INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 3, No. 10, p. 273-279, 2013

RESEARCH PAPER OPEN ACCESS

Study of the plant diversity in Hyrcanian forest (case study: Lajim forest, Mazandaran province, North of Iran)

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Key words: Hyrcanian (Caspian) forest, plant diversity, Lajim forest, Rosaceae, richness, evenness.

doi: http://dx.doi.org/10.12692/ijb/3.10.272-279 Article published on October 21, 2013

Abstract

Hyrcanian (Caspian) forest in northern Iran has a richness of biological diversity, with endemic and endangered species, and a diverse range of economic and social conditions. The aim of this study is a study of the plant diversity in Lajim forest, Mazandaran province, north of Iran (Hyrcanian forest). In this study 100 circle sample plots (400 m2) were collected by random method. In every sample plot the kind of species and number of trees, shrub and Herbaceous were recorded. Species diversity indexes including Shannon Wiener (H′), Simpson (1-D) and Margaleff (R1). Data analyzing was done by Past and Ecological Methodological software's. Results showed that a total of 58 plant species were found in the studied area, of which 14 woody species (10 trees, 4 shrubs) and 44 herbaceous species existed (Table 1). Rosaceae and Fagaceae families play an important role in among plant species. Overall showed that the herbaceous are highest richness, evenness and diversity and Margaleff index has highest average in this study area.

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Introduction

Iran is the most attractive and versatile country among all countries in south –west Asia relating to vegetation**.** Hyrcanian (Caspian) forest in northern Iran has a richness of biological diversity, with endemic and endangered species, and a diverse range of economic and social conditions. About 45% of the Hyrcanian forests are located in mountainous areas, where forest lands are not readily accessible with ground-based logging equipment's, but cable yarding technologies are still undeveloped in this forest area (Jourgholami, 2012). These forests cover 1.8 million hectares of land area and are none commercial forests of Iran. Approximately 60 percent of these forests are used for commercial purposes and the rest of them are degraded. The Hyrcanian forests are extended at the altitude of a maximum of 2800 meters from sea level and have an uneven topography and very steep slopes. They are suitable habitats for a variety of hardwood species such as beech, hornbeam, oak, maple, alder, and encompass various forest types including 80 woody species. These forests are known as one of the most basic resources for wood production and have a big share in supplying wood to the related industries (Haidari *et al*, 2012)**.** Diversity of flora and vegetation of Iran due to wide variety of climate, vegetation history and its potential of development Specific soils and rocky substrates are often due to the differentiation of endemic species. In addition Iran's vegetation diversity flora is richer via sheltering those that have the wide distribution (Takhtajan, 1986). The balance between elements of plants and their life causes adapting to environmental conditions. Therefore, specific life-forms are created that harmonise with the environment (Mobaien, 1981). Biodiversity is defined as the kinds and numbers of organism and their patterns of distribution (Schuler, 1998). Generally, biodiversity measurement typically focuses on the species level and species diversity is one of the most important indices which are used for the evaluation of ecosystems at different scales (Ardakani, 2004). Gilli (1939) studied the vegetation sociological and also floristic studies were done by Zohary (1973), Asri and Eftekhari (2002), Assadi (1988-2003) and Kelin (1991). Researcher Study on vegetation structure, floristic composition and chorology of silver birch communities at Sangdeh, forest of Hyrcanian region and result showed the 181 species, 129 genera and 52 families were determined in study area. The most important families were Rosaceae, Asteraceae, Poaceae, lamiaceae and caryophyllaceae which contain 41 percent of the total species Hemicryptophytes, Phanerophytes and Cryptophytes were the most important structure groups of the local biological spectrum according to Raunkiaer Method, whereas according to Suzuki and Arakane Method caespitose Hemicryptophytes, Rhizom-Geophytes and broad leaved deciduous shrubs were the most important life forms (Akbarinia *et al*, 2004). Researcher studied the life forma and plant diversity in in Afratakhteh reserve and Flora of this region includes 97 plant species that belong to 86 genera and 51 families, of these, 7 species are endemic of Iran. The important families are Asteraceae, Rosaceae and Papillionaceae with 13.04%, 10.87% and 6.52% respectively. Life form of the plant species of Afratakhteh yew site in Runkaier classification Hemichryptophytes, Phanerophytes and in Suzuki-Aracane sub classification Hemichryptophytes with one stem (HC) and Decidous trees (DML) are dominated (Esmailzadeh *et al*., 2005). Researcher studied the Flora, Life form and chorological study of Box tree (*Buxus hyrcanus* Pojark.) sites in Khybus protected forest (Mazandaran province) and results showed that Flora of this region included 60 plant species which belonged to 54 genera and 39 families. The important families were Rosaceae, Aspidiaceae, Cyperaceae, Asparginaceae and *Poaceae* with 10%, 6.7%, 6.7%, 5% and 5% respectively. These families contained 33.4 percent of the total species. Phanerophytes (40%), Hemicryptophytes (28.3%) and Cryptophytes (25%) were the most important structure groups of the local biological spectrum according to Raunkaiaer method (Asadi *et al*., 2011). The researcher study of Shrub and Tree Species Diversity and its Application in Forest Planning in the hyrcanian forest and results showed that number of species and Margalef indices were significantly greater in unlogged area than logged area. The

