

## IDENTIFICATION OF BEST MANAGEMENT ALTERNATIVES FOR SHRUB FORMATIONS IN ALBANIA

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### Abstract:

Mediterranean scrublands occur naturally in the Mediterranean forests, woodlands, and scrub biomes, located in the five Mediterranean climate regions of the world. The Albania National Forest Inventory has identified two distinctive categories of shrub forest in Albania, respectively Mediterranean macchia (220'000 ha) and Maquis and garigue (139'000 ha). Management of scrub needs careful planning, especially where it has to be integrated with other habitats and features of interest. Management planning ensures that decisions are based on a full audit and evaluation of all management issues, including the conservation interest, landscape, economic benefits and traditional uses.

**Keywords:** Mediterranean machia, shrub management, grazing, firewood, financial analysis

### 1. Introduction

Shrubland, scrubland, scrub or brush is a plant community characterized by vegetation dominated by shrubs, often also including grasses, herbs, and geophytes. Shrubland may either occur naturally or be the result of human activity [1]. It may be the mature vegetation type in a particular region and remain stable over time, or a transitional community that occurs temporarily as the result of a disturbance, such as fire. A stable state may be maintained by regular natural disturbance such as fire or browsing [1, 4].

In botany and ecology a shrub is defined as a much-branched woody plant less than 8 m high and usually with many stems. Tall shrubs are mostly 2–8 m high; small shrubs 1–2 m high; subshrubs less than 1 m high. In some places shrubland is the mature vegetation type, and in other places the result of degradation of former forest or woodland by logging or overgrazing, or disturbance by major fires [7].

Mediterranean scrublands occur naturally in the Mediterranean forests, woodlands, and scrub biomes,

located in the five Mediterranean climate regions of the world. Scrublands are most common near the seacoast, and have often adapted to the wind and salt air of the ocean. Low, soft-leaved scrublands around the Mediterranean Basin are known as “garrigue” in France, “phrygana” in Greece, “tomillares” in Spain, and “batha” in Israel [4].

Shrub formations cover a significant area in Albania. Existing data are insufficient and often incongruent just because of different definitions of shrub formations used. In order to have an estimate of the area covered by shrub formations in Albania we have used data from two important projects dealing with land cover issues. One is the Corine Land Cover 2000 Project (EEA) and the other is the Albania National Forest Inventory finalized in 2004.

The Corine Land Cover 2000 Project [5] has identified about 730'176 ha in three categories of shrub formations. Further validation and clarification of this estimate shows that may be it includes under shrub formation data on abandoned agriculture lands, already under natural regeneration.

**Table 1:** Area covered by shrub formations in Albania

Shrub category	Corine Legend code	Area (ha)
Moors and heathland	3.2.2	36'349.24
Sclerophilus vegetation	3.2.3	373'068.99
Transitional woodland/shrub	3.2.4	320'757.27
Total		730'175.50

Source: Corine Land Cover 2000 (EEA 2009)

The Albania National Forest Inventory, implemented through a two-phase stratified sampling procedure on the basis of satellite interpretation, and field work inventory, has identified two distinctive categories of shrub forest in Albania, respectively Mediterranean macchia (220'000 ha) and Maquis and garigue (139'000 ha) [6]. These two categories cover about 360'000 ha. In addition to these two distinctive shrub vegetation types, ANFI has identified three types of mixed land cover classes which in a certain level can still be classified as shrub open forests. These categories cover more than 210'000 ha, and since the majority is degraded coppice forest there is a great potential for the establishment of forests in these lands.

## 2. Material and Methods

The identification of shrub management options for Albania, should consider carefully the needs and capacities of the authorities responsible for the management of these areas, which include both forest service and the communes where forests area are transferred. For each management option, as described in the above chapters, it is necessary to estimate not only the benefits of the interventions but also the risks and costs for implementing these management options.



