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# MIZIARA FOREST MANAGEMENT PLAN

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2021

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## **Executive summary**

The objective of this document is to detail a forest management plan for Miziara Municipality to undertake proper forestry practices securing continuous improvement of forest stands. The municipality has a conservative approach in dealing with the forest and has historically managed some stands, for aesthetic purpose and for fire prevention. The municipality is currently broadening their objective to encompass other services such as ecotourism, removal of fuel wood, etc. and enlarging the geographical scale of actions to cover all the communal forest. The forest, predominantly an evergreen broadleaved forest, is currently subject to minimal activities such as the collection of edible and aromatic plants and honey production, and provides an important aesthetic value to the village, and hosts ecological, recreational and religious touristic attractions. The field inventory identified four management units. The plan presented below provides recommendations for the management of each of those four units in a way that ensures forest health and improves ecosystem services.

### **1 Introduction**

The proposition of management of Miziara forest is inspired from the general forest management guidelines earlier developed by the Catalonia Forest Technical Centre (CTFC) for *Quercus calliprinos* stands in Lebanon, in collaboration with the Lebanese Ministry of Agriculture (MoA) and the general forest management guidelines provided under the Sustainable Land Management for Qaraoun Catchment (SLMQ) project, as well as other technical guidelines for similar contexts, provided by the FAO or the French National Forest Office (ONF).

## 2 Miziara Forest



Figure 1. Communal forest of Miziara

Miziara is located in the Caza of Zgharta, at an elevation varying between 400 and 900 m asl, on the western slopes of Mount Makmel and overlooking Zgharta and Koura plain. The woodlands and forests are surrounding the village from all sides. The forests and woodlands are located in the Mediterranean biome, specifically in the Meso-Mediterranean vegetation level in the sub-humid bioclimatic zone. Jurassic limestone is the predominant bedrock, with a shallow terra rossa or rendzine soils.

There is no meteorological station close enough to Miziara that could be representative of the village, but based on villages with similar elevation, temperatures vary between 5°C (coldest mean of the coldest month) and 27°C (highest mean of the hottest month). Annual precipitations could reach up to 1,100mm.

The selected site for the project is a forest area of ~ 100ha. The forest is a communal land owned by the village dwellers and managed by its municipality (Fig.1).

*Quercus calliprinos* dominates the forest. Stands are heterogeneous, mostly dominated by the evergreen *Q. calliprinos*, and accompanied by other evergreen broadleaved trees like *Arbutus andrachne*, for which the frequency increases with slope, mainly in the western stands, or Calabrian pine (*Pinus brutia*) which is an intruder to the forest due to the absence

of management of this species, very frequent in the surrounding villages to the north and south. Some oak stands are old growth dense forest, while others are an open coppice. Other deciduous species might also be present including *Pistacia palaestina*, *Styrax officinalis*, *Pyrus syriaca* or other species. The forest hosts a major religious attraction (Saydet el Marahem), a campsite (Aisha camp), and other recreational areas (Miziara club and a venue for events). Many stands are encroached with residential areas or industrial facilities.

### 3 Socio-economic study

The socio-economic survey was conducted through direct meetings with the local authorities during the field visits, and the owner of Aisha camp, and was not conducted with the villagers due to the COVID19 restrictions.

The population is low with roughly 2000 inhabitants permanently living in the village, distributed into 500 households. Miziara hosts no Syrian refugees or workers in the village, although these might come to work in the village during the day.

The representatives of the municipality estimated that the total number of consumed fuel wood is 400 tons/year, mostly bought from other villages, or coming from the pruning and cutting of fruit orchards (Table 1). Most of the wood is for chimneys consumption and is considered as extra to the heating relying on electricity or fuel. However, due to the economic crisis, the reliance on fuel wood is expected to increase.

**Table 1. Fuelwood consumption in Miziara**

Permanent residents	Number of families	Families relying on fuelwood	Tons of fuelwood consumed/year
2000	500	Max. 100	400t

#### 1.1. Current activities in the forest

Field surveys showed that the major activities within the woodlands include recreational and touristic activities (religious site of Em el Marahem, Aisha camp, Meziara club

playground, hiking trails, events venue), while minimal human presence was reported inside the forest (plant collection, hunting...).

There are shepherds in the village and in the surrounding villages to the north and west, but their herds are not roaming inside the forest.

