The effect of thinning on oak forests growth . Case study from Dumreja in central Albania

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Background of the Study

Coppice forests cover a significant area in Albania. They cover about 41.5 percent (623,799 ha) of total forest area and 19.3% (14.2 million m^3) of total standing volume at national level (ANFI 2004). They are always used for firewood, fodder for livestock and providing timber for mining sector. The Albanian National Forest Inventory (ANFI 2004) displayed that coppice forests are very young, where 88 % of coppice forest area belong to young age classes (e.g. 1 - 10 years (26.5%); 11 - 20 years (46.86 %) and 21 - 30 years (12.6%)). The most conventional way of managing coppice forests is clear cutting in small areas implementing a 40 to 50 years production cycle). Coppice forests are spreaded in the whole country ranging from 150 to 600 m.a.s.l. The aim of conversion of the coppice into high forests still remains a concern for the Albanian silviculture and must be the main arch into the future perspective. Since coppice forests are widespread and important for Albania we decided to analyze the oak forest stand structure regarding to diameter, age and volume from central Albania (Belshi area), highlighting the importance of thinning on oak forests growth.

Figure 1. View of forests stands during thinning intervention

Material and methods

The study was performed in the two sites located in Belshi area in central Albanian (ST-1 40° 54' 10" N; 19° 56' 53"E, ST-2 40° 54' 11" N; 19° 56' 53"E ; altitude 136 m. a. s. l). The first site (ST-1) is composed of a natural oak forest stand which has been clear cut on 1999 and then is implemented a thinning intervention on 2013. The second site (ST-2) was clear cut on 1999 but is not subjected to silvicultural thinning. We analyzed both forests stand using two square sample plots with 400m^2 each. On each sample plot were measured diameters at breast height (dbh), three heights per each diameter classes as well as distances and azimute of each tree from the left corner of square sample plot. The tree variable were measured using caliper, Vertex III and compass. Based on the measurements we have studied the current dbh distribution, age classes and based on the distance and azimute data determined for each tree we built a 3D view of forest stands which display the spatial distribution of trees. After we evaluated the dimensions of mean tree of basal area for each sample plot we cut them and based on the stem analysis method we estimated the annual and mean growth of diameter, height, basal area and volume. We aimed to compare the parameters of both forests stands in order to reveal the differences that exist between an treated and untreated forest stands and based on the findings to define the management form in the future.

Results

The studied forest stands are pure stands composed of *Q.frainetto* L. So far we built the dbh structure for both forest stands. We noticed that Dbh distribution was significantly different between both forest plots(Fig.2). In the ST1 it was with a Gauss shape where the maximum tree number was in dbh class of 6 cm, but in the ST2 this distribution was distinctly different where the maximum number of trees was reached in dbh class of 2 cm . In the ST1, the dbh of the mean tree of basal area was 5.7 cm while the tree height was 6.4 m while in the ST2 the dbh and tree height were 3.7 cm and 3.9 m respectively. Both sites have a higher stem density, basal area and volume per 1 ha than volume tables(Table 1), but the trees dimensions and timber quality was much lower indicating the urgent demand for high intensity thinning (Table 1) in order to improve the trees growth and timber quality. At the ST-1 the mean area per tree was 1.96 m^2 which is three time higher than mean area per tree in the ST-2 (0.6 m^2) that are not thinned. By the comparison of current stem density for both oak stands with volume tables we concluded that thinning intensity should from 45 % (ST-1) to 88 % (ST-2) of tree number (Fig.3)

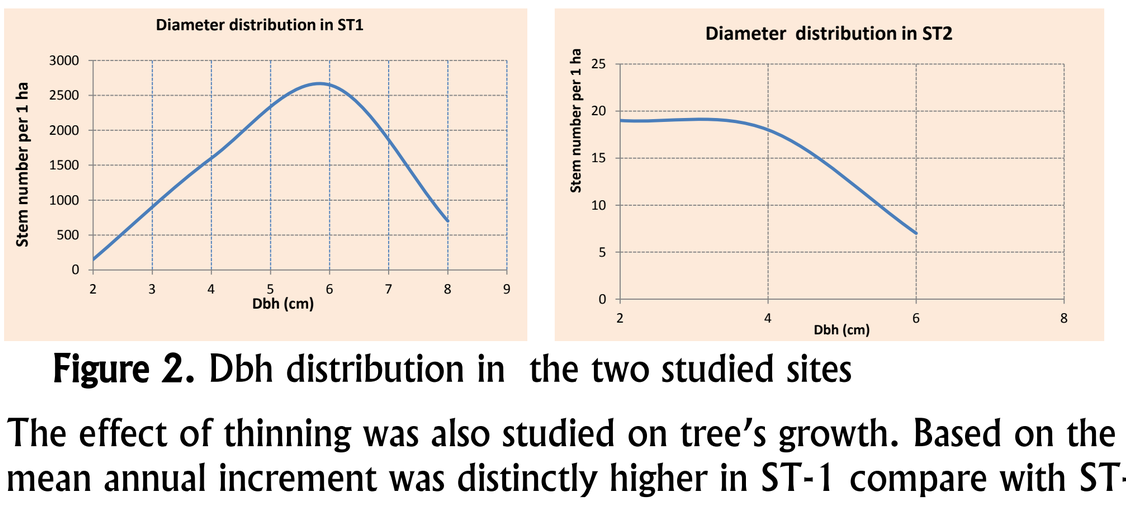

Figure 2. Dbh distribution in the two studied sites

Table 1. Comparison of dendrometric parameters of two sites with volume tables

Forest site	Stem number per 1 ha	Basal area (m^2/ha)	Volume (m^3/ha)
ST 1	5100	13.06	131.1
ST 2	17600	19.34	196.4
Volume tables	2138	11.50	69.0

The effect of thinning was also studied on tree's growth. Based on the stem analysis of the mean trees of basal area we noted that mean increment and mean annual increment was distinctly higher in ST-1 compare with ST-2 (Fig. 4). Statistically this difference was evaluated by means of t-Test assuming than both sets of data of increments have unequal variance.

