

GIS Applications for Environmental Archaeology and Historical Ecology: Problems and Potentialities.

The case study of Punta Mesco (Cinque Terre National Park – Italy).

Nicola Gabellieri, Alessandro Panetta, Valentina Pescini

Dipartimento di Antichità, Filosofia, Storia e Geografia

Università di Genova

Genova, Italy

n.gabellieri@hotmail.com, archeopanetta@gmail.com, valpes87@gmail.com

Abstract—Research in environmental archaeology and historical ecology provides valuable information about past vegetation and its activation related to past societies activities. Different tools are used in order to better describe the historical plant coverage and ecosystems, environmental resources and the agro-silvo-pastoral systems. Combining field data and historical information in a GIS application gives multiple perspectives on the dynamics of changing landscape. This paper deals with the issue of GIS as a tool for historical ecology research, outlining the used methodologies and problems related to them. Our study focuses on Punta Mesco, in the Cinque Terre National Park (Italy), as case study.

Index Terms — historical ecology, environmental archaeology, GIS, local history

I. INTRODUCTION

Historical ecology and environmental archaeology are a cluster of approaches and methods that extract information from features and offer a holistic perspective to the study of historical environmental changes. Based on a definition of ecology that includes humans as a component of ecosystem, they try to find out the relationship between humans and environment, how people adapted to their surrounding, how they activate resources and how they take part in landscape transformations. According to Rackham [1], the same vegetation of a given site is considered by a special kind of artefact; the outcome of the activation processes to which the environmental resources have been subjected. Following this route, the resources are considered “social products”, historically defined by practices, conditioned by forms of control, access, production, activation and by technology and knowledge of societies. Moreover, environmental archaeology studies those remains (pollen, spore, wood, charcoal, seeds, bones, etc.) as material signs of past environment and past human activation both at the site and off-site scale. Combining historical ecology approach and environmental archaeology results allow us to have a rich and analytic insight on the historical landscape [2]. If many of these concepts may be extraneous to archaeologists, its salient characteristic will be recognized as familiar of most archaeological practices [3].

II. A GIS FRAMEWORK FOR HISTORICAL ECOLOGY DATA

Historical perspective increases the understanding of the environmental dynamics of landscapes and provides a frame of reference for assessing modern patterns and processes. In many cases, however, historical records are too brief or fragmentary to be useful. New tools and technologies allow a better understanding of collected data and new approaches for hypothesis testing; scholars have demonstrated that Geographic Information Systems (GIS) can offer a tool for visualizing past landscape. Archaeologists are used to collect and analyse spatial data since the early days of the discipline, and application of GIS analysis is nowadays fundamental part of the archaeological routine, especially associated to *landscape archaeology* [4]. Since 90's until today archaeology failed to interpret ecological data as a result of historical processes, limiting itself to the analysis and representation of 'traditional' survey results (statistical and distribution of pottery or sites) without merging them with environmental data. Fundamental works deal on the detailed collection of horizontal and vertical spatial data, the close analysis of ecofact and artefact, the integration of locational and spatial attribute and the ability to integrate very diverse data into a single analytical framework [5]. Layers can also be correlated through various calculating functions to produce analysis of aggregated data. However, if these capabilities make GIS ideal for historical ecology [6], this approach has a number of inherent limitations, and its application in this field needs to be reshaped.

III. THE CASE STUDY OF PUNTA MESCO (ITALY)

Our project focuses on the area of Punta Mesco, a promontory located in the Cinque Terre National Park (Italy). Actually the place shows the signs of an advanced state of abandonment, with the ruins of buildings, barn and wine cellar. Since 2009 there is a project of reclamation of the area for the conservation of the pre-existing landscape and the revival of traditional farming methods sponsored by Fondo Ambiente Italiano (FAI), still ongoing. This project, that involves the Laboratorio di Archeologia e Storia Ambientale (LASA) of the University of Genoa, concerns the study of geomorphology, architectural, historical and environmental features of the area, with a double objective: firstly, to facilitate the restore of the

building and the terraces and the rebuilding of the past culture systems; secondly, to produce contents for the communication and dissemination about the past landscape. This project has been an occasion for an analysis of an 'atypical' landscape and to develop an interdisciplinary approach to the study of archaeological landscape that are different from those studied in traditional Mediterranean landscape archaeology since early days [7]. The area of Punta Mesco is completely different from the ones investigated by classical 'ploughsoil archaeology' or 'settlement' archaeology', so we needed an unusual archaeological approach in which also vegetation, slopes and land use were contemplated as an object of investigation, as well as pottery, buildings and mines. Historical ecology and environmental archaeology got techniques and perspectives that allow us to understand landscape past through the study of documentary sources and field sources. Following these route, we collected a wide range of different sources, combining site level fieldwork, landscape level interpretations of historical cartography and areal photos.

IV. OUR RESEARCH WORKFLOW

We assembled a various range of historical record, through visiting local historical archives and field survey. Our problem deals with the organization of the large volume of heterogeneous data into a more accessible form of interpretation. GIS application has been used to develop ecological information at various spatial scales for the landscape. In order to create a historical landscape mapping, the first step was the collection of the historical cartography, and the creation of a vector landscape map of XIX century. Using historical cartography for recreate landscape changes cannot be undertaken without an awareness of the problems relating both to the survey and to the integration in the GIS. Each map was scanned and geo-referenced using a minimum of four ground control points- The analysis with the method of map regression [8] hallows us to reconstruct the changes in vegetation patterns, land use, road network and settlement. Once created a landscape model, the second step was to reproduce observational sites on the map, in form of point and polygon features. We transcribe every different sources and relevant quotes into one comprehensive document, creating a large scale map. Sources include pollen cores, charcoal identifications, dendrochronological analysis, historical documents such as cadastres and archaeological features identified by survey (mining areas, settlement buildings, pottery concentrations, charcoal kilns, etc.). To document mapping sources used, we assigned a set of attributes including data descriptions and derivation. These attributes contribute to data transparency and accuracy. The digitalization phase involves problems related to the integration of different sources, such as nomenclature, the choice between point and polygon features, the standardization of the set of information. Synthesis and interpretation should follow general rules of spatial analysis; however, because each specific set of data is based on different data source available, interpretation is based on cross-checking of all the sources. As a final result, we created one comprehensive georeferenced map with spatially located quotes. GIS application in historical research can be not only a digital tool. In this case study it becomes a fundamental epistemological tool (a metasource, *sensu* Genet

[9]) to produce a new way to compare, join and understand a very heterogeneous dataset of different sources and features. Only combining all of them we can reconstruct the historical processes of activation and management of environmental resources. As part of the research phase, we use GIS spatial analysis tools such as transect and kernel. In a second moment, overlaying maps and narrative information may represent an important tool for the dissemination of the results, in a more accessible format for stakeholders as well as scholars.

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