Source: Albanian National Forest Inventory 2004

**Figure 1:** Map of shrub distribution in Albania [6]

Albania forest literature on shrub management, as well as the tradition is very limited. To be able to have a long term strategy on scrub management it is necessary to identify and learn from the wrong deforestation practices in the socialist era, and propose ways of creating and maintaining the ecological balance.

On the identification of shrub management options we tried to follow the principle of “achieving most benefits with less costs in the shortest time possible without degrading the resource”. This principle is important in countries like Albania where shrubs are expected to provide some contributions to the economy without jeopardizing the other ecological functions of they carry out.

Considering the real situation of shrub formations in Albania, which cover almost one third of the country forest area, there is some potential to provide the following goods and services:

Fuel wood and construction timber:

On areas covered by oak species (*Quercus petraea*, *Q. pubescens*, *Q. frainetto*, *Q. cerris*, *Ostrya carpinifolia*, *Carpinus orientalis*) on altitudes higher than 600-800 m managed as regular or irregular (as result of illegal cuttings) coppice which still have some important volume and if growing older (60-70 years) could produce some medium size industrial round wood;

on dense Mediterranean machia areas (most suitable areas for machia regarding soil conditions) with a considerable standing volume that have not been damaged by human activities yet;

Grazing sites:

on degraded areas sparsely covered by oak species, with limited standing volume (if coppiced these areas could be transformed to regular coppice as described above but his requires considerable investments for coppicing and afforestations as well as the protection from grazing for several years (at least 3-5 years), and a long waiting time (25 years) to provide some important timber)

on degraded Mediterranean machia areas which have been continuously grazed and has no or limited timber volume and are mixed with pasture areas.

on woodlands, with sparse shrub cover where the herbaceous cover is dominant

Analyzing the results of the field surveys, in cooperation with the Forest and Pasture User Association, we have identified five potential sites for to be used as trials to represent each of these categories

and proposed management options that are appropriate for each category. On each site we have described the actual situation as well as proposed possible management options for improving the situation and generation of incomes for local communities. The sites are as following:

The first trial in Krraba, (road from Tirana to Elbasan) consists of two sites located close to each other (under and over the land slide location) representing typical Mediterranean machia in relatively good soil and climate conditions, with extensive cover but limited volume due to continuous cuttings. This trial represents the areas classified as Mediterranean machia (2MM) by ANFI covering an area of 220'096 ha at national level.

The second trial is located on the upper part of Krraba and consist of broadleaved forests dominated by sparse coppiced oak species mixed with heavily grazed shrub shaped trees and grasslands or arable lands. It represents one of the mixed shrubs category of the ANFI (CXB) which normally occurs at the border of shrub vegetation zone and oak vegetation zone and covering about 119'021 ha at national level. This category includes the majority of degraded oak forest areas that once were managed as coppice forest but nowadays due to continuous human pressure seems like shrub vegetation.

The third trail site is located at "Plazhi i Gjeneralit", at the coastal area of Kavaja district. It represents the garrigue vegetation with low growing shrub species that are under continuous pressure from animal grazing and climate conditions and have no potential for any valuable timber production. This trial represents the maquis and garrigue category identified by ANFI (2MG) covering an area of about 139'000 ha at national level.

The fourth trail is located on the lower slopes of Karaburun called "Brinjat e fushës". It consists mainly on garrigue formations covering less than 30% of the area (mainly on steep slopes and rocky areas) preserved for the protection of the soil and with no potential for any timber production, surrounded by areas of summer pastures with some agriculture terrains within it. It represents one of the mixed shrubs category of the ANFI (CXM) covering an area of about 70'340 ha, at national level.

The fifth trail site is located at "Lagjia e Hamitajve" Karaburun. This is the upper area of machia vegetation dominated by oak species (in this case *Quercus macrolepis* and *Quercus ilex*) covering less than 30 % of the area, while the rest of the area is

used as summer pasture for many years. It represents one of the mixed shrubs category of the ANFI (MXB) covering an area of about 21'628 ha, at national level.

