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CASE STUDY

The Harvesting Memories Project: Historical ecology and landscape changes of the Sicani Mountains in Sicily

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Abstract – The Harvesting Memories project aims to investigate the historical landscape dynamics in an inner area of the Sicani Mountains district in Western Sicily (Contrada Castro, Corleone-Palermo). The interdisciplinary approach of the project allowed us to combine and integrate methods from different disciplines such as historical ecology, landscape archaeology, archaeobotany and GIS-based spatial analysis. In this paper some results have been summarized. The comparison between land mosaic change during the last 60 years, the relationship between site catchment area and land suitability and the correlation between archaeobotanical and phytosociological data. This approach underlined the relevance of the historical ecology for understanding landscape trajectories and planning strategy of suitable development of rural areas.

Keywords – Historical ecology, Landscape Archaeology, Archaeobotany, Vegetation, GIS, Sustainability, Early Middle Ages.

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INTRODUCTION

In recent years, the interest in a diachronic and holistic approach to the dynamics of landscapes has grown considerably according to the theoretical and methodological principles of Historical Ecology, intended as a bridge between science and humanities (Crumley 2021).

Inspired by the Historical Ecology principles, the Harvesting Memories project began in 2015 with the collaboration between the Bona Furtuna company (project-funder), the University of Palermo and the Superintendency BB.CC.AA of Palermo (Castrorao Barba et al. 2017, 2018a). As part of a holistic vision of landscape conservation connected to 100%-organic farming activities, a research program was developed aimed at understanding the historical and ecological dynamics of a sector of the Sicani Mountains located in the southern part of the municipality of Corleone (province of Palermo). The project, therefore, has taken an interdisciplinary approach that has seen the intertwining of historical, archaeological, botanical, paleo-environmental studies also using GIS and remote sensing tools.

The long occupation of this rural district has been documented by an archaeological survey which has made it possible to identify and map different areas of human occupation from protohistory to Modern age. This survey identified a settlement with a high archaeological potential located in the hill-top plateau of Contrada Castro on which archaeological excavation campaigns have been carried out since 2017 (Castrorao Barba et al. 2018b, 2018c, 2020). The excavations have confirmed the long occupation of the hill starting from an inhabited area of the 6th-4th century BC with a reoccupation that saw the formation of a settlement during the Early Middle Ages characterized by two macro phases of life between the late 8th-9th century AD and 10th-11th century AD, the centuries of the complex transition between the Byzantine and Islamic periods (Figure 1).

Figure 1. The hill-top plateau of the archaeological site of Contrada Castro (Corleone, Palermo, Sicily).

The early Medieval occupation of Contrada Castro is a privileged case study to verify the resilience of territorial occupation strategies, of the exploitation of environmental, agricultural, animal and geological resources (Castrorao Barba et al. 2021; Montana et al. 2022) in an inland area before and after the arrival of the Arabs which in some areas led to the emergence of new agricultural landscapes connected to a systematic use of irrigation systems (Metcalfe 2017; Todaro et al. 2020).

In this article we propose some of the project results regarding the dynamics of historical ecology from different time-scale perspectives. First of all, the formative processes of the current landscape were analyzed through the comparison and photo-interpretation of aerial images dating back to the 50s of the 20th century and 2016 (Bazan et al., 2019). A second study was dedicated to the correlation between the catchment areas of archaeological sites, identified according to GIS-based spatial calculations of walkable isochrone areas, and the areas relating to the spatial distribution of potential vegetation intended as an indicator of land suitability for agricultural or forest-pastoral purposes (Bazan et al., 2020a).

A third analysis, finally, it was possible to propose a temporal dimension to the observations on the dynamics of the landscape through a comparison between the archaeo-botanical data on the remains of wood of the early medieval phases of the Contrada Castro site and the current observations on the phytosociological composition of current vegetation (Bazan et al., 2020b). These showed how a historical ecology approach is fundamental to address all the complexities of human-environment interactions in a rural Mediterranean landscape.

THE LANDSCAPE

The Sicani Mountains are a system of mountainous reliefs of central-western Sicily located between the valleys of Belice in the east and Platani in the west. It reaches its highest elevation at Rocca Busambra (1,613 m a.s.l.) which represents the northern limit of the mountainous system. Among the most important mountains are Monte Cammarata (1546 m a.s.l.), Monte delle Rose (1436 m a.s.l.) e Monte Monte Barraù (1.420 m a. s.l.).

The research area is located 8 km from Corleone (province of Palermo) in the inland area of Sicani Mountains, next to the SS188dir/c road in the direction of Campofiorito (Figure 2).

The whole project area (1464.46 hectares) includes the sites of Contrada Castro, Contrada Giardinello and Contrada Valle Fredda, which goes up the slopes of Monte Barraù (or Monte Barracù).

