Restoration Plan

Mediterranean Mosaic Project

Shouf Biosphere Reserve (SBR)

2014

Project title:

Mediterranean Mosaics:

strengthening the resilience of Mediterranean landscape to socio-economic and climate change

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Funded By

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Implementation in Lebanon

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Introduction

1. INTRODUCTION

The Mediterranean environment is characterized by hot dry summers and cool to cold wet winters and faces recurrent extreme events, such as drought and heat weaves. Throughout the millennia Mediterranean ecosystems and their inhabitants developed adaptation strategies to cope with water scarcity and environmental risks. Nowadays, the effects of combined ecological, socio-economic, and cultural modifications have dramatically increased the vulnerability of Mediterranean socio-ecosystems. These factors, combined with water deficit, extreme weather events, and large-scale disturbances due to climate change are causing irreversible shifts towards undesirable conditions– the point of "no-return".

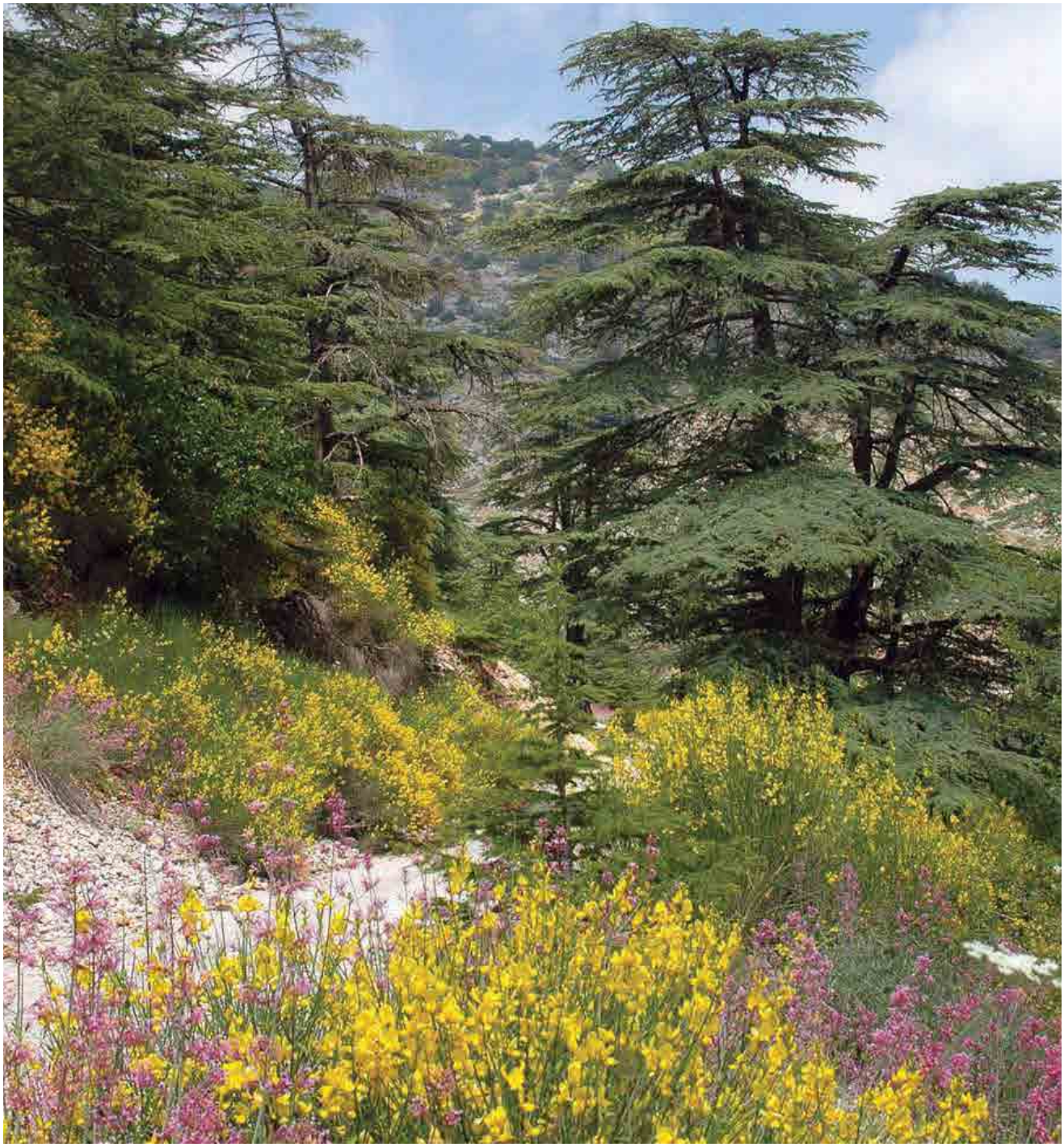
Mediterranean Mosaics: Strengthening the Resilience of Mediterranean Landscapes to Socio-economic and Climate Change (hereinafter MM) is a project funded by the MAVA Foundation to preserve and enhance diversity at all levels – biological, ecological, economical, and cultural - as the best strategy to build resilience and secure the viability of Mediterranean socio-ecosystems.

The MM project started in two pilot areas:

- The region known as "Terra dei Vestini" on both sides of the limestone massif of Gran Sasso, in Central Italy, including the two national parks of Gran Sasso-Monti della Laga and Velino-Sirente.
- The Shouf Biosphere Reserve (UNESCO 2005) located in the southern part of the Lebanon Western Range, rising from sea level to 2000 meters, and east to the Bekaa Valley. The region is famous for hosting some of the largest remaining stands of Lebanese cedar. This area is the target of the actions proposed in this document.

The project addresses the need to build "disturbance-smart" landscapes, by engaging local societies and decision makers in the formulation and implementation of shared visions. The first phase of this project runs between 2012 and 2015 and it will:

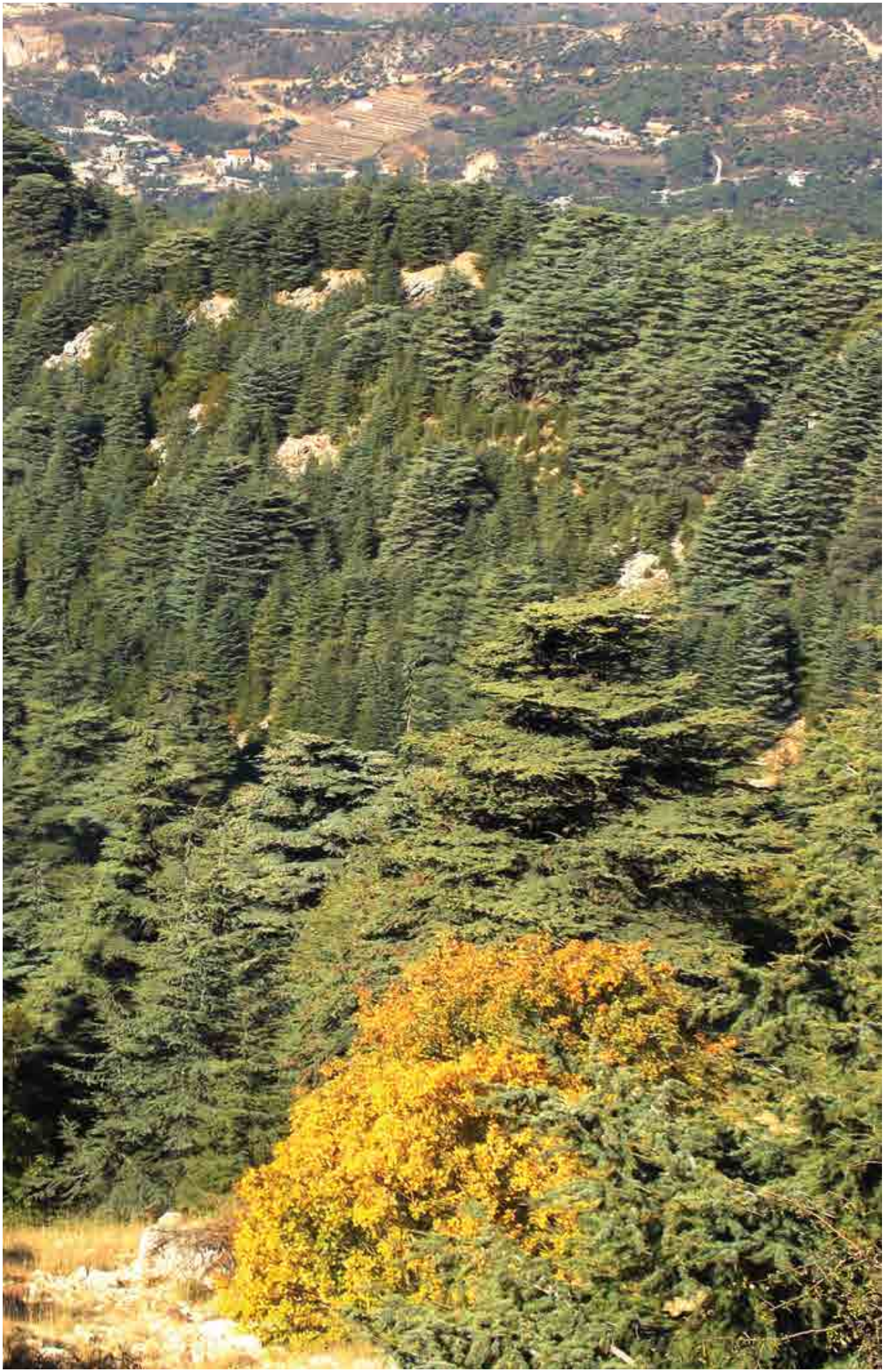
- Design and implement a pilot landscape restoration plan to increase the resilience to climate change of river and forest ecosystems along the altitudinal gradient from the Bekaa Valley to the Lebanon Western Range, creating joint ventures between the private sector, the civil society, and the public sector.
- Design innovative strategies to strengthen sustainable land uses and tourism development in the rural communities in/around the protected areas and create pilot projects in villages surrounding the protected areas.
- Build an extended network of partners among public administrations,



private sector, NGOs and community groups, to ensure expansion and continuity of the restoration work.

The MM team is a consortium of partners consisting of Shouf Biosphere Reserve (SBR) and the Association for Forests Development and Conservation (AFDC) in Lebanon, LIPU (the Italian partner of Birdlife), ILEX (Italian Landscape Exploration), the Italian environmental cooperative COGECSTRE, and the Sylvestris Group, a Spanish company with a solid track record in the production of seeds and seedlings, as well as forest restoration and rural development.

The restoration site within the territory of the SBR will create an ecological corridor that connects the Beqaa valley with the Shouf Mountains, increasing biodiversity, supporting ecological processes, promoting sustainable land uses and cultural practices, and enhancing landscape resilience to climate change. All restoration work should give priority to the regeneration of the relic cedar forest, the diversification of natural habitats, and the preservation of threatened species.




Legal
Status

2. LEGAL STATUS

2.1. NATIONAL STANDING

Law No. 532 of 24 July 1996 declared "The communal lands of Niha, Jebaa, Mrosti, Khreibeh, Maasser, Barouk, Bmohray, Ain Zhalta, Ain Dara villages, in addition to the Government owned lands on the eastern side of Barouk Mountain" a Nature Reserve.

The SBR is under the authority of the Lebanese Ministry of Environment (MOE), which manages it through the Appointed Protected Area Committee (APAC) that includes among its members the Al-Shouf cedar society (ACS), the Mayors of the larger villages, and independent environment experts. APAC liaises with the Reserve's Management Team, which deals with the Reserve's day-to-day management and planning.

2.2. LOCATIONS AND BOUNDARIES

The Reserve lies between longitude 35º 28'- 35º 47' East and latitude 33º 32'- 35º 48' North at an altitude ranging from 1200-1980 meters. It is located along a mountain range comprising the Barouk and Niha Mountains that are the southern extension of the Mount Lebanon Range running parallel to the Mediterranean coast.

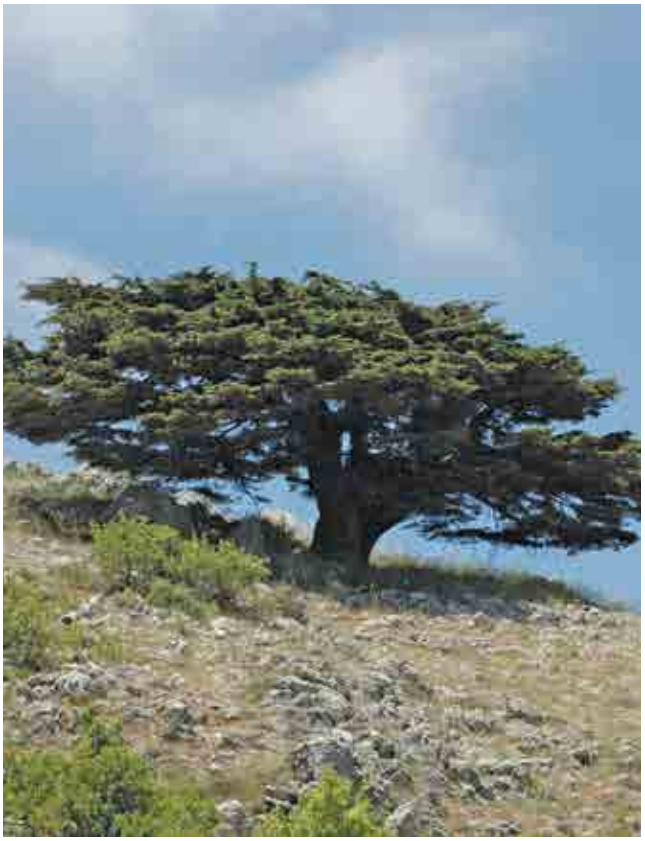
The Beirut-Damascus highway and the town of Jezzine define the northern and southern borders of the reserve respectively. The western slopes of the range face the Shouf region while the eastern slopes face Mount Hermon and form the western escarpment of the Beqaa Valley.

2.3. BIOSPHERE RESERVE

In July 2005, UNESCO declared the Shouf Cedar Nature Reserve a "Biosphere Reserve" with an area of approximately 50,000 hectares - or 5% of the total area of Lebanon. The SBR includes:

1. The Shouf Cedar Nature Reserve (established in 1996) located in the Shouf mountains.

2. The Ammiq Wetland east of the Shouf in the Beqaa Valley. Ammiq is a



Ramsar site and one of the last remaining wetlands in the Middle East.

3. The twenty two villages of Niha, Jebaa, Mrosti, Khreibeh, Baadarane Maasser el Shouf, Batloun, Barouk, Ain Zhalta, Bmohray, Ain Dara, Qab Elias, El Safra, Ammiq, Aana, Kefraya, Khirbet Qanafar, Ain Zebde, Saghbine, Bab Mareh, Aitanit and Machghara.

