Effect of traditional forest management practices in Havarekhol pattern on forest structure (Case study: Kurdistan province, Northern Zagros forest).

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Abstract: To study of forest structure in the Northern Zagros forest, Havarekhol forest in Baneeh region, Kurdistan province in west of Iran was selected. 60 square sample plots 20×20 meters (400 m²) were collected by randomized-systematic method in the 200×300 Net. In every plot the position of tree, kind of species, number of trees, and diameter at breast height (cm), height (m), crown height (m) and two diameters of crown were recorded. Vertical and horizontal of this forest showed in the one sample (50×50 m, 0.25 hectare). To analysis of horizontal structure (spatial pattern), used was made of the quadrat method, variance/mean ratio, Green and Morisata index. Data analyzing was done by SPSS16, SVS (Stand Visualization System) and Ecological Methodological software's. Results showed the mean of forest characteristics including DBH, height, crown height, and crown area, canopy density and density was 8.2 (±1.8), 2.45 (± 0.40), 2.2 (±0.22), 5.6 (±1.01), 35.8 (±4.6) and 640 (±22). Overall results showed Havarekhol forest was two forest story and Quercus libani Oliv and Quercus infectoria Oliv were the most dominant woody plants and located in over story. DBH distribution graphs showed reduced uneven-aged young aged stand and spatial pattern of this forest was uniform to clumped pattern. Overall results showed the Havarekhol Traditional Forest Management Practices lead to increase the young tree and regeneration.

Key words: Havarekhol forest, forest structure, horizontal structure, vertical structure, spatial pattern, Zagros forest.

I. Introduction

Forests cover about 12 million ha in Iran, including 5 million ha in the mountainous Zagros region [5]. 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 [9 and19]. One of traditional forest management practices in the Kurdistan province are pruning at the ground level to facilitate regeneration of the new saplings (i.e. HavarehKhol pattern, Figure 2). In this method once the trees are taller than livestock threshold (i.e. above 2 m) maintain at a constant height of 12 to 16 meter for 25 years to allow strong trunk development [14]. Stand structure can be defined as the species composition, size and spatial distribution of trees and other vegetation within a forest stand [6]. Vertical structure of a forest includes its differentiation into layers between the ground and the canopy [2]. The horizontal structure of a forest is composed of diameter size distribution of tree species considered individually or as a community [3]. This several researches (forest structure) implemented in the Iran and Zagros forest in cloud: Study structure of less degraded Oak forests in Illam province. Results show that, the stands are basically uneven-aged old forests among which Quercus persica with its vigorous existence outcrops as pure or original species of forest type [8]. Investigated to determine spatial pattern of tree in the Zagros forests. He concluded that the trees were arranged in a clumped pattern [13]. Investigated on heterogeneity of structure in mixed beech forest of Iran, The results showed that alder and maple combined with beech can indicate the primary stages of succession and in this state; ironwood and persimmon trees are mostly found in the middle story and understory. In this forest, trees diameter distributions are normal based on De Liocourt index [6]. Study on structure of oriental beech (Fagus orientalis Lipsky) stand at optimal stage in north of Iran. Results showed that the stand has a closed canopy cover and distribution of stem number per diameter class was more or less homogenous (Bell shape) with a semi even-aged structure. [7] Study of spatial pattern Manna oak trees (Quercus brantii Lindl.) in Bayangan forests of Kermanshah province, zagros forest. All of the applied indicators showed a clumped pattern for Quercus brantii [12]. The aim of this research was Study of vertical and horizontal forest structure in Blake forest, Baneeh region, Kurdistan province, in Northern Zagros Forest (west of Iran). The aim of this research was Study of vertical and horizontal forest structure in Havarekholforest, Baneeh region, Kurdistan province, in Northern Zagros Forest (west of Iran).
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II. Materials and Methods

II.1: Site description
This research was investigated in the Baneh region, northern Zagros forest, and western Iranian state of Kurdistan (Figure 1). Havarehkhol village (prune at the ground level) and Armardeh or Blake village (prune tree crowns) were selected to this research. Havarehkhol village is located in east of Baneh city and the conventional territory of this village covers 574 ha including 345 ha of forests. The forests are located between 1580 and 2100 m a.s.l [14].