### 3. Results and Discussion

Management of scrub needs careful planning, especially where it has to be integrated with other habitats and features of interest [2]. Management planning ensures that decisions are based on a full audit and evaluation of all management issues, including the conservation interest, landscape, archaeology, amenity value and access as well as health & safety [3, 4].

The management plan should set priorities and SMART objectives (Specific, Measurable, Achievable, Relevant, Timebound) and describe how these will be achieved. It is important to monitor the impact of the work and review plans in light of the monitoring results [3]. A management plan is a useful framework for consultation with statutory agencies as well as local interest groups and taxonomic specialists [4]. The techniques to be used on a particular site will depend on the objectives for the site, an assessment of the status of scrub on the site and the particular local conditions determining what the most practical option is.

Table 2 shows the range of techniques that can be used to meet each management objective; some techniques can be used to achieve more than one objective, and some will be used in combination to achieve a single objective [3].

#### 3.1. Description of main management techniques

Natural regeneration: Natural regeneration is effective in encouraging the expansion of scrub stands where there is an existing proximate seed source or the desired species have suckering roots, and no constraint on their development. This encourages natural spatial distribution and promotes local genotypes. Large open areas will be colonised only slowly unless there are species with wind blown seed locally. Where necessary, the ground may need preparation in order to create a seedbed, by either removing or breaking up competing vegetation or scarifying the ground to encourage rooting. This can be through using livestock, manual or mechanical methods. Ground scarification can encourage weed species so precautions may be necessary.

**Table 2:** A summary of techniques applicable to the main management objectives

Management techniques		Applicable to							
		Enhance				Maintain			
		Increase extent	Improve quality	Manage scrub stands	Manage dynamic mosaics	Manage scrub stands	Manage dynamic mosaics	Reduce	Eradicate
Natural regeneration		✓	✓	✓	✓	✓	✓		
Afforestation	Protect from browsing	✓	✓						
	Reduce browsing	✓	✓						
	Grazing - reduce competition	✓			✓		✓		
	Ground scarification	✓							
	Planting	✓							
Browsing - diversify structure			✓	✓		✓			
Browsing - control scrub				✓	✓	✓	✓	✓	✓
Grazing - reduce competition		✓	✓	✓	✓	✓	✓		
Browsing and grazing animals	Goats			✓	✓	✓	✓	✓	✓
	Cattle	✓	✓	✓	✓	✓	✓	✓	✓
	Sheep	✓	✓	✓	✓	✓	✓	✓	✓

Protecting from browsing: Browsing by both wild and domestic herbivores can affect regeneration, survival and development of seedlings. This has a major impact on lowland and particularly upland scrub communities; high numbers of deer prevent regeneration of seedlings and re-growth of coppice stools. Browsing also damages the structure of dense scrub and strips bark. Where damage is an issue, protective measures are needed. The methods most frequently used are tree guards or tubes, fencing or stock removal and in some instances culling of wild herbivores.

Livestock grazing and browsing: Grazing and browsing will shape scrub stands affect the balance between scrub and open habitats. Poor grazing management can lead to loss or damage to scrub features and prevention of regeneration. There are limitations to using livestock as a management tool:

Certain shrubs are not palatable to some livestock, so may gain a competitive edge (this is beneficial when they are the conservation priority).

Excessive browsing damages habitat structure and prevents regeneration.

They require time and skill to manage.

Rare species may be vulnerable to grazing.

Public access may be constrained by livestock.

*Coppicing and thinning:* Coppicing is a traditional method of woodland management that is equally applicable to managing scrub; standing growth is harvested on a rotation over several years, and allowed to regenerate. It can be adopted to manage

scrub to rejuvenate stands. Coups or areas are usually coppiced rather than individual stools. Thinning involves either the selective removal of individual trees to create a more open structure to a stand, or the selective cutting of stems from individual stools.

