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The Assessment of Plant Species Importance Value (SIV) in Beech (*Fagus orientalis*) Forests of Iran
(A Case study: Nav District 2 of Asalem, Guilan Province)

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ABSTRACT: The aim of this research was to determine plant Species Importance Value (SIV) in the *Fagetum orientalis*, Nav district of Asalem, Guilan province. The sampling procedure was performed according to the transect method. Seventy three plots were sampled and tree, shrub and herb species were identified. Their frequency and coverage percentage were measured within each sampling plot. Species Importance Value (SIV) was calculated in the tree, shrub and herbaceous layers. The diagrams were drowning based on log SIV. The results indicated that the mean richness of tree, shrub and herb species in Nav were 11, 12 and 79, respectively. The highest and lowest value of the SIV tree species layer belong to *Fagus orientalis* (142.88%) and *Sorbus torminalis* (2.84%), in the shrub species layer *Ilex spinigera* (86.23%) and *Prunusdivaricata* (1.40%) and in the herbaceous layer *Asperulaodorata* (83.06%) and *Physalisalkekengi*, *Capsella bursa – pastoris*, *Carpesiumabrotanoides*, *Humuluslupulus*, *Petasileshybridus* and *Physalisalkekengi* (1.38%), respectively. Diagrams of species frequency followed a lognormal pattern, which shows that the majority of species are of moderate presence in the community and a few number of them are more frequent or rare.

Keywords: Species Importance Value, *Fagus orientalis*, Asalem.

Introduction

Beech forests are the most economically important forest communities of the Hyrcanian forest that are distributed along Caspian shore. Cloudy weather always is always present in the plant community. Although the community was extensively exploited in the last two decades, some large and virgin areas can be found in the middle of the Hyrcanian forest (Javanshir, 1993).Consequently, plant vegetation study is very important and vital in Beech forests. Determination of plant distribution patterns is necessary in a forest ecosystem which can help to better recognize biodiversity patterns and ecological processes. Plant cover basically is described by density, DBH and frequency parameters (McCarthy et al., 2001). Species importance value (SIV) as an index covers all of these parameters together for the determination of distribution and frequency patterns of species as well as judgments about ecological conditions that have more significance. Ravanbakhsh (2002) separately studied a frequency distribution model for the relative density, dominance and frequency parameters in the upper and lower floors of Gissom forest reserve (Talesh, Gilan province). His results showed normal and logarithmic models for the three studied factors in the upper floor. On the other hand on the lower floor, normal and logarithmic models were recorded for the relative frequency parameter and a geometric model was presented for the relative density and dominance parameters. He demonstrated that high diversity of tree and shrub species with medium frequency led to this logarithmic model. Destruction factors were explained for the geometric model by the researcher. Zare et al (2004) showed normal and logarithmic models for the *Quercus macranthrea- Acer hyrcanum* community in the Siah Bisheh forest of Chalous (Mazandran province). Abedi (2009) used the relative importance index for determination of distribution-abundance models of plant species in a forest area (Gilan province) and explained plant vegetation conditions of the forest by the index. Curves of the frequency distribution of species according to SIV for the tree, as well as regeneration and grass floors was normal as was the logarithmic model but in contrast the curves showed the broken stick model for the shrub floors. Abedi et al (2009) studied the relative importance index of species for the tree, shrub and regeneration floors. His results from two forest reserves in the Arasbaran forest showed normal and logarithmic models for the all curves of the three studied floors. MacCarthy et al (2001) surveyed structure of forests of south –east Ohio and showed that *Fagus* and *Acer* species were of highest relative importance value. Miangi et al (2006) calculated SIV in the 71 sampling plots by means of DBH and number of grass species in the riparian forest of Tana River and then performed the ordination and clustering analysis by the index. Timilsina et al (2007) analyzed the plant community of *Shore robusta* (Terai- Nepal) separately in the tree, shrub, sapling, seedling and grass floors by means of the relative importance index. They expressed that correct management is necessary for preservation of each plant community and its biodiversity. Poorbabaei et al (2008) studied plant biodiversity of a forest reserve (Ghalarang- Gilan province) and showed relative importance curves followed by the log normal distribution. In our current research, we will survey distribution patterns of plant species in the tree, shrub and grass floors of series 2 Nav (Asalem forest- North-west of Iran). The aim of the study is to use SIV for the assessment of distribution of abundance of species.

