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Beyond the scale. Building formal approaches for the study of spatial patterns in Galician moundscapes (NW Iberian Peninsula)

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ABSTRACT

In Galicia, works that studied the megalithic locational patterns developed only fieldwork-based approaches. As a result, the locational criteria were defined using ideas through a direct analysis at field, and never have been quantified and modelled with GIS methods until nowadays.

In this work, a GIS methodology and a point pattern approach for the study of megalithic locational patterns is carried out. Starting from the definition of locational factors managed by literature, a number of first and second order properties were converted into spatial variables. From this point, specific regularities among the distribution of sites were established, which allows to determine trends in Galician megalithic occupation and open new possibilities of analysis in the study of Galician megalithic landscapes.

1. Introduction: Site location patterning in Galician megalithic complex

In Galicia, studies that incorporated a spatial perspective began in 1930s, with the contributions of G. and V. Leisner (Leisner, 1938) who proposed the first map of the distribution of the megalithic phenomenon in the NW of the Iberian Peninsula, identifying areas with high presence of sites as a result of an intensive survey work. Different works have continued this research, with the contributions of Rodríguez Casal (1990) or the latest one proposed by ourselves (Carrero-Pazos, Rodríguez Casal, n.d.).

The study of the megalithic locational factors certainly had greater attention during the 1980s, with the efforts of authors such as J. M. Bello Diéguez, F. Criado Boado, J. M. Eguileta Franco or J. Vaquero Lastres, which continued the work initiated by previous authors such as Maciñeira or López Cuevillas (Maciñeira, 1943–1944; López Cuevillas, 1959; Bello Diéguez et al., 1984; Criado Boado et al., 1986, 1990; Criado Boado and Vaquero Lastres, 1991; Vaquero Lastres, 1989, 1990, 1993–1994; Vaquero Lastres, J., 1991–1992; Eguileta Franco, J. M., 1999; Villoch Vázquez, 2000, among others). Their contributions aimed the definition of locational regularities registered during fieldwork. They noticed, for example, that mounds are located at specific altitudes, in relation to the geological substrate or the visibility and intervisibility between sites.

However, following M. Lake and P. Woodman (2003, p. 690), such approaches can be classified as “informal” as they are characterised by the absence of an explicit methodology and the development of a commonsense interpretation, as it mostly happened with visibility studies, centred on viewshed maps determined by eye during the survey works. On the basis of the locational model that can be extracted from all these works, we can summarise the main locational criteria of the Galician Megalithic mounds (Fig. 1).

Starting from the rasterization of these variables,[1] we will use site predictive modelling to determine which ones can predict the distribution of monuments, hence supposing that they were relevant in the configuration of the megalithic landscapes. In this work we are not criticising the validity of traditional approaches but discussing them through a quantitative perspective supported by GIS and spatial statistics (Llobera, 2007).

2. Study area and dataset

The study area is located in the south of Galicia, belonging to the region of Vigo and Baixo Miño. These are roughly the limits of the current councils of Soutomaior, Pazos de Borbén, Redondela, Mos, Vigo, O Porriño, Tui, Gondomar and Nigrán (Fig. 2).

The megalithic monuments of this zone have been already studied, with the investigations of Álvarez Limeses (1935), Mergelina (1936), Díaz Álvarez, P. (1973), Filgueira Valverde, J., García Alén, A. (1977), and Hidalgo Cuñarro and Costas Goberna (1979). In more recent times, the works of C. Gómez Nistal (Gómez Nistal, C., 2000; Gómez Nistal, C., Rodríguez Casal, A. A., 2000) or Fábregas Valcarce, R. (2010), orig. 2001) deal with megalithic sites from an overall perspective, but never from a GIS-based methodology. With respect to archaeological data, we

[1] The research of this paper has been carried out using open source software, specifically GRASS GIS 7.0.2 (GRASS Development Team, 2017), SAGA GIS 6.0.0 (Conrad et al., 2015) and R Statistics 3.2.5 (R Core Team, 2008).

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LOCATIONAL ANALYSIS PREDICTIVE MODELING		Variables	Description
First order covariates	*Physical and orographic factors*	Elevation	25 m. resolution DEM, obtained from LiDAR data.
		Slope	Maximum inclination of elevation at a given point. Derived from DEM.
		Hydrology	Potential hydrologic network.
		Geology	Official MAGNA cartography for geology (IGME).
		Wetlands	Topographic Wetness Index (Boehner et al. 2002).
	Potential factors	Topographic prominence	Defined as a function of height differential between an individual and his/her surroundings as apprehended from the individual's point of view (Llobera, 2001).
		Potential transit	Identification of areas that are statistically more likely to be transited, key points or theoretical nodes in a natural transit network (Rodríguez Rellán, Fábregas Valcarce, 2015).
		Visual prominence of landscape	Areas of the landscape that can be perceived more frequently.
Second order covariates	*Cultural factors*	Tradition	Evaluation of the spatial dependence between points (atraction or repulsion)

Fig. 1. Locational covariates that will be considered in this study (following Carrero-Pazos, 2017).

are using the archaeological database of the megalithic studies group from the University of Santiago de Compostela (GI-1520), which has 121 sites for that area analysed through fieldwork and "ground-truthing" (LiDAR visualisation techniques) (Carrero-Pazos, 2017).

The limits of the study zone were defined as vectors, based on the different watersheds and sub-watersheds calculated in GRASS GIS 7.0.2 with *r.watershed*. The reason behind this decision is a geographic justification rather than using the current administrative divisions such as counties. In such a way, regions are usually better working areas as they are supported by historical and natural constitutions, although for this concrete case they had to be discarded since it supposed the use of a too big study surface. Therefore, the watershed approach[2] provided a more representative and suitable area for the study of the location of sites and the background.

2.1. Geographical and archaeological context

The study area, located to the South of Vigo, is characterised by a flat surface that belongs to the current councils of Nigrán, Vigo, Mos and Redondela. It is truncated by some elevations such as Outeiro Grande (442 m), Alto do Cepudo (524 m) or As Pereiras (514 m). From a hydrological point of view, the watersheds of Verdugo and Oitavén rivers stand out, as well as the Miñor one that closes to the South the region of Vigo. The Pico San Vicente (432 m), located in Redondela, is the highest point in the North, and has one of the largest concentrations of mounds such as Monte Penide (Chan da Cruz's group has thirty sites, some of them dolmens, such as the case of A Mamoa do Rei) (Fig. 3).

The main mountain range of the zone is further to the East, Serra do Galiñeiro (Coto de Cales, 742 m). This is an elongated sierra (N—S direction) which truncates the depression of a geological stretch in two sides. In the East, other natural formations can be observed, such as Cavada do Burro's Peak (532 m) or Coto da Eira (881 m), linking with the Meridian Dorsal.

To the South a small plain opens, Mondariz-Balneario, shared by

[2] After several tests the chosen size for basins was 62,500 m.