Diversity of woody species in the ecosystems of Sweet chestnut (*Castanea sativa L.*), Hazel (*Corylus avellana L.*) and Italian cypress (*Cupressus sempervirens var. horizonatalis*) trees in Guilan forests, Iran

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ABSTRACT

The purpose of this study is to determine the woody species diversity in Sweet chestnut tree, Hazel-tree and Italian cypress ecosystems in the Guilan forests. A lozeng 0.5 ha sample plot was selectively established on each site based on species composition. on each plot, physiographic data including elevation, aspect, slope and floristic data including type of woody species and their population (abundances) were recorded. In total, 14 plots were taken from the 14 sites. Simpson's and Shannon-Wiener's diversity indices were used to evaluate woody species diversity in the each site. At the same time, evenness was calculated for each site using Simpson's and Shannon –Wiener's indices. Species richness was characterized by means of Margalef's (R1) and Menhinick's (R2) species richness indices. The results indicated that 22, 19 and 20 woody species were found in the Sweet chestnut, Hazel tree and Italian cypress ecosystems, respectively. Diversity indices calculations showed that sites No.1 and 2 (Sheshad and Malaleh respectively, which are in Rezvanshahr) had the highest value of diversity of Sweet chestnut ecosystems, while sites No.3 and 4 (Visroud and Averes Koh respectively which are in Shapht) had the lowest, sites No.2(Chamlar, Baharestan, Astara) and No.5 (Ghalah-Bin, Agh-Evlar , Talesh) had the greatest value of diversity of Hazel tree ecosystems, while sites no.3 (Ab-Baglee , Baharestan , Astara) and 4(Ghalah-Bin, Agh-Evlar, Talesh) had the lowest. Finally, in the Italian cypress ecosyetems, sites no.5(Garmabdasht, Rahim-Abad, Roudsar) and 3 (north aspect of Mougshar , Siidan , Rahmat-Abad , Roudbar) had the greatest value of diversity, while sites no.1 (northwestern aspect of Moughshar, Siidan, Rahmat-Abad, Roudbar) and 2 (eastern aspect of Moughshar, Siidan, Rahmat–Abad, Roudbar) had the lowest.

Key words: Castanea sativa, Corylus avellana, Cupressus sempervirens var.horizontalis, Diversity indices, Guilan forests

INTRODUCTION

In the recent decade, biological diversity has become a subject of increasing scientific and popular interest. Biodiversity is defined as the variety and variability among living organisms and the ecological complexes in which they occur (Brockway, 1998). It has an indispensable value to the society in that: (a) it serves as a reservoir of genetic material that enhances productivity and stress tolerance of domesticated species and a source of new medicines, energy and industrial feedstock, (b) it provides ecological services such as amelioration of climate, water purification, soil stabilization and flood control and, (c) it provides animals and natural landscapes which have an overall benefit on human health and well-being through various forms of outdoor recreation (Brockway, 1998). The first time, woody species diversity was investigated in the Guilan forests, and results indicated that diversity in the west of Guilan was more than that in the east (Pourbabaee, 1999). The aim of this study is to determine the woody species diversity in Sweet chestnut tree, Hazel-tree and Italian cypress ecosystms in the Guilan forests.

MATERIALS AND METHODS

Materials

The Guilan forests is located in longitude from 48° 31′ to 50° 30′ E and in latitude from 36° 36′ to 38° 27′ N. The total area of Guilan forests is 550133.74 ha. The Sweet chestnut-trees have been limited to two ecosystems (240-380 m elevation and 35-85٪ slope). The first one is located in Douran of Shafaroud of Rezvanshahr and the second ecosystem in Visroud of Emamzadeh –Ebrahim of Shaft. The Hazel trees are also limited to two ecosystems: The first one is located in Chamlar of Astara and the second in Ghalehbin of Aghevlar of Talesh (1140-1580 m elevation and 4-65٪ slope). There are Italian cypresses which are in two areas named Roodbar and Roodsar (380-430 m elevation and 20-90٪ slope). Roodbar is more extensive than Roodsar.