Beehives were also encountered inside the forest, and oak honeydew is produced.

The forest is crossed by the main road from Zgharta to Miziara, as well as the road from Miziara to Hmeis. Secondary roads to access the forest stands are few but enough for this type of production/wood removal.

Private residences, industrial premises and agriculture farms are encroached with the forest from the village side (east, southeast). All this mixture is a favourable environment for fire risk, but at the same time hinders its large expansion, due to the presence of roads, and water outlets, namely in Em el Marahem, and the events venue.

## **1.2. Orientations for the future**

The municipality is keen to ensure the sustainability of the forest, and its aesthetic value, with the wood removal as a secondary activity. For this purpose, the main activities would focus on a management plan allowing fire risk reduction, preserving the aesthetic value, and enhancing rural tourism activities inside the forest.

On the forest health side, a second objective would be to avoid the invasion of the Calabrian pine into the oak forest. The Calabrian pine forests are present to the south and the north of Miziara oak forest, and cutting of this species is prohibited by law.

Economic objectives from wood removal, honey production, ecotourism or other non-wood forest products and services are secondary benefits under the current management plan.

## **4 Forest inventory**

The LRI team carried out the forest inventory of Miziara in summer 2021. The purpose of the inventory was to determine the profile of the forest, including forest typology, forest

structure and composition and the desired future activities in order to delineate management units, with each unit having its specific management plan.

The field inventory was inspired from the general forest management guidelines earlier developed under the Sustainable Land Management for Qaraoun Catchment (SLMQ) project, as well as other technical guidelines for similar contexts, provided by the FAO or the French National Forest Office (ONF).

The prescribed forestry practices consider the national forest law and its amendments and related decrees and regulations, and the technical recommendations developed by the Catalonia Forest Technical Centre (CTFC) for *Quercus calliprinos* stands in Lebanon.

## **5 Technical assessments methodology**

### **5.1. Forest Mapping**

An initial mapping was conducted for the forest using several techniques:

- The Google Earth Satellite Image was used as an initial background
- The cadastral map of the village was retrieved from an AutoCAD file prepared by the municipality and converted into a Kml file to be exported to Google Earth. This allowed the team to locate the targeted cadastral units, and avoid private lands.
- The delineation of the village and the defined management units from the field inventory were also drawn as polygons directly on Google Earth.
- The position of the field plots (from the field inventory) respective to the management units were also exported into Google Earth.

### **5.2. Field inventory**

The inventory followed the following guidelines and procedures:

The partition of the forest into apparently homogeneous units is based on field inventory results, topography maps, satellite imagery (Google Earth) expressing vegetation cover and density, topographic features (slope, aspect), and the current and the prevailing forest fire risk (encroachment with the urban, industrial, touristic and agriculture land uses).

The field inventory was based on the selection of sampling plots in each pre-defined management unit. The area inventoried depends on the density of the inventoried stand, the objective being to collect data from a fixed plot size.

In each plot, we collected the following information:

- The coordinates and altitude of the survey point
- Locality name
- Proximity from infrastructure (roads, civil defence, water outlets, shepherds, etc.)
- Terrain characteristics (soil type/depth, organic matter, aspect, slope, topography)
- Disturbance and risks (human or natural)
- Potential features (archaeological and cultural sites, landscape, belvedere...)
- Forest type, canopy density, forest vertical structure, forest age and nature
- Tree inventory, including species, DBH (for stems above 10cm), height, health status, number of stems per tree, and the respective distance of each tree from the plot centre.
- Shrub coverage and height, with the associated species.

The collected information would allow the generation of key parameters to determine the wood capacity of the forest:

- Number of trees and number of stems per hectare
- Basal area ( $\text{m}^2/\text{ha}$ ) which is the sum of the section of the largest stem in a coppice per hectare
- Wood volume ( $\text{m}^3/\text{ha}$ ) and wood weight (Tons/ha).

## 6 Results

The main results of the field inventory are displayed in the tables below. The terrain and topographic characteristics show a certain heterogeneity among the different management units, namely when it comes to aspect, slope, organic matter content, forest composition, and access to roads.

The forest is healthy, with few dead trees, while most oak trees (*Quercus calliprinos*) are healthy. The observation of any eventual resurgence of the gypsy moth is a must in the next season due to its widespread outbreak all over Lebanon.