![Figure 1. Study site location in the Kurdistan Province, Zagros region, Western Iranian state of Iran.](image)

II.2: Analysis
In this study 60 square sample plots (400 m²) were collected by randomized-systematic method in the 200×300 Net. In every sample plot the position of tree, kind of species, number of trees, origin of trees (i.e. coppice and high tree), and diameter at breast height (cm), height (m), crown height (m) and two diameters of crown were recorded. Vertical and horizontal of this forest showed in the one sample (50×50 m, 0.25 hectare). To study of vertical structure study of distribution of tree and species in the height and diameter classes

![Figure 2. Havarehkhol traditional forest management practices (Prune at the ground level)](image)
Effect of traditional forest management practices in Havarekhol pattern on forest structure (Case (diameter in the 5 cm classes). To analysis of horizontal structure (spatial pattern), used was made of the quadrat method, variance/mean ratio, Green and Morisata index. Data analyzing was done bySPSS16, SVS (Stand Visualization System) and Ecological Methodological software’s.

III. Result

The vertical stratification of tree crowns is a forest attribute that influences both trees Growth and understory community structure [10].

Table 1. The mean of forests characteristics in the Havarekhol forest.

<table>
<thead>
<tr>
<th>forests characteristic</th>
<th>means</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter at breast height (cm)</td>
<td>8.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Height (m)</td>
<td>2.45</td>
<td>0.40</td>
</tr>
<tr>
<td>Crown height (m)</td>
<td>2.2</td>
<td>0.22</td>
</tr>
<tr>
<td>Crown area (m²)</td>
<td>5.6</td>
<td>1.12</td>
</tr>
<tr>
<td>Canopy density (%)</td>
<td>35.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Density (N/hectare)</td>
<td>640</td>
<td>22</td>
</tr>
</tbody>
</table>

The results showed that the mean of forest characteristics including DBH, height, crown height, and crown area, canopy density and density, 8.2 (±1.8), 2.45 (± 0.40), 2.2 (±0.22), 5.6 (±1.01), 35.8 (±4.6) and 640 (±22) in Havarekhol forest.

![Figure 3: frequency percentage of tree species in Havarekhol forest.](image)

Figure 3 showed that nine tree species were found in the Havarekhol forest. And *Quercus libani* Oliv and *Quercus infectoria* Oliv were the most dominant woody plants in this area.

Table 2: the mean of species height and forest story in Havarekhol forest.

<table>
<thead>
<tr>
<th>Main species</th>
<th>Tree height (m)</th>
<th>vertical structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Quercus libani</em> Oliv</td>
<td>5.5±0.98</td>
<td>over story*</td>
</tr>
<tr>
<td><em>Quercus infectoria</em> Oliv</td>
<td>4.2±0.65</td>
<td>understory**</td>
</tr>
<tr>
<td><em>Quercus persica</em></td>
<td>4±0.55</td>
<td>understory**</td>
</tr>
<tr>
<td><em>Crataegus azaarolus</em></td>
<td>2.5±0.40</td>
<td>understory*</td>
</tr>
<tr>
<td><em>Acer Monspessulanum</em> L</td>
<td>3.05±0.58</td>
<td>understory*</td>
</tr>
<tr>
<td><em>Pyrus glabra</em></td>
<td>3.24±0.51</td>
<td>understory*</td>
</tr>
</tbody>
</table>

1* over story: tree height 5 to 9 meter 2* understory: tree height less 5 meter.

Results showed that HavarehKhol forest has two story and *Quercus libani* Oliv located in the over story
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Figure 4. The number of trees in diameter classes in the Havarekhhol forest.

The diameters of the trees in the study site were measured at the breast height and recorded in classes of 5 cm. We measured DBH of trees ranging from 2.5 to 37 cm in Havarekhol forest, respectively. The DBH distribution graphs in the stands indicate reduce uneven, aged young stand.

Figure 5. The number of trees in diameter classes in the Havarekhol forest.

Figure 6 showed that the less 4 meter height class has a maximum N/hectare and this forest has a two layer story.

Table 3. The means of regeneration (N/hectare) in Havareh khol forest

<table>
<thead>
<tr>
<th></th>
<th>Seed regeneration</th>
<th>Coppice regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/hectare</td>
<td>130.6±17</td>
<td>6214±354</td>
</tr>
<tr>
<td>Total</td>
<td>6344.6±331</td>
<td></td>
</tr>
</tbody>
</table>

The results of table 3 showed that the estimated number of regeneration is as follows: mean seed regeneration equal to 130.6 and for Coppice regeneration equal to 6214 (N/Hectare) in the HavarehKhol forest, respectively.