The landscape has been shaped by frequent changes in geological strata, with the alternation of clayey or marly hills and calcareous reliefs of the Mesozoic period (Sicana facies). The detailed geological framework of the study area was described in Montana et al. (2022). This has resulted in a sequence of hills with gentle slopes, irregularly interrupted by isolated mountains with steep, if not abrupt, slopes, which reach the considerable height of 1420 m a.s.l. (Monte Barraù). Due to variation in elevation, the study area is quite diversified from a bioclimatic point of view as well, presenting different gradients from the Lower Mesomediterranean (Upper dry) and the Lower Supramediterranean (Lower subhumid) (Bazan et al., 2015).

The natural vegetation of this area is composed of remnant forest patches, shrublands and extensive grasslands which represent different stages of degradation of pre-existing forest due to anthropic activities.

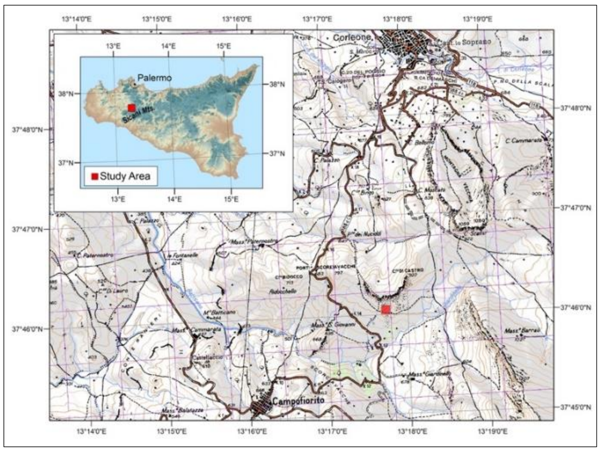

Figure 2. Location of archaeological site (Contrada Castro) on topographic base map by the Italian Geographic Military Institute (aut. n. 4848 27/07/1998). The U.T.M. grid, in purple, has an interval of 1000 metres.

Figure 3. Holm oak forest and grassland in the western slopes of Mt. Barraù.

Five different woods have been identified according to the environmental characteristics (bioclimate belts and substrate). The main forests formation are evergreen oakwoods (*Ampelodesmo mauritanici–Quercetum ilicis* Gianguzzi, Cuttonaro, Cusimano & Romano 2016 and *Sorbo torminalis–Quercetum ilicis* Gianguzzi, Cuttonaro, Cusimano & Romano 2016) and deciduous oakwoods (*Oleo oleaster–Quercetum virgilianae* Brullo 1984 and *Sorbo torminalis–Quercetum virgilianae* Brullo, Minissale, Signorello & Spampinato 1996) (Figure 3). Along the rivers also grow hygrophilous woodlands with poplars and willows (*Ulmo canescentis-Salicetum pedicellatae* Brullo & Spampinato, 1990). Shrublands dominated by thorny bushes belonging to Rosaceae family or other evergreen Mediterranean species are the result of wood degradation due to cutting or fire. Grazing and frequent fires normally lead to the establishment of *Ampelodesmos mauritanicu*s grasslands. These natural and semi-natural vegetation patches are embedded in a matrix of agricultural land uses characterized by cereals, grapevines and olive trees, "the Mediterranean triad" (Figure 4).

The landscape mosaic can be ecologically distinct in two different ecotopes defined in relation to lithological and morphological homogeneity, to which mainly correspond to two different vegetation series: 1. Holm oak woods series (A*mpelodesmo mauritanici-Querco ilicis* sigmetum) 2. Downy oak series (*Oleo oleaster-Querco virgilianae* sigmetum). The first vegetation series is found in the submountain belt, at altitudes between 800 and approximately 1300 m a.s.l., where it prefers shady and humid steep slopes, with predominant western/southwestern exposure and soils rich in detrital material, produced by erosion and landslides. The second series is widespread over clayey substrates (sometimes with a rocky matrix originating from limestone) with hilly morphologies, in stations with a certain environmental xericity (average annual rainfall from 500 to 800 mm). The soils are deep and fertile with high agricultural potential.

A high level of biodiversity is indicated by the presence of 502 taxa of vascular flora, 38 of which are endemic to Sicily (Bazan et al., 2019).

Figure 4. The agricultural landscape of the Castro/Giardinello valley.

These ecological characteristics of the study area particularly rich in freshwater springs offer optimal conditions for agricultural and sylvo-pastoral activities and, hence, for historical human settlement. Like a typical Mediterranean countryside, this rural area has a long settlement occupation, spanning from Prehistory to the Medieval period.

The case study area in the Corleone area of central-western Sicily has a long tradition of settlements, such as the renowned site of Montagna Vecchia (D'Angelo and Spatafora 1995), together with the 30 settlements spanning from Prehistory to the Medieval period (Spatafora 1997).