eveness indices (Simpson and Smith & Wilson) were significantly greater in unlogged area. All of heterogeneity indices were significantly higher in unlogged area. (Nouri *et al*., 2010). Researcher studied the impact of single selection method logging on the tree and shrub diversity in the Hyrcanian forests and results showed that Results showed that shrub layer had the higher diversity indices (richness, diversity and evenness). In total Single selection method Logging has negative effect in the tree and shrub diversity (Haidari *et al*., 2012). The Hyrcanian forest (north of Iran) has a large ecological and economic value, but so far researcher has not been a study on plant diversity in this area. The aim of this research is a study of the plant diversity in Lajim forest, Mazandaran province, north of Iran (Hyrcanian forest).

Materials and methods

Study site description

Iranian habitats support about 8000 species of flowering plants (belonging to 167 families and 1200 genera), of which almost 1700 are endemic (Eftekhari and Ramezani, 2004). This plant species growing on four ecological zones (Figure 1).

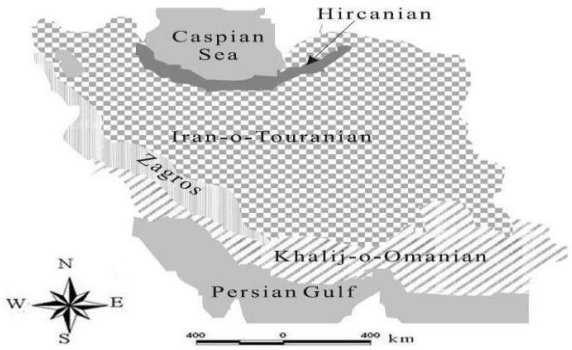

Fig. 1. Distribution of Hyrcanian zone in the four ecological zones of Iran.

The study was carried out in the Lajim Forest plantation, located Approximately 60 km south of Sari city, Mazandaran province, northern Iran (Figure 2). Lajim forest plantation accrued 1963 in 65 hectare area by used the bored leaf and deciduous species. The planted species include *Picea abies*, *Alnus Subcordata* and *Acer cappadocicum*. This plantation and nature forest has a four forest type (table 1).

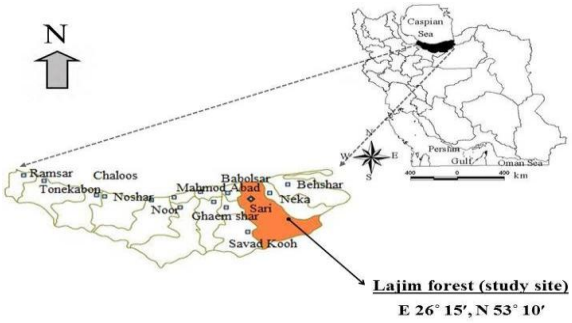

Fig. 2 Study site location in the Mazandaran Province, Hyrcanian forest, northern Iranian state of Iran.

Altitude ranging between 900 and 1000 meters above the sea level. Average annual precipitation of about 1290 mm/year, with the heaviest precipitation in the summer and fall. Temperatures are moderate, ranging from a few below -6.4 C in December, January, and February to +40°C during the summer.

