Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 5, No. 6, p. 318-328, 2014
http://www.innspub.net

RESEARCH PAPER | OPEN ACCESS

Evaluation of species diversity in Iranian-Turanian forest islands and its relation with climate factors and natural sites bionomics (A case study of Markazi Province)

Asadollah Mattaji[1], Iraj Mehregan[2], Sasan Babaei Kafaei[3], Mostafa Yousefirad[4], Siavash Aghakhani[5*]

[1,2,3]*Department of Forest Ecology and Silviculture, Science and Research Branch, Islamic Azad University, Tehran, Iran*

[4]*Arak Payame Nour University*

[5]*Department of Forestry, Science and Research Branch, Islamic Azad University, Tehran, Iran*

Article published on December 14, 2014

Key words: Species diversity, Environmental influences, Iranian-Turanian region, MRPP test, Cluster analysis.

Abstract

In order to study the species diversity and genetic diversity of *Amygdalus scoparia* and *Pistacia atlantica*, 21 thousand hectares of forest ecosystem were made in Markazi province and the effects of climatic and bionomic factors on the deployment and development of these areas and important factors were examined. Therefore biological units were made and 225 sample plots were taken with the method of least level of helical structure, the biological elements were noted by Brown Blunck's method. Next species diversity in groups was checked by Simpson and Shannon – Viner and Species richness indicator. Finally ANOVA was performed and there were comparison of means. The results showed that the composition of forests in Markazi province included of 9 families and 12 species of trees and shrubs. The most spreading of forests are on the geological formation material such as: tuff, limestone and sandstone, shallow sandy, shallow sandy loam soil. They are in dry, cold and semi-arid zones. The result of plant species diversity tests showed that the third group is influenced climate and physiographic conditions, in term of ingredients vegetative, had the highest diversity in both Simpson and Shannon-Viner. Also it has the highest species richness. CCA test result had shown that *Rhus coriana* spreading was unaffected by rainfall directly, Iranian *Quercus brantti* spreading was unaffected by height, Barberries spreading was unaffected by temperature, *Amygdalus scoparia* and *Pistacia atlantica* were unaffected by rainfall and high. Biodiversity in Iranian- Touranian forests was directly related to the type of geological formation, altitude and slope. There was no significant correlation between the geographic and climatic conditions.

***Corresponding Author:** Siavash Aghakhani ✉ saghakhani60@gmail.com

Introduction

Knowing the importance and value of diversity in natural ecosystems has had undeniable role in sequence and frequency of ecosystems, so the importance of this resource will be double (Smith *et al*, 1993). Through the study of plant diversity we could investigate plant community dynamics. By measuring species diversity we could examine species distribution in environment and with emphasis on the dynamics of ecosystems, provide appropriate management recommendations (Wilson, 1988). Large-scale plant diversity in vegetation studies and environmental assessments were used as the most important indicators of ecosystem determination status (Gromstev, 2010). Iran acts as a bridge between four geographical of plant regions: Iranian-Turanian, Europe-Siberian, Mediterranean and sandy desert and also influenced by Sudan- Dekan, as a result we can find five main regions in Iran. They are included Caspian, Zagros, Iranian- Touranian and Gulf- Oman that each of them consist of diversity and valuable ecosystems (Bagheri, 2011). We know Iran as an important of ten major source of plant speciation in the world. In Iran there are 167 families of vascular plants, they are included 1215 genera and 8000 species, subspecies, varieties or hybrids (Ejtehadi *et al*, 2009). Iran in comparison with other countries in number species factors is in eighth rank and fifteenth in exclusive species plant. It is unique in Middle East because of diversity species (Akbarinia, 2005). In Iran the most number of plants are endemic. According to estimates have done in Iran, there were been 1727 endemic species. That includes 22% of the total known flora (Mozafarian, 2004). On the other hand, Iranian- Touranian with 1452 endemic species almost has 85% of Iran's endemic species (Mozafarian, 2004). The researchers are sought to identify environmental factors associated with biodiversity and natural areas. Through the identification and dissemination of analyzes that can provide optimal management areas (Moghadam, 2001). As an example Akbarinia (2005) said that in relation examination of species diversity with physiographic factors, usually have more species diversity in northern, also the highest quantity was found in the slope of less than 30%. Zarechahouki (2009) in the relations examination between species diversity and environmental factors mentioned that Factors such as the geographic location, depth, texture, lime and potassium (K) have the greatest effect on species diversity. Chen (2010) said that high diversity is a result of continuous variable situation and he has predicted that higher levels of damage caused by high level of diversity. Also the destruction of high and low intensity variation could reduce the diversity. Debyle (1995) announced that species diversity indicates an inverse relationship with latitude. Species diversity decreases with increasing latitude however genetic diversity increases. Ali *et al* (2000) have investigated the relationship between species diversity and environmental factors in areas with sparse forest cover and understood that 52% of species diversity change caused by climate change and other items such as altitude, type of geological formation and intensity of human activities are other effective factors (Pourbabaei *et al*., 2010). In this regard detailed examination of Iranian- Touranian's species diversity in forest vegetation zone and determination their status in forested islands and determination the relationship with climate ecological factors in natural habits in Markazi province can be helpful for appropriate management suggestion in this vegetative area.