Within this huge district, an area was almost pristine from an archaeological point of view, and the only known archaeological site was a small, allegedly prehistoric settlement located on the southern slopes of Rocche di Castro. The Alto Belice Corleonese district probably acted as a hinge between the southern and northern coasts of Sicily. It is likely that a network of roads between Palermo and Agrigento had already been established in the Roman period (the road *Panormus-Agrigentum* of the imperial cursus publicus), as became apparent in the Medieval period (Verbrugghe, 1976; Uggeri 2001).

The first historical mention of the area dates to the Middle Ages is about the toponym Barraù or Barracù is cited in the Jarida (Sicilian medieval land register) of Monreale dating to AD 1182. This toponym shows a clear Arabic origin, with a possible derivation from a probable former Greek toponym: Rā's Bū al-rakhū, latinised into *caput Burrachu* (Nef 2011).

A Latin parchment (5 October 1428) of the *Tabularium* of the monastery of Santa Maria del Bosco di Calatamauro (owner of the area at least since the end of the fourteenth century) mentions a forest covering Mount Barraù that still remain on the southern slopes of the mountain (Arcadipane et al., 1991).

LANDSCAPE CHANGE FROM 50S TO PRESENT-DAY

The first approach to understanding the landscape formation processes was the analysis of changes in land use and vegetation. The analysis on land-use changes consisted of comparing two temporal frames, 1950s and the present day, for which we had different data availability and quality (Bazan et al., 2019). The land-use change of this inland area of Sicani Mountains was evaluated by comparing the area of different EUNIS habitats and its degree of transformation across the two periods. The land-use maps were combined through GIS overlay analysis to obtain a comparison matrix for quantifying the extent of changes between the different types of vegetation (classified as EUNIS habitats).

The current forest cover shows an increase compared to that observed in 1955 (Figures 5-6). In particular, between 1955 and 2016, the "Southern Italian holm-oak forest" habitat increased from 0.6% of the total surface area to 2.6%, with a growth rate of 310.6%. Existing oak forests are derived from a vegetation succession process that has affected shrubs for 42.07% and formations of *Ampelodesmos mauritanicus* for 30.8%. The same trend, though to a lesser degree, has affected the "Italo-Sicilian *Quercus pubescens* woods" habitat which, in 1955, covered 1.1% of the total surface area and 1.5% in 2016 (a growth rate of 34.3%). Of the current surface area, only 36.73% was previously woods, while 31.36% derives from the colonisation of uncultivated land (prairie) and 23.96% from abandoned cultivated farmland. Among the wooded areas, the maximum increase was recorded in the non-riverine *Ulmus* woodland habitat, passing from 0.1% in 1955 to 3.9% in 2016 (growth rate of 3981%), repopulating areas that were 81.39% covered by grasslands. The secondary formations of Thermo-Mediterranean brush, thickets and heath-garrigues have also experienced increases, rising from 4.3% of the study area in 1955 to 6% in 2016 (growth rate of 39%). There are frequent cases of shrubs that extend into areas previously characterised by grasslands for 47.48% and farmland for 28.11%. The increase of woody formations (woods and shrubs) has occurred at the expense of grassland pastures which have decreased: in 1955, Mediterranean xeric grassland covered 9.6% of the total surface area and 5.2% in 2016 (an 45.6% decrease); in 1955, *Ampelodesmos mauritanicus*-dominated garrigues covered 13.4% of the total area and 11.9% in 2016 (a 10.7% decrease). The current grasslands, in some cases, have reoccupied previously cultivated areas, Mediterranean xeric grassland for 27.02% and Mediterranean-montane grassland for 19.6%, a situation different from the habitat of *Ampelodesmos mauritanicus*-dominated garrigues which, in large part, have not undergone changes (81.53%), and only 0.82% have developed in areas which were cultivated in 1955. This trend demonstrates that the grasslands (Mediterranean xeric grassland and Mediterranean-montane grassland) which today are growing in the downy oak series are attributable to the abandonment of cultivated areas, while the *Ampelodesmos mauritanicus* grasslands of the holm oak woods series have maintained their own status as pastures. The extension of cultivated areas mainly planted with wheat, vineyards and olive groves–has declined in the period between 1955 (42.6%) and 2016 (35.5%), with a relative decrease of 20.2%. Furthermore, the magnitude of land-use change was detected as variation of naturalness degree assessed through the distance between actual vegetation and Potential Natural Vegetation (Baiamonte et al., 2015). Both maps (1955 and 2016) were reclassified in five classes of naturalness corresponding to five physiognomic stages of vegetation series (ruderal association, crop-weed association, herbaceous association, shrubby association, woody association). A value from 1 (minimum naturalness) to 5 (maximum naturalness) has been assigned to each naturalness class. Then, the difference of naturalness values between 1955 and 2016 for each feature was calculated (see Fig. 7 in Bazan et al., 2019). In this way, it was possible to identify the areas in which the most intense changes occurred between in two time ranges (Bazan et al., 2019).