Material and Methods

The current research was conducted in district 2, forest area of watershed 7 (Nav-Asalem forest- North of Iran) which is 10 km from Talesh city (Gilan province). The area of the district is about 3527 ha and the lowest and highest elevation from sea level is 280 and 2120 meter respectively. The general slope of the forest region is 0-60% except for the completely reserved districts. The general aspect of the region is N. According to the Amberjeh procedure, climate of the region is highly humid (Razavi, 2009).

Inventory was performed by the transect method. We designed two transects with 200 meter distances (depending on tree density) (Zobeiry, 2002). Distance between each sampling plot along these transects was 150 meters. The first and last sampling plots were set in the uppermost growth boundary of beech species (1450 meter from sea level) and lowermost growth boundary of the species (480 meter) respectively. We recorded all the plant species, as well as frequency and percent of vegetation cover for each species on the three floors (grass, shrub and tree floor). Area of the sample plots was determined by the minimal area method. The minimal area method shows the smallest and the most appropriate area of a sample plot where plant composition is similar to plant community of the studied region. According to the minimal area method, the sample plot with 400 and 100 m2 was determined for tree-shrub and grass floor respectively.

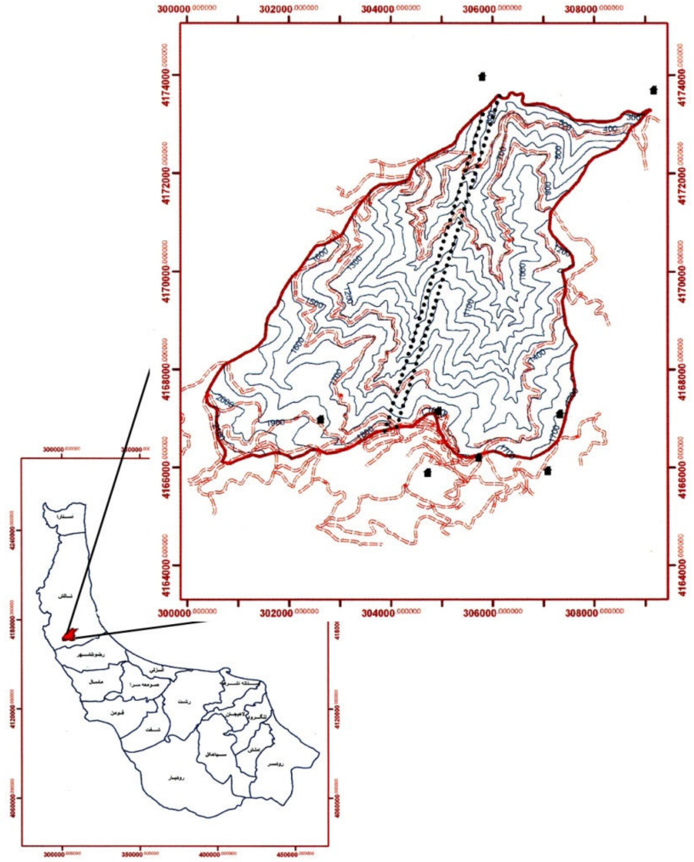

Figure 1: Location of the study region.

Species importance value (SIV) was used for the assessment of the distribution of species abundance which is calculated in the following formula:

SIV= relative frequency+ relative density+ relative dominance

Mentioned parameters in the above formula calculated the following formulas:

$$\textit{Relative frequency} = \frac{\text{numberofsampleplotswhereacertainspeciesisdistributed}}{\text{numberof totalsampleplots}} \times 100$$

$$\textit{Relative density} = \frac{\text{totalnumber of a certain species in the totallsample plots}}{\text{number of all species in the totalsample plots}} \times 100$$

$$\textit{Relative dominance} = \frac{\text{sum totalDBH of a certain species in the totallsample plots}}{\text{sum totalDBH of all species in the total sampleplots}} \times 100$$

In the current research, we used frequency and percent of vegetation cover for the calculation of SIV.

SIV= relative frequency+ relative density

Finally according to species rank (from most abundant to rarest species) and the SIV logarithm, we plotted the curve of the distribution of abundance of species for the judgment about ecological condition of each species. Generally, logarithms were used with base two so that each class or octave showed two folds of the last class value. This procedure is contracted but prevalent in the ecological studies and for the first time was introduced by Periston (1984) (Porbabaie, 2004).

