local workers themselves or by using donkeys/horses, which would facilitate the work to a great extent. Donkeys/horses would be well-suited for working in such a
terrain. In addition to the work during thinning and harvesting operations, they could also support transport of water and equipment during forest fire fighting activities.

In case of an opening of forest areas through control/working paths and logging lines reaching a larger scale, the distribution and/or sale of harvested vegetation material would be needed to be organized. If applicable, small scale processing workshops may be established, such as fuel wood dealer or wood pellet producer.

4.3.2.2 Forest fire prevention

The prevention of fires in the forest is a key element of the forest management plan at hand. The proposed set of measures aims at the reduction of fire risk in the respective forests. In particular, the site clearing from bushes and shrubs along streets adjacent to the forest and forest roads is urgently recommended. Besides clearing a width of about 10 m on both sides of the roads, the pruning of the remaining trees within this belt is necessary. Highly flammable material, such as dead and dry vegetation, should be removed from these areas. The incurring material might be tradable as fuel wood (light fuel wood for bakeries) in some areas. This work as well could be done by local workers who have received a short training beforehand. The work input regarding fire prevention is very much depending on the condition of the forest site (stand density, species of shrub and trees, need for pruning). The average productivity per day (8 working hours) is estimated to reach about 300 m². Most probably, the labour costs cannot be covered by the revenues gained from the traded fuel wood. Besides site clearing, fire prevention is especially achieved by the increase of broad-leaved species (Quercus, Pistacia, Acer and other species) regeneration under the canopy of pure pine stands.

4.3.2.3 Pruning

Pruning of branches is suitable for improving the quality of individual trees in case the silvicultural target is the production of high value timber. At this moment of time, pruning for this purpose is not useful within Andqet Forest as the quality of the existing average pine stands is too low. A higher quality of timber will be reached in the future after the first cycles of professional forest management (enhancement of natural regeneration, selection of potential future crop trees, regular selective thinning) have been completed inside the respective forest stands. In fact, the increase of timber value through pruning is seldom compensating the higher productions costs. Therefore, for Andqet Forest pruning is only advisable in combination with forest fire prevention activities.
4.3.2.4 Disease Prevention

For prevention, control and limitation of diseases, sick and especially trees infected by fungi should be cut and removed from the forest in a timely manner. Generally, infected trees are weaker against abiotic impacts like storm and snow damage. For this reason, disease prevention activities always lead to a higher quality and stability of forests.

4.3.3 Stabilization and quality improvement by selective cutting

Selective cutting has a high influence on the growth, quality and stability of *Pinus brutia* stands. This process can be initiated when the trees of the forest stand reach approximately 25 years of age and may be repeated every 7 – 10 years. Thinning by selective cuttings is always to be combined with a preliminary check of the forest and with the marking of trees. Ideally, the potential future crop trees (those belonging to the desired species and disposing over the highest vitality and quality) will receive a permanent marking for easy identification. Surrounding trees which have a negative impact on the growth of the future crop trees and which are of less quality should be marked as competitor trees. They should be cut during subsequent thinning activities. Selecting and marking of the trees must be done by an experienced forester or a forest guard. The number of future crop trees and respective competitor trees to be removed depends on the site conditions and the quality of the stand. Normally, the volume of trees removed during one thinning cycle amounts to 20 – 30 m³ of solid wood per ha, which equals about 20 t of fuel wood per ha.

4.3.4 Special measures

Some additional activities, such as, controlled grazing of animals and tourism, should be modified and/ or further promoted in order to serve as additional sustainable income source from the forest of Andqet for the local people. Tourism is applicable even for the protected areas of the forest. Recommended measures would be the opening of some trails and routes for hikers and the establishment of camp grounds and other points of interest. The grazing of animals is a very special issue and should be allowed only in designated areas of Andqet Forest to control and limit the accompanying environmental degradation. At the moment, an oak forest of the forest type four on a steep southeast oriented slope could be used for grazing, at least seasonally. In all other parts of the forest, especially inside pine forests, grazing should be prohibited.
4.4 Work program and finance statement

The Andqet Forest consists of 1,247 ha of mainly *Pinus brutia* stands. Only one area of 77 ha, located in the southwest of the property, is dominated by oak. The largest part of pine stands shows an ordinary development of growth, in some areas with shallow soil the growth rate is considerably lower. The average yield of wood production in young pine stands will be about 5 m³ of wood per year during the planning period (10 years). In medium-aged pine stands the yield will be about 3 m³, and in old pine stands about 1 m³. The average standing volume of young pine stands is about 50 tons, for medium aged-stands it is about 80 – 100 t, and for old stands around 100 t. Some old pine stands include less pine trees, but plenty of undergrowth consisting of oak, pistachio and other broadleaf trees. Here, the standing biomass can reach more than 100 t per ha.

Round about 90% of the pine stands’ standing biomass can actually be utilized. The main product at the moment would be fuel wood for which there is a high demand by the market. Due to the mostly rather low quality of trees, construction wood and other timber assortments cannot be obtained from the forest stands, yet. In fact, it is not advisable to cut timber-bearing trees at this point of time, because the limited existing number of better quality trees should be maintained during the next ten years in order to support the natural regeneration of higher quality trees.

The focus of work during the planning period is laid upon the opening of the forest stands by establishing foot trails and skidding lines, fire prevention by site clearing, and selective thinning with the aim to remove trees of minor quality (bended, twisted, bad). All above mentioned activities lead to the accumulation of harvested wood, which can partly comply with the fuel wood demand of the village. Also, the implementation of a professional forest management provides work for a number of people. In the following tables and charts the volume of labour input and the amount of wood yield of the main activities are listed. Based on feasibility and need, three different categories have been set up. In category I, areas have been included which should mainly be treated as protected forests. Here, only a few measures are necessary and planned. The forests of the category II will be prepared for a more intensive timber production in the future (after 10 years), and in the forest stands listed under category III forest management activities should start directly.

This management plan at hand provides time schedules for each category. The schedules contain measures and activities which have to be implemented within the next ten years. All schedules are included in detail in the annex to this report. An example for a work program, is given below for the southern part of Andqet Forest category III (managed forest).
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 29: Program Cat.III South, Andqet Forest

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw)</td>
<td>Price Fuel Wood</td>
</tr>
<tr>
<td>Cat. III (III)</td>
<td>Area 49 ha</td>
<td>70%</td>
<td>30%</td>
<td>0%</td>
<td>Labour Work Hour (mixed Chain Saw)</td>
</tr>
<tr>
<td>Input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Trail / Line / Strip Spacing Length (m)</td>
<td>Trail / Line / Strip Spacing Width (m)</td>
<td>Belt Area (ha)</td>
<td>Biomass Output (m³)</td>
<td>Capacity Work (per ha)</td>
</tr>
<tr>
<td>Opening</td>
<td>1,900</td>
<td>2</td>
<td>0</td>
<td>40</td>
<td>160</td>
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<tr>
<td>Fire Prevention by Site Clearing</td>
<td>1,800</td>
<td>20</td>
<td>4</td>
<td>20</td>
<td>280</td>
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<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td>15</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Biomass for Light Fuel Wood (%-basal)</td>
<td>Biomass for Fuel Wood (%-basal)</td>
<td>Revenue ($ / t)</td>
<td>Labour Cost ($ / ha)</td>
<td>Delivery Cost ($ / ha)</td>
</tr>
<tr>
<td>Opening</td>
<td>60</td>
<td>40</td>
<td>88</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90</td>
<td>10</td>
<td>67</td>
<td>117</td>
<td>56</td>
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<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>20</td>
<td>80</td>
<td>116</td>
<td>36</td>
<td>18</td>
</tr>
</tbody>
</table>

En association avec: ELARD
This table is also available as an EXCEL-sheet with the possibility to adjust selected data, for example prices, number of work hours or the benches of work areas.

In order to use this calculator as an economical instrument, all planning specifications have to be included in a financial statement with overall results for the whole planning period, but also accounted as annual results.

This schedule can be used as an instrument for the yearly management of Andqet Forest, but also for the budgeting and planning process. Especially, it is suitable for informing decision makers about necessary interventions and the overall budget, e.g. while asking for financial support.

Figure 30: Input-output Table for Andqet Forest

<table>
<thead>
<tr>
<th>Results Andqet Forest</th>
<th>Total Area (ha)</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activity</td>
<td>Work Area (Bench, ha)</td>
<td>Result per Activity ($)</td>
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<tr>
<td>III (South)</td>
<td>49 Pine</td>
<td>Opening 0,38</td>
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<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 3,60</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Thinning 15,00</td>
<td>$23,250</td>
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<tr>
<td>III (Middle/South)</td>
<td>78 Pine</td>
<td>Opening 0,98</td>
<td>-$78</td>
</tr>
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<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 3,00</td>
<td>-$7,065</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thinning 60,00</td>
<td>$93,000</td>
</tr>
<tr>
<td>III (Middle/North)</td>
<td>24 Pine</td>
<td>Opening 0,46</td>
<td>$773</td>
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<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 0,50</td>
<td>-$1,178</td>
</tr>
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<td></td>
<td></td>
<td>Thinning 20,00</td>
<td>$54,200</td>
</tr>
<tr>
<td>III (North)</td>
<td>13 Pine</td>
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<td></td>
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<td>Fire Prevention, Site Clearing 0,60</td>
<td>-$1,413</td>
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<td></td>
<td></td>
<td>Thinning 9,00</td>
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<tr>
<td>III (South/West)</td>
<td>77 Other Stands</td>
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</tr>
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<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 5,84</td>
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</tr>
<tr>
<td>II</td>
<td>575 Pine</td>
<td>Opening 14,20</td>
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<tr>
<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 0,40</td>
<td>-$828</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fire Prevention, Site Clearing 7,60</td>
<td>-$17,499</td>
</tr>
<tr>
<td>Sum Decade</td>
<td>142</td>
<td>$128,579</td>
<td>15,866</td>
</tr>
<tr>
<td>Annually</td>
<td>14</td>
<td>$12,858</td>
<td>1,587</td>
</tr>
</tbody>
</table>
4.5 Sustainability

Maintenance measures, mostly consisting of thinning activities and in some cases pruning of branches, would lead to even more extracted material from the forest. This would further enhance the development of a long-term oriented, local to regional based, organized wood supply. Since all maintenance activities would always extract less wood material from the forest than the annual increment, the concept of sustainability is guaranteed. Due to the large size of the forest areas, as well as the rather difficult terrain, forestry activities during the first years will predominantly focus on the opening of forest stands. After completion of the basic infrastructure, an extended period for conducting maintenance measures, i.e. thinning and pruning will follow.

The long-term target for the next 20 - 30 years would be the development of a healthy and stable as well as productive pine forest with an increasing share of native broadleafed tree species (e.g. Quercus, Pistacia, etc.).
5

PROPOSED MANAGEMENT PLAN OF QORNET EL HOSN MOUNTAIN FORESTS

5.1 Summary

5.1.1 The current situation of the forests

The forest stands of Qornet el Hosn Mountain Forest vary considerably in their appearance.

Some stands are growing under favourable conditions, showing a productive growth performance and a good shape. However, a significant percentage of the Brutia pine forest stands have been degraded (category I). These parts of the forest must be managed very carefully. Rehabilitation measures should be the main objective in order to improve their multiple ecological functions and environmental contributions (positive impact on hydrological balance, protection of biodiversity of flora and fauna, protection against soil erosion, recreational values, etc.).

The other forest stands (category II, III) should be managed in a way to improve stand stability and to increase productivity. Particularly, used measures must target at the improvement of the average quality of the pine forests and at securing the fuel wood supply to local households. Furthermore, there is a need to consider new developments regarding legal, silvicultural, or technical issues, and to adapt the management of the forests accordingly (preservation, sustainability, promotion of natural regeneration, multiple use of forests, tourism, etc.).

5.1.2 Silvicultural treatment and marking rules

The silvicultural treatment of the forest stands has to be integrated into a few operational management activities. Forest opening, forest fire prevention, thinning and the enhancement of the natural regeneration of pine are the main important activities. All these activities have to be prepared, first theoretically during the planning process and then practically in the forests, the latter by marking future crop trees and competitor trees prior to the thinning. It is important that tree marking is exclusively conducted by experienced foresters or very well trained forest guards. Only they dispose over the necessary understanding of the silvicultural concept and can make the right decisions adapted to the prevailing conditions in the respective forest stands. In general, they are in charge to control all ongoing as well as finalized operations inside the forest, especially felling activities.
5.1.3 The management and inventory system

Up to the present, forestry as practised in Qornet el Hosn Mountain Forest does not have the character of a sustainable management system. The need of modification in order to become more detailed and to consider the implementation of criteria and indicators for sustainable management should be fulfilled by the new management plan. This change is a first beginning and it requires improvements in the inventory system as well as continuous research for significant issues related to the management including regeneration, silvicultural treatment and its impact on the functioning and on the output of the forest ecosystems. In the future, a continuous forest inventory based on permanent sampling plots would be a very useful tool for forest monitoring. It should incorporate some additional parameters such as the age, site quality, and other parameters of ecological interest. There is also a need for more detailed mapping with regard to the species composition and the structure of stands.

5.1.4 The prospective situation of the forests

This first management plan for Qornet el Hosn Mountain Forest includes the basic data for a sustainable management of the forests in the future. The practical planning horizon is ten years, but the plan initiates the forest development also beyond this era.

Pursuing the plan by opening the forest area, prevention of forest fires, directed improvement of quality and health conditions of the pine stands through professional thinning activities, will help that the situation of the forests is steadily becoming better. Increase of the yield of wood, raising quality, more stability, protected biodiversity and a higher amount of standing volume of trees will be the result.

Professional cutting of trees will not lead to a depletion of the forest resources. This selective thinning combines timber harvest with improvement and progression of yield. With the amount of harvested wood a part of the local demand for fuel wood can be supplied. In the future even timber needs can be met to a certain extent.