Materials

Markazi province with 29405 square kilometers is located in the center of Iran. The coordinate of this province are 35.33 northern latitude and 57.48 eastern longitude (Fig. 1). On one side it is located in the central desert of Iran and the other side is in the folded angle of Albors and Zagros. Markazi province of Iran has an arid and semiarid climate and rich diversity ecosystem. Markazi Province plant included of 71 families, 440 genera and 1100 species. In this area there were been almost 21 thousand hectares of forest. Almost 62% of forests were been in the mountain areas, 32% were been in the slope areas and 5% were been in the plain areas. The forests at altitudes ranging from 800 to 3200 meters, which have the highest distribution class of 1800-2200 m. In terms of climate (Domarten) there were published in almost 54% in semi-arid and cold climate regions and 41% in the dry and cold climate regions. In terms of slope there were been more than 25% slope with 83% and had the highest distribution. But in terms of distribution it had the maximum percent in North 27% and it had the minimum percent in South West 9%. The studied forests were located in 46 geological formations. 55% of the forests of Markazi Province were on 5 Formation: sandstone, limestone, marl, limestone, between layers of sandstone and tuff gray tuff and green. Distribution of soil texture and structure of the forests in seven grade class was shown that sandy shallow soil with 63% had the highest percentage of attendance in the classes.

Methods

In order to biodiversity assessment and according to the Polygon, mountains and high distribution, forests were affected by Earth morphological features (slope, aspect and elevation). So the homogeneous units of land were formed. 225 samples were taken with a systematic random sampling of the 165 islands of forest in the area and environmental conditions. Selecting the level sample were done via Minimal Area, development of level via Nasted plot (based on Cain species- levels curve) were used. Next inside the each of these pieces the samples of trees, shrubs, were recorded. I addition, physicochemical properties of soil and physiographic features (aspect, slope and altitude) in each plot were recorded in a separate file. Then data related to direction were used in the analysis it was based on Beers, 1996.

A' = Cos (45-A) +1

A' = Amount converted to direction

A= Amount of Azimuth direction

Amount of A' was been between zero and two, North East direction had the highest amount and South East direction has the lowest amount. All data were checked for normality and data were transformed to normalize their relations. Due to the various units of environmental variables, data were standardized with zero mean and unit variance. Illustration the nature and composition of plant species manufacturer vegetation classification was done via using the Braun Blanquet. The classification was conducted via PC-ORD software and TWINSPAN. Measurement of the distance from the cluster sample parts of the plant was done via Sarensun and the integration group was done via Flexible beta method. Great selection of clusters was done via indicator species analysis.

After samples classification from the cluster analysis, MRPP (Multi-Response Permutation Procedures) was used and separate treatments paired based on vegetative composition were tested. In order to select the optimal cluster the indicator species analysis method and Mont- Carlo test were used. Finally analyses of criterion abundance- dominant species was evaluated via conventional indicators such as species diversity indices conventional (Simpson, Shannon -Viner), species richness and evenness (Shannon -Viner). After calculating indicators of biodiversity plots, the average separation of the different treatments on the level of samples were determined. Then Canonical Correspondence Analysis (CCA) was used to find non-linear variables relationship with vegetation (Grabherr *et al*., 2003). At the end, the analysis and interpretation of the results were done.

Results

In floristic terms 12 species of trees, shrubs (Table 1) were identified in 9 families. So that the Rosaceae family with 60% is the highest and Anacardiaceae with less than 1% is the lowest (Fig. 2). *Amygdalus scoparia* had the highest frequency of 53% and then there were been *Ficus carica*, *Rhamnus pallasi*, *P. khinjuk*, *Amygdalus lycioides*, *Daphne*, *Berberis integerrima*, *Tamarix, Quercus branti*, *Berberis integerrima*, *Rhus coriaria* and *Acer cineracens*. Diagram of total value of the cumulative variance of indicator species (Fig. 3) had shown that the largest number of species indicator and fewest total value cumulative variance of species indicators were founded in six clusters. In (Table 2), MRPP analysis had shown that the results of the four treatments have had significant differences in the vegetation composition. And groups 1 and 2 had compared with the other treatments and they had had the largest difference because T-statistics in them were been small. Comparisons between groups had shown a significant difference between the variances of all the clusters. Diagram of the cluster analysis data into six major groups 1, 2, 3, 4, 5 and 6, respectively, each with 8, 6, 45, 53, 29 and 84 were plots of separation (Fig. 4). Value of species indicator had shown that *Quercus brantii* and *Rhus coriaria* respectively represent the values 11 and 38, they were been present only in one group, and *Berberies inegerrima* has had the highest indicator value among the groups elements (Table 3). There was been just *Tamarix* with 95 indicator value in the second group. One way ANOVA analysis of species diversity indices had shown that there was been significant difference between the means. (Table 4). Duncan test results were shown in the following figure. The lowest indices of species richness, Simpson diversity, Shannon-Wiener diversity and Shannon-Wiener uniformity are visible in the first cluster. The highest mean species richness and Shannon-Wiener diversity index and Shannon-Wiener uniformity were been in third group and the most Simpson diversity index with a minimum difference to third group was been visible in fifth group (Fig. 5). The result of CCA analyses has shown that the first and the second axis of CCA had the highest Eigen Value with 0.230 and 0.038, so they were used for showing correlation (Table 5). Correlation analysis was done for the environmental variables and it indicated that factors such as amount of rainfall and temperature had a positive correlation with axis and factors such as altitude, slope and aspect have negative correlation with axis. Pearson correlation test results between environmental features in first and second axis in CCA analyses indicated that variance of the rainfall and slope did not have significantly difference with the second axis (Table 6). At the first coordination quarter, *Quercus brantii* (first group indicator) species had had positive correlation with altitude and rainfall in first and second axis (Fig. 6).