Tables 2 and 3 show the main characteristics of the inventoried plots, and the delineated management units, based on field observation and satellite imagery (Google Earth).

Table 2: Main forest characteristics in each plot for each management unit (MU)

MU	Plot nb.	Dominant species	Canopy cover (%)	Shrub cover (%)	Regeneration	Threats
1	3	<i>Q. calliprinos</i> , <i>P. brutia</i>	40%	70%	<i>Q. calliprinos</i>	Fire
1	4	<i>Q. calliprinos</i> , <i>P. brutia</i>	90%	40%	<i>Q. calliprinos</i>	Fire
1	9	<i>Q. calliprinos</i>	40%	30%	<i>Q. calliprinos</i> , <i>P. latifolia</i>	Fire, litter
2	1	<i>Q. calliprinos</i>	90%	<5%	<i>Q. calliprinos</i> , <i>C. monogyna</i> , <i>P. latifolia</i> , <i>Pistacia</i>	Fire, litter
2	2	<i>Q. calliprinos</i>	80%	40%	<i>Q. calliprinos</i>	Fire
3	5	<i>Q. calliprinos</i>	40%	10%	<i>Q. calliprinos</i>	Fire
3	6	<i>Q. calliprinos</i>	90%	<5%	<i>Q. calliprinos</i> , <i>P. latifolia</i>	Fire, litter
3	8	<i>Q. calliprinos</i>	55%	35%	<i>Q. calliprinos</i> , <i>P. latifolia</i> , <i>P. palaestina</i>	Fire
4	7	<i>P. brutia</i> , <i>Q. calliprinos</i>	80%	10%	<i>Q. calliprinos</i>	Fire
4	10	<i>P. brutia</i> , <i>Q. calliprinos</i>	70%	10%	<i>Q. calliprinos</i> , <i>P. latifolia</i> , <i>P. palaestina</i>	Fire
4	11	<i>P. brutia</i> , <i>Q. calliprinos</i>	90%	<5%	<i>Q. calliprinos</i> , <i>P. latifolia</i> , <i>P. palaestina</i> , <i>A. andrachne</i>	Fire

Table 3: Main characteristics of the growing stock in the forest use

MU	Plot	density (trees/ha)	density (stem/ha)	Ho (m)	DBH (cm)	Weight t/ha	MU area (ha)	Average growing stock in tons	Desired stem density/ha
1	3	541	1082	5	11	9	10.5	260	800
1	4	764	891	7.5	17.5	40			
2	1	700	1719	13	18.5	94	18	848	800
2	2	318	446	8	17	18			400
2	9	891	2546	7	14	29			800
3	5	350	350	5	15	8	21.7	1327	<b>350 stems/ha*</b>
3	6	382	1464	15	30	108			450
3	8	477	1369	14	21	67			500
4	7	318	2387	9	17	97	29.5	1382	800
4	10	859	2101	13	18	35			800
4	11	573	3501	10	14	8			800