With an increased health and higher productivity, the forest will also more easily fulfil ecological issues and multipurpose functions.

5.2 Inventory / Rapid forest survey

For a more detailed appraisal of the Qornet el Hosn forest parameters please refer to chapter 2 “Appraisal of relevant forestry parameters”, paragraph 2.3.
The survey of the forest area of Qornet el Hosn Mountain Forests included measurements of various forest parameters and intensive discussions with local stakeholders. It revealed that in order to ensure and improve the health and productivity of the forest ecosystem in the future, a combination of protection and maintenance activities within the forests will have to be applied.

The forested area (611 ha) consists of some 386 ha state-owned forest. The three municipalities Btormaz, Sfiré and Tirâne share the Qornet el Hosn Mountain forests at a rate of approximately 40:40:20%.

Accordingly, a classification of existing forest resources and a number of measures are recommended in the following which should be implemented during the next years. In spite of an intensive mixture of different aged stands the pine forests of Qornet el Hosn Mountain, common structures were identified and classified as different forest types as described in the following.
Young pine stands

Young stands of *Pinus brutia* are defined to include trees reaching the age between 0 up to 25 years. They originated from natural regeneration after forest fires. Often these stands are quite dense with more than 4,000 trees per ha. Some of them show crown damages caused by the weight of snow, negative effects of different fungi and the impact of grazing animals.

**Figure 32 : Forest type T1: Young pine stands at Qornet el Hosn forest**

Medium aged pine stands

Medium-aged stands of *Pinus brutia* are defined to consist of trees at the range between 25 and 50 years of age. Their origin is also from natural regeneration after forest fires. In and after their youth phase the stand density had been reduced by diseases, cuttings and die-offs during the natural selection process.
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 33: Forest type T2: Medium-aged pine stands at Qornet el Hosn forest

Old pine stands

Old pine stands of *Pinus brutia* are defined to reach an age of > 50 years. Also large part of these stands originated from natural regeneration after forest fires. Yet, some stands maybe had been planted during the last century. In the past, the stands included under this forest type have been reduced in density by diseases, cuttings and the natural selection process.

Figure 34: Forest type T3: Old pine stands at Qornet el Hosn forest
Other forest stands

Other forest stands are oak dominated stands mixed with cypress and some pine. They are mainly found on slopes in small fringe areas of Qornet el Hosn Mountain Forest and selective other places.

Figure 35: Forest type T4: Other forest stands at Qornet el Hosn forest

Figure 36: Main characteristics of forest types T1 to T4

<table>
<thead>
<tr>
<th>Forest type</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Young pine stands</td>
<td>Medium-aged pine stands</td>
<td>Old pine stands</td>
<td>Other forest stands</td>
</tr>
<tr>
<td>Age [years]</td>
<td>&lt; 25</td>
<td>25 - 40</td>
<td>&gt; 50</td>
<td>medium-aged</td>
</tr>
<tr>
<td>Possible sustainable activities</td>
<td>- Opening - Fire prevention - Pruning</td>
<td>- Opening - Fire prevention - Thinning</td>
<td>- Opening - Fire prevention - Thinning</td>
<td>- Opening - Grazing</td>
</tr>
<tr>
<td>Standing volume [m³/ha]</td>
<td>0 - 50 depending on age</td>
<td>20 - 70 depending on age</td>
<td>20 - 150 depending on age</td>
<td>5 - 25 depending on age</td>
</tr>
<tr>
<td>Average yield [m³/year]</td>
<td>0 - 5</td>
<td>2 - 5</td>
<td>0.5 - 1</td>
<td>0.5 - 1</td>
</tr>
<tr>
<td>Expected extraction</td>
<td>Fuel wood</td>
<td>Fuel wood</td>
<td>Fuel wood Construction wood</td>
<td>Fuel wood</td>
</tr>
<tr>
<td>Work input per ha [hrs./10 years]</td>
<td>40</td>
<td>50</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>Cut volume per ha [m³/10 years]</td>
<td>6</td>
<td>30</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Expected revenue [$/ha]</td>
<td>800 $/ha</td>
<td>4,000 $/ha</td>
<td>3,500 $/ha</td>
<td>2,400 $/ha</td>
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<tr>
<td>Assumption</td>
<td>1 m³ = 0.9 t</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.3 Planning / Management activities

5.3.1 Forest management categories

In order to enable an effective management, Qornet el Hosn Mountain Forest should be divided into three distinct categories:

Forest management category I (red)
Forest stands growing on poor sites facing unfavourable growth conditions, being not or hardly reachable.

Forest management category II (blue)
Forest stands growing on medium to good sites, being generally difficult to access, but should be developed.

Forest management category III (green)
Forest stands growing on medium to good sites, which are mainly within easy reach and should be managed immediately.

For category I protection and preservation are the main targets and must be considered during future management of these forest areas. The management should predominantly focus on controlling activities, such as fire and pest control, protection against overgrazing as well as other damages. Consequently, the main investment measures would be the opening of the respective forest areas by the construction and maintenance of a small scale network consisting mainly of control paths and some working trails. Furthermore, reliable control systems are desirable and should be installed and operated continuously.

Category II and III forests need to be managed differently and more intensively than category I. In order to secure the health and stability of the forests as well as to improve their productive function it is necessary to provide access to the stands and to apply suitable maintenance measures on a regular basis. In Qornet el Hosn Mountain Forest, this management concept could be implemented as in the category I without costly investments, but starting soon. To reach this target, it is of great importance to plan and set up a basic infrastructure system. Such system would mainly consist of extended footpaths and skidding lines with a width of ca. 1.5 m. This would enable forest guards and workers to access the partly remote and very dense forest sites for control and maintenance work.
For **category II** some investments, notably to reach remote stands, are necessary. But maintenance as in the category II is not very urgent and may not be started until ten to fifteen years from today, at the earliest.

**Figure 37** : Spatial distribution of forest management categories in State-owned parts of Qornet el Hosn Mountain Forest
5.3.2 Maintenance of forests

Maintenance of existing forest stands would focus on improving health conditions and the growing process of the existing pine (*Pinus brutia*) forest stands, which in turn will increase the stability of the forests and thereby reduce the vulnerability towards natural disasters and other risks. After having improved the access to the forest stands, selective activities can be implemented successfully, including thinning of forest stands, selection of potential future crop trees and the regulation of the existing species composition in favour of valuable local broadleaved tree species. As a result, it would be possible to specifically improve the condition of the forests in terms of quality, resistance to damages and diversity of products. For that purpose it is necessary to apply regular professional silvicultural measures.

5.3.2.1 Opening

First of all, it is essential to open the forest area by installing a site-adapted control and working path network including logging lines for reasons of better clarity and accessibility. Priority of all interventions must be the enhancement of forest protection, especially regarding forest fire, damage by insects and fungal infestation.

Maintenance activities in pine stands growing on sites of forest category III, later II, should start early. During a first step, control paths and logging lines as basic infrastructure are needed to be laid out and cleared from vegetation. On the hillside, systematic spacing of paths (200 m apart from each other in vertical direction, generally following contour lines) and skidding lines (every ca. 100 m or following ridges) is suggested. As a second step, thinning and (rarely) pruning may be started within the opened forest area.

The construction of paths is comparably easy and could be done by local workers that have received a short training beforehand. The accumulated vegetation material (branches, small and bad shaped trees) resulting from the clearing should be collected and could be provided as fuel wood to the local market. In case there were no funds available for the local workers, the collected material could also be distributed to them as compensation in kind.

Technically, the clearing of paths can be done using simple tools such as handsaws and axes. If available, small chain-saws or trimmers could be used as well. The cut off vegetation material from the paths shall be removed from the forest and brought to nearby roads where it can be picked up by small trucks. The removal itself could be done either by the local workers themselves or by using donkeys, horses, which would facilitate the work to a great extent. Donkeys/horses would be well-suited for working in such a terrain. In addition to the work during thinning and harvesting operations, they
could also support transport of water and equipment during forest fire fighting activities.

In case of an opening of forest areas through control/working paths and logging lines reaching a larger scale, the distribution and/or sale of harvested vegetation material would be needed to be organized. If applicable, small scale processing workshops may be established, such as fuel wood dealer or wood pellet producer.

### 5.3.2.2 Forest fire prevention

The prevention of fires in the forest is a key element of the forest management plan at hand. The proposed set of measures aims at the reduction of fire risk in the respective forests. In particular, it is the site clearing from bushes and shrubs along streets adjacent to the forest and forest roads in a width of about 10 m on both sides of the roads. The pruning of the remaining trees within this belt is necessary. Highly flammable material should be removed from these areas. The incurring material might be tradable as fuel wood (e.g. light fuel wood for bakeries).

This work as well could be done by local workers who have received a short training beforehand. The work input regarding fire prevention is very much depending on the condition of the forest site (stand density, species of shrub and trees, need for pruning). The average productivity per day (8 working hours) is estimated to reach about 300 m². Most probably, the labour costs cannot be covered by the revenues gained from the traded fuel wood. Besides site clearing, fire prevention is especially achieved by the increase of broad-leaved species (Quercus, Pistacia, Acer and other species) regeneration under the canopy of pure pine stands.

### 5.3.2.3 Pruning

Pruning of branches is suitable for improving the quality of individual trees in case the silvicultural target is the production of high value timber. At this moment of time, pruning for this purpose is not useful within the Qornet el Hosn Mountain Forest as the quality of the existing pine stands is too low. A higher quality of timber will be reached in the future after the first cycles of professional forest management (enhancement of natural regeneration, selection of potential future crop trees, regular selective thinning) have been completed inside the respective forest stands. In fact, the increase of timber value through pruning is seldom compensating the higher productions costs. Therefore, pruning is only advisable in combination with forest fire prevention activities.
5.3.2.4 Disease Prevention

For prevention, control and limitation of diseases, sick and especially trees infected by fungi should be cut and removed from the forest in a timely manner. Generally, infected trees are weaker against abiotic impacts like storm and snow damage. For this reason, disease prevention activities always lead to a higher quality and stability of forests.

5.3.3 Stabilisation and quality improvement by selective cutting

Selective cutting has a high influence on the growth, quality and stability of Pinus brutia stands. This process can be initiated when the trees of the forest stand reach approximately 25 years of age and may be repeated every 7 – 10 years. Thinning by selective cuttings is always to be combined with a preliminary check of the forest and with the marking of trees. Ideally, the potential future crop trees (those belonging to the desired species and disposing over the highest vitality and quality) will receive a permanent marking for easy identification. Surrounding trees which have a negative impact on the growth of the future crop trees and which are of less quality should be marked as competitor trees. They should be cut during subsequent thinning activities. Selecting and marking of the trees must be done by an experienced forester or a forest guard. The number of future crop trees and respective competitor trees to be removed depends on the site conditions and the quality of the stand. Normally, the volume of trees removed during one thinning cycle amounts to 20 – 30 m³ of solid wood per ha, which equals about 20 t of fuel wood per ha.

5.3.4 Special Measures

Some additional activities, which are not primarily forestry activities, should be further promoted in the Qornet el Hosn Mountain Forest in order to serve as additional sustainable income source from the forest for the local people. This could be tourism. Tourism is applicable even for the protected areas of the forest. Recommended measures would be the opening of some trails and routes for hikers and the establishment of camp grounds and other points of interest.

5.4 Work Program and finance statement

The Qornet el Hosn Mountain Forest consists of 611 ha of mainly Pinus brutia stands. Only very small fringe areas are dominated by oak (type T4).
The largest part of pine stands shows an ordinary development of growth, in some areas with shallow soil the growth rate is considerably lower. The average yield of wood production in young pine stands will be about 5 m³ of wood per year during the planning period (10 years). In medium-aged pine stands the yield will be about 3 m³, and in old pine stands about 1 m³. The average standing volume of young pine stands is about 50 tons, for medium-aged stands it is about 80 – 100 t, and for old stands around 100 t. Some old pine stands include less pine trees, but plenty of undergrowth consisting of oak, pistachio and other broadleaf trees. Here, the standing biomass can reach more than 100 t per ha.

Round about 90% of the pine stands’ standing biomass can actually be utilized. The main product at the moment would be fuel wood for which there is a high demand by the market. Due to the mostly rather low quality of trees, construction wood and other timber assortments cannot be obtained from the forest stands, yet. In fact, it is not advisable to cut timber-bearing trees at this point of time, because the limited existing number of better quality trees should be maintained during the next ten years in order to support the natural regeneration of higher quality trees.

The focus of work during the planning period is laid upon the opening of the forest stands by establishing foot trails and skidding lines, fire prevention by site clearing, and selective thinning with the aim to remove trees of minor quality (bended, twisted, bad). All above mentioned activities lead to the accumulation of harvested wood, which can partly comply with the fuel wood demand of the village. Also, the implementation of a professional forest management provides work for a number of people. In the following tables and charts the volume of labour input and the amount of wood yield of the main activities are listed. Based on feasibility and need, three different categories have been set up. In category I, the areas of Qornet el Hosn Mountain Forest have been included which should mainly be treated as protected forests. Here, only a few measures are necessary and planned. The forests of the category II will be prepared for a more intensive timber production in the future (after 10 years), and in the forest stands listed under category III forest management activities should start directly.

