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Studying the Results of Two Methods of Harvesting
After a Period of Forest Management Plan

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Abstract: To study the results of interference of strip cutting and single selection systems during the performance of the plan (1993-2003) in the Janbe Sara district, raw data which was collected during two years were compared together. Inventory was done in systematic random way and intensity of 3.3% in both years. In this research parameters like average diameter of basal area mean (in breast height), volume mean and density in ha, diameter distribution, regeneration situation and qualitative class of trees were studied. Totally this study's results showed that although the diameter distribution curve in 2003 was getting close to the normal curve, as compared with 1993, but was still for from it in district. Also against the reduction of volume mean in ha, diameter of basal area mean and the percentage of trees in high qualitative classes in both methods were reduced, we should point that, this reduction in single selection parcels is less than strip cutting parcels. Results of studying the density in ha of trees and regeneration show the equal increasing process in both groups of parcels (single selection and strip cutting). Generally according to failure of the plan, with comparing both methods, we can conclude that we can get better results of single selection rather than strip cutting. Meanwhile considering 68% strip cutting harvest of the district the majority of strip cutting is affecting the failure of the plan.

Key words: Forest management plan, single selection, strip cutting, harvesting

INTRODUCTION

Forests have played an important role in economic growth and stable development of a country, as main parts of renewable resources and performing accurate curriculums, can change their potential talent to actual talent which needs enough knowledge of these resources (Asli and Eter, 1969). The average share-out of forest in the world is 0.56ha and unfortunately Iran's share-out of forest including forests in west and south, is 0.17 ha which is (1 in 3) a third of universal share-out (Seyedi, 2006). Therefore our country is considered as one of the poor countries for the sake of forest share-out so that it's placed in 45th place among 56 countries with forests (Asadi, 1999). The area of forest in our country is now estimated 12 million ha which forms 7% of Iran's area (Mosadegh, 1998). But just forests which are located in northern profile of Alborz can be used in commercial laud of wood production. But unfortunately because of lack of accurate program and harvesting, lack of renewed replacement, these valuable reserves are reduced progressively and changed to destroyed forests. This process threatens the forests, therefore it's very important to find a correct and desired usage way of the reserves which are going to be destroyed. In other words, selecting an accurate system of interference can be useful in the future of forests. The purpose of this research is that which method of harvesting is better for these forests therefore we were studying and comparing the results of strip cutting and single selection systems during 10 years of performance the forest management plan. Hypothesis was based on that results of single selection system are better than strip cutting method.

The suitable and correct system to sustainable harvesting at each of forest ecosystem should select and perform according to site condition, silviculture situation and site's economic-social condition. Selection systems (single selection and group selection) can answer to these needs and we don't accept any systems as ideal model (Mohajer, 2000).

Moayeri about Golband forest management plan said These forests basically are uneven aged and old, so they can't be even aged and because strip cutting system leads them to be even aged, it isn't suitable for these forests (Moayeri, 1988).

Mohajer (2005) has mentioned that the single selection system is the best method of use of forests potential, but in this method harvesting is so difficult. The other hands single selection system is the best way for forest conservation, also planning in this method is so easy and simple but about strip cutting method, we can't reach to maximum of diameter growth (Mohajer, 2005).

MATERIALS AND METHODS

Geographical and Ecological situation of study area: Janbesara district is a part of Shafarood's 10th catchments area and is located in west of Paresar town (west of Guilan province, in north of Iran). Its 1849 hectare and between 100 to 850 m altitude. It contains 33 parcels, 21 strip cutting parcels and the rest (12 parcels) single selection cutting parcels in which 12 single selection cutting parcels have been compared with 12 strip cutting parcels, so that we would be able to infer the results.

The average annual rainfall is 1542.2 mm, the annual mean temperature is 15.7°C, the average maximum temperature in the hottest month (July) is and in the coldest month (January, February) is 30.0°C during a year, therefore the study site is 2.5°C considered as a very humid area with cool winters (Forest, Range and Watershed Management Organization of Iran, 2003).

The soil of the district is acid (pH<5.5). Ecological situation in parts lower than 200 m height forms a forest type with single or small groups of iron tree, horn beam, persimmon, lime, alder, ash, maple, elm and cherry tree. In higher parts, especially with steep slope which is less reachable, we can see beech stands with desired quality (Forest, Range and Watershed Management Organization of Iran, 2003).

Process of the research: Raw data, related to inventory and description of stands, were prepared at the beginning and the end of the 10 years period, for comparing the results of strip cutting and single selection systems during 10 years of plan's performance.

The initial inventory for supplying the main plan was done at the end of 1992. Five hundred sample plots of 0.1 ha in 200×150 grid dimensions were measured is systematic random way. The second inventory was done in the same way to the renewal plan in 2003.