Table 1. Tree and shrub species identified.

Row	Family	Latin names	Vegetative form
1	Rosaceae	*Amygdalus scoparia*	Shrub
2	Moraceae	*Ficus carica*	Shrub
3	Rosaceae	*Amygdalus lycioides*	Shrub
4	Rhamnaceae	*Rhamnus pallasi*	Shrub
5	Anacardiaceae	*Pistacia atlantica*	Tree
6	Anacardiaceae	*Pistacia khinjuk*	Tree
7	Fagaceae	*Quercus branti*	Tree
8	Anacardiaceae	*Rhus coriaria*	Shrub
9	Thymelaceae	*Daphne mucronata*	Shrub
10	Berberidacea	*Berberis integerrima*	Shrub
11	Tamaricaceae	*Tamarix sp.*	Shrub
12	Aceraceae	*Acer cineracens*	Shrub

Table 2. Results of multiple comparisons based on the combination of MRPP growth.

P	A-statistic	Delta Expected	Delta Views	T-statistics	Groups
0.0001	0.2188	0.8453	0.6603	-6.0687	Group1,2
0.000	0.1997	0.5024	0.4020	-25.2499	1,3
0.000	0.1823	0.4885	0.3994	-27.7984	1,4
0.000	0.1978	0.5518	0.4426	-16.4325	1,5
0.000	0.1359	0.4697	0.4058	-31.8396	1,6
0.000	0.1378	0.4051	0.3493	-17.0879	2,3
0.000	0.1108	0.3978	0.3537	-15.5862	2,4
0.000	0.1888	0.4537	0.3680	-14.4453	2,5
0.000	0.0726	0.4054	0.3760	-15.2471	2,6
0.000	0.0666	0.3601	0.3361	-18.8851	3,4
0.000	0.1639	0.4032	0.3371	-30.715	3,5
0.000	0.1472	0.4173	0.3558	-44.6892	3,6
0.000	0.1330	0.3939	0.3415	-27.5671	4,5
0.000	0.1647	0.4278	0.3573	-54.2821	4,6
0.000	0.1240	0.4139	0.3626	-34.8621	5,6

Table 3. species value indicator produced by analysis of species indicator.

Clusters						Investigated Clusters / Plant species	Row
6	5	4	3	2	1		
15	20	29	24	8	0	*Amygdalus scoparia*	1
1	12	7	44	1	0	*Ficus carica*	2
5	3	18	3	19	0	*Amygdalus lecyoides*	3
3	1	29	16	2	0	*Rhamnus pallasi*	4
2	1	4	16	2	0	*Pistacia atlantica*	5
3	4	21	25	6	1	*Pistacia khinjuk*	6
0	0	0	0	0	11	*Quercus brantii*	7
0	0	0	0	0	38	*Rhus coriaria*	8
0	45	5	0	0	15	*Daphne macronata*	9
0	1	0	1	0	50	*Berberis integerrima*	10
0	0	0	0	95	0	*Tamarix*	11
0	1	0	2	0	0	*Acer cineracens*	12

Table 4. Analysis of variance (ANOVA) index of species diversity in plots.

	Significant level	Mean-square	The sum of squares	F	(df)	Species diversity index
**	0.000	30.646	153.231	18.094	5	Species richness
**	0.000	0.055	0.276	13.715	5	Uniformity Shannon-Wiener
**	0.000	1.422	7.110	23.181	5	Shannon-Wiener diversity
**	0.000	0.137	0.685	22.340	5	Simpson Diversity

** Significant at 0.01* Significant at 0.05 No significant :ns

Table 5. The special value and variance analysis of CCA axis.

The cumulative variance (percent)	Variance (percent)	special value	Axis
9.2	9.2	0.230	1
10.7	1.5	0.038	2
12	1.2	0.031	3

Table 6. Pearson correlation coefficient between the environmental parameters in the two axes of a CCA analysis.

