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Ecological species groups in the rural heritage museum of Guilan Province, Iran

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ABSTRACT
The objective of this research was to identify and describe the different Ecological Species Groups (vegetation types) present in the Rural Heritage Museum of Guilan. The study area was approximately 260 ha, which is located in the Saravan Forest Park in Guilan province, north of Iran. Sampling procedure was performed with a systematic random technique. A total of 89 plots were sampled. Classification of vegetation carried out using the Two Way Indicator Species Analysis (TWINSPAN) method showed that there were five ecological species groups in three layers; three groups in the shrub layer, nine groups in the herb layer and six ecological species groups in the regeneration layer. The results suggest improved protection and management of this area and that it can be proposed as a protected area on the basis of the numerous important species. The information obtained from the current study about this forest is useful for the design and management of this site because of its aesthetic values.

Keywords: *Ecological species groups, TWINSPAN, Rural Heritage Museum, Guilan.*

INTRODUCTION
Vegetation can function as a useful classifier of habitats because plants are a conspicuous and stationary habitat element, making them relatively easy to survey and track over time. Vegetation can also be highly sensitive to extrinsic biotic, environmental, or geomorphic factors, expressing localized changes through patterns in survival, growth and propagation (Bowers and Boutin, 2008).
The floristic composition of a habitat can be expressed in a number of ways. Simple measurements such as plant species richness (Pearman and Weber, 2007), the number of non-native species present, and the percent cover of plant types can all be employed to characterize a habitat of interest (Bowers and Boutin, 2008).
Phytosociology is a subset of vegetation science that deals with plant communities and puts particular emphasis on their classification. As a tribute to the originator of its founding ideas, phytosociology is also termed the Braun-Blanquet approach. The basic data record of phytosociology is the releve, which lists all plants, their occurrence, cover-abundance and supplementary data on geographic position, environmental factors, and vegetation structure are also recorded in the releve. Vegetation units are classified according to their species composition into a hierarchical system. These units are given scientific names derived from the names of typical species. Nowadays, traditional classification based on manual table-sorting is replaced by numerical algorithms that allow classifying large sets of releves in a repeatable manner. Phytosociology's major applications are in ecological assessment; vegetation mapping, monitoring environmental changes and nature conservation inventory (Dengler *et al*., 2008).
Species groups were based on similarities in species composition and abundance patterns among sampling plots. Ecological species groups act to integrate site attributes and can simplify the process of mapping ecological land units (Host and Pregitzer, 1991).
Numerical classification has been reported as a powerful tool in detecting fine patterns

of floristic variation and is confirmed in the present study. Successful long term monitoring of habitats is best achieved when using quantitative analysis for precise determination of change in vegetation over time (Benhouhou *et al.*, 2003). The results of vegetation classification can be used for ecological studies and practical monitoring of vegetation cover (Woldewahid *et al.*, 2007). Determining of vegetation types has been the subject of numerous studies in a wide range of environments (Orloci, 1968; Cowlishaw and Davies, 1997; Dias *et al.*, 2004; Rolecek, 2005; Davis *et al.*, 2005; Morgenthal *et al.*, 2006).

This study provides baseline information on plant types in the study area. There was no previous research in this area. So, this study was the first detailed work on the vegetation of this region. The present study focuses on the vegetation types of the Rural Heritage Museum of Guilan and the objective was to identify the ecological species groups and dominant species in this region.

MATERIALS AND METHODS

Study area:

The Rural Heritage Museum of Guilan, approximately 260 ha in area is located in the Saravan Forest Park in the north of Iran and extends from 37˚ 6' to 37˚ 8' N latitude and from 49˚ 37' to 49˚ 39' E longitude (Fig.1). The altitude ranges from 60 to 120 m a.s.l. The climate is humid and very humid with cool winter according to Emberger climate classification. The mean annual temperature is 16.33 ˚C and annual precipitation is 1366.64 mm. Maximum and minimum temperature is 27.8 ˚C in August and 4.1 ˚C in February, respectively (Anonymous, 2008). The data was obtained from 1985 to 2005 from http://www.weather.ir.