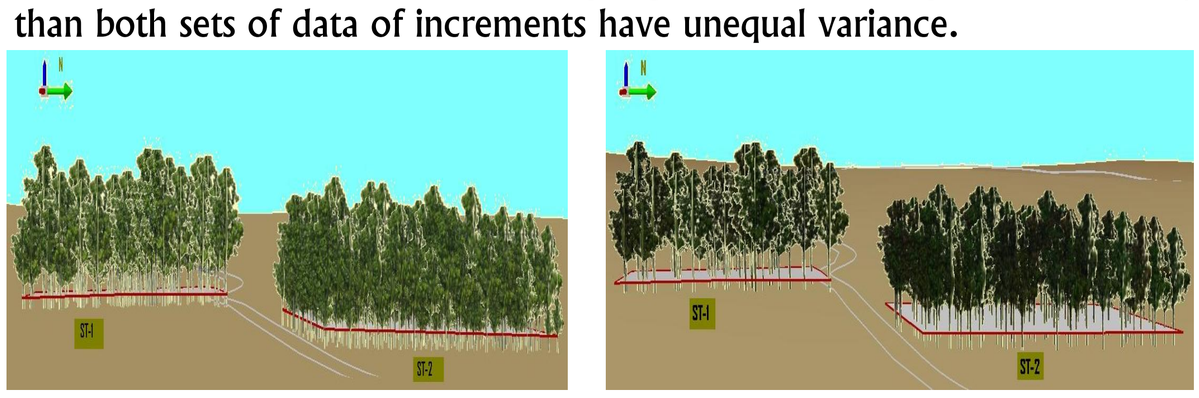

Figure 3. The 3D view of oak stands before thinning (left) and after thinning(right)

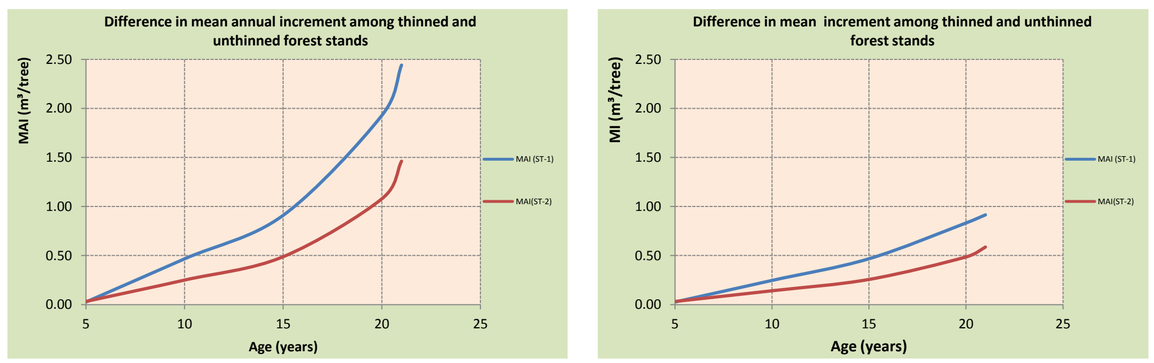

Figure 4. Difference in volume increments with age among two sites

The statistical analysis showed that in the both cases the (t_{-llog}) was higher than two tail critical(t_{-tab}) meaning that the difference in mean annual increment and mean increment of volume was significant. The statistical analysis showed that the difference was pretty higher during the comparison of diameter increments and less significant in others. That means that the lack of thinning has a greater effect on radial growth than in height and consequently on volume growth.

Table 2. The t-statistical Test used for evaluation of thinning effect on volume increments (left-mean annual increment ; right- mean increment)

t-Test: Two-Sample Assuming Unequal Variances		
Mean	1.51	0.74
Variance	0.64	0.15
Observations	5	5
Hypothesized Mean Difference	0	
df	6	
t Stat	2.94	
P(T<=t) one-tail	0.05	
t Critical one-tail	1.94	
P(T<=t) two-tail	0.01	
t Critical two-tail	2.45	

t-Test: Two-Sample Assuming Unequal Variances		
Mean	0.95	0.42
Variance	0.31	0.05
Observations	5.00	5.00
Hypothesized Mean Difference	0.00	
df	5.00	
t Stat	2.96	
P(T<=t) one-tail	0.05	
t Critical one-tail	2.02	
P(T<=t) two-tail	0.11	
t Critical two-tail	2.57	

Conclusion

Oak forests in Albania are generally too young with a high demand for thinning. The study is highlighting the importance of thinning interventions on oak growth. The study showed that the effect of thinning is more pronounced on radial increment and consequently on volume increment. The stem analysis and t-Test showed that this difference was statistically higher in radial increment and volume increment between the two sites with various stem density. The thinning will play an important role in the improvement of the timber quality and timber assortments derived from oak forests.