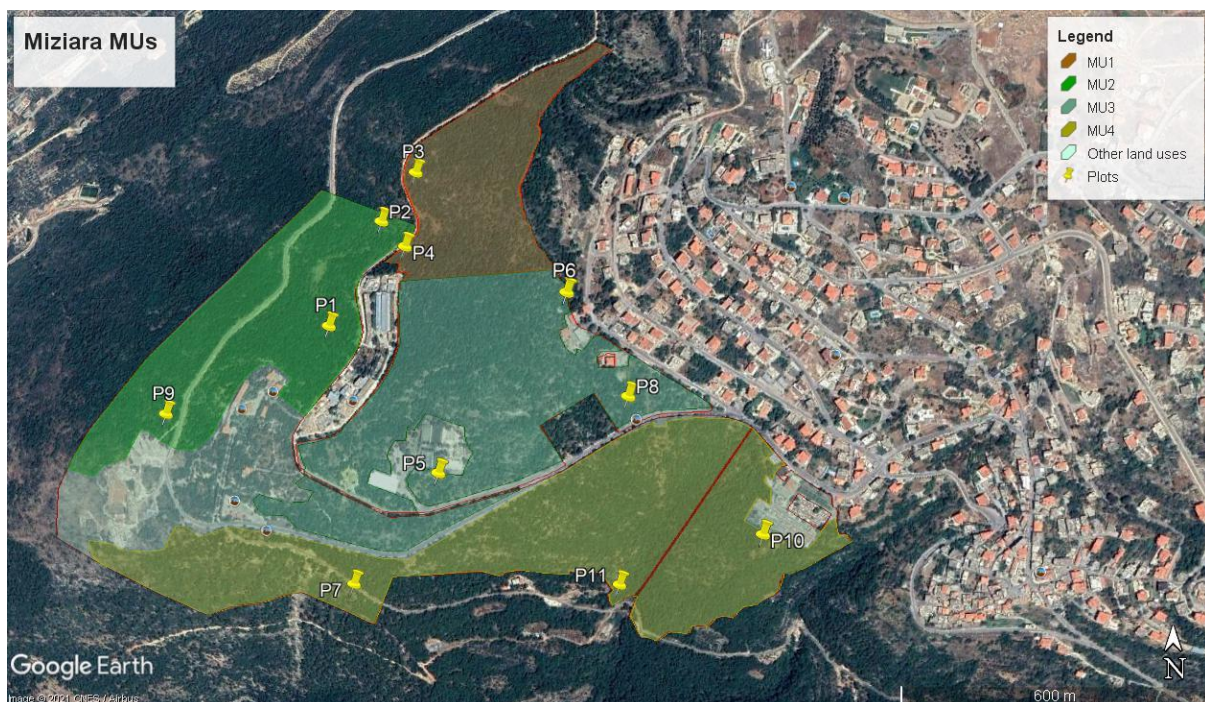


Figure 2: Miziara management units and plots

Based on the survey, the forest was divided into 4 major management units:

**MU1:** is originally an oak coppice with an intrusion of Calabrian pine, leading in some parts to the formation of mixed *Quercus calliprinos* and *Pinus brutia* stands. The forest is relatively young (less than 40 years), with average slope, situated to the northwest of the village. It is accessible from the village (north of the civil defense center through unpaved roads), or from a dust road behind Miziara club and the industrial and chicken farms. The area is prone to fire. The area of this MU is 10.5ha.

**MU2:** is an oak coppice, with regeneration of oaks and sometimes Calabrian pine. Some parts were previously subject to thinning and pruning, leading to a dense oak forest with single stem trees. The area lies on the western side of the village, on a western slope. It is crossed by Miziara main road, and reaches the dust road separating it from MU1. Also the area is prone to fire, due to the presence of roads, the slope and the discharge of solid waste. Several persons place their beehives in this MU. The southern limit of this MU is an industrial zone and Saydet el Marahem (religious pilgrimage site). The area of this MU is 18ha.

**MU3:** is known as “Horsh Meziara” which is the main oak forest to the west of the village. It has been historically managed into a park forest with single stem oak trees. It is predominated by *Quercus calliprinos*, with few intrusions of *Pinus brutia*. The area is currently being also pruned. The terrain is mostly with a gentle south-western slope, encroached to the village as well as to Miziara club and Saydet el Marahem, and crossed by the main road of the village. The forest area of this MU is 21.7ha. Areas that are fenced or have other land uses or management objectives and found within the same cadastral lot are excluded.

**MU4:** is the southern extension of Horsh Meziara, but on a steeper slope with substantial intrusion of *Pinus brutia*, leading to the formation of a mixed forest. This MU lies to the south of Miziara main road, and is crossed by the secondary road reaching Hmais and the sewage treatment plant. It is encroached with the village near the cemeteries. The area is highly prone to fire. Hunting and ecotourism activities are evident; Aisha camp is located on the western limit of this MU. The forest area of this MU is 29.5ha excluding areas that are fenced or within other land uses or management objectives.

In addition to those, there are more than 20ha that are dedicated for other land uses and include among others, Saydet el Marahem religious site, Miziara club, Aisha camp, a wedding venue, the cemetery of the village, etc.

We measured the site index (SI) for inventoried plots within each MU, and replaced age with DBH since dendrochronology was not an option to date trees. The low correlation values between Height (H) and DBH in some MUs is related to the uneven age of trees, with old specimen scattered within the younger coppice. Most plots showed low fertility, except P1 (MU2), P10 and P11 (MU4).

