

Introduction

Background Information

Sardinia is an island off the coast of western Italy that has diverse landscapes and an equally diverse cultural history. During the Middle Bronze Age to the Early Iron Age (1700-700 BCE), the Nuragic culture was present, a group that partook in mixed farming and lived in farmsteads (Blake, 2001) with a complex social history.

What remains of them today is their 7,000+ sites, scattered around the island with types pertaining to:

- Nuraghes** - Monumental stone settlement towers, the most common type of site, with subgroups of simple, complex, archaic, and non-determinable, based on their architectural complexity (Fig. 2).
- Tombe di giganti** - Otherwise known as giants' tombs, are megalithic chamber tombs with a large forecourt and sometimes a frontal stela (Fig. 5).
- Pozzo sacro** - Well temples that started appearing later in Nuragic chronology (Blake, 2001), are less frequent and where cult activities likely took place.
- Other: open settlements, caves, and wells.

Social organization is contested with many approaches such as: Webster's elite hierarchical ranked, González-Ruibal's house society, and Araque Gonzalez's non-hierarchical interpretation. One way of examining it is with the use of theoretical frameworks and the archaeological record, which in our case is with spatial site data.

Project Goals

Objectives

- Collect data and index the number of sites from a wide array of municipalities and regions, then store them in a database.
- Utilize the house society model by González-Ruibal as a theoretical framework in coalition with statistical methods to analyze social organization.
- Build our GIS map of the sites in each region across Sardinia to help visualize our data and provide a foundation for future research.

The 'House Society' model & Hypotheses

Variability in spatial organization was used to examine social organization based on González-Ruibal's (2023) house society model, a patrimonial kinship model based off of a heterarchical system where there is competition on a level field with varying amounts of wealth and power. When applied to Sardinia, it is stated: "thousands of competing houses... but [one] never manages to control large territories."

Nuraghes represent habitation centers and those that are complex are houses with more wealth and power. Tombs may also be an indication of wealth.

Based off this model, we hypothesize the following:

- Heterarchy** = Areas with *more* complex nuraghes and tombs are signs of social fragmentation among autonomous houses.
- Hierarchy** = Areas with *fewer* complex nuraghes, or fewer tombs and many habitation sites, are signs of concentration and collaboration of power centers.

Methodology

Data Collection

1. Previous Archaeological Work

Many researchers have done large-scale regional surveys (e.g., Namirski, 2020) or small-scale municipal surveys (e.g., Cicilloni et al., 2017,) that record a plethora of site data.

2. Piano Urbanistico Comunale (PUC)

The municipalities of Sardinia have public record of their land through their 'Municipal Urban Plan' documents that have surveys or information of sites on their land.

Excel & SPSS Statistics

Excel is the application used to house our database. This includes the site index in each municipality and the ratios used for analyses. SPSS Statistics was used to derive a cluster analysis and a scatterplot to explore possible relationships between regions, after standardizing our data on a range of 0 to 1.

ArcGIS Pro

A map with Sardinia's municipalities as features was used on ArcGIS Pro 2.7.0 to help plot the data from our collected and see the relationship of our spatial data (see Fig. 3).

