CONNECTING NATURAL VALUES & PEOPLE

Strengthening Sustainable Private and Decentralised Forestry Project Kosovo & regional

Coppice Forest Management

Small scale coppice management an option for degraded coppice forest in Kosovo

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Content

1. Introduction

Coppice forest or so called low forest as part of small scale forestry was considered as an important part of activities of the project "Strengthening Sustainable Private and Decentralized Forestry; Promotion of Economic Development through Capacity Building in Farmer Based Forest Management in Kosovo and its Region" The project is implemented by Connecting Natural Values and People Foundation (CNVP) with financial support from the Swedish International Development Cooperation Agency (Sida) and the SNV (Netherlands Development Organisation) and ran from January 2009-March 2014.

Coppice forest covers 38% of Kosovo's total area, sharing 84% of the total forest area, situated mainly in the geographical basin of Kosovo between 500 - 800 masl (meter above sea level). Coppice forest occur therefore in the lows part of the mountains surrounding the country; the mountains in central north-south ridge; and most of the hills/valleys throughout Kosovo. As a result of the geological formation with a great extent of Potassium and Granite rock the soil in the low parts of mountain chain increase the conditions for forest production with the presence of nutrients transported in a solution of water in the surface to the benefit of all trees standing in its way down slope.

An important part of coppice forest is Oak coppice forest occupying land surrounded by agriculture-along steep-sided valleys, on rocky hillocks, or in belts or groups around streams, everywhere in rural areas. The Oak coppice contribute to the typical contrasting landscape combining agricultural lands. In those areas exist different forms of forest; multi age multi story coppice (mainly private coppice forest), combined with uniform shrub forms of degraded public Oak coppice forest, agroforestry on the side of streams with slowly moving water in plain parts of the country and rural settlements. Coppice forest are scattered everywhere in relatively small isolated plots, covering hills, valleys in between the open cultivated 185.764 small farmlands (an average farm size of about 1,5 ha). The patches of forest both private and public historically are used by rural population as integral part of the farm securing additional income and provision of materials, e.g. building and fencing material, domestic firewood and other materials used in the small agricultural farms. Many of the coppice forest are private forest characterized everywhere from the presence of small clearings created each year from the patch clear cutting by owners to fulfil the annual needs on firewood.

Figure 1 Typical coppice forest are in Kosovo

Most of the public Oak coppice forest however are degraded and over exploited. The expert's opinion is that substantial portions of current public Oak coppice forests in Kosovo do not fully utilize the site production potential. For decades the attempts to convert the degraded Oak

coppice in high forest have failed. Main stakeholders in the forestry sector such as the national forest policy administration and Kosovo Forest Agency (KFA) share different opinions from rural communities and private forest owners regarding the management system of coppice forest and the reasons of their degradation.

Figure 2 Degraded Oak forest

The paper aims to share the main findings resulting from the close cooperation with forest owners during project implementation and raising awareness among policy decision makers regarding actual practices and problems of coppice forest management and propose to review and improve actual practices coming from policy legal and management guidelines, leading to the increase of biomass production in Kosovo.

This paper tells one of the eight stories on the project's impacts and lessons learnt of the project. It provides insights in the concepts, project activities, the outcomes and impacts, the challenges and opportunities. The stories function as a background document for learning and further use, capturing the results and experiences. The other seven stories include: 1) Organisational set up of the APFO network in Kosovo, 2) Forest Decentralisation in Kosovo, 3) Sustainable Forest Management practices, 4) Development of regional networking with REFORD, 5) Wood biomass production and utilisation with Private Forest Owners (PFO), and 6) Gender & forestry, 7) Service provision by Associations.

2. Review approach

This paper is an attempt to share the gained experiences coming from the overall study of actual practices implemented in coppice forest and the specific project activities related to coppice forest management. The planning and implementation of forest practices are referring to historical background in forest management as well the actual forest policies and legislation and guidelines on management plans preparation and implementation. The main focus of the paper is the Oak coppice forest. It is divided approximately equally in private and public ownership. The background information was collected from different sources. The main policy legal documents used are: Kosovo forest law 2003/3; Policy and Strategy Paper on Forest Sector Development in the Republic of Kosovo (PSPFSD); Guidelines on preparation of management plans; the National Forest Inventories (NFI) of 2002 and 2012 and the format used on the annual operative forest plans. Further use is made of activities in the frame of the project different surveys, sample plots and model trees measurements and analyses, as well consultations with rural population and Private Forest Owners. The results of measurement on coppice forest (planning and practices) are used and analysed to compare the impact of different management systems. Among others, the demands on firewood, combined with the identification of legal constraints for implementation of traditional coppice forest were taken in to consideration.

Field data collected in the frame of preparation management plans for public forest in cadastral zone scale in Llabjan, Malishinca (Nova Brde municipality), Lypovec (Gjakova Municipality), as well the private forest management plans for private forest in Gjakova and Kaçanik, the

consultations with forest owners and the data from analysis of increment on model trees, as well project staff experiences, professional articles, project reports are used. The character is exploratory-descriptive with introduction of main findings coming from both forest policy and legal documents and project field activities (sample plots and surveys) analysing basic facts and concerns, followed by formulation of main questions for future research on impact of management systems in private and public Oak coppice forest and reporting on the background of present Oak coppice forests management in Kosovo.

The study is divided in four main parts. The first part describes the actual status of coppice forest in Kosovo, based on the National Forest Inventory (2012); followed by the analysis of actual policy and legal frame work related to the coppice forest. The priorities of main stakeholders related to the coppice forest management are identified and analysed in the third part grouping the two main trends, on support traditional coppice forest management and the results of management systems aiming at conversion of coppice forest in high forest. The last part shows the current status of different coppice forest stands, under the impact of management systems, and describe the experiments established with the project support and results achieved.

3. Actual status of Oak coppice forest

3.1 Share of coppice forest in land use

Coppice forest in Kosovo cover about 405.200 ha, sharing 38% of the total country area and 84,2% of total forest area. From the total coppice area 397.800 ha is characterized as simple coppice forest and 7.400 ha as coppice with standards. The coppice forest is 166.400 ha (41%) privately owned, 234.800 ha (58%) public forest (State owned) and about 4.000 ha is classified as unknown ownership.

Land use categories	Area ha
High forest	75800
Coppice forest	405200
other wood land	29200
crop land	309000
grassland	161400
settlements	48000
water	5200
other wetlands	800
other land	42400

Table 1 Land use in categories

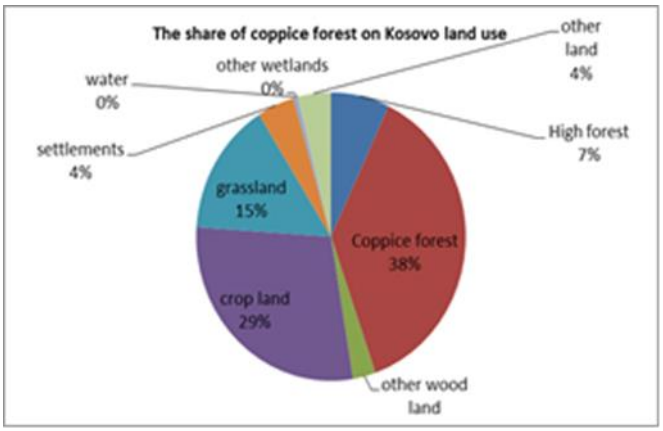

Figure 3 Share of coppice forest

3.2 Growing stock

Total growing stock of Kosovo forest considering the trees with dbh > 7 cm over bark is calculated 40.508.000 m^3. The growing stock of Oak coppice forest is 9.243.000 m^3 or 22% of the total. This is very low taking in to consideration the total are of coppice and share within Kosovo's forest.

The area distribution by species, shows that different Oak species (*Quercus* spp.) cover more than 200.000 ha. The Oak species composition and distribution have changed between the NFI 2002 -2012. According to the last forest inventory the Oak forest is divided in Turkey Oak (*Quercus cerris*) with 46% of growing stock, Sessile Oak (*Quercus petrea*) 40% of growing stock and other Oaks a category dominated by Hungarian Oak (*Quercus frainneto*) 14% of the total growing stock of Oak spp.

3.2.1 Growing stock

According to the diametric classes of Kosovo's forests the main share (42% of the total volume) is in the category 10-20 cm. The domination of small diameters come from the fact that most of the forest is young and the high presence of coppice forest (see figure no 2).

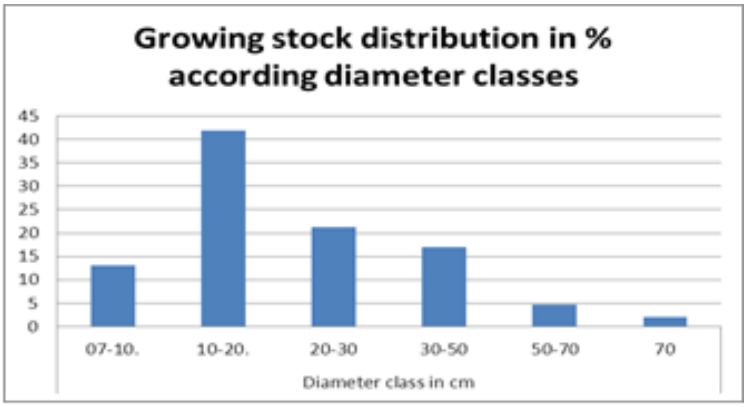

Figure 4 Growing stock according diameter classes

3.3 Accessibility of Oak coppice forest by rural population

Superposition of both, the map of Kosovo settlements with the forest cover map shows the easy accessibility of rural population especially to the Oak coppice private and public forests. Most of them are situated up to 900 masl. The Oak species are mainly growing between 500 and 1,000 masl (figure 5). The Beech covers mainly the altitudes higher than 900 m. These figures could support the estimation of forest stands of the main broadleaves species and their accessibility from rural population related to the maintenance and in other side their growing stock available for wood supply and distances from the respective settlements. Approximately the Oak forest is situated in the same elevation with the Kosovo settlements which allows easy accessibility for people working on forest maintenance and provide short distances of firewood transport.

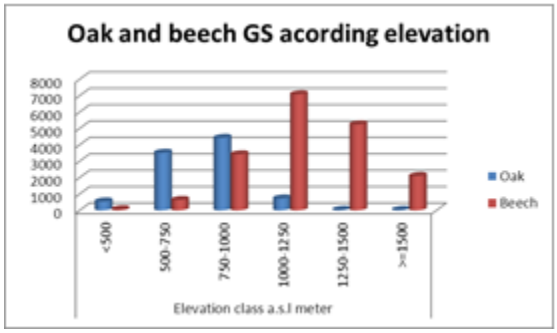

Figure 5 Distribution of Oak according to elevation

From an ecological point of view Oak is situated mainly hilly areas of the country, while Beech is situated on mountain slopes. This leads to differences in the slope class of sites where forest stands are situated. Approximately 62% of Oak coppice forest growing stock is situated on

slopes less than 45%. The specific for Beech forest stands is different, most growing stock volume (57%) grows on slopes steeper than 45% (graph no 4).

