IUFS Journal of Biology *Short Communications*
IUFS J Biol 2014, 73(1): 43-51

A Study on Floristic Composition, Chorology and Ecological Structure: A case Study from a Small-scale Forest Reserve, Talesh, Iran

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Abstract

This study, carried out on vegetation of the Gisoum forest reserve with 171 hectares area located 14 km to Resvanshar city, Guilan province, was to examine the structure and composition of the forest vegetation. A first topographic map of the area with the scale of 1:10000 was prepared and the study area was delimited. Transect- quadrate method of sampling was used to record the floristic and phytosociological data necessary for the analysis in about 44 quadrates of 400 m2. Some vegetation parameters viz. density and diameter at breast height (DBH) for trees (over story vegetation) as well as cover-abundance for under story vegetation were recorded, respectively. The life form spectrum of Raunkiaer, the dominant vegetation type of the area, is based on importance value and vegetation structure based on frequency classes, also their chorology caring a central importance in vegetation description were determined. The study of the floristic list showed that 76 species belonging to 66 genera and 45 families existed in the area.The largest families were Asteraceae and Rosaceae with 5 species. Investigation of the geographical distribution of plant species indicated that 44 % belonged to the Europe – Siberian zone. Plant life forms by Raunkiaer method showed that phanerophytes with 35.5 % and hemicryptophytes with 27.6 % were the most frequent life forms. Dominant vegetation type based on importance value index was *Buxus hyrcanus-Parrotia persica*. Also the evaluation of vegetation structure based on frequency class revealed that abundance-distribution was irregular in under story and regular in upper story vegetation.

Keywords: *Floristic composition, Chorology, Ecological structure*
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(Received: 22.04.2013 Accepted: 22.02.2014)

Introduction

Forests support about 65% of the world's terrestrial taxa and have the highest species diversity for many taxonomic groups including birds, invertebrates and microbes. Conserving forest biodiversity is therefore a critical task and has rightly become a key component of many national and international forest management agreements. Most programs to sustain forest biodiversity have focused on the creation of protected areas. Reserves are a critical part of any credible strategy for conserving forest biodiversity, but reserves alone are insufficient to adequately conserve forest biodiversity, because 92% of the world's forests are outside formally protected areas (Lindenmayera et al. 2006). Forest ecosystem diversity is determined by the combination of a variety of natural factors at differing scales, ranging from the global (climate), to regional (elevation, precipitation, and physiography), and local (slope, aspect, substrate, and succession). At the same time, anthropogenic disturbances also have significant impacts on ecosystems, including their diversity (Polyakov et al. 2008). Conservation is an integral part of sustainable forest management. ‘‘Existence and implementation of management guidelines to: (a) keep undisturbed a part of each production forest, (b) protect endangered, rare and threatened species of forest flora and fauna, and (c) protect features of special biological interest, such as seed trees, nesting sites, niches and keystone species.’’(Matthew et al. 2005).

Protected areas of Iran have been affected by anthropogenic impacts. Therefore, recognition and documentation of plant species and their geographical distribution are essential for further researches as well as for their protection. That information is particulary important for the succes of efforts intended to prevent loss of genetic and species diversity by the destruction of natural habitats.

This study was adressed to document the floristic composition and to determine the chorology and Life forms of plant species, and also to quantify the dominant type of vegetation by IVI index and in the final community structure by frequency parameter.

Material and methods

Study area

The study area is located in south-west of Caspian Sea in the Guilan province with a total area of 171 ha (latitude ranges from 37º42’23” to 37º42’31” northern and longitude ranges from 49º00’29” to 49º00’46” eastern) (*Fig.1*). Altitude ranges from -20 to +20 m. According to the De Martonne method and dryness coefficient (I= 57.7), the climate of the study area was very humid. The mean annual precipitation is 1365.8 mm and the mean annual temperature was 13.7°c. Geologically, the study area, it’s level and plain, belong to the Quaternary period.

Methods

First of all, a topographic map of the area with the scale of 1:10000 was prepared and the study area was delimited. The Transect-quadrate method was used to record the floristic data, and totally 44 quadrates with 400 m^2 area were taken (Mueller-Dombois& Ellenberg 1974).