Corre-lation	Second axis	corre-lation	First axis	Environmental features
Ns	0.155	**	0.043	The average of rainfall
**	-0.003	**	-0.020	The average of temperature
*	0.010	**	-0.044	Altitude
ns	0.144	**	0.027	Percentage slopes
**	-0.047	**	-0.030	Slope direction

**Significant 0.01 * Significant 0.05 : ns No significant

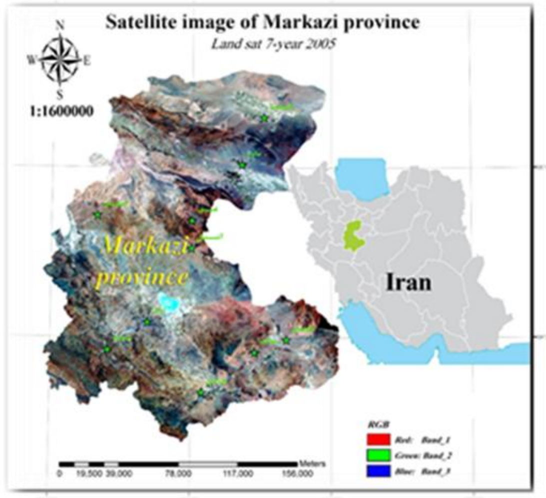

Fig.1. Satellite image of markazi province.

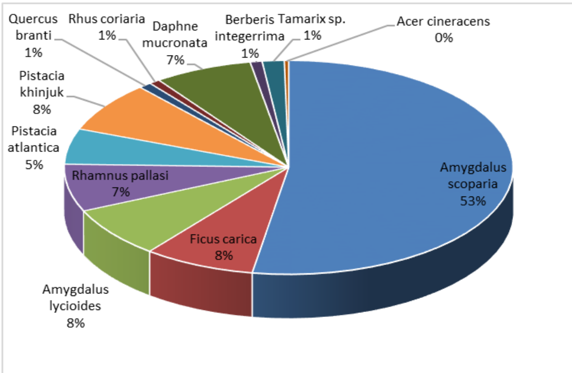

Fig. 2. Frequency of different plant species.

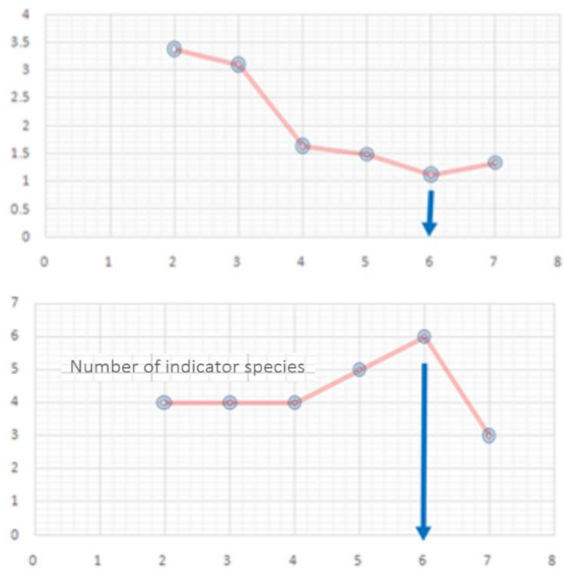

Fig. 3. Number of indicator species (right) and change the value of the cumulative variance plot (left) in the clustering.