The phenomenon of abandonment and reduction of agricultural areas can be connected to the socio-economic and demographic dynamics which characterized Sicily, and all of southern Italy, between the post- World War II years and the 1970s which caused, on the one hand, the migration of rural Sicilian populations toward urban centers and other more economically developed places (northern Italy, Northern Europe and America), and, on the other hand, a reduction in the number of workers employed in agriculture due to employment in other economic sectors (industrial and service) (Galeotti, 1971).

LAND SUITABILITY, POTENTIAL VEGETATION AND SETTLEMENT PATTERNS

The Harvesting Memories Project archaeological field surveys has confirmed the long human occupation of this area testified by the identification of sites dating from the Protohistoric to the Medieval to the Modern period (Castrorao Barba et al., 2016; 2017; 2018a). In particular, we identified and delimited 12 areas (Figure 7) of pottery concentration (Sites: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12 and 16) and nine areas with architectural remains of the activities of shepherds during the pre-industrial time (Sites: 10, 13, 14, 15, 18, 19, 20, 23, 24) such as enclosures made of dry limestone walls with rubble filling, so called *mannare*, and some circular shepherd shelters (*pagghiari*) built with a dry-stone foundation for a roof made of perishable materials such as wood, earth and straw. Late Modern and Early Contemporary agricultural buildings (Sites: 17, 21, 22, 25) was also identified (Figure 8).

The long anthropic occupation of the area is also related to the exploitation of the natural resources. The spatial distribution of the potential vegetation allows us to hypothesize the different land use vocations. In particular, the distribution of the downy oak vegetation series covers the areas most suitable for agricultural exploitation, while the holm oak series area characterizes the areas most suitable for sylvo-pastoral practices (Bazan et al., 2019; 2020a).

Thus, we utilized a GIS procedure (Rotolo 2016; Becker et al., 2017) as a method to estimate the area walkable in half an hour and one hour around each site, by creating a cost surface based on Tobler's Hiking Function (Tobler, 1993).

For the most part, the catchment areas of the sites from the northwestern area of the study cover the zones linked to the *Oleo oleaster-Querco virgilianae* sigmetum/*Sorbo tormi-*

nalis-Querco virgilianae sigmetum, with very high average values of 91.5% (30 min) - 90.5% (1 h) for the protohistoric sites, 94.4% (30 min) - 90% (1 h) for the medieval sites, and 96.7% (30 min) - 91.2% (1 h) for the modern sites. medieval sites and 2.9% (30 min) - 8.5% (1 h) for the modern sites.