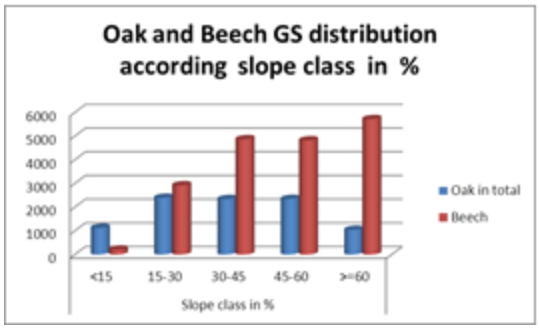

Figure 6 Oak and Beech distribution according to slope class

Harvesting and terrain transport when the inclination is >45% may be difficult and are generally more expensive. Slope length and distance to forest road should also be taken into consideration when assessing accessibility. In general this is more favourable in Oak forest compared to the Beech forest, but depending on the local circumstances and forest road infrastructure. The differences in accessibility can be recognized when management objectives and systems are defined. Increased slope levels lead also to increased risk for erosion and as such is also influencing Sustainable Forest Management (SFM) practices.

3.4 Increment

The data on increment are obtained from the Kosovo NFI (2012). All volumes of increment and wood removals are given in cubic meter over bark. The results indicate that the total annual increment of Kosovo forest has declined slightly; the most difference results to the *Quercus spp.*, whereas the increment of coniferous species has increased.

Table 2 Annual increment of trees with dbh >=7 cm in forest (2002 and 2012)

Forest species	Growing stock 2002		Growing stock 2012	
	000 m^3	% according forest species	000 m^3	% according forest species
Turkey Oak (*Quercus cerris*)	258	16.5	193	12.4
Sessile Oak (*Quercus petrea*)	182	11.6	158	10.2
Other Oak spp as Hungarian Oak (*Quercus frainneto*, *Quercus trojana etc*)	5	0.3	68	4.4
Subtotal of Oak	445	28.4	419	26.9
Beech (*Fagus spp*)	501	32.0	576	37.0
Other broadleaves	174	11.1	329	21.1
Undefined broadleaves[1]	228	14.6	0	0.0
Subtotal of Beech (*Fagus spp*) and other broadleaves	903	57.6	905	58.2
Fir (*Abies Alba*)	92	5.9	82	5.3
Spruce (*Picea abies*)	51	3.3	71	4.6
Pine (*Pinus spp*)	70	4.5	77	4.9
Other conifers	8	0.5	2	0.1
Subtotal of coniferous	221	14.1	232	14.9
Total	1567	100.0	1556	100.0

[1] This category was used in the first NFI for the increment of the part of forest located at inaccessible areas to a large extent was classified as "undefined broadleaves". Much of this volume is classified in NFI 2012 as either Beech or other broadleaved species.

The average growing stock for coppices dominated by Oak result 39.7 m^3/ha. While the average growing stock for the total of Kosovo forest is calculated 84 m^3/ha. The average annual increment per hectare Oak forest is only 1.98 m^3/ha. The inventory reports for the last 9 years a harvest of 2.002.000 m^3 from Oak forest.

3.4.1 Growing stock

Within the CNVP forestry project the tree stump analyses was realized in 16 model trees as part of training and preparation and implementation of management plans for private forests. The aim of this investigation is to determine age-diameter, age-height and age-volume relations throughout the life of the tree. The analysis thus assess the average rate of diameter, height and volume increment. Such trees were selected to be over the rotation size and representative of the site quality to which the results of investigating are to be applied. The height of the tree and its crown width is also calculated and recorded after which the tree is felled to take the measurements. The following measurements are taken: (i) Height of the first green branch and lowest point of the full crown to calculate clear bole and crown length (ii) Total height of the tree, and (iii) The crown volume.

The felled tree is then divided into sections from base including stump, in each meter starting from 130 cm. The odd length at the top is treated as a separate section. The tree is then cut at these mid-points by a cross-cut saw for ring counting. If the measurements cannot be done in the field, transverse sectional discs of 5-8 cm thick are sawn, but in such cases, sectional height is noted. For each section, average radius is calculated on the basis of two diameters (u.b) callipered at right-angles, total, averaged and halved and then recorded in tables. Results of calculation for one model tree are in table no 3. The inner and outer bark diameter is measured as explained in figure 7. Cross- section tree model measurements

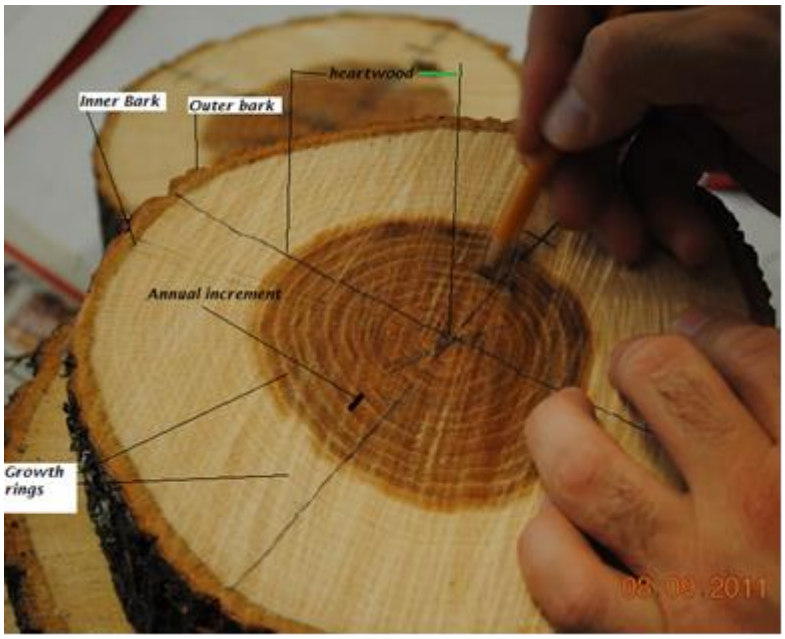

Figure 7 Cross section tree model measurement

Table 3 Calculation of model tree volume in different ages

No	Height of section M	Area of cross sections (cm2) and volume (dcm3) of 28 years old tree						
		28 years						
		outer bark	inner bark	25	20	15	10	5
I	1.3	7.54385	5.936563	5.024707	3.363647	2.0096	1.029155	0.301754
II	2.3	3.974063	3.834019	2.83385	1.947291	0.898747	0.395719	0.059366
III	3.3	3.379916	3.061991	2.236735	1.605247	0.362984	0.2418	0
IV	4.3	2.804099	2.431616	1.650463	1.32665	0.311567	0.166106	0
V	5.3	2.715786	2.137163	1.560659	1.149319	0.2826	0.04712	0
VI	6.3	2.473241	1.984559	1.494954	1.020186	0.255047	0.009499	0
VII	7.3	2.255325	1.885963	1.430663	0.800779	0.224687	0.003317	0
VII	8.3	2.137163	1.516699	0.907166	0.336785	0.021372	0	0
IX	9.3	1.947291	1.378166	0.821525	0.259541	0.010382	0	0
X	10.3	1.650463	1.111639	0.521417	0.138474	0.007085	0	0
XI	11.3	1.484141	0.993516	0.390165	0.022687	0	0	0
XII	12.3	1.399047	0.94985	0.2826	0.015386	0	0	0
XIII	13.3	0.882026	0.738607	0.362984	0.00785	0	0	0
XIV	14.3	0.521417	0.184652	0.016505	0	0	0	0
XV	15.3	0.336785	0.090746	0.013267	0	0	0	0
XVI	16.3	0.131959	0.104582	0.011304	0	0	0	0
Total		32.36533	26.27189	18.8723	11.9706	4.384068	1.892714	0.36112
Volume (dm3)		323.6533	262.7189	188.723	119.706	43.84068	18.92714	3.611196
Volume of the top		0.175945	0.139442	0.015072	0.010467	0.009446	0.004422	0.079154
Volume of stump		0.754385	0.593656	0.502471	0.336365	0.20096	0.102915	0.030175
Volume total .(dm3)		324.584	263.452	189.241	120.053	44.051	19.034	3.721

3.4.2 Rotation, mean and current (periodic) annual increment

The analysis of the growth gives insight in the optimal rotation periods. Analysis of the increment are shared with the forest administration (KFA), Ministry of Agriculture, Forestry and Rural Development (MAFRD) and other stakeholders by the project to open the debate related to the decision making for the type of rotation from the forest manager. This debate is not common in Kosovo despite the fact that it can be an important factor on selecting the kind and length of rotation to suit the purpose of management. Between (i) physical rotation, (ii) silvicultural rotation, (iii) the technical rotation, (iv) the rotation of greatest volume production, (v) rotation of highest income and (vi) financial rotations. The preferences differ between forest administration and private forest owners.

The forest administration is in favour of the silvicultural and physical rotation (both long) and coincides with natural lease of life of a species in a given site[2], the last four are more directly oriented on the product, (firewood or timber dimensions) as well the financial returns. In actual Kosovo conditions with high demands on firewood most of the private forest owners without theoretical knowledge's, can be considered to be oriented to the rotation of greatest volume production or the rotation that yields the greatest annual quantity of material.

[2] F.C. Osmaston, The management of forest, printed in Great Britain Aberdeen University Press

As clearly indicated by the graph on the increment of model tree analysed, the current annual increment varies from year to year, and this is as a mean over a period of years, termed the *periodic annual increment* (PAI). The curve of *mean annual increment* (MAI) shows the whole period from origin to the calculated age. The interrelationships of the PAI and MAI curves of a tree (as indicated in figure 8), their relative shape, and the position of their point of intersection, are of particular interest for forest management depending from the owner's objectives. The rotation oriented in quantity (which is usually assessed as volume of wood above a minimum thickness) is preferred and frequently used as mentioned above. The length of rotation in this case will obviously coincide with the year when the average rate of growth or volume increment per stand reaches a maximum. As shown in the graph the PAI of analysed tree increased slowly in extreme youth, than accelerates and then slackens until the PAI culminates after which it progressively falls. The MAI being the mean of all PAI, looks with more regular and restrained progress, being for years less than PAI, but continues to rise until the two become equal. The moment when PAI and MAI are equal is the moment when MAI achieves its maximum, and that is considered the rotation with greatest volume production, around 23 years in the graph below.