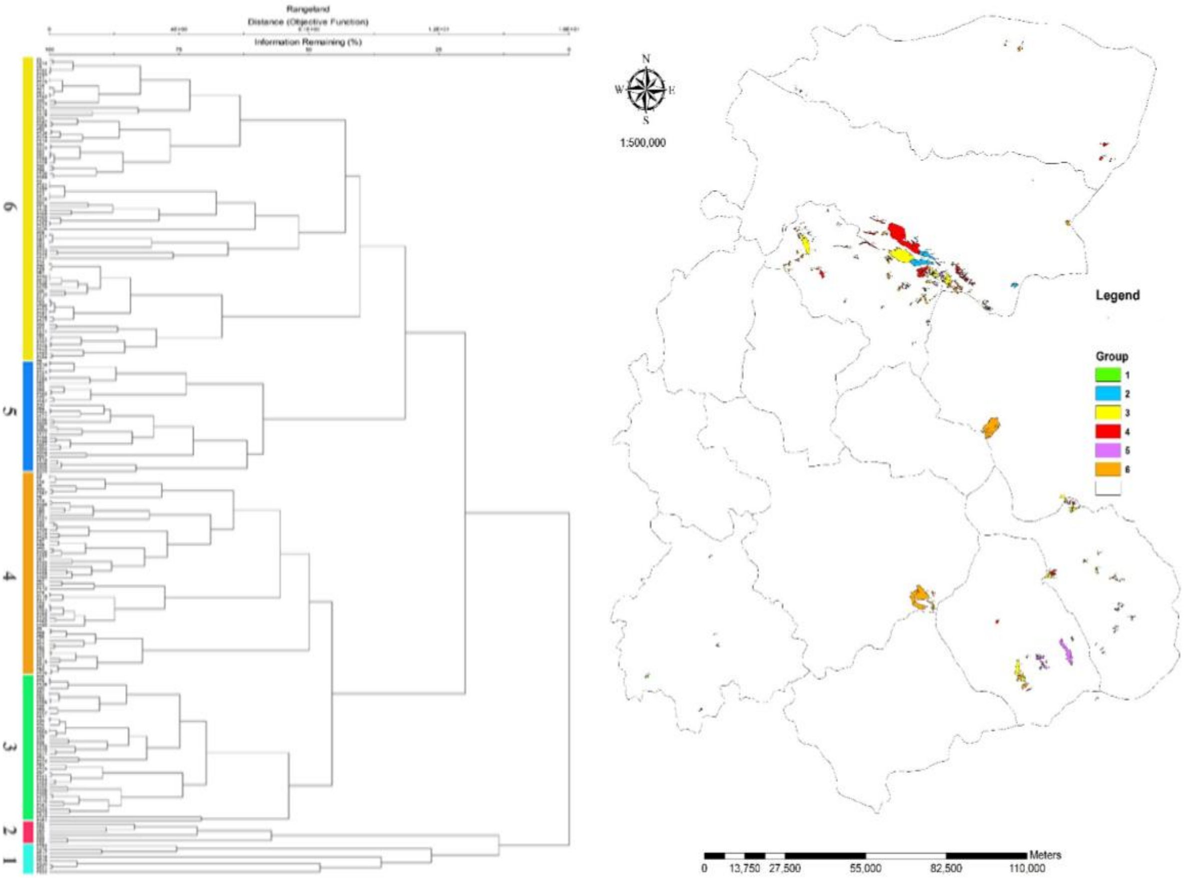

Fig. 4. diagram of the cluster analysis of vegetation and Determining the scope of groups (top) clustering forests of Central Province map (bottom).

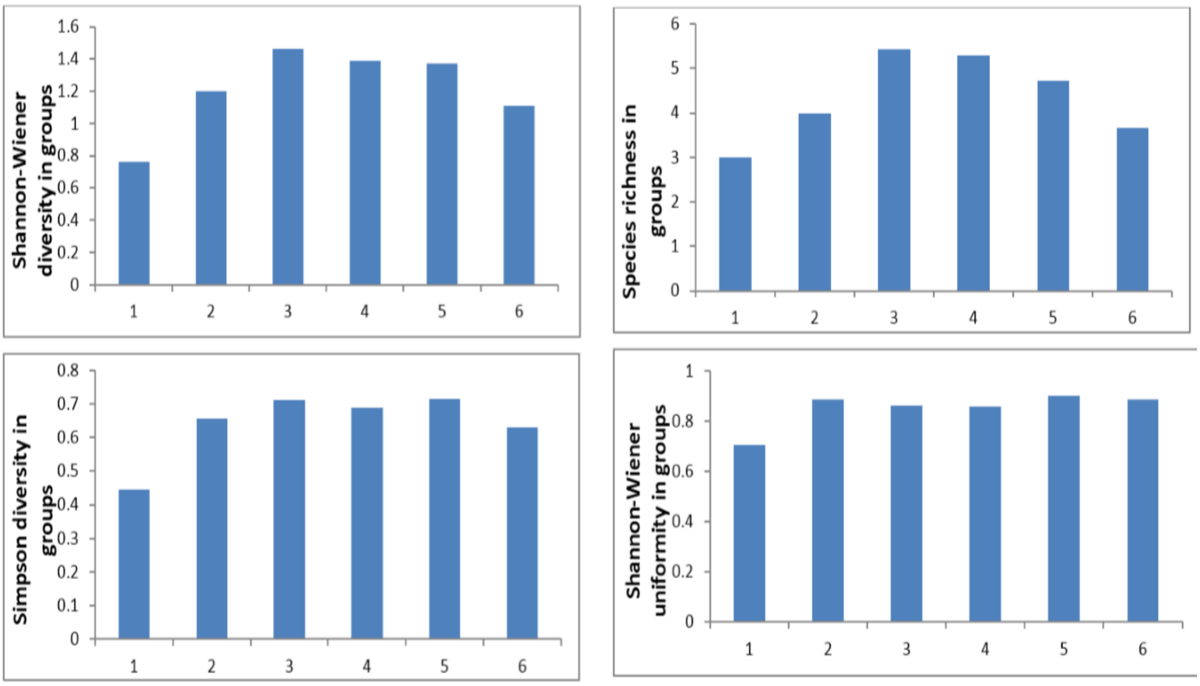

Fig. 5. Duncan index of species richness, Simpson diversity, Shannon-Wiener diversity and Shannon-Wiener uniformity in groups.

