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Comparison of Trees Characteristics in the Managed (Interference) and Unmanaged (Control) Forest Units in North of Iran

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Abstract: The technical Evaluation of used silviculture methods is possible in different ways which one of them is the comparison of managed areas with adjacent and same unmanaged areas. For this purpose the evidence parcel and one managed parcel of series no. 3 of Lesakouti for qualitative and quantitative investigation was selected to compare the efficiency of different silviculture methods. For data collecting, Systematic random sampling with a 150*200 inventory network was used. The study of qualitative and quantitative characteristics of trees was accomplished in 1000 m^2 circular sample plot and the quantitative study of regeneration was fulfilled in 100 m^2 circular micro plot concentricity with main 1000 m^2 sample plot. The results of the research revealed that there was no significant difference between quantitative characteristics (dbh, basal area of stand, height, number per unit of area, basal area of tree) of trees in managed and evidence parcel. Meanwhile the number of very old tree (dbh >70 cm) in managed parcel is greater than it's in evidence parcel. On the other hand the number of regeneration in different stages per unit of area in managed parcel was greater than in evidence parcel. Study of trees quality showed that the number of tree with high quality in managed parcel is lower than it's in evidence parcel. Besides the number of healthy trees with dbh <42.5 cm in evidence parcel is greater than its in managed parcel.

Key words: Control parcel · Interference parcel · Lesakouti · Qualitative characteristics · Quantitative characteristics · Iran

INTRODUCTION

In the ideal case, the final goals of forest management are the continuing products and services that these purposes are guaranty to profit to forest owner and to survive of the forest ecosystem. Therefore Silviculture techniques are select for the management of the forest stands considering to the existing situation and targets for each region. Forestry plans with even-age seed-breeding, refuge-gradual and unit- segment methods were developed, implemented and performed in Iran according to the policies of the Forestry. Existences of some problems in social and economic conditions, ecological characteristics of forest sites, short-term breeding establishment, lack of facilities and possibilities were caused to failure of most of forestry plans with mentioned methods in Iran. Thus mentioned methods were abolished from 1997 and un-even- age seed-breeding method with different single-selection systems was replaced to manage of northern forests in Iran. So all the plans have been based on this method from 1997. Each management method can influence on forest structure, ecosystem and the remaining trees because of the executive, technical and scientific reasons. Thus it is essential that we provide the conditions for accurate implementation of un-even-age seed-breeding method in the northern forest of Iran by comprehensive scientific investigations related to mentioned method.

Researches, reviews and evaluations of similar projects in implementation of the forestry plans in northern forests of Iran were done that we mention to the most important of them. Hamidi Rad (1992) [1] reviewed Silviculture goals in seed-breeding forests with refuge-gradual cuttings in Kordkooy in his research and concluded that the exploitation and export of wood from mentioned forests has the negative effects on seedling quality and quantity. Therefore he recommended that the second and final cuttings have been done in Beech site when trees are in sapling growing stage to reduce losses.

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Shaghaghi Afzali (1993) [2] Also investigated the 10-year operation of single-selection method on Beech silviculture and concluded that the qualitative and quantitative regeneration of this species have been successful in the single-selection method. the design and implementation of single-selection method was investigated in the series Tooskachal, Watson and Karmozd in Sari In another similar study. Therefore, the frequency percentage of forest species based on diameter classes were investigated using normal curves as indicator and the trend of the project implementation was evaluated [3]. Asadi Otooyi (2000) [4] evaluated the implementation of Mekaroud forestry Plan and concluded that the improper changes of regeneration in term of species composition indicate the lack of complete realization of plan objectives. Regenerations mostly are poor to medium in term of quality in the end of the project. In addition the seedling distribution change (density per area unit) is undesirable.

Brad *et al.* (1999) [5] studied the middle-land forest management with the single and group selection method and concluded that the implementation of selective method would reduce the natural regeneration greatly and reduce the number of high quality seedlings per area unit whereas implementation of single-selection method improve and expand the natural regeneration process. Group-selection method increases the amount of the reached light to the forest floor and thus spread the invasive grass species in the forest floor. Wiemann *et al*. (2004) [6] examined the impact of uneven-age management methods and the limit diameter techniques on quality of oak species in the interference region in comparison with un-interference region (control). Results showed that the periodic cutting increase the tendency in trees stem and create a tension in trees wood that it reduces the quality of trees.