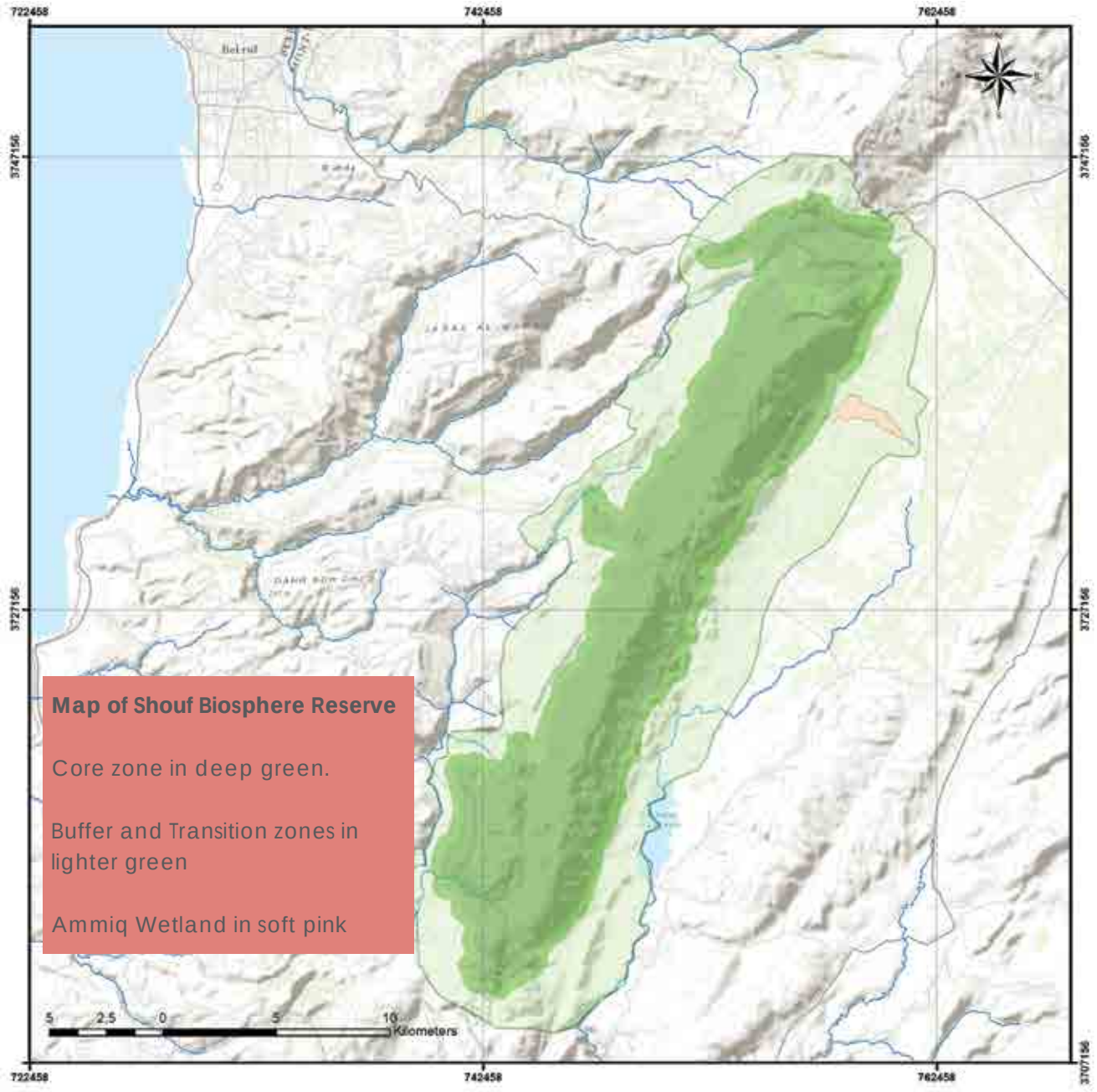
2.4. ZONING

Biosphere reserves should contain one or more core zones, buffer zones, and a transition zone to accommodate their multiple functions.

1. The core zone of the SBR covers approx. 161 sq km. Its main objectives are the protection and rehabilitation of the SBR's natural and cultural values.

2. The buffer zone of the SBR is approx. 54 sq km and surrounds the core zone(s) where activities compatible with conservation can take place.

3. The transition zone (development zone) of the SBR is approx. 233 sq km and includes all the villages surrounding the SBR where sustainable resource management practices are promoted.



Map of Shouf Biosphere Reserve

Core zone in deep green.

Buffer and Transition zones in lighter green

Ammiq Wetland in soft pink


NATURAL
FEATURES

3. NATURAL FEATURES

3.1. Mountain configuration

The altitude of the Shouf Biosphere Reserve varies from 1000 meters to 2000 meters approximately. The trend from north to south is for the eastern slopes to change from very steep to less steep and for the western slopes to become increasingly steep. Very steep slopes make it impossible to work with tractors in some of these zones.

Most of the shaded zones are in the north of the ridge facing to the NW whereas sunny areas face to the SE. The highest insolation faces to SW.

The whole of the Barouk Mountain is cavernous limestone, with many surface features such as dolines indicating the underlying cavernous forms of the mountain range.

3.2. Hydrology

Precipitation in the watershed is the source of both surface stream flow and groundwater. The major portion of this occurs as rain. Snowfall often occurs at the upper elevations but snow seldom persists more than a few days and disappears before the end of the rainy season. However, on rare occasions warm rain falling on the snow-pack may result in rapid melting and release of large quantities of water at a time when the soils are already fully saturated. These conditions result in rapid runoff and floods.

A large proportion of the exposed surface rock in the Barouk region is cavernous, fissured and broken limestone, and its porous condition makes it very permeable. This results in a high rate of infiltration with minimum surface runoff despite the often-shallow soils and sparse vegetative cover. Surface water flows originating on the range are mostly seasonal but some are perennial such as the Al Awali River (Al-Barouk River) and the Damour River (Al-Safa River).

The summit of the range is considered a divide between two hydrological systems. The eastern slope is much steeper and favors surface stream flows, whereas the western slope is less steep and favors ground water aquifers.

The rivers that flow in the valleys are the major source of agricultural irrigation and supply a dozen Shouf villages with domestic water as well as some western Bekaa villages. It is also the main source of water for the Ammiq Swamp.

3.3. Climate

The climate of the area is characterized by cold winters with frequent precipitation as snow and rigorous summers with prolonged

physiological drought. The correct choice of climate-adapted plant species and the selection of suitable planting and/or sowing periods are essential factors in the success of ecological restoration. Therefore, this project will carefully assess the specific climate features of the intervention area to effectively select and plan the restoration work.

Of the existing meteorological observatory network in Lebanon, the Maasser el Shouf weather station '4575' is the most suitable for the purpose of the project. However this station is only two years old so it was decided to also gather weather data from Damascus and Beirut that have older data sets. After careful analysis of the data it was shown that the distribution of rainfall and temperatures calculated from Damascus and Beirut are similar to those occurring in the past two years in the reserve. The only variable showing a significant difference between the older and newer data is the total annual rainfall, which in the past two years has been on average 236 mm lower than that calculated from the Damascus and Beirut data. Nevertheless the physiological drought period (about 5 months) and the growing period (about 6 months) are similar in both cases.

Climatology calculated for the reserve

If climatic variables are calculated with the corresponding corrections taking into account data from the three selected stations for the reserve we get:

Variable.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
R.M.T.	17,5	25,0	26,5	30,5	34,5	34,0	34,0	35,5	32,5	30,5	26,0	19,5	35,5
A.M.T.	9,0	10,2	13,0	17,5	21,8	25,0	27,8	28,8	26,0	21,5	15,5	10,2	18,9
A.T.	4,9	6,1	8,4	11,8	15,8	18,9	21,3	21,9	19,9	16,1	11,0	6,6	13,6
A.m.T.	0,8	2,0	3,7	6,0	9,8	12,8	14,8	15,0	13,8	10,8	6,5	3,0	8,3
R.m.T.	-9,0	-8,5	-5,5	-3,0	3,0	5,5	10,0	9,5	7,5	3,0	-4,0	-8,5	-9,0
PP.	213,6	182,0	95,6	62,9	19,4	2,9	0,0	0,0	17,8	56,0	155,7	206,4	1,012,3

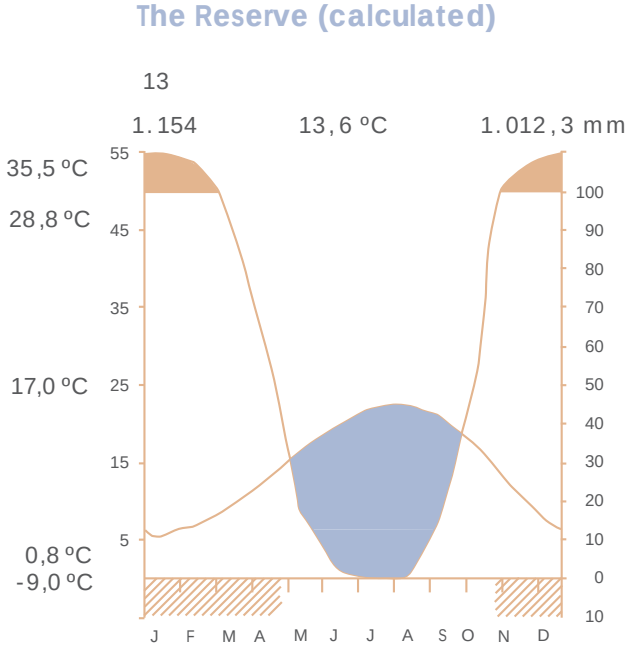
R.M.T. Record Maximum Temperature (°C) **A.M.T.** Average Maximum Temperature (°C) **PP.** Average Precipitation (mm)

R.m.T. Record minimum Temperature (°C) **A.m.T.** Average minimum Temperature (°C) **A.T.** Monthly Average

The above climate diagram is based on a set of historical data on temperature and precipitation. Because of the global warming trend and assuming that current and future climate conditions will be different from those shown by historical data, the Project has integrated the forecasts of future climate scenarios in Lebanon into the historical data. The chosen model/scenario for the Lebanese case study for Vulnerability Assessment to Climate Change is HadCM2/HHG Gax, according to which CO2 emissions will continue to increase with an annual rate of 1%, leading to a doubling of the 1990 CO2 level by the year 2060.

The variables according to this methodology are calculated for each 30 years period, from 1990. We select variables calculated for 2020 and estimate increases in 2013 since 1999.

From the analysis we conclude that for 2013 the average temperature is 0.7 ° C higher than that obtained by the historical series, and annual precipitation is 17 mm less. This slightly



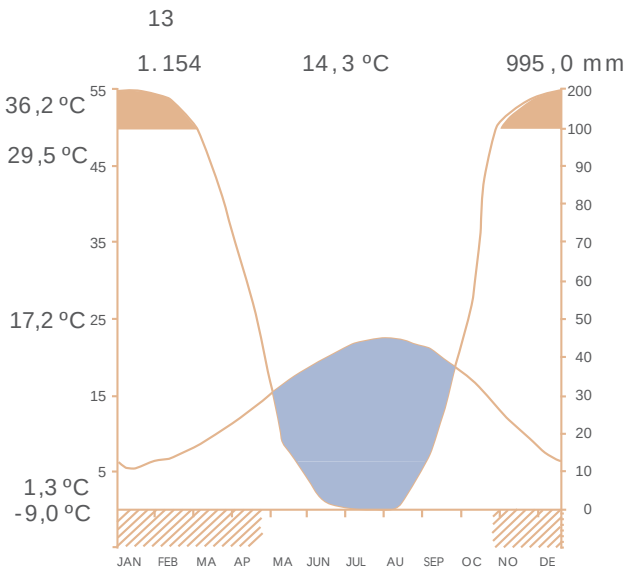
In this way, we obtain the current climate for Maasser El Shouf Maasser:

Variable.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
R.M.T.	18,1	25,8	27,4	31,3	35,3	34,7	34,8	36,2	33,4	31,4	26,7	20,1	36,2
A.M.T.	9,6	11,0	13,9	18,3	22,6	25,7	28,6	29,5	26,9	22,4	16,2	10,8	19,6
A.T.	5,4	6,7	9,1	12,5	16,6	19,6	22,1	22,6	20,8	17,0	11,7	7,1	14,3
A.m.T.	1,3	2,5	4,4	6,7	10,6	13,5	15,6	15,9	14,7	11,7	7,2	3,3	9,0
R.m.T.	-9,0	-8,5	-5,5	-3,0	3,0	5,5	10,0	9,5	7,5	3,0	-4,0	-8,5	-9,0
PP.	212,2	178,5	94,0	61,6	18,0	2,7	0,0	0,1	17,6	54,9	153,8	201,6	995,0

R.M.T. Record Maximum Temperature (°C) **A.M.T.** Average Maximum Temperature (°C) **PP.** Average Precipitation (mm)

R.m.T. Record minimum Temperature (°C) **A.m.T.** Average minimum Temperature (°C) **A.T.** Monthly Average

The Reserve(calculated 2013)



anticipates the planting or seeding period in spring and postpones the planting and seeding period in autumn. While summer drought increases in average a few days, the growing vegetative period remains the same thanks to the slightly shortening of the winter break.

3.4. Flora

The Shouf Biosphere Reserve harbors a rich flora that includes medicinal, edible, and aromatic plants. The reserve is home to 25 internationally and nationally threatened species; 48 endemic to Lebanon or the Syria/Lebanon/Turkey area; 14 rare species; and 214 species that are restricted to the Eastern Mediterranean or Middle East area.

The SBR, however, is most famous for hosting the largest stand of Lebanese cedar *(Cedrus libani)* in the country. The cedar of Lebanon is a highly symbolic, world-famous conifer tree, and one of the most cited plants in history, religion and mythology. The reserve hosts about 620 hectares of cedar forest, which are largely confined to the steeper and less accessible areas, and represents the natural southern limit of this tree. Nowadays the cedar forest, protected from grazing and other human interference, is showing clear signs of natural regeneration.

The list of SBR's Reserve species includes 436 identified plants distributed over 61 families. The following 14 species deserve special mention:

1- *Cedrus libani*– the symbol of Lebanon and the flagship species of SBR

2- *Quercus brantii* subsp look – an endemic tree in the southern part of Mount Lebanon that is abundant in the project area

3- *Arrhenatherum elatius* and *Melica inaequiglumis* – grass species, rare and localized in the reserve where they have suffered in the near past from grazing

4- *Helichrysum pallasii* – threatened in the past and not very common in reserve

5- *Tulipa montana* and *Phytolacca pruinosa* – species with high ornamental and economic value that are found in very limited numbers within the reserve

6- *Cephalaria cedrorum* – endemic to the Shouf Biosphere Reserve

7- *Gundelia tournefortii* – locally threatened because it is heavily collected and uprooted by people who sell it for a high price

8- *Origanum ehrenbergii*, *Origanum syriacum*, and *Rhus coriaria* – edible multipurpose species widely harvested by people

9- *Geum urbanum* and *Micromeria myrtifolia* – popular medicinal species

A large number of native species of SBR perform critical functions for ecological restoration (e.g. re-sprouting species responding well after fire, cutting, grazing and other disturbances; species producing fruits that attract seed-dispersal fauna and favor natural regeneration; species that create microclimate conditions, or improve soil structure and

fertility facilitating the growth of other plants; drought resistant or salt tolerant species; etc) while at the same time provide valuable products (fruits, wood, medicinal aromatic and culinary herbs, honey, etc) and services to support local livelihoods and market opportunities. Therefore, restoration plans should include inventories of the native trees, shrubs and herbal species that occur in the project area, and the collection of information on their ecological, cultural and socio-economic value based on the local and scientific knowledge. This will facilitate the identification and selection of those species that may play an important role in restoration - both in terms of ecological and socio-economic benefits – and the development of protocols for their collection, production and use in restoration work.