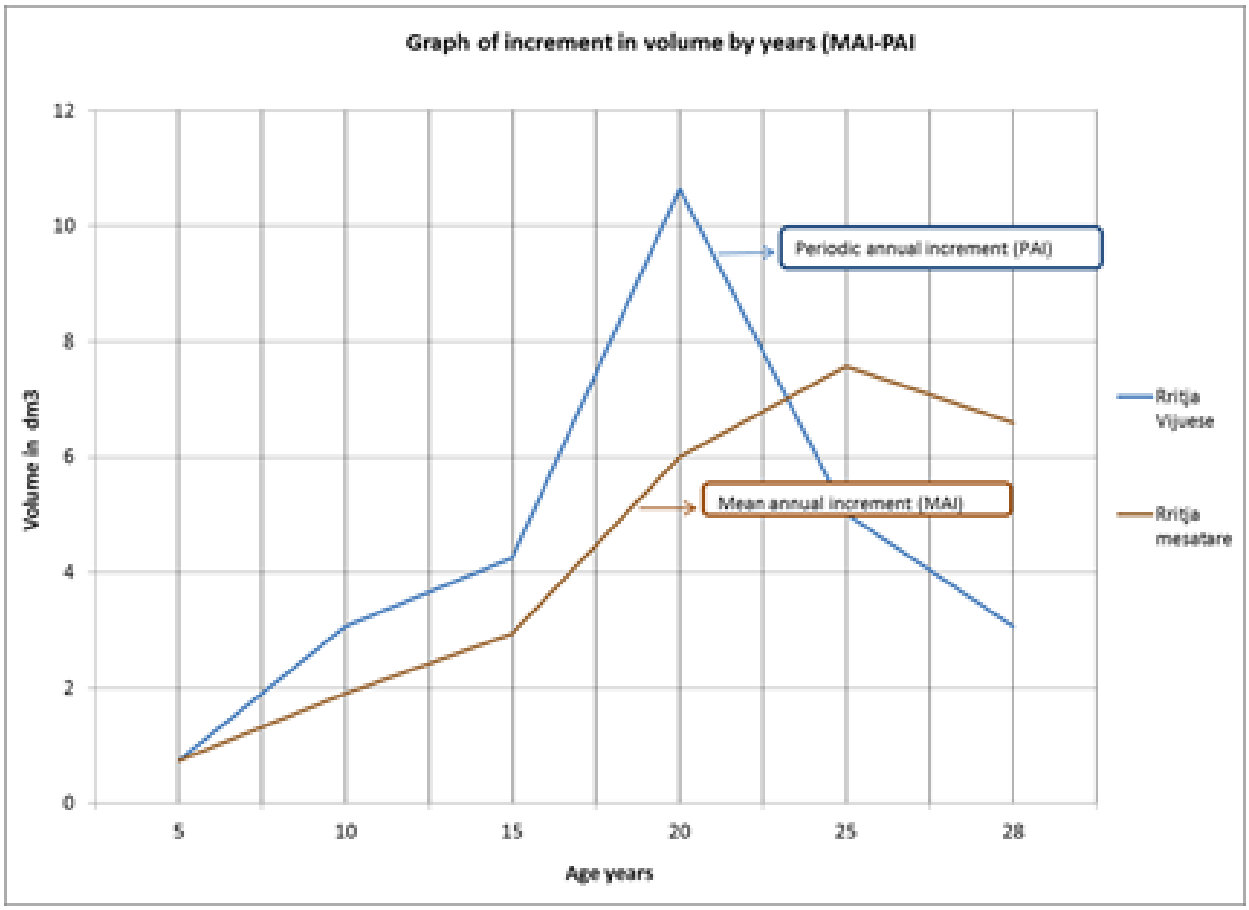

Figure 8 the curves resulting from model tree measurements showing the periodic (current) annual increment (PAI) and mean annual increment (MAI) & rotation of maximum volume production at 23 years

The biomass assessment of the model tree is realized through calculating the volume of stem and crown volume calculated through sampling method. The measurement were focused on the total volume resulting from main stem and crown. The relation between volume and weight are calculated based on the specific weight of stem in the moment of measurements. The

crown volume is calculated through samples, calculating the branches and top volume, the weight and rate between branches and leaves. The results are in table 4.

Table 4 Biomass assessment

Municipality	Kline	Age years	28	weight of stem kg	363.35
sample plot no	1	DBH cm	22.5	Weight of crone branches kg	119.6
Forest specie	Hungarian Oak (*Quercus Frainneto*)	Height m	17.76	Total biomass kg	532.35
Model tree no	1	Total volume of tree m^3	0.325	Expansion factor	1.47

4. Policy and legal framework

4.1 Policies and strategy for forest sector development

The Government of Kosovo launched a process of formulating a National Forest Policy and Strategy Plan from May 2008 and approved the final version in March 2010. Related to the Oak coppice forest as the main source of firewood production the strategy recommend to introduce joint management systems in which local communities, Private Forest Owners Associations (APFO) and entrepreneurs with proven skills and capacities are given greater responsibilities for forest management within certain delineated areas. According to the strategy priority will be given to areas of low forest where the overwhelming part is firewood production, and where new forest management plans exists.

4.2 Forest law

There are no specific articles in the actual forest law 2003/3, related to the coppice forest. The regulations in article 3.7 states: "no person removing trees may leave the land with less than forty per cent tree cover." Without clear references related to the management system in this article, this statement creates different interpretations regarding the implementation of coppice management system. The forest administration in Kosovo interpreted this article that no coppice is allowed using clear cuts, even not with small scale strips. This is actual leading to a ban on coppice forest management.

4.3 Guidelines on forest management

After 2006 with the support of International donors and the investments of the government almost half of the management units are covered with updated management plans. Priority was given to develop management plans for management units dominated by high forest. The guidelines applied for management plans follow the same approach as NFI. The guidelines on forest management plans and the final reports of the NFI (2002 and 2012) use as base for analyses the actual management system. There are six basic categories of forests included in a forest management plan. The categories are; high forest with natural regeneration, degraded high forest, forest plantations, coppice forests, bare land and non-productive areas.

The forest management planning method for Kosovo includes classification of forest stands according to management classes, a combination of each of the categories into broader ecological-production classification units (management classes), based on species, composition and soil productivity. Every stand is assigned to a management class based on their ecological composition and planned method of silvicultural treatment. Generally management classes are named after the dominant tree species, for example management class of Beech from seed (i.e. Beech high forests), or coppice management class (CMC) dominated by Oak. The present division of the forest area into different categories and management classes, varies in different documents in use by KFA or the forest service in a Municipality. The definitions of criteria used are not so clear and not easy to use.

4.4 Coppice forest management classes

Coppice forests is a typical forest for central Kosovo. Most of the stands shaped by intensive anthropogenic influence and different ownership regimes, define many of its current stand characteristics. The Sida CNVP project activities were focused on the actual status of coppice forest in public and private coppice forests. The project assessed the overall situation related to criteria and indicators for SFM. Data collection and analysis are realised during the implementation of project activities, supporting municipalities and private forest owners in preparation of simplified management plans, in cadastral zones level for public forest and group of private forest owners for private forest management.

Table 5 Data on coppice forest management classes (NFI 2012)

Management classes	Area in ha	Area %	Growing stock 000 m^3	Growing stock %	Average growing m^3/ha	felling 000 m3 last 9 years	felling % last 9 years
Coppice forest							
Beech dominated coppice forest	37000	7.7	4556	11.2	123.1	893	10.3
Mixed Beech and other broadleaved forest	15800	3.3	1066	2.6	67.5	370	4.3
Oak dominated coppice forest	209200	43.5	8305	20.5	39.7	2002	23.2
Degraded coppice forest due forest fire	5200	1.1	224	0.6	43.1	27	0.3
Degraded coppice forest due to other reasons	1000	0.2	43	0.1	43	0	0.0
Degraded coppice forest due to improper management	18600	3.9	213	0.5	11.5	801	9.3
Hornbeam dominated coppice forest	23600	4.9	897	2.2	38	199	2.3
Coppice forest of other broadleaves	79600	16.5	3578	8.8	44.9	1090	12.6
Bushes							
Bush land suited for conversion to pine forest	1200	0.2	0	0.0	0	0	0.0
Forest of *Pinus mugho*	1800	0.4	30	0.1	16.7	0	0.0
Bush land not suited for conversion	5800	1.2	349	0.9	60.2	1	0.0
Unclassified area	2200	0.5	0	0.0	0	0	0.0
Total of coppice forest	401000	83.4	19261	47.5		5383	62.4
Total of Kosovo forest	481000	100	40508	100	84	8633	100

According to the guidelines coppice forest is divided into 6 management classes named after the dominant tree species; (i) Coppice forest, (ii) Beech dominated coppice forest, (iii) Mixed Beech and other broadleaved forest, (iv) Oak dominated coppice forest; (v) Hornbeam dominated coppice forest and (vi) Coppice forest of other broadleaves. Three more management classes for coppice forest are divided in the last NFI; (vii) Degraded coppice forest due to forest fire, (viii) Degraded coppice forest due to other reasons, (ix) Degraded coppice forest due to improper management.

According to the data of the last inventory the general situation on Oak coppice forest results with less growing stock, giving a low volume per hectare. Oak dominated coppice forest cover 43.5% of total forest area, the growing stock covers 20.5% of the total growing stock of Kosovo forest. Their present condition is not satisfactory, i.e. with regard to production capacity, species composition, quality, stability, vitality, health, unfavourable age structure etc. On the other hand generally coppice forests frequently occupy high-quality sites with a higher potential of productivity. There are differences in growing stock, annual increment and forest composition between private and public owned Oak dominated coppice forest. With private coppice forest giving in general a much better situation.

5. Management systems for Oak coppice forests

A silvicultural system gains importance when it meets specific demands of the human society on the forests. Management systems in coppice forests are among the oldest forestry practices, used to provide regular supplies small sized wood. In roman times coppice woods with annual coupes for production of firewood, vine stakes and other small material were termed *silva caeduae,* short rotations were adopted. Pliny, in his 'Historia naturalis', mentions 8 years for Chestnut for the production of vine stakes and 11 year for Oak. After declining in the last century, the coppice forest experiences a sort of worldwide revival, because of reasons that are closely connected with the energy production based on biomass or energy wood (Stähr)[3].

Coppice forest means different things to policy makers, forestry specialist and people from different socioeconomic contexts. This is also valid for Kosovo. It leads on discrepancies between two main Kosovo stakeholders in forestry related to the systems applied for coppice forest management, (i) the state as owner of public forest has demonstrated in the last decades a strong urge for the conversion of coppice forest to high forests, for its focus on timber and better economic appraisal, and has supported it with the legal framework, while (ii) the private forest owners consider coppice forests as an integral part of their farm securing local employment, livelihood and provision of materials, e.g. building and fencing material and especially domestic firewood and charcoal (Evans, 1992).

