Boletín de la Asociación de Geógrafos Españoles N.º 59 - 2012, págs. 447-451
I.S.S.N.: 0212-9426

GEOGRAPHICAL PHYTODIVERSITY OF MIRALRÍO COMPARED WITH FLORA OF WESTERN «LA ALCARRIA» OF GUADALAJARA PROVINCE. TAXONOMIC AND VASCULAR RICHNESS ANALYSIS

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I. INTRODUCTION

We define here «Geographical Phytodiversity» as measuring number and variety of plants in space. In this conceptual context, it must take into account that sub-regional, regional and supra-regional floristic synthesis performance are central in Phytogeography to understanding local patterns of phytodiversity. This provide useful biodiversity data for exploring issues relating to the role of scale and the dimensions of geographical range. In his turn, the details detected in fine-scale studies serve as basis of large-scale ones at the same time as they allow a better approach to truth current biogeographical state.

Vegetation landscapes always change because they are the expression of the disturbances of mankind in the environment. Besides the geographical features imposed by natural driving forces, the passage of time and the vegetation dynamics, different vicissitudes of human history, demographic evolution and land use, among other factors, leave profound marks on the landscape. In this way, when humans modify the original geotopes, landscape units and elements, they propitiate transformation, dispersion, disappareance and creation of the biotopes. All this impacts on the flora and plant communities.

In this respect, we think the knowledge the taxa that make up the plant landscape is strongly recommended, because it allows treat a Geography of Plants at different scales. These ideas are being applied in the natural region of «La Alcarria» and associated geographical units (Central Spain) in order to better understand the presence and distribution of plants. To do this, in the two past decades have continued making surveys and studies to incorporate new data.

In this study we aim: a) to present quantitatively a floristic synthesis of one of the areas of that region: Western «La Alcarria» of Guadalajara Province (from now AOG) by creating a floristic database based on different type of sources; b) to gather new floristic data in an locality with a recently biogeographical detected interest that belongs to the area referred (Miralrío and surroundings); c) to establish two new spatial units (4 and 9 km^2) for floristic inventorying, which employ in his turn the U.T.M. grid 1 km^2 (ED50) as minimum unit of reference; d) to present the list of plants of that area once it has reached the last inventory campaign in 2007; e) to perform a comparative and nested analysis of floristic (vascular) richness; f) to determine the floristic similarity between these minor geographic units; and finally g) to determine the taxonomic spectra in the 1, 9 km^2 cartographic enclosures and AOG to compare them.

II. STUDY AREA

The study was conducted in Miralrío, a spanish municipality covering something more than 8 km^2 inside the natural region of Western La Alcarria and «Mesa» of Ocaña (from now AM). It belongs to AOG (covers a total of 3.200 km^2; Fig. 1). In previous studies were found singular spots and enclaves around that locality due to presence of outstanding plant taxa (García-Abad *et al*., 2009b). Therefore, we decided to initiate a complete floristic study of Miralrío. Related with this topic, nowdays there are two papers about Geography of Miralrío: one treats on the geographic general traits, with a strong geormorphological basis (García-Abad & Panareda, 2007-08); and other one on the vegetation and flora general, geohistorical and geoecological evaluation and interpretation (García-Abad y Panareda, 2009).

III. METHOD

A procedure based on the previously applied by García-Abad (2006) is considered. This study employed the 1×1-km U.T.M. grid cells as floristic inventory observational unit with geographical aims. He carried out a systematic and exhaustive floristic inventory in order to know the composition of vascular plants of the natural region of Western La Alcarria and «Mesa» of Ocaña (Central Iberian Peninsula). The survey method was applied in the NNE-SSW transect forming for five 1×1-km U.T.M. cells (ED50). Each cell was visited fifteen times during one agricultural year. The results showed that richness ranged from 311 to 474 plants (wild taxa up to subspecies rank, as native as non-native). The present study employs a variant of the method shown above. The modifications and considerations to take in account are as follows:

— 9 contiguous grid cells are surveyed, that grouped they shape a 3×3-km grid cell (from now named 9C).
— As a strategy to solve enough of the phenologic problems to sight species plant we designed a campaing in 2007 with three visits to cells each 45 days in major growing period: mid April, early June and mid July. Hence, richness will be able to compare between the nine cells. This would allow to detect approximately 90% of the absolute richness according to data verified by García-Abad (2006).

