CONNECTING NATURAL VALUES & PEOPLE

Strengthening Sustainable Private and Decentralised Forestry Project Kosovo & regional

Wood biomass production

Opportunities for sustainable biomass production from small scale forestry in Kosovo and its region

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Content

1. Introduction

Biomass in forestry is defined as by product of the forest management activities. In other side it is a stored by biomass solar energy, and use of biomass is similar with use of sun power for growing. Traditionally used by local people for heating and cooking is an important source of income for forest owners and for employment in rural area. This paper provides insights in the impacts and lessons learnt of the "Strengthening sustainable private and decentralised forestry: Promotion of economic development through capacity building in farmer based forest management in Kosovo and its region" the project activities on assessment of potential of biomass production and use for bioenergy, has an important impact leading to sustainable forest management. The project is implemented by Connecting Natural Values and People (CNVP) with financial support from the Swedish International Development Cooperation Agency (Sida) and the Netherlands Development Organisation SNV and ran from January 2009-March 2014.

This paper aims to identify the potential of biomass production and the opportunities for effective use of fuel wood and wood waste in Kosovo and region. Using renewable energy is one effective way of making our energy supply more environmentally friendly. It will enable the diversification of energy sources and reduce the excessive dependence on coal and oil. It is thus the surest means people have of both reducing emissions and improving the security of our energy supply. In addition, at a time of economic uncertainty, the renewable energy technology industry is one which keeps on growing, providing jobs and developing new technologies, and helps Europe to maintain its place at the forefront of global industrial innovation.[1]

The importance of use biomass for bioenergy lies in the fact that it goes in the same direction as the major global objectives, such as:
• reducing the phenomenon of global warming, about the “greenhouse effect.” Through increased use of renewable fuels in order to reduce the use of fossil fuel origin.
• Reducing the phenomenon of global warming, about the "greenhouse effect", through the development of sustainable management systems for forest ecosystems - the biggest absorbing carbon dioxide gas that is in the air.
• Increased efficiency in energy production from a new material without processing, which we will assess current levels of minimal value.
• Increased use of one of the greatest natural resource, wood. In other words, to create a new connection within the value chain in bioenergy production.

This paper tells one of the seven 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 six stories include: 1) Organisational set up of the APFO network in Kosovo, 2) Forest Decentralisation in Kosovo, 3) Sustainable Forest management practices (coppice and pre-commercial thinning) for joint forest management, 4) development of regional networking with REFORD, 5) Service provision by Associations, and 6) Gender & forestry.

[1] Renewables make the difference – EU Commission, Directorate for energy, Luxembourg: Publications Office of the European Union, 2011

2. Wood biomass in Kosovo and region

2.1 What is wood biomass?

Wood biomass as term is often used to refer to any non-merchantable wood materials that do not have actually local market. This could include live trees and wood plants including branches, tops, needles, leaves and other wood parts grown in a forest, or agroforestry systems that are by product of forest management. Forest management practices include a wide range as thinning operations, sanitary cutting or measures to reduce wildfire risks. The type and quantity of woody biomass removed from such practices varies widely. In practice, the term "woody biomass utilization" refers to economic uses for the remaining small diameter trees, branches and needles. Energy stocks such as woodchips, wood pellets, briquettes, can be produced from the smallest size materials as well as leftover scraps and sawdust from the production of finished woods products.

Figure 1: Woodchips and pellets

Kosovo is situated in the Balkan Peninsula and is surrounded by Albania, Macedonia, Serbia and Montenegro. Currently, Kosovo is divided into 37 municipalities and circa 1,298 villages. The geographical basin of Kosovo covers in total an area of 10,840 square kilometers and is situated at an altitude between 500 - 600 m and is surrounded by mountains. Most of the area of Kosovo consists of two plains divided by a hilly ridge running north to south. The Sharr Mountains are a major range forming the southern border; the Albanian Alps form the western border, both ranges covered with the main forest and pasture resources of the country. Country varies in elevation from 265 to 2,656 m above sea level (asl). The variety of elevations and soils have contributed in rich natural biological resources, very important on providing fuel, food, shelter, and a source of income for Kosovars.

A country-wide forest inventory conducted during the years 2011- 2012, concluded total forest land area of 476,000 ha, out of these a total of 180,800 ha (38%) of Kosovo's forest is classified as privately owned, and 295 200 ha (62%) classified as public forest. Coppice forest covers 84% of the total forest area. This is a result of extensive harvesting, in particular by short rotation coppice forestry for firewood production. The forest which regenerates naturally is normally beech (*Fagus spp*.), mixed beech and conifers, and pure coniferous forests located at higher elevations.

The average size of private forest estates in Kosovo[2] is in the order of 1.5 ha considering about 131,000 owners. Structure of private forests in Kosovo **:** forest property size *per* owner (*ha*)

[2] FAO 2005. Private forest owners in Kosovo

1,5 hectare, number of forest parcels 317,100, average size of forest parcel (*ha*) 0,63 (FAO 2005)). The average area of 1.50 ha per owner is split on (average) 2.4 parcels. From the above figure it may be concluded that about 117,000 forest owners has less than 3.0 ha of forest land (in total 148,000 ha). This means that a remaining group of 3 700 owners has about 34 000 ha with an average size of 9.3 ha. The distribution of owners between the categories <1.0 and 1-3 ha is very uncertain.

2.2 Methodology (the process and activities of the project)

The assessment of potential of forest biomass in Kosovo and region is part of Sida CNVP project activities and is realized through using the sources of MAFRD in Kosovo, as NFI (National Forest Inventory) of 2002-2012, realizing case study on assessment the different sources (Junik Municipality), supporting farmers on piloting the short rotation coppice, demonstration on planning and implementation silvicultural works on young and degraded forest.

Project support Forest owners association in Macedonia and Kosovo to implement the production of the biomass from different sources and supply with it piloting heating systems. Two innovative heating systems based on biomass use are established in Macedonia Berovo and Kosovo in Rugova. The assessment of biomass potential and four case studies in both potential and use of biomass in innovative heating systems are part of this paper.

2.3 Legal frame work on biomass bioenergy

In relative terms the legal structure for guiding forest sector activities is in place. There is a Forest Law and other laws with bearing on forestry in a wide sense. There are also a fair number of administrative directives. However, regardless of this supportive legislation one of the biggest challenges is the lack of adherence to the laws. This situation most likely depends on a multitude of reasons. (i) Staff and affected persons are not aware of the legal framework, (ii) the legal framework is not as meaningful, (iii) the legal framework is neglected since it is regarded as obstructing the operations/activities, (iv) supervision and enforcement is not in place and (v) the police, prosecutor and court systems do not follow up properly on reports of law transgresses.

The main institution in charge of forestry issues in the field (KFA) was established by a UNMIK regulation in year 2000 as an Authority, and transformed to an Agency in 2003. This state branch is facing many difficulties, the main reason being factors such as staff competence, lack of resources and funds, unclear/disputed roles and mandates.

Ministry of Economic Development is responsible institution for all drafting of strategies and energy policies. Some of the most important law in the field of energy sector are:

- Law on Energy (approved in late 2004), which stipulates (in article 12), that the MED shall each year establish indicative targets for the consumption and also for the production of electricity or heat generated from renewable energy sources or cogeneration for the whole of Kosovo for the following ten years.

- Law 2004/9 "On Energy Regulator" established fully independent Regulator (Energy Regulator office-ERO), completely autonomous from any Governmental Department to exercise economic regulation in the energy sector including electricity, district heating and natural gas, and defined its executive powers, duties and functions.

- Kosovo Government on May 2007 approved Decision No 05/250 named "Incentive measures for generation of electricity from renewable energy sources and co-generation in Kosovo for the period 2007-13".

- Another document is Report of the Implementation of the "Plan for Implementation of the Acquis on Renewables", which was prepared from MEM in May 2008. The report provides information on the status of the Plan, and prepared to comply with the requirements of the Treaty for the Energy Community in South East Europe. The report however is focused on the following two Directives.

- Directive 2001/77/EC, on the promotion of electricity produced from renewable energy sources in the internal electricity markets.

- Directive 2003/30/EC, on the promotion of the use of bio-fuels or other renewable fuels for transport.

It is also important to mention Efficiency and Renewable Energy Program of Kosovo for 2007-2009, was prepared in late 2006, and currently is under implementation. The Ministry of Economic Development on behalf of Kosovo signed the Energy Community Treaty (EnCT) in October 2005, and the Treaty entered into force in July 2006.