Thus the technical assessment of the used silviculture methods is possible of many ways that one of them is the qualitative and quantitative comparison of the interference stands with un-interference stands by gathering the complete and accurate information of them. Therefore in this study we selected the control Parcel (321) and neighboring interference Parcel (320) in the Seri 3 of Lesakouti forest plan to evaluate the used silviculture methods.

MATERIALS AND METHODS

Geographic Location of the Study Area: The Seri 3 of Lesakouti forestry plan locates in the basin 36 of Zalemroud forests. This Seri locate in the Mazandaran - Noshahr Natural Resources administration and Tonekabon Natural Resource office. This Seri locates in longitude 50 ° 56´ 52" to 51 ° 2´ 15" and in latitude 36° 36´ 5" to 36° 38´ 42". This Seri is limited to Terorje from north, Bazika from south, Khanikesh from west and Helloben Valley from east. Area of the Seri is about 1107.95 hectares.

The Studied Qualitative and Quantitative Characteristics: The examined Qualitative and quantitative characteristics in this study include species type, diameter at breast height (DBH), volume, height, tree quality and health, regeneration and recorded marking.

Research Method: We used of Random- systematic inventory method with a random starting point and the inventory grid with dimensions 150 m*200 m in order to compare the qualitative and quantitative of objective stands. We set larger side of inventory grid along slope in order to investigate species type change along height change. Thus 10 plots attribute to each Parcel (stand). qualitative and quantitative Evaluation of trees with DBH>12.5 cm (counting threshold) was done in the circular sample plots with an area of 1000 square meters (3.3% inventory intensity) and regeneration quantitative evaluation (for trees with DBH<12.5 cm) was done in the circular sample plots with an area square meters which this little circular sample plot was concentric with the major circular sample plot.

Methods of Data Analysis: We used t and Mann-Withney test respectively to compare the mean of Parametric data (for normal continuous quantitative data with homogeneity variance) and non-parametric data (for normal continuous quantitative data with heterogeneity variance that haven't been homogeneity even using the normal change) in two control and interference Parcels. Investigation of the discrete quantitative data was performed using K-square test. Data analysis was done using SPSS software and diagram drawing was done using Excel software. All of the hypotheses were tested at 95% probability level.

RESULTS

Results of Quantitative Characteristics

Distribution of Total Number in Different Diameter Classes: Results showed that the frequency of total number in the entire diameter classes less than 65 cm (except 15 and 55 cm diameter classes) in control Parcel is less than interference Parcel. Frequency of total number in the entire diameter classes more