3.5. Fauna

The SBR is one of the last remaining areas in Lebanon where large mammals

Species	Ecological value	Socio-economic and cultural value
Styrax officinalis	Re-sprouting species from fire and cutting; high soil retention capacity in degraded soils due to rooting system and cushion-shape	Medicinal, apiculture, resin for incense and culinar condiment, handcraft
Rhus coriaria	Fast growing re-sprouting species; high soil retention in removal soils along roads and degraded land	High economic potential for sumac; tanning from leaves
Quercus calliprinos; Q. Infectoria; Q. brantii subsp. look	Re-sprouting species from fire, cutting and browse; high soil retention capacity, especially the cushion-like Q. Brantii	High value honey; high value fuel-wood from sustainable tree pruning
Celtis australis	Re-sprouting species from fire and cutting; good soil retention in	Ornamental use; edible seeds
Pinus pinea	Obligate seeder species with high colonization potential and soil retention in denuded soils	High economic potential for pine nuts
Pinus brutia, P.halepensis	Obligate seeder species with high colonization potential and soil retention in denuded soils; high regeneration after fire	Wood; resin; potential edible use of Aleppo pine seeds
Cedrus libani	Obligate seeder species; dense canopy species with high potential of soil development and micro-climate	Symbol of Lebanon; honey production
Juniperus spp	Attracts seed-dispersal birds; nursery-species facilitating the growth of tree seedlings	Medicine, essence oils
Legume shrubs (Genista spp, Cytisus spp, Adenocarpus spp, Astragalus spp, Calycotome villosa;	Nitrogen fixing species; nursery-species facilitating the growth of tree seedlings; colonization of denuded soils	Fodder for livestock
Rosacea fruit trees and shrubs (Prunus spp, Malus spp, Pyrus spp, Sorbus spp, Crataegus spp, Rosa spp)	Fruit species attracting seed-dispersal fauna (birds and mammals)	Edible fruits; medicinal uses; wood handicraft
Labiatae shrubs (Thymus spp, Origanum spp, Salvia spp, Satureja spp, Lavandula spp)	Easily produced by seeds and cuttings; potential nursery role facilitating the growth of tree seedlings in the field.	High economic potential (herbal tea and culinary uses; essences) for production in old abandoned terraces
Riparian trees (Fraxinus sp, Alnus sp, Populus spp, Platanus sp, Ulmus sp, Salix spp, Tamarix spp)	Fast-growing species well adapted to river dynamics, regulating runoff, nutrients and sediments from flooding; provide shade to the streams and other wetlands to optimize light and temperature conditions for aquatic plants, fish and other fauna; provide important habitat for rare flora and fauna	Wood; wind-barriers; fodder for livestock

Photos of selected species are included in Annex 2

that once roamed the region can still be found, such as the wolf, wild boar, and wild cat – or can be reintroduced such as the ibex and mountain gazelle.

Wolves are few and their numbers are unlikely to hold a stable population, due to the absence of large herbivores on which the wolf feeds. Striped hyenas live on the borders of the reserve, mainly feeding on the garbage dumps and agricultural crops of surrounding villages. Wild boar, wild cat and jungle cat have all increased in numbers since the reserve was established, as well as the jackal, red fox, porcupine, and squirrel. The gazelle is sporadic in the area.

About 250 species of birds have been recorded in the SBR and the Ammiq Wetland (Ramsar site and Important Bird Area-IBA). The birdlife of the Shouf Mountains includes rare or endemic birds such as the Syrian serin (*Serinus syriacus*), eagle owl, chukar partridge, longlegged buzzard, etc. The whole area, placed strategically between Europe, Africa, and West Asia, is very important for bird migration. Every year countless storks, birds of prey and other migrants pass over the SBR and use it as a roosting site.

The region contains 31 species of reptiles including chameleon, tortoise, and several species of snakes, lizards, frogs, and toads.

Some animals may cause damage to planted seeds and/or seedlings by predation:

- Rodents: mice and rabbits may feed on seeds and can cause damage to seedlings, but they avoid areas without vegetation where most of the restoration work will be implemented.

- Birds: It is not expected that birds will cause large losses as they often prefer cereal seeds that are smaller than acorns.

- Wild boar (Sus scrofa): Boars love to eat buried acorns.

- Wild hervibores: No significant damages are expected from these animals.

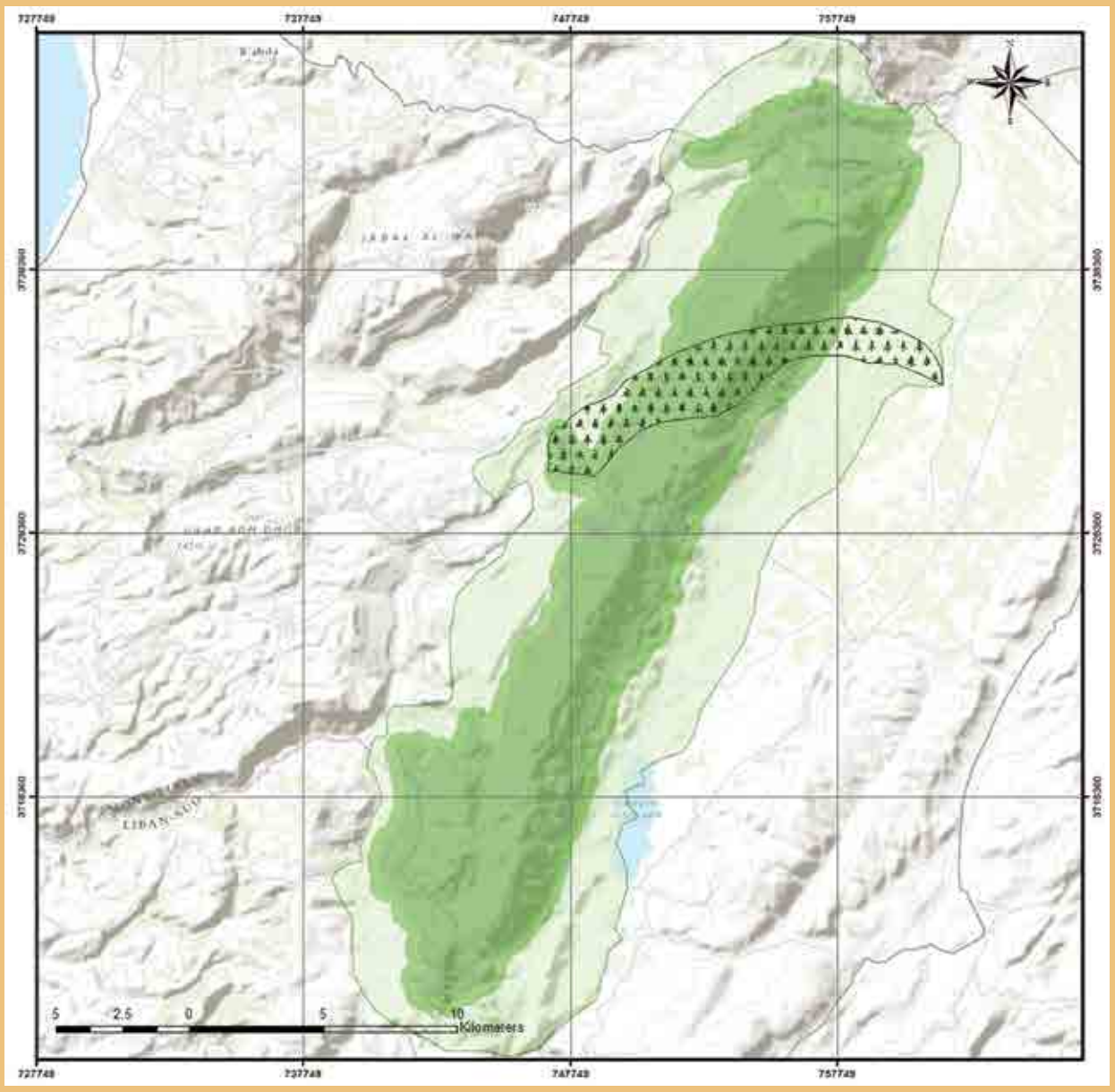
- Livestock: There are goats in the lower areas, so plants will have to be protected from them.

- Pests and diseases: Pests and diseases are part of ecosystems and are only worrying when generating considerable damage. It is preferable to treat seeds with a fungicide before planting.


RESTORATION
AREAS

4. RESTORATION AREAS

The areas to be restored are located in a woodland ecological corridor that connects the Shouf Mountains with the Beqaa valley through the Shouf Biosphere Reserve.




DIRECT
SOWING

AREA 1: DIRECT SOWING

- UTM coordinates (WGS84, 36S):
X: 751,899, Y: 3,732,117
- GPS Coords:
X Lat.: 33 41´ 57´´, Y Long.: 35 43´ 04´´
- Surface 2012: 0.28 ha
- Surface 2013: 4.00 ha
- Surface 2014: 2.00 ha
- Exposition: Shadow.
- Altitude: above 1,566 m.
- Slope: 20-40% approx.

Steep slope with abundant rocky outcrops and bare soil with stony sediments; scarce vegetation cover, with an average coverage of grasses and scattered small shrubs

The objective is to prevent erosion and bring connectivity between cedar forest patches in high mountain denuded areas by supporting the establishment of a dense cushion-like *Quercus brantii* layer that could have a nursery-effect, improving soil fertility and micro-climate conditions, and facilitating the natural colonization and growth of cedar seeds and seedlings, as well as other plant species. Direct sowing is a restoration method that imitates the natural dispersal of plants. *Quercus brantii* was selected as the most appropriate species for direct sowing.

This area represents the highest point of the project and it is located between 1,500 and 2,000 meters, with high rainfall from November to March, physiological drought of approx. 4.3 months and a growing period of 4 months. The potential frost period goes from November to December and from March to April, with actual frost during the months of January and February. The average temperature is 11.6 º C.

The restoration method in Area 1 involves the direct sowing of seeds in excavated holes.

In order to avoid erosion problems in a landscape of considerable slope and scarce vegetation it is necessary to obtain a complete green cover of the ground. Thus, the initial sowing density is 1,100 holes/ha, with a sowing framework of 3.15 x 3.15 meters between holes.

The preparation of the different holes for sowing should begin in October, starting in the highest areas first. The holes should be left open, with the excavated soil to the side allowing it to become oxygenated and moistened by the autumn rains.

The holes should be made with a

mechanical digger with auger of 12 cm in diameter. Holes should have a truncated pyramid shape, with an upper area of 40 cm, a bottom of 30 cm and a depth of 40 cm. The estimated performance for this work per operator is of 20 holes per hour.

Acorns of *Quercus brantii* will be collected from local trees or from a similar region. The acorns should be sufficiently moist (never below 35%), and with no bites or signs of germination. Very small seeds should be avoided, as bigger seeds have more reserves and a better chance of survival. The separation of low quality acorns should be made by flotation in water (the bad seeds will float). In case of low humidity (outer shell much separated from embryo), the seeds should be kept in water for up to 12 hours prior to sowing so as to ensure rehydration.

The sowing has to take place in the late fall, once the vegetative period is clearly over to prevent unwanted germination just before winter. The most appropriate time for sowing would be between 1 November and 31 December, before the snow prevents the execution of the work. The first seedlings should not be expected before May or June because of the high altitude of the area.

Manual sowing

1. By hand or with a small hoe or other hand tool fill most of the hole with soil from around the hole.

2. In the center of the hole put two acorns horizontally and cover them with the rest of the soil to a thickness equivalent to 1.5 to 2 times the diameter of the seed.

3. Compact the soil with the hands to eliminate empty air gaps and make sure the filled hole does not exceed the natural soil level.

4. Having finished the sowing, sprinkle the ground a few times with a spray bottle filled with generic cologne, because in certain areas it acts as a good repellent for wild boars that may dig up the seeds and eat them.

The total amount of seeds required for one hectare will therefore be:

Species	Nº holes	Density of sowing	Nº of seeds	Weight for 1,000 seeds	Purity	Total quantity
Quercus brantii	1,000	2 seeds /hole	2,000	10 kg	98%	24 kg

Microwatersheds

Successful reforestation in Mediterranean environments is limited mainly by the availability of water, especially during periods of high water stress.There are different soil preparation techniques such as microwatersheds aimed at increasing the amount of water in the holes to be used for seeding and planting. This basically consists of digging two 1.5 m long, 0.20 m high ridges forming an oblique angle upslope from the planting hole (see example in Annex 1). In order to maximise benefit of runoff water the layout of holes should be set as shown in the Annex 1.

The estimated sowing performance per operator is 15 holes per hour.

Contribution to bird populations:

When the Quercus brantii begin to bear fruit the acorns they produce will feed crows and other birds.


PLANTING
SEEDLINGS

AREA 2: PLANTING SEEDLINGS

UTM coordinates (WGS84, 36S):
X: 751,910, Y: 3,732,673
- GPS Coords:
X Lat.: 33 42´ 15´´, Y Long.: 35 43´ 05´´
- Surface 2012: 1.18 ha
- Surface 2013: 20.00 ha
- Surface 2014: 5.00 ha
- Exposition: Shadow.
- Altitude: above 1,545 m.
- Slope: 20-40% approx.

Steep slope with abundant rocky outcrops and bare soil with stony sediments; scarce vegetation cover, with an average coverage of grasses and scattered small shrubs

The objective is to enhance habitat functionality and restore species diversity in the mountain cedar forest belt by establishing scattered copses of several trees and tall shrubs in between cedar forest stands and thickets of shrubs and small trees in the edge of forest stands. Restored copses and thickets will act as sources of seeds and will provide habitat for a wide range of species including seed-dispersal birds and mammals, thus accelerating natural regeneration and the colonization of forest in adjacent open areas.

Restoration method in Area 2 involves planting seedlings from selected evergreen and deciduous native species in high mountain areas located between 1,500 and 2,000 meters.

This area represents the highest point of the study with high rainfall from November to March. The physiological drought is about 4.3 months and growing period is 4 months. Possible frost from November to December and from March to April and certain frost during the month of January. The average temperature is 11.7 º C.

Species	Relation	Density
Cedrus libani	275 / 500	275 seedlings/ha
Quercus brantii	40 / 500	40 seedlings/ha
Crataegus azarolus	25 /500	25 seedlings/ha
Sorbus flavellifolia	25 /500	25 seedlings/ha
Sorbus torminalis	25 /500	25 seedlings/ha
Acer tauricolum	25 /500	25 seedlings/ha
Prunus ursina	25 /500	25 seedlings/ha
Berberis libanotica	15 /500	15 seedlings/ha
Cotoneaster nummularia	15 /500	15 seedlings/ha
Lonicera nummulariifolia	15 /500	15 seedlings/ha
Styrax officinalis	15 /500	15 seedlings/ha

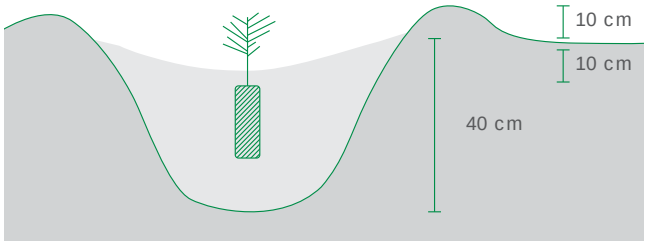
The density proposed is 500 holes/ha. To reach this density the planting framework should be 4.5 x 4.5 meters between holes.

The preparation of the different holes for planting should begin in October starting in the highest areas first. The holes should be left open, with the excavated soil to the side allowing it to become oxygenated and moistened by the autumn rains.

The holes will be made by individual mechanical digger with auger of 12 cm in diameter. They will have a truncated pyramid shape, with an upper area of 40 cm, a bottom of 30 cm and a depth of 40 cm. Drill in three contiguous points on the ground where the hole will be excavated to get the necessary depth. If you do not have the mechanical auger, you can make holes with a spade or pick with a minimum depth of 40 cm and an opening of 40x40 cm.

The operator will move forward following the contour line and locate the point where to dig the hole, making sure location does not fall on an area of dense brush or a rocky spot. Should this happen, look for another spot within a radius of 1.5 meters. If an appropriate spot is not found, then skip this cell and move to the next one.

Plants should be 1-2 year old seedlings, grown in appropriate containers[1] , especially for Quercus species where container with vertical rips helps preventing root spiraling. The main substrate is usually peat. The plant should be sufficiently lignified and the proportion between aerial and subterranean parts will be balanced where the length of the aerial part of the plant is not much longer than the container length. Avoid plants with injuries, deformations, dry or damaged leaves, spiral roots or unbranched



[1]Container must be in accordance with the morpho-functional characteristics of the species, its development patterns and the environmental conditions where it will be planted. It is necessary to produce seedlings with an appropriate biomass distribution, an optimum root/shoot ratio and a root system capable of reaching as fast as possible the deeper horizons where soil moisture could be available during the dry summer. Currently, there are a wide variety of containers on the market, defined in terms of their material, shape, size, depth, shallow opening and bottom cells. Containers with vertical ribs inside help prevent root spiraling.

stems, absence of healthy terminal buds, and pruned plants. Before planting the plant should be heavily irrigated in the nursery.

