The impact of fire on the plants diversity in Iranian Oak forest (Case study: Kermanshah province)

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ABSTRACT

Fire, as a natural ecological disturbance factor in forest, this study located in the Osmanvand region, central Zagros forest, and western Iranian state of Kermanshah. In each study area 30 plots 5 R (500 m²) were random methods. Trees and shrub species and number tree were recorded in circle sample plots. Species richness, Shannon index, Simpson index, Menhinik index and Margalev diversity indices were used to evaluate plant diversity in each sampling plot. The means of different diversity indices were calculated and t-test was used to analysis all indices means differences between burned and unburned area. To analysis data use the SPSS16 and Ecological Methodological software's. The tree species identified in the region studied belonged to four tree species in the two Families. Results showed that the tree species in the burned and unburned area is 4 and 3, but number of shrub species is 6 and 2 species. The mean of diversity index in the burned area are higher and differences between biodiversity indexes in the two areas were statistically significant and tree and shrub in burned area are higher the unburned area.

INTRODUCTION

Forests cover about 12 million ha in Iran [21], 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 [9]. For centuries, these ecosystems have been subject to much human activity, such as cutting to obtain wood, and clearing and fire. Recurrent fires have seen an enormous increase in frequency over the recent decades and they are the main disturbances to this ecosystem [11]. Disturbances such as fire, windstorms, floods, and grazing play a role in the maintenance of species diversity that has become well recognized in ecological theory [13]. Effects of Fire on vegetation are usually the most obvious impacts of burning. Fire affects natural ecosystems by consuming plants, altering successional patterns, and changing vegetative resources such as timber, forage and wildlife habitats [4]. Burning alone can result in increased forb abundance [20], grained abundance and under story species richness [10]. The zagros where fire occurs in 300-400 ha annually [1]. Atrakchaiee, [2] proclaimed that fire increased herbal species cover in burned area but did not effect on biodiversity indices in temperate forest of northeast of Iran. Banj Shafei et al [3] study effect of fire on herbal layer biodiversity in a temperate forest of northern Iran and results showed the biodiversity indices and coverage percent of shade tolerant species in unburned area were higher then burned area. Pourreza et al [18] investigated on the preliminary results of post fire re sprouting of manna oak (Quercus brantii Lindl.) in the Zagros forests and results showed that post-fire re sprouting is positively related to the number of pre-fire sprouts and the fire intensity. In pine/oak forest USA, most post fire under story dominants were previously inconspicuous or absent from the wetter communities and these species increased significantly more than others [17]. The burned plots in ponderosa pine/Douglas-fire forest had reduced species richness and cover of the under story in early years after fire, however after three years, richness increased to the level of the unburned plots. Simpson evenness increased in subsequent years [15]. These are mostly surface fire and effect mainly undergrowth and young trees. Despite such fires, there are unfortunately limited scientific studies or published papers about investigation of fire effects on temperate forests in Iran. Undergrowth biodiversity could help scientists determine if forest fire influences the presence or absence of certain plant species Biodiversity is useful to understand the distribution of new and native species in the study area. The aim of this study is an effect of fire on tree and shrub diversity in Osmanvand forest, Kermanshah province, Central Zagros forest (west of Iran).
**MATERIAL AND METHODS**

*Site description:*

This research was investigated in the Osmanvand forest, Kermanshah province; Central Zagros forest (Figure 1). Is located at an altitude of about 1600 – 1800 in the top hills of Osmanvand forest, with slop between 15 – 35%, 85 km southeast of Kermanshah city in Kermanshah, Iran (west of Iran) (Figure 1). The forest type is even aged mixed broad leaves trees consisting of oak spp. (*Quercus branti* and *Quercus infectoria*) as dominant species, where mean annual precipitation is 650mm. For this study, the fire event occurred in 2008 where 16.5 ha of forest were burned in 1 day, field data and sample collection was done 5 years later in 2012. Our study areas included both burned and unburned area (each study area has 15 ha).

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

**Analysis:**

In each study area 30 plots 5 R (500 m²) were random methods. Trees and shrub species and number tree were recorded in circle sample plots. Species richness, Shannon index, Simpson index, Menhinik index and Margalef diversity indices were used to evaluate plant diversity in each sampling plot. The means of different diversity indices were calculated and t-test was used to analysis all indices means differences between burned and unburned area. To analysis data use the biodiversity and spss16 software.

