International journal of Advanced Biological and Biomedical Research
ISSN: 2322 - 4827, Volume 1, Issue 4, 2013: 375-381
Available online at http://www.ijabbr.com

Determination of suitable sampling methods for study of canopy cover in the Oak Forest

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ABSTRACT

To detection of suitable sampling method to study tree canopy cover in the northern Zagros forest, Baneeh region forest, 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 two diameter of crown (m) were recorded. To study of canopy cover 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 canopy cover used the $\%E^2 \times T$ indexes. 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 canopy cover (%).

Key words: kurdestan province, sample methods, canopy cover (%), northern zagros forest, $\%E^2 \times T$ criteria.

INTRODUCTION

Forests cover about 12 million ha in Iran (Haidari *et al*, 2013a, Askari *et al*, 2013, Parma and Shataei, 2013, Haidari *et al*, 2013d). Including 5 million ha in the mountainous Zagros region. The Zogros Mountains are divided into two parts: northern and southern (Pourbabaei and Navgran, 2011, Bazyar *et al*, 2013a; Bazyar *et al*, 2013b; Haidari *et al*, 2013c). 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*,

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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 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 canopy cover (%) in northern zagros forest.

MATERIAL AND METHOD

Site description

This research was investigated in the Baneh region, northern Zagros forest, and western Iranian state of Kurdistan (Figure 1).

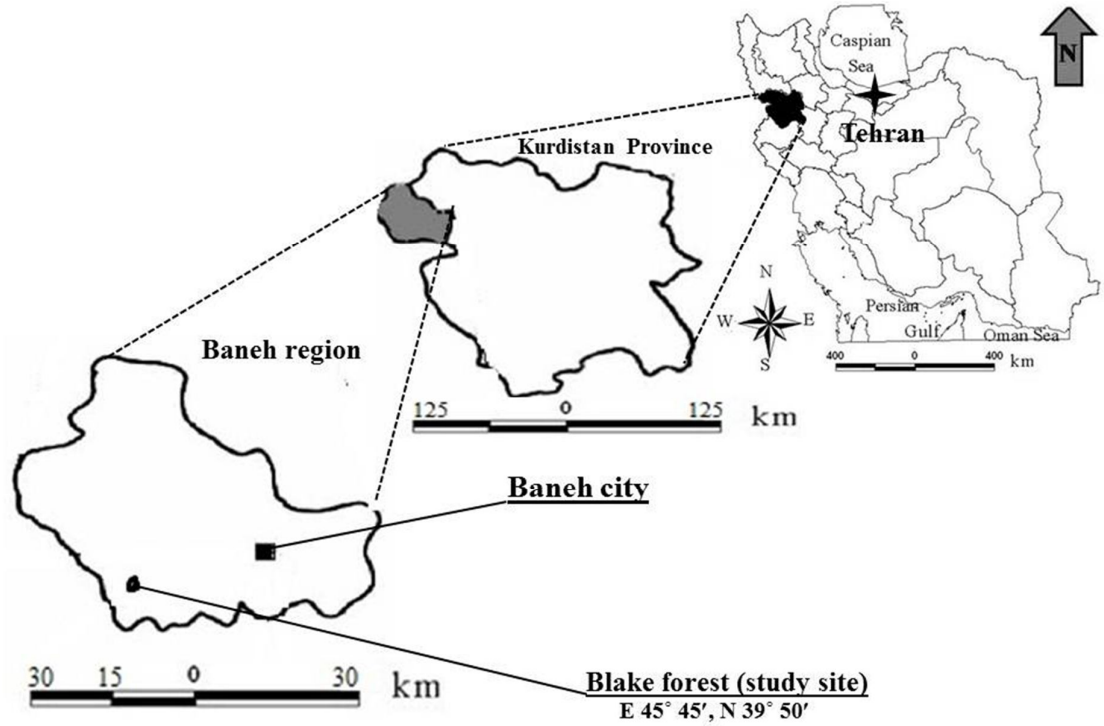

Figure 1. Study site location in the Kurdistan Province, Zagros region, Western Iranian state of Iran.

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 two diameter of crown (m) were recorded.