The MUs of Miziara shall be managed with different technical itineraries according to forest type, site index (fertility), density, previous interventions-uses, risks, and slope:

- Low fertility oak coppice: MU1
- Variable fertility oak coppice: MU2
- Low fertility park forest: MU3
- Average fertility mixed forest on slope: MU4

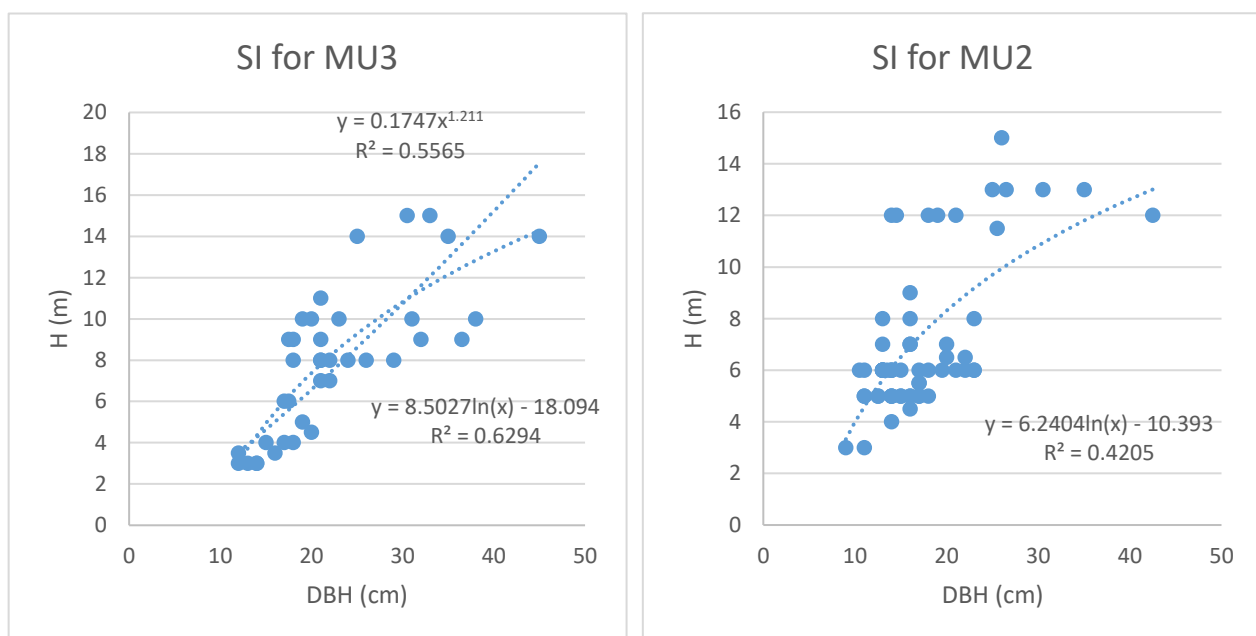


Figure 3: Site indices for the combined data from the inventoried plots of MUs 2 and 3 y

## **7 Forest Management Plan**

### **7.1. Current management status of the forest**

Miziara forest is an evergreen broadleaved forest dominated by *Quercus calliprinos*, which hasn't been subject to management or wood removal since more than 60 to 100 years. Some parts are natural regeneration (uneven-aged), while others result from coppicing (even-aged). The intrusion of *Pinus brutia* is turning some stands into a mixed forest.

The current characteristics are favourable for various activities such as: ecotourism and recreation, fuelwood, non-wood forest products (honey, herbs, snails, hunting preys, mushrooms, etc.).

Miziara forest includes primary and secondary roads (dirt roads) that are within parts of the forest. Protection from forest fire is also necessary along roads and along areas of encroachment with urban, agriculture or industrial zones.

### **7.2. Management objectives**

The main management objectives as expressed by the local authorities aim to preserve the landscape and canopy cover from fire and other risks allowing multiple use of wood and non-wood products and services. The main priority for the community is the aesthetic aspect and easy access to the forest.

### **7.3. Characterization of Management Units**

The details of the prescriptions and indicators of the management units of each group are presented in Table 4. Note that the prescriptions target the main objective to achieve, but takes into consideration the multi-functionality of the forest. For instance, removing the regeneration of Calabrian pines not only helps preserving the oak forest landscape, but also preserves honey production, and reduces fire risk. Note that these management prescriptions are not sustainable if they were targeting wood production, in which case, the regeneration cutting should have been conducted at least 20 years ago. In a normal forest coppice for fuel wood production, most of these units are at the end of their cycle, and should be subject to regeneration or clear cutting. However, and since this is not the desire of the local community, nor acceptable by the Ministry of Agriculture, hybrid

practices are hereby suggested allowing to sustain the forest as much as possible while maintaining its ecosystem services and reducing threats.