For planting you should follow indications in the above drawing. The ground shall be compacted to the root ball by trampling and foot pressure for a good establishment of roots. Bury part of the stem (2-4 cm) of the plant as shown in the drawing; the root ball should be moist enough from the nursery's irrigation at the last moment before taking the plant to the field for planting.

Consider the use of micro watersheds as in Area 1.

The most appropriate time to plant seedlings would be between 1 November and 31 December, before the snow prevents the execution of work.

The estimated performance for an operator with an auger is of 5 holes per hour.

The optimal layout of the holes to maximase water runoff is shown in Annex 1.

The estimated performance for planting seedlings per operator is 8 plants per hour.

Contribution to bird populations:

Fruit-bearing species will be planted such as Hawthorn and Rowan that will attract seed dispersal bird species, such as black bird and golden oriole.


FENCED
PLOTS

AREA 3: FENCED PLOTS

- UTM coordinates (WGS84, 36S): X: 751,794, Y: 3,733,163
- GPS Coords:
X Lat.: 33 42´ 31´´, Y Long.: 35 43´ 01´´
- Surface 2012: 1 fenced plot for 0.50 ha
- Surface 2013: 14 fenced plots for 7.00 ha
- Exposition: Suntrap.
- Altitude: 1,458 m.
- Slope: 20% approx.

Gently Rolling hilly karstic land with dolines, with a medium to dense cover of pasture and small shrubs, with scattered thorny tall shrubs....

The objective is to restore "woodland islets" in extensive overgrazed open areas, developing a landscape of grassland with scattered tree cover that can provide an integral set of ecological, social and economic services:(i) act as a source of propagules, which greatly accelerates woodland development in the surrounding denuded land, greatly enhancing species diversity; (ii) improve soil fertility and microclimate conditions facilitating the germination and growth of plant species, and providing protection for livestock and wild fauna during hot days; (iii) provide habitat and food for seed-dispersal fauna (birds and mammals) that play a major role in natural forest regeneration; (iv) provide additional fodder supply from tree pruning, and edible fruits for local food production; (v) represent a flexible restoration approach supporting a diverse set of land uses, from extensive livestock, to the production of wood and non-wood forest products and ecotourism (vi) restoration costs are reduced because intervention areas are small.

The restoration method in Area 3 involves the use of fenced plots in current grazing areas located between 1,000 and 1,500 meters.

This area represents a middle altitudinal restoration plot with high rainfall from November to February. The physiological drought is about 4.4 months and growing period is 4 months. Probable frost extends from November to December, from March to April, and actual frost in January. The average temperature is 0.7 ° C higher than in the upper zone.

In order to increase plant diversity through woodland islets, it was decided to install 2 fenced

enclosures per hectare and plant inside them different species that will remain protected from herbivores. These enclosures are established in grazing areas between 1,000 and 1,300 meters with a dimension of 25 x 25 meters.

The fence will be made of wooden or metal poles placed at a distance of 3-4 meters and firmly anchored. If wooden poles are used, the same machinery to dig the holes for plantings can be used. They must be covered up at least 40 cm, leaving a minimum fence height of 1 m above ground. Place barbwire on top of fence to prevent livestock from jumping. The 4 corners of the fence should be strengthened with two braces per corner.

Species	Relation	Density
Quercus infectoria	60 / 240	60 seedlings/ha
Sorbus flavellifolia	30 / 240	30 seedlings/ha
Sorbus torminalis	25 / 240	25 seedlings/ha
Acer tauricolum	25 / 240	25 seedlings/ha
Prunus ursina	30 / 240	30 seedlings/ha
Crataegus azarolus	25 / 240	25 seedlings/ha
Quercus calliprinos	15 / 240	15 seedlings/ha
Crataegus monogyna	15 / 240	15 seedlings/ha
Rosa canina	15 / 240	15 seedlings/ha

The planting density is 120 seedlings/ enclosure, which corresponds to a relatively high density in order to take advantage of the installation costs and efforts for the enclosures. The higher plant density will reduce excessive sun exposure to the plants during the first year. However, thinning operations will need to be performed in later years without delay.

Preparation of the different holes for planting should begin in October starting with the highest areas first. The holes should be left open, with the excavated soil to the side allowing it to become oxygenated and moistened by the autumn rains.

Plants will be 1-2 year old seedlings and grown in appropriate containers. Especially for Quercus species it will be essential to use containers that prevent root spiraling (containers separated from the ground and with vertical ribs inside).

Seedlings should be sufficiently lignified and the proportion between aerial and subterranean parts should be balanced. We recommend a minimum diameter of root collar of about 4 mm for Quercus and of about 3mm for Acer, Prunus, Rosa, Crataegus and Sorbus. Avoid seedlings with injuries, deformations, dry or damaged leaves, spiral roots or unbranched stems, absence of healthy terminal buds, and pruned plants. Before planting make sure the containers are heavily irrigated in the nursery.

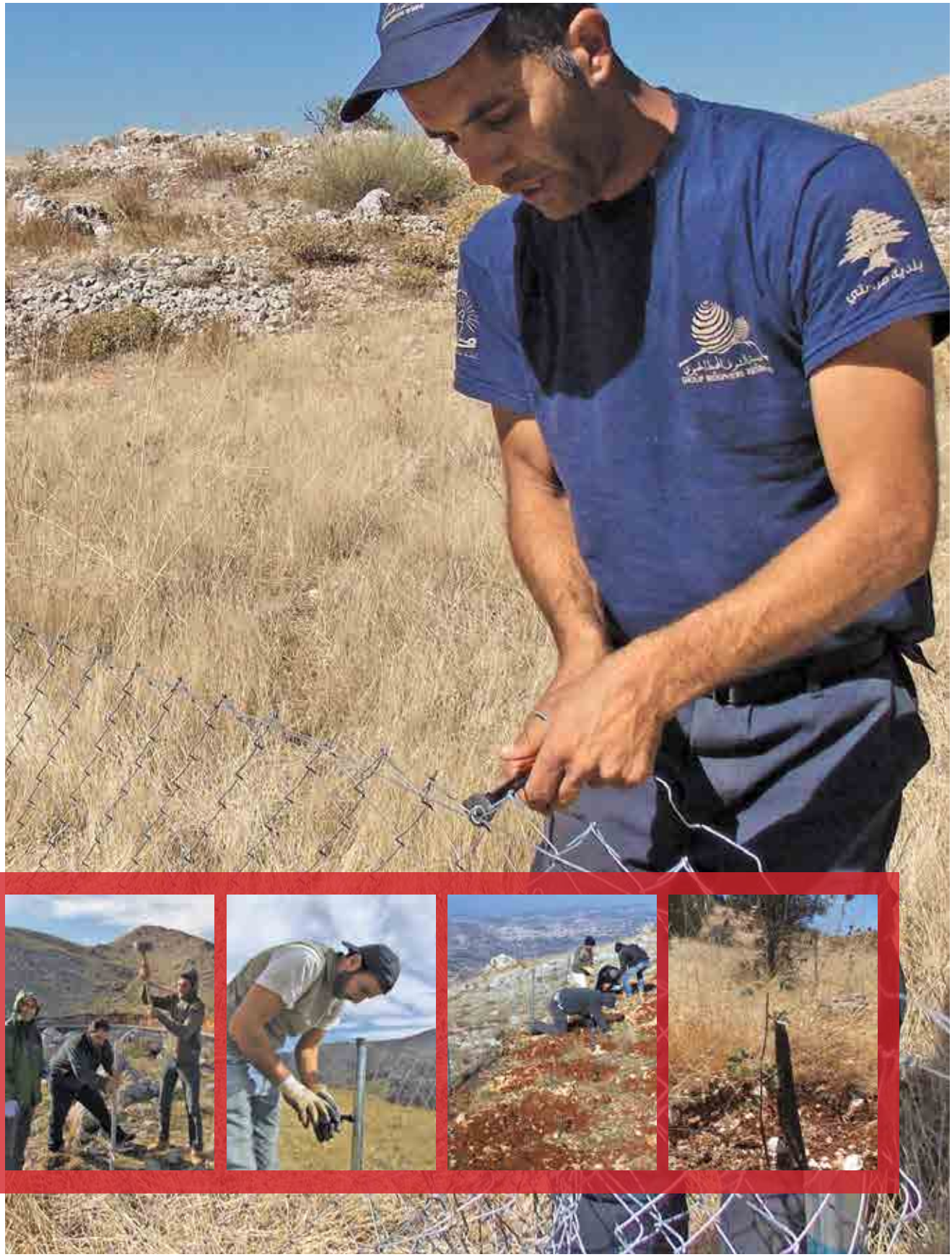
The most appropriate planting period would be between 1 November and 31 December, before the snow prevents the execution of the work.

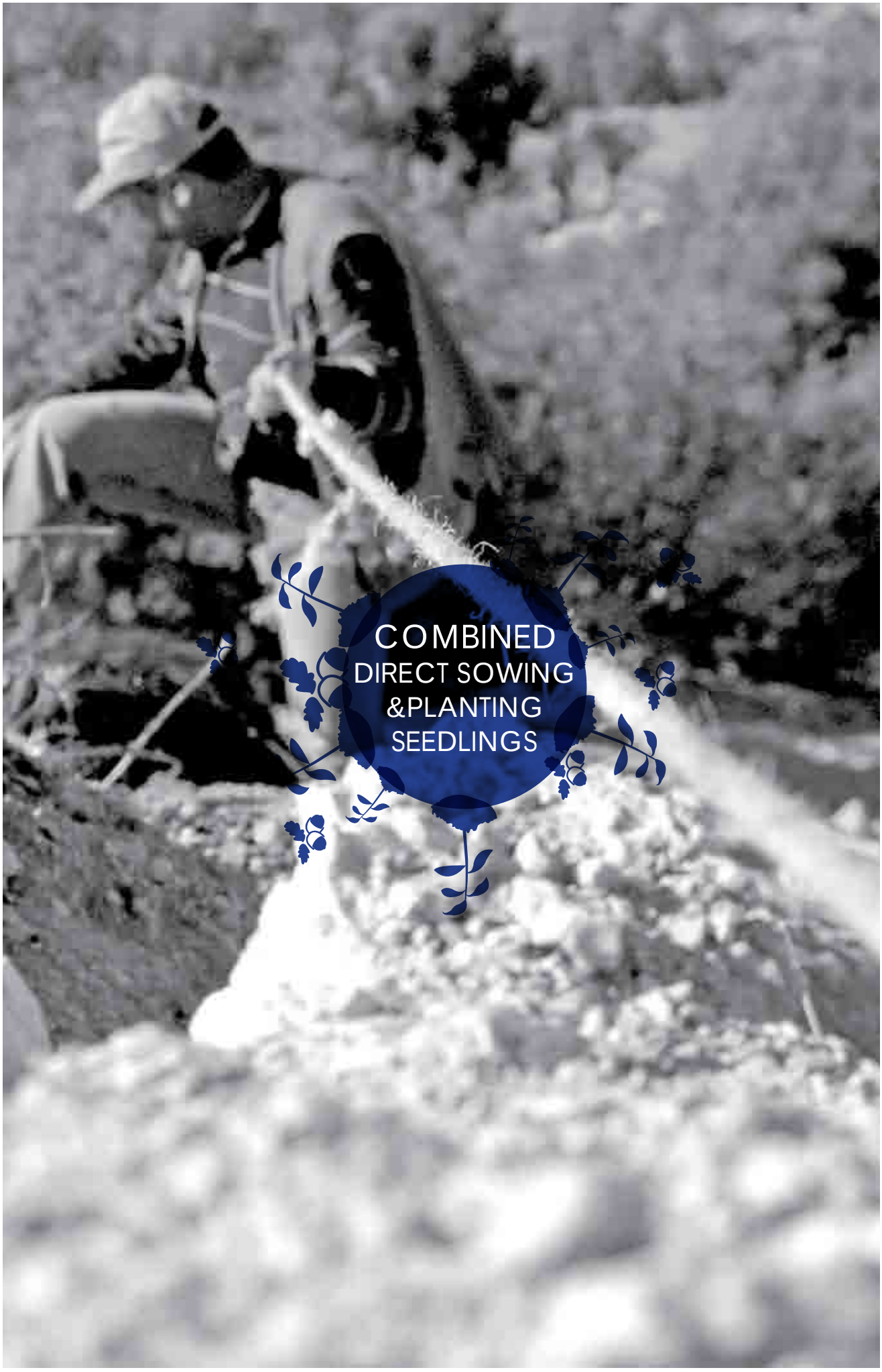
The estimated performance per operator is 6.4 linear meters per hour, 5 holes per hour and 8 plants per hour. As tested an average of 6.4 linear

meters per hour and per operator can be performed.

Contribution to bird populations:

Fenced enclosures will protect plants that will provide nesting and resting sites for different bird species; fruit producing shrubs and small trees, especially Rosaceae species, will attract seed dispersal bird species such as black bird and song thrush.




COMBINED
DIRECT SOWING
&PLANTING
SEEDLINGS

AREA 4: COMBINED DIRECT SOWING AND PLANTING SEEDLINGS

- UTM coordinates (WGS84, 36S):
  X: 739,377 Y: 3,721,715
- GPS Coords:
  X Lat.: 33 36´ 30´´, Y Long.: 35 34´ 48´´
- Surface 2012: 0.50 ha
- Surface 2013: 0.50 ha
- Surface 2014: 0.00 ha
- Exposition: Suntrap
- Altitude: 1,280 m.
- Slope: 20-50 % approx.

Restoration in Area 4 is located in a quarry waste dump with very sandy soil near Mrosti. This area represents an intermediate altitude and high rainfall from November to February. The physiological drought is about 4.6 months and growing period is 5 months. Probable frost extends from November to December and from March to April. The average temperature is 1.8 ° C higher than in the upper zone.

The objective is to restore an abandoned quarry inside the Reserve by increasing the ecological significance of the excavated limestone walls and debris, revegetate and fix the instable debris, and reduce the visual impact of the quarry.

The restoration will include 50% seedlings and 50% seeds. For direct sowing the final choice is *Quercus calliprinos*. The density of holes is 500 cells/ha with a sowing framework of 3.15 x 3.15 m between holes.

The preparation of the different holes for planting should begin in October starting with the highest areas first. The holes should be left open, with the excavated soil to the side allowing it to become oxygenated and moistened by the autumn rains.

The most appropriate period to plant would be between 15 November and 31 December, before the snow prevents the execution of work. The first seedlings will not be expected before May or June, due to the high altitude of the area. The total amount of seed required for one hectare is 12 kg.

The estimated performance per operator is the excavation of 20 holes per hour, the sowing of 15 holes per hour, and the planting of 8 seedlings per hour.

Contribution to bird populations:

The planted fruit-bearing species such as stone pine, oak, hawthorn and rowan will attract seed dispersal bird species, such as song thrush and golden oriole.

Species	Relation	Density
Quercus calliprinos	100 / 500	100 seedlings/ha
Styrax officinalis	100 / 500	100 seedlings/ha
Pinus brutia	100 / 500	100 seedlings/ha
Pinus pinea	100 / 500	100 seedlings/ha
Rhus coriaria	50 / 500	50 seedlings/ha
Rosa canina	50 / 500	50 seedlings/ha





Rehabilitation of a quarry in Mrosti village

Located in the village of Mrosti, one of the main access points to the Shouf Biosphere Reserve, the quarry face will be rehabilitated as an important entry point guiding the visitor to the rest of the Reserve.

The rehabilitation of this quarry targets the reinstatement of the maximum original ecological functionalities that were lost through the extensive excavation activities, and reintegrates the site in its natural environment and restores its biotic features. This existing scar will thus regain its vital functions and uncover hidden potentials that were lost in its confines.