2.4 Potential on Biomass production/use Kosovo – Region

The use of firewood remains as a main source for the majority of families in rural areas and considerable families of urban areas. The firewood is considered as a most valuable alternative with low costs, taking into account the current economic situation in the country. Local people are aware that the main cost on firewood in its transport. Is this one of the main reasons why everywhere in Kosovo the sides of canals, roads, streams and demarcation of the private agricultural farm, are lineated with strips with tree species in different shapes, ages and landscapes.

Table 1: Woody biomass separated on above and below-ground components, and total corresponding carbon stocks and carbon dioxide equivalents in forest by tree species group (1000 ton).

Tree species Group	Basic wood density	Above –ground biomass			Below- ground biomass		Total bio-mass	Total carbo n mass	Total
		Growing stock	Biomass expansion factor	Total	Root/ shoot ratio	Total			
	tonnes/m3	m3		tonne s		tonne s	tonne s	tonne s	tonnes
Coniferous	0.40	6080	1.3	3162	0.35	1107	4269	2134	7825
Broadleaves	0.58	40251	1.4	32684	0.35	11439	44123	22062	80892
Total		46 331		35746		12546	48392	24196	88717

Explanation to the table: The biomass expansion factor adds biomass of small branches, tree tops and leaves to stem biomass. Below-ground biomass is 35% of above-ground biomass (root/shoot ratio). Dry biomass contains 50% carbon. The total weight of carbon dioxide molecules containing one tonne of carbon is 3.667 tonnes (CO2/C-ratio=44/12)2.

At present biomass is by far the most important renewable energy source in Europe. In the 27 member nations of the European Union (EU27, population 500 M) biomass contributed 8.2% of total final energy consumption in 2010 or nearly 64% of European renewable energy (AEBIOM 2012). Forest biomass is the dominant feedstock contributing about two thirds of total biomass for energy production or about 50% of total renewable energy (Mantau 2010).

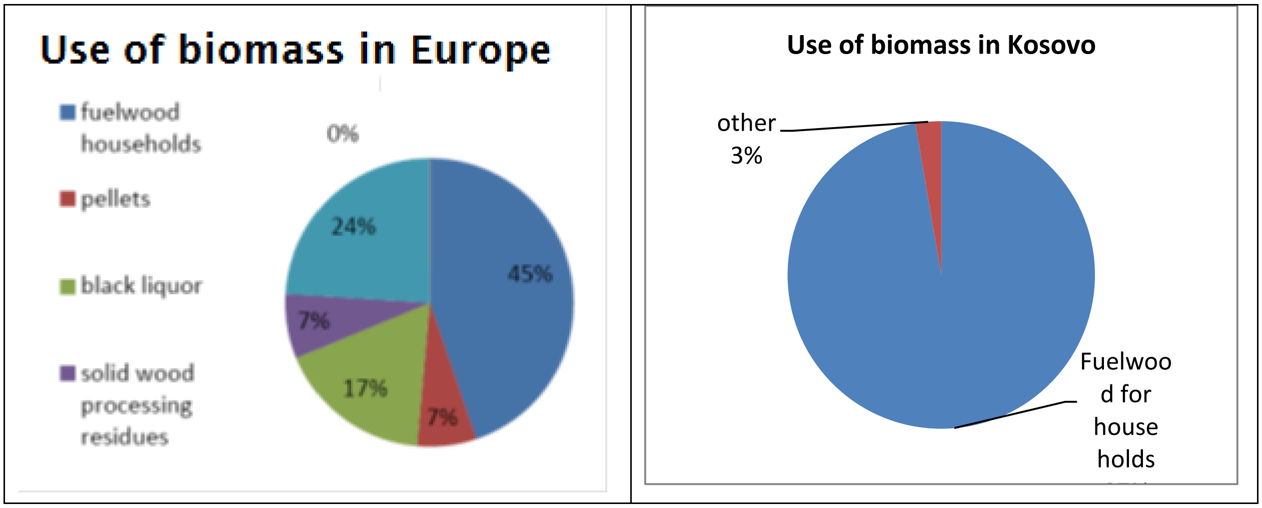


Figure 2: Use of forest biomass for energy production in the EU (346 M m^3) and Kosovo 1.1 M m^3, EU data from Mantau (2010), data for Kosovo CRESP Study

3. Description of biomass status, development

3.1 Current situation

Most of the increment is in public forest, because most of the forest is publicly owned (62%).

Table 2[3]: *Area, mean growing stock and annual increment in forest by tree species group and ownership (ha, m3/ha, % of growing stock)*

Ownership	**Tree species group**								
	Coniferous			Broadleaved			Mixed		
	area	vol/ha	increm	area	Vol/ha	increm	area	vol/ha	increm.
Public	21000	209	3.1	266000	80	3.2	7000	251	3.5
Private	2600	152	3.8	177200	68	3.7	600	342	3.1

[3] Source Kosovo NFI 2013

89% of the coniferous forest area stocked by trees with (diameter breast height) dbh >7 cm is owned by the public, including most of the natural forest at higher altitudes. This explains the higher average growing stock in volume per ha in public forest. Also for broadleaved forest, average growing stock is higher in public forest than in private. The large portion of *Fagus spp.* forest under public ownership may contribute to the higher mean stocking level. The relatively large portion of broadleaved forest actively managed for short rotation coppice, may explain the higher volume increment percent in private forest compared to public forest.

Annual increment in 2012 is similar to 2002, the results indicate that the annual increment of *Quercus spp.* has declined slightly, whereas the increment of coniferous species has increased.

Table 3: *Average annual felling in forest by tree species group and ownership (1 000 m3). Data are based on re-measured sample plots*

	Ownership			
Tree species group	Unknown	Public	Private	Total
Coniferous	0	123	12	135
Broadleaved	2	496	326	823
Total	2	619	338	959

These figures are based on measurements on re-measured trees, i.e. exactly the same trees as in 2002.This enabled the fieldworkers to assess exactly which trees that had been harvested during the period 2002-2012. These re-found plots represent 60% of the total forest area in Kosovo. Assuming that the surveyed area is representative for the total forest area, 1.6 million m^3 have been felled annually, with 1.0 million m3 felled in public forest and 560 000 m3 felled in private forest.

3.2 Main sources of firewood and biomass production

Four main different sources of supply with biomass are considered and analyzed as follows.

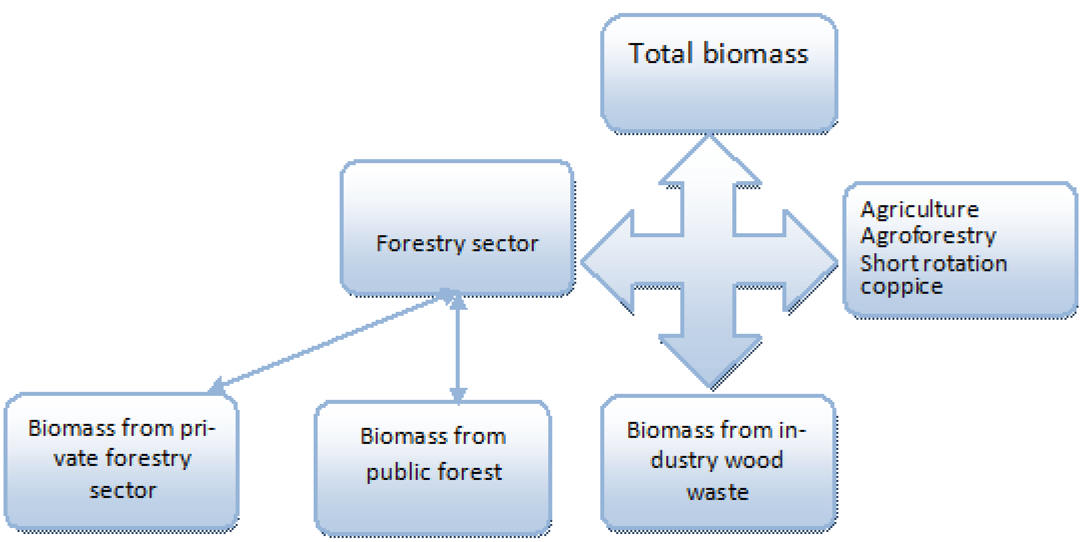


Figure 3: Source of supply for wood biomass

3.3 Public forests

The Kosovo Forest Agency (KFA) issues annual cutting plans and municipalities issues licenses for cutting wood in the public forests. The volumes licensed are registered but the ability to actually control what is being taken out is limited, and subsequently, the statistics are of limited use in estimating the actual output. Statistics collected and compiled for 2011 shows that only a fraction of the wood cut in public forests is accounted for and thus harvested within the framework of existing regulations.