This management plan at hand provides time schedules for each category. The schedules contain measures and activities which have to be implemented within the next ten years. All schedules are included in detail in the annex to this report. An example for a work program, including input and output table, is given below for Qornet el Hosn Mountain Forest category III, (managed forest):
Elaboration of management plans of two pine forests
in view of sustainable forest management and forest fire protection

En association avec:

Figure 38 : Program Cat.III, Qornet el Hosn Mountain Forest

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Qornet el Hosn Pine (III)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Price Light Fuel Wood</th>
<th>$ 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
<td>Price Fuel Wood</td>
</tr>
<tr>
<td>Cat. III (HIS)</td>
<td>Area</td>
<td>142 ha</td>
<td>10%</td>
<td>70%</td>
<td>20%</td>
</tr>
<tr>
<td>Activity</td>
<td>Trail / Line / Strip Spacing length (m)</td>
<td>Trail / Line / Strip Spacing width (m)</td>
<td>Ranch Area (ha)</td>
<td>Biomass Output tons (per ha)</td>
<td>Capacity Work hours (per ha)</td>
</tr>
<tr>
<td>Opening</td>
<td>4,500</td>
<td>2</td>
<td>1</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>4,600</td>
<td>20</td>
<td>9</td>
<td>15</td>
<td>280</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>110</td>
<td>25</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Activity | Biomass for Light Fuel Wood (% Radio) | Biomass for Fuel Wood (% Radio) | Revenue ($ / t) | Labour Cost ($ / ha) | Delivery Cost ($ / ha) | Result ($ / t) | Result ($ / ha) | Result per Activity ($) | Result per Activity (work hours) | Result per Activity ($) |
| Opening | 60 | 40 | 88 | 60 | 30 | -2 | -80 | -72 | 14 | 36 |
| Fire Prevention by Site Clearing | 90 | 10 | 67 | 149 | 75 | -157 | -2,335 | -21,856 | 2,575 | 138 |
| Selective Cutting and Disease Prevention | 20 | 80 | 116 | 73 | 11 | 82 | 2,056 | 228,108 | 4,125 | 2,750 |
This table is also available as an EXCEL-sheet with the possibility to adjust selected data, e.g. prices, number of work hours or the benches of work areas. In order to use this calculator as an economical instrument, all planning specifications have to be included in a financial statement with overall results for the whole planning period, but also accounted as annual results. This schedule can be used as an instrument for the yearly management of Qornet el Hosn Mountain Forest, but also for the budgeting and planning process. Especially, it is suitable for informing decision makers about necessary interventions and the overall budget, e.g. while asking for financial support.

**Figure 39 : Input-output Table for Qornet el Hosn Mountain Forest**

<table>
<thead>
<tr>
<th>Results Qornet el Hosn Mountain Forest</th>
<th>Total Area (ha)</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>611</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>142</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening</td>
<td>0.9</td>
<td>-$72</td>
<td>144</td>
</tr>
<tr>
<td>Fire Prevention, Site Clearing</td>
<td>9.2</td>
<td>-$21,666</td>
<td>2,576</td>
</tr>
<tr>
<td>Thinning</td>
<td>110.0</td>
<td>$226,188</td>
<td>4,125</td>
</tr>
<tr>
<td>II</td>
<td>158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening</td>
<td>1.0</td>
<td>$768</td>
<td>154</td>
</tr>
<tr>
<td>Fire Prevention, Site Clearing</td>
<td>0.6</td>
<td>-$1,413</td>
<td>168</td>
</tr>
<tr>
<td>I</td>
<td>311</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>311</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening</td>
<td>0.4</td>
<td>-$1,088</td>
<td>64</td>
</tr>
<tr>
<td>Fire Prevention, Site Clearing</td>
<td>0.5</td>
<td>-$1,178</td>
<td>140</td>
</tr>
<tr>
<td><strong>Sum Decade</strong></td>
<td>123</td>
<td>$201,539</td>
<td>7,371</td>
</tr>
<tr>
<td><strong>Annually</strong></td>
<td>12</td>
<td>$20,154</td>
<td>737</td>
</tr>
</tbody>
</table>

### 5.5 Sustainability

Maintenance measures, mostly consisting of thinning activities and in some cases pruning of branches, would lead to even more extracted material from the forest. This would further enhance the development of a long-term oriented, local to regional based, organized wood supply. Since all maintenance activities would always extract less wood material from the forest than the annual increment, the concept of sustainability is guaranteed. Due to the large size of the forest areas, as well as the rather difficult terrain, forestry activities during the first years will predominantly focus on the opening of forest stands. After completion of the basic infrastructure, an extended period for conducting maintenance measures, i.e. thinning and pruning will follow.
The long-term target for the next 20 - 30 years would be the development of a healthy and stable as well as productive pine forest with an increasing share of native broadleaved tree species (e.g. *Quercus, Pistacia*, etc.).
6 PROPOSED MEMORANDUM OF UNDERSTANDING WITH MINISTRY OF AGRICULTURE

The Arabic version of the proposed memorandum of understanding (MoU) between the concerned municipalities and the Ministry of Agriculture (MoA) is documented in the annex. Here, we recapitulate some framework issues only.

6.1 Objective/Purpose of implementing sustainable forest management plans

Until today, Andqet Forest and Qornet el Hosn Mountain Forest have not been the subject of professional technical forest management plans. Unsuitable pruning techniques and lack of planning in thinning and cutting are the main characteristics of these forests. Thus insects and diseases find optimal conditions for their development. The non-professional pruning technique applied causes a delayed recovery of the trees which leads to fungus and insects attacks. In addition, non-target oriented thinning decreases the quality of remaining forest stand, including the reduction of timber quality to be harvested in the future. Furthermore, high density forests contain excessive fuel load vulnerable to forest fires. Too dense forest stands limit the natural regeneration and the development of a well-structured forest. As a consequence, numerous trees die off and encourage the outbreak of fungus, diseases and fires. So, the implementation of the management plans is a need to increase the wood quality, decrease the risk for fire, insects and fungus hazards and enhance the natural regeneration essential for the sustainability of the forest.

The management plans thus ensure an improved forest biodiversity, productivity, natural regeneration and vitality. As a result, the forest will be strengthened to fulfill long-term ecological, economic and social functions.

6.2 Overview of relevant forest legislation

The main forest legislation goes back to 1949. It is further backed by additional decrees signed by the Minister of Agriculture. This law mentions the need for sustainable forest management plans. According to article 11, the Minister of Agriculture approves a sustainable forest management plan prepared by Forestry Department. This plan ensures simultaneously the framework conditions for harvesting, improvement and sustainability of the forest.
The forestry department staff is responsible for the application of this law. During the lack of control period which started in 1975, illegal cutting and abusing of natural resources were observed. This urged the assembly to approve the three articles Law (Law 58 dated on 7 September 1991) which prohibits the cutting and harvesting of coniferous trees found in all types of ownership. This law allows cutting of coniferous trees in case of construction and public works, only. The objective of this law was the protection of the forest resources during a period of insufficient control from government side and lack of awareness among the local population abusing the use of forest resources.

Many questions related to the application of this law were raised and the Ministry of Agriculture asked the Ministry of Justice for clarification. The advisory committee which depends on the Ministry of Justice found additional exception cases where cutting of coniferous trees could be authorized. For example, thinning of Pinus pinea trees is authorized since it aims at the protection and maintenance of this resource (Interpretation number 405/2006 – 19 June 2006). Cutting and removing of dry and dead trees infected by insects and diseases could be authorized to protect the healthy trees and avoid the propagation of the diseases. In this case, the administration should be sure through technical and specialized people (Interpretation number 67/2000 – 1 February 2000).

Basing on the above, the advisory committee, the official institution responsible on the interpretation of the laws in the country, refers its interpretations to three objectives/principles: The protection of the forest, the maintenance of resources and the reports of technical and specialized people. So, it will not be strange if the Ministry of Agriculture approves the management plans according to article 11 of the forest legislation (1949). In fact, these plans aim at the protection, maintenance and sustainability of the forest resources and they are technical reports prepared by specialized persons following field data collection and analysis. It is important to mention that the management plans at hand were presented to the local population and authorities and their implementation will be controlled by qualified forestry department personnel.


*Interpretation number 68/1999 – 26 February 1999:* Authorization could be given to cut coniferous trees used as wind breaks because they are out of the forest.

*Interpretation number 67/2000 – 1 February 2000:* The law does not prohibit cutting coniferous trees totally died due to insects and diseases and
remove these trees outside the forest in order to avoid the propagation of insects and diseases to the healthy trees. The administration should be sure in a correct manner via the technical and specialized people that these trees are completely dry.

**Interpretation number 813/2004 – 6 December 2004:** The law does not allow cutting coniferous trees to convert the use to agriculture land.

**Interpretation number 567/2005 – 19 August 2005:** The law does not prohibit cutting coniferous trees growing within agricultural land and cause damages to fruit trees.

**Interpretation number 405/2006 – 19 June 2006:** Authorization could be given to thin Pinus pinea dense trees since thinning aims to the protection and maintenance of this resource.

### 6.3 Current forest exploitation and management procedures

Apart from the current forest management in Andqet Forest and Qornet el Hosn Mountain Forest, the forest legislation grants the forestry department the control on all types of forests in the country. Amongst others, this control includes maintenance, forest products collection, harvesting, grazing. The authority of Forestry Department varies depending on the type of land tenure of the forests.

#### 6.3.1 Ownership

According to the forest legislation, forests are classified as state forests, municipal forests and private forests.

**State forests:** These forests are owned by the government, they are also called republic forests.

**State forests with right of use (interest):** These forests are the ownership of the state, but neighbouring population has the right to collect forests products and grazing. This right needs in some cases the authorization of the forestry department (Articles 44 and 51 – Forest law 1949).

**Communal forests:** These forests are totally owned by the villages.

**Private forests:** Forests owned by private persons.

The forest legislation (1949) organizes all types of interventions and harvesting in the above mentioned forests.
6.3.2 Procedures

The forestry department (FD) within the Ministry of Agriculture (MoA) is the official technical institution responsible on forests and forest management related issues. It issues authorizations for all types of intervention in the forests.

In private forests, the owner has to request officially the authorization if (s)he wants to cut trees in his private forest. This request is accompanied by a certification of ownership. The forest centre attaches to the request a detailed report. Currently, the request is transmitted to the forestry department (FD) and the Minister will sign the permission.

The municipality, as a local authority elected by local population, is responsible for all environmental issues with coordination of the government institutions. So, the Municipalities are also responsible for the management of the communal forests.

All types of interventions within the communal forests need an authorization or license from FD. In addition to the request, a municipal decree signed by the municipal council should be delivered to the MoA mentioning the type of intervention in the forest.

The MoA (FD) prepares the Terms of References of the adjudication and the bid will be opened by a committee headed by a FD representative and composed from representative of the Ministry of Interior and Municipalities and representative of the owner municipality. The FD has the right to approve the decision of the above mentioned committee and deliver the authorization.

The forest legislation (1949) also gave the forestry department the control of one third of the municipal forest revenues.

In case there is no municipality in the village, a committee will be established and its decisions will not be active (implemented) without the approval of the Minister of Agriculture.

According to forest legislation, the Forestry Department (FD) is responsible for the management of state forests. The FD prepares management plans (Article 11), prepares the terms of reference and bids to sell wood and rent services (grazing). Further, the FD used to implement these activities through adjudication (bids) to private sector.

6.4 Proposed procedures for the implementation of forest management plans

The implementation of the management plan should be based on technical and official basis. In both cases, Qornet el Hosn Mountain Forest and Andqet
Forest, an official document is needed between the FD and the respective municipality.

Both management plans were presented to the concerned municipalities which expressed their interest to the sustainable forest management concept. So, a memorandum of understanding between the MoA and the municipalities could be a way to implement the management plans. The process is designed to respect the forest legislation and the juridical interpretations of the Ministry of Justice and is inspired by previous MoU signed with other municipalities.

The MoU will be written in Arabic language and should be used as official document to apply the management plans in Qornet el Hosn Mountain Forest and Andqet Forest.

It is composed of different parts:

- Preface: It shows the presentation of the institutions or partner of the MoU and the common objective to sign it.
- Partners: It includes the name of the institutions/partners of their representatives and responsibilities.
- The basis: It contains all articles and description of legal issues the partners agreed upon.

The MoU with their respective management plans found in the annex include the proposed activities and their descriptions, maps showing where activities will be implemented and work plans that illustrate the schedule of activities.

6.4.1 Municipal ownership (Case of Andqet forest)

As Andqet Forest is owned by the municipality, the MoA is the official organization which issues the permission to cut, transport and store forest products. However, the management plan shows that valuable timber or wood will not be produced during the following ten years. The products which will be removed are restricted to small and low quality wood and shrubs. The application of the management plan can be considered as the last permission delivered to the municipality on 6 September 2012 where the municipality harvests directly after the approval of the FD (Article 58/1949) and distributes the products to the citizens (Article 62/1949).

6.4.2 State ownership (Case of Dannieh)

Qornet el Hosn Mountain Forest is a state-owned forest under the responsibility of MoA which will implement the management plan. Previous MoU were concluded with various municipalities (Kfarhamam and Ibl Essaki),
these MoUs delegated the maintenance and the fruit collection of *Pinus pinea* to the municipality. However, MoA can delegate this task to the municipality through this current MoU without an auction for two reasons, the removed products are valueless and the municipality or the federation of municipalities is providing service to MoA (Article 14/1949).
Annex 1

Terms of reference

1. Informations sur le projet

La zone d’intervention du projet, dans les cazas de Akkar, Danniye et Hermel, située au Nord du pays sur un relief montagneux, est une des zones les plus pauvres du Liban. La situation socio-économique a des raisons aussi dans la faible richesse en ressources naturelles à exploiter de cette zone, mais aussi dans son historique : Le Nord du Liban n’a bénéficié jusqu’à ce jour que de peu de services publics et de programmes de coopération externe.

La zone d’intervention est caractérisée par un relief collinaire et montagneux. Environ la moitié des terres sont de vocation agricole. Le développement du secteur agricole est freiné par des contraintes d'ordre politique, institutionnel, technologique et financier.

La région témoigne actuellement d’un recul de ses ressources économiques : l’activité agricole et la compétitivité de la région sont touchées et le recrutement militaire est pratiquement fermé aux nouvelles recrues ; ces deux secteurs représentent les deux piliers économiques de la zone.