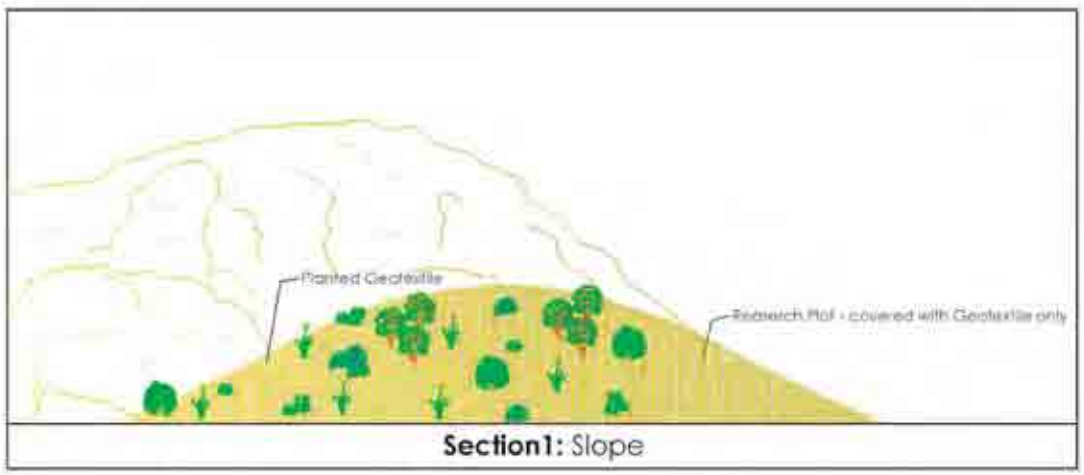
Before and after plans for the quarry

Technical drawings by: Christine MAKSOUD (CNRS-L)

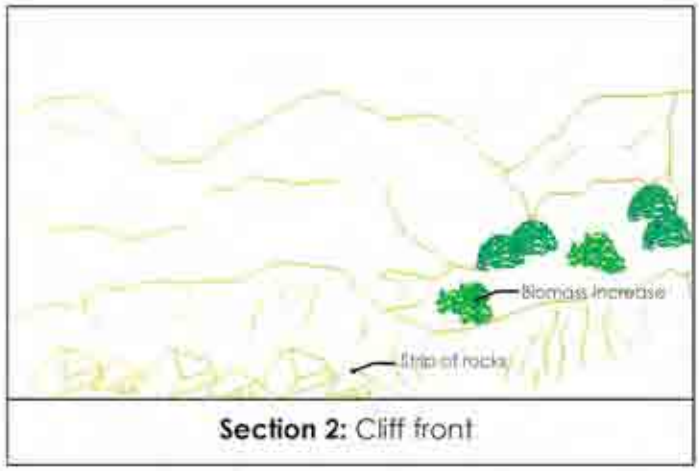
Objectives and suggested actions for the quarry face rehabilitation

Objective	Suggested Action
1. Visual integration	a- Plant trees/shrubs/herbs on the quarry face to keep the natural aspect of the cliff b- Reduce visual impact of white rocks : promote rock weathering (paint)
2. Increase biomass	a- Use native plants to improve vegetation dynamics and natural integration of the quarry in its surroundings b- Create holes in the quarry face to attract birds and encourage them to nest c- Place a strip of rocks to attract reptiles and encourage them to nest
3. Limit erosion	a- Reduce slope and use geotextile net which can be planted b- Use retention wall in case of heavy erosion
4. Promote research	Plan monitoring plots for research purposes
5. Enhance visitors experience	Use friable cliff face to engrave a sculpture symbolizing a cultural or natural heritage aspect

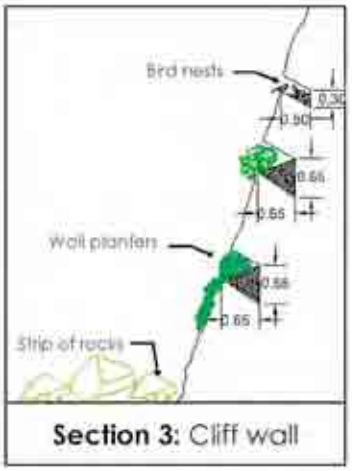
Prepared by: Carla Khater PhD (CNRS-L) & Johnny FENIANOS (Urban Art) assisted by Eng. Christine MAKSOUD (CNRS-L) & Rita El-HAJJ (CNRS-L)



Section1: Slope



Section 2: Cliff front



Section 3: Cliff wall


BORDER
OF AMMIQ
WETLAND

AREA 5: BORDER OF AMMIQ WETLAND

- UTM coordinates (WGS84, 36S): X: 757,928, Y: 3,736,009
- GPS Coords: X Lat.: 33 43´ 58´´, Y Long.: 35 47´ 02´´
- Surface 2012: 0.000 ha
- Surface 2013: 0.725 ha
- Surface 2014: 0.725 ha
- Orientation: Suntrap
- Altitude: about 870 m.
- Slope: 0-10 % approx.

This is a more or less flatland area located between a road and Ammiq wetland. From the road there is a gradient of soil, vegetation and humidity: a first zone with gentle stony slope where bare areas alternate with medium coverage grassland, resulting in a flat area of dense grassland, close to the wetland.

The objective is to create a green barrier between the road and the wetland and increase the diversity of riparian forest habitats – slightly present in the wetland – to provide nesting areas, observation posts and protection for birds and other fauna.

Area 5 occupies the lowest elevation where precipitation occurs from November to February. The physiological drought is about 5.4 months and growing period is 7 months. Frost extends from November to December and from March to April. The average temperature is 4.5°C higher than in the upper zone.

Restoration in area 5 employs planting seedlings of *Populus bologna, Fraxinus syriacus, Celtic australis* and *Ulmus minor*, at different levels to create a visual/sound barrier between the protected wetland of Ammiq and the main road.

Restoration in the border of Ammiq wetland consists of two distinct areas:

- Lineal zone in the edge of the road where a total of 1,000 plants will be planted along a 1,000 linear meters stretch, in order to connect a *Populus bolleana* shelter belt in the north of the lake with a cypress alignment in the south.

- Flat polygonal area near the water to be planted with different species according to the proximity to the wetland. In the area furthest from the water and closest to the road place the *Celtis australis* and *Ulmus minor* and between the latter and the water plant the *Fraxinus syriacus*. The

area to restore will be about 900 m2. A total of 450 plants will be planted, 150 per species.

To achieve the desired density, the planting framework in the lineal zone will be 1x1m between holes and in the polygonal area 1.5x1.5m between holes:

We recommend a minimum diameter of root collar of about 5-6 mm. Avoid seedlings with injuries, deformations, dry or damaged leaves, spiral roots or unbranched stems, little branched, absence of healthy terminal buds and pruned plants.

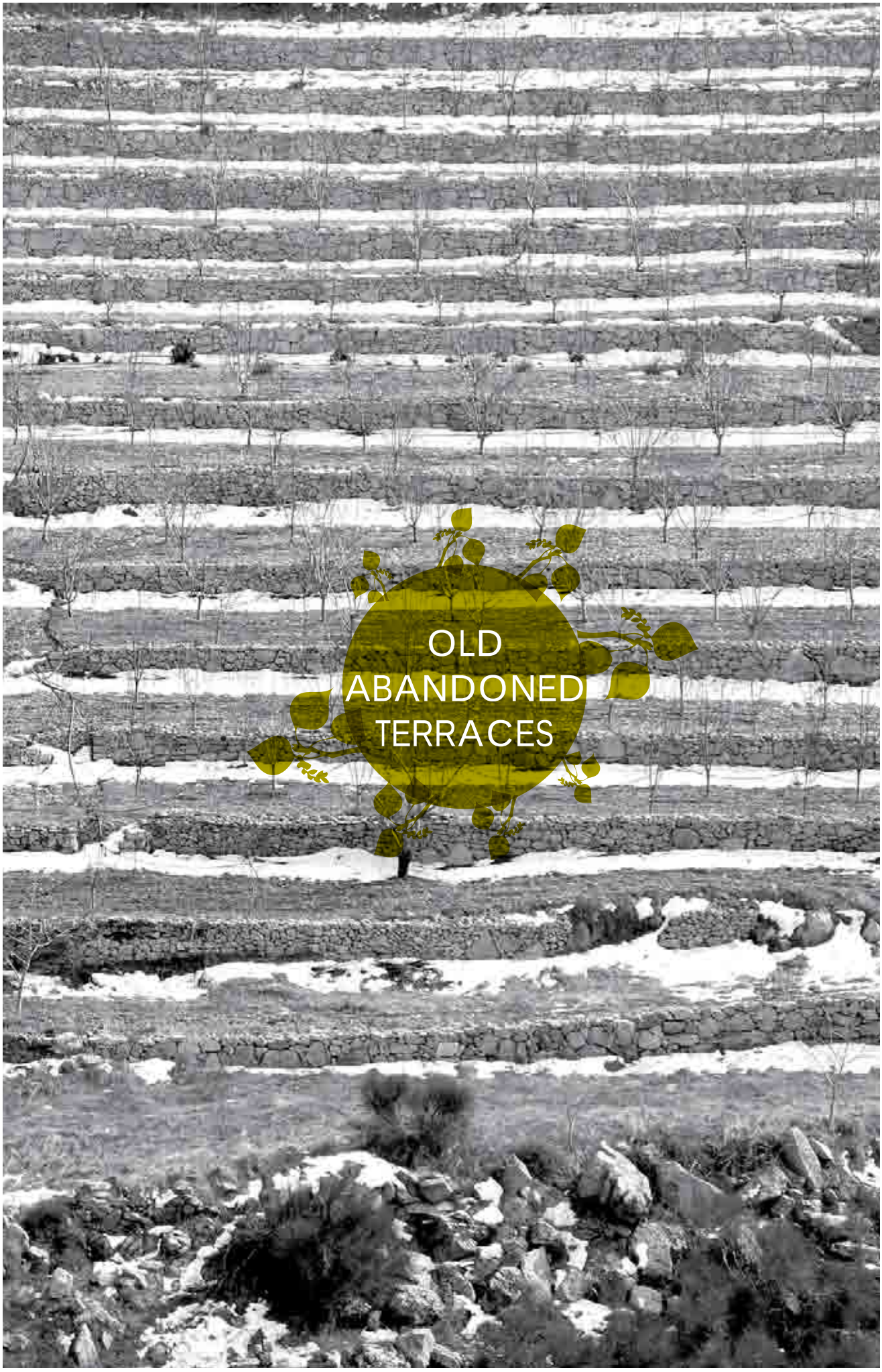
Before planting the seedling will be heavily irrigated in the nursery.

The estimated performance per operator is of 5 holes per hour and of 8 seedlings per hour.

Contribution to bird populations:

A green barrier will minimize noise and other disturbances from the road affecting bird populations in the wetland; the planted riparian trees will provide habitat for nesting and observing points for a number of birds such as syrian serin and song thrush.





OLD
ABANDONED
TERRACES

AREA 6:
OLD ABANDONED TERRACES

- UTM coordinates (WGS84, 36S):
X: 747,344, Y: 3,729,519
- GPS Coords:
X Lat.: 33 40´ 36´´, Y Long.: 35 40´ 04´´
- Surface 2012: 0.00 ha
- Surface 2013: 1.00 ha
- Surface 2014: 1.00 ha
- Orientation: various orientations
- Altitude: about 1,170 m.
- Slope: 10-20 % approx.

The area includes abandoned stone terraces formerly used for the cultivation of crops, mainly vineyards.

The objective is to restore viable traditional farming systems in terraces based on the cultivation with drip irrigation of high quality produce from native and cultivated species requiring low maintenance, such as aromatic, medicinal or culinary herbs, and productive trees such as figs, almonds, pine trees, while preserving the ecological niche of the numerous species of flora and fauna that colonize the stones, holes and soil of the terraces. This will also provide complementary touristic attraction based on the cultural, biodiversity and landscape value of the terrace systems. The growing of medicinal and aromatic plants provides a good complementary source of revenue, driven by the increasing market demand linked to the growing prestige of the Shouf Nature Reserve. The restoration of terraces requires striking a balance between modernity and tradition: the traditional irrigation system will be integrated with modern drip irrigation and fog water collection.

Area 6 represents a low elevation with precipitation from November to February. The physiological drought is about 4.8 months and growing period is 6 months. Frost extends from November to April and the average temperature is 2.5 ° C higher than in the upper zone.

Species	Relation	Density
Origanum syriacum	225 / 1000	225 seedlings/ha
Salvia fruticosa	225 / 1000	225 seedlings/ha
Thymbra spicata	75 / 1000	75 seedlings/ha
Lavandula officinalis	75 / 1000	75 seedlings/ha
Rhus coriaria	75 / 1000	75 seedlings/ha
Rosa canina	75 / 1000	75 seedlings/ha
Gundelia tournefortii	75 / 1000	75 seedlings/ha
Amygdalus communis	75 / 1000	75 seedlings/ha
Ziziphus jujuba	50 / 1000	50 seedlings/ha
Crataegus azarolus	50 / 1000	50 seedlings/ha

Restoration in this area employs formerly tilled terraced fields and crops, generally vines, which have been abandoned and colonized by oaks, pines and aromatic plants.

When mixing different species with different sizes, the suitable density is of 1,000 plants / ha.

The abandoned terraces in some cases have been colonized by plants naturally. It is important not to disturb this vegetation that holds the soil and creates defenses for wildlife. The new plants to be introduced will be distributed as much as possible respecting the existing vegetation.

The distribution of plants and species will be lineal, to facilitate harvesting. The number of lines per terrace will depend on on the width of the terrace and may have one or two irrigation lines per terrace. Distribution of the new plants will depend on the existing vegetation.

Recommended distance between plants:

- Origanum syriacum, Salvia fruticosa, Thymbra spicata, Lavandula officinalis: separation 0.3 to 0.5 m.
- Rhus coriaria, Rosa canina, Gundelia tournefortii: separation 1 m.
- Amygdalus communis, Ziziphus jujube, Crataegus azarolus: separation 4 m.

A total of 1.000 plants per hectare should be planted between 1 April and 15 May.

Irrigation: for the growth and rooting of plants in terraces use drip irrigation techniques. Install a header tank and a main and secondary network of dripper hose. In the absence of a direct source of water, condensation panels or fog catchers could be installed.

Fog catchers have been used for years to irrigate areas of low rainfall. This technique consists of placing low-cost panels in order to condensate the fog in specific areas and then using its water to irrigate plants. Fog is a common feature in the Shouf Biosphere Reserve especially during the early hours of the day because of its proximity to the sea and high altitude slopes that face the sea coast.

It has been proposed to place multiple screens and fog catchers in the area of abandoned terraces to collect the water during the early hours of the day, especially in summer. This condensed water will be used to fill a number of water tanks that will supply a drip irrigation system. Micro water sheds need not be considered in this case because terraces have the same purpose.

Contribution to bird populations:

The introduced plants on abandoned terraces can become an important source of feed for granivorous birds.


DALBOUN
OAK FOREST

AREA 7: DALBOUN OAK FOREST

- UTM coordinates (WGS84, 36S): X: 747,238, Y: 3,730,978
- GPS Coords: X Lat.: 33 41´ 24´´, Y Long.: 35 40´ 02´´
- Surface 2012: 0.00 ha
- Surface 2013: 0.05 ha
- Surface 2014: 1.00 ha
- Orientation: various orientations
- Altitude: about 1,170 m.
- Slope: 5-10 % approx.

In Area 7 the restoration is not based on the introduction of new plants but on the removal of part of the biomass from too dense unmanaged coppice woodlands with growth stagnation conditions and low plant diversity.

The Dalboun Oak Forest is located in the western slope of the Shouf Biosphere Reserve and consists of some 150 hectares of continuous *Quercus calliprinos,* with some specimens of *Quercus infectoria* and maples. It is a very dense forest with clumps of 3 to 10 saplings of *Quercus calliprinos*.

Restoration in area 7 focuses on the removal of excess wood to reduce the risk of fire, allowing the establishment of plants that need more light, increasing forest biodiversity, and creating better grazing conditions.

It is proposed that traditional clear cutting should be stopped and replaced by thinning work, as a first step in the process of turning this scrubland into a high forest with oak saplings. The restoration work can make the forest a long-term sustainable environment by:

- Reducing the risk of fire
- Opening the forest to the growth of light loving species
- Creating better grazing
- Preventing unwanted regrowth
- Allowing the remaining plants to grow resulting in larger amount of biomass
- Encouraging forest visits

It is important to develop a management plan for the forest that allows the use of firewood and maintains forest sustainability.