In this study, parameters like volume mean, density and number of regeneration in hectare were calculated. Diameter distribution curve in both years and normal diameter distribution for uneven-aged forests were also drawn. Diameter of basal area mean was calculated for analysis because of uneven aged forest. In addition to diameters, qualitative classes of trees with diameter classes of 45 and over were taken (Zobeiry, 2000).

Qualitative classes of trees with diameter of 42.5 cm and over were divided into 4 classes (Zobeiry, 2000).

Analysis of input: Analysis of input and designing of the curves were done with soft wares like Spss and Excel.

Because of two different dates of sampling of a forest stand considering growth and harvesting that are independent and different (Zobeiry, 2002), input related to both inventories is separate, too. The independent t-test was used to examine the difference between norms of both individual societies. For surveying validity of difference between distribution of qualitative class and diameter distribution during 2 years chi-square test was used (Zobeiry, 2002).

RESULTS

Results showed that although diameter distribution curve in 2003 was moved a little toward the normal curve in compare with 1993, but according to chi-square they have still obvious statistical differences with normal curve in 0.01 and 0.05 levels (Fig. 1).

According to the results, the average diameter of basal area mean has been reduced from 42.36 cm in 1993 to 36.31 cm in 2003 in strip cutting parcels that is significant considering t-test in 0.01 levels. Also the average of this parameter in single selection parcels has been reduced from 42.42 cm in 1993 to 40.57 cm in 2003 that isn't significant in 0.05 levels according to t-test.

The volume mean in hectare has been changed from 196.38 silve in hectare in 1993 to 163.84 silve in hectare in
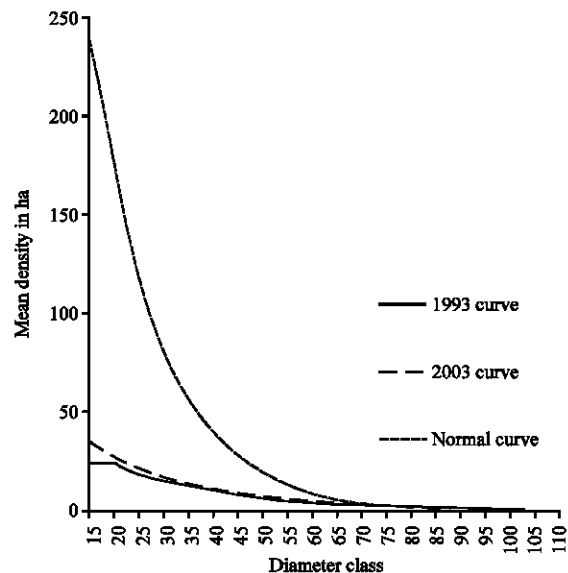

Fig. 1: Graph comparison of diameter distributions of 1993 with 2003 and normal

strip cutting parcels that is significant according to t-test in 0.05 levels. Also the average of these parameters which were in effect with single selection system has been increased from 204.26 silve in hectare in 1993 to 213.33 silve in hectare in 2003 which is significant in 0.05 level considering t-tests.

The density mean in hectare has been increased from 138.77 numbers in hectare in 1993 to 149.36 numbers in hectare in 2003 which isn't significant in 0.05 levels according to t-test. This development was related to these diameter classes 45 or less, 60, 65, 75, 85, 90, 95 cm. Meanwhile the average of this parameter in parcels in effect with single selection system has been increased from 144.28 numbers in hectare in 1993 to 165.3 numbers in hectare in 2003 that isn't significant according to t-test in 0.05 levels. The increasing is related to 50 or less, 60 and 65 cm diameter class.

The regeneration density mean in hectare in parcels which were in effect with strip cutting was increased from 88.145 numbers in hectare in 1993 to 241.12 numbers in hectare in 2003 which is significant in 0.01 level considering t-tests. Also the average of this parameter in single selection parcels was changed from 78.34 numbers in hectare in 1993 to 256.67 numbers in hectare in 2003 that is a meaningful increasing in 0.01 levels according to t-test.

According to chi-square test, reduction in first and third qualitative class's trees and increasing in second and forth qualitative class's trees have been significant in 0.01 levels during 10 years of performance of plan (Table 1).

According to chi-square test reduction in the first qualitative classes trees and increasing in 2nd, 3rd and 4th qualitative classes trees have been significant in 0.01 levels during 10 years of performance of plan (Table 2).

