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# Evaluation of different sampling method to study of Diameter at Breath Height in the Zagros forest

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## ABSTRACT

For maintaining of Zagros forests role in wild life, water and soil conservation, the suitable solutions and methods for assessing the existing conditions and planning for management of this forests should be given. To detection of suitable sampling method to study tree Diameter at Breath Height in the northern Zagros forest, Blake forest, in Baneeh region, Kurdistan province, and west of Iran was selected. 40 square sample plots one hectare (100×100 m) were selected and perfect inventoried. In every sample plot the position of tree, kind of species and Diameter at Breath Height (DBH) were recorded. In order to study of tree density (tree/ha) different sampling methods (rectangular sample with 20×50 m and 10×50, random sampling method with 40, 50 and 60 circle sample plots which everyone was 1000 $m^2$) compered the prefect inventory. To determination of suitable sampling for study of tree Diameter at Breath Height (DBH) used the $\%E^2 \times T$ indexes. To compere the Diameter at Breath Height (DBH) in the every sampling methods and perfect inventory used the t-test analysis. Data analyzing was done by SPSS16 software's. Results showed that the rectangular sample with 20×50 m sample methods was the best methods and have maximum of accuracy. Overall results showed that the rectangular sample with 20×50 m sampling methods was (have minimum of time and $\%E^2 \times T$ criteria) the suitable methods to study of density (tree/ha). Authors suggested to study of tree density (tree/ha) in the northern zagros forest used the rectangular sample with 20×50 m sampling methods.

**Key words:** kurdestan province, Sample methods, Tree density northern zagros forest

## INTRODUCTION

I.R. of Iran is located in the North Temperate Zone from 25 to 40 latitude and 44 to 63 longitude degrees, with a total area approximately 1,650,000 $Km^2$ (Haidari *et al*, 2012a, Haidari *et al*, 2012b). Forests cover about 12 million ha in Iran (Haidari *et al*, 2013c, Askari *et al*, 2013). Including 5 million ha in the mountainous Zagros region. The Zogros Mountains are divided into two parts: northern and southern. The northern Zagros is consisted of the growing site of *Quercus infectoria* Oliv. And also *Q.libani* Oliv. And *Q.persica* J. & Sp. (*Q.brantii* Lindl.) (Haidari *et al*, 2012c). Species are found in this part. However, the southern Zagros is included Q.persica site which it extended to Fars province (i.e., 29º 5´ N). The

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northern Zagros is wetter and cooler than the southern one (Pourbabaei and Navgran, 2011, Bazyar *et al*, 2013a; Bazyar *et al*, 2013b; Haidari *et al*, 2012d). The researcher studied and Comparison of Randomized-Systematic Sampling with Circle Shape Plot and Transect Method, Based on Precision and Cost. Parameters evaluated were number per hectare, crown cover and basal area. Results showed that random-systematic sampling with circle shape plots is of less error than transect method in all cases (Nimvari *et al*, 2002) researcher determination of the most appropriate transect length for estimation of quantitative characteristics in Zagros forests and results showed that transects with 140m length had the most precision for estimating the above-mentioned parameters (Naghavi *et al*, 2009). The researcher Comparison of circular plot and transect sampling methods in the Zagros Oak Forests, for this purpose and based on cost and precision ($E\%^2 \times T$) criterion. Results showed that the more suitable method for these forests in west of Iran is the circular sample plot with 1000m2 area (Heidari *et al*, 2009). The researcher studied the estimation of Basal Area in west Oak forests of Iran using remote sensing imagery and results showed that the square root of basal area without consideration of aspects has a high correlation with band B1 ($r = –0.60$). The consideration of aspects resulted in corre-lation of different indices with square root of basal area such that in northern forests, band B1 had higher correlation coefficient($r = –0.67$) among other indices. In Eastern forests, the same band showed correlation of basal area with dif-ferent correlation coefficient ($r = –0.65$). In southern and western forests, the square root of basal area had higher corre-lation ($r = –0.68$) with RVI. The use of the square root of basal area as a dependent variable in multivariate linear regression improved the results (Gharamani *et al*, 2012). The researcher studied different sampling method to study of tree density (tree/hectare) in the Zagros forest and Results showed that the rectangular sample with 20×50 m sample methods was the best methods and have maximum of accuracy. Overall results showed that the rectangular sample with 20×50 m sampling methods was (have minimum of time and %E2×T criteria) the suitable methods to study of density (Haidari *et al*, 2013a). The researcher study of vertical and horizontal forest structure in Northern Zagros Forest and results showed that Overall results showed Blake forest was two forest story and *Quercus libani* Oliv and *Quercus infectoria* Oliv were the most dominant woody plants and located in over story (Haidari *et al*, 2013). The aim of our study was comparing the accuracy and precision of several of the sampling methods to study of tree diversity and tree parameters in northern zagros forest.