Table 4. Prescriptions according to the main objectives of the management units

Main Objectives	Prescriptions	Indicators/target	MUs
Wood production and landscape preservation	Selective thinning for production of fuelwood when stand density is > 600 stems/ha, pruning <i>Pinus brutia</i> lower branches and removal of its regeneration and minimal grazing.	Tons of wood removed, <i>Pinus brutia</i> regeneration counts, and number of livestock allowed in spring.	MU 1, MU2, MU4
Maintain a park forest with easy access	Selective thinning when stand density is > 500 stems/ha, weeding along roadsides, trails and recreational areas, removal of <i>Pinus brutia</i> regeneration.	Tons of wood removed, mileage of trails maintained, <i>Pinus brutia</i> regeneration counts.	MU3

### 7.3.1. Landscape preservation

#### Low fertility oak coppice (MU1):

The density is to be reduced to around 800 stems/ha. The area could be open for grazing also to avoid undesirable regrowth. Here 25% of the BA is to be extracted, mostly by removing undesirable stems within a stump, and keeping the straight and bigger ones. If there is pine regeneration which is not qualified as tree (DBH < 5cm and height below 5m since these do not regenerate wood and are not under law 85), they should be removed to avoid increasing intrusion of pines into the coppice and to reduce forest fire risk.

Wood removal volume remains modest in this MU (8t/ha) with a larger amount of small diameter shoots of oaks and pines (wood removal that could be used as fuel or for charcoal production is for branches having a DBH superior to 10cm over bark). This area is not a priority for undertaking silviculture practices on the short term, but an initial pruning and thinning could be conducted along the main road to Miziara, and below the dirt road on the top of this MU.

#### Variable fertility oak coppice (MU2):

This management unit embeds different stands with variable fertility, as it was managed in a very inconsistent manner leading to uneven aged spots and clearing in rotations. In all cases, the desired density should be between 400 and 800 stems/ha, depending on tree height and diameter, and tree density.

Thinning (reducing the BA by 30%) should focus on the reduction of the number of stems rather than stumps, except in areas, where trails need to be opened to easy access, and to reduce forest fire risk. Wood removal should not exceed 17t/ha. Pine regeneration should be closely monitored in this MU, and removed whenever possible.

The areas that are close to the main road, near Aisha camp and dirt road beyond Miziara club are of a priority, in order to reduce forest fire risk.

#### Mixed forest stands (MU4):

Clearing or selective felling is preferred for all oaks or pines under a scientific based wood production scenario, but since the law doesn't allow the removal of coniferous trees, the only solution is to reduce a bit the oak biomass and prune the lower branches of pines, and remove eventual pine regeneration (they are not trees). Maintaining a relatively high density of oaks despite their age would prevent further undesired regeneration of pines. Since dense canopy is prevailing in almost all stands, the ultimate desired density is 800 stems/ha on slopes and where there is intrusion of *Pinus brutia*. Here 30% of the oak Basal Area (BA) is to be removed, with total removal of trees underneath the pines (in the understory) or thinning in areas close to trails and relatively open and devoid from pine trees. This area is a high priority in order to reduce fire risk, therefore activities should start near the road to Hmeis and upward, and where there is encroachment with the village (below the cemetery). The amount of wood removal is substantial (14t/ha) with variable stem diameters, useful as fuelwood but mostly for charcoal production. Pine residues could be used for briquettes if shredded.



## 8. Plan overview

In order to implement the management plan, the responsibilities of each actor should be clearly predefined and the following constraints should be considered:

- The ownership of the local community (through the municipality and users) to the project, which should be normally done through a validating meeting with them, once the management plan is over.
- The financial resources in order to implement and monitor some activities related to the plan.
- The compliance of the exploiters and users to the regulations related to the exploitation of wood and non-wood forest products in communal lands, as described by the Forest law and the regulations issued by the ministry of agriculture.
- The commitment of the forest guards and municipality guards to supervise the implementation of the management plan, and protect the forest from threats.

This volume could be also broken down according to zones within each management unit and by the years of the Management Plan.