The collected specimens were identified and named based on the classification and terminology applied to various Flora, such as Flora Iranica (Rechinger 1963-1999), Flora of the U.S.S.R. (Komarov 1933-1964), Flora of Iraq (Townsend et al. 1966-1968), Flora of Turkey (Davis 1965- 1988), Flora of Iran (Assadi 1988-2003),Colored Flora of Iran (Ghahreman 1978-2002). Some vegetation parameters viz. density and diameter at breast height (DBH) for trees (over story vegetation) as well as cover-abundance for understory vegetation were recorded, respectively. The raw data were entered using the Excel program package to perform the necessary data processing.

The biological spectres and the dominant vegetation type of the area based on importance value (IVI) were determined using Raunkiaer’s method (1934). IVI is the sum of the relative frequency, relative density and relative dominance.

Relative Frequency = (Number of plots containing a species x 100)/sum of frequencies of all species.

Relative Density = (Number of individuals of a species x 100)/total number of individuals of all species.

Relative Dominance = (DBH of a species x 100)/total DBH of all species.

Also community structure based on Raunkiaer’s frequency classes, and the chorology of species on the basis of Zohary (1973) and Takhtajan (1986) were determined.

Results

Flora

The total number of 76 plant species belonging to 66 genera and 44 families were identified in the study area. Rosaceae and Asteraceae with 5 species are the most abundant families and 27 families just with 1 species were identified in this area (*Fig. 2*).

Figure 1. The map of study area

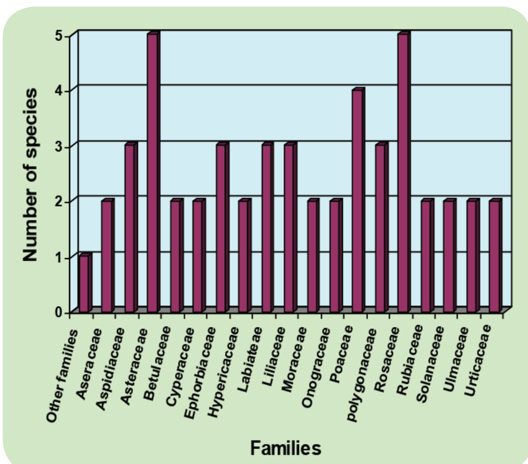

Figure 2. A bar diagram showing contribution of different plant families in the study area as well as the number of species in each family.

Life forms

Phanerophytes consist of 35% (27 species) of the vegetation and are the dominant biological spectre in the studied area, followed by hemicryptophytes, with 28% (21 species), as the second dominant type. There was a good climate condition with frequent precipitation and suitable temperature for growing the semi closed forests (*Figs. 3 and 4*).

Frequency class

Various authors have worked on the application of Raunkiaer 's method of frequency in one or other way in order to study plant communities (Mishra 1963). According to percentage frequency of species, Raunkiaer (1934) grouped vascular plants into five classes which are as follows:

A: 1-20
B: 21-40
C: 41-60
D: 61-80
E: 81-100

The law of distribution of the frequency was expressed by him as: A>B>C<=>D<E

The fluctuations in the percentage frequency distribution in two plant layers (under story and over story) are shown in *Figures 5 and 6.*

According to Figure 5 and 6 frequency distribution in over story vegetation is normal and follow Raunkiaer frequency equation but frequency distribution in under story vegetation is abnormal (E class "species with 80-100% presence" is less than D class); this subject shows the disturbance in under story vegetation.