IV. RESULTS

1. Taxa richness analysis

1. The Floristic Subregional Context (Western «La Alcarria» of Guadalajara Province - AOG)

The plant taxa amount of AOG according to García-Abad (2006 and 2009) was as follows: 1206 natives species (1255 up to subspecies rank and 1270 up to variety rank), plus 60 non-native naturalized taxa and 50 spontaneous taxa escaped from cultivation. Hence, if we add all wild and spontaneous plants up to subspecies rank, would have a total of 1365 taxa in AOG (this represents approximately 18% of the entire flora of Iberian Peninsula and Balearic Islands). Finally, there are 14 wild nothotaxa.

2. Phytodiversity of Miralrío (The 3×3-km U.T.M. grid cell coded as 30TWL0425)

a) Amount of plant taxa in 1, 4 and 9- km² U.T.M. cells:

Once finished the floristic surveying performed in 9C, the outcomes are expose in Table 1. The sighted taxa appear listed in an Annexe. Since the grid cells where each taxon is present and their abundance are pointed out, this Annexe reveals the Geography of vascular plants of Miralrío. We performed the taxa richness comparative analysis at three increasingly large grains (1, 4 and 9 km²). In his turn, these quantitative ranges can be compared with totals of the entire sub-regional flora (AOG). The resultant numbers allow us to establish the richness tops and bottoms in those size units, taxonomic rank and plant conditions that reader prefer. For instance, plant richness ranged from 326 to 505 taxa (wild plants up to subspecies rank, column D) in 1-km² grid cells, and from 571 to 643 in 4-km² grid cells. 711 plants were finally found in the whole of 9C. 134 native taxa were found in all 9 grid cells (Common Flora). As many as 140 taxa were recorded in only one grid cell (Very Rare Flora).

b) Floristic Similarity:

The Jaccard's index (g) is used to determine the floristic similarity between the nine grid cells. Only native plants were considered. For the examination of geographical heterogeneity influence in floristic dissimilarity, this statistical approach was used between all pair of cells. The Jaccard distance was calculated and produced a symmetrical matrix of similarity values between each pair in the 9 U.T.M.-grid cells of 1 km² (Table 2). It will be useful to determine, later, the average similarity of each cell of 1 km×1 km, which provide the following values: the similarity matrix has 36 values, ranging from a minimum of 0,442 (pair C5C9) to a maximum of 0,667 (pair C2C8), with a mean central tendency of 0,583; it dispersion from the mean given by the standard deviation is 0,057. Each cell has an average similarity value (the lower row in Table 2). From these values a unique mean value for the whole study area is calculated, 0,583, with a standard deviation of 0,035, a minimum value of 0,524 (C5) and a maximum of 0,617 (C2).

c) Phytodiversity geographical analysis of Miralrío: Outstanding notes

According column D of Table 1, in 9C were found just over a half of all plants of AOG (the 52,1%). The high richness of the C4 is explained by its largest geodiversity. C5 is a cartographic enclosure extremely disturbed and the less geodiverse. Therefore, richness and average similarity of C5 are the smallest. In constrast, C9 is the less disturbed cell, so that its average similarity is very low and its richness remains medium-low level. Obviously, C5C9 is the pair with the flora more dissimilar.

2. Taxonomic spectrum in Native Flora of Miralrío

The native (vascular) flora, as main part of all plants exposed in Annexe, is typified by taxonomic family in Table 3. Besides taxonomic category-subcategory ratios are expressed. These data are reduced to percentages in Figures 4 and 5.