Jumelée à cette situation économique est la situation de la gestion du terroir et de l’exploitation des ressources en sols et en eaux. L’agriculture dans la zone du projet – à part des enclaves irriguées – reste peu développée et elle est souvent pratiquée avec peu de soins de l’environnement. L’agriculture est considérée comme la deuxième activité économique des familles résidant dans la plupart des villages de la zone ; activité qui vient soutenir le revenu militaire. Les productions agricoles et animales, y compris l’apiculture, jouent un rôle important dans l’économie familiale et peuvent représenter jusqu’à 60 % des revenus des ménages ruraux.

La région de Akkar-Dannieh au Nord du Liban est unique dans son aspect d’héberger une variété de forêts à différent associations d’espèces et dans différents écosystèmes et habitats. Puzzles compris de diverses associations de plants et forêts marquent la région avec un paysage montagneux et méditerranéen. Les forêts d’intérêt spécifique dans la région incluent des espèces suivants: Pin calabrien, Cèdres, Sapin et Gènevrier, Sapin et Cèdres, Chêne vert, et Quercus cerris.

La sous-préfecture (caza) de Akkar dispose d’un des rares espaces de biodiversité dans la région. Au sud de la petite ville de Qobayat entre Fnaydek au Sud-Ouest et Qobayat au Nord-Est s’étend une zone d’environ 50 km² de forêts naturelles de diverses espèces.

Depuis quelques années, des préparations sont en cours de déclarer la zone du Haut Akkar ensemble avec le Haut-Dannieh en zone de parc national afin de mieux protéger ce patrimoine forestier et environnemental.
Le projet d’appui au développement local dans le Nord du Liban (ADELNORD) trouve sa justification dans l’existence de fortes inégalités territoriales en ce qui concerne le développement économique et social.

L’objectif général du projet est de triple nature et vise :

- De contribuer à l’unité nationale et à l’amélioration des conditions de vie de la population libanaise par la valorisation des potentialités de la région souffrant d’un déficit de développement ;
- De contribuer à une politique nationale d’aménagement du territoire ; et
- De contribuer à l’amélioration de la protection de l’environnement.

L’objectif spécifique du programme met en évidence l’interaction participative avec les communautés locales dans la gestion durable des ressources agricoles et naturelles. La philosophie du projet souligne donc la durabilité de l’activité économique et oriente le développement local vers des projets en harmonie avec son espace naturel.

Pour le projet entier, trois résultats étaient formulés, à savoir :

- Les administrations, les collectivités locales, le secteur privé et la société civile sont mobilisés autour de stratégies de développement durable du territoire.
- L’agriculture est diversifiée, sa productivité et sa rentabilité sont améliorées. Le recours à des Bonnes Pratiques Agricoles (BPA) est systématisé et les emplois du secteur agricole maintenus et augmentés.
- Les écosystèmes de montagne sont protégés.

2. Contexte de la mission

Au sud de la petite ville de Qobayat entre Fnaydek au Sud-Ouest et Andqet au Nord s’étend une zone d’environ 50 km² de forêts naturelles, composées de pin, de sapin, de chêne vert et de quelques cèdres, dont environ 15 km² surtout de forêts d’espèces résineux appartiennent aux municipalités de Andqet et aux divers privés dans la zone cadastrale de Qobayat (voire carte ci-dessous), dont la forêt de Andqet est de propriété municipale. Cette zone a été affectée dans le passé par l’occurrence de plusieurs incendies de forêt. Ce qui a amené la municipalité de Andqet d’établir une étude stratégique sur le combat d’incendies de forêt et par la suite d’installer des postes (tours) de surveillance dans la forêt. Cependant, cette mesure isolée n’arrive pas à combattre la problématique, vu qu’il n’y a - à l’état actuel – pas de gestion professionnelle de la forêt qui pourra par elle-même réduire le risque des incendies. D’où la nécessité d’élaborer un plan de gestion qui fera l’objet d’une approbation par les services forestiers compétents afin de permettre au propriétaire de la forêt, la municipalité, de gérer la forêt de manière durable.
Au Nord de la ville de Sir El Dannieh, près du village Es Sfireh, se trouve une forêt de Pinus brutia mélee de Cypressus sempervirens d'environ 400 ha qui appartient à la municipalité. La problématique d'incendies de forêt est aussi bien présente dans cette forêt de résineux à Es Sfireh. Ce qui a amené la fédération des municipalités de Dannieh à réfléchir sur les possibilités de création de réserve naturelle afin de mieux protéger cette forêt. Cependant, l'idée de protection et de mise en défens par une déclaration de réserve a été abandonné, vu que la forêt en question ne représente pas un tel grade de biodiversité comme d'autres forêts avoisinantes (forêts de cèdres, de chêne vert, de genévrier à Qemmamine, Jayroun et Kfar Bebnine) et que la mise en défens ne résoudra pas la problématique d'incendies. D'où la nécessité d'élaborer un plan de gestion qui fera l'objet d'une approbation par les services forestiers compétents afin de permettre au propriétaire de la forêt, la municipalité, de gérer la forêt de manière durable.
3. Services demandés

3.1. Tâches et responsabilités

L’équipe des experts collaborera étroitement avec le chef d’équipe de l’assistance technique du projet ADELNORD ainsi qu’avec la Direction du projet (UGP) au CDR, et assurera une étroite concertation avec le Ministère de l’Agriculture, qui a la tutelle de la gestion des forêts au Liban. L’équipe assurera également une communication et échanges avec les autres parties prenantes telles que les municipalités/centre forestier/défense civile/ONG…etc.

Les tâches du consultant comprennent en une première étape l’établissement d’un état des lieux et un diagnostic des activités antécédentes en vue de la protection des forêts contre les incendies tout en tenant compte de l’avis des acteurs en jeu.

Ensuite il analysera les données recueillies et évaluera les enjeux qui influencent la gestion des forêts de Andqet et de Es Sfireh dans le cadre de la protection contre les incendies.

Finalement il en déduira une stratégie de prévention et d’intervention / plan de gestion dans le but de la protection de ces forêts contre le risque des incendies et pour une gestion durable de ces espaces forestiers.

3.2. Activités

1. Le consultant présentera dans une séance de briefing sa méthodologie ainsi qu’un plan de travail et qui couvrent les activités suivantes:

2. Diagnostic des zones cibles sur le plan forestier, naturel, environnemental et socio-economic, spécifiquement :

   - Révision des études et rapports déjà produits sur ce sujet ;
   - Visite de la zone cible ;
   - Interview avec les acteurs locaux (Centre forestier, municipalité, moukhtar, ONG, riverains …etc.) ;
   - Identifier les projets/activités à prévoir dans les plans de gestion ;
   - Collecter les données sur la forêt : les espèces forestières existantes, densité des arbres, l’état sanitaire, la croissance de biomasse ligneuse, la biodiversité ;
   - Historique des incendies : causes, superficie affectée, régénération existante, infrastructure existante
   - Cartographie grossière des zones cibles.

3. Evaluation de l’état des lieux des forêts :

   - Analyse des informations requises de l’étape précédente ;
• Evaluation de la valeur des forêts qui nécessite des activités de protection et de gestion durable ;
• Identification des enjeux qui menacent la survie des forêts de résineux et surtout ceux qui sont en relation avec la gestion durable de ces forêts.

4. Elaboration d’un plan de gestion durable pour chaque forêt dans le but de la protection de ces forêts et de la prévention contre le risque des incendies. Ces plans de gestion comprennent entre autre un cahier de charge sur les activités de prévention ( ) à approuver par les services forestiers compétents et permettant aux municipalités de mettre en œuvre les activités de gestion durable. Coordination, concertation et – dans la mesure du possible recherche de l’approbation – du cahier de charge par les services compétents au MinAgr.

5. Illustrer l’état des lieux et stratégies proposées par des cartes/graphes/tableaux/photos.

3.3. Résultats attendus

• Les propriétaires des forêts d’étude disposent d’une vision comprenhensive de développement et de la gestion durable de la forêt qui réduira le risque d’incendies de forêt.
• Les propriétaires des forêts d’étude disposent d’un plan de gestion durable et y inclus un cahier de charge susceptible d’être approuvé par les services forestiers afin de pouvoir entamer les activités de gestion nécessaire à la maintenance et au développement durable de ces espaces forestiers.

3.4. Livrables

1. Présentation de la méthodologie et du plan de travail (séance de briefing avec UGP).
2. Briefing sur l’état d’avancement après avoir achevé les activités 2 et 3.
3. Présentation d’un rapport par zone cible intitulé : «Plan de gestion durable de la forêt de Andqet (et l’autre de Es Sfireh) et de la prévention contre le risque des incendies » comprenant :
   • Descriptif de l’état des lieux ;
   • Diagnostic forestier ;
   • Les directives de la gestion durable et stratégies d’intervention, sous forme d’objectifs et activités détaillées à entretenir dans les dix à vingt années suivantes, comprenant un plan de pr évention contre les incendies dédié aux propriétaires de forêts (municipalités) avec le concours des acteurs locaux (entreprises, ONGs) ;
• Cahier de charge spécifique pour les activités de taille, de coupe et d’entretien traduit en arabe ;
• Présentation des démarches administratives nécessaires à la mise en œuvre des plans de gestion ;
• Schémas/Cartes/photos de support.

4. Structure et durée de la mission
La mission s’étalera sur une durée totale de deux mois. La première partie de terrain de quatre semaines en continue servira des enquêtes et de discussions avec les parties prenantes. La deuxième partie d’une semaine sera dédiée à la rédaction des rapports. Il s’y ajoute une restitution des résultats aux parties prenantes.

5. Profile d’expert
Face aux termes posés, cette mission nécessite l’emploi d’une équipe d’experts composée de la façon suivante :

A) Un expert senior d’expérience internationale en gestion durable forestière avec une bonne connaissance de l’établissement de plans de gestion forestier (chef de mission) pour une durée d’intervention de 27 jours ouvrables, dont 5 en Europe. Il sera en charge de guider l’équipe dans ses analyses et évaluations, et de définir les stratégies de gestion durable future. Il assurera également la rédaction finale d’ensemble des livrables.

B) Un expert junior d’expérience internationale en matière de foresterie pour une durée d’intervention de 27 jours ouvrables, dont 5 en Europe. Il se chargera de la collecte des données de terrain, des enquêtes, de la cartographie et de la documentation.

C) Un expert senior d’expérience nationale en matière de gestion forestière avec une connaissance dans les stratégies de prévention d’incendies de forêts pour une durée d’intervention de 31 jours ouvrables. Il collaborera étroitement avec le chef de mission et contribuera à la rédaction des livrables, assurera la concertation avec les parties prenantes locales, se chargera de l’adaptation des plans de gestion proposés aux spécificités libanaises, veillera sur la conformité de la proposition avec les exigences des services forestiers et produira le cahier de charge pour la gestion durable des forêts en question dans sa version arabe. Il se chargera également de la restitution des dossiers aux parties prenantes, coordonnera avec les services forestiers compétents et initiera la démarche nécessaire à la mise en œuvre des plans de gestion.
## Annex 2

### Bibliographic references

<table>
<thead>
<tr>
<th>Author/Institution</th>
<th>Title/Reference</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Forest fire fighting management plan Andqet, Oobayat, Akkar el Atiqa. 2010</td>
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MADA

“The North Horizon Forest Trail, a New Perspective for Conservation and Management of Dannieh forests”, Initial Field Analytical Report; on behalf of GIZ and Environmental Fund for Lebanon. 2011

Shater, Zuheir et al.

A growth and yield model for even-aged Pinus brutia Ten. stands in Syria. Hamburg 2011

University of Cordoba, AFDC

Forest nurseries in Lebanon for native species production. 2011
Annex 3

Diagnostic Forest fiches
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 40: Collected data on pine plots

<table>
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<tr>
<th>Plot</th>
<th>Age</th>
<th>Mean Diameter of Pine (cm)</th>
<th>Mean Red. Height of Pine (m)</th>
<th>Plot Basal Area (cm²)</th>
<th>Basal Area (m²/ha)</th>
<th>Diametral Quotient</th>
<th>Growing Stock (m³/ha)</th>
<th>Number of trees (per ha)</th>
<th>Remarks</th>
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<tr>
<td>El Dannieh 1</td>
<td>29</td>
<td>18</td>
<td>7</td>
<td>5,531</td>
<td>55</td>
<td>0.30</td>
<td>119</td>
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<td></td>
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<td>El Dannieh 2</td>
<td>30</td>
<td>13</td>
<td>8</td>
<td>3,594</td>
<td>36</td>
<td>0.30</td>
<td>86</td>
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<tr>
<td>El Dannieh 3</td>
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<td>13</td>
<td>3,359</td>
<td>34</td>
<td>0.30</td>
<td>131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andaqet 1</td>
<td>23</td>
<td>10</td>
<td>4</td>
<td>958</td>
<td>28</td>
<td>0.30</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andaqet 2</td>
<td>0-5</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48,000</td>
<td></td>
<td></td>
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<tr>
<td>Andaqet 3</td>
<td>55</td>
<td>20</td>
<td>12</td>
<td>943</td>
<td>5</td>
<td>0.45</td>
<td>26</td>
<td>Natural Regeneration after Forest Fire</td>
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<td>Andaqet 4</td>
<td>55</td>
<td>27</td>
<td>6</td>
<td>1,774</td>
<td>4</td>
<td>0.45</td>
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<td>Old Pine Stands with a few pine and dense shrubby undergrowth</td>
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<td>Andaqet 5</td>
<td>7</td>
<td>8</td>
<td>3</td>
<td>339</td>
<td>14</td>
<td>0.20</td>
<td>8</td>
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<td>Andaqet 6</td>
<td>25</td>
<td>11</td>
<td>6</td>
<td>1,383</td>
<td>14</td>
<td>0.30</td>
<td>27</td>
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<td>Andaqet 7</td>
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<td>19</td>
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<td>36</td>
<td>Old Pine Stands with a few pine and dense shrubby undergrowth</td>
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Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 41: Simulation on pine biomass production and comparison with growth conditions in Turkey