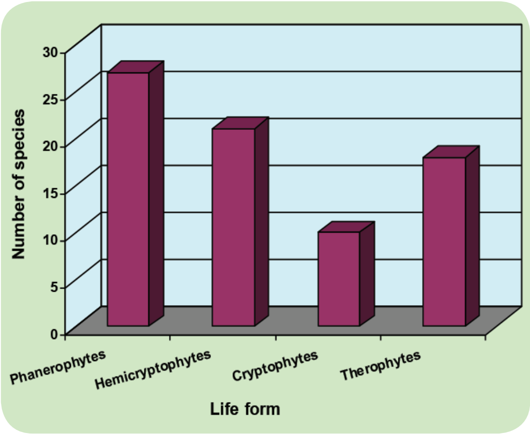

Figure 3. A bar diagram showing Life form in the Gisoum forest reserve

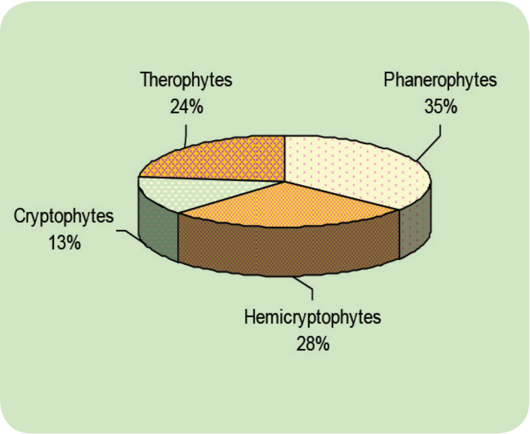

Figure 4. Percentage of Life forms in the Gisoum forest reserve

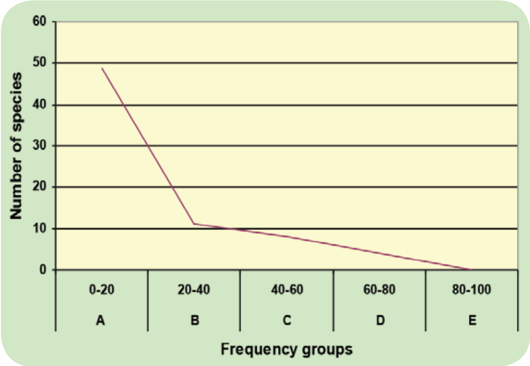

Figure 5. Under story vegetation frequency groups

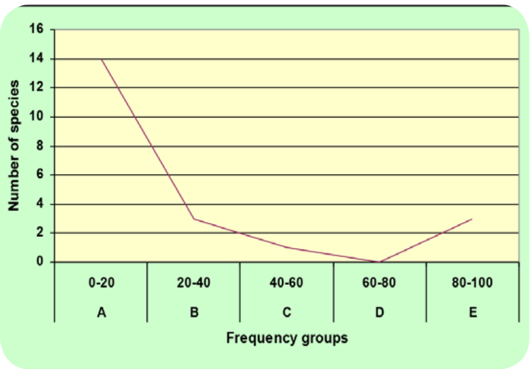

Figure 6. Over story vegetation frequency groups

Species importance value index (IVI)

IVI was determined for tree layer only. Importance value index (IVI) of tree species indicated that *Buxus hyrcana* (i.e., 121.69) was the dominant species followed by *Parrotia persica* (i.e., 55.54) (*Table 1*).

Table 1. Importance Value Index (IVI) of most dominant tree species

Species	Frequency	DBH	Density	IVI	Rank
Buxus hyrcana Pajark.	20.26	18.39	82.61	121.69	1
Parrotia persica (DC.)C.A.Mey.	20.69	28.14	6.71	55.54	2
Carpinus betulus L.	19.21	22.00	3.27	44.49	3
Alnus glutinosa (L.)Gaerth	9.85	12.43	4.16	26.44	4
Fraxinus excelsior L.	7.39	5.11	0.75	13.25	5
Pterocarya fraxinifolia (Lam.)Spach.	4.93	4.90	0.96	10.79	6
Ulmus carpinifolia Miller.	4.93	3.10	0.33	8.35	7
Diospyros lotus L.	8.96	1.22	0.40	4.58	8
Alnus subcordata C.A.Mey.	8.46	1.64	0.27	4.37	9
Quercus castaneaefolia C.A.Mey	1.97	1.02	0.12	3.11	10
Populus nigra L.	0.99	0.75	0.23	1.97	11
Zelkova caprinifolia (Pall.)Diopp.	0.99	0.71	0.08	1.77	12
Ficus carica L.	1.48	0.17	0.06	1.71	13
Acer cappadocicum Gled.	0.99	0.31	0.04	1.33	14
Acer velutinum Boiss.	0.49	0.10	0.02	0.62	15
Total	100.00	100.00	100.00	300.00	

Chorotype

Phytogeographical elements of the study area are ES, IT, PLO, COS, M-IT, ES-M, ES-IT and M-ES-IT. Their rates are 43%, 3%, 23%,9%, 3%, 4%, 7%, 7%, and 8% respectively (*Figs. 7 and 8)*.