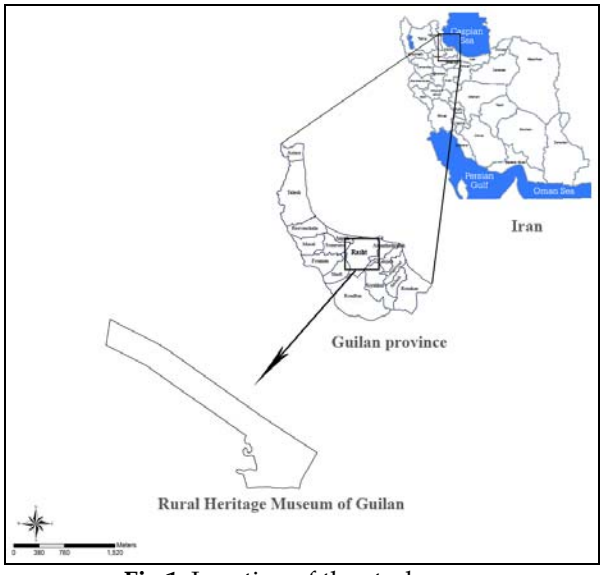

Fig 1. Location of the study area

Field sampling:

Field sampling was based upon the systematic-random method. A total of 89 plots were sampled during the fieldwork. Data were collected in tree (≥10 cm DBH) and shrub layers (number of individuals) in 1000 m² circular plots. In the center of these plots, cover percentage of herbaceous species including, herbs, ferns and mosses was estimated as 32 m² area using Domin criterion by minimal area method, and number of regeneration in two classes including, sapling (≥1.30 m height and ≤10 cm DBH) and seedling (<1.30 m height) were sampled in 100 m² circular plots. Plant specimens were collected and stored in the Herbarium of the Department of Forestry in the Faculty of Natural Resources at the University of Guilan.

Data analysis:

Vegetation data were classified using Two Way Indicator Species Analysis (TWINSPAN) method separately for each vegetation layer

(tree, shrub, regeneration and herbaceous species). This analysis was used to produce a divisive classification of the stations and plant species matrix (Murphy *et al*., 2003). This method is a commonly employed program in ecological studies for the classification of vegetation types according to their floristic similarity (Kent and Coker, 1992). The classification was carried out with PC-ORD for windows program, version 4.17 (McCune and Mefford, 1999). The basal area for tree layer, number for shrubs and regeneration layers and cover percentage using Domin criterion for herbaceous layer were used for the analysis. Classification was stopped at the third level for the tree layer, at the second level for shrub and at the fifth level of division for both the regeneration and herbaceous layers, so that the resulting groups would contain sufficient number of samples to characterize each vegetation groups (Khaznadar *et al*., 2009; Vogiatzakis *et al*., 2003). The names of identified vegetation types were derived from the dendrogram and importance of more frequent species into each groups of plots.

RESULTS

Flora:

A total of 77 plant species including 75 native species and *Pinus taeda* and *Populus* sp. as plantation (see Table 1) belonging to 44 families and 71 genera were found within 89 sampling plots in the study area. The richest families in terms of species composition were Rosaceae (8 Species) and Lamiaceae (6 Species).

Table 1. List of plant species in the study area.