Table 4. The spatial pattern index of tree in HavarehKhol forest

<table>
<thead>
<tr>
<th>Spatial pattern index</th>
<th>Spatial pattern</th>
<th>Quantity of</th>
<th>Quantity index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance /mean Ratio</td>
<td>Clumped pattern</td>
<td>240.1</td>
<td>4.069</td>
</tr>
<tr>
<td>Green</td>
<td>Clumped pattern</td>
<td>-</td>
<td>0.0019</td>
</tr>
<tr>
<td>Morisata</td>
<td>Clumped pattern</td>
<td>238.712</td>
<td>1.117</td>
</tr>
<tr>
<td>Spatial pattern</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table 4 showed all of the applied indicators have a clumped pattern for Havareh kohl forest.
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Figure 6. Stand visualization simulation of Havarekholforest(horizontal structure)
Figure 6 indicate spatial pattern (horizontal structure) of Havare khol forest was Clumped pattern.

Figure 7. Stand visualization simulation of Havarekholforest(vertical structure).
Results showed that Havareh Kohl forest have to story and Quercus libani Oliv located in over story layer (5.5 m height average) and other species located in understory.

Figure 8. Stand visualization simulation of Havarekholforest(vertical and horizontal structure)
Figure 8 showed Havare khol forest have two story layers.

IV. Conclusion

IV.1, DISSCUSION

Structural changes that result in differences in the amount and distribution of leaf area and cover in stands affect stand functions such as tree growth [1] and understory plant diversity [9]. In this forest nine tree species were found and Quercus libani Oliv and Quercus infectoria Oliv were the most dominant woody plants in this area (Figure 3). To study of vertical structure use the height species and SVS output. Study of vertical structure showed Havare khol forest less 4 meter height class has a maximum N/hectare, in Havareh Kohl forest more trees has more 9 meter height and Quercus libani Oliv (5.5 m height average) located in over story and has
major effect in this forest and other species are in understory layer (Figure 7 and table 2). The overall results showed that Havarekhol forest have two story layers. The mean of diameter at the breast height ranging from 2.5 to 37 cm in Havarekhol forest, respectively. The DBH distribution graphs in the stands indicate reduced uneven-aged young stands (Figure 4). Hosseinzadeh et al, 2004 [8] indicated that DBH distribution graphs was uneven-aged old stand (destruction forest) and our study showed different results. Havarekhol forest has young forest.

On the other hand, traditional forest management of Havarekhol forest increases the frequency of young trees and regeneration. These data showed that traditional forest management practiced in Havarekhol forest can regulate diameter distributions as uneven-aged young stands system and lead to support forest regeneration. The major problem in Havarekhol forest is lack of large (i.e. 30–50 cm) and very large (50 cm) diameter classes as well as dead trees have decreased habitat for wild animal. This study showed Havarekhol forest has negative effect on the old tree and degradation of this forest. Results showed that the estimated number of regeneration is as follows: mean seed regeneration equal to 130.6 and for Coppice regeneration equal to 6214 (N/Hectare) in the Havarekhol forest. This results emphasis that Havarekhol forest has sufficient regeneration and traditional forest management practice. Havarekhol pattern supported the forest regeneration (table 3). Spatial pattern information for individual trees is increasingly sought by forest managers and modelers as means to improve the spatial resolution and accuracy of forest models and management scenarios (Wulder et al, 2004 [13]). There are three basic spatial patterns as following: clumped, random and uniform [11]. Results showed that spatial pattern (horizontal structure) of Havarekhol forest was clumped pattern (table 4 and figure 6). Safari et al, 2010 [12] showed a clumped pattern for oak forest and our study in the Havarekhol forest has a Clumped pattern. Results of this study showed Havarekhol (Havarekhol Pattern) have negative effect on the forest and degradation of this forest. Overall results showed the Havarekh traditional forest management practices lead to increase the young tree and regeneration. Traditional forest management may be considered a short-term and medium-term approach for regional forest management to meet the basic local community needs for fuel wood and livestock fodder as long as people in this region are dependent on these resources for their livelihoods.

IV.2. CONCLUSION

Overall results showed Havarekhol forest was two forest story and Quercus libani Oliv and Quercus infectoria Oliv were the most dominant woody plants and located in over story. DBH distribution graphs showed reduced uneven-aged young aged stand and spatial pattern of this forest was uniform to clumped pattern. Overall results showed the Havarekhol Traditional Forest Management Practices lead to increase the young tree and regeneration.

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References