## MATERIALS AND METHODS

### *Site description*

This research was investigated in the Baneh region, northern Zagros forest, and western Iranian state of Kurdistan (Figure 1). Blake Village is located in west of Baneh city and 40 (600×675 meter) hectare of conventional territory of this village was selected (Ehle, 2003).

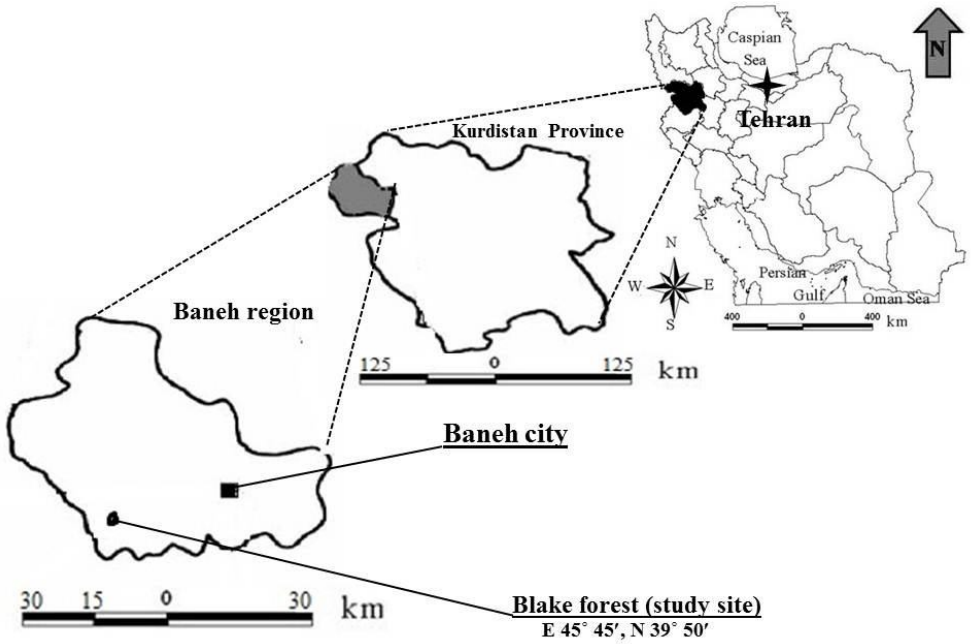


**Figure 1.** Study site location in the Kurdistan Province, Zagros region, Western Iranian state of Iran.

***Analysis***

In this study 40 square sample plots one hectare (100×100 m) were selected and perfect inventoried (Figure 2) and in every sample plot the position of tree, kind of species and Diameter at Breath Height (DBH) were recorded.