Biomass Pinus brutia, Lebanon North

Biomass Pinus brutia

En association avec:

85
Annex 4

Maps
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

En association avec:
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Andqet forest
History of forest fires

Legend
- Cadastre zone Andqet
- Délimitation Forêt
- Incendies de forêt
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Andqet Municipality Forest Management Categories

Legend
- Cadastral zone Andqet
- Protected forest, only fire management
- Mid-term forest management zone
- Short-term forest management zone

Kilometers

En association avec:
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection.
Municipalities of Sfiré, Btormaz, Tirâne
Base map with cadastral zones

Legend
- Cadastral zones
- Tertiary road
- Highway
- Main road
- Secondary road
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Qornet El Hosn Mountain (Sfiré Forest)
Aerial Photo (2003)

Legend
- Cadastral zones
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Qornet El Hosn Mountain (Sfiré Forest)
Forest Area (Pinus brutia)

Legend
- Forest boundaries
- Main road
- Tertiary road
- Secondary road
- Highway
- Forest trails
- Main permanent river
- Small permanent river
- Seasonal river
- Affluent
- Ravine
Elaboration of management plans of two pine forests
in view of sustainable forest management and forest fire protection

Qornet El Hosn Mountain (Sfiré Forest)
Boundaries of Municipal Forest Area

Legend
- Municipal Forest Qornet El Hosn Mountain
- Qornet El Hosn Pine Forest Boundaries
- Forest trails
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Qornet El Hosn Mountain (Sfiré Forest) and surroundings
Land use

Legend
- Green: Cornet El Hosn Forest boundaries
- Light green: Scattered trees, shrubs
- Black: Urban zone
- Brownish grey: Urbanised zone
- Deep green: Forest
- Dark green: Plants
- Orange: Intensive agriculture
- Yellow: Agriculture
- White: Shrubs
- Brown: Rocky bare lands

En association avec: ELARD
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Qornet El Hosn Mountain (Sfiré Forest)
Points of interest

Legend
Points de repère
- Cemetery
- Quarry
- Roman Temple
- Summit
- Trail
- Water Tank
- Forest boundaries
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection.
Elaboration of management plans of two pine forests
in view of sustainable forest management and forest fire protection

Legend
- Forest Boundaries Qornet El Hosn Mountain
- Forest trails
Management Categories on State Forest
- Protected Forest, only fire management
- Mid-term management zone
- Short-term management zone
Annex 5

Forest management fiches/ Silvicultural Guidelines

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<th>Wood Utilisation</th>
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<tbody>
<tr>
<td>Country</td>
</tr>
<tr>
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[Diagram showing wood utilization distribution]
Figure 42: Development of sustainable forest stands through management activities depending on stands and age.
Figure 43: Management activities depending on stands and age, T1 young pine stands

### T1 Young Stand, Pinus brutia

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Age (years)</th>
<th>Possible sustainable activities</th>
<th>Standing Volume (m³/ ha)</th>
<th>Average Yield (m³/ year)</th>
<th>Expectable Wood Products</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 1</td>
<td>Young Stand</td>
<td>0 - 24</td>
<td>Opening, Forest Fire Prevention, Pruning</td>
<td>0 - 50 Depending on Age</td>
<td>0 – 5 Depending on Age</td>
<td>Fuel Wood</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Work per ha (hrs. / 10 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cut Volume per ha (m³/ 10 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Revenue ($ / ha)</td>
<td></td>
<td></td>
<td></td>
<td>m³ = 0.9t</td>
</tr>
<tr>
<td>Opening, Forest Fire Prevention</td>
<td>40</td>
<td>6</td>
<td>800 $</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
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</table>
Figure 44: Management activities depending on stands and age, T2 medium-aged pine stands

### T2 Medium-Aged Stand, Pinus brutia

<table>
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<tr>
<th>Type</th>
<th>Description</th>
<th>Age (years)</th>
<th>Possible sustainable activities</th>
<th>Standing Volume (m³/ha)</th>
<th>Average Yield (m³/year)</th>
<th>Expectable Wood Products</th>
<th>Remarks</th>
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<tr>
<td>T2 Medium Aged Stand</td>
<td>25 - 40</td>
<td>Opening Forest Fire Prevention Thinning</td>
<td>20-70 Depending on Age</td>
<td>2-5 Depending on Age</td>
<td>Fuel Wood</td>
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#### Activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Work per ha (hrs. / 10 years)</th>
<th>Cut Volume per ha (m³/10 years)</th>
<th>Revenue ($ / ha)</th>
<th>m³ = 0,9t</th>
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<tbody>
<tr>
<td>Opening, Forest Fire Prevention, Thinning</td>
<td>50</td>
<td>30</td>
<td>4,000$</td>
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Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 45: Management activities depending on stands and age, T 3 old pine stands

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<th>Type</th>
<th>Description</th>
<th>Age (years)</th>
<th>Possible sustainable activities</th>
<th>Standing Volume (m³/ha)</th>
<th>Average Yield (m³/year)</th>
<th>Expectable Wood Products</th>
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<td>T 3</td>
<td>Old Stand</td>
<td>&gt; 50</td>
<td>Opening, Forest Fire Prevention, Thinning</td>
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<td>0.5-1</td>
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<td></td>
<td>Depending on Age</td>
<td>Depending on Age</td>
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<tr>
<td></td>
<td>Activities</td>
<td></td>
<td>Work per ha (hrs. / 10 years)</td>
<td>Cut Volume per ha (m³/10 years)</td>
<td>Revenue ($ / ha)</td>
<td>m³ = 0.9t</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Opening, Forest Fire Prevention, Thinning</td>
<td>40</td>
<td>25</td>
<td>3,500 $</td>
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Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 46: Management activities depending on stands and age, T 4 other stands, Andqet

### T4 Other Forest Stands, Andaqet

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Age (years)</th>
<th>Possible sustainable activities</th>
<th>Standing Volume (m³/ha)</th>
<th>Average Yield (m³/year)</th>
<th>Expectable Wood Products</th>
<th>Remarks</th>
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<tr>
<td>T 4</td>
<td>Medium Aged Stand</td>
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<td>Opening, Grazing</td>
<td>5 - 25 Depending on Age and Density</td>
<td>0,5 - 1 Depending on Age and Density</td>
<td>Fuel Wood</td>
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#### Activities

<table>
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<tr>
<th>Work per ha (hrs. / 10 years)</th>
<th>Cut Volume per ha (m³ / 10 years)</th>
<th>Revenue ($ / ha)</th>
<th>Remarks</th>
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<td>160</td>
<td>15</td>
<td>2,400</td>
<td></td>
</tr>
</tbody>
</table>

Remarks
Figure 47: Management activities depending on stands and age, T 4 other stands, Qornet el Hosn Mountain

### T4 Other Forest Stands, Qornet el Hosn Mountain

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Age (years)</th>
<th>Possible sustainable activities</th>
<th>Standing Volume (m³/ ha)</th>
<th>Average Yield (m³/ year)</th>
<th>Expectable Wood Products</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 4</td>
<td>Medium Aged Stand</td>
<td>Opening</td>
<td>5 - 25 Depending on Age and Density</td>
<td>0,5 - 1 Depending on Age and Density</td>
<td>Fuel Wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Activities</td>
<td>Work per ha (hrs. / 10 years)</td>
<td>Cut Volume per ha (m³/ 10 years)</td>
<td>Revenue ($ / ha)</td>
<td>m³ = 0,9t</td>
</tr>
<tr>
<td>Opening, Forest Fire Prevention, Thinning</td>
<td>160</td>
<td>15</td>
<td>2,400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

En association avec:

Figure 48: Input-Output table of forestry activities, Andaqet, Management category III (green), southern part, Pine stands

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Andaqet South</th>
<th>Pine (III S)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Labour Work Hour (without Chain Saw) = $ 3</th>
<th>Price Fuel Wood</th>
<th>$ 60.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (mixed Chain Saw) = $ 8</td>
<td>Delivery, % of Labour Cost</td>
<td>$ 130.00</td>
<td></td>
</tr>
<tr>
<td>Cat. III</td>
<td>Area</td>
<td>49 ha</td>
<td>70%</td>
<td>30%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing length (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Beam Area (ha)</th>
<th>Biomass Output (per ha)</th>
<th>Capacity Work (per ha)</th>
<th>Work hours (per)</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / ha)</th>
<th>Labour Costs ($ / t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>1,900</td>
<td>2</td>
<td>0</td>
<td>40</td>
<td>160</td>
<td>4</td>
<td>15</td>
<td>2,400</td>
<td>60</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>1,800</td>
<td>20</td>
<td>4</td>
<td>20</td>
<td>280</td>
<td>14</td>
<td>8</td>
<td>2,240</td>
<td>112</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Biomass for Fuel Wood (% Ratio)</th>
<th>Biomass for Fuel Wood (% Ratio)</th>
<th>Revenue ($ / t)</th>
<th>Labour Cost ($ / t)</th>
<th>Delivery Cost ($ / t)</th>
<th>Result ($ / t)</th>
<th>Result ($ / ha)</th>
<th>Result per Activity (work hours)</th>
<th>Result per Activity (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>60</td>
<td>40</td>
<td>88</td>
<td>(60)</td>
<td>80</td>
<td>-2</td>
<td>-80</td>
<td>-30</td>
<td>61</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90</td>
<td>10</td>
<td>67</td>
<td>112</td>
<td>56</td>
<td>-101</td>
<td>-2,020</td>
<td>-7,272</td>
<td>1,008</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>20</td>
<td>80</td>
<td>116</td>
<td>36</td>
<td>18</td>
<td>62</td>
<td>1,550</td>
<td>23,250</td>
<td>900</td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 49: Input-Output table of forestry activities, Andqet, Management category III (green), middle southern part, Pine stands

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Andqet Middle South, Pine (IIIIMS)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Price Light Fuel Wood = $ 60,00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
</tr>
<tr>
<td>Cat. III (IIIIMS)</td>
<td>Area</td>
<td>78 ha</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>Activity</td>
<td>Trail / Line / Strip Spacing (m)</td>
<td>Trail / Line / Strip Spacing width (m)</td>
<td>Beach Area (ha)</td>
<td>Biomass Output tons (per ha)</td>
</tr>
<tr>
<td>Opening</td>
<td>4,900,00</td>
<td>2,00</td>
<td>0,98</td>
<td>40,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>1,500,00</td>
<td>20,00</td>
<td>3,00</td>
<td>15,00</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>60,00</td>
<td>25,00</td>
<td>60,00</td>
<td>2,40</td>
</tr>
<tr>
<td>Activity</td>
<td>Biomass for Light Fuel Wood (% Ratio)</td>
<td>Biomass for Fuel Wood (% Ratio)</td>
<td>Revenue ($ / t)</td>
<td>Labour Cost ($ / t)</td>
</tr>
<tr>
<td>Opening</td>
<td>60,00</td>
<td>40,00</td>
<td>88,00</td>
<td>60,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90,00</td>
<td>10,00</td>
<td>67,00</td>
<td>149,33</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>20,00</td>
<td>80,00</td>
<td>116,00</td>
<td>36,00</td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 50: Input-Output table of forestry activities, Andqet, Management category III (green), middle northern part, Pine stands

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat. III</td>
<td>Area</td>
<td>24 ha</td>
<td>10%</td>
<td>45%</td>
<td>45%</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>(III+MN)</td>
<td>Input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td>Trail / Line / Strip Spacing length (m)</td>
<td>Trail / Line / Strip Spacing width (m)</td>
<td>Bench Area (ha)</td>
<td>Biomass Output (per ha)</td>
<td>Capacity Work hours (per ha)</td>
<td>Work hours (per t)</td>
</tr>
<tr>
<td>Opening</td>
<td></td>
<td>2.300,00</td>
<td>2,00</td>
<td>0,46</td>
<td>60,00</td>
<td>160,00</td>
<td>2,67</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td>500,00</td>
<td>10,00</td>
<td>0,50</td>
<td>15,00</td>
<td>280,00</td>
<td>18,67</td>
</tr>
<tr>
<td>Selective Cutting and Desease Prevention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td>Biomass for Light Fuel Wood (% Ratio)</td>
<td>Biomass for Fuel Wood (% Ratio)</td>
<td>Revenue ($ / t)</td>
<td>Labour Cost ($ / t)</td>
<td>Delivery Cost ($ / t)</td>
<td>Result ($ / t)</td>
</tr>
<tr>
<td>Opening</td>
<td></td>
<td>60,00</td>
<td>40,00</td>
<td>88,00</td>
<td>40,00</td>
<td>20,00</td>
<td>28</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td>90,00</td>
<td>10,00</td>
<td>67,00</td>
<td>145,33</td>
<td>74,67</td>
<td>-157</td>
</tr>
<tr>
<td>Selective Cutting and Desease Prevention</td>
<td></td>
<td>20,00</td>
<td>80,00</td>
<td>116,00</td>
<td>25,71</td>
<td>12,86</td>
<td>77</td>
</tr>
</tbody>
</table>

En association avec: ELARD
Figure 51: Input-Output table of forestry activities, Andaqet, Management category III (green), northern part, Pine stands