Results

Species richness of the tree, shrub and grass species was 11, 12 and 79 respectively. Species distribution in the plant families was presented for each floor separately (figure 2, 3 and 4). The relative importance curves for each floor were presented in figure 5, 6 and 7. These curves were plotted according to the species and logarithms of SIV such that arrangement of the species is based on the number of each species in sample plots.

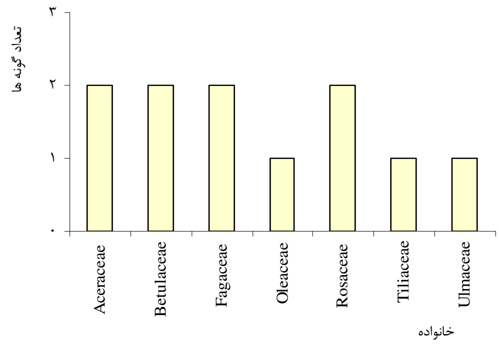

Figure 2: distribution of tree species in the plant

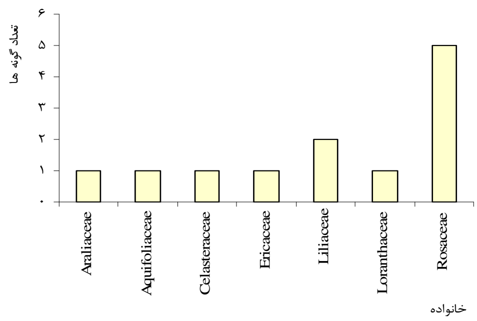

Figure 3: distribution of shrub species in the plant families.

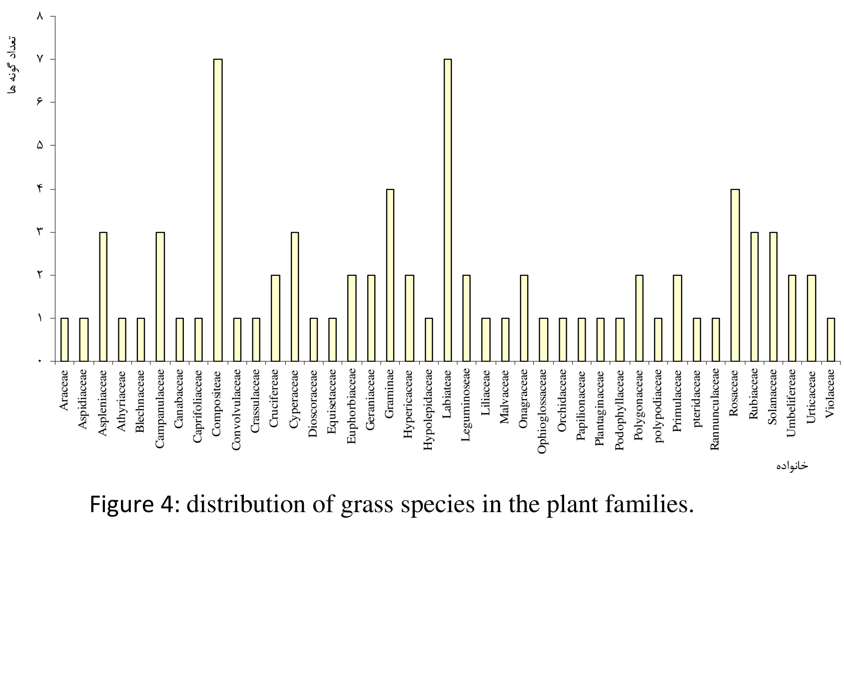

Figure 4: distribution of grass species in the plant families.