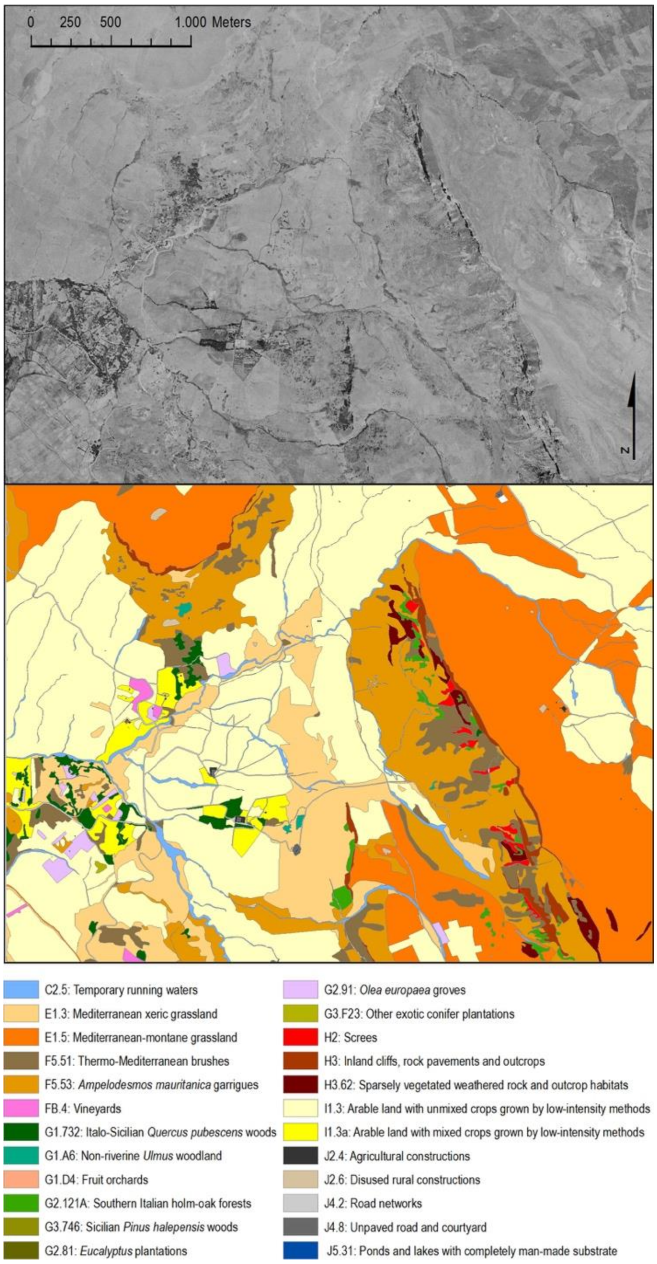

Figure 5. Aerial photo (Italian Geographic Military Institute 1955) and Land-use classification maps of study area in 1955.

On the contrary, the *Ampelodesmo mauritanici-Querco ilicis* sigmetum has catchment areas with very low average values: 8.1% (30 min) - 9.5% (1 h) for the protohistoric sites, 5.1% (30 min) - 10% (1 h) for the medieval sites and 2.9% (30 min) - 8.5% (1 h) for the modern sites.

The tendency is rather different in the catchment areas of the sites related to shepherding activity (*mannare* and *pagghiari*), located in the southern and eastern areas of the study (Figure 8). At these sites, although the *Oleo oleaster-Querco virgilianae* sigmetum/*Sorbo torminalis-Querco virgilianae* sigmatum are predominant, they occupy a smaller portion of the catchment areas for an average value of 79.7% (30 min) - 74.9% (1 h), with higher average values (20%, 30 min - 24.7%, 1 h) for the surfaces covered by the *Ampelodesmo mauritanici-Querco ilicis* sigmetum series.

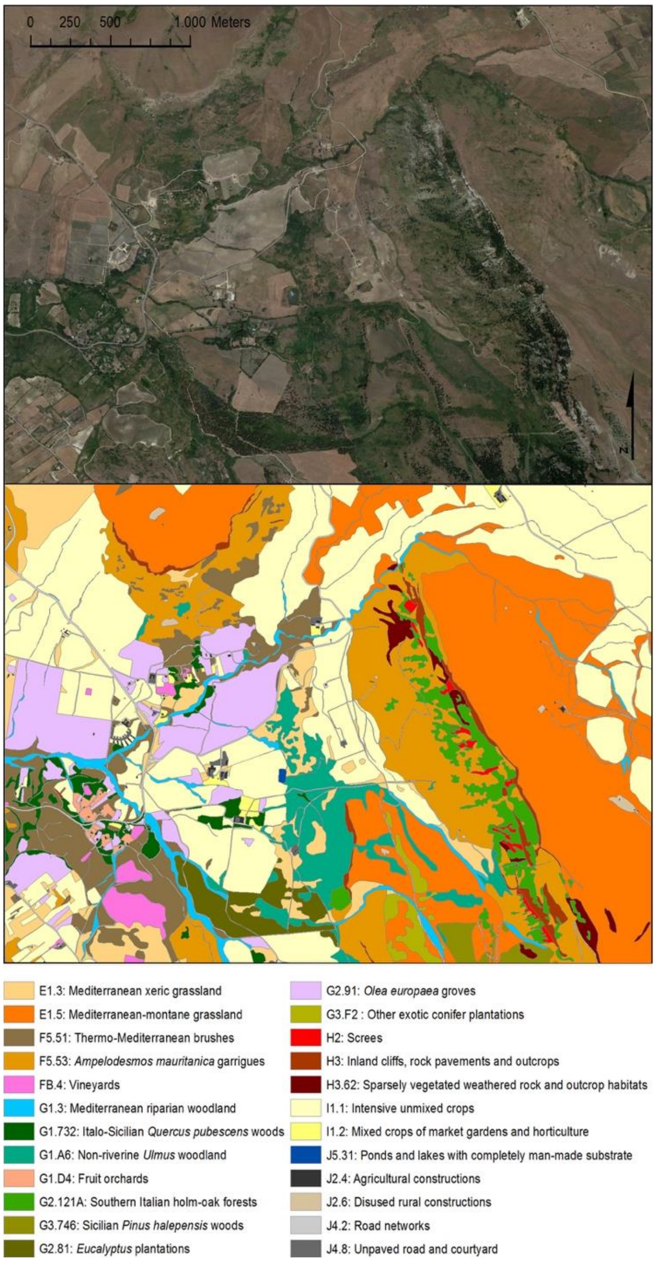

Figure 6. Google Earth satellite image and Land-use classification maps of study area in 2016.