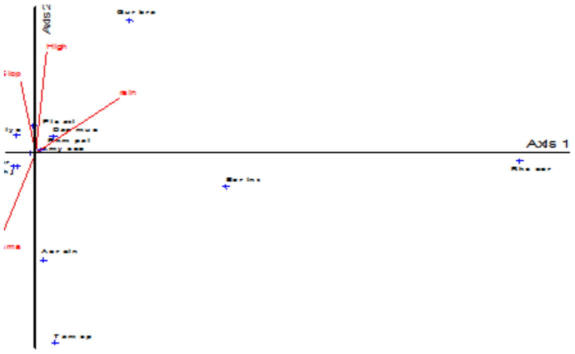

Fig. 6. Forest species classification from the CCA analysis.

Discussion

For the first time the result of this research had shown that, for the first time we had found 9 family and 12 species of trees and shrubs in natural forests of Markazi Province (Vegetation areas of Iranian-Turanian). On the other hand over 70% of those identified families were been Anacardiaceae family and Rosaceae because 60 percent of species *Amygdalus scoparia* and *Amygdalus lecyoides* (Salarian *et al*, 2010) In addition to its high resistance species such as: *Pistacia atlantica*, *Pistacia khinjuk* and *Rhus coriaria* from Anacardiaceae caused the broad dissemination of the two families. On the other hand extreme dependence of *Acer cineracens* and *Quercus brantii* and *Berberis integerrima* to minimum environmental conditions caused limited spread of them same as rare species in ecological groups. Due to the broad distribution of natural forest area and Polygon structure of Iranian- Turanian and mountanous structure of these areas, selection sample area size of 128 square meters, could show changes in forest communities and it approves the result of Zahedipour *et al*, 2007. On the other hand, the study of diversity within plots was shown that both the intensity and inventory levels will increase diversity (Solinska, 1997). Forest evaluation results had shown that there were been nearly 95 percent of forests in mountainous regions and slope types. The dominant species typology in the forests such as: *Amygdalus scoparia*, *Pistacia atlantica*, *Rhus coriaria*, *Ficus carica* had needed to be in the mountain area. Human activities such as industrial activities, housing, agriculture, etc. in plain areas and valley's floor were increased which have resulted loss of forest species. So they have a significant role in creating the current distribution. These results approve Zahedipour *et al.*, (2007) and Aghakhani (2009). Distributed evaluation had shown that more than 75% of forests were been in 800 ranging from 1400 meters to 2200 meters altitude. The ecological needs of the dominant species had had effect on this phenomenon (Zahedipour et. al, 2007) and (Salarian et. al, 2020). On the other hand the effect of slope evaluation in the area had shown that 98% of forests were been on the slopes over 12% and 83% of them were been on slopes over 83%. That was because of human activities limitation in this area limitation machines (Akbarinia, 2003). In these slopes there were been heavy seed species such as *Amygdalus scoparia* (Iranmanesh, 2007). There were been almost 50 percent of forests in the north, Northeast and Northwest, and just 27 percent in the South, Southwest and Southeast could show that there was been direct effect of direction on forest species distributions. We could see it perfectly in 75% *Amygdalus scoparia* distribution (Zahedipour et. al, 2007) and (Iranmanesh, 2007). Variety of geological formations in Markazi provinces and 55 percent forests distribution had shown direct correlation of geological formations on forests distribution. In the end effects of geological formations to natural forest distribution of Markazi provinces included three categories:

A: By direct effect on produced soil, the examples could be seen in igneous formations areas such as tuff (Tafresh and South of Saveh). These rocks have had high organic material so they have had direct effect on forests distribution (due to low fertility soils).

B: By hydro geo botanical effects on geological formations. Due to humidity limitation of high level of Markazi forests were been limestone and calcareous formations, because these formations hold more moisture in them and have provided water to the plant roots (Salarian et. al, 2010).