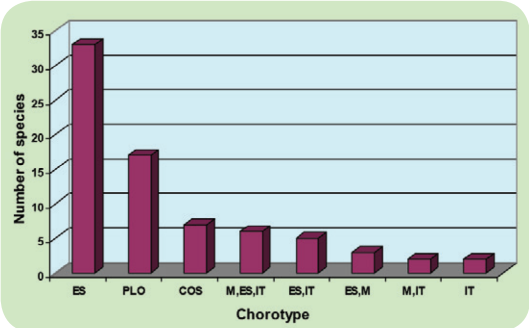

Figure 7. Geographical distribution of plant showing number of species in each chorotype

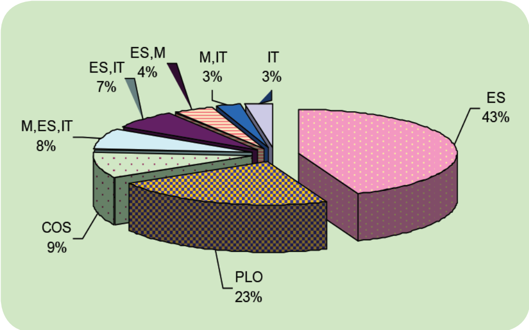

Figure 8. Percentage of various chorotype in the studied area

(Abbreviations: IT=Irano-turanian, M=Mediterranean, ES=Euro-Siberian, Plo=More than 2 chorotypes, Cosm =Cosmopolitan)

Species composition along with their families, chorotype and life forms are presented in Table 2.

Table 2. Floristic composition of Gisoum forest reserve (Family name, Chorotype and life form of each species have been presented.)

No.	Scientific name	Family	Life Form	Chorotype
1	*Acer cappadocicum Gled.*	Aceraceae	Ph	Euro.-Sib.(Eux.-Hyrc.)
2	*Acer velutinum Boiss.*		Ph	Euro.-Sib.(Hyrc.)
3	*Albizzia julibrissin Durazz.*	Mimosaceae	Ph	Euro.-Sib.(Eux.-Hyrc.)
4	*Alnus glutinosa (L.)Gaerth*	Betulaceae	Ph	Euro.-Sib.
5	*Alnus subcordata C.A.Mey*		Ph	Euro.-Sib.(Hyrc.)
6	*Buxus hyrcana Pajark.*	Buxaceae	Ph	Euro.-Sib.(Eux.-Hyrc.)
7	*Carpinus betulus L.var Betulus*	Corylaceae	Ph	Euro.-Sib.
8	*Crataegus microphyla C.koch*	Rosaceae	Ph	(W. Ir.-Tur.). Euro.-Sib. (Eux.-Hyrc.)
9	*Mespilus germanica L.*		Ph	Euro.-Sib.(Eux.-Hyrc.)- Ir.-Tur., Medit.
10	*Potentilla reptans L.*		H	Plure.
11	*Rubus hyrcanus Juz.*		Ph	Euro.-Sib.(Hyrc.)
12	*Prunus divaricata Ledeb.*		Ph	Euro.-Sib.(Pont.)-Ir.-Tur.
13	*Diospyros lotus L.*	Ebnaceae	Ph	Ir.-Tur.-Sino-Jap.
14	*Ficus carica L.*	Moraceae	Ph	Medi.- Euro.-Sib.-Ir.Tur.
15	*Morus alba L.*		Ph	Plure.
16	*Fraxinus excelsior L.*	Oleaceae	Ph	Euro.-Sib.
17	*Gleditschia caspica Desf.*	Cesalpinaceae	Ph	Euro.-Sib.(Hyrc.)
18	*Parrotia persica (DC.)C.A.Mey*	Hammamelidaceae	Ph	Euro.-Sib.(Hyrc.)
19	*Populus nigra L.*	Salicaceae	Ph	Euro.-Sib.
20	*Pterocaria fraxinifolia (Lam.)Spach*	Juglandaceae	Ph	Euro.-Sib.(Hyrc.)
21	*Quercus castaneaefolia C.A.Mey*	Fagaceae	Ph	Euro.-Sib.(Hyrc.)
22	*Ulmus minor Miller.*	Ulmaceae	Ph	Euro.-Sib.
23	*Zelkova caprinifolia (Pall.)Diopp*		Ph	Euro.-Sib.
24	*Ilex spinigera*	Aquifolliaceae	Ph	Euro.-Sib.(Hyrc.)
25	*Hedera pastuchovii Woron ex Grossh.*	Araliaceae	Ph	Euro.-Sib.