Family	Scientific Name
Aceraceae	*Acer insigne* Boiss.
Alismataceae	*Alisma plantago - aquatica* L.
Aquifoliaceae	*Ilex aquifolium* L.
Araliaceae	*Hedera helix* L.
	Hedera pastuchovii Woron. Ex Grossh.
Asclepiadaceae	*Periploca graeca* L.
Aspleniaceae	*Asplenium adiantum-nigrum* L.
	Phyllitis scolopendrium (L.) Newn.
Asteraceae	*Artemisia annua* L.
	Corsium arvense (L.) Scop.
	Erigeron canadensis L.
	Solidago virga-aurea L.
Athyriaceae	*Athyrium fillix-femina* (L.) Roth.
Betulaceae	*Alnus subcordata* C. A. Mey.
	Carpinus betulus L.
Brachytheciaceae	*Brachythecium plumose*
	Palamocladium sp.
Caesalpinaceae	*Gleditsia caspica* Desf.
Caprifoliaceae	*Sambucus ebulus* L.
	Viburnum lantana L.
Convolvulaceae	*Convolvulus betoniceafolius* Mill.
Cypraceae	*Carex divolsa* Stokes.
	Cyperus rotundus L.
Ebenaceae	*Diospyros lotus* L.
Euphorbiaceae	*Acalypha australis* L.
	Euphorbia amygdaloides L.
Fagaceae	*Quercus castaneifolia* C. A. Mey.
Poaceae	*Cynodon dactylon* (L.) Pers.
	Oplismenus undulatifolius (Ard.) P.Beauv.
	Setaria glauca (L.) P. Beauv.
Hammamelidaceae	*Parrotia persica* C. A. Mey.
Hypericaceae	*Hypericum androsaemum* L.
	Hypericum perforatum L.

Table 1. Continued:

Hypolepidaceae	*Pteridium aquilinum* L. Kuhn in Decken.
Juglandaceae	*Pterocarya fraxinifolia* (Lam) Spach.
Juncaceae	*Juncus bufonius* L.
	Juncus glaucus Ehrh.
Lamiaceae	*Laminum album* L.
	Lycopus europaeus L.
	Mentha pulegium L.
	Nepeta involucrate (Bunge) Bornm.
	Prunella vulgaris L.
	Scutelaria albida L.
Liliaceae	*Danae racemosa* (L.) Moench.
	Ruscus hyrcanus Woron.
	Smilax excelsa L.
Mimosaceae	*Albizia julibrissin* Durazz.
Mniaceae	*Plagiomnium cuspidatum*
Moraceae	*Ficus carica* L.
	Morus alba L.
Orchidaceae	*Epipactis latifolia* All.
Oxalidaceae	*Oxalis corniculata* L.
Papaveraceae	*Chelidonium majus* L.
Pinaceae	*Pinus taeda L.*
Polygonaceae	*Polygonum aviculare* L.
Polypodiaceae	*Polypodium vulgare* L.
Primulaceae	*Primula heterochroma* Starf.
Pteridaceae	*Pteris cretica* L.
Rosaceae	*Crataegus ambigue* M. B.
	Fragaria vesca L.
	Geum heterocarpum Boiss.
	Mespilus germanica L.
	Potentilla reptans L.
	Prunus domestica L.
	Pyrus communis L.
	Rubus persicus Boiss.
Salicaceae	*Populus caspica* Bornm.
	Populus sp.
	Salix eagyptiaca L.
	Salix alba L.
Salviniaceae	*Azola filiculoides* Lam.
Solanaceae	*Solanum dulcamara* L.
Ulmaceae	*Ulmus carpinifolia* G. Suckow.
	Zelkova carpinifolia (Pall.) Dipp.
Urticaceae	*Urtica dioica L.*
Verbenaceae	*Phyla nodiflora* (L.) Greene.
Violaceae	*Viola odorata* L.

TWINSPAN analysis:

The application of TWINSPAN analysis led to identify vegetation groups associated with the distribution of these plants in the region. Based on floristic composition, 89 sampling plots were classified into five ecological species groups for tree layer, three groups for shrub layer, nine groups for herbaceous layer and six groups for regeneration layer. The results of TWINSPAN analysis are summarized in Fig 2, 3, 4 and 5.