C: Through the local micro-climate creation. Igneous formations such as tuffs compared to other geological formation have had great resistance to erosion. During the last centuries they have had less erosion and have created small local climates caused by micro physiographic. The factors have affected the forest species dispersion. In recent centuries, the main purpose of vegetation science was been the isolation of plant communities with a focus on distribution composition and classification of plant communities (Kashian *et al*, 2003). Methods for classification and ordination were used as a fundamental work for the study and description of vegetation changes (Grabherr *et al*, 2003). For simplify the interconnection of the vegetation structure and understand helping the relationship between vegetation and environmental factors, vegetation classification was used via cluster analysis and two-way indicator species analysis (Mattaji, 2002), (Salehi, 2004), (Magurran et. al, 1988), (Hardtle et. al, 2005). But in many of these studies, quantitative measure was not used to select the number of groups, generally based on available knowledge and understanding of the ecological nature of the species, the numbers of group were selected to optimize ecologic (Maccune and Grance, 2003). Results of this research had shown that indicator species analysis with Monte Carlo analysis can be used as a quantitative method for choosing the optimal number of groups in different ways to the site classification. The result of this research was same as other researchers' results (Ata Roshan et. al, 2012) and (Eshaghirad et. al, 2010). Forest coverage classification had led to the six distinct ecological groups in this area (Fig. 7). MRPP test results have shown that the separation of the groups were significant difference in terms of vegetative, that indicated the optimal number of groups and grouping between vegetative indicator (Ata Roshan, 2012). The fourth and sixth group have had big T statistic, so there were been minimum difference among their vegetative influences. The main species of clusters have had most similarity in the richness and abundance of these elements. On the other hand there were been similarity of climate and physiographic conditions between most of groups so there were directly effects of environmental conditions on the group formation. In the ANOVA test, there were been significant differences between biodiversity indicators within clusters. And it could show the different diversity indicators between vegetative groups. Species richness factor in the third group species have had highest richness, because they were been great compatibility with the environmental condition. Unlike the first group have had lowest richness because they were located in Mediterranean and ultra-cold climate. In the diversity index, of Simpson diversity index, the rate of this index in the fifth group was increased to the highest level, due to the sensitivity of the indicator species with high frequency (affected by high frequency of *Daphne mucronata* species). In the Shannon-Wiener diversity index there were been maximum levels of index in the third group (due to sensitivity of rare species such as *Acer cineracens* and *Berberis integerrima*). In both species diversity index in the first group, there was been the lowest variability. Results comparison of Shannon- Winner uniformity averages index has shown that the fifth group has had a uniform distribution of vegetative elements (because of suitable abundance species). The geographical distribution of plants in an area was been a reflection the influence of the different vegetative regions (Asri et. al, 2004). Ecological landing and forests habitats grouping were been the main issues of forest management. Distribution and vegetation development in nature were not accidental and different ecological factors were been effective on them. Evaluation of these factors had been very important for forest management. Nowadays multi variables methods are widely proposed in ecological classification (Greig-Smith, 1983). Among these methods, PCA and CCA classification methods have been used with great success (Zahedi Amiri, 1998) and (Orloci, 1978). Therefore, the results of the Pearson correlation test between environmental features and on the first and second axis of a plant species in CCA analysis have shown that *Rhus* *coriaria* needs high moisture compared to other vegetative elements of Markazi forest, so it has had directly influence of environmental factors (Zahedipour et. al, 2007). *Amygdalus scoparia* and wild *Pistacia atlantica* have needed ecological needs so they were directly unaffected by slope factor. *Pistacia khinjuk* and *Acer cineracens* have had negative correlation with temperature and dryness. Also *Quercus branti* as an indicator species of first group has direct influence of environmental features on altitude and rainfall and it could accept the result of Hasanvand (2007) and Abdoli(2009). Effect of height factor in Iranian- Touranian vegetative region was proven (between 2000 and 2500). At the end, considering the importance of these forested islands in the protection of soil, moisture, erosion prevent, conserve habitat, fruits and seeds production of other species in the food chain we should protect and management these areas for increasing the environment sustainability, conserve the ecological capacity and improve the biodiversity of the area. So by detecting the ecological capacity of forest ecosystems in Markazi province with further studies of diversity value and genetic diversity of all species in this region the other researchers should study about the ecosystem sequences of the region and determine the footprint of ecological human activities. In order to the unique resources provided and continuous improvement of it we could produce plans such as: "The management of forest islands ecosystem of Markazi Province".

References

Abrari Vajari K, Veis Karami G. 2005. Floristic study of Hashtad Pahlu Region in Khorramabad (Lorestan) and Sazand., **67**,58-64.

Aghakhani S. 2007. Oak forest reserve management plan tenacity Shazand. Research Project, Department of Natural Resources and Watershed Central Province, 132.

Agakhani S. 2009. The development and positioning bushfires, tree of Markazi province lands and natural forests using satellite images and field studies with the aid of satellite imagery and field studies. Research Project, Department of Natural Resources and Watershed Markazi Province, 292.

Akbarinia M. 2005. Evaluation of plant diversity in forested catchments in connection with dozens of red. Journal of Agronomic Research, **4(1),** 105-129.

Ali MM, Dickinson G, Murphy KJ. 2000. Predictors of plant diversity in a forest ecosystem, Journal of forest Environments, **45**, 215-230.

Asri Y. 2004. Flora, Life forms and Corotype desert plants biosphere reserve, Science and Technology of Agriculture and Natural Resources **7(4),** 260-247.

Asri Y. 2010. Plant diversity Wildlife Muteh in Bushehr, BOTANY journals **9(1),** 48-25.

Bagheri R. 2011. Effects of allelopathic Kermani thyme (Thymus caramanicus. Jalas) on some peanuts vegetation index (Amygdalus scoparia Spach). Research and spruce forests of the summer of 2009 **17(2),** 161-166.

Chen S, Shaoging T. 2010. Acta ecology silica **30(3),** 184-189.

Dufrene M, Legendre P. 1997. Species assemblages and indicator species: the need for a flexible asymmetrical approach. Ecological.

Ejtihadi H, Sepehri A, Akeafi H. 2009. Methods of biodiversity measuring.. Mashhad University Press, first edition, 203.

Eshaghirad J, Zahedi Amiri Gh, Mttaji A. 2008. Determination the optimal number of groups is the classification of vegetation (Read: Teaching and Research Forest Kheiroudkenar noshahr), Iranian Journal of Forest and Poplar Research **16(3),** 466 -455.