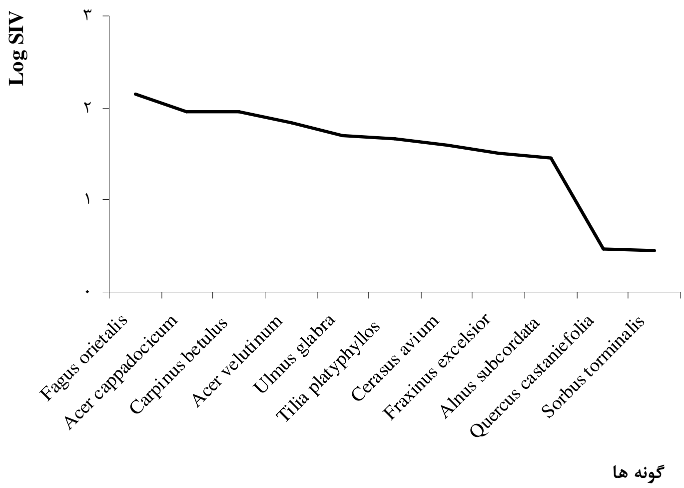

Figure 5: SIV values for tree

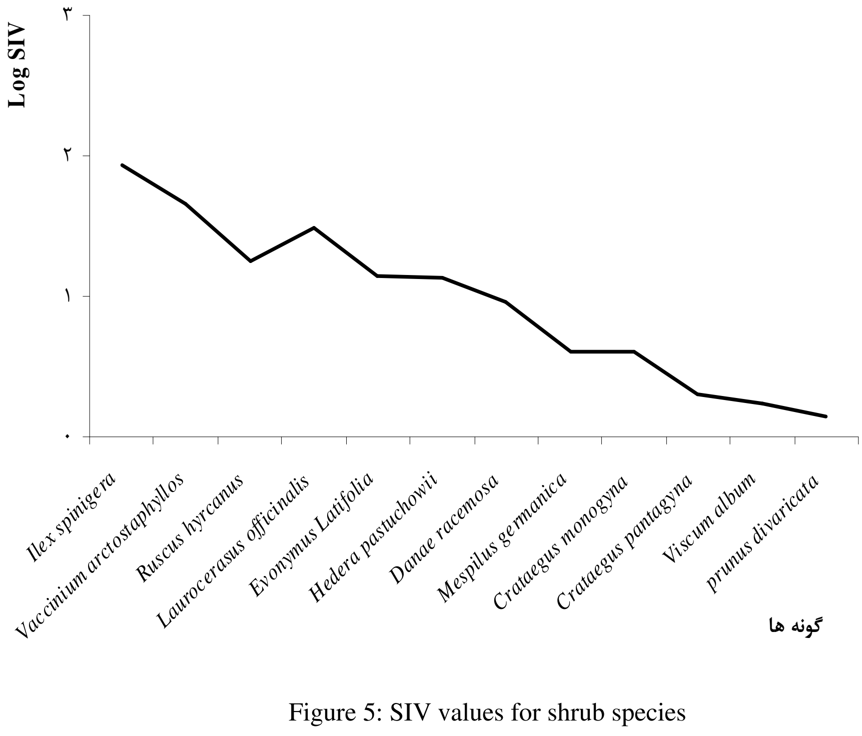

Figure 5: SIV values for shrub species

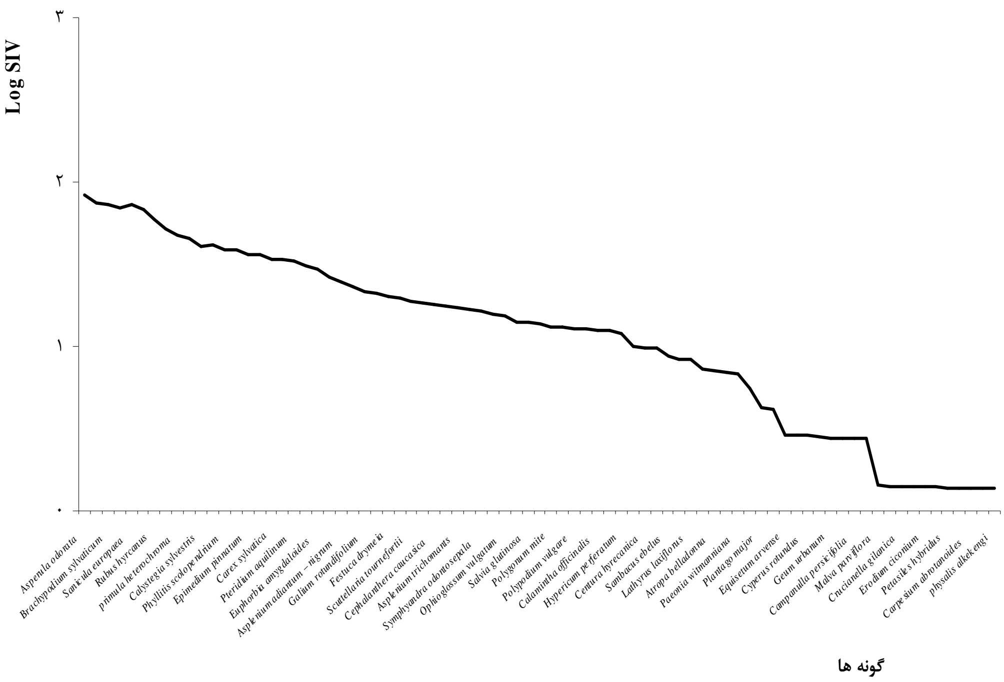

Figure 5: SIV values for grass species

Discussion

The highest tree species number was found in Aceraceae, Betulaceae and Fagaceae families with two species (Figure 2). The highest shrub species number is Rosaceae (with 5 species) and Liliaceae (with 2 species) (Figure 3), while Compositeae and Labiateae families with 7 grass species showed the highest species number on the grass floor (Figure 4). In fact, dominant species refer to species with considerable and prominent effects on their habitats in respect to size, frequency, production their activity (Ardakani, 2009). In the plant community, dominant species are characterized by abundance, growth and biomass production. Dominant species utilize their resources and have an extensive effect on the environmental conditions. If the dominant species is removed from the habitat, biotic and abiotic components and finally metabolic of the habitat will change. In contrast, remove the lesser important species and they will not considerably effect the structure and metabolic habitat. The researcher believed that number of dominant species in the temperate ecosystem is lower than in tropical ecosystems (Ardakani, 2009). Ecologists proposed some models for the determination of frequency patterns. These models experimentally explain the frequency relationship between species which can describe the main ecological structure of community (Porbabaie, 2004). After presentation of the species frequency data as a relative frequency graph (from the highest to lowest frequency), the final curve describes species evenness and relative dominance in the plant community. These distributions included geometric series, normal logarithmic and broken stick methods (Ejtehadi and Akkafi, 2000, Hamilton, 2005). The geometric distribution model shows that the plant communities characterized by many low species numbers can be predict an immature plant community with low biodiversity. The broken stick model suggests a plant community with relatively uniform