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
</tr>
<tr>
<td>Cat. III (III-N)</td>
<td>Area</td>
<td>13 ha</td>
<td>10%</td>
<td>40%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing length (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Bench Area (ha)</th>
<th>Biomass Output trees (per ha)</th>
<th>Capacity Work hours (per ha)</th>
<th>Work hours (per t)</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>900,00</td>
<td>2,00</td>
<td>0,18</td>
<td>60,00</td>
<td>160,00</td>
<td>2,67</td>
<td>15,00</td>
<td>2,400,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>300,00</td>
<td>20,00</td>
<td>0,60</td>
<td>15,00</td>
<td>280,00</td>
<td>18,67</td>
<td>8,00</td>
<td>2,240,00</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>9,00</td>
<td>40,00</td>
<td>60,00</td>
<td>1,50</td>
<td>15,00</td>
<td>900,00</td>
<td>22,50</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Biomass for Light Fuel Wood (%-Ratio)</th>
<th>Biomass for Fuel Wood (%-Ratio)</th>
<th>Revenue ($ / t)</th>
<th>Labour Cost ($ / t)</th>
<th>Delivery Cost ($ / t)</th>
<th>Result ($ / ha)</th>
<th>Result ($ / t)</th>
<th>Result per Activity (work hours)</th>
<th>Result per Activity (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>60,00</td>
<td>40,00</td>
<td>88,00</td>
<td>40,00</td>
<td>20,00</td>
<td>28</td>
<td>1,680</td>
<td>302</td>
<td>29</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90,00</td>
<td>10,00</td>
<td>67,00</td>
<td>149,33</td>
<td>74,67</td>
<td>-157</td>
<td>-2,355</td>
<td>-1,413</td>
<td>168</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>20,00</td>
<td>80,00</td>
<td>116,00</td>
<td>22,50</td>
<td>11,25</td>
<td>82</td>
<td>3,290</td>
<td>29,610</td>
<td>540</td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

Figure 52: Input-Output table of forestry activities, Andqet, Management category III (green), south western part, Other stands

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td></td>
<td></td>
<td>Labour Work Hour (without Chain Saw) = $3</td>
<td>Price Fuel Wood</td>
</tr>
<tr>
<td>Cat. III (III SW)</td>
<td></td>
<td></td>
<td>Labour Work Hour (mixed Chain Saw) = $8</td>
<td>Delivery % of Labour Cost</td>
</tr>
<tr>
<td>Area</td>
<td>77 ha</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing length (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Beach Area (ha)</th>
<th>Biomass Output tons (per ha)</th>
<th>Capacity Work hours (per ha)</th>
<th>Work hours (per t)</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / t)</th>
<th>Labour Costs ($ / t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>1.500,00</td>
<td>2.00</td>
<td>0.30</td>
<td>15.00</td>
<td>160.00</td>
<td>10.67</td>
<td>15.00</td>
<td>2.400,00</td>
<td>160.00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention (III SW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Biomass for Light Fuel Wood (%-Ratio)</th>
<th>Biomass for Fuel Wood (%-Ratio)</th>
<th>Revenue ($ / t)</th>
<th>Labour Cost ($ / t)</th>
<th>Delivery Cost ($ / t)</th>
<th>Result ($ / t)</th>
<th>Result per Activity (work hours)</th>
<th>Result per Activity (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>70.00</td>
<td>30.00</td>
<td>81.00</td>
<td>160.00</td>
<td>80.00</td>
<td>-159</td>
<td>-2.385</td>
<td>-716</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests
in view of sustainable forest management and forest fire protection

En association avec:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input-Output Table</strong></td>
<td></td>
<td><strong>Appointed Price/Cost</strong></td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
<td>Price Fuel Wood</td>
<td>$ 130,00</td>
</tr>
<tr>
<td>Cat. II</td>
<td>Area Input</td>
<td>575 ha</td>
<td>25%</td>
<td>65%</td>
<td>10%</td>
</tr>
<tr>
<td>(II)</td>
<td>Activity</td>
<td>Input</td>
<td>Trail / line / Strip Spacing</td>
<td>Trail / line / Strip Spacing</td>
<td>Bench Area</td>
</tr>
<tr>
<td>Opening</td>
<td></td>
<td></td>
<td>29,200,00</td>
<td>2,00</td>
<td>5,04</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td></td>
<td>7,100,00</td>
<td>20,00</td>
<td>14,20</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(II)</td>
<td>Activity</td>
<td>Output</td>
<td>Biomass for Light Fuel Wood (kg-t/ha)</td>
<td>Biomass for Fuel Wood (kg-t/ha)</td>
<td>Revenue ($ / t)</td>
</tr>
<tr>
<td>Opening</td>
<td></td>
<td></td>
<td>60,00</td>
<td>40,00</td>
<td>80,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td></td>
<td>90,00</td>
<td>10,00</td>
<td>67,00</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

En association avec:

Figure 54: Input-Output table of forestry activities, Andaqet, Management category I (red), Pine stands

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Andaqet Pine (I)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Price Light Fuel Wood $ 60.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
</tr>
<tr>
<td>Cat. 1 Area Input</td>
<td>431</td>
<td>35%</td>
<td>45%</td>
<td>20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing length (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Bench Area (ha)</th>
<th>Biomass Output (tons per ha)</th>
<th>Capacity Work Hours (per ha)</th>
<th>Work Hours (per t)</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening (Touristic Trails)</td>
<td>2,000,00</td>
<td>2,00</td>
<td>0,40</td>
<td>15,00</td>
<td>160,00</td>
<td>10,67</td>
<td>15,00</td>
<td>2,400,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>3,800,00</td>
<td>25,00</td>
<td>1,60</td>
<td>15,00</td>
<td>280,00</td>
<td>18,67</td>
<td>8,00</td>
<td>2,240,00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening (Touristic Trails)</td>
<td>60,00</td>
<td>40,00</td>
<td>102,00</td>
<td>160,00</td>
<td>80,00</td>
<td>-138,00</td>
<td>-2,070,00</td>
<td>-8,280,00</td>
<td>60,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90,00</td>
<td>10,00</td>
<td>70,50</td>
<td>149,33</td>
<td>74,67</td>
<td>-153,50</td>
<td>-2,362,50</td>
<td>-17,499,00</td>
<td>2,128,00</td>
</tr>
</tbody>
</table>
Figure 55: Input-Output table of forestry activities, Qornet el Hosn Mountain, Management category III (green), Pine stands

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Qornet el Hosn Pine (III)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Price Fuel Wood</th>
<th>$ 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Young Stands</td>
<td>Medium Aged Stands</td>
<td>Old Stands</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
<td>Price Fuel Wood</td>
</tr>
<tr>
<td>Cat. III (III5)</td>
<td>Area</td>
<td>142 ha</td>
<td>10%</td>
<td>70%</td>
<td>20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / line / Strip Spacing Length (m)</th>
<th>Trail / line / Strip Spacing width (m)</th>
<th>Bench Area (ha)</th>
<th>Biomass Output (tons)</th>
<th>Capacity Work hours (per ha)</th>
<th>Work hours (per ha)</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / ha)</th>
<th>Labour Costs ($ / t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>4.500</td>
<td>2</td>
<td>1</td>
<td>40</td>
<td>160</td>
<td>4</td>
<td>15</td>
<td>2.400</td>
<td>60</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>4.600</td>
<td>20</td>
<td>9</td>
<td>15</td>
<td>280</td>
<td>19</td>
<td>8</td>
<td>2.240</td>
<td>149</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>60</td>
<td>40</td>
<td>88</td>
<td>60</td>
<td>30</td>
<td>-2</td>
<td>-80</td>
<td>-72</td>
<td>144</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90</td>
<td>30</td>
<td>67</td>
<td>145</td>
<td>25</td>
<td>-157</td>
<td>-2.355</td>
<td>-21,666</td>
<td>2,976</td>
</tr>
<tr>
<td>Selective Cutting and Disease Prevention</td>
<td>20</td>
<td>80</td>
<td>136</td>
<td>73</td>
<td>11</td>
<td>82</td>
<td>2,058</td>
<td>226,388</td>
<td>4,325</td>
</tr>
</tbody>
</table>

En association avec:
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

En association avec:

Figure 56: Input-Output table of forestry activities, Qornet el Hosn Mountain, Management category II (blue), Pine stands

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Qornet el Hosn Pine (II)</th>
<th>Appointed Price/Cost</th>
<th>Labour Work Hour (incl. Chain Saw) = $ 15</th>
<th>Price Light Fuel Wood</th>
<th>$ 60,00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td>Area: 158 ha</td>
<td>Young Stands: 10%</td>
<td>Medium Aged Stands: 30%</td>
<td>Old Stands: 60%</td>
<td>Labour Work Hour (without Chain Saw) = $ 3</td>
</tr>
<tr>
<td>(II)</td>
<td>Input</td>
<td></td>
<td></td>
<td></td>
<td>Labour Work Hour (mixed Chain Saw) = $ 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Beach Area (ha)</th>
<th>Biomass Output tons (per ha)</th>
<th>Capacity Work hours (per ha)</th>
<th>Work hours</th>
<th>Labour Costs ($ / hour)</th>
<th>Labour Costs ($ / ha)</th>
<th>Labour Costs ($ / l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>4,800.00</td>
<td>2.00</td>
<td>0.96</td>
<td>50.00</td>
<td>160.00</td>
<td>3.20</td>
<td>15.00</td>
<td>2,400.00</td>
<td>48.00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>300.00</td>
<td>20.00</td>
<td>0.60</td>
<td>15.00</td>
<td>280.00</td>
<td>18.67</td>
<td>8.00</td>
<td>2,240.00</td>
<td>149.33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Output (1)</th>
<th>Biomas for Fuel Wood (% Ratio)</th>
<th>Biomas for Fuel Wood (% Ratio)</th>
<th>Revenue ($ / l)</th>
<th>Labour Cost ($ / l)</th>
<th>Delivery Cost ($ / l)</th>
<th>Result ($ / l)</th>
<th>Result per Activity ($ / l)</th>
<th>Result per Activity (work hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>60.00</td>
<td>40.00</td>
<td>88.00</td>
<td>48.00</td>
<td>24.00</td>
<td>16.00</td>
<td>16.00</td>
<td>800.00</td>
<td>153.60</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90.00</td>
<td>10.00</td>
<td>67.00</td>
<td>145.33</td>
<td>74.67</td>
<td>-157</td>
<td>-2.355</td>
<td>168</td>
<td>9</td>
</tr>
</tbody>
</table>
Elaboration of management plans of two pine forests in view of sustainable forest management and forest fire protection

En association avec:

**Figure 57: Input-Output table of forestry activities, Qornet el Hosn Mountain, Management category I (red), Pine stands**

<table>
<thead>
<tr>
<th>Work Programme</th>
<th>Qornet el Hosn Pine</th>
<th>Area (ha)</th>
<th>Young Stands (10%)</th>
<th>Medium Aged Stands (30%)</th>
<th>Old Stands (60%)</th>
<th>Appointed Price/Cost Labour Work Hour (incl. Chain Saw) $ 15</th>
<th>Price Light Fuel Wood $ 60,00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input-Output Table</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labour Work Hour (without Chain Saw) $ 3</td>
<td>Price Light Fuel Wood $ 130,00</td>
</tr>
<tr>
<td>Cat. I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labour Work Hour (mixed Chain Saw) $ 8</td>
<td>Delivery, % of Labour Cost 50%</td>
</tr>
<tr>
<td>(I)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>311 ha</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Input

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trail / Line / Strip Spacing length (m)</th>
<th>Trail / Line / Strip Spacing width (m)</th>
<th>Average Area (ha)</th>
<th>Biomass Output tons (per ha)</th>
<th>Capacity Work hours (per ha)</th>
<th>Work hours (per l)</th>
<th>Labour Costs ($ / l)</th>
<th>Labour Costs ($ / l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening (Touristic Trails)</td>
<td>2,000,00</td>
<td>2,00</td>
<td>0,41</td>
<td>10,00</td>
<td>160,00</td>
<td>16,00</td>
<td>15,00</td>
<td>2,400,00</td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>250,00</td>
<td>20,00</td>
<td>0,50</td>
<td>15,00</td>
<td>280,00</td>
<td>18,67</td>
<td>8,00</td>
<td>2,240,00</td>
</tr>
</tbody>
</table>

### Output

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening (Touristic Trails)</td>
<td>60,00</td>
<td>40,00</td>
<td>85,00</td>
<td>120,00</td>
<td>-272,0</td>
<td>-2,72,0</td>
<td>-1,988,0</td>
<td>64,00</td>
<td>4,00</td>
<td></td>
</tr>
<tr>
<td>Fire Prevention by Site Clearing</td>
<td>90,00</td>
<td>10,00</td>
<td>67,00</td>
<td>149,33</td>
<td>-157,0</td>
<td>-2,355,0</td>
<td>-1,777,5</td>
<td>140</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
Annex 6

Aide memoire used to brief the Minister of Agriculture
Projet d’Appui au Développement Local
dans le Nord du Liban (ADELNORD)

AIDE MEMOIRE
À l’INTENTION DU MINISTRE DE L’AGRICULTURE
Briefing sur la mission : Elaboration de plans de gestion durable de deux forêts de pin en vu de la protection contre les incendies et de la gestion durable

Préparé par :
Rainer KOEPSELL
Michel BASSIL
Jan-Eric VOSS

Septembre 2012
TABLE DES MATIERES

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2  METHODOLOGIE DE TRAVAIL  4
2.1 La collecte et l'analyse des données  4
2.2 La synthèse  4
2.3 Le programme d'action (le plan de travail)  5
3  OBSERVATIONS  6
4  PROPOSITIONS  8
4.1 Catégorie 1 (objectif de conservation et protection)  8
4.2 Catégorie 2 (objectif de améliorer les services de la forêt) :  9
4.3 Catégorie 3 (objectif d'intervention) :  9
5  DIFFERENCES ENTRE LA METHODE TRADITIONNELLE ET LA METHODE PROPOSEE  10
1 OBJECTIF DE LA MISSION

L’objectif de la mission est l’élaboration d’un diagnostic de la foret d’Andaket (Akkar) et de la foret de Sfireh (Dannieh), l’identification et l’analyse des problèmes. Le plan d’aménagement et de gestion durable des deux forets sera rédigé à la fin de la mission. Ce plan comprendra :

• Les directives de la gestion durable de ces deux forets
• Les différentes activités à entretenir dans les prochaines années
• Les descriptions des activités
• Schéma et Cartes de support
• Un plan de travail
• Présentation des aspects administratifs nécessaire à la réalisation des activités
2 METHODOLOGIE DE TRAVAIL

2.1 La collecte et l’analyse des données

Elle est la base dans l’aménagement durable des forêts. Les données appartiennent aux deux types principaux :

Données liées au milieu naturel : Elles concernent la richesse, la potentialité et la dynamique des stations écologiques, de la biodiversité, animales et des risques naturels.