Methods

In this study 100 circle sample plots (400 m2) were collected by random method. In every sample plot the kind of species and number of trees, shrub and Herbaceous were recorded. Species diversity indexes including Shannon Wiener (H′), Simpson (1-D) and Margaleff (R1) were used to evaluate plant diversity in each sample plot (Table 2). The means of different between diversity indexes in trees, shrub and herbaceous layer were estimated by Anova Data analyzing was done by Past and Ecological Methodological software's.

Results

Calculation and comparison of different indices of diversity, as a favorite method is considered for study on biodiversity (Baev & Penev, 1995). The assessment of biodiversity in forest has become an important issue for studying ecosystems and their conservation (Aubert *et al*. 2003).

The tree species identified in the region studied belonged to ten tree species in the eight Families. In this forest have 58 plant species, which consist of 10 trees, 4 shrubs and 44 herbaceous species. (Table1).

Table 1. the area of forest types in Lajim forest.

Species name	English name	stands	Area (hectare)
Picea abies		Pure stand	29.1
Mixed *Picea abies* (with *Alnus Subcordata and Acer cappadocicum)*	Maple	Mixed stand	36
Alnus Subcordata	Alder	Pure stand	4.9
deciduous forest		Mixed stand	2228

Table 2. Biodiversity Indices used in this paper.

Indices	References	Equation*
Shannon's (H')	(Peet, 1974)	$H' = \sum_{i=1}^{S} pi \ln(pi)$
Simpson (1-D)	(Peet, 1974)	$1 - D = (\sum (pi)^2$
Margaleff (R1)	(Ejtehadi, 2009)	$M = \frac{S - 1}{Ln\ (N)}$

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

Discussion and conclusion

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 (Mirdavoodi and Zahedi Pour 2005). All three calculated indices in this study have been mentioned as the most applicable indices (Baev & Penev, 1995; Neufeldt & Guralink, 1988). A total of 58 plant species were found in the studied area, of which 14 woody species (10 trees, 4 shrubs) and 44 herbaceous species existed (Table 1). Therefore, it is concluded that herbaceous richness is high in the studied area. Also, it can be deduced from Table 2 that Rosaceae and Fagaceae families play an important role in among plant species. Results showed Herbaceous layer had the highest richness, evenness and diversity in the vegetation layer (Figure 3). The results of Figure 4 showed that the computed plant species diversity index is as follows as: mean species Shannon index: 2.06, Simpson index: 0.76 and Margaleff index: 3.2 (Figure 4). Therefore, overall showed that the herbaceous are highest richness, evenness and diversity and Margaleff index has highest average in this study area.

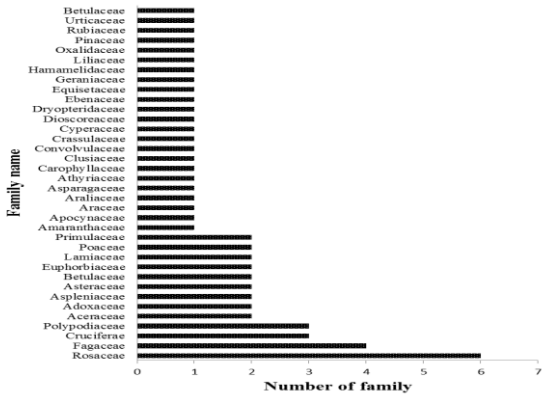

Fig. 3. The number of plant species in the plant family in the study area. The tree, shrub and herbaceous species belonged to 36 families and 58 species were identified in the study area (Table 1). Thus for the classes of Rosaceae, Fagaceae, Cruciferae and Polypodiaceae, six, four, three and three species were existed and have largest number of species, respectively (Fig. 2).

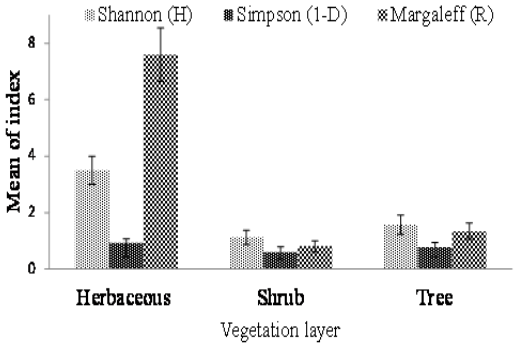

Fig. 4. The means of diversity indices in the vegetation layer. Results Figure 3 showed Herbaceous layer had the highest richness, evenness and diversity in the vegetation layer.