### 3.2. Environmental impacts

There is a duty in conservation management to employ techniques that minimise environmental impacts and to ensure they are as environmentally sustainable as possible. Increasingly this duty is being enshrined in codes of conduct, law and regulation, but in any case it is important to consider the impact of any techniques on the wider environment. Some scrub management techniques (involving hand tools for instance) have little impact on the environment. Most, however, have at least some considerable degree of impact [3].

Wider environmental impacts include the use of non-renewable fuels and oils, atmospheric pollution, introducing toxins into the environment (herbicides, oil or fuel leaks) and noise. Environmental impacts also include issues of public nuisance (smoke, noise, restriction of access). The environmental impact of the management should be assessed by carrying out a 'risk assessment' at the planning stage, and alternative less impacting methods considered. For large-scale projects a full environmental impact assessment (EIA) may be necessary or desirable [3].

A number of shrub species and scrub types have high conservation value in their own right. Scrub habitats are generally under represented in Albania and particularly in the uplands because of clearance for agriculture and high grazing pressure from domestic herbivores. Rates of successional change may also be slower in the uplands, limited by factors such as soil fertility and climate. The management objective for scrub in the uplands is often to maintain existing stands, increase the extent and improve quality. If left unmanaged then this can seriously affect the conservation value of such habitats, but if a mosaic of scrub and open habitats is maintained then the overall biodiversity value will be enhanced.

### 3.3. Identification of shrub management options for Albania

#### 3.3.1. Option 1: Maintenance of shrub areas through livestock grazing and browsing

*Objective:* The management objective is to maintain existing shrub stands, and use them as grazing and browsing sites for animals.

Techniques to be used:

*Livestock grazing and browsing:* Grazing and browsing will shape scrub stands affect the balance between scrub and open habitats. Poor grazing management can lead to loss or damage to scrub features and prevention of regeneration.

Recommended when (assumptions/risks):

The livestock raising is an important activity for local communities

There is a need for grazing areas

The natural density of the shrub cover is less than 80%.

There are no available funds for financing other interventions (coppicing thinning, fencing)

For the financial analysis of this management option we have assumed that a sustainable grazing management plan will be implemented. It means that the area will be grazed in turns for a five year period and only one fifth of the area will be available for grazing at each turn, allowing for the rest of the area to regenerate. The costs for implementing a sustainable grazing management plan include:

Fencing of some part of the area to protect from grazing or browsing 120 USD/ha (this will happen at least every 5 year). An additional 60 USD/ha will be spent each year for maintenance and adaptation of fencing to allow animals to use different areas

Additional costs for not using part of the area for 4 years (cost of renting similar grazing area) 150 USD/ha.

At the other hands, benefits include use of an improved grazing area. The income from using the area as grazing site is calculated at 180 USD/ha/year for the first 5 years. This value is increasing after the fifth year since the site situation has been improved and the regeneration offers more grazing capacities for the same site, so it is calculated at 250 USD/ha/year for years 6-10, 280 USD/ha/year for years 11-15 and 300 USD/ha/year for years 16-20.

The normal interest rate used for calculations is 7 %. Based on all these assumptions and calculations the Net Present Value (NPV) for this management option is 128,7 and the Internal Rate of Return (IRR) is 12,2 %. In this model we have not calculated costs for managing animals at grazing sites as well as benefits from environmental services (erosion control, biodiversity protection). The management option is economically feasible only if the carrying capacity of the grazing site is almost doubled after 15 years.

#### 3.3.2 Option 2: Management of shrub stands for wood production

*Objective:* The management objective is to maintain existing stands, and improve quality for wood production by implementing all necessary silvicultural treatments.

Techniques to be used:

*Coppicing and thinning:* Coppicing is a traditional method of woodland management that is equally applicable to managing scrub; standing growth is harvested on a rotation over several years, and allowed to regenerate. It can be adopted to manage scrub to rejuvenate stands. Coups or areas are usually coppiced rather than individual stools. Thinning involves either the selective removal of individual trees to create a more open structure to a stand, or the selective cutting of stems from individual stools.

