Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 3, No. 12, p. 166-173, 2013
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

The study of natural forest stand`s structure of oaks in the northern Zagros (a case study: Baneh)

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Article published on December 14, 2013

Key words: forest structure, SVS software, Zagros, Banes.

Abstract

The forest structure is the horizontal and vertical composition of a stand. There are many factors take part in the formation of forest structure that most important of them is genetically and environmental factors. The influence of these factors is various in different areas. For Evaluation of management, regeneration and destruction factors in forest stands, some stands with similar characteristics should be used to compare the structure of utilized and natural stands. This compare will be helpful to first save destroyed stands, second Resuscitate destroy stand and third they will be restored to the normal structure. To investigate the structure of natural stands in Baneh, two natural stand in villages Nejo and Balva selected and then plot with dimensions of 100 × 100 meter so that plots indicate the stand situation selected and implemented, then required data for study inventoried and recorded into plots. Next stage horizontal, vertical and perspective structures have been drowning. To draw the stand structure specialized software SVS (Standard Visualization System) be used, then by statistical software (Excel, SPSS), related statistics for diameter and height were also measured. The mean basal area per hectare stand of Balva and Nejo was 25.96 and 31.85 square meters corresponding, the average height was 6.1 and 5.9 meters consecutive, the ratio of crown height divided to total tree height was 0.6 and 0.5 respectively and the mean crown radius was 2 and 1.9 meter corresponding..

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Introduction

With due attention to climate conditions of Iran that 65% area includes arid and semi-aired and degradation rapid of north and west, because of degradation of natural resources will cause to degradation agricultural lands and human environmental (Zabiholahii *et al*, 2012, Haidari *et al*, 2012a, Haidari *et al*, 2013b and Askari *et al*, 2013a). Forests cover about 12 million ha in Iran (Forest and Rangeland Organization, 2002), including 5 million ha in the mountainous Zagros region. The major element of Zagros forest destruction include: fire, grazing, farm operation in forest, fuel wood and timber, mining, semi-parasite plant and non-wood forest production (Jazirei and Ebrahimi Rastaghi, 2003, Bazyar *et al*, 2013a, Parma and Shataei, 2013). Increasing population, low level of development and high dependence of local communities on forests for their primary livelihood needs, are the main reasons of this destruction. The lack of regeneration in these forests is a major concern (Fattahi 1994, Jazirei and Ebrahimi Rastaghi, 2003, Bazyar *et al*, 2013b, Rezaei *et al*, 2013, Askari *et al*, 2013c).

Stand Structure and its relation with forest management: Generally, the composition of horizontal and vertical elements of a forest stand called structure. In Silvicultural view structure is the horizontal and vertical distribution of trees and shrubs in a forest or stand. The DBH, tree height, crown height, crown diameter and some other characters be measure used to map the structure of stand. In ecological vision forest stand structure in fact is the time and spatial distribution of the plants in the forest. A stand structure has been created by the evolution of a multi-year competition, regeneration and human interference and structure recognition can make the appropriate plan for forest management procedures and help to take a better decision about regulate the utilizing models. One of the most important factors in forming the structure is competition, for example, competition for light among different trees from a specific species and between different species creates a layers (height classes), also the genetic factors not be ignored. Simply being a tree in a height level is the result of both genetic and environmental factors. Factors influencing the structure of a stand: Some factors caused to Stand Structure are very complex, so when considering the stand structure those factors should be considered in various aspects. These factors are: 1. Environmental or climatic Changes (precipitation, temperature, topography, etc.), 2. Plant growth (competition, diversity, establishment of regeneration, age, mortality age, etc.), 3. Natural phenomena (fire, wind, insects, diseases, etc.), 4. Human intervention (grazing livestock, tree removal, forest fires, etc.), 5. Different methods of forest stand management.

Impact of each of above factors in different regions vary, for example, in northern Iran, the most important factor affecting the structure of human interference in the logging while in the forests of northern Zagros grazing livestock and burning To add farm land are the most important factors. If the information of the structure of a stand be been, it will be possible to some depict stand structure in the future, also more than some properties (for example, the age distribution pattern and canopy) with respect to some other factors (eg, variation in diameter) will be possible to predict. Also the stand management system can also be determined by stand density. In the even-aged forests to determine the competitive intensity and management system (due to competition) density or basal area per area unit usually can be used, but these indicators for uneven-aged forests are not proper so this kind of forest should be used by structure and spatial distribution of components to choose proper management system: Studies about structure of stands tries to effect on management system by compared exist stands structure with normal or ideal stands structure, by the result of comparison management try to lead exist stand to normal conditions, also stand regeneration must also be considered. Therefore, to evaluate the management, determine the damage factors and the regeneration