As mentioned earlier the interpretation of the Kosovo forest law does not allow for coppice forest, being regarded as clear cut (leaving less than 40% of the stand). Forest owners, managers, especially private forest owners are therefore implementing against the instruction of the forest law, when applying the simple coppice forest and coppice forest with standards, based on principles of vegetative reproduction, rapid growth, single-storied stand structure, early use of clear cut system (usually with a rotation of max. 20 years). Securing the forest products from coppice forest was mostly realised through a complete use by clear felling, rarely as selective removal of the largest poles of a stump. Total annual sustainable harvest

[3] Renaissance and global utilisation of the coppice system

from a holding of 1.5 ha[4] is in the order of 5 m^3 and with a market value of roughly 300 € (FAO, 2005)[5].

The approach of CNVP within the project implementation is to put people before trees and discuss how local people feel about the forest law and forest situation. This has shown that local people are confused about their local public and private forest, for example, believing that managing them for coppice products is 'butchering forest.' A participatory approach was applied on studying and comparing both coppice forest management systems (coppice under implementation in private forest and different systems aiming at conversing of public coppice forest in high forest) with the contribution of forest experts and forest owners. The assessment of impact of past and recent human interventions in both implemented actually management systems is analysed, reviewing the coppice Oak stands' current conditions. It was realized through two phases. In the first phase the main management systems were classified as implemented by main stakeholders in the past and actually, followed by analysis of sample plots from different systems and compare the current stand conditions resulted by the management systems applied.

5.1 System identification and description

In Kosovo actual coppice forest conditions and management, the identified systems can be divided in two important subgroups: (i) Traditional coppice systems and (ii) Systems for converting coppice in high forest. Within the traditional coppice systems there are three management practices identified: (i) Simple traditional system, (ii) Coppice with standards and (iii) Shredding and pollarding systems. The second group of converting coppice in high forest is divided: (i) High coppice forest, (ii) Coppice forest for conversion and (iii) Selection coppice forest. For each of these a short description on theory and current situation in Kosovo is presented.

5.2 Simple (traditional) Oak coppice forests management

5.2.1 Simple coppice forest

Simple coppice system is an old silvicultural system that is based on the ability of (leaf) trees to sprout, in other words, the ability of vegetative regeneration and reproduction. The coppice is usually cut in the season of dormancy, close to the ground to enable forming the independent roots, the stools being given a sloping surface which is trimmed smooth to prevent water from settling and causing decay. Coppice is essentially a system applied by forest owners for the production of firewood and small to medium sized material up to pole size. The rotation varies from 1-2 years in the case of willows to 10-40 years for production of poles and firewood of large size.

The traditional coppice is practiced by the method of area coupes. The rotation is first determined, primarily on the bases of wood size required. The area is then divided into annual coupes in a number equal to the number of years of rotation. One coupe is coppiced each year.

[4] The average size of household forest holdings

[5] Report on Private forestry in Kosovo, prepared by FAO expert Pristina March 2005.

Where the maximum annual volume production on a given forest area is of special importance, as in the case of high needs for firewood, the rotation of the maximum mean annual increment should be determined. Traditionally this is done by felling sample coupes of different ages, ascertaining by measurement of the volume per area unit (100 m^2) produced on each, and dividing this volume by corresponding age. That age which gives the maximum quotient will be the rotation producing the maximum volume outturn per annum over the whole forest. By adopting this procedure the total area required to produce a given outturn of firewood per annum maybe reduced in maximum. However, the system is very flexible and this kind of coppice landscape can be seen everywhere from one private coppice forest to another. It allows individual stools to be partly harvested or left longer for different needs of the owner as fodder production or any specific needs on livestock infrastructure.

Figure 9 Form and area of the annual cutting coupe

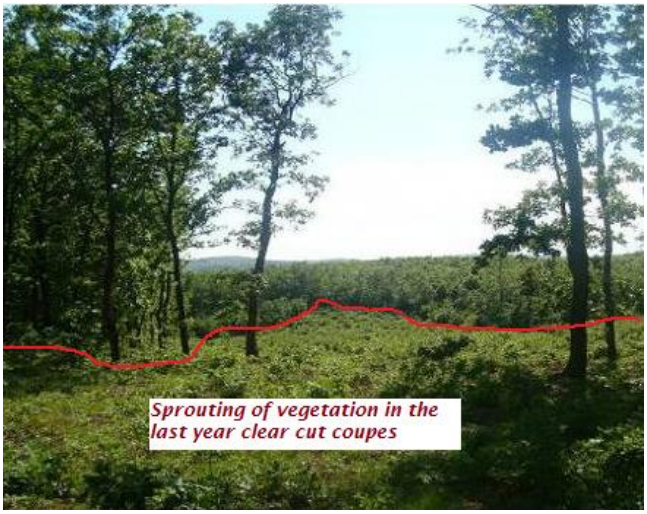

Figure 10 Different ages and height of trees are present

In a well-managed coppice, the stools are closely spaced (from 1.2-1.8 m). The ground is fully shaded by the leaves and coppice shoots. When it is cut, sunlight pours in, dormant seeds of different kinds of plants waiting for light merge and different birds, animals and insect life move into the newly created habitat. After the stools sprout and grow the coppiced coupe area gradually closes again and the undergrowth disappears again, but will be available in the next coupe areas created in the meantime.

5.2.1.1 Stakeholder preferences

Most of the forest owners in selected municipalities and private forest of the project, participate and contribute to realize forest measurements on their managed forests. They contribute on implementation of project activities, such establishment of permanent sample plots, measurement to analyse the increment of the model trees, volume and annual increment calculation in simple ways.

Most owners are farmers working for part time to produce firewood, and have more practical experience than theoretical knowledge's about coppice forests. The debates and explanation show that the owners develops an intimate knowledge of their private forest and of the regenerative properties of trees. They prefer the coppice to fulfil their annual demands for firewood. The implementation needs small capital involved and has quick returns. The period of most rapid growth (i.e., early youth) is taken advantage of by cutting the stand when this period is past, the coupe area is harvested and starting a new cycle. Hence the amount of

wood produced per year should be greater than under high forest methods. The fact that sprouts grow faster in early life than trees originating from seed supports this theory.

The securing of reproduction by sprouts is simple and certain as compared with reproduction from the seed. The advantage of private properties consist on the good protection of young sprouts from grazing after the first years of coppicing.

This system provides a valuable crop with high demands and generally high price in firewood market in Kosovo. Case studies with farmers that manage well coppice forests, has demonstrated that this system can sustain more people from one hectare for their firewood needs. Besides the traditional firewood is can also produce woodchips for use in innovative heating systems. The short distances for transport to the end users are an important advantage.

Coppice creates a cyclical habitat and unique ecosystem, and is one of few patterns of symbiosis known in nature where humans are an important part of the relationship[6]. There is some debate about the minimum area that constitutes a clear-cut. Kosovo families own generally very limited Oak forest areas. The annual coupes are in very small size, depending on the forest holding size between 0.005 – 0.5 ha. In the current system these require permission from the authorities. The interpretation of the impact of this traditional coppicing for annual familiar needs in very small clearings, and its scientific definition need further investigations and consultations (treated by the authorities as clear cuts in the Kosovo system and banned due to the interpretation of the legal acts).

5.2.2 Coppice with standards

The last national forest inventory estimated a presence of 7,400 ha coppice with standards. These coppice consist of two distinct elements; (i) lower even aged story treated as simple coppice forest and (ii) coppice with an upper story of standards forming an uneven aged crop and treated as high forest on the principle of the selection system.

Coupes are formed as in the case of simple coppice, and rotation is fixed according to requirements. The area is divided in to as many annual coupes as there are years in the rotation. As each annual coupe in turn becomes due for felling, the following operations are carried out: (i) the coppice is clear cut as in the case of simple coppice, and (ii) a certain number of existing standards are reserved for at least one more coppice rotation and the remainder is felled. As a rule the standards are scattered singly over the area (as in figure 11). Sometimes the standards are concentrated in groups amongst the coppice, or in belts with intervening belts of coppice, an arrangements which produces a larger proportion of clean timber in the standards.

[6] The Woodland Way: A Permaculture Approach to Sustainable Woodland Management, Ben Law Permanent Publications, 2001 - Nature -

Figure 11 Coppice forest with standards in private forest (Caraleve)

5.2.3 Shredding and pollarding system

Shredding is an old coppice forest management system, which offers a productive use of trees especially in a farm situation where fodder is needed for livestock. Shredding is the term used to describe for example an Oak tree that has had the side branches and sometimes the top removed leaving an expanding pole. The practice of shredding seems to be almost extinct in Kosovo, only rare cases can be observed, but the old shredded Oak trees shows its presence still. This system of shredding and pollarding is still active in northern Albania.

Figure 12 Old shredded Oak tree, Nova Brde

The Oak trees are shredded in late summer, when there is still a good amount of protein in the leaves which are than dried in nature, packed, stacked and stored to feed goats and cattle during the winter months. Larger branches are used for cooking, heating or in agricultural practices to produce vine/vegetable stakes, fencing etc. Generally the forest user divides his/her forest in three equitable parts, and each one is shredded each three years (3 year-cycle). Once the trunk of the tree has reached a useful size it is felled and used for construction or firewood and the system is re-established.

This system is used only in some agroforestry traditional systems as shown in the figure 12. The characteristic of system is multiple-use and multiple-production. It yields three main products, namely fodder, sticks from shredding the trees, timber from the shredded trees, and pasture from the herbaceous ground cover beneath the underwood, especially in the first year after shredding standard trees, or cutting the shredded trees.

Pollarding is the terms used to describe a broadleaves tree that has been cut 180-200 cm or more above the ground. The tree sends up shoots in a similar manner to a coppice stool but is cut at a height were animals cannot graze the regrowth of young shoots. The pollard poles are cut in a rotation and used in similar way to coppiced wood. This treatment is typical for agroforestry hedgerows,

especially for willows. Pollards are often seen as boundary of agricultural lands along streams roads canals in rural zones.

Figure 13 Pollard trees in hedge rows, Gjakova

5.3 Systems for conversion of coppice forest into high forest

5.3.1 'High coppice' forests

This term can be used for coppice stands managed by a silvicultural system typical for high forests such as longer rotation periods and an objective of producing large dimension trees with good quality stems[7]. The "Blinaja" Forest Management Unit (FMU) in Kosovo is an example of this management system developed as a result of efforts to convert coppices into high forests. The forest has the function of hunting reservation.