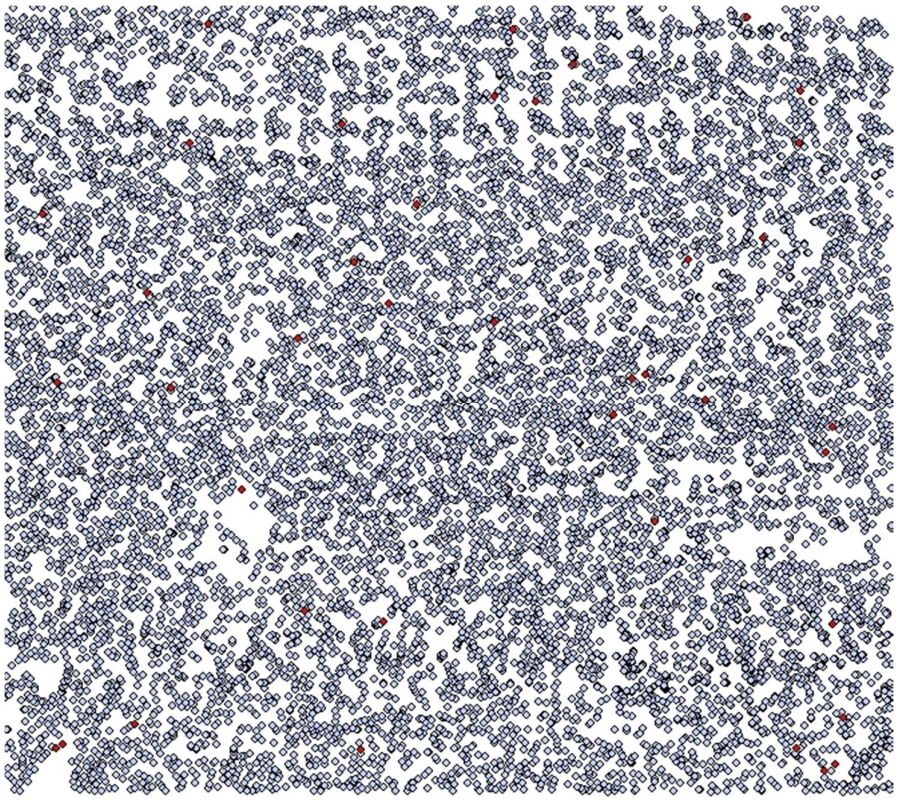

Figure 2: dispersion of tree in the study area (600×675 m)

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 canopy cover (%) 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 canopy cover (%) used the $\%E^2 \times T$ criteria. To study of canopy cover in the study area, tree characters include kind of species and canopy cover was recorded. To compere the canopy cover (%) 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

Table 1: results of canopy cover (%) in the different sampling methods

Sampling methods	Number of sampling	Canopy cover (%)	Percent of Inventory error
Perfect inventory	40	21	-
Transect (with 50 meter length)	40	27	18.5
rectangular sample with 20 m×50	40	20	7.8
rectangular sample with 10 m×50m	40	20.5	9.1
random method with 40 sample	40	28	13.2
random method with 50 sample	40	26	12.1
random method with 60 sample	40	25	10.6

Table 2: results of t-test analysis to study of canopy cover (%)

Compere means			
Sampling methods	t	Sig.	results
Transect (with 50 meter length)	- 3.213	0.032	*
rectangular sample with (20 m)×50	-2.324	0.059	ns
rectangular sample with (10 m)×50	-0.657	0.243	ns
random method with 40 sample	-0.783	0.342	ns

random method with 50 sample	-0.892	0.123	ns
random method with 60 sample	-1.312	0.065	ns

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

Table 3: Compering of the accuracy and cost between different sampling methods to study the canopy cover (%)

Sampling methods	time of sampling (minute)	percent of Inventory error	T × $\%E^2$	suitable sampling method
Perfect inventory	7776	-	-	-
rectangular sample with 50 m×20	542	7.8	4228	First
rectangular sample with 50 m×10	452	9.1	4113	Second
random method with 40 sample	600	13.2	7920	tertiary
random method with 50 sample	720	12.1	8712	fourth
random method with 60 sample	860	10.6	9116	fifth

Results showed that the rectangular sample with (20 ×50m) and (10 ×50m) have a maximum of accuracy, minimum of inventory error and nearest of canopy cover (%) in compere of real quantity (Perfect inventory) (Table 1). These sampling methods are suitable methods for study of canopy cover (%). Results showed that the rectangular sample with (20 ×50m) and (10 ×50m) have a maximum of accuracy, minimum of inventory error and nearest of canopy cover (%) in compere of real quantity (Perfect inventory). These sampling methods are suitable methods for study of canopy cover (%) (table 1). After the statistical analysis and detected of significant and non-significant different between sampling methods use the compering the accuracy and costs index ($\%E^2\times$ 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 2 and 3). Overall results showed that the rectangular sample with 20 m×50m sampling methods were the suitable methods was suitable to study of canopy cover (%). Authors suggested to study of canopy cover (%) in the northern zagros forest used the rectangular sample with 20 m×50m sampling methods.

CONCLUSION

Overall results showed that to study of canopy cover (%) in the northern zagros forest used the rectangular sample with 20 m×50m sampling methods.

Acknowledgements

We thank Mr. Rahmat Namdari and Frazad Jabari for their help in the field and we thank Dr. Foad Fatehii for their help in the analysis of data.

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