establishment in a specific site, it is necessary to inventory some natural stands that have same conditions like destroyed stands and compare them, then comparison of stands structure can help and guidance forest management to conservation biodiversity as they provide natural habitat. Importance of stand Regeneration in maintains stand structure succession: Whenever a new stand by the process (whether natural or artificial) grow and develop, it mean stand regeneration and that process can be called a regeneration style. In other words, the process of replacement of stands is called regeneration. Common Management methods usually remove old trees to establish stand regeneration by this operation trees and seedlings receive fresh light and continue to grow rapidly and can reach up to upper layers. If seedling can't get a lot of light they will be lost and the remaining seedlings is often in the form of zigzag and bad form, in economics view this kind of trees very low profit trees. Of course, above operations are wholly done based on silvicultural detailed techniques. Important factors in succession structure: The succession of structure is the reason of the relationship between different species that difference at dynamism, mortality and regeneration method. A lot of factors are involved in the succession structure; in a general divide them into two categories, climatically and genetically. Among the climatically factors the condition of habitat (in terms of temperature, precipitation, soil, aspect, slope, etc.) could be mentioned, and Among the genetically factors the growth rate, seed viability, seed ripening cycle, tolerance against bad environmental condition, pests and diseases, the crown shape, the rate of photosynthesis etc. could be mentioned. If all of the above factors has been in a tree species, it will be possible choose the best management system in stands for each age or logging stages. A management system consists of a series of operations that are performed during the life of a stand, and includes all operations, including the establishment of regeneration, marking and logging.

The vertical structure of forest in Zagros: Because of continuous and inordinate utilizing by inhabitants the forest has been destructed, much of the forest regions of Zagros have been regressed so that the majority of high forests of this region have been changed to coppice forests, so that finding a natural stand is so difficult . Generally, three types of forests are found in the following structure.

A: coppice forests: this kind of forest has only one story and mostly derives from coppice shoots that re-seed after cutting or burning forest. However, the most defects of these forests are that most of the organic and inorganic materials be used so it caused to intensively increase the soil fertility. Coppice forests In comparison with high forests have less biodiversity, canopy, they of seed diversity, the canopy, make shade, keep soil and save moisture. Generally, this type of stand is used to supply firewood and livestock feed.

B: coppice with standard forests: These kinds of forests have tow vertical story that over story is high trees and under story is coppice trees. This type of forest structure regularly was browsed in regions that forest management plans to obtain char has been done and in other part of Zagros irregularly and occasionally was browsed. In areas that forest have been less destructed, the upper story has been made up seed *Quercus spp*. trees and the under story has been made up coppice *Quercus spp*. Trees, *Acer spp., Pyrus spp., Crataegus spp., Pistacia spp*. and etc. trees.

C: high forests: this stands have been observed as one story (usually older forest around and near villages and destroyed without understory grasses and forest floor has been destructed), and sometimes two or three story (in the height elevations that over story has been made of Quercus spp, and middle story has been made of *Acer spp., Pyrus spp., Fraxinus spp., Pistacia spp*.. and under story has been made of *Coteneaster sp. Daphnea spp. and Amygdalus spp*.. in some places this forests have

three quite distinct story(especially in the northern Zagros cemeteries) has been seen. In this regions the over story has been made of Quercus spp, (especially Quercus libanii) and middle story has been made of *Acer spp., Pyrus spp., Fraxinus spp., Pistacia spp., Crataegus spp. mahalep spp. and Amygdalus spp.* and under story has been made of *Coteneaster sp. and Daphnea spp.* Hosseinzadeh (2002) to study the structure of forests in Ilam less degradation forest of oak and pistacia habitat in the different highlands and areas. To display the structure by SVS software a 60*20 meter plot was determined in a 4 hectares area. The results showed that the maximum canopy about 35%, the maximum basal area 22.6 square meters per hectare and forest volume 43.33 cubic meters per hectare, was calculated. Heidari (2005) evaluate and compare the structure of the natural and less disturbed stands in Baneh, results showed that the natural stands have more diversity, number in hectare, regeneration diversity, variation in height and sorey. Also showed natural stands are uneven aged stands and have west diameter range in compare with less disturbed stands.

The aim of this research is study of natural forest stand`s structure of oaks in the Baneh region, Kurdistan province in Northern Zagros forest.

Materials and methods

Study area

Baneh city in the west of Kurdistan province is located near the western border with Iraq. The city of longitude 45 degrees 30 minutes to 46 degrees 15 minutes latitude of 35 degrees 45 minutes 36 degrees and 15 minutes. The average elevation level of the city is from 1550 meter (with a maximum and minimum elevation at 1000 to 2697meter corresponding). The climate is Semi-humid temperate region based on climatograph and the climate is semi-humid region based on Domarten classification system.