Données économiques et sociaux : Elles concernent la demande, la dépendance et l’évolution de la récolte de bois, des produits non ligneux, l’utilisation traditionnelle, l’accueil du public, l’écotourisme, la conservation, la protection,…

2.2 La synthèse

Ils consistent à :

• Examiner la gestion passée
• Choisir les objectifs : protection paysagère, protection biologique, production dans le respect des milieux naturels et des paysages :
• Classer les objectifs selon leur importance
• Décider les perspectives à moyen terme (10 years) regardant la composition en essence et le structure du peuplement
• Choisir la durée de l’aménagement (traitement sylvicole et surface à régénérer)
• Faire le zonage selon l’objectif
• Identifier les interventions dans chaque zone : Elles comprennent l’abattage et la récolte de bois, l’élagage, l’éclaircie, la plantation, l’enrichissement, la sélection des arbres mère, l’entretien et la fermeture des sentiers et
des pistes, contrôle de l'usage du feu, la gestion des épidémies d'insectes et des maladies cryptogamiques et de la végétation concurrente de même que toute autre activité ayant un effet sur la productivité de la forêt.

2.3 Le programme d'action (le plan de travail)

Le programme d'action du plan de gestion définit la programmation des interventions sylvicoles dans la forêt pour une durée de 10 ans.
3 OBSERVATIONS

• La population dépend de la forêt dans la collecte du bois de chauffage et de l’origanum
• Un pasteur fréquente la forêt six à sept mois quotidiennement, d’autres arrivent occasionnellement pendant l’été et d’une manière discontinu
• Le bois utilisé par la boulangerie n’affecte pas négativement la forêt, au contraire il aide à se débarrasser de bois vulnérable à l’incendie
• Des sentiers pédestres sont aménagés dans la forêt soit pour l’écotourisme soit pour la collecte de bois
• Des pistes sont de plus en plus longues et nombreuses pour la collecte du bois à Andaket
• Les activités agricoles et la construction s’approchent de plus en plus de la forêt, c’est un risque supplémentaire d’incendie et de coupes non organisées
• L’absence du cadastre bien clair et présence du chevauchement entre la propriété publique et la propriété privée.
• L’Elagage des arbres (taille) est pratiqué d’une manière favorisant le développement des parasites et diminuant la qualité du bois.
• Coupes non organisées
• Coupes non professionnelles et non technique
• Présence des attaques d’insectes et des champignons parasites qui cause la mort de l’arbre
• Présence des arbres à cimes cassées ou totalement déracinés due au poids de la neige
• Le volume sur pied est dans certains places supérieur à la moyenne (50 à 60 mètres cubes par hectare) ou parfois inférieur.
• La surface terrière (critère de mesure de densité du peuplement forestier) est rarement proche de la moyenne (35 to 40 mètres carré par hectare)
• L’accès est dans la plupart de la forêt est rendue difficile vu la densité des arbres et des arbustes
• …
4 PROPOSITIONS

Trois catégories de gestion ont été identifiées. Dans chaque catégorie, les interventions sylvicoles seront identifiées. L’objectif de ces interventions est d’amener la forêt à une situation de production continue tout en respectant sa conservation et sa richesse. Au bout de quelques années, l’écosystème la forêt sera plus stable, riche en arbres sains, de plusieurs classes d’âges, rectilignes et présentant une bonne qualité du bois (figure 1).

4.1 Catégorie 1 (objectif de conservation et protection)

Les zones classées dans cette catégorie présentent au moins une des caractères suivants :
- Forte pente,
- Faible qualité du sol
- Présence de risque d’érosion
- Présence des arbres caractéristiques (forme, dimension…)
- Spécificité écologique

Aucune intervention n’est proposée pour cette catégorie à l’exception du débroussaillement dans les zones vulnérables (à haut risque d’incendie) ou l’entretien des sentiers éco touristique.
4.2 **Catégorie 2 (objectif de améliorer les services de la forêt):**

Les zones classées dans cette catégorie présentent un potentiel productif dans le futur lointain. Dans ces zones, les arbres d’avenir vont être sélectionnés dans la période située entre 10 et 20 ans.

Les interventions à entreprendre dans ces zones consistent à créer des passages à pieds (1.5m de large), du débroussaillement dans les zones vulnérables (à haut risque d’incendie) et l’entretien des sentiers éco touristique pour mieux contrôler la forêt.

4.3 **Catégorie 3 (objectif d’intervention):**

Les zones classées dans cette catégorie contiennent un volume de bois supérieur à la moyenne ce qui pourrait diminuer la production annuelle de la forêt. Pour assurer la durabilité de la forêt, des interventions favorisent la régénération naturelle. Ces interventions devront commencer dans le meilleur délai.

Les interventions à entreprendre dans ces zones sont limitées à l’enlèvement du bois mort, les arbres endommagés, les arbres malades de mauvaise qualité de bois.

Dans ces zones, une sélection des arbres d’avenir est faite et une éclaircie sera pratiquée en faveur des arbres d’avenir.
## Différences entre la méthode traditionnelle et la méthode proposée

<table>
<thead>
<tr>
<th>Méthode traditionnelle</th>
<th>Méthode proposée</th>
</tr>
</thead>
<tbody>
<tr>
<td>A besoin d’enrichissement ou de plantation</td>
<td>Enrichissement et régénération sont naturelles</td>
</tr>
<tr>
<td>A besoin de débroussaillement</td>
<td>Débroussaillement naturel</td>
</tr>
<tr>
<td>Elagage manuel</td>
<td>Elagage naturel</td>
</tr>
<tr>
<td>Qualité médiocre du bois</td>
<td>Bonne qualité du bois</td>
</tr>
<tr>
<td>Accroissement annuel limité</td>
<td>Accroissement annuel supérieur</td>
</tr>
<tr>
<td>Revenu limité discontinu</td>
<td>Revenu annuel continu</td>
</tr>
<tr>
<td>Risque incendie élevé</td>
<td>Risque incendie limitée</td>
</tr>
<tr>
<td>Risque d’attaque parasitaire élevé</td>
<td>Risque d’attaque parasitaire réduit</td>
</tr>
</tbody>
</table>

**Figure 1:** Différences entre la méthode traditionnelle et la méthode proposée
Annex 7

Proposed Memorandum of Understanding between
Ministry of Agriculture
and Municipality of Andqet
مذكرة معمولة:

فحوى الأول

وزارة الزراعة - اللواء م.د. ف.ف.، للمجتمع الفيحص، والوزير للزراعة واللائحة نخير.

جهن

بلدة عريقة - المجتمعة، واللائحة عريقة.

هيئة:

بناءة في المادة 11 من قانون-formed للاشجار، 1949 صادر وزراء الزراعة في خطة الدارا

ية، حلبة عريقة أو الخطة الدارية. 49 خضرة، ص. 144، ووضعها د. د. د. ف.، للمجتمع

وهما أن الخطة الدارية تكون لها عريقة، عند الخطة. والخطوة، وقد تدلى إلى المصلحة، وتبنيها، وأليك، وофية استردادها

وظفاً، لضمانة، ورقة، وتزداد.

في كلما تكونت له، ف، عريقة، وللشرطة، وللشراكة في، برامج، كما في المادة 54 مصريون

بما أن الخطة الدارية تكون لها عريقة، عند الخطة، وقد تدلى إلى المصلحة، وتبنيها، وأليك، ووفية استردادها.

لبيك

شفق فيحان في مايلي:

للمادة الأولى: متغير قدم الدواء، والمحاصيل، للقيق، كجزء من الخطة، وتغذّب الهدف، نداء، تغيّر شروط

خاصة، مصلحة، عريقة.

للمادة الثانية: يمكن أن يُحذّر، قرار، للسبقية، للاستغلال، لخطة الدارا، للقيق، بحجة، دون طرير، وحبيب

מאוחרة لمساحة: عريقة. للسبقية، للسبقية، للاستغلال، للسبقية، للسبقية، للاستغلال، للسبقية، للسبقية.

للمادة الثالثة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الرابعة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الخامسة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة السادسة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة السابعة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الثامنة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة التاسعة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الحادية عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الثانية عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الثالثة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الرابعة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الخامسة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة السادسة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة السابعة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.

للمادة الثامنة عشرة: يمكن أن يُحذّر، قرار، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية، للسبقية.
لODULE لاعادة تزويدي: حدد هذا الفبدأ بعد قلادة الرحمه. تقدمت جدد هذا الفبدأ لتكون استعمالات جهة خطئة.

لODULE لاعادة تزويدي: عرضة وتهمس الملاح، والخروط التي قررت جزءاً من خطئة نظام هذا الفبدأ في إبريق، بناءً على واحد من الفيلين ونظام الرمل، تقليل المد. ود. الدكتور، وزراء الزراعة

م. عزج محمد
فترة طولية تعمد الدعاية لعيد رمضان في غيرة تحفيظ

1-فسحة تعداد:

لا.

لا تجنب المفاهيم، الأدب، والذاتات البيضاء، نعم، ما لا يُنكِذ ل

لا ـ تجربة، نواحي، ابتداء، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواحي، نواح
13-الجراح
- وضع الجلد على الجرح
- شرب العينين في ماء شراب,
- ضع فنجان من ماء شراب
- ضع غطاء على الجرح

14-الباقورة
- تكون على الباقورة
- تربة نبات
- تربة الأرض

Categories:
1. قطعة الأرض
2. قطعة الأرض
3. قطعة الأرض
4. قطعة الأرض

للمادة ليبية: 
- قطعة الأرض
- قطعة الأرض
- قطعة الأرض
- قطعة الأرض

استخدام:
1. وضع شرارة في الباقورة
2. وضع شرارة في الباقورة
3. وضع شرارة في الباقورة
4. وضع شرارة في الباقورة

لمادة لحية:
- قطعة الأرض
- قطعة الأرض
- قطعة الأرض
- قطعة الأرض

استخدام:
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- قطعة الأرض

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2. وضع شرارة في الباقورة
3. وضع شرارة في الباقورة
4. وضع شرارة في الباقورة

لمادة لحية:
- قطعة الأرض
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- قطعة الأرض
- قطعة الأرض

استخدام:
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3. وضع شرارة في الباقرة
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**لمادةً ليومًا:**

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**لمحة عن الغفوة:**

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**لمحة عن الغفوة:**

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**لمحة عن الغفوة:**

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<th>الغفوة الثالثة</th>
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</tbody>
</table>
للموضوع الأول - للموضوع الثاني - للموضوع الثالث - للموضوع الرابع

السؤال: صرّب في الجملة التي تأتي من الصرح:

الجواب: صرّب في الجملة التي تأتي من الصرح.

السؤال: الصور من الصرح.

الجواب: الصور من الصرح.

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الجواب: الصور من الصرح.

السؤال: الصور من الصرح.

الجواب: الصور من الصرح.
- لمن اللبال: صنادقة لعباً للحاوية من الحرقة للاهداف مباشرةً

لمينة لليجاعة
- لمن اللبال: القيمة البيضاء لعباً للخربة موقعة رقم 2
  - المربع: 147 فشار
  - قلم: الأليف

- لن왔: صنادقة للمبهرات والبائنة من الحرقة للاهداف مباشرةً

- لنوات: قلم: لمن اللبال

- لنوات: صنادقة للمبهرات والبائنة من الحرقة للاهداف مباشرةً

- لنوات: صنادقة للمبهرات والبائنة من الحرقة للاهداف مباشرةً

- لنوات: الصنادقة لعباً للحاوية من الحرقة للاهداف مباشرةً

لمينة لخلاصة
- لمن اللبال: جود الوصول لعباً للحاوية من الحرقة للاهداف مباشرةً
  - المربع: 131 فشار
  - قلم: الأليف

- لنوات: صنادقة للمبهرات والبائنة من الحرقة للاهداف مباشرةً

- لنوات: الصنادقة لعباً للحاوية من الحرقة للاهداف مباشرةً

- لنوات: الصنادقة لعباً للحاوية من الحرقة للاهداف مباشرةً

- لنوات: الصنادقة لعباً للحاوية من الحرقة للاهداف مباشرةً
• للفحص قلاليث
- الأعم: صغرى للوبرات والبقية من الحرق للهدم مسبقًا - قطع فقيل حفرة معطوفة محددة

لمكان النموذج: جود في الفحص قطع للإيوام، قطع هذه المواقع للوقاية
- للفحص قلاليث 

لمینة للاشارة

لمكان النموذج: لميضيف قريبًا في الخرائطة، المصادر رقم 2
- للفحص قلاليث
للمادة الأولى:

"الجهاز المالي للزراعة"، يحتوي على مجموعة واسعة من المبادرات والبرامج تتعلق بالزراعة. يهدف إلى تطوير قدرات الدولة في مجال الزراعة وتوزيع الموارد بشكل أكثر كفاءة.

للمادة الثانية:

"الميزانية". تعني الميزانية لمشروعات الزراعة في العام الحالي. الميزانية الصغيرة: تتعلق بالميزانية المخصصة للمشروعات الصغيرة. الميزانية الكبيرة: تتعلق بمعدلات المالية لميزانية المشروعات الكبرى. الميزانية المبتدئة: تتعلق بالميزانية المخصصة للمشروعات المبتدئة.

للمادة الثالثة:

"الميزانية". تعني الميزانية لمشروعات الزراعة في العام الحالي. الميزانية الصغيرة: تتعلق بالميزانية المخصصة للمشروعات الصغيرة. الميزانية الكبيرة: تتعلق بمعدلات المالية لميزانية المشروعات الكبرى. الميزانية المبتدئة: تتعلق بالميزانية المخصصة للمشروعات المبتدئة.