Table 1: Comparison of percentage of qualitative classes in strip cutting parcels with each other in both inventories

	Percentage of trees	
Qualitative classes	2003	1993
Qualitative classes 1	22	53
Qualitative classes 2	59	31
Qualitative classes 3	8	9
Qualitative classes 4	11	6

Table 2: Comparison of percentage of qualitative classes in single selection parcels with each other in both inventories

	Percentage of trees	
Qualitative classes	2003	1993
Qualitative classes 1	14	49
Qualitative classes 2	48	35
Qualitative classes 3	17	8
Qualitative classes 4	22	7

DISCUSSION

Because of the altitude of this area, about 100 to 850 m, it's known as a winter shelter for the local inhabitants, meanwhile illegal and forbidden usages of the jungle cause damages and reduction in the quality of the jungle in this site. In preparing the first plan for this district in 1993, problems like people and cattle that use forest as shelter and food were found (Forest, Range and Watershed management Organization of Iran, 1993). We should mention that we need more time (more than a 10 year period) for reaching more desired conditions in a forest (Etemad, 1994). Now let's discuss about results of the survey in details.

The diameter of basal area mean in strip cutting parcels has been reduced because all trees in the cutting strip are cut and in the other strips, cutting is done with both company and local residents on thick trees. The diameter of basal area in single selection parcels has been reduced because of thick trees, harvest, but the reduction isn't significant because the single selection harvest is less than strip cutting harvest.

Totally, density in hectare in both parcels (single selection and strip cutting) has been increased which isn't significant. Increase in density in hectare, opened forest stand canopy, it's regeneration, so many trees which weren't counted in the inventory in 1993 are reasons for increasing density in hectare. This survey shows that increase in density in hectare of the young diameter classes in 2003 in compare with 1993 can be derived from activities like marking which has been done for developing young diameter classes.

Asadi (1999) has also mentioned that activities like marking had been one of the reasons of increasing young diameter classes in Makarood forest management plan.

Therefore because of opening forest stands canopy during harvesting for the first time, regeneration has been developed, so that trees with countable and desired diameters have been created during 10 years. Therefore growth in the whole density in hectare in 2003 in compare with 10 years ago is caused of increasing in number of young diameter classes in hectare.

In strip cutting parcels the increase in diameter classes of below 35 cm is more than single selection parcels because all the trees in cutting strip are in strip cutting harvesting so regeneration, although in non industrial species like persimmon, iron tree and alder, is being developed because of opening forest canopy. Finally this increase in density of low diameter classes accurse which has been one of the aims of the plan after 10 years.

Because of harvesting a large number of trees and local inhabitant's harvesting in strip cutting parcels, reduction of volume mean in hectare is significant. Meanwhile it's not significant in single selection parcels because of less harvesting volume than strip cutting parcels. Also the difference between real and predicted harvesting in single selection parcels is more than parcels which were interference with strip cutting. Resaneh *et al.* (1996) compared the qualitative and quantitative changes in north of Iran forests during last 10 years in 1996. They mentioned that the results of increase in volume in hectare (70) were protection, forest management and less harvesting than growth, but in this study we found out that volumes of standing trees has been reduced in most of the parcels and in whole district at the end of 10 years. We can say that the reduction of volume mean in hectare is because of harvesting. The first plan for the study site was prepared in 1993 and except illegal harvesting of the locals, no harvesting was done before. Therefore are many economic and social problems in this district. So, as we mentioned before, forbidden harvesting is one of the reasons of reduction in volume of standing tree. According to the reasons above, the limited reduction in volume mean in hectare (19.67 silve) seems natural during 10 years.

The reason of significant increase in regeneration density in hectare for all species in district can be opening of forest stand, getting lighter, planting and growing of the saplings. Performance of the plan during 10 years and protection of the forest are also the reasons for increase in regeneration density. Asadi (1999) has also mentioned that group selection and regeneration protection were reasons of this increase after 10 years of performance of plan (Asadi, 1999).

Related results to qualitative classes of trees show that the first qualitative class trees have been decreased vice versa, low qualitative class trees have been increased during 10 years which can be the result of forbidden harvesting, cutting and selection. Finally we can say that during 10 years of performance of the plan in the study site, not only it hasn't been improved, but also has been declined in some qualitative and quantitative particulars that density and qualitative condition of the stand has been decreased at the end of 10 years of performance. At the same time, considering gradually development of regeneration of different species, high potential and quality of the site we can improve this study site with accurate and basic plans in future. So we can reach long-term aims after performances of some successful renewal plans considering good regeneration protection, solving some social and economic difficulties, avoiding destroys and harvesting of locals.

Totally in relation to the failure of the plan and comparing 2 systems we conclude that we can get better results of single selection rather than strip cutting, because the decrease in 3 items like diameter of basal area mean, volume mean in hectare and percent of trees with first qualitative class, in single selection system was less than decrease in strip cutting.

Meanwhile 68% of the study site has been interfered with strip cutting so that it could be effective in the failure of the plan in the whole district.

CONCLUSION

At the end, according to high potential, site quality and regeneration increase of different species, we suggest that we can get better qualitative and quantitative results, long-term aims of forestry (maximum and sustainable output), with protective plans for regeneration, solving some economic and social problems in relation to local inhabitants, destroys and forbidden harvesting and selecting an accurate silviculture system for the study site.

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