Contribution to bird populations:

After thinning and clearing the Dalboun Oak Forest the dangers of fires will decrease and more flowering plants will grow to attract insects and produce seeds. All these factors will provide more food for insectivorous, granivorous and frugivorous birds.

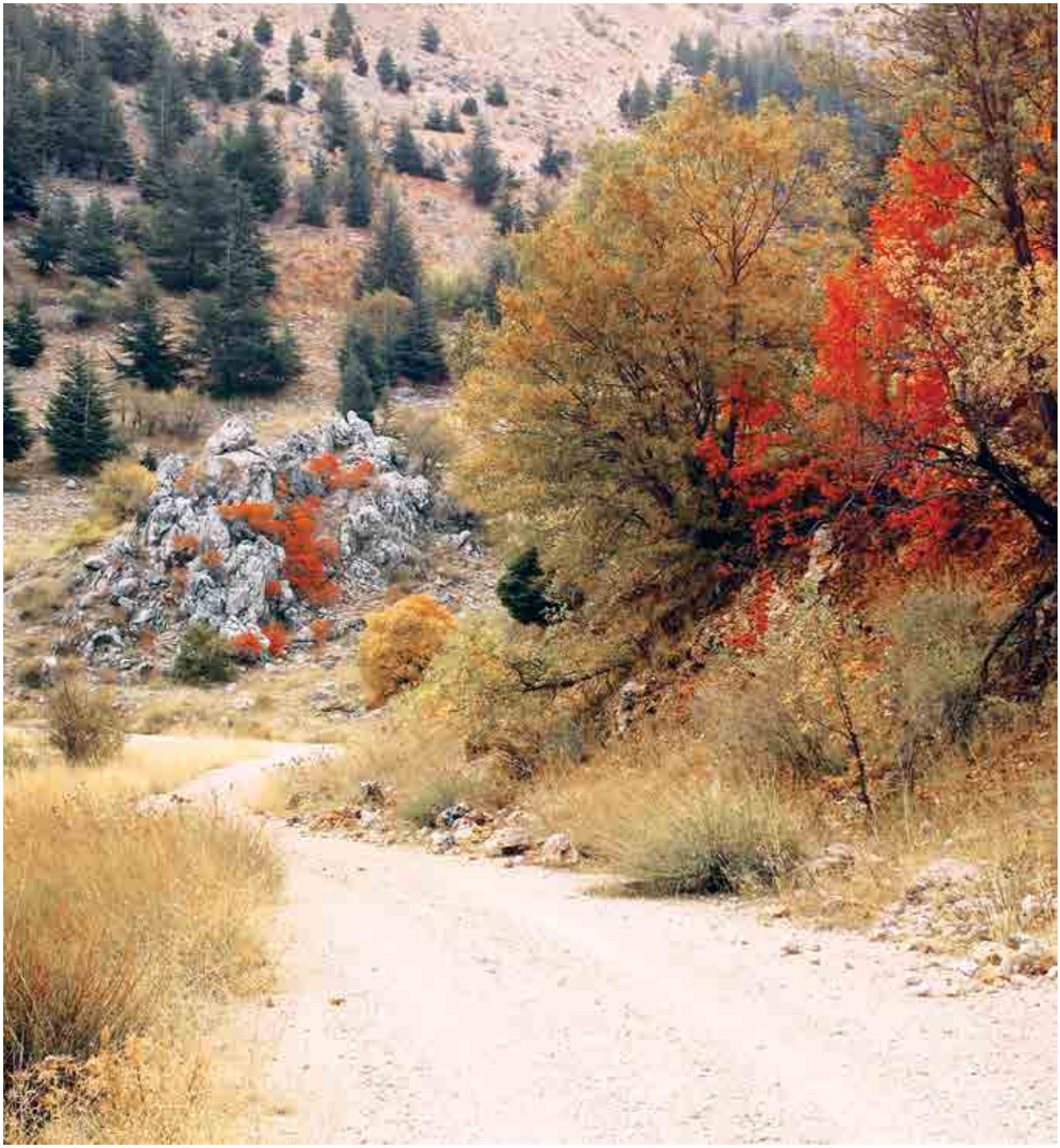



adidas


BUDGET

5. BUDGET

A detailed budget and work plan that includes the following documents were prepared to carry out the work during the years 2012, 2013 and 2014:



5.1. PARTIAL BUDGETS PER YEAR

AREA 1 CHAPTER 01. Ha of site preparation and sowings

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
01.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 30 cm. Or by manually performing hole digging holes of 40x40x30 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$0.56	1,000.00	$556.61
01.02	Ut. Sowing in the center of the hole place two acorns in horizontal and cover with the remaining soil so that seeds are covered 1.5 to 2 times the diameter of the seed. Include. Includes performing a small tree surround less than 50 cm in diameter or if micro watershed slope greater than 15%.	$0.56	1,000.00	$556.61
01.03	Kg of Quercus brantii, forestry seeds prepared and moisturized.	$2.10	24.00	$50.28
			CHAPTER 01:	$1,163.50
			UNIT:	$1.16

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.28	$153.63	4.00	$2,226.46	2.00	$1,113.23	6.28	$3,493.31
0.28	$153.63	4.00	$2,226.46	2.00	$1,113.23	6.28	$3.493.31
6.62	13.88	96.00	201.12	48.00	$100.56	150.62	$315.56
	$321.13		$4,654.04		$2,327.02		$7,302.18

AREA 2 CHARTER 02. Ha of site preparation and planting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
02.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 40 cm. Or by manually performing hole digging holes of 40x40x40 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$1.39	500.00	$692.94
02.02	Ud. Manual planting, including cover and carrying a small tree surround below 50 cm in diameter, on slopes less than 50%, including plant layout, or micro watershed if slope greater than 15%.	$0.69	500.00	$347.21
02.03	Ut. Forest plant in container 2 years seedlings of Cedrus libani.	$1.11	275.00	$303.88
02.04	Ut. Forest plant in container 1 year seedling of Quercus brandii.	$1.11	40.00	$44.20
02.05	Ut. Forest plant in container 1 year seedling of Crategus azarolus	$1.11	25.00	$27.63
02.06	Ut. Forest plant in container 1 year seedling of Sorbus flavellifolia.	$1.11	25.00	$27.63
02.07	Ut. Forest plant in container 1 year seedling of Sorbus torminalis.	$1.11	25.00	$27.63
02.08	Ut. Forest plant in container 1 year seedling of Acer tauricolum.	$1.11	25.00	$27.63
02.09	Ut. Forest plant in container 1 year seedling of Prunus ursina.	$1.11	25.00	$27.63
02.10	Ut. Forest plant in container 1 year seedling of Berberis libanotica.	$1.11	15.00	$16.58
02.11	Ut. Forest plant in container 1 year seedling of Cotoneaster nummularia.	$1.11	15.00	$16.58
02.12	Ut. Forest plant in container 1 year seedling of Lonicera nummulariifolia.	$1.11	15.00	$16.58
02.13	Ut. Forest plant in container 1 year seedling of Stirax officinalis.	$1.11	15.00	$16.58
			CHAPTER 02:	$1,592.70
			UNIT:	$3.19

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
1.18	$817.67	20.00	$13,858.84	5.00	$3,464.71	26.18	$18,141.22
1.18	$409.71	20.00	$6,944.21	5.00	$1,736.05	26.18	$9,089.98
1.18	$358.57	20.00	$6,077.50	5.00	$1,519.38	26.18	$7,955.45
1.18	$52.16	20.00	$884.00	5.00	$221.00	26.18	$1,157.16
1.18	$32.60	20.00	$552.50	5.00	$138.13	26.18	$723.22
1.18	$32.60	20.00	$552.50	5.00	$138.13	26.18	$723.22
1.18	$32.60	20.00	$552.50	5.00	$138.13	26.18	$723.22
1.18	$32.60	20.00	$552.50	5.00	$138.13	26.18	$723.22
1.18	$32.60	20.00	$552.50	5.00	$138.13	26.18	$723.22
1.18	$19.56	20.00	$331.50	5.00	$82.88	26.18	$433.93
1.18	$19.56	20.00	$331.50	5.00	$82.88	26.18	$433.93
1.18	$19.56	20.00	$331.50	5.00	$82.88	26.18	$433.93
1.18	$19.56	20.00	$331.50	5.00	$82.88	26.18	$433.93
	$1,879.33		$31,853.05		$7,963.26		$41,695.64

AREA 3

CHAPTER 03. Ha of fenced plots installation, site preparation and planting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
03.01	Ut. Fenced plot installation of approx. 100 m perimeter and 1 m in height, with metal posts and braces, in ground slope less than 50%.	$531.39	2.00	$1.062.78
03.02	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 40 cm. Or by manually performing hole digging holes of 40x40x40 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$1.39	240.00	$332.61
03.03	Ud. Manual planting, including cover and carrying a small tree surround below 50 cm in diameter, on slopes less than 50%, including plant layout, or micro watershed if slope greater than 15%.	$0.69	240.00	$166.66
03.04	Ut. Forest plant in container 1 year seedling of Quercus infectoria.	$1.11	60.00	$66.30
03.05	Ut. Forest plant in container 1 year seedling of Sorbus flavellifolia.	$1.11	30.00	$33.15
03.06	Ut. Forest plant in container 1 year seedling of Sorbus torminalis.	$1.11	25.00	$27.63
03.07	Ut. Forest plant in container 1 year seedling of Acer tauricolum.	$1.11	25.00	$27.63
03.08	Ut. Forest plant in container 1 year seedling of Prunus ursina.	$1.11	30.00	$33.15
03.09	Ut. Forest plant in container 1 year seedling of Crategus azarolus.	$1.11	25.00	$27.63
03.10	Ut. Forest plant in container 1 year seedling of Quercus calliprinos.	$1.11	15.00	$16.58
03.11	Ut. Forest plant in container 1 year seedling of Crataegus monogyna.	$1.11	15.00	$16.58
03.12	Ut. Forest plant in container 1 year seedling of Rosa canina.	$1.11	15.00	$16.58
			CHAPTER 03:	$1,827.28
			UNIT FENCED PLOT:	$913.64
			UNIT:	$7.61

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.50	$531.39	7.00	$7,439.46	0.00	$0.00	7.50	$7,970.85
0.50	$166.31	7.00	$2,328.28	0.00	$0.00	7.50	$2,494.59
0.50	$83.33	7.00	$1,166.63	0.00	$0.00	7.50	$1,249.96
0.50	$33.15	7.00	$464.10	0.00	$0.00	7.50	$497.25
0.50	$16.58	7.00	$232.05	0.00	$0.00	7.50	$248.63
0.50	$13.81	7.00	$193.38	0.00	$0.00	7.50	$207.19
0.50	$13.81	7.00	$193.38	0.00	$0.00	7.50	$207.19
0.50	$16.58	7.00	$232.05	0.00	$0.00	7.50	$248.63
0.50	$13.81	7.00	$193.38	0.00	$0.00	7.50	$207.19
0.50	$8.29	7.00	$116.03	0.00	$0.00	7.50	$124.31
0.50	$8.29	7.00	$116.03	0.00	$0.00	7.50	$124.31
0.50	$8.29	7.00	$116.03	0.00	$0.00	7.50	$124.31
	$913.63		$12,790.77		$0.00		$13,704.40

AREA 4 CHAPTER 04. Ha of site preparation and sowing

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
04.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 30 cm.	$0.56	500.00	$278.31
04.02	Or by manually performing hole digging holes of 40x40x30 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$0.56	500.00	$278.31
04.03	Ut. Sowing in the center of the hole place two acorns in horizontal and cover with the remaining soil so that seeds are covered 1.5 to 2 times the diameter of the seed. Include. Includes performing a small tree surround less than 50 cm in diameter or if micro watershed slope greater than 15%.	$2.10	12.00	$25.14
			CHAPTER 04:	$581.76
			UNIT:	$1.16

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.50	$139.15	0.50	$139.15	0.00	$0.00	1.00	$278.31
0.50	$139.15	0.50	$139.15	0.00	$0.00	1.00	$278.31
6.00	$150.84	6.00	$150.84	0.00	$0.00	12.00	$301.68
	$429.15		$429.15		$0.00		$858.29

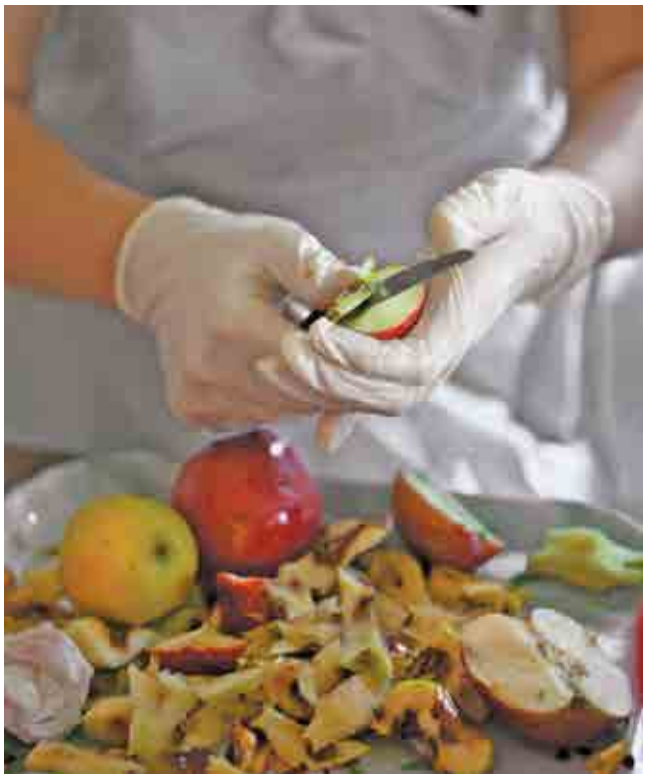
AREA 4 CHAPTER 05. Ha of site preparation and planting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
05.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 40 cm. Or by manually performing hole digging holes of 40x40x40 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$1.39	500.00	$692.94
05.02	Ud. Manual planting, including cover and carrying a small tree surround below 50 cm in diameter, on slopes less than 50%, including plant layout, or micro watershed if slope greater than 15%.	$0.69	500.00	$347.21
05.03	Ut. Forest plant in container 1 year seedling of Quercus calliprinos.	$1.11	100.00	$110.50
05.04	Ut. Forest plant in container 1 year seedling of Stirax officinalis.	$1.11	100.00	$110.50
05.05	Ut. Forest plant in container 1 year seedling of Pinus brutia.	$1.11	100.00	$110.50
05.06	Ut. Forest plant in container 1 year seedling of Pinus pinea.	$1.11	100.00	$110.50
05.07	Ut. Forest plant in container 1 year seedling of Rhus coriaria.	$1.11	50.00	$55.25
05.08	Ut. Forest plant in container 1 year seedling of Rosa canina.	$1.11	50.00	$55.25
			CHAPTER 05:	$1,592.65
			UNIT:	$3.19

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.50	$346.47	0.50	$346.47	0.00	$0.00	1.00	$692.94
0.50	$173.61	0.50	$173.61	0.00	$0.00	1.00	$347.21
0.50	$55.25	0.50	$55.25	0.00	$0.00	1.00	$110.50
0.50	$55.25	0.50	$55.25	0.00	$0.00	1.00	$110.50
0.50	$55.25	0.50	$55.25	0.00	$0.00	1.00	$110.50
0.50	$55.25	0.50	$55.25	0.00	$0.00	1.00	$110.50
0.50	$27.63	0.50	$27.63	0.00	$0.00	1.00	$55.25
0.50	$27.63	0.50	$27.63	0.00	$0.00	1.00	$55.25
	$796.33		$796.33		$0.00		$1,592.65