للمادة الرابعة:

"الميزانية". تعني الميزانية لمشروعات الزراعة في العام الحالي. الميزانية الصغيرة: تتعلق بالميزانية المخصصة للمشروعات الصغيرة. الميزانية الكبيرة: تتعلق بمعدلات المالية لميزانية المشروعات الكبرى. الميزانية المبتدئة: تتعلق بالميزانية المخصصة للمشروعات المبتدئة.
Andqet Municipality
Forest Management Categories

Legend
- Cadastral zone Andqet
- Protected forest, only fire management
- Preparatory Forest Management Program
- Complete Forest Management Program

Kilometers
Andqet Municipality
Annual Forest Management Areas

Legend

- Cadastral zone Andqet
- Forest annual management
  - Year 1
  - Year 2
  - Year 3
  - Year 4
  - Year 5
  - Year 6
  - Year 7
  - Year 8
  - Year 9
Annex 8

Proposed Memorandum of Understanding between Ministry of Agriculture and the Municipalities of Qornet el Hosn Mountain Forest
مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

فريق الأول

مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

فريق الثاني

وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج المقبل، ووزارة الزراعة والتعليم في مصر:

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مذكرة تفاهم بين وزارة الزراعة - اللج موردة للسعودية، لعمق تنشج الم
ل站着 لشيء غريبة: "لقد هذا الفضاء، في ذات الحالة. "جبيت جبد هذا الفضاء (التعرفة) مدة لخطبة الباردة" (3).

في الانتباه مدلالية جيد المسميات.

ل站着 لشيء غريبة تظهر لللاحظ والخطوة المفيدة جزء من الخطبة

نظم هذا الفضاء تغريبت من مهبط وحيدة دخلنها وليلة محصلة.

ب رونف "...............

وزرّ الزراعة

د. جيم للاج جس

رئيس باردة تاران

رئيس باردة ماز
فتنشر وظائف أماعم الدارة لمبتداء قصى غبقوطنة لحجر.

لاقـ ـروـ ـط فيـ ـة

1. **Checking Meridians**
   - تحضير الأرض في وضعية غير مثمرة تتعلق بسيطة للزراعات.
   - تشكّل الأرض في وضعية غير مثمرة تتعلق بسيطة للزراعات.
   - تحضير الأرض في وضعية غير مثمرة تتعلق بسيطة للزراعات.
   - تحضير الأرض في وضعية غير مثمرة تتعلق بسيطة للزراعات.

2. **Ridges**
   - وضعية سفلية مبطنة ذات سفليا رميا. (أو مبطنة مثمرة فيضع في الشرارات للواجه بمطاعن)
   - وضعية سفلية مبطنة ذات سفليا رميا. (أو مبطنة مثمرة فيضع في الشرارات للواجه بمطاعن)
   - وضعية سفلية مبطنة ذات سفليا رميا. (أو مبطنة مثمرة فيضع في الشرارات للواجه بمطاعن)
   - وضعية سفلية مبطنة ذات سفليا رميا. (أو مبطنة مثمرة فيضع في الشرارات للواجه بمطاعن)

3. **에는 الازهار**
   - إطلاق الأزهار في مواقع الحقول: سفليا سفليا سفليا سفليا
   - إطلاق الأزهار في مواقع الحقول: سفليا سفليا سفليا سفليا
   - إطلاق الأزهار في مواقع الحقول: سفليا سفليا سفليا سفليا
   - إطلاق الأزهار في مواقع الحقول: سفليا سفليا سفليا سفليا

4. **Cutting (انفصال)**
   - قطع الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - قطع الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - قطع الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - قطع الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة

5. **Notes**
   - يمكن أن تكون أسنان الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - يمكن أن تكون أسنان الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - يمكن أن تكون أسنان الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة
   - يمكن أن تكون أسنان الآجر فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة

**Notice:**
- إن التعميقات في وضعية غير معطرة فيوضع في وضعية غير معطرة فيوضع في وضعية غير معطرة من النوع يتفصّل إعادة فتح الشرارات للواجهة.
6. قطع الأشجار لعلاج الأمراض أو الجروح.
- قطع الأشجار للحد من تلف الأجزاء المبتلة والجروحات.
- جرعة نسبة 1:1 من جذر النباتات في الماء المغلي لعلاج الجروح وآفات الأورام.
- تجفيف جذور النباتات قبل استخدامها في العلاجات.

7. تفصيلات
- قطع الأشجار لعلاج الجروح.
- تجفيف جذور النباتات قبل استخدامها.
- تطبيق علاجات خاصة للجروح المسببة للجروح.

8. صور مبيرات لغادة
- عرض نادر أو نادر وصوص.
- تشخيص الأشجار.

Categories

1. فئة الأولية (A)
- لحمة الأذن: 1000 ـ 10000
- لحمة اليد: 1000 ـ 10000
- لحمة القدم: 1000 ـ 10000
- لحمة الكتف: 1000 ـ 10000

2. فئة الثانية (B)
- لحمة الأذن: 10000 ـ 100000
- لحمة اليد: 10000 ـ 100000
- لحمة القدم: 10000 ـ 100000
- لحمة الكتف: 10000 ـ 100000

3. فئة الثالثة (C)
- لحمة الأذن: 100000 ـ 1000000
- لحمة اليد: 100000 ـ 1000000
- لحمة القدم: 100000 ـ 1000000
- لحمة الكتف: 100000 ـ 1000000

4. فئة الرابعة (D)
- لحمة الأذن: 1000000 ـ 10000000
- لحمة اليد: 1000000 ـ 10000000
- لحمة القدم: 1000000 ـ 10000000
- لحمة الكتف: 1000000 ـ 10000000
<table>
<thead>
<tr>
<th>جدول الاعمال السريرية للحفرة</th>
<th>جدول الاعمال السريرية للحفرة</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>العمل</strong></td>
<td><strong>العمل</strong></td>
</tr>
<tr>
<td>تثبيت ورشة في ق Fisheries</td>
<td>تثبيت ورشة في ق Fisheries</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
السماحة: 88 فتحر

الموذج الأول - الموذج الثالث - الموذج للبريدع

الاعمال: صكية مهرات - قطع في نقل متحرك

لخريطة مساحة

الموذج الأول - الموذج الثاني - الموذج للبريدع

الاعمال: صكية مهرات - قطع في نقل متحرك

لخريطة مساحة

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الاعمال: صكية مهرات - قطع في نقل متحرك

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الاعمال: صكية مهرات - قطع في نقل متحرك

لخريطة مساحة

الموذج الأول - الموذج الثاني - الموذج للبريدع

الاعمال: صكية مهرات - قطع في نقل متحرك

لخريطة مساحة

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لخريطة مساحة

الموذج الأول - الموذج الثاني - الموذج للبريدع

الاعمال: صكية مهرات - قطع في نقل متحرك
لا توجد نص يمكن قراءته بشكل طبيعي من الصورة المقدمة. من فضلك، قدم نصاً يمكن قراءته بشكل طبيعي.
لمادة 1: إجراءات: أن إجراء المعالجات يجب أن تتم بعد انتهاء العامل خطير، وقبل البدء بها.

لمادة 2: خفض طاقة الشروط: إذا تنظر إلى الشروط للطيفات، فإن الشروط يجب أن تكون على درجات حرارة معينة.

لمادة 3: اتخاذ إجراءات: إذا كانت هناك حاجة إلى اتخاذ إجراءات، يجب أن تكون هذه الإجراءات متبعة بشكل صحيح.

لمادة 4: تعديلات الشروط: إذا تغيرت الشروط، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 5: إجراءات الإخلال: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 6: إجراءات اللياقة: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 7: إجراءات السلامة: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 8: إجراءات السلامة: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 9: إجراءات السلامة: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.

لمادة 10: إجراءات السلامة: إذا كانت هناك حاجة إلى إجراءات، يجب أخذ إجراءات حفاظ على الطيفات من حيث الحفاظ.
Qornet El Hosn Mountain (Sfiré Forest)
Forest management categories

Legend
- Protected forest, only fire management
- Preparatory Forest Management Program
- Complete Forest Management Program
- Forest trails

الأقسام الثلاثة
- القسم الأول
- القسم الثاني
- القسم الثالث
Qornet El Hosn Mountain (Sfiré Forest) Annual forest management areas
Annex 9

Presentation at debriefing session

Projet d'Appui au Développement local dans le Nord du Liban (ADELNORD)

Mission d’appui:
Elaboration de plans de gestion de deux forêts de pin en vue de la gestion durable et de la protection contre les incendies

Rainer KOEPSELL
Michel BASSIL
Jan-Eric VOSS

20/11/2012

Structure of presentation

I. Progress of mission
II. Assessment of status quo
   - Current forest utilization
   - Impact on environment
III. Forest management plans
   - Objective
   - Inventory
   - Planning
IV. Outlook

20/11/2012
1. Establishment of a natural, environmental and socio-economic inventory of target areas for forest management
2. Evaluation / Analysis of information acquired during the inventory step
3. Elaboration of a sustainable management plan for each forest in order to protect these forests and prevent the risk of fires. These management plans include a further set of specifications on prevention activities to be approved by the competent forestry departments and allowing municipalities to implement the sustainable management activities.

Progress of Mission:

<table>
<thead>
<tr>
<th>Work step</th>
<th>Content</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Collection of Information</td>
<td>✓</td>
</tr>
<tr>
<td>Step 2</td>
<td>Analysis</td>
<td>✓</td>
</tr>
<tr>
<td>Step 3</td>
<td>Mid-term presentations</td>
<td>✓</td>
</tr>
<tr>
<td>Step 4</td>
<td>Elaboration of draft management plans</td>
<td>✓</td>
</tr>
<tr>
<td>Step 5</td>
<td>Debriefing</td>
<td>✓</td>
</tr>
<tr>
<td>Step 6</td>
<td>Reporting</td>
<td>...</td>
</tr>
<tr>
<td>Step 7</td>
<td>Liaising Ministry &amp; Municipalities</td>
<td>...</td>
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Elaboration of management plans of two pine forests
in view of sustainable forest management and forest fire protection

Assessment of status quo (1)

• Current forest utilization:
  • Fuel wood collection (households, bakery…)
  • Non wood forest products and services:
    o Culinary and medicinal plants
    o Hunting
    o Camping
    o Grazing
    o Ecotourism

Assessment of status quo (2)

General observations:
• Land use interface (agriculture/forest) [1]
• Non-organized grazing [2]
• Buildings/infrastructure [3]
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Assessment of status quo (3)

Technical observations:
- Unsuitable pruning techniques
- Non-target oriented thinning/cutting
- Lack of planning

Assessment of status quo (4)

Impact on environment
- Degradation of forest stands & soil erosion
- Unstable forest structure
- Insufficient natural regeneration
- Loss of production (increment per year)
- Minor quality of forest products
- Limited access to the resources
- Fire
- Insects and fungus attacks
Assessment of status quo (5)
Impact on environment

Assessment of status quo (6)
Elaboration of thematic maps

Mapping
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Forest management planning (1) - Objective

...to convert the forest from the current situation into a more productive, diverse, and stable forest ecosystem.

Forest management planning (2) – Definition of Objective

Growth potential of Pinus brutia

Standing Volume (m³/ha) vs. Age (years)

- Turkey (Plantation)
- Lebanon (present)
- Lebanon (future)
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Forest management planning (3) – Definition of Objective

Forest types (age/species-based):
- Young Pine Stand (1)
- Medium-aged Pine Stand (2)
- Old Pine Stand (3)
- Other Stands (4)

Cyprus
- Good Stand
- Medium Stand
- Bad Stand

Lebanon
- Present
- Future

Annual growth potential of Pinus brutia

Dominant height Ho (m)

Current annual increment Zv (m³/ha/year)
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Major elements of forest management plan

- Inventory / rough assessment of forest resources
- Identification of forest types
- Definition of specific interventions/activities per forest type
- Definition of management categories
- Mapping

Identification of interventions

Diagram showing:
- Opening
- Forest Fire Prevention
  - Pruning
    - Enhance Natural Regeneration
    - Disease Prevention
    - Selective Thinning and Quality Improvement
  - Age
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Forest management activities (1)

**Opening**

Expectable Wood Products: Fuel Wood

Forest management activities (1a)

**Opening**

Trails & skidding lines

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Forest management activities (2)

Forest Fire Prevention (Site Clearing)

Expectable Wood Products: Fuel Wood

Forest management activities (3)

Pruning

Expectable Wood Products: Fuel Wood
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Forest management activities (4)

**Disease Prevention**

**Expectable Wood Products: Fuel Wood**

Forest management activities (5)

**Stabilisation & quality improvement by selective cutting in medium aged stands**

**Expectable Wood Products: Fuel Wood**
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En association avec:

Forest management activities (6)

Stabilisation & quality improvement by selective cutting in old stands

Expectable Wood Products: Fuel Wood & Construction Wood

Forest management activities (7)

Selection of Future Crop Trees

1. Tree vitality
2. Tree quality
3. More or less even distribution
Forest management planning
Definition of management categories

**Category 1:** Protection
- Fire prevention and ecotourism

**Category 2:** Development
- Fire prevention, ecotourism
- Opening

**Category 3:** Active management and exploitation
- Fire prevention, ecotourism
- Opening
- Selection of Future Crop Trees
- Thinning
- Enhance natural regeneration
- Controlled grazing

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Forest management planning
Mapping of management categories

**Mapping**

**Category 1:** Protection

**Category 2:** Development for medium-term management

**Category 3:** Active management and exploitation
Outlook

1. Reporting

2. Preparation & submission of the MoU to municipalities and MoA

Necessary steps for continuation:

• Identification of funding opportunities for realizing the management plans
• Training of forest guards & workers
• Implementation & Monitoring