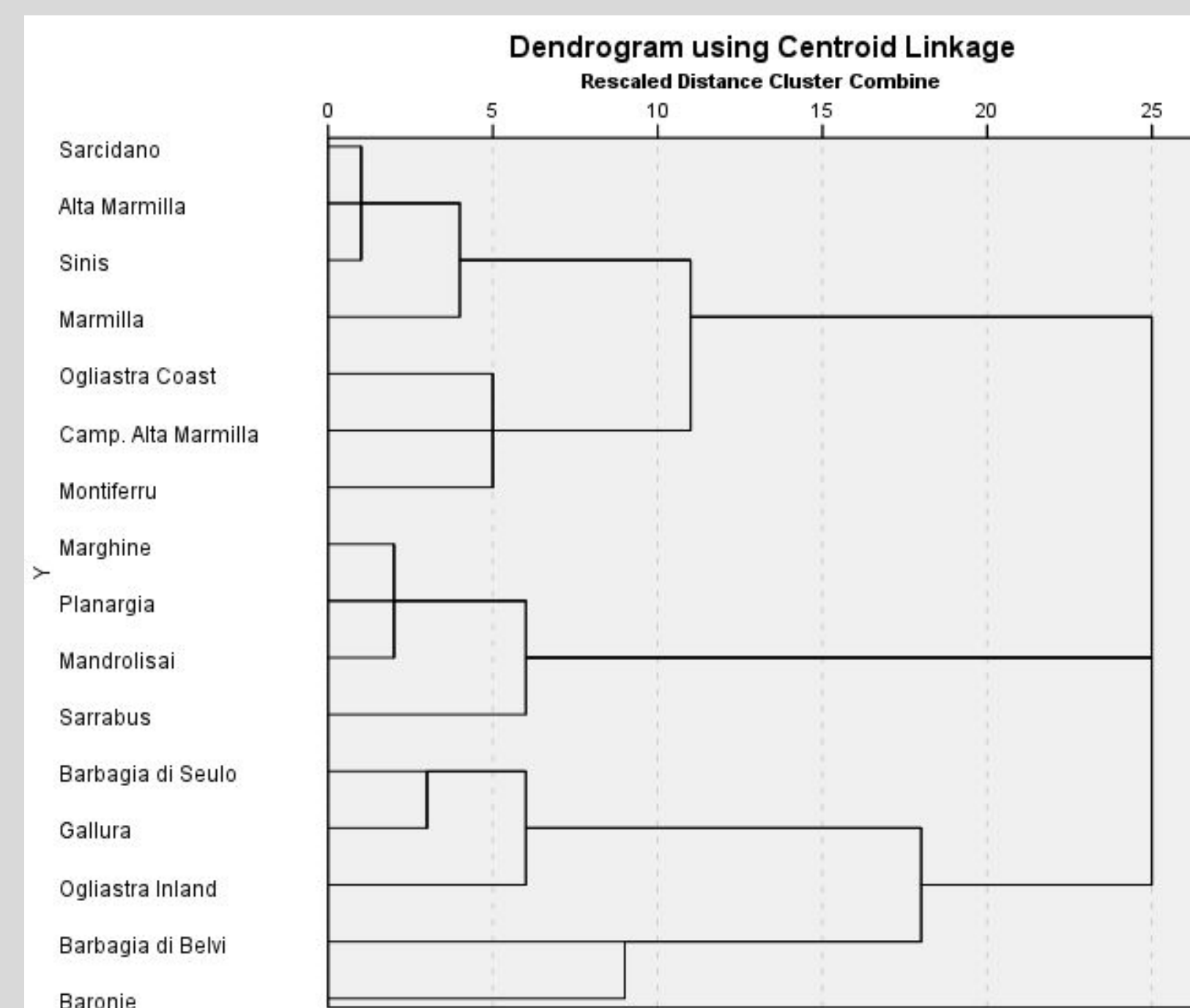


Fig. 1: Cluster Analysis Chart showing clusters of similar regional spatial data.



Fig. 2: Nuraghe Su Nuraxi
Norbert Nagel, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0/>, via Wikimedia Commons

Collected Data & Results

Regional Spatial Data

Our analysis is derived from regional data using these metrics:

- Total : Complex Nuraghes ratio:** To see social fragmentation or power concentration.
 - Every X nuraghes, there is 1 complex nuraghe.
- Nuraghes : Tomb ratio:** Another form of social fragmentation.
 - Every X nuraghes, there is 1 tomb.
- Nuraghes Density:** Population represented in the form of habitation centers (nuraghes).
 - Every X km², there is 1 nuraghe.

Reading the Data

- Heterarchy** = greater relative amounts of complex nuraghes and tombs within an area.
 - High density of nuraghes (low ratio) **paired with** frequent complex nuraghes (low ratio) and frequent tombs (low ratio)
- Hierarchy** = fewer complex nuraghes or fewer tombs and many habitation sites within an area.
 - Low density of nuraghes (high ratio) **paired with** infrequent complex nuraghes (high ratio)
 - High density of nuraghes (low ratio) **paired with** infrequent tombs (high ratio)

Results

Data collection was collected from **142** municipalities, with a total of 2,302 nuraghes indexed, 533 of which are complex in nature (23.15%). 590 burial sites were recorded, 532 of them were chamber tombs (90.16%).