Figure 14 Coppice "high" forest in Blinaja FMU

[7] Past and recent coppice forest management in some regions of South Eastern Europe, Branko Stajic et.al, Belgrade University, 2009

The last clear cut was in 1946. The whole area was fenced and no commercial activities were implemented for last 68 years. The rotation period is prolonged, changing the coppice in to high forest.

This system was introduced to convert coppice to high forest, but the results are not satisfactory. Analysing the inventory data from the management plan of 2013, shows that the forest area covers 2,027 ha treated in the process of transformation for an excessively prolonged period. The best coppice forests with a (well stocked and healthy) annual increment of 4.8 m^3/ha/year with growing stock of 194/m3/ha, composed predominantly of economically valuable species (Oaks and scattered other broadleaves) on good-quality sites fenced and protected for 70 years are included in this form of management; coppice in process of transformation.

5.3.2 Coppice forest for conversion through planting

Coppices for conversion into stands with trees from seedlings, include stands dominated mainly by different Oak species and Beech on good sites, in good health condition and with relatively high productivity. Transformation by planting coniferous trees was set as the main approach of their management by KFA.

Two case studies were undertake by the project. The first was in Istog municipality in the FMU 'Lugu i bute', parcel no 21. In the 50-60s of the last century it was decided to experiment with the adoption and increment of fast growing species as Scots Pine (*Pinus sylvestrus L*), Douglas Fir (*Pseudotsuga menzienses*), European Larch (*Larix decidua syn. L. europaea*) and Black Pine (*Pinus nigra*), planted in degraded Oak forest. After the first thinning in 1980 and improved the light conditions, the presence of Oaks sprouts was increasing. The average growing stock of the experiment area was assessed by the KFA Forest Institute in Peja as 332 m^3/ha. Some severe windstorms of January 2012 felled down more than 30% of the planted trees.

Figure 15 Converted coppice forest after the windstorm in Istog

The second case study was realized in Junik municipality. The Beech mixed high and coppice forest was replaced by European spruce, (*Pica abies*) and Fir tree (*Abies Alba*) mainly during the period 1970-1985. The plantation was realized after clear cutting existing Beech forest by strips 30 meter wide, alternating strips planted by coniferous with strips by existing vegetation of Beech. The development of the planted trees went well. There is a high competition between the planted Spruce and Fir trees and sprouts of Beech. The Spruce bark beetle (*Ips typographus L.*), is identified by KFA Forest Institute as the most significant forest pest causing damages to the planted trees during the last decade. The high risk of fires in Spruce and Fir planted forest is another concern. After 1970, it was expected that transformation would be achieved in relatively short periods (several decades), through converting in coniferous Oak coppice

forests. Despite the initial expectations, the total area of the high forest resulting from planting and artificial seeding resulted 2,000 ha in public forest and 800 ha in private forest (NFI 2012).

Despite the efforts to convert all the coppice area in high forest by KFA and decrease the area under simple coppice forest management (through the ban on coppicing in the forest law and no planned coppicing activities by KFA) all these efforts resulted in a contrary result of increased coppice forest. Data of NFI 2003 shows a share of coppice forest of 46% of the total surveyed forest area. The data of NFI 2012, however, shows a share of coppice forest of 84%. Maybe a part of this non-logical trend on the increase of coppice forest share came from wrong classification in field in by the first NFI. This can, however only partly the reason, there is the trend in the last 50 years of increase of coppice forest in Kosovo.

5.3.3 Selection coppice forests

This coppice management concept is very similar to a selection system in high forests. The marking of trees are realized by KFA. Trees from largest diameter classes being harvested and tending performed in lower diameter classes. The Kosovo forest experts consider this selection cutting in coppices a more appropriate way of forest regeneration than clear cutting. The dying of shoots and decrease of the number of active shoots by inappropriate light regime for Oak coppice is however not taken in consideration. The experts prefer this management for soil protection from erosion, arguing that a continuous forest cover makes it especially appropriate in erosion and water protection areas[8]. Back in 1937, however, Šenšin (1937) recommended it as one of the most appropriate management systems for private forests in Yugoslavia of that time[9]. The last is based on the cutting each year the larger poles in each stump. At present this management concept is currently implemented in Kosovo by KFA.

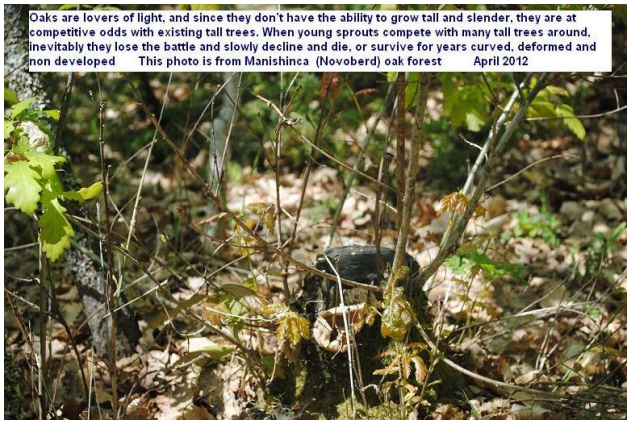

Figure 16 Selective cutting in coppice

Figure 17 The selective cutting leads to curved stems and degradation

[8] Actually, erosion has almost nothing to do with **how much** wood is removed, but has almost everything to do with **how** it is removed. Non-road areas of clear cuts are comprised of the root mass and humus of a forest soil. This root mass is the world's best sponge for rainfall and runoff, regardless of the presence of stems.

[9] Branko Stajic at al: Past and recent coppice forest management in some regions of South eastern Europe; Silva Balcanica, 10(1)/2009;

5.3.3.1 Impact of selective cuttings in coppice forest

Silviculture is defined as "the art of producing and tending a forest; the application of the knowledge of silviculture in the treatment of a forest"[10]. Unfortunately the experience gained on forest management has not yet supplied either the accurate detailed knowledge of the silvicultural requirements of most commercial species under coppice forest regime, nor has it determined with precision the exact effects of the various factors, thinning, cutting, fire and grazing; upon the moisture, light and heat conditions of the site. The impact of selective cutting will be analysed specifically for the coppice forest in this part since this is a wide spread practice in Kosovo. The selective coppice has (i) its impact in biomass production and quality, as well (ii) its impact in coppice forest regeneration and development of next rotations.

Impact of selective cutting in biomass production
The selective cutting is preferred from the most foresters in Kosovo for its perceived positive impact on keeping an unchanged forest shape to the public in the ethical and social point of view. It is also regarded in principle leading to an improved quality and increased value of production in young dense forest.

Actually the young and overstocked forest form a considerable part of the forest area. The density is in many areas so high that the stands have a natural self-thinning, which means that trees die because of lack of light, space and loss of crown volume. The reduced crown being the engine of the tree and competition with other trees lead to decay of the smaller trees. It is one of the factors with a negative impact in the growth actually considered as below optimum (Jacobson 2003). It is basically because the high density has caused a reduction of the green crown size. A considerable portion of the growth is on low quality trees with little or no value as industrial wood.

The study on analyses of firewood production (Jacobson 2003), proposes to implement urgently a restoration programme. The main aim is to reduce the density and remove the low quality trees, moving the growth to the trees with a higher quality and giving the trees a chance to develop a crown size, which optimises growth[11]. The question raised in this important strategic decision related to the coppice forest is: what is the final impact of treatments with long rotations with selective cutting in coppice forest (i) in production of wood biomass, (ii) in financial return, (iii) in the reproduction abilities and development of next rotations.

Impact of selective cutting on coppice forest regeneration
The term "silvicultural system" is used frequently as practically synonymous with reproduction method (Hawley 1921). A reproduction method may be defined as an orderly procedure or process by which a forest is renewed or established either naturally or artificially. This process is accomplished during the reproduction or regeneration period, which comes when the stand is harvested at the end of every rotation. It is accomplished through skilful cuttings where necessary by special treatment to create and maintain conditions favourable for the start and early life of reproduction.

[10] Ralph C. Hawley, The practice of silviculture, http://www.archive.org/details/cu31924073869541
[11] Åke Jacobson, Silvi Nova AB, Analysis of the potential for increased firewood production in Kosovo, the study report 2003.

The basis for coppice forest regeneration are the healthy and active stumps. Sprouting ability decreases with age and is at its best during the first few decades of a stand's life. Therefore for the coppice method of reproduction is should be short. How short depend principally upon the inherent sprouting ability of the species, together with its rate of growth and on the other hand is influenced by the age at which firewood or other preferred products can be obtained.

The selective cutting leads generally to the long rotations. By extending the rotation to >40 years a good yield of timber can be secured, although due to is heritage generally considered still an inferior product and often unprofitable. In order to secure lumber a rotation of 60 to 100 years will be found necessary. When a very short rotation (less than 20 years) is used, reproduction should be fully stocked and vigorous. With a 40 year rotation there may still be satisfactory sprout reproduction, but with 60 to 100 year rotation sprouts cannot be counted on to establish a fully stocked stand[12]. Under the selective cutting the sprouting ability is limited despite the fact that stump can be small. The callousing process required light and heat, both impossible in selective cutting stools due to shading by remaining trees.

Figure 18 Stool with reduced sprouting ability

Figure 19 Died stool after selective cutting

The difference in the light required by different species of trees is considered by many authors as the most important factor for regeneration, the competition between trees and succession in forests (Vera 2000)[13]. Oaks are lovers of light, and since their newly sprouts do not have the ability to grow tall and slender, they are at competitive odds with existing taller trees around the stools. When young sprouts compete with many tall trees around, inevitably they lose the battle for light and slowly decline and die, leading the rot to penetrate in the stump and step by step reducing abilities and functions of the root system and dying of the stumps.

Some of surviving sprouts produce typical deformed and curved degraded existing coppice forest. The last characterized by limited growing stock and very slow trees growth (about 1 m^3/ha/year).

Finally its lead to decreasing the number of healthy old stools. Even though all the stumps of the trees should sprout after coppicing, the stocking would be incomplete because these old trees were too few in number and too far apart to reproduce the area completely by sprouts. This is supposed to be the reason why the Oak participation in degraded coppice is reduced and the hornbeam and ash increased. When coppicing is realized in short rotation and

[12] Ralph C. Hawley, The practice of silviculture, http://www.archive.org/details/cu31924073869541
[13] Grazing ecology and forest history / [edited by] F.W.M. Vera. Cabi International 2000

stumps are small, it may be entirely calloused and the entrance of rot before this is accomplished may be prevented by a smooth cut stump.