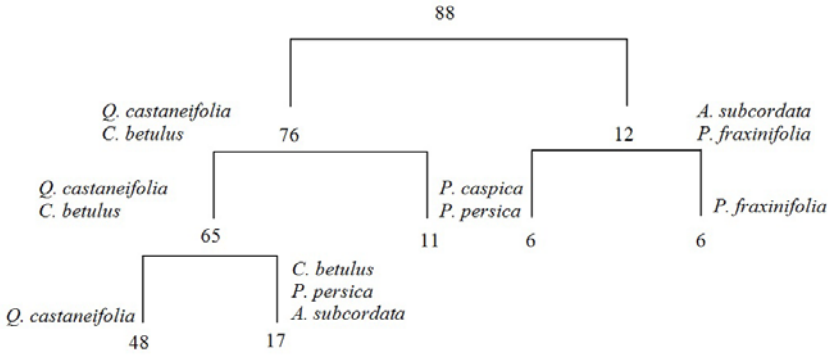

Fig 2. Dendrogram derived from the TWINSPAN analysis in tree layer
Group 1: *Quercus castaneifolia*
Group 2: *Quercus castaneifolia - Carpinus betulus*
Group 3: *Alnus subcordata - Quercus castaneifolia- Parrotia persica*
Group 4: *Quercus castaneifolia - Populus caspica*
Group 5: *Pterocarya fraxinifolia*

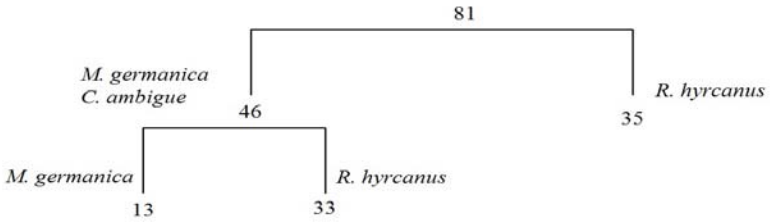

Fig 3. Dendrogram derived from the TWINSPAN analysis in shrub layer

Group 1: *Crataegus ambigue - Mespilus germanica*
Group 2: *Crataegus ambigue - Ruscus hyrcanus*
Group 3: *Ruscus hyrcanus*

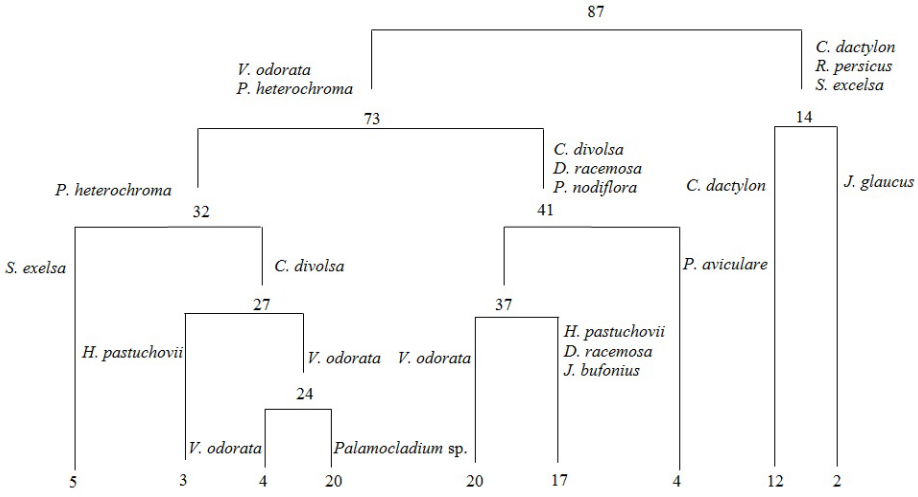

Fig 4. Dendrogram derived from the TWINSPAN analysis in herbaceous layer

Group 1: *Viola odorata - Carex divolsa*
Group 2: *Cynodon dactylon - Rubus persicus*
Group 3: *Carex divolsa - Danae racemosa*
Group 4: *Juncus bufonius - Rubus persicus - Viola odorata*
Group 5: *Smilax exelsa*
Group 6: *Viola odorata - Carex divolsa - Hedera pastuchovii*
Group 7: *Carex divolsa - Phyla nodiflora*
Group 8: *Viola odorata - Primula heterochroma - Carex divolsa*
Group 9: *Palamocladium* sp. - *Viola odorata*