26	*Dryopteris borrei Adens*	Aspidiaceae	H	Euro.-Sib.
27	*Polysticum branunii (Spenner)Fee*		H	-
28	*Polysticum meyerii Roth*		H	-
29	*Phyllitis Scolopendrium L.(newm.)*	Aspleniaceae	C	Plure.
30	*Artemista annua L.*	Asteraceae	T	Euro.-Sib.
31	*Conyza canadensis (L.)Cronq.*		T	Cosmo.
32	*Carpesium cernuum L.*		T	Plure.
33	*Dichrocephala integrifolia D.C.*		T	Cosmo.
34	*Eclipta alba (L.)Hask*		T	Plure.
35	*Athyrium filix- femina (L.)Roth*	Athyriaceae	H	Euro.-Sib.
36	*Cardamine uliginosa M.B.*	Brasicaceae	H	Euro.-Sib.(Pont.)-Ir.-Tur.
37	*Symphyandra odontosepala A.DC.*	Campanulaceae	T	Euro.-Sib.
38	*Sambucus ebulus L.*	Caprifoliaceae	H	- Euro.-Sib.-Medit. -Ir.-Tur.
39	*Stellaria media (L.)Cyr.*	Caryophylaceae	T	Cosmo.
40	*Carex divulsa L.*	Cyperaceae		Plure.
41	*Carex sylvatica L.*		H	Plure.
42	*Acalypha australis L.*	Ephorbiaceae	T	Cosmo.
43	*Euphorbia squamosa Willd.*			Euro.-Sib.(Hyrc.)
44	*Euphorbia turcomanica Boiss.*		C	Ir.-Tur.
45	*Equisetum ramosisum Desf.*	Equisetaceae	C	Plure.
46	*Geranum lucidum L.*	Geraniaceae	T	Plure.
47	*Hypericum helianthemoides (Spach)Boiss.*	Hypericaceae	H	Euro.-Sib.- Ir.-Tur.
48	*Hypericum perforatum L.*		H	Euro.-Sib.
49	*Calaminta umbrosum (M.B.)C.Koch*	Lamiaceae	T	Plure.
50	*Lycopus europaes L.*		T	Euro.-Sib.
51	*Mentha aquatica L.*		H	Euro.-Sib.
52	*Danae racemosa (L.)Moench*	Liliaceae	Ph	Euro.-Sib.
53	*Smilax excelsa L.*		Ph	Euro.-Sib.(Pont.)-Ir.-Tur
54	*Ruscus hyrcanus Woron.*		Ph	Euro.-Sib.(Hyrc.)
55	*Circaea lutetiana L.*	Onograceae	C	Plure.
56	*Ludwigia palustris (L.)Eilliott*		H	Plure.
57	*Oxalis cornicolata L.*	Oxalidaceae	H	- Euro.-Sib.-Medit. -Ir.-Tur.
58	*Plantago major L.*	Plantaginaceae	H	Plure.
59	*Cynodon dactylon L.*	Poaceae	C	Plure.
60	*Digitaria sanguinalis (L.)Scop.*		T	Euro.-Sib.-Medit.
61	*Oplismenus ndolatifolius (Ard. P.Beauv.*		T	Euro.-Sib.-Medit. -Ir.-Tur
62	*Oplismenus compositum L. P.Beauv.*		T	Euro.-Sib.-Medit. -Ir.-Tur
63	*Polygonum hydropiper L.*	Polygonaceae	C	Plure.
64	*Polygonum mite Schrank*		C	
65	*Rumex Acetosa L.*		H	Euro.-Sib.
66	*Polypodium vulgare L.*	Polypodiaceae	C	Plure.
67	*Pteris ceritia L.*	Pteridiaceae	C	Euro.-Sib.-Medit.
68	*Galium fumifusum L.*	Rubiaceae	T	
69	*Galium setaceum*		T	Medit. -Ir.-Tur.
70	*Atropa Belladonna L.*	Solanaceae	H	Euro.-Sib.
71	*Solanum nigrum L.*		T	Cosmo.
72	*Thelypteris palustris Schott*	Thelpteridaceae	H	Euro.-Sib.
73	*Urtica dioica L.*	Urticaceae	H	Euro.-Sib.
74	*Urica urens L.*		T	Euro.-Sib.
75	*Viola odorata L.*	Violaceae	H	Euro.-Sib,Medit.
76	*Juncus rigidus Desf.*	Juncaceae	H	Plure.