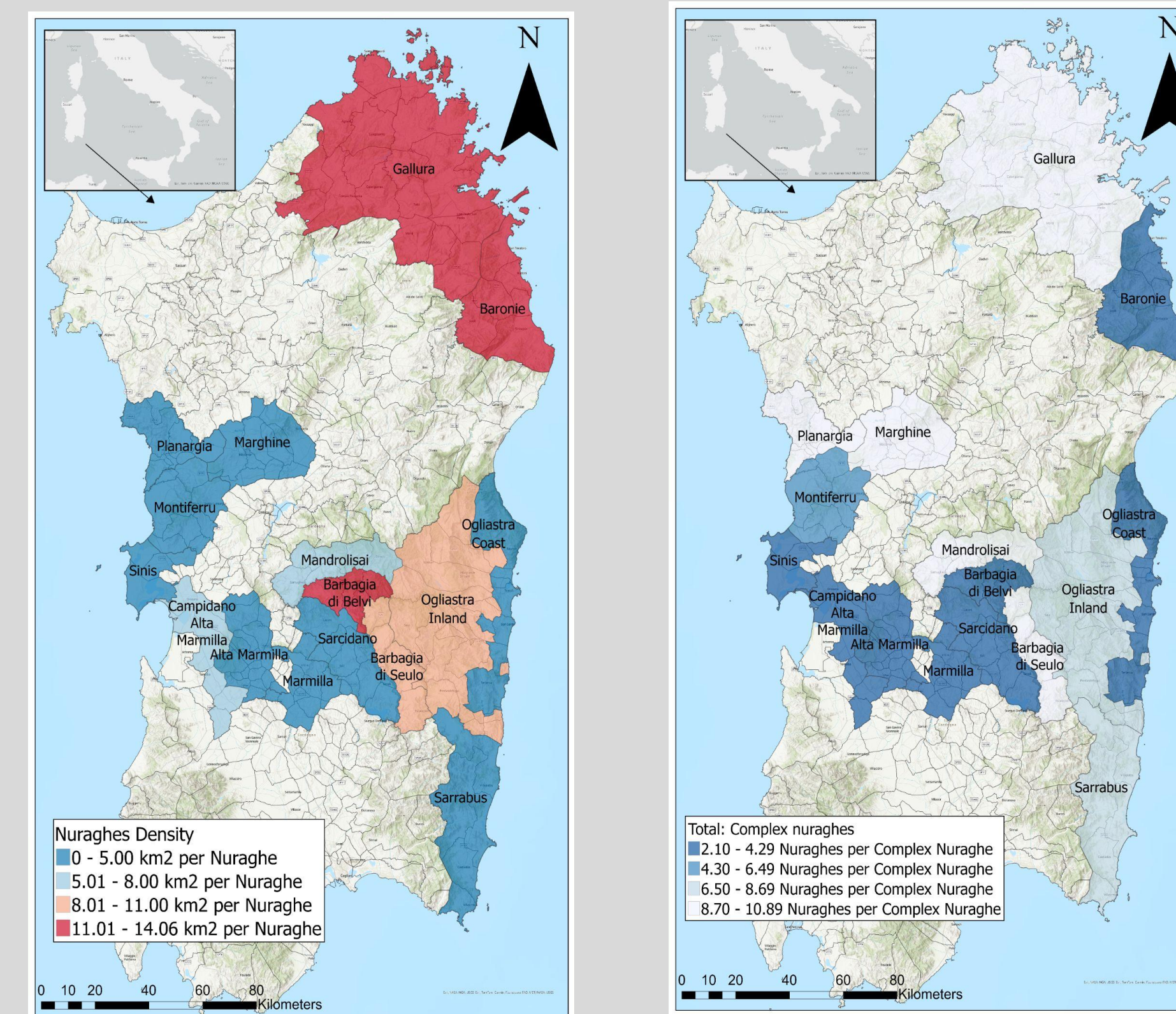


Fig.3: GIS maps displaying:
a) Nuraghe density
b) Total : complex nuraghes ratio
c) Nuraghes : tomb ratio

Conclusions

Limitations

A multitude of factors beyond the number and proportion of sites can affect what can be considered a competitive environment; landscape type, geolithology of sites and preservation are examples that can impact results. These factors play into missing sites, either due to preservation over time or due to not being found yet.

One methodological approach that I would like to consider for future reference is a principal component analysis (PCA). It would enable standardization of many datasets on one scatter plot.

Analysis

This data does not take into account limitations mentioned above, and instead is representative of the quantitative data of each region.

- Quadrant 1:** The cluster chart similarly clusters Sinis, Sarcidano, Alta Marmilla, and Marmilla; regions that have high population densities that also show a skew towards a lack of tombs with more complex nuraghes as a form of hierarchy.
 - Social fragmentation is displayed by the presence of complex nuraghes.
- Quadrant 2:** Containing only Sarrabus, hierarchy is seen with less tombs and complex nuraghes, and a high population density.
- Quadrant 3:** The coast of Ogliastra, Montiferru, and Campidano / Alta Marmilla show evidence of high social fragmentation.
 - Baronia (and Barbagia di Belvi according to the cluster chart) remain nearby to the cluster, though have some of the lowest population densities (1.00 and 0.907 standardized values).
- Quadrant 4:** Two clusters are present, with social fragmentation displayed by the presence of tombs rather than complex nuraghes.
 - Red Cluster** - a low density of nuraghes with a skew towards many tombs and less complex nuraghes.
 - Blue Cluster** - a high density of nuraghes with the least amount of complex nuraghes but slightly less tombs than **Red Cluster**.