Beside the high potential on the use of remaining wood residues after illegal or legal harvesting (It will be treated in the details from the case study in Junik part of this paper), public coppice forest can be considered as non until now used opportunity to increase the legal production.
A lot of surveys and measurements realized in different municipalities as Nova Brde, Gjakova, Kline, Suhareka, shows a high potential in biomass production. The analyses of the model tree organized in participatory way in Kline and Kaçanik, shows the high potential of biomass production from coppice forest in the first years. The biomass assessment of the model tree is realized through calculate volume of stem and crone volume calculated through sampling method. The measurement were focused on the total volume resulting from main stem and crone. The relation between volume and weight are calculated based on the specific weight of stem in the moment of measurements. The crone volume is calculated through samples, calculating the branches and top volume, the weight and rate between branches and leaves.

Table 4: Estimated total biomass results

The indicator	amount	The share in %
weight of stem kg	363.35	68
Weight of crone branches kg	119.6	22
Total biomass kg	532.35	
Expansion factor	1.47	

The calculation of the potential of coppice forest in biomass production in national scale can be realized through further measurement and surveys in filed. From the last national inventory, the results in national scale shows the urgent needs of the oak coppice forest for rehabilitation works.

Table 5[4]: The actual area and growing stock of Oak coppice forest in Kosovo

Management classes	Area in hectare	Area %	Growing stock 000 m³	Growing stock %	Average growing m³/ha	felling 000 m³ in last 9 years	felling % in last 9 years
Coppice forest							
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

Actual status of coppice forest shows an urgent need for national reflection. And put under management this important resource. Being for a long time one problem, it can be transformed in the current solution. The models for rehabilitation are designed and implemented. The monitoring results show high rate of growth in the implemented models. In other side coppice forest rehabilitation works are real employment opportunities, to increase the productivity of biomass on large areas of currently degraded forests which under efficient management can produce a much higher yield of timber, fuel wood and wood biomass. Based on the experience and traditions on management practices on low forest implemented by forest owners there are some advantages in management, production, and revenues:

• The coppice system is very simple in application, needs less expertise in field and regeneration is usually more certain and cheaper than in the case of reproduction by seed.
• In the earlier stages coppice growth is more rapid, hence where a large outturn of firewood of small to moderate size is required coppice is generally superior to high forest.
• Coppice is worked on a shorter rotation than most high forest crops, and very soon can have positive impact in reducing illegal logging and fill the gap between the plan and demand on firewood.
• Coppicing in careful demarcating strips as experimented can transform the problem of "illegal cutting" in the "solution", legal cutting in each planned degraded forest parcels with clear definitions, to transform the degraded forest in an improved forest.
• This system can enable a radical change from "no management" approach leading to 'illegal management", to the management approach, leading to employment and forest improvement, with less investments and capital tied up in the growing stock, and earlier returns obtained, than in the case of high forest.

[4] Source NFI, Kosovo 2013

Figure 4: Wood waste resulted from coppicing in degraded Oak coppice forest

3.4 Private forests

A considerable part of the firewood supply can be assumed to come from the private forests (especially in the 2011-2012 season winter conditions when the firewood prices have been very high). According to the forest law, a private owner is required to report to the KFA the intent to cut wood on the estate, and KFA shall approve the plan and make the marking of the trees to be cut. KFA, however, has limited capacity to control the activity, and less so to record the actual volumes cut. Due to this administrative bureaucracy and the limited capacity private forest owners harvest therefore much more than the amount for which permission is requested.


Figure 5: Private forest in Kosovo, Leskovic

For all groups the analysis will assess the biomass production based on the forest inventory and forest planning and production data available. As base for the assessment of forest resources related to capacity of wood biomass production will be the last National Forest Inventory database (FAO 2033) Cross checking with field data and field assessments will be made as well using stakeholder key person knowledge.

3.5 Agro-forestry

A significant part of the firewood supply is coming from agroforestry, outside the traditional forestry sector. This source is not considered in the biomass firewood country balance, while it is assumed that this is a considerable volume. The case study realized in Junik shows the high potential of agroforestry in biomass production.


Figure 6: Agroforestry in Kosovo, producing wood waste, biomass

3.6 Wood waste from wood processing industry

Actually the wood processing and chain shows supply the dominant part on pellet and briquette production in Kosovo. The available data are very limited. Further surveys are needed to estimate the potential of the sector on biomass production.

Forest wood residues consist of bark stripped off round logs, thin branches with bark and stumps with large roots. Some residues are already being used for other purposes, and most stumps are left in the ground. In a well-organized company, practically all wood waste is used in either board production or as fuel to produce heat and electricity. However, some wood processing companies in Kosovo have available wood biomass, but do not use its full potential. Instead, they either spread the waste around their property, or simply push it into streams and rivers, discarding a potentially valuable energy producing resource. Much more wood could be cut, generating more of the wood waste resource and a greater percentage of that waste could be converted into energy.

Figure 7: Saw dust from sawmill in Peja, Kosovo, sold for briquette making

Case studies

In the next chapters several case studies related to wood biomass production are presented. These case studies are made as part of the CNVP Forestry Project for Kosovo and its region. The case studies relate to direct activities of the project undertaken with the partners as part of the project implementation and capacity strengthening and gaining experience with the partners.

4. The assessment of potential of biomass production in Junik Municipality

This case study aims to identify existing opportunities effective use of fuels from wood and wood waste, which till now have been very little or not used at all, mainly for the production of thermal energy / heating.

Geographic position: Junik Municipality is located in the western part of the Republic of Kosovo, lies in the Albanian Alps in an area of: 77.77 km2 at an altitude of 450 m in the area of

Kallavajit of up to 2,656 m at the top of Gjeravica - the highest peak of Kosovo. The surface area is presented as: 7,777 ha of land, 4,439 ha or 57.08% agricultural land (meadows and pastures are 2000 ha) and forests are 3,029 ha or 38.95% of total area.

There are two main rivers: Erenik and Travë. Ereniku. In Junik currently are found 4 types of ownership: private ownership, state ownership, municipal ownership and properties under the Privatization Agency.

Population[5]: according to preliminary results from the census in 2011 Junik Municipality has: 6078 inhabitants, who create: 768 households (number of members per household is: 7.91), whereas the average population per km ² is 78.2 inhabitants/km².

Public facilities: Among public facilities that use or could use biomass for heating should be mentioned: the elementary school building.

4.1 Junik Forests

Private forests share 22% forest of total forest are and are distributed in over 400 parcels located in Cadastral Zone Junik and Jasiq - Gjocaj, most of them consisting of patches of chestnut forest. State Forests form the Unit Management "Forest of Junik" that since 1957 have been managed on the basis of 10-year periodical forest management plans. This Management Unit lies except in the territory of municipality of Junik also in the territory of the municipality of Decani and Gjakova.

Table 6: Based on the new Management Plan of the Junik Forests, the actual structure of the forests

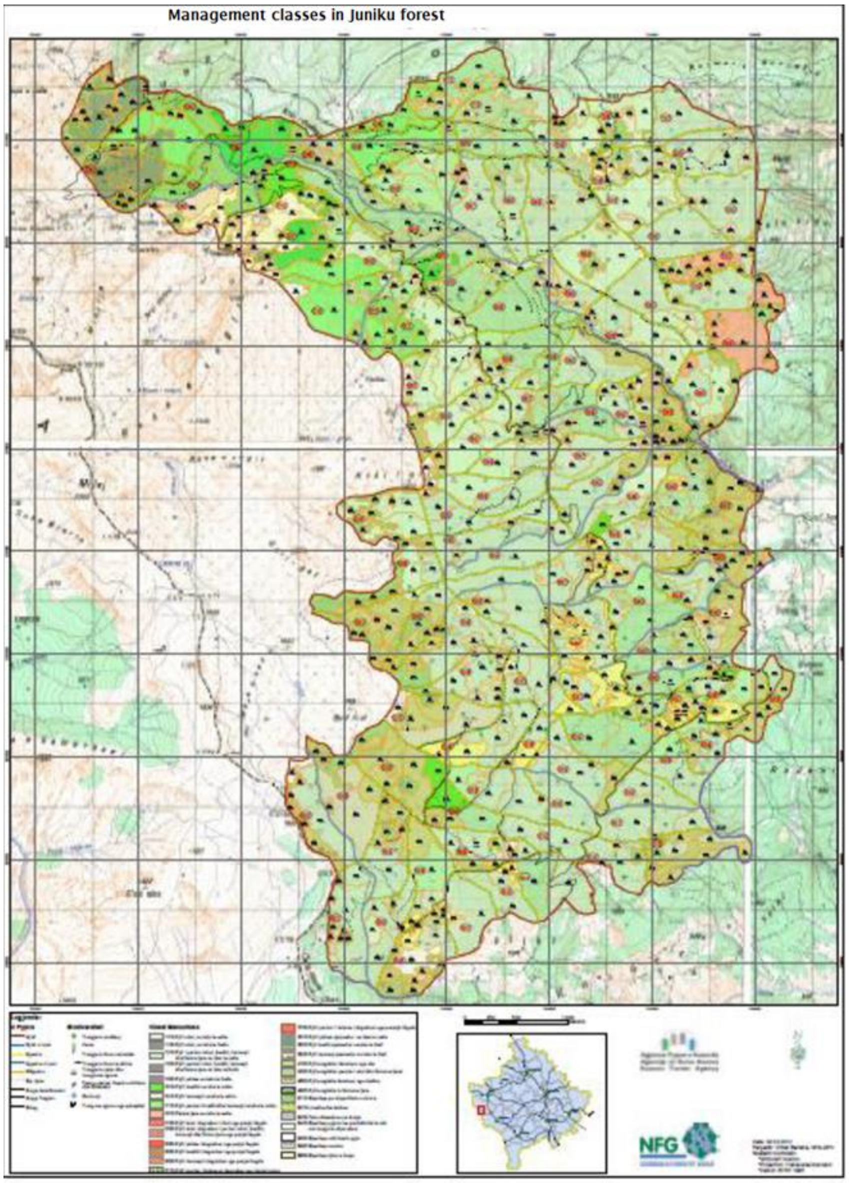
No	Management classes	Surface (ha)	Growing stock (m^3)
1	High forest uneven age	2,423	607,393
2	Degraded forest	333	62,347
3	High forest even age	97	21,093
4	Coppice forest	360	51,633
5	Bushes	0	0
6	Non-productive surface area	231	
	Total	3,444	742,466