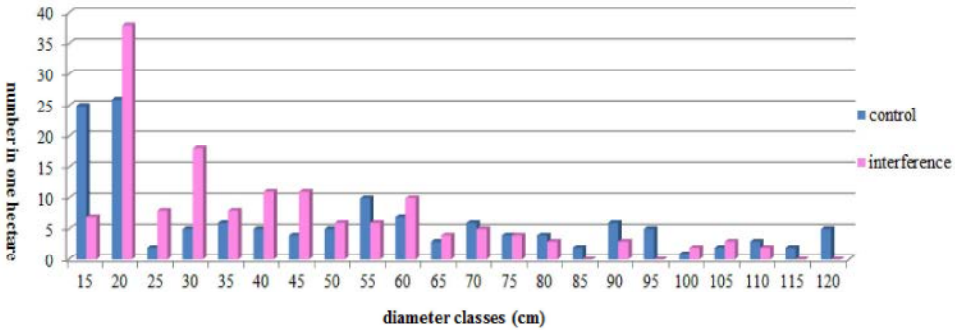

Fig. 1: Distribution of the total number in diameter classes

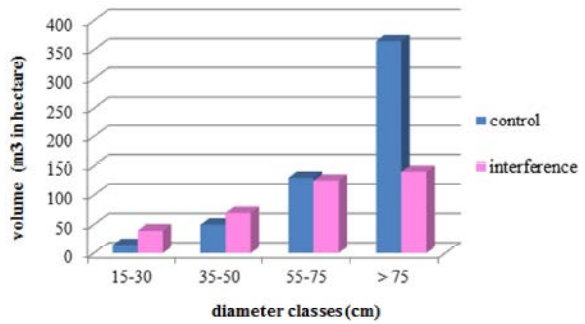

Fig. 2: Total volume distribution in different diameters classes

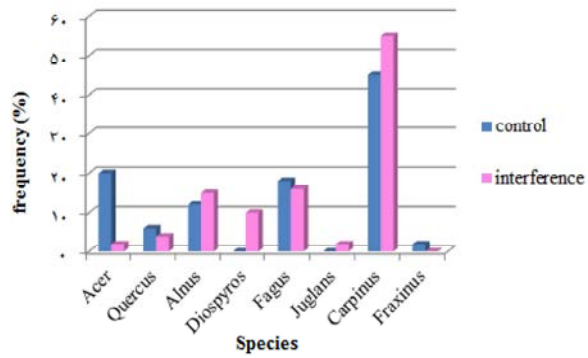

Fig. 3: Species composition

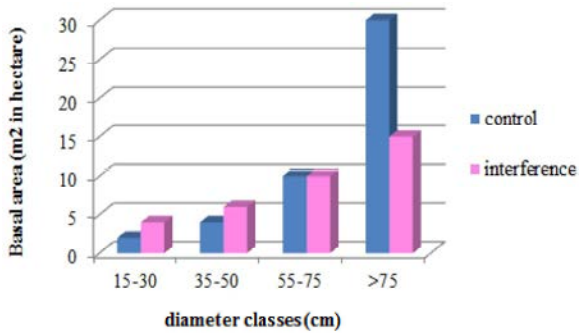

Fig. 4: Cross section of the breast in different diameter classes

than 70 cm (except 75, 100 and 105 cm diameter classes) in interference Parcel is more than control Parcel (Figure 1). We used K-square test to compare the total number in both Parcels. Considering to computing x^2 (0.681) is less than table value (x^2 (1, 0.05) = 3.84), so this result is not significant *(P* = 0.409) and there isn't the difference between the total number of trees in control Parcel and interference Parcel.

The Total Volume Distribution in Different Diameters Classes: Comparison of the total volume distribution in different diameters classes in control and interference Parcels shows that the volume in the young and middle-aged classes in interference Parcel is more than control Parcel. In addition volume in very aged class in interference Parcel is less than control Parcel significantly. The volume difference between two Parcels in the aged diameter class is very small (Figure 2).

Species Composition: Species composition of control and interference Parcel were compared in term of number (Figure 3). As can be seen in figure 3, frequency of hornbeam is 45 and 58% in control and interference Parcels respectively. Thus the species type is hornbeam along with alder and beech in interference Parcel and the species type is mix in control Parcel.

Basal Area in Different Diameter Classes: As seen in Figure 4 Basal area in young and middle-aged diameter classes in control Parcel is less than interference Parcel. Basal area in aged diameter class in control Parcel is more than interference Parcel. Basal area in aged diameter class in control and interference Parcel is approximately equal.

Mean Comparison of Some Quantitative Characteristics: Mean of number per hectare, mean of diameter at breast height (DBH), mean of basal area in DBH and mean of height in control and interference Parcels has been presented in Table 1. Results of T-test showed that there is no significant difference between the mean of diameter

Table 1: Mean Comparison of some quantitative characteristics in two control and interference Parcels along with statistics table, computing and *P* value

	Standard deviation ± mean of quantitative characteristics				
	Diameter in breast height (cm)	Basal area of tree (m^2)	Basal area of stand (m^2 in hectare)	Height (m)	Number in hectare
Control Parcel	3.5±52.4	0.07±0.34	7.5±44.14	1.0±26.6	10±137
interference Parcel	4.2±46.4	0.04±0.26	5.9±32.5	0.9±26.1	17±151
Computing	t=1.092	t=0.915	t=1.212	t=0.387	x^2=0.681
p	0.289	0.372	0.241	0.700	0.409

Table 2: Mean Comparison of some quantitative characteristics in two control and interference Parcels along with statistics table, computing and *P* value