Methods

Sweet chestnut-tree, Hazel-tree and Italian cypress sites were visited to survey the woody species diversity. A suitable location (virgin or undisturbed) was found after forest surveying to take sampling plot. A lozeng 0.5 ha sampling plot was selectively established on each site (Zobiery, 1994; Maguran, 1988). In the Sweet chestnut ecosystems, 4 sites were taken whereas 10 sites of Hazel-tree and Italian cypress ecosystems were taken based on species composition. On each plot, physiographic data including elevation, aspect, slope and floristic data including type of woody species and their populations (abundances) were recorded. Totally, 14 plots were taken from the 14 sites.

Species diversity is composed of two components: species richness and evenness (equitability). Species richness was characterized using Margalef (R1) and Menhinick Species richness (R2) (Ludwig and Reynolds, 1988). Evenness (approaching unity when all species are of equal abundance and declining toward zero when few species dominate) was determined using Hurlbert's V′ and Pielou's J′ (Ludwig and Reynolds, 1988). Diversity indices combine species richness and evenness components into single numeric value. The most commonly used indices of diversity are Simpson's index (1-D) and Shannon-Wiener's index (H′). In this way, Hill's N2 and McArthur's N1 were calculated based on Simpson's and Shannon-Wiener's indices, respectively (Krebs, 1989). The results of calculations have been used in the form of figures.

RESULTS

The results show that associated woody species in the Sweet chestnut-tree sites are as follows:

Acer cappadocicum Gled, *Acer insigne* Boiss, *Albizia julibrissin* (DC.) Willd, *Alnus subcordata* C.A.Mey., *Buxus hyrcana* A.Pojark, *Carpinus betulus* L., *Castanea sativa* Mill, *Cerasus avium* (L.)Moench., *Diospyros lotus* L., *Fagus orientalis* Lipsky., *Ficus carica* L.var.*genuina* Boiss., *Fraxinus coriariifolia* Scheele., *Gleditsia caspica* Desf., *Ilex spinigera*(Loes). Loes., *Mespilus germanica* L., *Parrotia persica*(DC.)C.A.Mey., *Prunus divaricata* Ledeb., *Quercus castaniifolia* C.A.Mey., *Rhamnus frangula* L.,

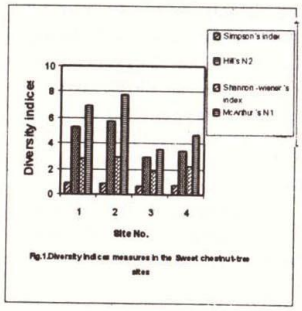

Fig.1.Diversity indices measures in the Sweet chestnut-tree sites

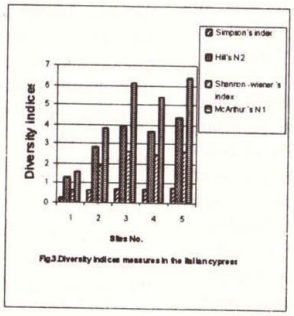

Fig.3.Diversity indices measures in the Italian cypress

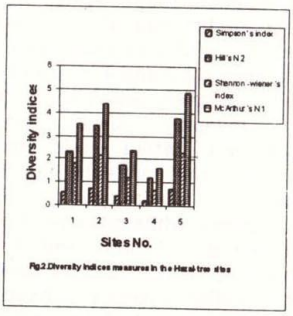

Fig.2.Diversity indices measures in the Hazel-tree sites

Ruscus hyrcanus Juz., *Tilia begonifolia* Stev., *Ulmus glabra* Huds., and in the Hazel- tree sites were as follows: *Acer campestre* L., *Acer cappadocicum* Gled., *Carpinus betulus* L., *Cornus australis* C.A.M., *Corylus avellana* L., *Corylus colurna* L., *Corylus pontica* C.Koch., *Crataegus ambigua* Becker., *Euonymus latifolia*(L.) Mill., *Fagus orientalis* Lipsky., *Ilex spinigera*(Loes).Loes., *Malus orientalis* Ugl., *Mespilus germanica* L., *Prunus divaricata* Ledeb., *Pyrus communis* L., *Quercus castaniifolia* C.A.Mey., *Q.iberica* Stev., *Rosa aucheri* Crepin., *Viburnum lantana* L. Finally, in the Italian cypress sites were as follows:

Acer cappadocicum Gled., *Berberis vulgaris* Linn., *Carpinus betulus* L., *C.schuschaensis* H.Winkl., *Cornus australis* C.A.M. *Crataegus ambigua* Becker., *C.microphilla* (Willd) Jacq., *Cupressus sempervirens* var.*horizontalis* Mill., *Diospyros lotus* L., *Ficus carica* L.var.*genuina* Boiss.,*Gleditsia caspica* Desf., *Mespilus germanica* L., *Paliurus spina-christi* Mill., *Parrotia persica*(DC.)C.A.Mey., *Prunus divaricata* Ledeb., *Punica granatum* L., *Pyrus communis* L., *Quercus castaniifolia* C.A.Mey., *Q.iberica* Stev., *Zelkova carpinifolia*(Pall.) Dipp (Djavanshir, 1976).

The results of diversity indices are shown in Fig.1 to Fig.2 .

Figure 1 shows that the greatest species diversity are in the site 1 and 2; Simpson's measurment equal 0.828, 0.812 and Hill's N2 5.741, 5.266 and Shannon-Wiener's measurment 2.958, 2.788 and McArthur's N1 7.77, 6.910 are in the mentioned sites. Also, figure 1 shows that the lowest species diversity are in the site 3 and 4; Simpson's measurment equal 0.665, 0.710 and Hill's N2 2.974, 3.423 and Shannon-Wiener's measurment 1.802, 2.209 and McArthur's N1 3.490, 4.620 are in the mentioned sites. Figure 2 shows that the highest species diversity are in the sites 2 and 5; Simpson's measurment equal 0.710, 0.739 and Hill's N2 3.426, 3.760 and Shannon-Wiener's measurment 2.127, 2.280 and McArthur's N1 4.370, 4.860 are in the mentioned sites. Figure 2 also shows that the lowest species diversity are in the sites 3 and 4; Simpson's measurment equal 0.428, 0.189 and Hill's N2 1.764, 1.230 and Shannon-Wiener's measurment 1.238, 0.675 and McArthur's N1 2.360, 1.600 are in the mentioned sites. Finally, Figure 3 shows that the highest species diversity are in the site 3 and 5; Simpson's measurment equal 0.748, 0.773 and Hill's N2 3.911, 4.366 and Shannon-Wiener's measurment 2.607, 2.662 and McArthur's N1 6.090, 6.330 are in the mentioned sites. Also, figure 3 indicates that the lowest species diversity are in the site 1 and 2; Simpson's measurment equal 0.210, 0.650 and Hill's N2 1.265, 2.844 and Shannon-Wiener's measurment 0.662, 1.918 and McArthur's N1 1.580, 3.780 are in the mentioned sites.

DISCUSSION

As a simple measurment of the number and or distribution of abundance species, diversity has long been used to describe the taxonomic structure of communities (Halpern and Spies, 1995). Species diversity is a useful tool in plant ecology and forestry to compare effects of different methods of site preparation or effects of timber harvest with respect to species composition (Neumann and Starling 2001). Many diversity indices from ecological studies have been introduced and applied in forest management research in recent years to describe diversity (i.e.,variety) in size, species, spatial distribution, other aspects of stand structure, and to characterise species diversity in relation to nature conservation and environmental monitoring (Heuserr, 1996). The importance of indices is growing as they are used increasingly to compare alternatives and to control management decisions (Neumann and Starling 2001). In the Aljibe Mountains (S.Spain), three biodiversity components (species richness, endemism, and taxonomic singularity) have been evaluated in both shrub and herbaceous layers (Ojeda et al., 2000). Whereas, In this study two biodiversity components were considered (richness and evenness) for calculating woody species (trees and shrubs) diversity.

The results of this investigation indicated that 22, 19, 20 woody species (richness) were found in Sweet chestnut, Hazel-tree and Italian cypress, respectively.The climate is temperate in Sweet chestnut, and sub-mediterranean in both Hazel-tree, and Italian cypress ecosystems. Diversity indices obtained were the highest values in the Sweet chestnut ecosystems compared with other ecosystems (figure.1 vs.figures 2 and 3).

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