AREA 5 CHAPTER 06. M2 of site preparation and planting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
06.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 40 cm. Or by manually performing hole digging holes of 40x40x40 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$1.39	1450.00	$2,009.53
06.02	Ud. Manual planting, including cover and carrying a small tree surround below 50 cm in diameter, on slopes less than 50%, including plant layout, or micro watershed if slope greater than 15%.	$0.69	1450.00	$1,006.91
06.03	Ut. Forest plant in container 1 year seedling of Populus bolleana.	$1.11	1000.00	$1,105.00
06.04	Ut. Forest plant in container 1 year seedling of Fraxinus syriacus.	$1.11	150.00	$165.75
06.05	Ut. Forest plant in container 1 year seedling of Celtis australis.	$1.11	150.00	$165.75
06.06	Ut. Forest plant in container 1 year seedling of Ulmus minor.	$1.11	150.00	$165.75
			CHAPTER 06:	$4,618.69
			UNIT:	$3.19



Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.00	$0.00	0.725	$1,456.91	0.725	$1,456.91	1.45	$2,913.82
0.00	$0.00	0.725	$730.01	0.73	$730.01	1.45	$1,460.02
0.00	$0.00	0.725	$801.13	0.73	$801.13	1.45	$1,602.25
0.00	$0.00	0.725	$120.17	0.73	$120.17	1.45	$240.34
0.00	$0.00	0.725	$120.17	0.73	$120.17	1.45	$240.34
0.00	$0.00	0.725	$120.17	0.73	$120.17	1.45	$240.34
	$0.00		$3,348.55		$3,348.55		$6,697.10

AREA 6 CHAPTER 07. Ha of site preparation and planting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
07.01	Ut. Site preparation in staggered rows using mechanical auger of 12 cm in diameter. Will have a truncated pyramid shape, with an upper base of 40 cm, a bottom of 30 cm and a height of 40 cm. Or by manually performing hole digging holes of 40x40x40 cm depth and 20x20 cm and at the bottom with hoe, shovel, pick or similar in transition field and slope less than 50%.	$1.39	1000.00	$1,385.88
07.02	Ud. Manual planting, including cover and carrying a small tree surround below 50 cm in diameter, on slopes less than 50%, including plant layout, or micro watershed if slope greater than 15%.	$0.69	1,000.00	$694.42
07.03	Ut. Forest plant in container 1 year seedling of Origanum syriacum.	$1.11	225.00	$248.63
07.04	Ut. Forest plant in container 1 year seedling of Salvia fruticosa.	$1.11	225.00	$248.63
07.05	Ut. Forest plant in container 1 year seedling of Thymbra spicata.	$1.11	75.00	$82.88
07.06	Ut. Forest plant in container 1 year seedling of Lavandula officinalis.	$1.11	75.00	$82.88
07.07	Ut. Forest plant in container 1 year seedling of Rhus coriaria.	$1.11	75.00	$82.88
07.08	Ut. Forest plant in container 1 year seedling of Rosa canina.	$1.11	75.00	$82.88
07.09	Ut. Forest plant in container 1 year seedling of Gundelia tournefortii.	$1.11	75.00	$82.88
07.10	Ut. Forest plant in container 1 year seedling of Amygdalus communis.	$1.11	75.00	$82.88
07.11	Ut. Forest plant in container 1 year seedling of Ziziphus jujuba.	$1.11	50.00	$55.25
07.12	Ut. Forest plant in container 1 year seedling of Crataegus azarolus.	$1.11	50.00	$55.25
			CHAPTER 07:	$3,185.34
			UNIT:	$3.19

AREA 6 CHAPTER 08. Ut. of irrigation and fog catchers

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
08.01	Ud. Material and installation of fog catchers system comprising: collecting screen 18 m2 (9x2 m), 3 tanks of 1.000 liters each, filter, programmer with battery, general pipe, dripper line with emitters every each 3040/ cm, for 2,000 m2	$2,295.45	1.00	$2,295.45
			CHAPTER 06:	$4,618.69
			UNIT:	$3.19

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.00	$0.00	1.00	$1,385.88	1.00	$1,385.88	2.00	$2,771.77
0.00	$0.00	1.00	$694.42	1.00	$694.42	2.00	$1,388.84
0.00	$0.00	1.00	$248.63	1.00	$248.63	2.00	$497.25
0.00	$0.00	1.00	$248.63	1.00	$248.63	2.00	$497.25
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$82.88	1.00	$82.88	2.00	$165.75
0.00	$0.00	1.00	$55.25	1.00	$55.25	2.00	$110.50
0.00	$0.00	1.00	$55.25	1.00	$55.25	2.00	$110.50
	$0.00		$3,185.30		$3,185.30		$6,370.61

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.00	$0.00	1.00	$2,295.45	1.00	$2,295.45	1.45	$2,913.82
	$0.00		$3,348.55		$3,348.55		$6,697.10

AREA 7 CHAPTER 09. Ha of silvicultural treatment in Dalboun

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
09.01	Ha. Cut of material from silvicultural treatment of coppice oak forests, with a density of 1,000 scrubs/ ha, cutting all saplings of each scrubs except the most important. Extraction of cut material to the runway for later use. Slope area less than 20%.	$6,979.27	1.00	$6,979.27
			CHAPTER 09:	$6,979.27
			UNIT:	$6,979.27

AREAS: 1, 2, 3, 4, 5, 6 and 7 CHAPTER 10: Signposting

Key	UNIT OF WORK	PRICE UT.	Nº UT.	AMOUNT
10.01	Ut. Construction signpost of extruded aluminum with panel 1, 0 x0, 8 m, 2 support posts, screws, excavating and concreting, set to design and content of the Identity Manual of the Shouf Biosphere Reserve.	245.78 €	1.00	245.78 €
			CHAPTER 07:	$245.78
			UNIT:	$245.78

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.00	$0.00	0.05	$348.96	1.00	$6,979.27	1.05	$7,328.23
	$0.00		$348.96		$6,979.27		$7,328.23

Nº UT. 2012	TOTAL AMOUNT 2012	Nº UT. 2013	TOTAL AMOUNT 2013	Nº UT. 2014	TOTAL AMOUNT 2014	Nº UT. TOTALS	TOTAL AMOUNT
0.00	$0.00	7.00	$1,720.46	0.00	$0.00	7.00	$1,720.46
	$0.00		$1,720.46		$0.00		$1,720.46

AREAS: 1, 2, 3, 4, 5, 6 and 7

CHAPTER 10: Signposting

		2012	2013	2014
AREA 1	CHAPTER 01. Ha of site preparation and sowings	$321.13	$4,654.04	$2,327.02
AREA 2	CHARTER 02. Ha of site preparation and planting	$1,879.33	$31,853.05	$7,963.26
AREA 3	CHAPTER 03. Ha of fenced plots installation, site preparation and planting	$913.63	$12,790.77	$0.00
AREA 4	CHAPTER 04. Ha of site preparation and sowing	$429.15	$429.15	$0.00
AREA 4	CHAPTER 05. Ha of site preparation and planting	$796.33	$796.33	$0.00
AREA 5	CHAPTER 06. M2 of site preparation and planting	$0.00	$3,348.55	$3,348.55
AREA 6	CHAPTER 07. Ha of site preparation and planting	$0.00	$3,185.30	$3,185.30
AREA 6	CHAPTER 08. Ut. of irrigation and fog catchers	$0.00	$2,295.45	$2,295.45
AREA 7	CHAPTER 09. Ha of silvicultural treatment in Dalboun	$0.00	$348.96	$6.979.27
AREAS: 1, 2, 3, 4, 5, 6 and 7	CHAPTER 10: Signposting	$0.00	$1,720.46	$0.00
	AUGERS	$1,140.00	$2,280.00	$0.00
	SUBTOTAL	$4,339.56	$61,422.06	$26,098.85
	AUGER BUYING	$1,140.00	$2,280.00	$0.00
	TOTAL in final project:	$5,479.56	$63,702.06	$26.098.85
		5.8%	66.9%	27.4%
	INITIAL Ha in project	12.00	20.00	12.00
	FINAL Ha in project	2.46	33.28	9.73
	BUDGET/Ha initial project	$2,159.00	$2,159.00	$2,159.00
	BUDGET/Ha final project	$2,231.09	$1,914.41	$2,683.69
	TOTAL in initial project	$25,908.00	$43,180.00	$25,908.00
		27.3%	45.5%	27.3%

5.2. SCHEDULE OF PERFORMANCES AND EXPENSES

OPERATION	YEAR 2012								
	FEB	MAR	APR	MAY	JUN	SEP	OCT	NOV	DEC
CHAPTER 01. Site preparation							61.45	61.45	30.73
CHAPTER 01. Sowings								83.75	83.75
CHAPTER 02. Site preparation							327.07	327.07	163.53
CHAPTER 02. Planting								637.00	424.66
CHAPTER 03. Fenced plots installation						265.70	265.70		
CHAPTER 03. Site preparation							66.52	66.52	33.26
CHAPTER 03. Planting								129.56	86.37
CHAPTER 04. Site preparation							55.66	55.66	27.83
CHAPTER 04. Sowings								174.00	116.00
CHAPTER 05. Site preparation							138.59	138.59	69.29
CHAPTER 05. Planting								269.91	179.94
CHAPTER 06. Site preparation							-	-	-
CHAPTER 06. Planting								-	-
CHAPTER 07. Site preparation		-	-	-					
CHAPTER 07. Planting			-	-					
CHAPTER 08. Irrigation and fog catchers		-							
CHAPTER 09. Silvicultural treatment	-	-							
CHAPTER 10: Signposting						-	-		
AUGERS									1,140.00
TOTAL MONTHLY	$0.00	$0,00	$0,00	$0,00	$0,00	$265,70	$914,99	$1,943,51	$2,355,37
$5,479.56									

OPERATION	YEAR 2013								
	FEB	MAR	APR	MAY	JUN	SEP	OCT	NOV	DEC
Chapter 01. Site preparation							890.58	890.58	445.29
Chapter 01. Sowings								1,213.79	1,213.79
Chapter 02. Site preparation							5,543.53	5,543.53	2,771.77
Chapter 02. Planting								10,796.53	7,197.69
Chapter 03. Fenced plots installation						3,719.73	3,719.73		
Chapter 03. Site preparation							931.31	931.31	465.66
Chapter 03. Planting								1,813.82	1,209.21
Chapter 04. Site preparation							55.66	55.66	27.83
Chapter 04. Sowings								174.00	116.00
Chapter 05. Site preparation							138.59	138.59	69.29
Chapter 05. Planting								269.91	179.94
Chapter 06. Site preparation							582.76	582.76	291.38
Chapter 06. Planting								1,134.98	756.66
Chapter 07. Site preparation							554.35	554.35	277.18
Chapter 07. Planting								1,079.65	719.77
Chapter 08. Irrigation and fog catchers							2,295.45		
Chapter 09. Silvicultural treatment	174.48	174.48							
Chapter 10: signposting						1,032.27	688.18		
Augers					2,280.00				
Total monthly	$174.48	$174.48	$0.00	$0.00	$2,280.00	$4,752.01	$15,400.16	$25,179.48	$15,741.45
$63,702.06									

OPERATION	YEAR 2014								
	FEB	MAR	APR	MAY	JUN	SEP	OCT	NOV	DEC
Chapter 01. Site preparation							445.29	445.29	222.65
Chapter 01. Sowings								606.89	606.89
Chapter 02. Site preparation							1,385.88	1,385.88	692.94
Chapter 02. Planting								2.,99.13	1,799.42
Chapter 03. Fenced plots installation						-	-		
Chapter 03. Site preparation							-	-	-
Chapter 03. Planting								-	-
Chapter 04. Site preparation							-	-	-
Chapter 04. Sowings								-	-
Chapter 05. Site preparation							-	-	-
Chapter 05. Planting								-	-
Chapter 06. Site preparation							582.76	582.76	291.38
Chapter 06. Planting								1,134.98	756.66
Chapter 07. Site preparation		554.35	554.35	277.18					
Chapter 07. Planting			1,079.65	719.77					
Chapter 08. Irrigation and fog catchers		2,295.45							
Chapter 09. Silvicultural treatment	3,489.63	3,489.63							
Chapter 10: signposting						-	-		
Augers					-				
Total monthly	$3,489.63	$6,339.44	$1,634.01	$996.95	$0.00	$0.00	$2,413.94	$6,854.95	$4,369.94
$26,098.85									

5.3. SEED COLLECTION CALENDAR

SEED COLLECTION CALENDAR											
SPECIES	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY
Acer tauricolum							■	■			
Berberis libanotica					■	■					
Cedrus libani								■	■		
Celtis australis								■	■		
Cotoneaster nummularia							■				
Crataegus azarolus							■	■			
Crataegus monogyna						■	■				
Fraxinus syriacus							■	■			
Gundelia tournefortii					■	■					
Juniperus drupacea								■	■		
Juniperus oxycedrus								■	■		
Lavandula officinalis					■	■					
Lonicera nummulariifolia						■	■				
Micromeria myrtifolia				■	■						
Origanum syriacum				■	■						
Populus bolleana											WINTER CUTTING
Prunus prostrata						■	■				

SEED COLLECTION CALENDAR

SPECIES	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY
Prunus ursina											
Pyrus syriaca											
Quercus brantii subsp. look											
Quercus calliprinos											
Quercus infectoria											
Rhus coriaria											
Rosa canina											
Rosa glutinosa											
Salix alba									WINTER	CUTTING	
Salvia fruticosa ("triloba")											
Sorbus flabellifolia											
Sorbus torminalis											
Styrax officinalis											
Thymbra spicata											
Ulmus minor											
Zizyphus jujuba											

5.4. PRETREATMENTS AND SOWING TIME

Species	September	October	November	December	January	February	MARCH
Acer tauricolum							
Berberis libanotica							
Cedrus libani							
Celtis australis							
Cotoneaster nummularia							
Crataegus azarolus							
Crataegus monogyna							
Fraxinus syriacus							
Gundelia tournefortii							
Juniperus drupacea			Boiling water				
Juniperus oxycedrus							
Lavandula officinalis						GA3	
Lavandula officinalis							
Lonicera nummulariifolia							
Micromeria myrtifolia							
Origanum syriacum							
Populus bolleana							
Prunus dulcis							
Prunus prostrata							
Prunus ursina							
Pyrus syriaca							
Quercus brantii subsp. look							
Quercus calliprinos							
Quercus infectoria							
Rhus coriaria				Boiling water			
Rosa canina							
Rosa glutinosa							
Salix alba							
Salvia fruticosa (="triloba")							
Sorbus flabellifolia							
Sorbus torminalis							
Styrax officinalis							
Thymbra spicata							
Ulmus minor							
Zizyphus jujuba							

Cold stratification (cs) Warm stratification (ws) Alternance of cs and ws Sowing time Cuttings