The only exceptions are site 10 (*mannara*) in the northern part of the area, with a catchment area averaging 94.7% (30 min) - 89.9% (1 h) for the *Oleo oleaster-Querco virgilianae* sigmetum, and the site from the classical epoch (6th-5th century BC), located on the plateau of a small hill in the southeast, whose catchment area includes a slightly lower percentage of the *Oleo oleaster-Querco virgilianae* sigmetum (73.5%, 30 min - 71.7%, 1 h) compared to that observed for the other sites with settlements.

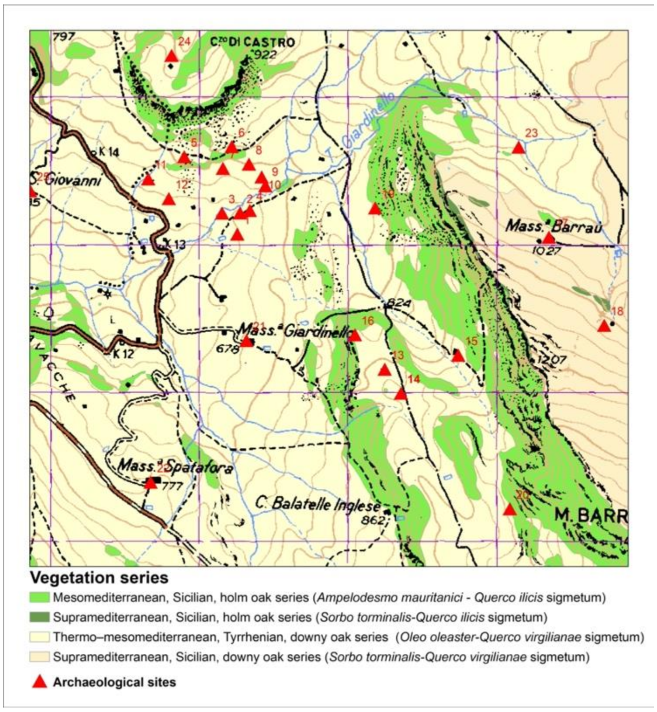

Figure 7. Archaeological sites and vegetation series in the case study area of Corleone on topographic base map by the Italian Geographic Military Institute (aut. n. 4848 27/07/1998).

Figure 8. A) Remains of dry-stone shepherd shelters, known as *pagghiari*, with a circular shape. B) Detail of the rectangular room of a large sheepfold; on the back the circular base of a small tower of the mannara. C) Traditional pens – *mannare* – for sheltering animals. This type of structure presents a layout of several enclosures made from dry stonework bases with brambles or spiny branches of gorse or blackthorn placed on top (photos by the authors).

This close relationship between vegetation series and an area's potential suitability for agricultural or grazing is an element that also allows us to read those phenomena in which these linkages have produced opposite situations, such as the previously described example of terracing, or of an oak forest being conserved around fully cultivated areas, which may indicate the persistence of particular constraints (i.e. public property or community use rights) which, over time, prevented its complete deforestation.

The mutual interaction between human settlements and vegetation series finds a corresponding representation in the spatial localization of 1-hour walking catchment areas for different types of sites. The sites oriented mostly towards agriculture are located in the core of the downy oak series, and the places related to transhumant and pastoral practices reveal a closer proximity to the holm oak series. Furthermore, the half-hour walkable catchment areas are almost completely within the space covered by the downy oak series, and only in the 1-hour zones have some parts arrived at the holm oak series. These relationships fit well with Bintliff's hypothesis (Bintliff, 1999) about the dimensions of site catchment areas in the Mediterranean countryside, where the daily access time for reaching the fields for ploughing is estimated at half an hour of walking, and the time for reaching cattle/sheep pastures or exploiting forest resources is estimated at one hour. Moreover, in this perspective, the role of the downy oak series in the formation of agricultural landscapes and of the holm oak series for sylvo-pastoral and forest landscapes is emphasized (Bazan et al., 2020b; Romano et al., 2021).

PHYTOSOCIOLOGICAL AND ARCHAEOBOTANICAL APPROACHES FOR UNDERSTANDING THE HISTORICAL SUSTAINABILITY

The improvement of the temporal depth in the analysis of landscape dynamics is possible through a Historical Ecology approach that integrates historical and archaeological data with ecological information (Szabó, 2015) and specifically – in this "vegetation series perspective" – with the dynamic–catenal phytosociology (Rivas-Martínez, 2005).

This multidisciplinary perspective makes it possible to study the interaction between human societies and biophysical environments while also considering long-term dynamics. The reconstruction of past landscape dynamics and the impact of agricultural, pastoral and forestry practices on vegetation during the long term can be significantly improved by archaeobotanical data (David and Thomas, 2008).