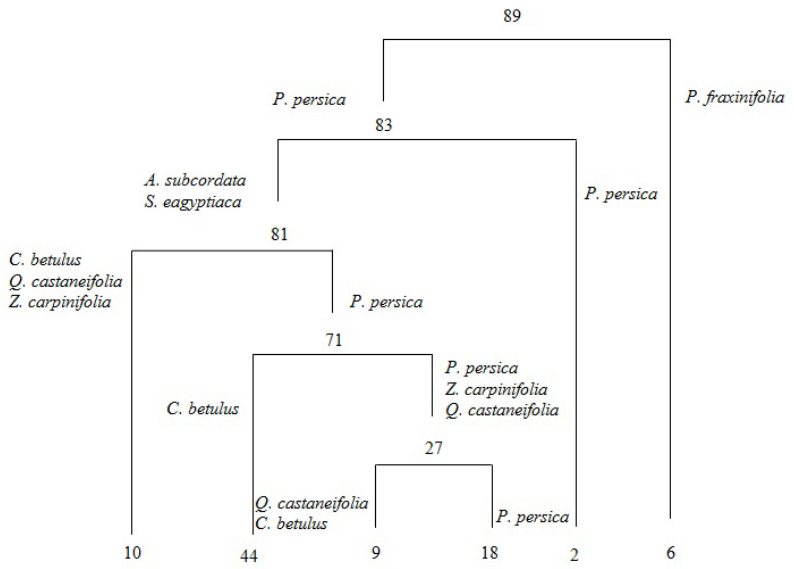

Fig 5. Dendrogram derived from the TWINSPAN analysis in regeneration layer

Group 1: *Parrotia persica - Quercus castaneifolia - Carpinus betulus*
Group 2: *Parrotia persica*
Group 3: *Parrotia persica - Quercus castaneifolia*
Group 4: *Parrotia persica - Quercus castaneifolia - Carpinus betulus- Zelkova carpinifolia*
Group 5: *Quercus castaneifolia - Carpinus betulus - Salix eagyptiaca*
Group 6: *Pterocarya fraxinifolia*

DISCUSSION

In the present study, TWINSPAN analysis was done to identify plant species groups (vegetation types) in different layers of plant species in the study area. Results of TWINSPAN analysis in the tree layer illustrated five groups of species. *Quercus castaneifolia* is the dominant species and the most widespread type in tree layer due to its presence in the four groups on classification. *Parrotia persica*, *Carpinus betulus*, *Pterocarya fraxinifolia* and especially *Populus caspica* (on threatened species (Jalili and Jamzad, 1999)) are the main species in this layer. The importance of their conservation seems to be essential. *Pterocarya fraxinifolia* is one of the main species in the coastal plain areas in the north of Iran presented in group 5 at some moist parts and coastsl river line of this study area. Also, it seems that, during the period of succession fast growing species such as *Alnus subcordata* dominate as a characteristic species in the tree layer of this area. The shrub layer has the least number of species in the area and makes just three groups, but these groups are well distributed in the area. Development of the shrub layer greatly depends on the method and intensity of forest management (Rolecek, 2005). This is reasonable for this region because there were no previous management practices in this area and this layer doesn't have good development and is species-poor. The number of shrub species is very low; we suggest that the shrubs common to this forest are relatively tolerant to shade (Timilsina *et al*., 2007).