The native flora of AOG presents the following taxonomic order as typical model:

Compositae > *Gramineae* > *Leguminosae* > *Cruciferae* > *Labiatae* > *Caryophyllaceae* > *Rosaceae* ≈ *Umbelliferae* ≈ *Scrophulariaceae*

The taxonomic order in 9C is nearly the same than in AOG. It is the same in the first six groups, while it lightly differ in the following three groups due to their almost identical numbers. However, the percentage of *Compositae* significantly increases in 9C (15,1%, when it was 12,7% in 9C). This increasing is low at *Cruciferae* (6,6%, when it was 5,6% in 9C). These relative rises must be explained by strong effects of human disturbances in small geographic spaces with regard to effects to Sub-regional scale. Following this trend, the relative effect of environmental artificialization is increasing with decreasing geographic space. This is proved when we observe how number of *Cruciferae* equates or surpasses number of *Leguminosae* in most of 1-km^2 grid cells. *Labiatae* occupy almost always the fifth position in taxonomic order, as AOG and 9C typical models. Finally, when naturalness is medium to high, *Rosaceae* surpass *Umbelliferae* and viceversa.

V. DISCUSSION AND CONCLUSIONS

In Biogeography, comparisons of biodiversity usually have been addressed such as ecological comparisons, i.e. treating to isolate factors for determining it, separating communities, between other approachs. These have been fruitful in advancing discipline, since they have solved a main part of facts to puzzle out. Nevertheless, several problems have arisen on comparing biodiversity along the territorial *continuum*. Geographical comparisons of species richness are different from those for they show reality as it is, i.e. the quantity of plant taxa as they are or appear to be in a certain time and a certain part of spatial *continuum*. In this respect, there is an approach using 1-km^2 U.T.M. grid cells in mapping of plant distribution that can propitiate this kind of comparisons at the local scale. The continuous juxtaposition of these units over broad expanses consistently gives rise to large-scale plant spatial patterns. Hence, is possible treating a geographical phytodiversity and detecting floristic variation patterns. Besides, future updating will allow us to do comparisons in time and to detect possible changes or dynamics in the environment.

The field surveys covering AM and AOG territories (García-Abad, 2006b, 2009 and current article) have provided data on species richness: 392, in 1 km^2; 567, in 4 km^2 (averaged and restricted to an annual cycle values); 660, in 9 km^2 (absolute value in a year); and 1206, in 3200 km^2 (AOG) and 1543, in 6700 km^2 (AM) —collected values at non-precise time units—. Species richness in the 1- km^2 U.T.M. grid cells studied as yet ranged from 306 to 476 (wild native plants).

In this way, it must be careful on two key questions on richness measures and comparisons in Geography of Plants: a) the procedure of survey effort (intensity and frequency), and b) the establishment of standard time units for the plant species account, and also of concrete moments inside these.

Over the last few decades, rural landscapes in Spain have undergone changes in land use. Land abandonement has resulted in a major shift in the habitats available. This have led to subsequent impact on vegetation and plant distribution. Therefore, currently management activities in rural landscape fall into three angles: The first is creation of green leisure spaces, second is forest fire prevention, and third is conservation of biodiversity and natural landscapes. As a result, basical phytogeographical studies are needed to take suitable decisions on land management.

In this way, all people must think that conserving biodiversity ¡is not a concern merely quantitative! Thus, implications of public actions are needed in order to maintain cultural landscapes or to restore open habitats. Here, the question is how to elucidate supervision levels of these vegetation landscapes. Different groups of users (farmers, managers, recreationists, city dwellers) have different lanscape preferences. Nevertheless, in this context, policies must take into account the natural driving forces and environmental dinamics rather than exerting severe or biased controls.

By all this reasons and contexts, in any case, make it advisable to know the floristic composition of a municipality, as unit of management, or local studies as a prerequisite to understand phytogeographical structure and environmental function. Hence, use these floristic data serves to establish the occurrence and quality of ecosystems, to light up true character of plants (native, adventice, naturalized, alien, invasive...) and, especially, to better understand the phytogeographical reality in which we live.