The aim of Harvesting Memories Project approach is to detect the relationship between the geobotanical characteristics of the landscape (phytosociological analysis of current vegetation dynamics) and the effective historical use of wood resources in order to understand the long-term suitability and sustainability of the historical landscape.

The analysis of the anthracological finds recorded in the early medieval phases (Phase 1, late 8th-9th century AD; and Phase 2, 10th-11th century AD) of the Contrada Castro settlement allowed to identify the wood species used within the site and therefore present in the surrounding territory (Table 1).

The intersection between the frequency data of the archaeobotanical record and the phytosociological analysis of current vegetation – in terms of vegetation series – have firstly confirmed the maintenance of the same plant communities over the last millennium (Table 1).

Table 1. Mean values of Braun-Blanquet's cover data of taxa for current vegetation and frequency of archaeobotanical findings (A-Qi = *Ampelodesmo mauritanici-Quercetum ilicis*; S-Qi = *Sorbo torminalis-Quercetum ilicis*; O-Qv = *Oleo oleaster-Quercetum virgilianae*; S-Qv = *Sorbo torminalis-Quercetum virgilianae*; E-Ps = *Euphorbio characiae-Prunetum spinosae*; R-Ps = *Roso siculae-Prunetum spinosae*; R-Ru = *Roso corymbiferae-Rubetum ulmifolii*; Cl = *Crataegetum laciniatae*; Sa-p = *Ulmo-Salicetum pedicellatae*).

	Current vegetation sampling									**Archaeobot. findings**	
Taxa	**A-Qi**	**E-Ps**	**S-Qi**	**R-Ps**	**O-Qv**	**R-Ru**	**S-Qv**	**Cl**	**Sa-p**	**Phase1**	**Phase2**
Quercus ilex	77,58	0,62	73,66		0,62		4,85			55,00	62,25
Emerus major subsp. *emeroides*	1,47	0,74			16,41						
Lonicera implexa	2,39		0,64								
Viburnum tinus	19,43						0,74				
Arbutus unedo	5,20		0,62								
Acer campestre			5,09	0,74			0,66	33,98			3,82
Daphne laureola	0,74	0,62	0,62	14,35		6,84	4,26	11,58			
Quercus virgiliana	6,20		6,60		73,72		70,79		0,66	6,00	
Sorbus torminalis			6,43				5,30			3,00	
Asparagus acutifolius	1,88	6,44	1,40	0,74	0,66	7,35	0,66	0,62			
Smilax aspera	7,95	25,15	2,61		4,78	0,54	0,66	0,49	0,49		
Rubia peregrina subsp. *longifolia*	0,62	0,60	0,52		0,62	3,31	2,03				
Fraxinus ornus	7,69		5,20	0,74	0,74		0,74			1,00	
Osyris alba	4,85	2,03	0,49		3,48				0,62		
Pistacia terebinthus	2,44									10,00	1,61
Rosa sempervirens	0,59	2,67	0,66		0,49	0,49	2,73		0,59		
Pistacia lentiscus	0,67										
Lonicera etrusca	0,54	10,19	1,14	0,74	0,62	0,70	1,98	0,62			
Cistus creticus subsp. *creticus*	0,49		0,64		3,39		0,49				
Chamaerops humilis	0,64										
Daphne gnidium	0,74										
Myrtus communis	0,74										
Calicotome infesta subsp. *infesta*					0,74						
Quercus amplifolia							0,74				
Euphorbia characias	1,37	7,33	0,53						0,55		
Prunus spinosa	0,59	71,84	0,62	74,19	0,49	3,09	0,66	4,78	0,49	1,00	1,69
Rosa sicula				9,60			0,62	3,92			
Rosa glutinosa				0,74				0,62			
Rubus ulmifolius	0,53	5,52	0,62	0,74	2,73	44,69	3,48	0,74			
Crataegus monogyna	1,11	1,44	0,58		0,49	31,32	4,02	6,13	3,10		
Rosa corymbifera		3,09	0,49			0,62		0,74	0,49		
Crataegus laciniata				4,85		0,49		47,46			
Rosa canina	1,44	15,50	2,23	2,79	3,48	5,87	0,74	4,72	1,94		
Pyrus spinosa		0,71				4,26		14,91			
Hedera helix subsp. *helix*	2,75	7,56	4,59	0,74	4,85	2,98	7,54	12,30	3,01		
Rosa micrantha						0,74					
Rosa balsamica						0,49					
Clematis vitalba	1,17	0,62	3,44	0,74	0,74		0,49	0,74	0,67		
Rhamnus alaternus		0,74								5,00	1,69
Ulmus minor		0,74	8,95						0,68	5,00	5,96
Rubus canescens			0,62	0,74			0,62	4,72			
Salix pedicellata									49,98		
Salix alba subsp. *alba*									16,98		
Populus nigra									5,43	6,00	0,72
Fraxinus angustifolia									2,38		
Nerium oleander									2,79		
Salix purpurea subsp. *lambertiana*									0,66		
Salix alba subsp. *vitellina*									0,66		
Popolus alba									0,86		
Tamarix africana									0,62		
Sambucus nigra									0,49		
Sorbus domestica			9,89		8,95						
Erica multiflora subsp. *multiflora*	3,37		0,74								
Malus sylvestris				0,74			0,74				
Euonymus europaeus							0,74				
Cytisus villosus							0,74				
Crataegus germanica							0,49				
Sorbus graeca							8,95				
Rhus coriaria					0,74						
Anagyris foetida		0,74									7,28
Artemisia arborescens											
Crataegus laevigata		0,74									
Ostrya carpinifolia							26,09				