	Mean of regeneration number for different diameter (Number in hectare)			
Diameter (cm)	0-2.5	2.5-7.5	7.5-12.5	Height loss than 1.3 meters
Control Parcel	3550	170	20	4650
Interference Parcel	8800	710	30	7480
Computing x^2	531.5	161.8	0.008	19.043
p	0.000	0.000	0.928	0.000

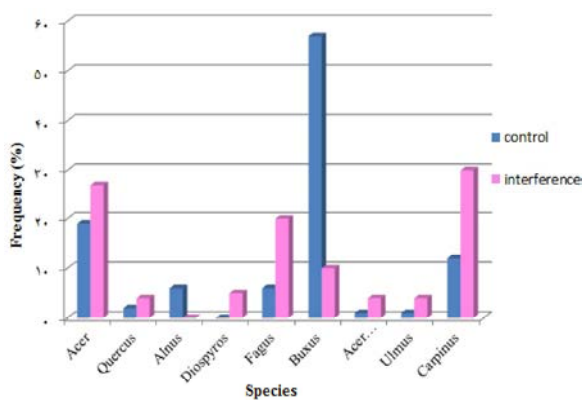

Fig. 5: Species Composition of regeneration in term of number

at breast height, the mean of basal area per hectare, the mean of tree height and the mean of tree basal area in two control and interference Parcels. Results of The x-test have shown that there is no significant difference between the mean of number in hectare in two Parcels.

The Species Combination of Regeneration in Term of Number: Comparison The species combination of regeneration in term of number in control and interference Parcels show that 32, 27 and 20% of regeneration allocate to *Carpinus*, *Fagus* and *Acer* respectively in interference Parcel. In versus 57, 19 and 10% of regeneration dedicate to *Buxus*, *Acer* and *Carpinus* respectively in control Parcel (Figure 5).

Regeneration Comparison of Control and Interference Parcels in Term of Number: Mean of number per hectare of regeneration species per hectare for control and interference Parcels has been presented in In Table 2. Tree *Buxus* with diameter 2.5 to 12.5 cm haven't been considered in regeneration considering to *Buxus* is a slow-growth. Results of K-square test showed that there is the significant difference between the number mean of regeneration for seedling in 0-2.5 and 2.5- 7.5 cm and seedling with height less than 1.3 m in two control and interference Parcels. In addition there is no significant difference for seedling with diameter of 7.5 to 12.5 cm between two Parcels.

The Results of the Qualitative Characteristics

Quality of Trees Stem: Quality of trees stem with diameter more than 42.5 cm to separate of species type in control and interference Parcels are presented in Table 3. With attention to table 3, Quality of the entire trees stem (except *Quercus*) in control Parcels is better than interference Parcel. Results of K-square for comparison of Quality of trees stem in control and interference Parcels showed that the calculating amount of this statistic parameter (21.952) is more than its value in table $(x^2_{(3, 0.05)} = 7.82)$ and difference is significant (P = 0.000) as trees in control Parcel have higher quality than trees in interference Parcel.

Health of Trees: Health of trees with diameter less than 42.5 cm to separate of species type in control and interference Parcels are presented in Table 4. With attention to table 4, Health of the entire trees (except *Quercus*) in control Parcels is better than interference Parcel. Results of K-square for comparison of Health of trees in control and interference Parcels showed that the calculating amount of this statistic parameter (54.870) is

Table 3: Comparison of frequency percentage of trees number with diameter more than 42.5 cm based on species quality in control and interference Parcels

Quality		1	2	3	4	total
Acer	Control	100	0	0	0	100
	Interference	100	0	0	0	100
Quercus	Control	50	50	0	0	100
	Interference	67	0	33	0	100
Alnus	Control	45	45	10	0	100
	Interference	21	72	7	0	100
Fagus	Control	91	9	0	0	100
	Interference	60	40	0	0	100
Juglans	Control	-	-	-	-	-
	Interference	0	0	100	0	100
Diospyros	Control	-	-	-	-	-
	Interference	0	0	0	100	100
Carpinus	Control	0	54	39	7	100
	Interference	0	21	55	24	100
Total	Control	46	34	17	3	100
	Interference	20	34	32	14	100

Table 4: Comparison of frequency percentage of trees number with diameter less than 42.5 cm based on species heaith in control and interference Parcels

Health		Healthy	Unhealthy	Total
Acer	Control	100	0	100
	Interference	-	-	-
Alnus	Control	100	0	100
	Interference	75	25	100
Fagus	Control	83	17	100
	Interference	50	50	100
Carpinus	Control	47	53	100
	Interference	25	75	100
Total	Control	82	18	100
	Interference	30	70	100

more than its value in table (x^2 (3, 0.05)= 7.82) and difference is significant (P = 0.000) as trees in control Parcel have higher Health than trees in interference Parcel.