Methods

To select the desired stand the natural stands identified, after surveying two stands at Balva (the northeastern city) and Nejo (in the northwestern city) villages has been selected, stands factor such as area, diameter distribution etc. were in good condition.

Fig. 1. Location of study areas.

Plots to draw the stand structure

To display the vertically and horizontally structure in each stand plot with dimensions of 100 × 100 meter (1 ha) by Painting border trees limited, information such as coordinates of every tree than one angle of the plot (x, y), height, total tree height, crown diameter, crown diameter in two directions - North, South and East - West was recorded in the corresponding table.

First, the recorded data of the plot by the software of SPSS and Excel organized and some necessary calculations (such as the crown height divided to total height) on the data is done and the table is derived from data for mapping structure is used.

Results

Specialized software SVS (Standard Visualization System) was used to map the structure, to using this software, stand structure in 3 horizontal, vertical and perspective were drawn. Vertical structure, shows the forest appearance and reflects the stratification of the forest and the density of trees on each height level. Perspective structure also is based on the density and distribution of species realized. Horizontal structure shows forest from above the crown and shows the differences between different stands (natural stand together or natural stand with utilized stands) in terms of canopy cover density,

distribution of tree species, the development of crowns diameter, stand gaps and regeneration distribution is determined.

A Part of the software in which there is a table that has required quantities must be measured to draw structure. These quantities are described in the following tables.

The required quantities to draw the structure (necessary).

Table 1. Distribution of rainfall in different seasons in the study area.

Climatic station	Average rainfall	spring	summer	autumn	seasons winter	Annual rainfall
Baneh	(mm)mount	179/18	2/3	210/13	321/17	712/78
	%	25/14	0/32	29/48	45/06	%100

Table 2. required quantities must be measured to draw structure.

1	2	3	4	5	6	7	8	9
Species code	DBH	Height	Crown ratio	Crown radius	Status code	Tree class	Crown class	Expansion Factor
oak	30	5	0.45	2.5	1.00	1	1	0
oak	27	6.4	0.68	2	1.00			

Table 3. optional quantities to map the structure.

10	11	12	13	14
X	Y	Mark status	Felling angle	Small end grazing
15.5	37	1	0	0

Table 4. Statistics of the diameter and height of the stand.

Quantity	Balva			Nejo		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
) cm (DBH	7/5	68/4	21/6	7/5	66/5	18/6
) m (Height	0/6	13	6/1	1	13	5/9
Crown ratio	0/2	1	0/6	0/1	1	0/5
Crown radius	0/6	6/4	2	0/5	6/4	1/9
individual tree basal area (cm)	44/2	3678/5	488/9	44/2	3473/2	330/1

(B) Unnecessary (optional) quantities to map the structure.

These quantities are described as follows

1. Species code: a tree species code that allows defaulting or defining new species. 2. DBH: diameter at breast height per centimeter. 3. Height: The total height of the tree. 4. Crown ratio: the ratio of height crown divided by the total height of the tree is the range of 0 to 1. 5. Crown radius: radius of the crown. 6. Status Code: the situation of individual trees in stand. It has four states: stand up trees, stand tree stand, fallen tree with branches, fallen tree without branches and stubs. 7. Tree class and Crown class: it is need to better determine of morphological situation of trees. 8. Expansion Factor: number of trees per unit area (hectare) shows. 9. X and Y: the position of the trees in the plot (per meter) shows. 10. Mark status: a specific parameter and its value are from 0 to 255. 11. Felling angle: The angle of falling or the angle of the tree division. 12. Small end grazing: Shows the diameter of the stem end.

The following table shows some statistics related to the stand.

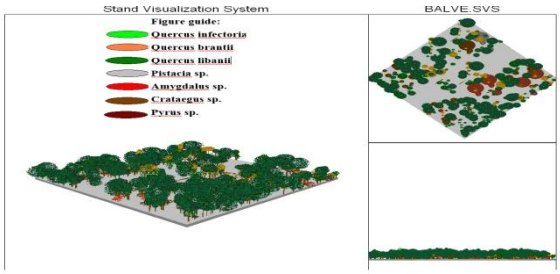

Fig. 2. structure perspective, horizontal and vertical tree and shrub species of Balva stand.

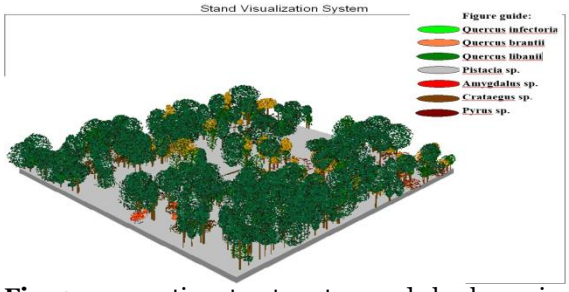

Fig. 3. perspective structure tree and shrub species of Balva stand.