The priority zones to start with are the areas that are close to the main roads (Zgharta-Meziara and Meziara-Hmeis), the dirt roads (behind Miziara club), areas of encroachment with urban settlements, orchards and facilities (the civil defence center, the cemeteries, Aisha camp, Miziara club, Saydet el Marahem). Further, the MUs could be divided into compartments allowing easy access for fuel wood removal (usually above roads, to descend with loads). The priority for the remaining compartments in each MU derives from their easy access, the need for fuel wood.

Hence, several compartments from different MUs could be implemented simultaneously and based on the above mentioned priorities, as illustrated in figure 4. The figure details priority compartments for the first two years. Afterwards, the compartments are to be selected by the municipality and the forest guards, following the need for fuel wood, the easy access to the compartment, fire risk mitigation, and the delineation of cadastral plots.

The volume of wood harvested on the densest plots could be used for fuelwood for the local population and for charcoal production. Wood removal could be planned either based on the annual needs in fuel wood, or based on the priority areas to be thinned and pruned, which depends on the size of the compartment within each management unit, and the existing volume to be extracted. Hence, in Table 6, we show in years 2021 and 2022 the extracted volume based on the size of compartments that are priority for pruning and thinning in the first two years (as shown in Figure 4). In the remaining columns and years, we used more or less a fixed amount adjusted as part of the total demand of the village.



Figure 4: Priority compartments for the first years of management plan implementation

Table 6: Distribution of cuts and Biomass (t) from harvested stems over the years of the Management Plan

Years	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
MU1	0	7	0	15	15	15	15	15.7		
MU2	151	0	20	15	15	15	15	20	40.8	20
MU3	22	55	50	50	50	50	50	50	50	85.5
MU4	62	46	50	50	50	50	50	50	10.3	0
Biomass Total (tons)	235	106	120	130	130	130	130	135.7	101.1	105.5

## **9. Additional technical aspects**

It is important in any management plan to consider the following aspects:

- Monitoring the gypsy moth (*Lymantra dispar*) which causes the defoliation of evergreen oaks, and registered an outbreak in 2017 and 2018 on the eastern slopes of Mount Lebanon, and in 2021 on the western slopes. If pruning affected trees did not reduce the infection, an aerial spraying with *Bacillus thurengiensis* should be requested from both the Ministry of Agriculture and the Lebanese Army.
- Particular attention should be given to the existing wildlife (hyenas, squirrels, snakes, bladders, wolves, wild boars, and the introduced mouflon, and birds like thrushes and the blue jay, etc.) that are key for biodiversity conservation, and play an important ecological role in the forest.

## **10. Legal, financial and organizational aspects**

The forest is owned by the community of Miziara, and therefore it is a communal land which management should be conducted by the municipality, under the supervision of the Ministry of Agriculture, as per the forestry law. It is hence necessary to request through the municipal council the required permission for exploiting the forest from the Ministry of Agriculture, and present a management plan for this purpose. The law allows the municipality to set a bidding process for the exploitation of the compartments defined on a yearly basis. One third of the winning bid amount should be kept for forestry activities within the communal land, such as reforestation, pruning pines, maintaining dirt roads and installing water outlets for forest fire prevention, etc. The two third of the amount could be used for rural development by the municipality. If the municipality decides to distribute the wood for free to its residents, a request for approval should be sent to the ministry of agriculture. All activities should be conducted with the approval of the ministry, and under its supervision through its regional forest guard centre.

All silviculture practices should comply with the administrative requirements and regulations.

## **11. Procedures for monitoring and evaluating the forest management plan**

It is important to ensure the quality and sustainability of the stands after harvesting. For this, activities should be supervised by dedicated personnel from the municipality and the forest guards. Based on this supervision, the permit for cutting and for wood removal is renewed on a yearly basis, for different compartments, until the completion of the management plan. The MOA forest guards are responsible for the supervision of wood removal from the designated plots as mentioned in the license, to ensure the abidance of the contractor by the regulations dictated by the ministry for forestry practices, wood removal volume, the delineation of the concerned plots, etc. The supervisor from the municipality side is responsible for the smooth implementation of the works as mentioned in the management plan in a smooth and timely manner within the designated plots (plot delineation, working hours, workers identification, routing of wood removal, etc.) and to make sure that hazards or accidents related to the activities are avoided by the contractors (dumping of forest residues, forest fire risk management, etc.)