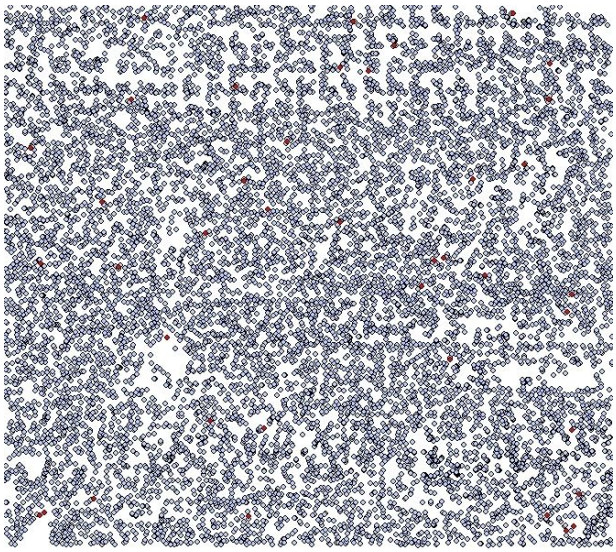

**Figure 2:** dispersion of tree in the study area (600×675 m)

The data of perfect inventory was transmitted in ARC GIS software and the dispersion map of trees was extract. To determination of suitable sampling method for study of Diameter at Breath Height (DBH) compered the different inventory methods to perfect inventory. In order

to study of tree parameter different sampling methods include: *rectangular sample with 20×50 m and 10×50 in the 100× 100 m net,* random sampling method with 40, 50 and 60 circle sample plots which everyone was 1000 $m^2$ and Transect (with 100 meter length in the *100× 100 m* NET, and this sampling methods compared with perfect inventory. To determination of suitable sampling for study of Diameter at Breath Height (DBH) used the $\%E^2 \times T$ criteria. To study of Diameter at Breath Height (DBH) in the study area, tree characters include kind of species and Diameter at Breath Height (DBH) was recorded. To compere the Diameter at Breath Height (DBH) in the every sampling methods and perfect inventory used the t-test analysis.

**Compere the different sampling methods by used the accuracy and costs index:**

After the statistical analysis and detected of significant and non-significant different between sampling methods use the compering the accuracy and costs index in the base of below formula:

$$A = \%E^2 \times T$$

T: total time of sampling E: Standard error

Each of sampling methods was lowest A ($\%E^2 \times T$) index is suitable sampling methods. Data analyzing was done by SPSS16 software's.

## Result and Discussion

Results of perfect inventory showed that five tree and shrub species observed in the study area. Species in the study area include the *Quercus libani* Oliv, *Quercus infectoria* Oliv, *Acer monspesolanum* L, *Pistacia atlantica* Desf, *Crataegus* sp and *Pronus* sp. *Quercus libani* Oliv was the most dominant tree and shrub plants.

**Table 1. List of Shrub species in the studied areas**

| no | Scientific name | Family |
|---|---|---|
| *1* | *Quercus libani* Oliv. | Fagaceae |
| *2* | *Quercus infectoria* Oliv. | Fagaceae |
| *3* | *Acer monspesolanum* L. | Aceraceae |
| *4* | *Pistacia atlantica* Desf. | Anacardiaceae |
| *5* | *Crataegus sp*. | Rosaceae |
| *6* | *Pronus sp*. | Rosaceae |

The shrub species belonged to four families were identified in the study area (Table 1) thus for the classes of rosacea, Fagaceae, Anacardiaceae and Aceraceae, two, two, one and one species were existed, respectively.

**Table 2:** results of Diameter at Breath Height (DBH) in the different sampling methods

| Sampling methods | Number of sampling | DBH | SD | Percent of Inventory error |
|---|---|---|---|---|
| Perfect inventory | 40 | 28 | 3.5 | - |
| Transect (with 50 meter length) | 40 | 26.5 | 5.2 | 14.5 |
| rectangular sample with 20 m×50 | 40 | 29.9 | 4.1 | 7.7 |
| rectangular sample with 10 m×50m | 40 | 28.5 | 6.7 | 8.1 |
| random method with 40 sample | 40 | 29 | 6.13 | 11.8 |
| random method with 50 sample | 40 | 29.1 | 5.5 | 10.5 |
| random method with 60 sample | 40 | 26.3 | 6.1 | 9.5 |

Table 2 showed that the rectangular sample with (20 ×50m) and (10 ×50m) have a maximum of accuracy, minimum of inventory error and nearest of Diameter at Breath Height (DBH) in compere of real quantity (Perfect inventory). These sampling methods are suitable methods for study of Diameter at Breath Height (DBH).