5.4 Comparisons of growth rate for stands under different coppice management regimes

The first measurements to assess the correlations between the traditional simple coppice forest and the coppice forest under selective cutting system were realized within the CNVP forestry project in Kosovo. This was done through combining project activities of the preparation of simplified management plans for private forests and the preparation of forest management plans based on cadastral zones as part of piloting decentralized forest management[14]. The fact that the trees are both, the product to be harvested and, allied with the site factors, the machinery of production; complicated the assessment and comparisons. Although the types of information wanted are interdependent and entwined with each other they are considered under three main heads constituents; the growing stock (structure, specific composition, density, ages, size and volumes), increment and properties of sites (details are provided in the annex 1).

5.4.1 Case study Nova Brde, Malishinca cadastral zone

The Malishinca cadastral zone in Nova Brde was selected to compare the simple coppice forest with the selective coppice forest. In the same site private forest exist with simple coppice and public forest with selective coppice. Despite the site similar conditions, stand structure and composition; the ages and size of the trees in the selected stands are different, due to the different implemented management systems. The private forest is under the simple coppice forest, originate from clear cutting and the public forest is under selective cutting (see annex 2 for the planned activities for coppice forest in 2013).

Figure 20 Public selective coppice forest

Figure 21 Private simple coppice forest

The indicator of forest increment is used as vital representative of stand conditions and used to compare the growth and productivity of the forest stands. The continued yields from the

[14] Refer for further information on these activities as well the thematic story on Forest Decentralisation and Sustainable Forest Management, of CNVP, 2014.

forest depend on the net increment that is essential to attain a dynamic state of equilibrium, which provides the differences coming from different management systems implemented. The final result, for forest products depends on the amount of the wood that can be annually expected. The manner of working the forest land (a selective coppice management system, or simple coppice forest system) will depend on how increment can be maintained or improved in quantity and quality.

Four permanent sample plots are established, two in the simple coppice forest and two in the selective coppice forest. Being in different ages (the selective coppice forest 18 years, the simple coppice forest 36 years) the comparisons of growing stock are eliminated. The differences in annual increment resulted with a coefficient k=2.9: (i) in an annual increment of 11.1 m^3/ha/year in simple coppice forest, and (ii) in an annual increment of 3.8 m^3/ha/year in selective coppice forest (details are presented in annex 1).

5.4.2 Case study Pashtriku FMU

The Pashtriku FMU in Gjakova, Lypoveci cadastral zone was selected as the second case study. The four sample plots selected have similar stand conditions, stand structure and ages. The differences are shown in stand composition, number of trees, diameters, growing stock and annual increment. The coefficient of differences of surveyed indicators (in the last column) are very high in growing stock and annual increment. The impact of light regime for the stools remaining in the shadow after selective cutting and intensive illegal selective cutting in public forest compared to the appropriate light regime and good protection and maintenance in private forest in simple coppice is regarded as the leading factor for this high difference in the important forest stand indicators.

Table 6 The measurements and coefficient of differences for number of trees, growing stock and annual increment between the two management systems

Management system	measurements unit	simple coppice	selective coppice	*The coefficient of differences %*
Sample plot area	m^2	100	100	*no difference*
Age	year	17	15	*no difference*
Height	meter	7.2	4.5	*160*
No of trees per sample plot	no of trees	51	111.5	*46*
Average diameter	cm	7	2.615	*268*
Growing stock m^3/sample plot	m^3	0.7	0.19	*370*
Growing stock m^3/ha	m^3	71	18.9	*370*
Annual Increment m^3/ha	m^3	4.17	1.3	*334*

The difference between the two practices are clearly indicated. The simple coppice management practice gives a much higher productivity. The situation in the selective coppice forests is showing a negative situation of unsustainable degraded coppice.

The situation in these degraded coppice forest is coming from actual forest management. The Kosovo forest administration is aiming at converting coppice forest in to high forest. This focus is remaining from past strategies. However, the actual low planning and even lower implementation of activities by KFA has led to a non-management of most of the coppice forest in which illegal logging takes place. As explained before this selective coppice is gradually degrading the coppice forests.

5.5 Proposed models for coppice forest rehabilitation

The main question is how to change the situation of degraded coppice forests. Two models are proposed and implemented in small scale for demonstration. These models are proposed based on the analysis in joint effort by the project and involved stakeholders. The suggested models are offering an option of SFM to deal with these degraded coppice forest in Kosovo. The model is aiming at the higher impact of the management regime according the degraded Oak coppice forest rehabilitation.

5.5.1 Nova Brde, Malishinca model

A new simplified management plan was prepared for the Manishinca cadastral zone in Nova Brde. The management plan was made in close cooperation with KFA of Gjilan, Nova Brde Directorate of Agriculture and APFO of Nova Brde. The parcel to establish the experiment area was defined. Five permanent sample plots were established. Based on the data collection and processing one detailed testing scheme was prepared, marked in the field and implemented at the end of April 2012. A coppice scheme of alternate clear cuts in small strips was implemented (see scheme in figure 22).

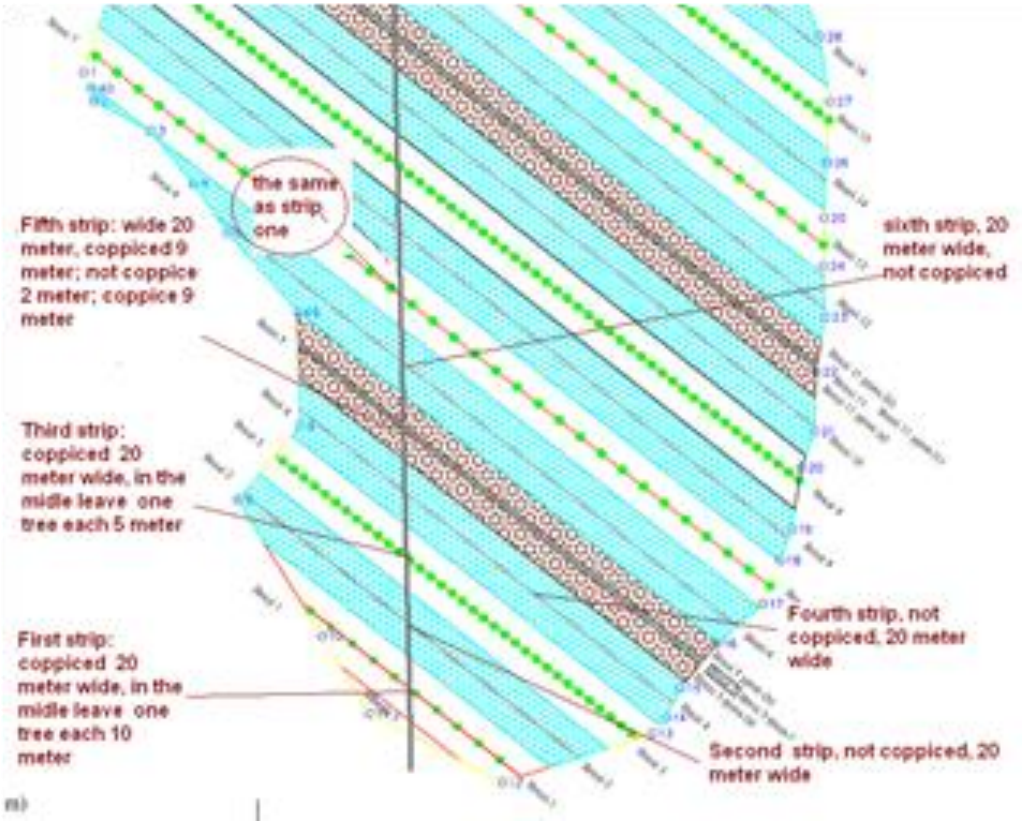

Figure 22 The scheme of small scale coppice strips in Novo Brde

The objective of the treatment is to demonstrate the rehabilitation of degraded forest and to transfer it to coppice forest with standards. The dimensions of the strips and the number of the standards are implemented in three different schemes, (i) strip 20 m wide, with an row of

standard trees in the middle with 10 m distance; (ii) strip 20 meter wide with a row in middle with standard Oak trees in distance 5 m, and (iii) strip 20 meter wide with 9 meter wide, 2 meter untouched existing trees followed by the second strip of 9 meter wide. The cut was advised close to the ground, giving a sloping smooth surface to prevent water from settling and causing decay.

The long term the goal of the experiment was: (i) to test the optimal dimensions and recommended "area of annual coupes," (ii) to assess the rotation age based on the size of material required; (iii) to determine the rotation of maximum annual volume production and (iv) to monitor the presence of biodiversity inside the annual coups.

This pilot intervention in Manishinca was implemented in May 2012 in cooperation with all stakeholders (KFA, Municipality of Nova Brde, APFO of Nova Brde and the local community). Specific permission was provided by KFA to implement this practice. Due to the interpretation on ban of clear cuts and hence coppice forests cuts a dialogue was needed. Since the model was practiced in strips with a width less than 1.5 times the tree height and leaving standards within the strips, permission was provided. APFO with the rural community under technical support of the Municipality and KFA implemented the activities. CNVP provided the overall support and guidance as part of the forestry project.

Figure 23 Strips cut with standards, implementation Malishince, May 2012

Figure 24 Development of regeneration, Malishince July 2013

Monitoring of KFA, Municipality and CNVP was realized through monthly field visits. Measurement of the number and dimension of new regeneration sprouts of the first vegetation period (May - October 2012) was realized through establishment of two permanent sample plots in two different interventions with an area of 100 m^2 with dimension 20m*5m. Data is recorded for all the (i) stools and (ii) per Oak species. Fifty spouts representing average height from each sample plot are cut.

Table 7 Summary of data resulted from measurements on experiment plots

All stools Indicator		Sessile Oak sprouts, data on mean sprout		Turkey Oak data on mean sprout	
No of sprouts for sample	50	Length cm	59.0	Length cm	60.0
weight g	1352	Mean diameter cm	0.6	diameter cm	0.5
Average weight of one sprout	27	Volume ml	20.0	Volume ml	15.0
No of stools for ha	6750	Weight of sprout with leaves	27.0	weight with leaves g	26.6
Mean of sprouts for stool	11	Weight of sprout without leaves	19.9	Weight without leaves g	13.3
No of sprouts for ha	74250	Weight of leaves	7.1	weight of leaves g	13.3

The weight with and without leafs is measured. The volume of 5 average sprouts is measured in graduated cylinders. Experts assess the observed growth as good vegetative regeneration and annual increment of sprouts based on this first vegetation season.

5.5.2 Pashtriku, Gjakova model

The second model was implemented in November - December 2012 in Gjakove, Lypoveci cadastral zone Pashtrik FMU. The model was designed on alternated strips of 20 meter wide

with 100 standard trees scattered inside the strip selecting the best trees in schemes with distances of approximately 10*10 m.