The share between forest species is: Beech 73%; Spruce 11%; Fir 7%; *Pinus Peuce* 4% and 5% others. Annual growth is assessed as 2.7% of the growing stock. In the past 5 years there are illegally cut over 45,000 m³ of wood material, about 60% of AAC (Annual Allowable Cut) every year, causing 10% degradation of forests (NFG 2012). 70% of the standing volume belongs to the third and fourth quality class. Beech belongs mainly to these two classes, while conifers belonging to the class rather than second quality. This dictates an inferior assortments of standing Beech (the report is usually: technical wood: fire wood 30:70).

Privately owned forests with soft chestnuts are quite heterogeneous considering the management form. There are small rough cutting and the selective thinning are applied.

[5] (source: http://esk.rks-gov.net/rekos2011/repository/docs/)

These forests represent another potential of wood biomass, in contrast to other types of forests in this case we are dealing with an area of about 400 ha of forest which is mainly infected with the cancer of chestnut bark, 40-50% of this forest type stands. According to some fragmented measures in these forest timber the volume of wood is: 145.11 m^3/ha, with average annual increment of 2.9 m^3/ha.



The map of management classes distribution in Juniku forest management unit

Figure 8: Management classes in Junik forest management unit

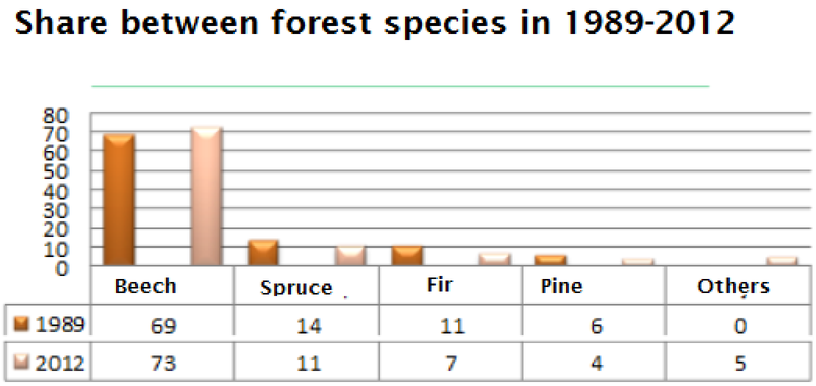


Figure 9: Share between forest species in Junik forests

Stocks of wood material in these part are estimated to be: 58,044 m3. Woody biomass resulting from dried trees and branches infected by *endotia parasitica* is estimated at about 26,000 m^3, the process of infection is ongoing on other trees chestnut trees.

4.2 Method of biomass assessment

The methodology is based on a combination of:

1. **Desk study:** All technical documentation for the Junik forests are being studied and recommendations and literature for calculation of potential biomass production;

2. **Surveys and Observations**: Is based on the specifics of the ecosystem. The intensity is combined with situations and variability, and every time where the evaluation was based on observation the samples were taken and the average is calculated for specific cases;

3. **Measuring directly in the field:** Measurements of samples and general calculations are main part of the study;

4. **Comparison analysis and synthesis:** The results provided by the three methods above will be subject to analysis and will result in the more accurate conclusions.

4.3 Assessment of assortments based on quality

The following calculations are based on several sets of data and interpretations as multiple measurements of different trees, consultations on volume and production tables as well the in consultation with KFA and harvesting companies:
1. The classification of wood material assortments based on the diameter categories:
-Logs with diameter bigger than 20 cm is considered as timber;

-Logs with diameter from 8 - 20 cm is considered as firewood;
-Small diameters remaining parts 3 - 7.5 cm, are considered "biomass" valid for the production of wood chips, pellets etc.
2. Classification of assortments based on valid management plan of Junik FMU are summarized in the table below.

Table 7: Classification of assortments

Nr	Quality of wood material	Distribution of wood quality		The share in FMU according categories
		Timber %	Firewood	
1	High quality	70	30	6%
2	Average quality	50	50	26%
3	Law quality	30	70	38%
4	Deformed trees	0	100	30%
5	Average	28.6	71.4	100%

4.4 Assessment of potential of wood biomass in state forest

The first step was the general assessment and classification of the main categories. The second step: Based on the forest management plan data and field surveys the Junik state forest are characterized. In the table below are given biomass sources of Junik grouped in categories based on the stage of forest stands and potential on production of firewood and chips (chips) from that part of the wood biomass that was not used in actual wood assortments standards. Third step: For each source of potential biomass production the coefficient of share between timber, firewood and biomass is calculated based on the sample plot measurement and criteria of assessment based on diameter and quality of logs.

Table 8: Wood biomass assessment – firewood and biomass

No	The source of biomass	The assessment description	Firewood %	Biomass %
1	Wood waste (WW) from dried trees inside forest stands	Based on the FMP data there are scattered 1.6% are dried trees inside the forest stands area of 317 ha are considered about 272 of trees	84	6
2	Wood waste from thinning and cleaning in the forest stands 20 m wide in both sides of forest road (Junik-Gjeravica)	The first calculation are realized using topographic map, the length of the road resulted about 50 km. The total area is estimated 200 ha. By the surveys concluded the trees in both sides of the road (the strip about 20 m wide) have more dense and developed tree crowns up to 2/3 of the tree height, profiting from light of road space. About 1/3 of crones proposed to be removed. The	60	14

		total amount of wood material to be removed 52,950 m^3 for the next 10 years.		
3	The wood waste after illegal logging from mixed stands of beech, and pine	Beech: remaining trunks in the forest have average height 0.7 m to 1 m, with the diameter of 35-40 cm. Spruce Remaining stumps of spruce in the forest are: the height of 1.1 m to 1.2 m and diameter of 35 cm to 45 cm	42 25	6.8 5.2
4	WW from wood harvested in beech forest	About 1/3 of wood material remained after harvesting last 5 years is classified as potential for firewood and biomass production	15	6.8
5	WW from wood harvested in spruce forest	The assessment is done for the wood waste with d <7 cm, with an average length 2.25 m. The average number of branches for each crone assessed is 42 with d>3 cm	10	5.2
6	Wood waste from planned for harvesting in beech forest	The FMP existing data used for estimation, 542 ha planned for harvesting about 4,950 m^3 wood material. The firewood planed is taken from FMP. The part of biomass is calculated from surveys on the top parts d< 7 cm in model trees, as well the volume of branches d > 3 cm	65	7
7	WW from mixed forest beech, spruce, pine and other broadleaves planned for harvesting	According FMP data 145 ha are planned to produce about 1,650 m^3 in the next ten years The firewood planed is taken from FMP. The part of biomass is calculated from surveys on the top parts d< 7 cm in model trees, as well the volume of branches d > 3 cm	50	6
8	WW from Coniferous forests planned for harvesting	According FMP data 72.4 ha are planned to produce 900 m^3 wood material in next ten years The firewood planed is taken from FMP. The part of biomass is calculated from surveys on the top parts d< 7 cm in model trees	35	6
9	WW from Beech and mixed forest planned for thinning	According FMP data 766.8 ha are planned to harvest about 4535 m^3 wood material Six sample plots with radius 15 m, established. No of trees for hectare 1500, Average diameter 24 cm. Recommended to cut 40-50% of trees The assessment of branches and residues for biomass with average d= 5 cm and h= 2.7 m about 15% of total branches Old seed trees scattered in the forest stand 1.5% of the total volume	82	8