In fact, the identified species in the anthracological sample have shown a coherent fitting with the data of current vegetation. Wood charcoal assemblage is not “anomalous”, because all the species identified are present today in the case study area.

Furthermore, the correlation of the archaeobotanical data with the plant associations and the related series have provided ecological and environmental information. This consistency between the occurrences in the archaeobotanical record and the vegetational pattern is linked to the fact that, over the last millennium, no radical changes occurred, and so the ecological patterns of the vegetation series have not changed. In fact, this ecological pattern is determined by environmental or abiotic factors (e.g., climate, lithology, landforms) that change only over a long period of time which is measurable on the scale of geological eras (Klijn and de Haes 1994). This long continuity in the vegetation pattern is also highlighted by the presence, as dominant species in these forest formations, of oaks, which are secular trees as regards their own physiology, as testified by the widespread presence in the Sicani mountains of numerous enormous individuals with biological cycles of 400–500 years (Schicchi and Raimondo, 2007; Schicchi et al., 2021). The archaeobotanical record has indicated an exclusive use of wood (as building materials or fuel) from the spontaneous plants specific to the natural vegetation of this area, especially evergreen oaks; no wood charcoals undoubtedly connected to cultivated tree plants have been found at the current stage of the investigation. Furthermore, according to the preliminary study of the seeds, the presence of fruits from fruit trees was not identified, apart from a single grape seed.

The high frequency of rose tree family, which are typical of the secondary aspects of the forest is an indicator both of human activities of wood cutting and the use of this species for combustible material for kilns and hearths, as identified in the archaeological excavation.

The low percentage of wood elements attributable to the Downy Oak series indicates the scarce use of this type of wood resource, which is probably due to the fact that the Downy Oak area was intensely deforested in order to make way for arable lands. The agricultural exploitation was also documented by the discovery of charred seeds – still under study – which are similar, as can be seen from the medieval layers of Contrada Castro to varieties of cereals and legumes connected precisely to the cultivation of the surrounding territory.

CONCLUSIVE REMARKS

The Harvesting Memories Project is based on the awareness that only a holistic and interdisciplinary approach can make it possible to address the complex issues of the ecological and historical trajectories of a Mediterranean landscape. In this project, interdisciplinarity was not just a label but it inspired from the very beginning the philosophy of the project carried out by researchers with different academic backgrounds (scientific and humanistic) who exchanged and intertwined their skills to propose new applications to read and understand landscape dynamics. An important element that has emerged is the enormous potentiality of the study of vegetation dynamics closely connected with the processes of change influenced by human activities in a given territory across the time. The vegetation, therefore, represented an element for reading the landscape biography in relationship with the historical settlement patterns and the archaeobotanical data. The overcoming of archaeology as a site-centric discipline but addressed in a landscape and environmental scale – or if we want also at an historical ecology scale – is a further inspiring principle of the Harvesting Memories Project. The holistic and historical vision of landscape ecology, however, is not only an interesting research perspective as an end in itself, but is indeed a crucial starting point for addressing and promoting virtuous practices of sustainable development of biocultural heritage.

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AUTHOR CONTRIBUTIONS

Angelo Castrorao Barba and Giuseppe Bazan were involved in the conceptualization of the study; Angelo Castrorao Barba and Giuseppe Bazan formulated the methodology used in this study (landscape and GIS analysis); Claudia Speciale contributed to the archaeobotanical analysis; Angelo Castrorao Barba, Roberto Miccichè, Filippo Pisciotta and Carla Aleo Nero performed archaeological investigations; Giuseppe Bazan and Pasquale Marino performed botanical studies; Angelo Castrorao Barba and Giuseppe Bazan contributed to writing: review and editing; Giuseppe Bazan was the project coordinator; and Pasquale Marino was responsible for funding acquisition. All authors have read and agreed to the published version of the manuscript.

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