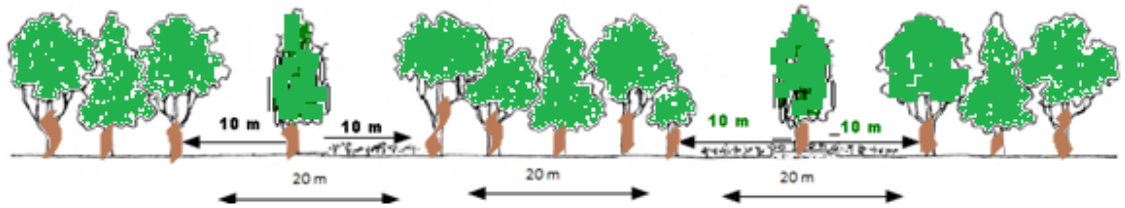

Figure 25 Schematic model applied in Pastriku

A similar approach was followed as in Nova Brde with involvement of the local community through APFO Gjavkova in cooperation with the Municipality and KFA.

The first year vegetation was challenging by insect and mild infection during May June 2013. The beginning of the second year the new sprouts have started. The second one looks promising as is shown in the picture of May 2014. Further surveys and studies are needed to know the impact of selective cutting in the density and sprouting abilities of stools.

Figure 26 Cut by strips with scattered standards, November 2012

Figure 27 Young sprouts development, May 2014

6. Conclusions

Coppice forest is an important land use practice in Kosovo. This system covers 38% of total country area. Oak coppice forest as part of this management system occurs especially in the surrounding of rural communities in the country.

The implemented management systems in public Oak coppice forest in the last 5 decades resulted in the degradation and decrease of annual increment. Annual biomass production is very low. The forest degradation in public coppice forest resulted from a management strategy by the forest authorities on conversion of coppice into high forest. This is well feasible if practiced and implemented well. However the low planning, lack of silvicultural interventions

and the focus on selective cuttings within the coppice stand has resulted in the degradation. This is further increased due to the pressure from the local communities to fulfil their needs of firewood. This is often supplied through illegal cutting in these public forests. As a result many of these degraded forests are without any management system and control.

On the other hand, despite the legal constraints, the traditional coppicing system survived in Kosovo's private Oak forest, implemented through small areas of group cutting scattered in very small plots. One of the features that differentiated small scale coppice management system (private forest generally) from selective cutting in coppice (public forest generally), is the care and vigilance for protection of the young coppice forest in the first years by forest owners.

This system of small scale coppice forest is officially regarded as illegally by the forest authorities, since it is contradicting with the interpretation of no clear cuts. This system in private forest is hence outside of the institutional setting. It is however wider spread and can be easily observed in Kosovo.

In the framework of the Sida-CNVP forestry project though participatory forest assessment this traditional practice is identified, experimented and shared with forest owners and forest administration. The results of the last national inventory shows that substantial portions of current coppice forests do not fully utilize the site production potential. Comparing different existing management systems and experimenting and practicing different coppice models of small scale interventions, sharing specific ecological knowledge's and reflecting on the results is needed to get a sustainable solution and avoid the further degradation.

It is extremely easy to grow an Oak tree from an acorn, showed and by indoor experiments in Junik elementary School (USAID-CNVP cooperation on environmental education 2011). On the other side, seeing the field practice, it is not easy to get one Oak originated by acorns within a real Oak stand. The Oak species of Kosovo do not like shade. They do not grow up underneath bigger trees of same species, but only in clearings, or sometimes under the lighter shade of other trees.

The practice of selective cutting in coppice forests of especially public forest has resulted in degraded coppice forest areas in Kosovo. Due to continuously harvest (legally or illegally) of the best trees, while not assuring appropriate space for regeneration of coppice, the stands have degraded in species composition and quality of species.

The practice of small scale interventions, the so called simple coppice forest, in private forest provide a different result, in which a regular production of wood biomass (firewood) is realized. And as well through the provision on small areas of cut coppice sufficient space for regeneration. These private forest are typical a mosaic of multi-aged forest in regular management and control by the private forest owners.

From this the most important conclusion, is that there seems still to be a silvicultural priority to have appropriate interventions to realize two important objectives; rehabilitation of degraded forest and a high standing volume of wood needed to realise higher production rates from the forests. Reviewing the results of the simple coppice forests of private forest owners, the potential amount for a sustainable Annual Allowable Cut (AAC) can be, most probably higher than previously thought, although of low quality (firewood quality).

The intervention for small scale coppice forest through strips has a great development potential for the degraded coppice forest in Kosovo. The forestry sector can increase its

importance as contributor to the national economy, both in terms of production and income from the wood and as a generator of employment opportunities. To realise this potential, however, a range of legal, technical and institutional procedures needs to be launched to make up for many years of neglected proper management. The challenge is to agree and establish legal local structures to implement the interventions in forest. The implementation of joint forest management as recommended by the Kosovo forest development strategy (2010-2020) can considered as the beginning of the positive change. The feasibility of this has been shown in the practice implemented for the cases in Nova Brde and Gjakova, in which the local community through their APFO in cooperation with the municipality and KFA practiced such joint forest management in degraded coppice forest.

Forestry is an important source of income for forest owners and for employment in rural areas. The future of the people, who make a living in rural areas from forestry, will considerably depend on how individuals and institutions react on stopping further degradation of this national property and turn it in a sustainable management. Increased awareness and understanding on treating these degraded coppice forest is crucial. It is therefore needed that forest owners and institutions will reflect on the old myths related to the coppice forest management. As well that stakeholders share with each other information and discuss how institutions, especially forest administration, and policy makers will be involved to know the reality. Such awareness and acceptance is needed to be able to put in to practice small scale coppice forest management based on traditional knowledge and experience, placed within a new institutional setting of joint forest management with shared responsibilities.

In the understanding of sustainable forest management (SFM) according to the Forest Europe the Ministerial Conference on the Protection of Forests in Europe (MCPFE) issues such as coppice forests are explicitly considered within the Pan-European criteria for SFM (MCPFE, 1998). It is acknowledged that traditional management forms contribute to the maintenance of forest biodiversity (Criterion 4), and have a valuable role with regard to social aspects such as maintaining traditional knowledge and practices (Criterion 6). The potential incorporation of small scale coppice forest management in Kosovo fits within these.

Most of the rural communities in Kosovo are surrounded by forest that could provide the necessary biomass for energy generation, making them more self-sufficient, reduce costs and provide employment. Especially the small scale coppice forest management may contribute to the sustainable biomass production. Besides traditional production of firewood, coppice forests are now supposed to deliver other wood biomass products for energy production (woodchips, pellets etc.). These products have not been considered by KFA as economically viable until recently. In this context, the MCPFE commitments to (i) contributing to the implementation of Kyoto-Protocol by promoting inter alia an increase in the use of bio-energy from sustainably managed forests (Vienna-Resolution V5 - MCPFE, 2003), and (ii) enhancing the role of the forestry sector in energy production, and promoting the mobilization of wood resources (Warsaw-Resolution W1 – MCPFE, 2007) are of interest.

Annex 1: Comparison of current stands resulting from management systems

Criteria of stands for selection of sample plots
Geographical position: To be situated in the pilot municipalities selected by MAFRD and in the same cadastral zones where the management plans are prepared for private and public forest.

Stand composition: To be dominated by Oak coppice forest (coppice dominated by Oak)

Soli condition: To be similar in point of view of type, deepness and slope.

Selected stands
Four municipalities were recommended by the MAFRD to pilot the decentralization of the forest management. Based on the agreed criteria the final stands for comparison selected are one cadastral zone of Nova Brde municipality and one cadastral zone in Gjakova municipality.

Nova Brde, Malishince case study
Selected stands are part of Malishinca cadastral zone. Both public and private forest are in similar ecological conditions. The detailed description of forest stands conditions are presented in the tables below.

Table 8 Current stand description

Main indicators	Public forest	Private forest
Municipality	Nova Brde	Nova Brde
Cadastral zone	Malishince	Malishince
Total area Altitude Topography Inclination Exposition Soil type Soil deepnes Erosion Stand Origin Yield Sanitary situation Wood quality Stand composition Herbaceous plants	22 ha 900-935 masl Slope 15-25% SE Brown Medium-deep no Coppice Low Good Poor Sessile Oak 68%, Turkey Oak 20%, Hungarian Oak 7% other 5 % (Hornbeam, Hazelnut, Sorbus, Juniper, Cherry, Hawthorn spp) Strawberry, Anemone, Hellebore, fern and poa spp scattered in the forest edges	1.2 ha 915-930 masl Slope 15-25% E Brown Medium deep no Coppice Normal/high Good Good Sessile Oak 65% Turkey Oak 35% Strawberry, Anemone, Hellebore, fern and poa spp scattered inside the stand and concentrated in the forest edges
Management	Selective coppice forest. No formally planned activities.	Simple coppice system with rotation 40 years in small coupes

System implemented in the actual rotation	Illegally implemented negative selection system	

Table 9 Sample plot measurement results Malishince

Indicators	Unit	SP No 1	SP No 2	SP No 1	SP No 2
Ownership		Public forest		Private forest	
Silvicultural regime		LF	LF	LF	LF
Management system		Selection CF	Selection CF	Simple coppice	simple coppice
Sample plot surface	m^2	100	100	100	100
Coppiced	year	1995	1995	1976	1976
Measured	month/year	Apr-12	Apr-12	Apr-12	Apr-12
Age	year	17	17	36	36
Height	meter	7.2	7.4	14.6	14
Trees with diameter less than 8 cm	no of trees	40	55	0	0
Trees with diameter more than or equal 8 cm	no of trees	11	7	31	33
Average diameter	cm	7	6	13.3	12.9
Growing stock m^3/sample plot	m^3	0.7	0.59	4.1	3.9
Growing stock m^3/ha	m^3	71	59	411	390
Annual Increment m^3/ha	m^3	4.17	3.5	11.4	10.8

Note: LF = Low Forest, CF = Coppice Forest, SP = Sample Plot

Gjakova, Pashtriku case study

Selected stands are part of Pashtriku cadastral zone. Both public and private forest are in similar ecological conditions. The detailed description of forest stands conditions are presented in the tables below.