		About 10% of total thinning volume appropriate for timber		
10	Wood waste from thinning in spruce and other coniferous forest	Two sample plots with r=15 m established. The results of measurements: no of trees/ha=800; with d= 19 cm and h=21 m. Top of tree with d< 7 cm 3.25 m Intensity of thinning 35%, about 17% of felled trees timber	75	8
11	Wood waste from cleaning in young forest	High forest. Survey realized in the parcel defined from thing in management plan, with total area 27 ha. Three sample plots with an area of 100 m^2 each established. Average data: no of trees ha 8,000, d= 8 cm; h= 12 m. All the removed trees can be used for woodchips production Low forest. Total area proposed for cleaning 13 ha with average diameter less than 8 cm. All removed trees can be used for woodchips production		100 100

Figure 10: Wood waste from dried forest trees (infected by under bark beetle)

Figure 11: Wood waste resulting after illegal logging

Figure 12: ***Wasteful tree harvesting: high stump, inefficient log utilization and damage to remaining trees. A lot of useful biomass remains in the forest[6]***

[6] Source NFI Kosovo, 2013

Figure 13: Wood waste potential from thinning and cleaning on two sides for the forest road

Figure 14: Wood waste resulted after forest harvesting in Beech forest

Figure 15: Wood waste after forest harvest in Spruce forest

4.5 Assessment of wood biomass in the private forests

Privately owned chestnut forests are infected by infected by chestnut blight (*endothia parasittica*). The infection is increased, resulting in devastated sweet chestnut forests in the last 30 years. Tree losses have been significant for forest owners. Sweet chestnuts are grown commercially in Junik and it was very important for the nut market, so in addition to the environmental and biodiversity impact, it have an economic impact as well. The infection enters through fissures or wounds in the bark, grows in and under the bark, girdling the cambium and soon kill the tree above the point of infection. The leaves above the point of infection die, followed by the limbs. Within two to ten years the entire tree is dead. Not uncommon to find many cankers on one tree. Removed the infected stems and branches of is recommended to halt the further infection spread. In the last two decades, scientists have attempted to debilitate the fungus by infecting it with a virus, a process called *hypovirulence*. *Hypovirulence* gives chestnut trees a much less potent form of the disease and gives chestnuts a fighting chance for survival (i.e., fungus is restricted to the outer bark).

Figure 16: Private forest with invested Chestnuts

Once introduced into a few trees, hopes are that *hypovirulence* will spread throughout the forest, offering hope to surrounding trees as well. Combination of the four approaches can bring the chestnut back Individual or group selection openings- an integrated management system using grafted trees, inoculating them with *hypovirulence* strains, and controlling hardwood competition.

Growing stock and wood material potential of chestnut private forest

According to some measures done in the frame of preparation of forest management plan for private forest the growing stock is estimated: 145 m^3/ha, with average annual increment 2.9 m^3/ha. In total growing stock is estimated: 58,044 m^3. The amount to of stems and branches to be removed to stop the further spread of infection is estimated to be about 26,000 m^3, but this figure is not final because the branch and stems dying process is ongoing.

4.6 Assessment of biomass potential from agroforestry

Agroforestry is present in all agricultural area. There are not data on the area covered and its share with agricultural land. There are not estimations on the forest species, dimensions and growing stock. Analyses of combined satellite images, aero photos and topographic photos, as well the interviews and small field surveys to assess the share of agroforestry in the total agricultural area of Junik. Agroforestry trees are generally called "mezhda", hedgerows with trees inside of agriculture plots, side of roads and channels, and streams. It is considered as a high potential source for the production of firewood and chips.

Figure 17: Hedgerows in Junik

Hedgerows and river banks, canal, roads parcels belts length

The estimation of agroforestry share in agricultural lands and the species and trees are realized through using satellite images, aero photo and field samples. 5 satellite images are analyzed. The cadastral maps, are used to locate the sample plots to measure the dimensions of hedgerows and tree species participation. The general length of all agroforestry components is estimated about 600 km (including and the sides of river Trrave and Ereniku).

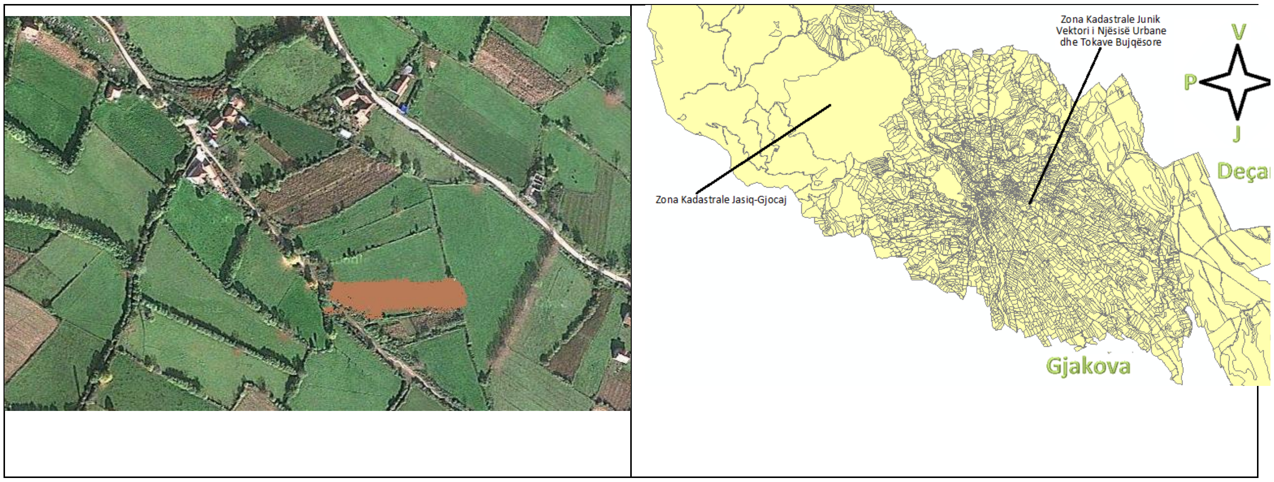


Figure 18: Aerial photos used for assessment of agroforestry in Junik

Figure 19: Measurement of Alder dbh in agroforestry belt as biomass source alongside of a stream

The forest trees and their management specifics and dendrometric characteristics are summarized in the table showing the potential wood biomass.

Agroforestry species	General description	Firewood %	Biomass %
Willow	Old pollarded 1-8-2.8 high trees, managed by farmers in a rotation of 3- 5 years. In the pollarding point the average number of branches is 8, with d=5 cm and length 5 m. The main trunk d = 30 cm height 2.8 m Willow shares 70 of total species	92	8
Black locust (Robina)	Short rotation coppiced trees with the biomass production mainly from the stem, with d 10-15 cm and height 12-15 m. The most of branches with d < 2.5cm not appropriate for biomass. In total about 40,000 tree	92	8
Poplar	Short rotation with d =45 cm h 25 m, in total about 6,000 trees	91	9
Alder and others	Short rotation coppiced trees with d =25 cm, h =13 m in total about 5,500 trees	90	10

4.7 Assessment of biomass production from sawmills, wood processing

In this case the analysis of samples is realized for type's Beech and Spruce. Calculations were made for each type and the results are given in the table attached

Table 9: Proportion of wood waste from timber production

The wastes resulting from	Total amount in m^3	Used for furniture production %	Wood dust %	Small wood pieces edges
Beech timber	1.45	53	22	25
Spruce timber	1.35	55	22.5	22.5

Figure 20: Wood waste from wood processing

Figure 21: Dust, wood waste, potential polluter of streams

4.8 Results of assessment for potential of wood biomass production in Junik Municipality

Based on the findings and analysis of nine surveys conducted measurements, for quantitative evaluation of available woody biomass for the production of firewood and chips in the Municipality of Junik, are identified four groups as the main source:

- The first group belongs to the currently available wood biomass in forests Junik and that requires an immediate intervention to assess its maximum.
- The second group belongs woody biomass in public forest, which is planned to be harvested for each next 10 years, according to the Management Plan, respectively, based on an annual opportunity to use concrete planning and key logging from thinning and cleaning.
- The third group of woody biomass includes potential of biomass that can be produced by the private forestry and agroforestry systems that we termed hedgerows in the side of agricultural lands, canals, roads streams and rivers.
- The fourth group belongs technological waste from the waste in the timber industry in the municipality of Junik.