*Protecting from browsing:* Browsing by domestic herbivores can affect regeneration, survival and development of seedlings. This has a major impact on lowland and particularly upland scrub communities; high numbers of animal prevent regeneration of seedlings and re-growth of coppice stools. Browsing also damages the structure of dense scrub and strips bark. The method most frequently used is fencing.

*Livestock grazing and browsing:* Grazing and browsing will shape scrub stands affect the balance between scrub and open habitats. Poor grazing

management can lead to loss or damage to scrub features and prevention of regeneration.

Recommended when (assumptions/risks):

The protection of the area from grazing is guaranteed for at least 3-5 years after first coppicing

The natural density of the shrub cover is more than 80%.

There are available funds for financing all necessary interventions (coppicing thinning, fencing)

For the financial analysis of this management option we have assumed that the costs implementing all necessary interventions are as follows:

First coppicing 400 USD/ha

Fencing of the area to protect from grazing or browsing 120 USD/ha

Thinning 350 USD/ha (there will be two thinning operations one after 5 years and the other after 12 years)

Final harvesting (coppicing) 400 USD/ha

For this analysis, we have considered as additional costs the fact that the animals are not using the area for the first 5 years (cost of renting similar grazing area) 150 USD/ha.

At the other hands, benefits include use of firewood produced from silviculture interventions (coppicing, thinning) as well as use of the area for grazing after the fifth year. The income from using the area as grazing site is calculated at 120-150 USD/ha/year. The price of firewood is assumed at 20 USD/m<sup>3</sup> and the amount produced at each intervention is as following:

First coppicing 10 m<sup>3</sup>

First thinning 5 m<sup>3</sup>

Second thinning 12 m<sup>3</sup>

Final harvesting 80 m<sup>3</sup>

Based on all these assumptions and calculations the net Present Value (NPV) for this management option is 23.35 and the Internal Rate of Return (IRR) is 7.2 %. In this model we have not calculated costs for managing animals at grazing sites as well as benefits from environmental services (erosion control, biodiversity protection). The option is profitable from the financial point of view only if the productivity at final harvesting is not less than 80 m<sup>3</sup>/ha

### 3.3.3. Option 3: Management of shrub stands for carbon sequestration

*Objective:* The management objective is to maintain and enhance existing shrub stands to provide for carbon sequestration. Shrubs, as all other plant

species, can sequester carbon during their growing process. In order to increase the amount of carbon sequestered from shrubs it is necessary to improve their situation and providing for a faster and better biomass increment. This could be achieved through silviculture treatment to support natural regeneration and growth (protection from grazing, coppicing, thinning) and/or by planting fast growing species that are suitable for local conditions.

Techniques to be used:

*Natural regeneration:* Natural regeneration is effective in encouraging the expansion of scrub stands where there is an existing proximate seed source or the desired species have suckering roots, and no constraint on their development. This encourages natural spatial distribution and promotes local genotypes. Large open areas will be colonised only slowly unless there are species with wind blown seed locally. Where necessary, the ground may need preparation in order to create a seedbed, by either removing or breaking up competing vegetation or scarifying the ground to encourage rooting. This can be through using livestock, manual or mechanical methods. Ground scarification can encourage weed species so precautions may be necessary.

*Planting:* Seeding and planting may be used where there is no appropriate seed source for natural regeneration. Layering or transplanting is used to assist the expansion of existing scrub stands. Good preparation and aftercare are critical. Without either, mortality rates will be high. The technique for each follows three basic stages; ground preparation, establishment (seeding, planting out, transplanting or layering) and aftercare. The selection of species should be in compliance with existing and potential vegetation of the area meaning that the most suitable species are Aleppo pine, Holm oak, poplar, black locust or other oak species.