**Table 1: Biodiversity Indices used in this paper**

<table>
<thead>
<tr>
<th>Indices</th>
<th>References</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shannon (H)</td>
<td>[16]</td>
<td>[ H = \sum_{i=1}^{S} p_i \ln(p_i) ]</td>
</tr>
<tr>
<td>Simpson (1-D)</td>
<td>[16]</td>
<td>[ 1 - D = \left( \sum_{i=1}^{S} p_i \right)^2 ]</td>
</tr>
<tr>
<td>Margaleff (R)</td>
<td>[6]</td>
<td>[ R = \frac{(S - 1)}{\ln(S)} ]</td>
</tr>
</tbody>
</table>

*S and *pi refer to total number of species in the sample and proportion of individuals in the species, respectively.

**Results:**

Biodiversity measurement is recognized as guidance for conservation plans in local scale. Species biodiversity is used greatly in vegetation studies, and environmental evaluation is one of the main criteria to determine ecosystems condition [12].
<table>
<thead>
<tr>
<th>burned area</th>
<th>unburned area</th>
<th>Tree/Shrub/Herb</th>
<th>Family name</th>
<th>Scientific name</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>*</td>
<td>Tree</td>
<td>Fagaceae</td>
<td>Quercus infectoria Oliv.</td>
<td>1</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Tree</td>
<td>Fagaceae</td>
<td>Quercus Brantii Lindl.</td>
<td>2</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Tree</td>
<td>Rosaceae</td>
<td>Cratagus azarolus</td>
<td>3</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Tree</td>
<td>Rosaceae</td>
<td>Acer cinerascens</td>
<td>4</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Caprifoliaceae</td>
<td>Lonicera nummularifolia Jaub &amp; spach.</td>
<td>5</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Aceraceae</td>
<td>Acer Monspessulanum L. Subsp. cinerascens (Boiss)</td>
<td>6</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Rosaceae</td>
<td>Daphne angustifolia</td>
<td>7</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Rosaceae</td>
<td>Rosa canina</td>
<td>8</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Rosaceae</td>
<td>Rhus canina</td>
<td>9</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>Shrub</td>
<td>Rosaceae</td>
<td>Pyrus Syriaca</td>
<td>10</td>
</tr>
</tbody>
</table>

The Tree species identified in the region studied belonged to four tree species in the two Families. Results showed that the tree species in the burned and unburned area is 4 and 3, but number of shrub species is 6 and 2 species.
The results of Figure 4 showed that the computed species diversity index is as follows: mean species Shannon index: 1.21 and 1.83, Simpson index: 0.60 and 0.73, Menhinik index: 0.80 and 1.52, Margalev index: 1.14 and 2.09 in unburned and burned area.

The results of Table 3 indicated the differences between biodiversity indexes in the two areas were statistically significant.

**Discussion:**

Disturbances such as fire, windstorms, floods, and grazing play a role in the maintenance of species diversity that has become well recognized in ecological theory [8, 13]. Fires have negative impacts on native plant diversity, with varying effects on species and ecosystems, including the potential for localized extinction [7]. Fire was historically a major influence on landscape patterns and species diversity in the forests [5]. One of the serious threats to most of the Iranian ecosystems is drought, because much of Iran lies in the arid or semi-arid regions. The other threats for plants are: fire, overgrazing, fuel wood extraction, conversion of forest and other wild lands for agriculture, road construction, overexploitation, and unscientific extraction of plant resources for medicine and food. The Tree species identified in the region studied belonged to four tree species in the two Families. Results showed that the tree species in the burned and unburned area is 4 and 3, but number of shrub species is 6 and 2 species. Results showed that the computed species diversity index is as follows: mean species Shannon index: 1.21 and 1.83, Simpson index: 0.60 and 0.73, Menhinik index: 0.80 and 1.52, Margalev index: 1.14 and 2.09 in burned and unburned area (Figure 4). The mean of diversity index in the burned area are higher and differences between biodiversity indexes in the two areas were statistically significant. Sanghoon et al [19] and Mehta et al [14] showed that plant diversity in the burned higher the unburned area and in our study emphasis this research. Banj Shafiei et al [3] showed the biodiversity indices and coverage percent of shade tolerant species in unburned area were higher then burned area but our study showed plant diversity in the burned higher the unburned area.

**Conclusion:**

Fire, as natural ecological disturbance factors in forest, in this study tree and shrub diversity were higher in the burned area and fire has positive effect on the plant diversity in the Oak forest.

**REFERENCES**