Table 10: The potential amount of wood material that can produced from the urgent silvicultural intervention needed in the actual forest conditions

No	Forest stand	Indicators	Total m^3	Firewood	Wood chips
I	Public Forest total		26,290	22,050	4,240
1	Wood waste from dried trees inside forest stands	About 1.6% of trees in 317 ha with mean diameter 35 cm	12,000	11,280	720
2	Wood waste from remaining wood material after illegal logging last 5 years in beech forest	147	18,664	3,730	1,270
3	Degraded pine forest	165 ha	29,211	5,840	1,520
4	After normal harvest in last 5 years		12,500	1,250	730

Table 11: The potential of wood biomass production for the planned activities resulted from the implementation of management plan

No	The forest category	Area hectare	Total amount to be produced m^3	Firewood	Woodchips m3
1	Beech forests planned for harvesting	542.13	4,950	3,200	340

2	Mixed forest beech, spruce, pine and other broadleaves planned for harvesting	145.25	1,650	825	100
3	Coniferous forests planned for harvesting	72.42	900	315	50
4	Beech and mixed forest planned for thinning	766.82	4,535	3,720	360
5	Coniferous forest planned for thinning	106.46	865	650	70
6	Beech forest and mixed(high coppice) planned for cleaning	27	745		745
7	Forest stripe throughout the forest road in the length from 50 km	200 ha	2,820	2,500	420
	Annual total			11,210	2,085

The biomass resulted from phytosanitary cutting in private chestnut forest are estimated in total 26,000 m^3. These wastes is not allowed to transport from the chestnut as a risk for increase the infection. The only use proposed by the farmers is the production of the wastes to produce charcoal.

Table 12: The potential wood biomass production from private forestry

II	Private forest	Degraded chestnut forest	26,000 m^3 resulted from intervention for rehabilitation can be used for charcoal production

In most cases agroforestry is neglected. Tress are not thinned or pruned. Their shadows often infiltrate to the interior of the field with a year-old culture creating negative impact on productivity. It is important to achieve an awareness campaign and a short intensive training of farmers to treat hedgerows. In the first year would be reasonable that the intervention to be realized with an intensity cut of about 50% of the biomass in dependency of wood type, conditions and ways of treatment chosen by the farmer.

Table 13: Potential of biomass production from the first intervention

Agroforestry species	Total number of trees	Participation %	Average volume of one tree m^3	To be removed in the first year total m^3	Firewood m^3	Woodchips m^3
Willow	84000	70	0,2017	9112	8400	712
Black locust (Robinia)	40000	20	1,05	210	195	15
Poplar	6000	5	2.15	4950	4500	450
Alder	5500	5	0.45	963	825	138

Note: From poplar can be taken from each tree about 0.5 m^3 of wood technical, while from every tree of alder is estimated to share 0.1 m^3 timber.

Annual potential for biomass for woodchips production 1,310 m^3
Annual potential for biomass for firewood 13,395 m^3

Waste from beech processing industry:
Annual potential for woodchips production 520 m^3, and for wood dust for pellets 450 m^3
Waste from coniferous sawmills and processing industry
Annual potential production for woodchips 245 m^3 and for wood dust for pellets 245 m^3

Table 14: Potential for biomass production according to the main products from the processing industry

No	Category of biomass	The first priority (To be removed in the first year) m^3	Average for other years (2-10) m^3
	Firewood	47,195	11,210
	Woodchips	8,400	2,850
	Wood biomass for pellet	695	695
	Biomass for charcoal production from private chestnut forest	26,000 in total shared in years based on the intervention for chestnut rehabilitation	

4.9 Conclusions

From state forests, private forestry and agroforestry, wood biomass which is valid for firewood and chips, and needs to be removed immediately from the forests of Junik is: 22,050 m^3, of which for production of chips is: 4,240 m^3, and the possibility of annual harvesting is: 11,210 m^3 firewood and 2,085 m^3 biomass for the production of chips.

From rehabilitation of infected chestnut stands (privately owned) must be removed and can be used for production of charcoal: 26,000 m^3 wood biomass.

The amount enable the installing of heating innovative system in a public building and supply it in sustainable way with woodchips.

One of the important problems that undertakes to solve this study is: What part of the forest wood biomass can be used for the bioenergy and removed from forest based on principles of sustainable development?

The removal of woody biomass of diameter greater than 3-4 cm is beneficial economically, and environmentally harmless. Biomass categorize 3-7 cm, contains 5-6 times less nourishing elements than new small sprouts, and constitutes a risk for the spread of diseases and wild forest fires.

4.10 Recommendations

As the first emergency intervention, we recommend intervention to remove the remained in the forest floor woody material resulted from illegal logging and legal harvesting. The proposed silvicultural woks in forest stands and the intervention proposed in two sides of forest road can have positive impact in forest growth as well in employment and incomes for rural population. Young forest of Junik are generally over-stocked. The density is in many areas so high that the stands are self-thinning, which means that trees die because of lack of light and loss of crown volume (the crown being the engine of the tree). The growth is well below optimum, 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. With a silvicultural programme (as thinning, cleaning and sanitary cutting) implemented, the density will be reduced and the low quality trees be contributed in biomass production, moving the growth to the trees with a higher quality and giving the trees a chance to develop a crown size, which optimises growth.

Junik has biomass reserves to support the bioenergy production of woodchips, pellet, and briquette. Production potential can be doubled if agroforestry system will be officialised and be managed properly. Woody biomass available for fuel wood as willow species, poplar and alder, species with soft wood are highly preferred for wood chips production.

5. Piloting on fast growing species for biomass production for renewable energy possibilities, through short rotation coppice in Macedonia and Kosovo

After the study analysis for assessment of current situation in agroforestry, potential and contribution of agroforestry for production of wood and biomasses for heating of the population, it has been shown that agroforestry is often neglected and not validated. A lot of agricultural land is not used for agricultural activities due to many reasons: poor quality, small sizes, shape of parcel is wrong for using mechanization, lack of water for irrigation etc. Considering the similar situation in Macedonia and Kosovo, the new agroforestry practices as sustainable natural resource management and rural development practices were promoted in both countries. The proposed measure and practices for the use of agroforestry potential includes fast growing species: *Salix alba var. Express* and *Robinia pseudoaccacia*.

Process of information collection, consultation and explanation was conducted among the farmers. The pilot focused on small scale farmers using their land. Sites were selected in consultation with the farmers. Farmers indicated small plots not in use, marginal land, alongside agricultural land for protection (erosion control from river, wind etc.), while at the same time producing biomass. Important factor was the willingness, dedication and understanding of the farmers.

In 2010 the CNVP project in Macedonia started to plant forest species on several locations in Macedonia. The selection of plots and locations and contacts with farmers interested for planting was done in cooperation with National Association of Private Forest Owners (NAPFO). In total there were 10 different sites proposed for pilot testing with different site conditions. Some were nearby river banks with water available over whole year; some were on poor conditions regarding soil.

Figure 22: Selection of plantation sites

In consultation with the Hungarian institute (producer of planting material) and experts from the Faculty of Forestry in Skopje, a model for planting of Energy willow was developed by planting of 10,000 stumps/ha.

The same variety of stumps imported from Hungary were used also for the sample plot in Kosovo by planting of 100 stumps/100 m2. Planting with stumps was realized from 20-30 cm length and diameter of 1.5-3 cm, and they were produced at the end of the winter, immediately prior to planting.

Figure 23: Planting of *Salix alba var. Express* stumps in Macedonia and Kosovo

5.1 Monitoring on wood biomass production (2010-2012) in Macedonia

In the first year of piloting, almost all sites showed a survival rate of over 90% of the plants in beginning of vegetation season (April-May). Almost all sites with Energy Willow showed a very good growth reaching in the first growing season a height of 1.5 to over 2 meter. Till the end of the year sites with Energy Willow where access to water was poor showed poor growth and till the end of year most of trees were not able to survive or the growth was very poor. The best sites were those having a high water table with moist clay soils. With very limited tending and no additional costs for irrigation, fungal, bacterial or pest control and nutrients supply, it is estimated that in the first year of growth the planting site of 1 ha could give approximately 6 m^3 or 5.2 t/ha of biomass (1 willow = 0.0006 m^3 (height = 2 m, d-mid = 2 cm) x 10,000 pieces = 6 m^3/ha; 1 m^3 = 840 kg, 5.2 t/ha wood mass in first year). Sites where Acacia was planted showed growth of 35 cm in a first year and very good rate of survival, more than 90%.

Figure 24: First and third year growth of *Salix alba var. Express* in Macedonia

In 2011 piloting with fast growing species was extended to new locations, where in cooperation with NAPFO we have selected sites and contracted new farmers in areas of Berovo and Konçe.