We found nine groups in the herbaceous layer. The composition of the herbaceous layer varied considerably depending on soil humidity, nutrient availability and openness of the canopy. Most stands with closed canopy are species-poor (Rolecek, 2005). This layer was species – rich and mostly dominant in *Carex divolsa* and *Viola odorata* which are repeated in the five groups. *Viola odorata* and *Nepeta involucrata* are in critical condition and *Danae racemosa* is endangered (Jalili and Jamzad, 1999) Hence conservation of this diverse layer is necessary. On the other hand, *Rubus persicus*, *Smilax excelsa* and *Hedera pastuchovii* in groups 4, 5 and 6, respectively, are typical species in disturbed parts in the study area.

Six groups were identified in the regeneration layer. This can lead to potential restoration of this region. *Parrotia persica* and *Quercus castaneifolia* showed

good dispensation in several parts of site as sapling and seedling, respectively. *Zelkova carpinifolia* as one of the main species in group 4 showed the most dispensations in several parts of the site. This species is in critical condition in the north forests of Iran (Jalili and Jamzad, 1999).

Each plant species has specific relations with environmental variables, which are affected by habitat condition, plant ecological needs and tolerance range. Understanding the indicator of environmental factors of a given site helps us to recommend adaptable species for restoration and improvement of that site and similar sites (Jafari *et al*., 2004). So, studying the relationships between environmental factors and vegetation in order to find the most effective factors in the vegetation distribution of groups is necessary. The relation between plant species distribution and environmental factors has been reported by many investigators and also, numerous authors published phytosociological papers about local vegetation types (Rolecek, 2005; Adam *et al*., 2007; Gajoti *et al*., 2010). Therefore, investigating the reasons for distribution of the communities in relation to measurable environmental variables should be carried out in this region.

The findings of this study have implications for designing rehabilitation programs (Barrett, 2006) and vegetation mapping (Khaznadar *et al*., 2009). The role of climate, quality of available water and microclimate (Shaltout *et al*., 2003) in vegetation development in the area can be investigated.

The above findings clearly indicate the need to improve protection and management of this area, because numerous plant species found in the Red List of Iran (Jalili and Jamzad, 1999) occurred in this region. This region has afforded no conservation and protection before, but now, it can be proposed as a protected area on the basis of the numerous important species. Many ecologists believe that protected areas are the only way to conserve forests (Hayes and Ostrom, 2005).

Although we suggested that the floristic composition of the vegetation in this region can be the result of competition and small scale habitat, the knowledge on the ecology of vegetation formation is poor.

The data obtained about this forest from the current study revealed the dominant and characteristic plant species and ecological groups, which because of their aesthetic values can be useful for the design and management of this area.

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معرفی گروه گونه های اکولوژیک گیاهی در موزه میراث روستایی گیلان، ایران

ر. عابدی، ح. پوربابائی

چکیده

به منظور معرفی و توصیف گروه گونه های اکولوژیک گیاهی (تیپ های گیاهی) در موزه میراث روستایی گیلان به مساحت حدود ۲۶۰ هکتار، واقع در پارک جنگلی سراوان در استان گیلان در شمال ایران، نمونه برداری به روش تصادفی - سیستماتیک انجام و در مجموع ۸۹ قطعه نمونه برداشت شد. طبقه بندی پوشش گیاهی به روش آنالیز دو طرفه گونه های معرف (TWINSPAN) در لایه های مختلف پوشش گیاهی منطقه انجام شد. نتایج طبقه بندی حضور پنج گروه گونه گیاهی در لایه درختی، سه گروه در لایه درختچه ای، نه گروه در لایه علفی و شش گروه گونه گیاهی را در لایه زادآوری نشان داد. بر اساس نتایج بدست آمده از تحقیق حاضر، به نظر می رسد منطقه نیازمند حفاظت و مدیریت مناسب بوده و پیشنهاد می شود به دلیل حضور تعداد زیادی گونه مهم به عنوان منطقه حفاظت شده معرفی شود. اطلاعات حاصل از این تحقیق می تواند برای برنامه ریزی و مدیریت منطقه به دلیل اهمیت ارزشهای زیبایی شناختی آن مفید باشد.