Eshaghirad J, Zahedi Amiri Gh, Marvi Mohajer M, Mtajy A. 2009. The relationship between plant cover and soil physical and chemical properties of beech communities (Case Study: Teaching and Research Forest Kheiroudkenar noshahr), Iranian Journal of Forest and Poplar Research **17(2)**, 187-174.

Grabherr G, Reiter K, Willner W. 2003. Towards objectivity in vegetation classification: the example of the Austrian forests. Plant Ecology, **169**, 21–34.

Greig- Smith P. 1983. Quantitative plant ecology. University of California Press. Berkeley.

Gromstev A. 2010, Natural disturbance dynamics in the boreal forest of European Russia, Silva Fennica, Review article **36(1),** 15.

Hardtle W, Goddert O, Christina W. 2005. The effects of light and soil condition of the species richness of the ground vegetation of the deciduous forest in northern Germany (Schleswig- Holstein). Forest Ecology and Management. **182**, 327-338.

Hasanvand A. 2007. Floristic survey and diagnosis of vegetative watershed Kahman Aleshtar, MS Thesis, College of Agriculture and Natural Resources, Islamic Azad University, Science and Research Branch, Tehran,110.

Iranmanesh A. 2007 Comparison of the mountain almond plantation forests in the northern and southern province were destroyed. Forest and Poplar Research Spring 2007, **15(1),** 19-31.

Kashian DM, Barnes BV, Walker WS. 2003. Ecological species groups of landform level ecosystems dominated by Jack Pine in Northern Lower Michigan. USA, Plant Ecology, **166**, 75-91.

Mttaji A. 2002. Site classification based on plant community structure, biomass and soil chemical and physical conditions in natural forests (Case study: forest Kheiroudkenar noshahr), thesis, Islamic Azad University, Science and Research Branch, Tehran.165.

Magurran AE. 1988. Ecological diversity and its measurements – croom Helm Ltd., London. 179.

McCune B, Mefford MJ. 2003. PC-ORD, Multivariate Analysis of Ecological Data, Version 4.MjM.

Mesdaghi M. 1999. Evaluation of species richness and life form under the three levels of exploitation in East rangelands of Golestan Province. Journal of Agriculture Research and Natural Resources.62-55.

Moghadam M. 2001. Vegetation ecology and descriptive statistics, Tehran University Press, 285.

Mozaffarian V. 2004. Trees and shrubs of Iran, published in Farhange Moaser, 982.

Mozaffarian V. 2005. Plant Classification, Volume **2**, published by Amir Kabir, 501.

Orloci D. 1978. Effects of site preparation on seedling growth: a preliminary comparison of broadcast burning and pile burning. USDA For. Ser. Res., Note PNW-RN:452, 12.

Pourbabai H, *et al.* 2010. Evaluation of stand structure and plant species diversity in habitat Gospel bin Gillan. Journal of Biology **23(1),** 9-18.

Salarian A, Mttaji A, Iranmanesh Y. 2008. Evaluation of habitat for species Cam (.Amygdalus scoparia Spach) in Zagros forests (Case Study: Habitat butter pies, Chahar Mahal Bakhtiari). Journal of Forest and Poplar Research 2008 **16(4)**,528-542.

Salehi A. 2004. Changes in physical and chemical properties of soils in relation to forest ecological groups in series of Namkhaneh Kheiroudkenar, Iranian Journal of Natural Resources **58(3)**, 237.

Smith LR, Smith MT. 1996. Elements of ecology. 4th edition, an imporint of Addison Wesley Longman, Inc., 567.

Solinska GB, Namura OA, Symonides E. 1997. Long term dynamics of a relict forest in an urban area. Floristica et Geobotanica. **42920**, 423-479.

Talebi M, Translucent Talebi Kh, Jhanbazy Gojani M. 2006. Methods for quantitative and qualitative some aspects of habitat and oak forests in the Chaharmahal Bakhtiari province. Journal of Forest and Poplar Research Spring 2006, **14(1),** 67-79.

Wilson E O. 1988. The current state of biological diversity. In: Biodiversity edited by: Wilson, E. O. National academy Press, Washington, D. C: 3-18.

Zahedi Amiri G. 1998. Relation between ground vegetation and soil characteristics in a mixed hardwood stand. Ph.D. thesis in applied biological science: Land and Forest management, academic press, university of Gent, Belgium.185-319.

Zahedipour H, *et al.* 2007. Collection, identification and evaluation of the tree of Markazi Province resources. Research projects. Agriculture and Natural Resources Research Center of Markazi Province.

Zarechahouki G. 2009. Investigation of the relationship between species diversity and environmental factors (Case study: pastures Artoun-Fashandak Taleghan). Agricultural Sciences Fall 2006, **12(3),** 525-534.

Zohary M. 1963. On the geobotanical structure of Iran. Bulletin of the Research Council of Israel. SectionD, Botany.