DISCUSSION AND CONCLUSION

This research was done to evaluate the used Silviculture techniques and to assess the quality and quantity investigation of control and the interference Parcels of Seri 3 in Lesakouti. Comparison of Diameter distribution of trees in control and interference Parcels showed that the number of trees in lower diameter classes in interference Parcels is more than in control Parcel. The statistics test also showed that there is a significant difference between very aged trees in two Parcels. Thus we conclude that the control Parcel is older than interference Parcel and interference Parcel is loaded to youth that it can be due to performed management system. In addition results of volume and basal area investigation in diameter classes also confirm this matter. Comparison of The species combination of two Parcels in term of number showed that the maximum number of species belong to *Carpinus* in two Parcels regardless to the number of *Buxus* that it is a shadow-phyte species and grow in under-story of other trees. However, based on the derived results of Basal area, *Carpinus* in interference Parcel and *Acer* (light-phyte) in control Parcel have allocated the maximum area to themselves. It can be a reason for species difference due to interference.

The results of investigation the quantitative characteristics of the two Parcels showed that there is no significant differences between two Parcels in term of the quantitative characteristics. Reason of this can be due to the high heterogeneity between different sample plots that shows the different stages of evolution phases at sample point (different parts) in stand forest. On the other

hand the results of Hamidi Rad (1992) [1] showed that the exploitation, logging and wood export of studied forest stands had the negative effects on the seedling quantity that this is inconsistent with the results of this study.

Statistics Investigation of regeneration showed that there is significant difference between the number of trees in each growth stage in the control and interference Parcels as number of trees in interference Parcel is more than control Parcel in all cases. One of the main reasons may be due to silviculture interferences for marking of trees in standing trees in forest stands. But other reason may be due to existence of dense *Buxus* trees in understory of other trees in control Parcel that it prevent of reach of light to the forest floor and it caused the disorder in regeneration of trees in up story of forest. Results of Brad *et al*. (1999) [5] research also showed that single-selection method increased the Natural regeneration.

Comparison of regeneration combination of control and interference Parcels with mother trees combination shows that presence of good species in regeneration composition of interference Parcel increase rather than mother tree composition and in control Parcel increasing rather than frequency percentage of the mother trees of Buxus species is quite evident. Research results of Shaghaghi Afzali (1993) [2] also showed that the regeneration of beech have been successful in single-selection method and qualitative and quantitative interferences.

Comparison of trees quality in control and interference Parcels shows that trees quality in the control Parcel is better than interference Parcel. It is may be due to interferences for trees marking in interference parcel. On the other hand there are *Buxus* species in understory of other trees in control Parcel that caused the nature prune of up story trees stems.. Research results of Wiemann *et al*. (2004) [6] also showed that the interferences are caused the reduction of trees quality. Also Hamidi Rad (1992) [1] concluded that the logging and timber export of planned forest have the negative effects on seedling quality.

Results of K-square for comparison of Health of trees in control and interference Parcels showed that trees in control Parcel have higher Health than trees in interference Parcel. Thus Health of the entire trees (except *Quercus*) in control Parcels is better than interference Parcel. It is may be due to interferences for trees logging in interference parcel.

Finally, we can conclude that basal area in control Parcel is more than interference parcel based on statistics investigations. The quantity and distribution of regeneration in interference parcel has been better than control Parcel. Number of species per hectare in interference parcel is more than control Parcel because of silviculture interferences. Species biodiversity and regeneration in interference Parcel is more than control Parcel because of silviculture interferences. Results showed that mean height of trees in control Parcel is more than interference Parcel. Quality and health of the entire trees (except *Quercus*) in control Parcels is better than interference Parcel.

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