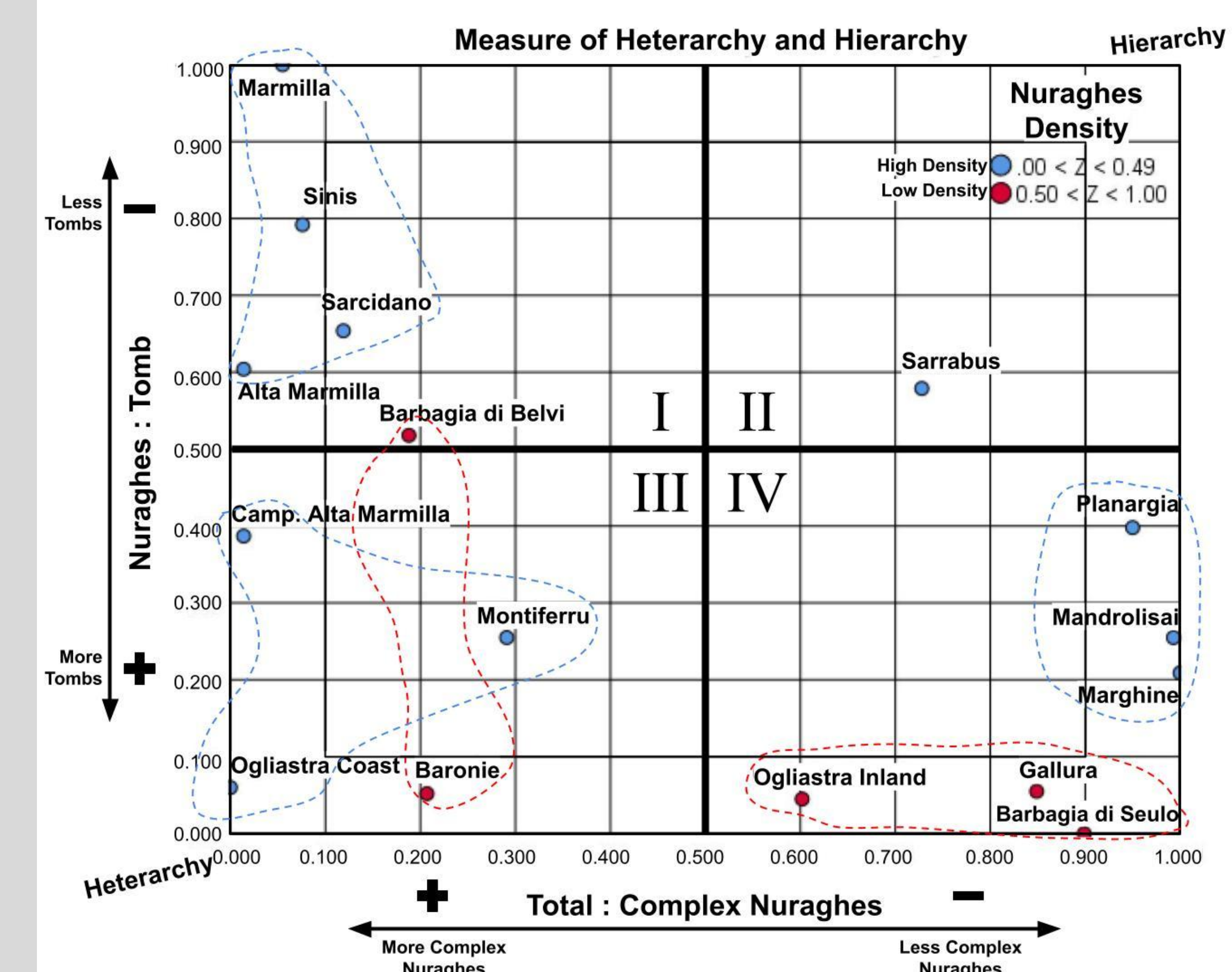


Fig. 4: Scatterplot displaying relationships of spatial data as a measure of heterarchy and hierarchy.



Fig. 5: Coddu Vecchiu Giants' Tomb
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- Please contact me for further citations regarding specific site data used with GIS, or scan the QR code!



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