The following table shows the potential carbon sequestered by different species that could be used for planting 500 trees/ha for a 20 year period. The table shows that poplar is the most profitable species from the financial point of view. But generally, the selection of species should consider other factors influencing the planting of a selected species as:

Level of soil erosion of the area

Soil and climate conditions

Biodiversity protection/restoration

Availability of planting material

Table 3:

Nr	Species	Annual increment	Volume (after 20 years)	CO <sub>2</sub> sequestered	Price (1 ton CO <sub>2</sub> )	Value (USD)
1	Poplar	1.5	30	42	10	420
2	Holm oak	0.3	6	9	10	90
3	Aleppo pine	1	20	30	10	300
4	Other oaks	0.6	12	18	10	180
5	Black locust	0.9	18	27	10	270

Community needs/requirements for species to be used

*Protecting from browsing.* Browsing by domestic herbivores can affect regeneration survival and development of seedlings. This has a major impact on lowland and particularly upland scrub communities; high numbers of animal prevent regeneration of seedlings and re-growth of coppice stools. The method most frequently used is fencing.

*Livestock grazing and browsing:* Grazing and browsing will shape scrub stands affect the balance between scrub and open habitats. Poor grazing management can lead to loss or damage to scrub features and prevention of regeneration

Recommended when (risks):

The protection of the area especially young seedlings) from grazing is guaranteed for at least 3-5 years after first coppicing

Additional planting are implemented by an irregular scheme and only if natural density of the shrub cover is less than 80%.

The site conditions (soil, climate, area) are suitable for natural regeneration and planting.

There are available funds for financing all necessary interventions (fencing, planting, coppicing, thinning)

For the financial analysis of this management option we have assumed that the costs implementing all necessary interventions are as follows:

Fencing of the area to support natural regeneration 120 USD/ha

Planting of fast growing species (500 trees/ha) 600 USD/ha

For this analysis, we have considered as additional costs the fact that the animals are not using the area for the first 5 years (cost of renting similar grazing area) 100 USD/ha.

At the other hands, benefits include incomes from carbon sequestration credits (5 USD/ton CO<sub>2</sub>) as well as use of the area for grazing after the fifth year. The income from using the area as grazing site is calculated at 150-200 USD/ha. The amount of carbon sequestered after 20 years is approximately calculated

at 30 ton/ha from afforestations (500 trees/ha) plus 20 ton/ha from the existing shrubs equals 50 ton/ha.

Based on all these assumptions and calculations the net Present Value (NPV) for this management option is 157.2 and the Internal Rate of Return (IRR) is 8.3 %. In this model we have not calculated costs for managing animals at grazing sites as well as benefits from environmental services (erosion control, biodiversity protection).

#### 4. Conclusions

Considering the sustainable management principles as well as the existing international experience on shrub management options and techniques and based on the situation of shrub vegetation areas in Albania we have reached the following conclusions.

It is difficult to identify best management practices for shrub management in Albania because of lack of experience in shrub management in the country and no verified results and benefits of different types of interventions. We have identified some best management practices considering that these are the most suitable interventions on shrub management in Albania.

The best management practices presented in this study and discussed for each trial site could be implemented in similar situations for all identified categories of shrub vegetation in Albania.

All management options have very low profitability (even that achieved under specific conditions) as shown by the IRR values which, except from the first option (use for grazing) are very close to the normal interest rate. Also, second and third option require initial funding which usually are not available to local communities, so it would be advisable if donors could support this initial part of the investment.

Considering the situation of shrub formations in Albania as well as other issues influencing management decisions, like availability of funds, availability of manpower, trends in livestock raising development (increase of number of animals), abandonment of areas from local communities; the most suitable management option for shrub management is grazing sites for animals.

In other cases, where there is no high demand for grazing sites (decrease of number of animals or abandonment of areas from local communities) and where there are funds available, shrubs can be managed for wood production (fire wood and construction timber). This option requires substantial investments and long term payback turns.

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