frequency for all the species (this pattern rarely can be found in nature). The normal logarithmic model suggests a plant community with rich diversity where most of the species have intermediate frequency with only a few species having very high or low frequency (Hamilton, 2005). In the current research, assessment of the frequency curves in the different layers (tree, shrub and grass layers) show a normal logarithmic distribution (figures 5, 6 and 7). It seems that small numbers of livestock in rural, low grazing and low or no utilization areas are the main reasons for the explanation of the model. The last research on the western forest of Iran (Zagrous Mountain) showed a normal logarithmic distribution for the grass floor (Poorbabaie et al., 2008). Furthermore, Abedi et al (2009) reported a normal logarithmic distribution for all the vegetation layers in the white oak forest of Arasbaran region. *Q. macranthera – Acer hyrcanum* type showed a normal logarithmic distribution because of many species with moderate frequency (Zare et al., 2004).

Conclusion

Briefly, the highest and lowest SIV values were found for the *Fagus oreintalis* (88.142%) and *Sorbus torminalis* (2.84%) in the tree layer, *Ilex hyrcana* (86.23%) and *Prunus spinosa* (1.40%) in the shrub layer and *Asperula* spp (83.06 and Physalisalkekengi, *Capsella bursa* – pastoris, Carpesiumabrotanoides, Humuluslupulus, Petasileshybridusand physalisalkekengi (1.83) in the grass layer. The highest value for a certain species suggests that the species is dominant in the layers. *Fagus orientalis* community with *Asperula* is a one of the important communities in the beech forest. In line with the point of view, the *Fagus orientalis* community with *Asperula* is prominent in the forest region too. As mentioned previously, *Fagus orientalis* with the highest SIV value suggested the dominance of this species in the forest. MacCarthy et al (2001) reported the same results from the beech forest of Ohio. SIV is introduced as a one of the most important indexes in forest management and the index can be useful in biodiversity preservation (Timilisina et al., 2007).

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