**Table 3:** results of t-test analysis to study of Diameter at Breath Height (DBH)

| Sampling methods | Compere means | | |
|---|---|---|---|
| | t | Sig. | results |
| Transect (with 50 meter length) | - 3.331 | 0.032 | * |
| 50×rectangular sample with (20 m) | -2.123 | 0.065 | ns |
| 50×rectangular sample with (10 m) | -0.567 | 0.354 | ns |
| random method with 40 sample | -0.657 | 0.435 | ns |
| random method with 50 sample | -0.789 | 0.514 | ns |
| random method with 60 sample | -1.123 | 0.087 | ns |

** Different letters indicate significant differences in 5% level ns. no significant different*

Results of table 3 showed that transect (with 50 meter length) is significant different from real quality (perfect inventory) and deleted in continues of study. Others sampling methods no significant different from real quality and was suitable sampling methods.

**Table 4:** compering of the accuracy and cost between different sampling methods to study the Diameter at Breath Height (DBH)

| Sampling methods | time of sampling (minute) | percent of Inventory error | × T $\%E^2$ | suitable sampling method |
|---|---|---|---|---|
| Perfect inventory | 7776 | - | - | - |
| rectangular sample with 50 20×m | 542 | 14.5 | 7859 | tertiary |
| rectangular sample with 10×50 m | 452 | 7.7 | 3480 | First |
| random method with 40 sample | 600 | 8.1 | 4860 | Second |
| random method with 50 sample | 720 | 11.8 | 8496 | fourth |
| random method with 60 sample | 860 | 10.5 | 9030 | fifth |

Results of table 4 showed that by used the (T × $\%E^2$) criteria best suitable sampling was rectangular sample with 20 m×50methods. Collection of appropriate qualitative, quantitative and diversity data is necessary for proper management and planning (Naghavi *et al*, 2009). For maintaining of Zagros forests role in wild life, water and soil conservation, the suitable solutions and methods for assessing the existing conditions and planning for management of this forests should be given (Karamshahi *et al*, 2012). To determine a suitable method, based on precision and cost, of inventory in Western oak forests (Nimvari *et al*, 2002). rectangular sample with 20×50 m and 10×50 in the 100× 100 m net, random sampling method with 40, 50 and 60 circle sample plots which everyone was 1000 $m^2$ and Transect (with 100 meter length in the *100× 100 m net*, and this sampling methods compared with perfect inventory. The tree and shrub species that identified in the studied region belonged to six trees and shrub species in four families. The presence of six tree and shrub species in 40 ha area indicates not considerable diversity in the study area (table 1). Rosacae family had high number of species (table 2). *Quercus libani* Oliv was the most dominant woody plants for the class of tree. Table 2 showed that the rectangular sample with (20 ×50m) and (10 ×50m) have a maximum of accuracy, minimum of inventory error and nearest of Diameter at Breath Height (DBH) in compere of real quantity (Perfect inventory). These sampling methods are suitable methods for study of Diameter at Breath Height (DBH). Results showed that the rectangular sample with (20 ×50m) and (10 ×50m) have a maximum of accuracy, minimum of inventory error and nearest of Diameter at Breath Height (DBH) in compere of real quantity (Perfect inventory). These sampling methods are suitable methods for study of tree density (table 2). After the statistical analysis and detected of significant and non-significant different between sampling methods use the compering the accuracy and costs index ($\%E^2$× T) to determination suitable sampling methods. Results showed that by used the (T × $\%E^2$) criteria best suitable sampling was rectangular sample with 20 m×50methods (table 4). Overall results showed that the rectangular sample with 20 m×50m sampling methods were the suitable methods was suitable to study of Diameter at Breath Height (DBH) and Heidari et al, 2009 emphasis this this results. Authors suggested to study of Diameter at Breath Height (DBH) in the northern zagros forest used the rectangular sample with 20 m×50m sampling methods.

## CONCLUSION

Overall results showed that to study of Diameter at Breath Height (DBH) in the northern zagros forest used the rectangular sample with 20 m×50m sampling methods.

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