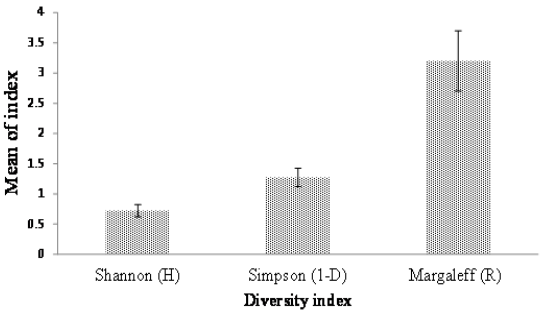

Fig. 5. the means of diversity indices in the study areaThe results of Figure 4 showed that the computed plant species diversity index is as follows as: mean

species Shannon index: 2.06, Simpson index: 0.76 and Margaleff index: 3.2.

Table 3. List of plant species (Tree, Shrub and Herbaceous) in the studied areas.

no	Scientific name	Family name	Tree/Shrub/Herbaceous
1	Alnus Subcordata	Betulaceae	Tree
2	Acer velutinum	Aceraceae	Tree
3	Acer cappadocicum	Aceraceae	Tree
4	Carpinus betulus	Betulaceae	Tree
5	Cerasus avium	Rosaceae	Tree
6	Diospyrus lotus	Ebenaceae	Tree
7	Fagus orintalis	Fagaceae	Tree
8	Picea abies	Pinaceae	Tree
9	Parrotia persica	Hamamelidaceae	Tree
10	Quercus castanifolia	Fagaceae	Tree
11	Crataegus monogyna	Rosaceae	*Shrub*
12	Mespilus germanica	Rosaceae	Shrub
13	Prunus spinosa	Rosaceae	Shrub
14	Ruscus hyrcanus	Asparagaceae	Shrub
15	Asprula odorata	Betulaceae	Herbaceous
16	Amaranthus albus	Amaranthaceae	Herbaceous
17	Aspelinum adianthum nigrum	Aspleniaceae	Herbaceous
18	Arum maculatum	Araceae	Herbaceous
19	Athyrium flix – femin	Athyriaceae	Herbaceous
20	Brachypodium sylvaticum	Poaceae	Herbaceous
21	Carex comans	Cyperaceae	Herbaceous
22	Convalvulus arvensis	Convolvulaceae	Herbaceous
23	Cyclamen officinalis	Primulaceae	Herbaceous
24	Droyptris flix – mas	Dryopteridaceae	Herbaceous
25	Equisetum arvense	Equisetaceae	Herbaceous
26	Euphorbia amygdaloides	Euphorbiaceae	Herbaceous
27	Fragaria vesga	Rosaceae	Herbaceous
28	Geranium spp.	Geraniaceae	Herbaceous
29	Galium odoratum	Rubiaceae	Herbaceous
30	Hedera helix	Araliaceae	Herbaceous
31	Hypericum perforatum	Clusiaceae	Herbaceous
32	Lamium album	Lamiaceae	Herbaceous
33	Lathyrus sativus	Fabaceae	Herbaceous
34	Mercuralis perennis	Euphorbiaceae	Herbaceous
35	Oplismenus ondulatum	Poaceae	Herbaceous
36	Oxalis acetosella	Oxalidaceae	Herbaceous
37	Poa palustris	Poaceae	Herbaceous

38	Pteris aquilina	Polypodiaceae	Herbaceous
39	Potentilla repens	Cruciferae	Herbaceous
40	Phylitis scolopendrium	Aspleniaceae	Herbaceous
41	Polygonum ariculata	Polygonaceae	Herbaceous
42	Primula acaulis	Primulaceae	Herbaceous
43	Rubus ideaus	Rosaceae	Herbaceous
44	Rumex acetosella	Polygonaceae	Herbaceous
45	Sedum acre	Crassulaceae	Herbaceous
46	Sambucus nigra	Adoxaceae	Herbaceous
47	Sambucus ebulus	Adoxaceae	Herbaceous
48	Salvia officinalis	Lamiaceae	Herbaceous
49	Scilla martima	Liliaceae	Herbaceous
50	Senecio vernalis	Asteraceae	Herbaceous
51	Stellaria media	Carophyllaceae	Herbaceous
52	Tamus communis	Dioscoreaceae	Herbaceous
53	Taraxacum officinalis	Asteraceae	Herbaceous
54	Trifolium arvense	Fabaceae	Herbaceous
55	Urtica diocia	Urticaceae	Herbaceous
56	Viola sativa	Cruciferae	Herbaceous
57	Viola odorata	Cruciferae	Herbaceous
58	Vintoxicum officinale	Apocynaceae	Herbaceous