Discussion

Describing the floristic composition of a habitat is valuable to continuing ecological research, management and conservation of plants and animals. Available resources for the conservation of species and ecosystems are in short supply relative to the needs for those resources. Targeting conservation and management actions toward the species and ecosystems require clearly established priorities such as the study of floristic composition as a principle tool in biodiversity which was considered in the study (Ejtehadi et al. 2003). Biodiversity is the totality of genes, species and ecosystem in a region. Apart from natural disturbances, human induced impacts have caused a significant loss to biodiversity (Mishra et al. 2008).

The Presence of 76 plant species in 171 ha area indicates considerable plant diversity in the study area. These species belonged to 66 genera and 45 families. The largest families were Asteraceae and Rosaceae. It seems that high plant diversity in our study area is due to topographic and physiographic condition. This study area is flat (Altitude ranges from -20 to +20 m). High plant diversity is also due to the fertility and humidity of the site (Gholami et al. 2007).

The data on species/genus ratio helps to compare the rate of species development because high ratio indicates diversification (Mishra et al. 2008). The results showed a low species/genus ratio (1.15), indicating that Gisoum's forest reserve has emerged over a long period of time, as Hyrcanian forests are relic vegetation belong to the third geology period (Tertiary).

Life-forms have close relationships with environmental factors (Muller-Dombois and Ellenberg 1974) and can be viewed as strategies for obtaining resources (Cody 1986). Also the life form classification is based essentially on plant reaction to climate; the individual spectrum should tell us much about macroclimatic patterns at field sites (Pears 1985).

Based on life form data of the study area, therophytes frequency(24%) is close to hemicryptophytes (28%).Although, therophytes occur abundantly in desert areas (Archibold, 1995), more or less high occurrence of this life form indicates some anthropogenic and over-grazing effects in the study areas (Solinska et al. 1997; Grime 2001; Naqinezhad et al. 2006; Ravanbakhsh et al. 2007). A similar proportion of therophytes has been previously observed in some other lowland forest south of the Caspian sea(Ghahreman et al. 2006; Ghahremaninejad et al. 2011).

Investigation on the geographical distribution of plants species indicated that the total flora was composed mostly of Europe – Siberian elements (44 %) followed by pluriregional elements (23%). Euro-Siberian elements constitute the large proportions of the studied forest. The occurrence of these elements reflects the phytogeographical link of the studied area with the Euro-Siberian region (e.g. Zohary 1973; Takhtajan 1986; Akhani et al. 2010). Also,and similar to previous investigations, pluriregional species constitute a remarkable proportion of the studied flora (Ghahreman et al. 2006; Naqinezhad et al. 2010; Ghahremaninejad et al. 2011).

In the study of plant biodiversity of hyrcanian relict forests in Iran, 17 main vegetation types in the South Caspian area have been introduced and Gisoum forest has been placed in the alluvial and lowland deciduous forests. These natural ecosystems have almost entirely been replaced by cultural landscapes; consequently, only a few small sites remain in some protected forests (Akhani et al. 2010).

Gisoum forest is one of the last remnants of the lowland Hyrcanian forests. These highly threatened ecosystems possess rare and endemic species (*Buxus hyrcana*) which have been drastically exterminated from other areas of the Hyrcanian forests. In regard to high biodiversity, the presence of dominant type " *Buxus hyrcana*" in the area and the importance of this species (Endangered in the IUCN Red list), this reserve needs more intensive conservation by preserving under story vegetation; It is essential to control human and domestic animals use of the reserve.

Acknowledgement
The authors would like to express their thanks and appreciation to Shafarood Forest Company and natural resources organization to providing facilities and help in the field work.

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