Table 10 Current stand description

Main indicators	Public forest	Private forest
Municipality	Gjakova	Gjakova
FMU	Pashtriku 2	Pashtriku 2
Cadastral code	Lypovec	PG1996; GM 1839
Forest stand data		
Total area of selected stand Altitude Topography Inclination Exposition Soil type Soil deepnes Erosion	15 ha 539 masl Slope 10-15% S Brown Medium-deep no	4.1 hectare 432-442 masl Slope 10-15% S Brown Medium-deep no

Stand Origin Yield Sanitary situation Wood quality Stand composition Herbaceous plants	Coppice Low Good Poor Sessile Oak 100% Hellebore, fern and poa spp scattered in the forest edges	Coppice Normal Good Poor Sessile Oak 36%, Ash 37%, others 37% (Hornbeam, Maple, Chestnut) Hellebore, fern and poa spp scattered inside the stand and concentrated in the forest edges
Management system implemented in the actual rotation	Selective coppice forest. No formal planned activities. Illegally implemented negative selection	Simple coppice system with rotation 25- 30 years in small coupes

Table 11 Sample plot measurement results, Pashtriku

Indicators	Unit	SP No 1	SP No 2	SP No 1	SP No 2
Ownership		Private forest		State forest	
Silvicultural regime		Low forest	Low forest	Low forest	Low forest
Management system		Simple coppice		Selection coppice	
Sample plot area	m^2	100	100	100	100
Coppiced	year	1995	1993	1970	1970
Measured	month/year	Sept.2011	Sept.2011	Dec.2012	Dec.2012
Age	Year	18	20	15	15
Height	Meter	8	8	4	5
Trees with diameter less than 8 cm	no of trees	39	38	120	103
Trees with diameter more than or equal 8 cm	no of trees	22	23		
Average diameter	Cm	11.1	11.7	2.53	2.7
Growing stock m^3/sample plot	m^3	1.528	1.712	0.168	0.21
Growing stock m^3/ha	m^3	152.8	171.2	16.8	21
Annual Increment m^3/ha	m^3	8.5	8.6	1.1	1.4

Note: LF = Low Forest, CF = Coppice Forest, SP = Sample Plot

The measurement results

The Malichince, Nova Brde case study

In the conditions of different age between compared forest stands, the only indicator that can be compared is the mean annual increment. The mean annual increment per ha in private forest result 2.9 times higher than in public forest.

The Pashtriku, Gjakova case study

The sample plots have forest stands with similar age. The results shows high differences in stand height, average diameter stand composition, no of trees per unit, growing stock and annual increment.

The impact of light regime on the stools remaining in the shadow after selective cutting and intensive illegal selective cutting in public forest compared with appropriate light regime and good protection and maintenance in private forest in simple coppice indicates that this leads in this high difference in the important forest stand indicators.

Table 12 The results of measurements and coefficient of differences on no of trees, growing stock and annual increment between two management systems

Management system	measurements unit	simple coppice	selective coppice	*The coefficient of differences %*
Sample plot area	m^2	100	100	*no difference*
Age	year	17	15	*no difference*
Height	meter	7.2	4.5	*160*
No of trees per sample plot	no of trees	51	111.5	*46*
Average diameter	cm	7	2.615	*268*
Growing stock m^3/sample plot	m^3	0.7	0.19	*370*
Growing stock m^3/ha	m^3	71	18.9	*370*
Annual Increment m^3/ha	m^3	4.17	1.3	*334*

Annex 2: The implementation of the management plan in public Oak coppice forest

From the forest management plan of KFA for 2013 the activities planned in Oak coppice management class are selected and systemized in the table and graph below. The implementation was designed through a detailed annual operational plan for each forest management unit and planned forest parcels. The planned interventions are dominated by pre-commercial thinning, selective cuttings and phytosanitary cuttings as described in the tables.

Table 13 Silvicultural works planned in forest management plan 2013

Operational plan for Oak coppice forest, planned silvicultural work for 2013	Area Ha	Volume m^3
Cleaning	13	85
Phyto Sanitary cleaning	505	893
Selective cutting	110	1620
Phyto sanitary cutting in burned forest	10	325
Pre commercial thinning	310	2365
Thinning	54.6	539
Total of silvicultural works hectare	1002.6	5827

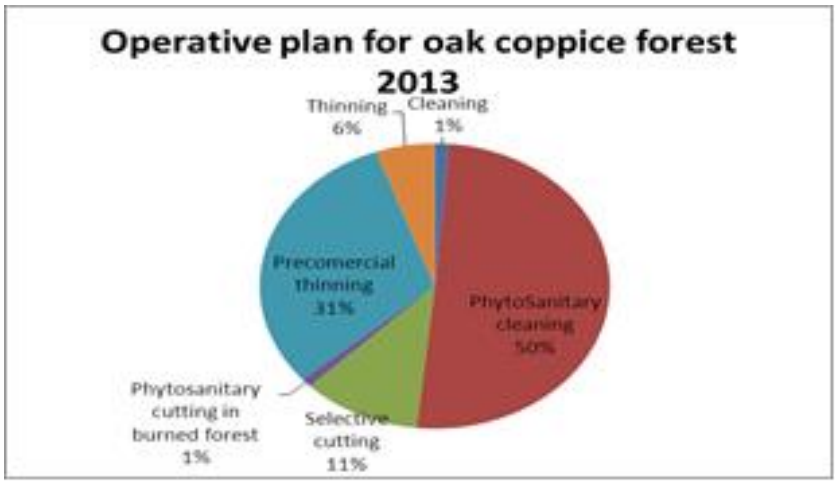

Figure 28 Structure of forest works planned (KFA annual plan 2013)

References

1. Åke Jacobson, Silvi Nova AB **,2003**, *Analysis of the potential for increased firewood production in Kosovo, the study report*
2. Bane, Peter, **2012,** *The Permaculture Handbook: Garden Farming for Town and Country* (Kindle Locations 940-942), Perseus Books Group, Kindle Edition.
3. Buckley, G. P. **1992,** Ecology and Management of Coppice Woodlands, Chapman & Hall, London.
4. CNVP, **2013,** *Progress report CNVP Sida Project "Strengthening sustainable private and decentralized forest management in Kosovo January-December 2013*
5. CNVP, **2014**, *Thematic story Forest Decentralisation* (Sida-CNVP Private and Decentralised Forestry Project, Kosovo and its region)
6. CNVP, **2014**, *Thematic story Sustainable Forest Management* (Sida-CNVP Private and Decentralised Forestry Project, Kosovo and its region)
7. Decanic, S., Dubravac, T., Lexer, M., Stajic, B., Zlatanov, T., Trajkov, P. **2009,** *Past and recent coppice forest management in some regions of South Eastern Europe*, *Silva Balcanica*, 10 (1): 47-62
8. F.C.Osmaston, **1968,** *The management of Forest,* Commonwealth Forestry Institute, Oxford, Printed in Great Britain Aberdeen University Press, George Allen and Unwin Ltd, (International Book Distributors, Dehra Duun 248001 India) Post box no 4
9. FAO **2005**, *Report on Private Forestry in Kosovo*
10. Glavonji, B. D.:**2011,** *Consumption of Wood Fuels in Households in Serbia* – Present … thermal science, Year 2011, Vol. 15, No. 3, pp. 571-585
11. Glück, P., Avdibegović, M., Čabaravdić, A., Nonić, D., Petrovic, N., Posavec, S., Stojanovska, M. **2010.** *The preconditions for the formation of private forest owners' interest associations in the Western Balkan Region*, Forest Policy and Economics, 12(4):250-263
12. Kleator, Glen, 1998, *The life of an Oak: An intimate Portrait*, Berkeley, Calif Heyday
13. Kola, H. **2013,** *Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkan: Forest Management Practices Supporting Wood Biomass Production*, CNVP, 35 pg
14. Krawczyk, M., Vermont, K., **2014**, *A New, Six-Thousand Year Old Forestry Model*, (Available at: www.keylinevermont.com. Last accessed on: 15 February 2014)
15. Law, B. **2001**. *The Woodland Way. A Permaculture Approach to Sustainable Woodland Management.* Permanent Publications, Hampshire. 272 p.
16. MAFRD (Ministry of Agriculture, Food and Rural Development of Kosovo), **2013,** *FAO Kosovo Forest Inventory Project,* (Available at: http:// kosovoforests.org/wp-content/uploads/2013/04/Kosovo report.pdf. Last accessed on: 28 February 2014)
17. Nestorovski, L., Trajkov, P., Hinkov, G., Decanic, S., Vuckovic, M. **2009**, *Contribution towards energetic potential and possibilities for forestry biomass energy utilization from coppice forests in some countries of south-eastern Europe*, Silva Balcanica, 10(1): 63-67
18. IEA, **2008**, International Energy Agency (IEA) in cooperation with UNDP, *Energy in the Western Balkans: The Path to Reform and Reconstruction*, IEA Publications, 9, rue de la Fédération, 75739 PARIS CEDEX 15
19. Peterken, G.F. **1992.** *Coppices in the lowland landscape*, in: Buckley (Ed.) Ecology and Management of Coppice Woodlands, Chapman & Hall, London, 3-17.
20. Popi Panoutsou at Al, **2011,** *ESC Biomass Consumption Study*, CRES Centre for Renewable energy resources and saving
21. R J Fuller and M S Warren, **1993**, *Coppiced woodlands: their management for wildlife*, second edition

22. Rackham, O. **2003**, *Ancient woodland. Its history, vegetation and uses in England,* London; Castle point Press, 584 p
23. Ralph C. Hawley, Professor of Forestry, Yale University, **1921,** *The practice of silviculture*, New York, London, http://www.archive.org/details/cu31924073869541
24. REC, **2010**, *Illegal logging activities in Bosnia and Herzegovina: A Fact-Finding Study*, Regional Environmental Center, 27 p.
25. Stajic, B., Zlatanov, T., Velichkov, I., Dubravac, T., Trajkov, P. **2009**. *Past and recent coppice forest management in some regions of South Eastern Europe*, Silva Balcanica, 10(1): 9-19
26. Vacik, H. Zlatanov, T., Trajkov, P., Dekanic, S., **2009,** *Role of coppice in maintaining biodiversity*, *Silva Balcanica*, 10(1): 35-45
27. Vera, F.W.M. **2000**, *Grazing Ecology and Forest History*, CABI Publishing
28. William Bryant Logan, **2005**, *Oak frame of civilization*, Copyright© 2005, Printed in USA
29. Wolfslehner, B., Krajter, S., Jovic, D., Nestorovski, L., Velichkov, I., **2009,** *Framing stakeholder and policy issues for coppice forestry in selected central and South Eastern Europe,* Silva Balcanica, 10(1): 21-34
30. Zlatanov, T., Lexer, M., **2009,** *Coppice forestry in South- Eastern Europe: Problems and Future Prospects*, Silva Balcanica, 10(1): 5-8

Abbreviations

APFO	Association of Private Forest Owners
CNVP	Connecting Natural Values and People Foundation
dbh	diameter breast height
FMU	Forest Management Unit
KFA	Kosovo Forest Agency
masl	meter above sea level
MCPFE	Ministerial Conference on the Protection of Forests in Europe, now called Forest Europe
NFI	National Forest Inventory
SNV	Netherlands Development Organisation
SFM	Sustainable Forest Management
Sida	Swedish Development Agency

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