In total all sites showed good success and growing rates, the negative effects that were visible in the field were caused by human factor only. There were no visible signs of pests or diseases harmful for the planted stands.

Figure 25: Three-year old Salix wood

5.2 Monitoring on wood biomass production data in Kosovo

The practice was promoted also in Kosovo in one sample plot in Ferizaj. The same approach was used with the farmers where the process was realized in close cooperation with NAPFO and APFO of Ferizaj that expressed the willingness for learning of this new innovative practice.

Figure 26: Planting *Salix alba var. Express* stumps and first year growth

The pilot was implemented in the agricultural land with very high level of water. Introduction of fast growing species Salix Alba with the local association of Ferizaj in the surface area of 100 m2 serving as demonstrative plot, to assess the growth, productivity and rotation, as well enabling other farmers to have planting material for agroforestry. The use of *Salix alba* is extended on biomass production. The pilot has very positive results. The increment in 100 trees in the first year is realized, trees reach in one year an average diameter of 2-4 cm and a height of over 3 m with several branches per trees. About 70% of saplings were coppiced after the first year to expand the planted area and produce cuttings for two other farmers of the 'Pyjet e Jezercit' forest owner association and for one farmer of the Gjeravica forest owner association of Junik.

From testing of selected area planted with fast growing tree in Ferizaj, the results of measurements are presented in the table below.

Table 15: Growth of Willow in agroforestry in Ferizaj, Kosovo

Agroforestry- Willow testing area - Ferizaj	First Year Measurements	Second Year Measurements	Third year Measurements
Diameter (cm)	2.8	4.9	7.9
Average tree high (m)	3.25	4.73	6.20
No of trees/ha	10,500	10,500	10,500
Volume/ha (m^3/ha)	15.9	52.5	176.0
Annual growth (m^3/ha)	15.9	36.6	42.0

Another practice suggested for the biomass production is pollarding that consists of cutting the tops of trees with the object of stimulating the production of numerous straight shoots near the top of the cut stem. The method can be carried out in the case of willows and poplars along the sides of streams and ditches.

Figure 27: Third year growth of *Salix alba var. Express* in Ferizaj, Kosovo

5.3 Potential for wood biomass production

Average volume of one Energy Willow tree after three season of growth has been calculated by cutting one average tree from the best plot in Macedonia. The tree was 6 m high and d = 6.5 cm on breast high: V = 0.013 m^3 gross wood biomass. Multiplied by 10.000 pieces/ha the potential of growth is 130 m^3/ha wood biomass for three year period.

Also the results of measurements for the three years period in Ferizaj showed that tree was with diameter of 7.9 cm; 6.2 m high and the potential for growth is 176 m^3/ha.

Based on these measurements it has been shown that the potential of Willow production is extremely high on sites where the soil is fertile and water access is sufficient. Willow can be best used as wood chips, giving the highest utilisation result. Heat power of Salix wood, 15% moisture is MJ/kg = 13.65.

6. Innovative heating systems in Kosovo and Macedonia

One of the main challenges in forest policy in Kosovo should be the mobilization of wood potential from public and private forests in order to meet the different needs of the wood to produce bio- energy, and other to contribute in the development of rural areas. Research about wood biomass potential in private forests has been made by the Private Forest Owner associations in Macedonia and Kosovo. Results showed high potential of non-used wood residues that can be utilised as a renewable energy source. This research provided opportunity for CNVP to continue supporting the Private Forest owner Association (NAPFO) and sustainable forest management in Macedonia and Kosovo. After results made by APFO they went with the proposal for using this potential as a material which could help community either with heating system either with other options. After consultation meetings done between APFO, NAPFO and CNVP the idea came up for the innovative heating system which could be the priority for the community leaving in these areas.

One of the activities in the Sida project on "Strengthening Sustainable Private and Decentralized Forestry" was to implement a pilot projects on wood biomass for production of energy.

For this pilot projects primary schools in Berovo Macedonia and Drelaj in Kosovo were selected. The heating system in Macedonia was supported by UNDP-GEF and implemented by NAPFO Macedonia with advisory support from CNVP through the Sida project. The heating system in Kosovo was fully part of the Sida project and used the experience made in Macedonia. The projects aimed to replace the old wood stoves in the classrooms with a heating system based on wood chips. This project aimed to contribute to rural economic development, awareness rising about potential use of wood biomass and sustainable use of forests. The private forest owners are producing wood chips for heating of school in their own community.

Figure 28: Drelaj School in Kosovo and Berovo School with woodchips storage in Macedonia

6.1 Woodchip production by Associations

In order to increase the market of Organisations there's a possibility for joint wood selling. The Associations could formally act as a buyer of the wood from the PFOs and sell the fuel wood to traders or final buyers. NAPFO Macedonia and NAPFO Kosovo was able to start the production of woodchips used for heating. Through the project support given to NAPFO and local Associations in Macedonia and Kosovo both were supplied with a new heating system using woodchips as a renewable energy. The project supported them in organisation of producing wood chips and selling this in a contract to the primary schools in Berovo and Drelaj.

Figure 29: Woodchip production by NAPFO Kosovo and NAPFO Macedonia

Use is made of wood waste and residues after exploitation of private forests to produce woodchips with a grinding machine. After drying and storage by NAPFO this is supplied to the school for heating. The new heating system uses biomass in the form of wood chips, made by wood waste and thinning wood materials from the PFOs. The use of wood chips, a renewable energy source is contributing to the sustainable use of forest. The advanced heating system has an energy efficiency of 95% which makes the heating system more environmentally friendly. The project supported both NAPFO Macedonia and NAPFO Kosovo with a wood chipping machine to grind the wood residues while the both Associations organised the PFOs to collect the wood waste from the private forests in the commune and produce the biomass. Within this pilot project, the first steps of public private partnership between forest owners Association of Kosovo and Peja Municipality have been made.

6.2 Woodchip boilers

After the municipalities both in Macedonia and Kosovo has selected a school buildings in Berovo and Drelaj for project implementation, CNVP established a contact with companies dealing with thermo installation issues, VGG engineering from Skopje and ATC engineering from Kosovo. The companies has provided a Study for Renewable Energy and mitigation of climate changes the school facility, estimating the required power for the wood chips boiler and installation works needed. In the process of selection of proper heating equipment for the selected school facility CNVP has contacted wide range of producers of boilers. There were several companies offering their products as: HERZ-Austria, Centro-Metal from Croatia, KWB-Austria, and RETIFICA-Macedonia etc. According to power required and offers received for the equipment, the project team decided for the boiler produced by Centro-Metal for the Berovo School and Boiler produced by HERZ-Austria for Drelaj School. Both boilers are automatically driven and supplied with storage for hot water, tank of 2 ton capacity. The wood chips are feeding the boiler through an automatic system bringing it from the storage for wood chips in to the boiler system. The boilers are installed and are operational.

Figure 30: Woodchips based boilers for the central heating systems installed for the schools

6.3 Woodchips grinding machine

Gridding machine is provided by the Sida-CNVP project for the National Association of Private Forestry Owners both in Macedonia and Kosovo, to be used by the local associations based on the agreement made. Wood chippers are TP160 is in accordance with EC Directives 2000/14/EC, produced by LINDDANA TP with modern production technology. The wood chipper is mobile and designed for stationary wood chipping in form of branches with diameter of about 16 cm. The machines are equipped with a lifting point that is used when lifting the machine with a crane or with a fork lift truck. The capacity of machine is: 59 Kw, weight in kg 585, RPM 540 with maximum pressure till 150 bars.

Figure 31: Woodchip grinding machines in use by the associations

6.4 Training for woodchips production

CNVP has supported the Association with the training on wood biomass production.

Figure 32: Practical vocational training provided to the association people

Training was held by professionals which has provided training for the owners and few other persons that assist the association in chipping the wood residues, on how to use and maintain the wood chipper.

6.5 Organisation of wood collection and wood chips production

The wood collection is organized by PFO were transported wood biomass is stored in the vicinity of storing place and through the mechanism of wood chipper is released directly in to the storage space. Permanent storage is of closed type and enables air circulation. It is built near by the school facility where the furnace is installed that is being supplied with wood chips through transporter of snail type. In the process of wood chips production, CNVP has provided assistance to operators on the chipper to take care on the standards for the chips produced. Operators are aware for the standards that chips needs to fulfill on size, moisture and density. Currently NAPFO is producing wood chips with standard ONORM M7 133 (DIN 66 165): G30, W20 and S200. The average weight of chips produced is 200 kg/m^3. For reaching desired moisture of the chips, operators are trained to measure the moisture in the material before chipping. For the size of the chips, operators are trained to adjust the size of the chips during chipping, depending on the wood species, length of the pieces, moisture condition etc.