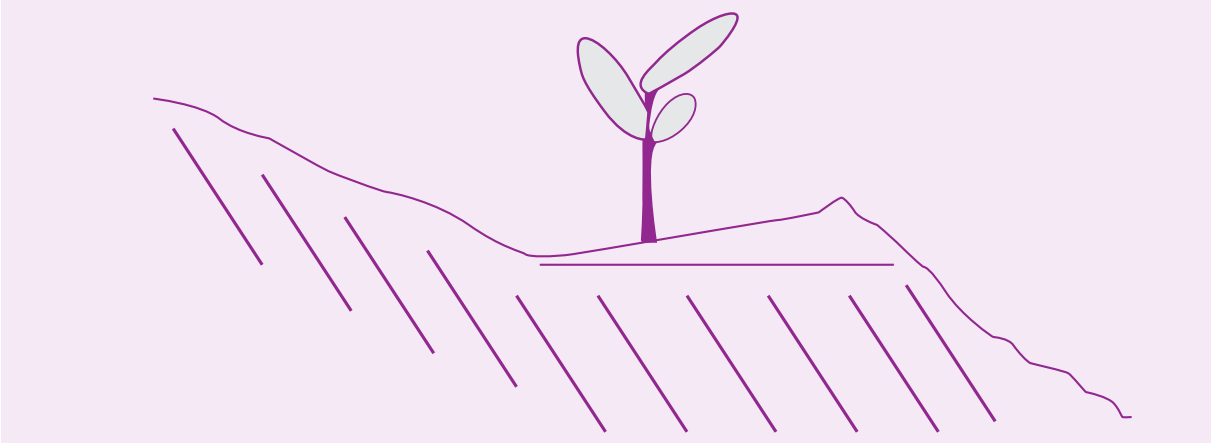
APRIL	MAY	JUNE	JULY	Pre-treatment
				CS(2 months)
				CS(2- 4 months)
				CS(1 - 1.5months)
				CS(3 months)
				Sow without pretreatment
				WS(1- 2) + CS(3- 4 months)
				WS(2weeks)+CS(6weeks)+WS(2weeks)+CS(2weeks)+WS(2weeks)+CS (10weeks)
				CS(2- 3 months)
				Sow without pretreatment
				Boiling water(5- 6")+CS(3 months)+WS(2)+CS(3)
				WS(2) + CS(3 - 4 months)
				Gibberellic Acid (GA3) 500 mg/l (24h)
				Spring or Autumn cuttings
				CS(1 month)
				Sow without pretreatment
				Sow without pretreatment
				Winter cuttings
				CS(2 months)
				CS(3- 4 months)
				WS(1) + CS(3- 4 months)
				CS(3 -4 months)
				Sow without pretreatment
				Sow without pretreatment
				Sow without pretreatment
				Bowling Water(5mn)+CS(12-months)
				WS(2) + CS(3- 4months)
				WS(2) + CS(3 -4 months)
				Winter cuttings
				Sow without pretreatment
				CS(3 months)
				CS(3- 4 months)
				CS(2- 4 months)
				Sow without pretreatment
				Sow without pretreatment
				CS(2- 4 months)

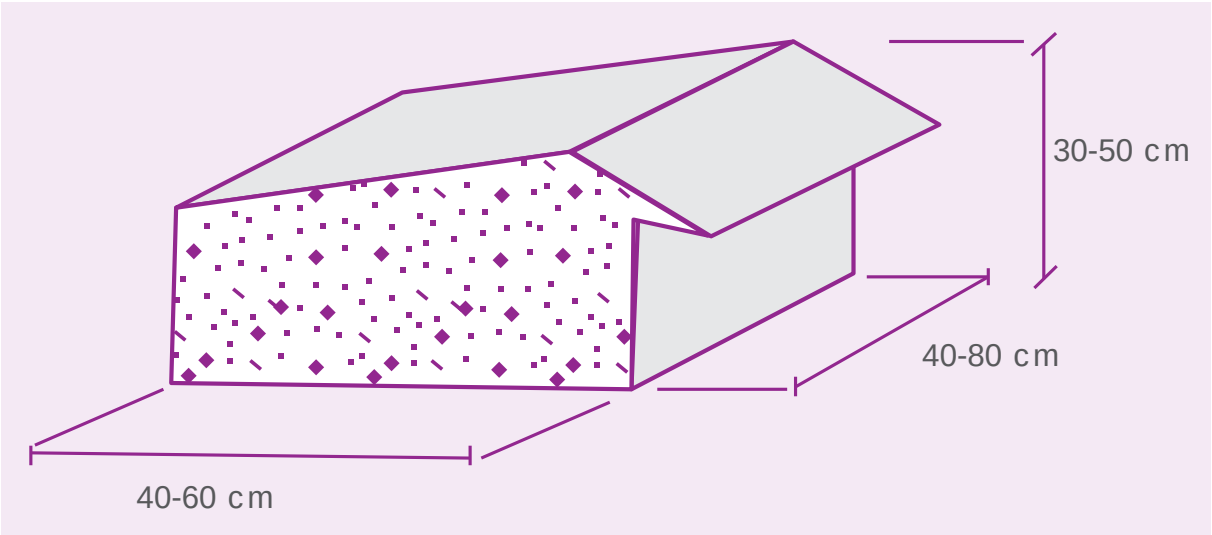
5.5. TOTAL SEEDLINGS AND SEEDS

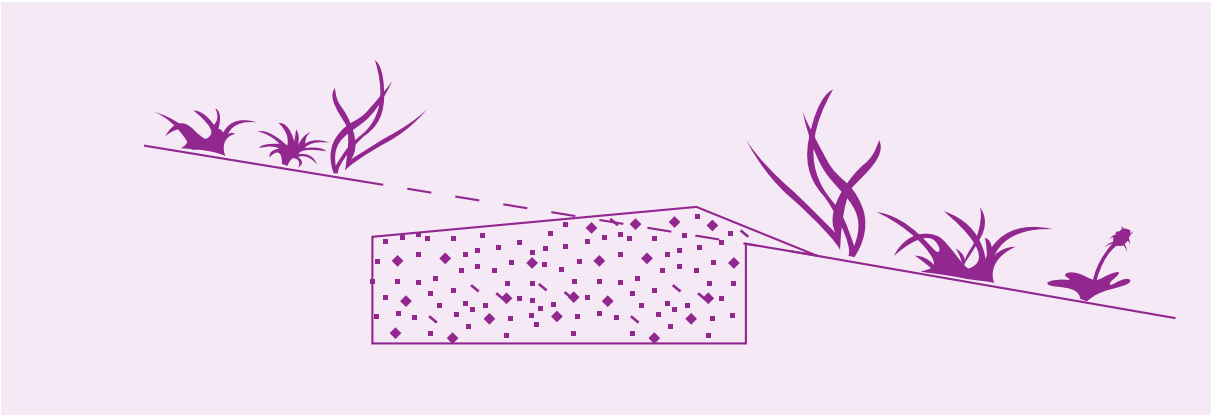
Total seedlings and seeds. YEAR 2 - 3			
SPECIES	TOTAL SEEDLINGS	SEEDLINGS YEAR 2 (Winter 2013)	SEEDLINGS YEAR 3 (Winter 2014)
Acer tauricolum	800	675	125
Berberis libanotica	375	300	75
Cedrus libani	6,875	5,500	1,375
Celtis australis	150	75	75
Cotoneaster nummularia	375	300	75
Crataegus azarolus	900	725	175
Crataegus monogyna	105	105	0
Fraxinus syriacus	150	75	75
Gundelia tournefortii	150	75	75
Lavandula officinalis	150	75	75
Lonicera nummulariifolia	375	300	75
Origanum syriacum	450	225	225
Pinus brutia	50	50	0
Pinus pinea	50	50	0
Populus bolleana	1,000	500	500
Prunus Dulcis	150	75	75
Prunus ursina	835	710	125
Pyrus syriaca	0	0	0
Quercus brantii subsp. look	1,000	800	200
Quercus calliprinos	155	155	0
Quercus infectoria	420	420	0
Rhus coriaria	175	100	75
Rosa canina	280	205	75
Salvia fruticosa (=«triloba»)	450	225	225
Sorbus flabellifolia	835	710	125
Sorbus torminalis	800	675	125
Styrax officinalis	425	350	75
Thymbra spicata	150	75	75
Ulmus minor	150	75	75
Zizyphus jujuba	100	50	50
Seedlings total quantity	**17,880**	**13,655**	**4,225**

SEEDS (kg)			
SPECIES	TOTAL SEEDS	SEEDS YEAR 2 (Winter 2013)	SEEDS YEAR 3 (Winter 2014)
Quercus brantii subsp. look	144	96	48
Quercus calliprinos	6	6	0

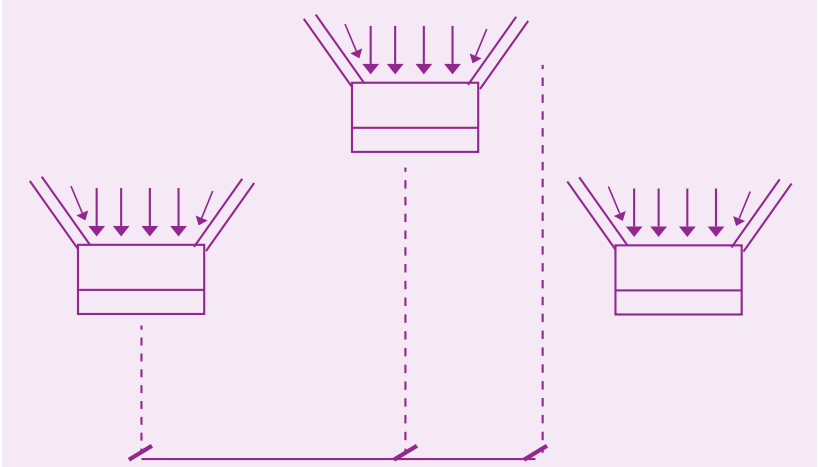
Annex 1.Building a microwatershed for collecting runoff water to increase the survival of the young plants







If the planting holes are staggered in their layout more runoff will be collected as shown in the following image:



Annex 2 - The main species used in the Restoration Project

Aceraceae

Acer tauricolum Boiss. & Bal • Taurus maple • Erable du Taurus
Distribution: East Mediterranean Region.
Range in Lebanon: 1000 - 1900 m above sea level.
Flowering time: March-May.

Anacardiaceae

Rhus coriaria L. • Tanner's sumach • Sumac des corroyeurs
Distribution: South and Middle Europe, South Russia, Caucasus, Turkey, Syria, Lebanon and Palestine.
Range in Lebanon: 0 - 1600m above sea level.
Flowering time: April - June.

Asteraceae

Gundelia tournefortii L • Tournefort's gundelia • Gundélie de Tournefort
Distribution: Turkey, Syria, Lebanon, Palestine, Jordan, Iraq, Iran, Armenia and Cyprus.
Range in Lebanon: Waste grounds and Mountains.
Flowering time: April – May.

Berberidaceae

Berberis libanotica Ehrenb • Lebanon barberry • Berbéris du Liban
Distribution: Lebanon and Syria.
Habitat: Mountains, 1400 - 1600 m above sea level.
Flowering time: May – June.
Medicinal Plant / Endemic species.

Caprifoliaceae

Lonicera nummulariifolia Jaub. & Spach• Nummular-leaved honeysuckle • Chèvrefeuille à feuilles nummulaires
Distribution: Turkey, Syria, Lebanon, Iraq and Iran.
Habitat: Rocky places at mountains.
Flowering time: June – July.

Cannabaceae

Celtis Australis • Mediterranean hackberry • micocoulier
Distribution: Southern Europe, North Africa and Asia Minor.
Range in Lebanon: 500 - 2,500 m above sea level.
Flowering time: March-April.
Medicinal, edible fruits, ornamental, air pollution resistant

Cupressaceae

Cupressus sempervirens L. • Evergreen cypress • cyprès toujours vert
Distribution: Mediterranean region, Iran
Range in Lebanon: 0 - 1700m above sea level.
Flowering time: Spring.

Cupressaceae

Juniperus drupacea • Syrian juniper • Genévrier de Syrie
Distribution: Southern Greece, southern Turkey, western Syria and Lebanon.
Range in Lebanon: 800 - 1,700 m above sea level.
Flowering time: March-May.

Ericaceae

Arbutus andrachne L • Oriental strawberry-tree • Arbousier d'Orient
Distribution: Mediterranean Region and around Black Sea.
Range in Lebanon: 500 - 1500m above sea level, woodlands.
Flowering time: December - March.

Fabaceae

Cercis siliquastrum L • Judas tree • Arbre – de – Judée
Distribution: South Europe, West Asia and Mediterranean Region.
Range in Lebanon: 0 – 1200m above sea level.
Flowering time: February - April.

Fagaceae

Quercus brantii, ssp. look (Ky) Mouterde • Brant's oak • Chêne de Brant
Distribution: Iran, Iraq, Turkey, Kurdistan, Syria and Lebanon.
Range in Lebanon: 1400 - 1800m above sea level.
Flowering time: April - May.

Fagaceae

Quercus calliprinos Webb • Kermes oak • Chêne kermès
Distribution: Turkey, Syria, Lebanon and Palestine.
Range in Lebanon: : 0 - 1500 m above sea level.
Flowering time: February - April.

Fagaceae

Quercus infectoria Oliv • Cyprus oak • Chêne tinctorial
Distribution: Mediterranean Region.
Range in Lebanon: 500 - 1500m above sea level.
Flowering time: March - April.

Lamiaceae

Origanum siryacum L • Syrian marjoram • Origan de Syrie
Distribution: Eastern Mediterranean Region.
Range in Lebanon: 100 - 800 m above sea level.
Flowering time: May -July.
Culinary and medicinal properties

Pinaceae

Cedrus libani L • Cedar of Lebanon • Cèdre du Liban
Distribution: Lebanon, Syria, South Turkey.
Range in Lebanon:1200 - 1900 m above sea level.
Flowering time: Autumn.
Medicinal plant Trees
Al-Shouf Cedar Nature Reserve

Pinaceae

Pinus brutia Ten. • Calabrian pine • Pin de Calabre
Distribution: Balkan, Greece, Cyprus, Turkey, Syria, Lebanon and Caucasus.
Range in Lebanon: 0 - 1500m above sea level .
Flowering time: Spring.

Pinaceae

Pinus pinea L.• Stone pine • Pin pignon
Distribution: Mediterranean Region.
Range in Lebanon: 0 – 1400m above sea level.
Flowering time: April.

Rosaceae

Cotoneaster nummularia Fisch. & Mey•Nummular cotoneaster • Cotonéastre nummulaire
Distribution: North Africa, Turkey, North Iran, Turkestan, North India and Lebanon.
Habitat: Rocky grounds in mountains.
Flowering time: May – June.

Rosaceae

Crataegus azarolus L • Common azarole • Azerolier
Distribution: South Europe, Turkey, Cyprus, Caucasus, Iraq, Iran, Syria, Lebanon and Palestine.
Range in Lebanon: 01600- m above sea level.
Flowering time: March – May

Rosaceae

Crataegus monogyna Jacqu • One-styled hawthorn • Aubépine à un style
Distribution: Europe, North Africa, West Asia and North West India.
Range in Lebanon: 0 - 1300 m above sea level.
Flowering time: March - May.

Rosaceae

Pirus syriaca Boiss • Syrian pear • Poirier de Syrie
Distribution: Turkey, Iraq, Syria, Lebanon, Palestine and Jordan.
Range in Lebanon: 400 - 1300m above sea level.
Flowering time: February - May.

Rosaceae

Prunus dulcis • almond • amande
Distribution: Middle East, eastwards to the Indus
Range in Lebanon: 0 - 1,000 m above sea level.
Flowering time: : January-March.
Culinary and medicinal properties

Rosaceae

Prunus prostrata Labill • Prostrate cherry • Cerisier couché
Distribution: Spain, North Africa, Balkan, Caucasus, Turkey, Lebanon, Syria, Iraq and Iran.
Habitat: Rocks at high mountains.
Flowering time: April – May.

Rosaceae

Prunus ursina Ky • Bear plum • Prunier des ours
Distribution: Turkey, Syria and Lebanon.
Range in Lebanon: 0 - 2800m above sea level.
Flowering time: March – May.

Rosaceae

Rosa Canina L• Dog rose • Rosier des chiens
Distribution: Europe, North Africa, and West Asia.
Range in Lebanon: 800 - 1,700 m above sea level.
Flowering time: May-July.

Rosaceae

Sorbus flabellifolia (Spach) C.K. Schneider • Fan–leaved service tree • Sorbier à feuilles en éventail
Distribution: Turkey, Syria, Lebanon and Iran.
Range in Lebanon: 1300 - 1800m above sea level.
Flowering time: March – June.

Rosaceae

Sorbus torminalis (L.) Crantz • Wild service-tree • Sorbier torminal
Distribution: South and Middle Europe, Balkan, Caucasus and Mediterranean Region.
Range in Lebanon: 1000 - 2000 m above sea level.
Flowering time: April - May.

Styracaceae

Styrax officinalis L • Storax • Aliboufier officinal
Distribution: Mediterranean Region.
Range in Lebanon: 500 - 1700m above sea level .
Flowering time: March - May.
Medicinal (Flower), Poisonous (Fruit)