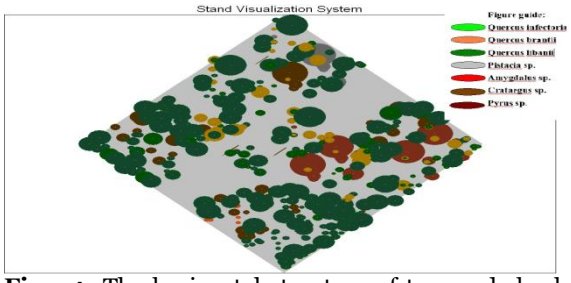

Fig. 4. The horizontal structure of tree and shrub species of Balva stand.

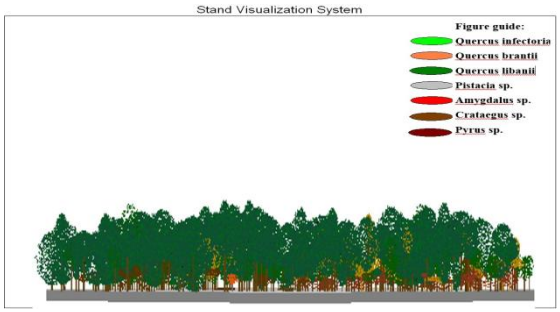

Fig. 5. The vertical structure of tree and shrub species of Balva stand.

The average stand basal area per hectare in Nejo and Balva was calculated 25.96 and 31.85 square meters corresponding.

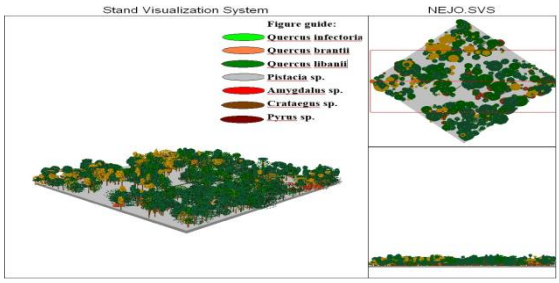

Fig. 6. structure perspective, horizontal and vertical tree and shrub species of Nejo stand.

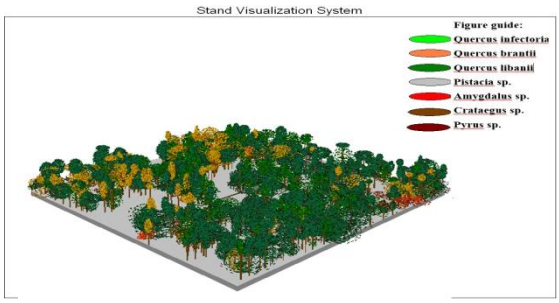

Fig. 7. perspective structure tree and shrub species of Nejo stand.

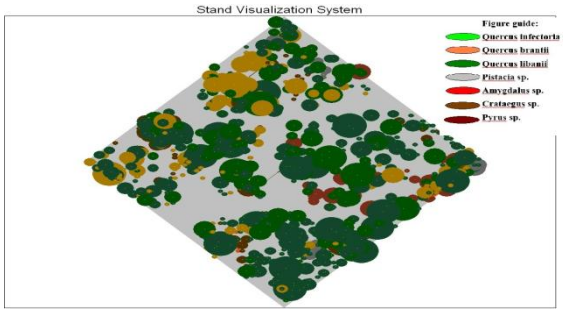

Fig. 8. The horizontal structure of tree and shrub species of Nejo stand.

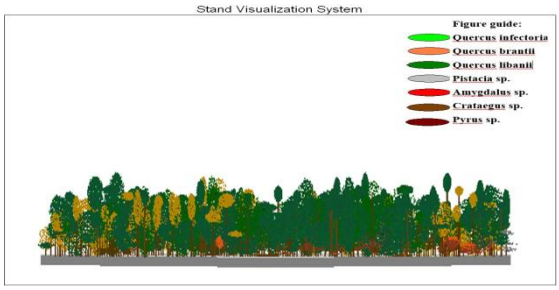

Fig. 9. The vertical structure of tree and shrub species of Nejo stand.

Conclusion

The mean basal area per hectare stand of Balva and Nejo was 25.96 and 31.85 square meters

corresponding, the average height was 6.1 and 5.9 meters consecutive, the ratio of crown height divided to total tree height was 0.6 and 0.5 respectively and the mean crown radius was 2 and 1.9 meter corresponding.

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