Figure 33: Woodchips according to standards

6.6 Wood processing from forest residues

Association engages families of private forestry for collection and treatment of wood residues in forest and from processing industry as well as transporting issue according to the annual agreements. Many of processors have wood removals after processing, which are sold on the market. Usually they are packed in 4 m length packages of wood that cannot be further used for processing. Mainly they are from Pine and Fir species. NAPFO requested from some of PFO to use their wood removals after harvesting. Many of forest owners allowed the association to chip the wood waste for free.

Figure 34: Wood residues from private forests used for production of woodchips

6.7 The actual situation on heating

The heating system installed in the schools of Berovo and Drelaj is actually the most sophisticated version in the market that is installed for the first time in the region. It utilizes in maximum energetic fuel potential (chips), minimizes waste from fuel in form of smoke with polluted and toxic substances, or form of ashes, and the system of transporting chips in the furnace is automatized. As small as moisture percentage is in woodchips, as much higher will be the level of energetic. The woodchips use of fuel and the durability of furnace will be longer.

Chips from the storage throughout the transporter are sent in the furnace that is supplied with oxygen from the room air. Released temperature is used for water heating that through pipes is forwarded to radiators installed in the surface area of the school. The process is fully automatized and can be controlled and directed from the distance such as adjustment of temperatures as well as eliminating possible obstacles if showed in the chip furnisher. NAPFO Macedonia already has the agreement with Berovo Municipality for selling the wood chips to the school during five years, while NAPFO Kosovo actually are negotiating with the municipality of Peja regarding the selling contract for the preparation of the next year season. They will harmonize the responsibilities and take actions on preparing the whole process for starting in time with heating system which is now installed and tested while working for 2 months. Agreement will be made between the school and Municipality on buying the wood chips from APFO.

6.8 Promotion of the system

Promotion of the innovative heating system has been made in different ways. One of the mayor promotional step was the inauguration events. During the launch ceremony the representatives argued that this is a system that uses heating elements to unexplored forest by humans. This system will now use the biomass produced by its community and that the school will take biomass waste from its locality and not to buy the fuel from somewhere else as before. There has been distributed also the promotional material as leaflets, newspaper etc.

Figure 35: Demonstration of the woodchip grinding machine in Drelaj at the school

7. Challenges and demands on markets

The market is an important component in completing the cycle of woody biomass, development, exploitation and processing. Given products derived depending on the scope, method and technology of production in the case of wood biomass processing approach to the market and be the presentation in adequate.

Traditional Fire wood: - as a product of wood biomass has sufficient market in Kosovo and region, is this a traditional market that has no specific requirements. Thus, investment in promotion and marketing and consumer awareness on preparation for market ready products for burning wood ; shortened for stove , cracked , dried and packaged is necessary and requires a serious approach by all stakeholders in the field of bio-energy.

Chips: a product is virtually unknown, - at the country level, for insight into the market and therefore need a multidimensional approach.

- In order to promote this product Organize visits and share how is organized and function of Drelaj in Kosovo and Berovo school where the l heating system that would use chips as fuel is installed and functioning,.
- To organize publicity campaigns mainly through rural areas where it would seem to be the goal of penetration with this product.

Briquettes: This product is now also present in the market and has customers, some manufacturers are supported with equipment and in the field of marketing by some donors.

Pellets: a relatively new product in the market of Kosovo, expanded in about 5 regions until now, based mainly in wood waste from industry in general but with enough success that has found its place mainly in urban areas. The business need support to enable the use of forest wastes resulting from harvesting and silvicultural works biomass so if pellets produced from wood biomass production potential is high and sustainable.

Charcoal: there is a high interest of farmers to be employed in the charcoal production especially in Novo Brde. In Junik this can be an opportunity to see the wood wastes after sanitary cutting in infected chestnuts. More investments in its production technology than in marketing is needed in this phase, but if production increases then the priority can be to target consumers’ household and hotel and therefore should organize promotion.
Use of biomass for lime production.

8. Importance of wood biomass and bioenergy

While every biomass project must be economically feasible, there are many other benefits that can help justify the commitment of time and energy to learning about biomass heat. While fossil fuel prices are expected to rise with scarcity, price increases in woody biomass fuels may be tempered as the infrastructure as well as the technology to harvest, transport and process biomass matures. The added benefits of woody biomass utilization include:

Cost Savings — woody biomass heat systems can provide comparable heating at a much lower costs. As the cost of fossil fuel has risen and is expected to continue, the financial attributes of woody biomass heat are very promising.

Local Economic Benefit — for many rural communities, utilizing biomass helps to support local job creation through forest restoration work and fuels reduction projects that produce woody biomass as a byproduct.
Air Quality — burning woody biomass in efficient boiler systems produces less air pollution than burning slash piles, prescribed burning and catastrophic wildfires.
Forest Restoration — thinning overstocked forests to meet ecological objectives is expensive. Using the woody biomass byproducts provides opportunities to offset the costs of these operations.
Wildfire Mitigation — biomass utilization can also subsidize the costs of forest fuels reduction projects, improving safety for rural communities.
Carbon Neutral — the trees used to produce woody biomass have absorbed carbon from the atmosphere equal to the amount released when the fuel is burned, therefore biomass is considered a carbon neutral fuel source. In contrast, fossil fuel consumption emits CO_2 that would otherwise remain trapped in underground deposits. When biomass fuels are used instead of fossil fuels, the net effect is lower carbon emissions.

9. Lessons learnt for wood biomass production in forestry

The forests in Kosovo have a great development potential and the forestry sector can become an important contributor to the national economy, both in terms of income from the wood production and as a generator of employment opportunities. To realize this potential, however, a range of silvicultural measures needs to be launched to make up for many years of neglected proper management. At the same time as the forests contain large volumes of low quality wood most Kosovars are struggling to find, reasonably priced, firewood for heating and cooking. With a thinning programme implemented, the density will be reduced and the low quality trees be removed, moving the growth to the trees with a higher quality and giving the trees a chance to develop a crown size, which optimizes growth.

Energy potential of biomass is concentrated in the waste from forests and wood processing industry. The popularity of the use of woodchips and pellets briquettes is increasing, similarly to other countries with good forest resources. The main constraints on realization of biomass capacity potential are the lack of experience, the lack of a fully developed market, and the fact that most of the domestic production is exported.

10. Conclusions and recommendations

Different forest practices are assessed for wood biomass production and its carbon sequestration. A value chain approach is used regarding the assessment of the production, processing and use. This includes traditional firewood logs used, as well as innovative wood biomass products (wood chips, pellets and briquettes). As experience shows, biomass for heat is competitive if compared to fossil fuels as far as the costs of the feedstock are concerned – the main barrier remains rather high investment cost to switch from a traditional fossil or electric heating system to a biomass heating system. Biomass is a stored solar energy because it's usage of sun power for growing – and, therefore, is available 8760 hours per year. This explains why bioenergy offers high synergies in combination with other forms of renewable energy to supply the needed heat or electricity.

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 changes, how forest owners and institutions obtain new knowledge or information and put it into practice, and how institutions, especially forest administration, extension services, forest research or other institutions deals with this changes.

The possibilities for producing biomass and supplying energy markets with this form of resources can provide a stable and reliable demand for rural communities For rural communities such a situation would offer good opportunities for development. These communities in Kosovo, Macedonia and Albania are in many cases surrounded by forest that could provide the necessary biomass for energy generation, making the community more self-sufficient, reduce costs and provide employment.

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Abbreviations

AAC	Annual Allowable Cut
Asl	Above sea level
APFO	Association of Private Forest Owners
CNVP	Connecting Natural Values and People Foundation
Dbh	Diameter breast height
FPUA	Forest and Pastures Users Association
KFA	Kosovo Forest Agency
NAPFO	National Association of Private Forest Owners
NFI	National Forest Inventory
NWFP	Non-Wood Forest Products
PFO	Private Forest Owner
REFORD	Regional Centre of Forestry and Rural Development (network of forest associations in the Balkans)
Sida	Swedish Development Agency

Working together to grow a canopy of trees providing home, shelter, food, a livelihood as well as a place to wander

CNVP, a The Netherlands based foundation, is a legacy organisation of SNV in the Balkans. Established through a legal demerger, CNVP will continue the SNV forestry and rural development programme in the Balkans and beyond.

CNVP envisions:

- Local communities achieving their own development goals;
- Maximising the production and service potential of forests through Sustainable Forest Management and locally controlled Natural Resource Management;
- Forests contributing to equitable local economic development supporting rural livelihoods;
- Forests contributing to wider societal interests and values including biodiversity conservation and wellbeing;
- Connecting natural values and people!

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