References

Akbarinia M, Zare H, Hoseini SM. 2004. Study on vegetation structure, floristic composition and chorology of silver birch communities at Sangdeh, forest of Hyrcanian region. Pajouhesh & Sazandegi **64,** 84-96.

Ardakani MR. 2004, Ecology. Tehran University Press, 340.

Asadi H, Hosseini SM, Esmailzadeh O, Ahmadi A. 2011. Flora, Life form and chorological study of Box tree (*Buxus hyrcanus* Pojark.) sites in Khybus protected forest, Mazandaran, Journal of Plant Biology **8**, 26-39.

Asri Y, Hamzeh B. 1999.The phytosociology study of N.Abad Garmsar. Journal of Research and Development **44,** 100-104.

Assadi M, Maassoumi AA, Khatamsaz M, Mozaffarian V. 1988-2003. Flora of Iran. Research Institute of Forests &Rangelands publication, Tehran (in Persian).

Aubert M, Alard D, Bureau F. 2003. Diversity of plant Assemblages in managed temperate forests: a case study in Normandy (France). Forest Ecology Management **175**, 321-337. http://dx.doi.org/10.1016/S0378-1127(02)00215-3

Baev PV, Penev LD. 1998. BIODIV. Program for calculating biological diversity parameters, similarity, niche overlap, and cluster analysis. Version 5.1. Pensoft, 57 P.

Esmailzadeh O, Hosseini SM, Oladi J. 2005. A phytosociological study of English yew (Taxus baccata L.) in Afratakhteh reserve. Pajouhesh & Sazandegi **68,** 66-76.

Gilli A. 1939. Die pflanzengesellschaften der Hochreion des Elbursgebirges in Nordiaran Beih. Journal of Experimental Botany **59,** 317-344.

Hosseini SAO, Haidari M, Shabanian N, Haidari RH, Fathizadeh O. 2012. The impact of single selection method logging on the tree and shrub diversity in the Hyrcanian forests, European Journal of Experimental Biology **2(6),** 2229-2237.

Jourgholami M. 2012. Environmental Impacts of Tree-Length Logging Method on Forest Soils in Kheyrud Forest, Journal of Natural Environmental, Iranian Journal of Natural Resources **64(4),** 363-374.

Klein JC. 1991. Endemism a1, Alborz (Iran). Flora et Vegetation Mundi **Ix,** 247-261.

Mirdavoodi HR, Zahedi Pour H. 2005. Determination of suitable species diversity model for Meghan playa plant association and effect of some ecological factors on diversity change. Pajuhesh & Sazandegi **68,** 56-65.

Mobaien S. 1981.The text book of Phytogeography. Tehran University Press. 271 Number, 271-902p.

Neufeldt V, Guralink DB, Websters A. 1988. New World dictionary, Third College Edition, Simon and Schuster. New York. 774 p.

Nouri Z, Feghhi J, Zahedi Amiri Gh, Zobeiri M , Rahmani R. 2010. The Study of Shrub and Tree Species Diversity and its Application in Forest Planning (Case study: Patom District, Kheyroud Forest), Journal of Forest and Wood Products (JFWP), Iranian Journal of Natural Resources **63(2),** 201-214.

Schuler A. 1998. Sustainability and biodiversity – forest historical notes on two main concerns of environmental utilization, Assessment of Biodiversity for Improved Forest Planning, Kluwer Academic Publishers, Dordrecht, 353-360.

Takhtajan A. 1986. Floristic Regions of the World. University of California Press.

Zohary M. 1973. Geobotabical Foudations of the Middle East. 2 vol. Stuttgart. 739 p.