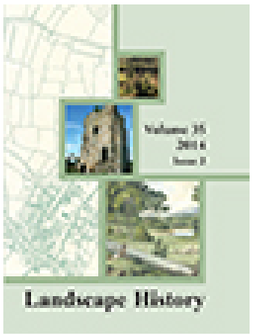

Landscape History

ISSN: 0143-3768 (Print) 2160-2506 (Online) Journal homepage: http://www.tandfonline.com/loi/rlsh20

The Halaesa landscape (III B.C.) as ancient example of the complex and bio-diverse traditional Mediterranean polycultural landscape

Giuseppe Barbera & Sebastiano Cullotta

To cite this article: Giuseppe Barbera & Sebastiano Cullotta (2014) The Halaesa landscape (III B.C.) as ancient example of the complex and bio-diverse traditional Mediterranean polycultural landscape, Landscape History, 35:2, 53-66, DOI: 10.1080/01433768.2014.981395

To link to this article: http://dx.doi.org/10.1080/01433768.2014.981395

The *Halaesa* landscape (III B.C.) as ancient example of the complex and bio-diverse traditional Mediterranean polycultural landscape

Giuseppe Barbera and Sebastiano Cullotta

ABSTRACT

Southern Europe and the whole Mediterranean area are distinguished by landscape types whose characters result from countless, long and complex cultural and historical processes that developed in an equally complex and varied environment. The Mediterranean rural landscape would keep these same distinctive characteristics until the crisis of the mixed crops, and the phenomena of urbanisation in the1960s/70s.

*This paper identifies the characteristics of the Mediterranean polycultural and polyspecific (*coltura promiscua*) landscape, characterised by the presence of trees (both wild and cultivated), starting from a historical overview of the central Mediterranean. The analysed case-study of the Halaesa landscape (Sicily), as one of the first historical detailed descriptions of a complex Mediterranean cultural landscape, is the result of a polycultural agro-silvo-pastoral system which guarantees complexity and richness (in terms of structural and biological diversity), as well as with reference to others environmental, cultural and economic multi-functionality. The analysis of these polycultural landscapes reveals a rich spatial configuration and the patchiness of the land mosaic. The presence of historical features, of traditional crops and land use, of traditional land management, and the conservation of the rural architecture and other material cultural heritage related to agricultural activity, as well as the non-material cultural heritage, are particularly important aspects considered by international and European organisations towards their valorisation and conservation. The pressure on these landscapes and their rapid transformation into more modern forms call out for a better knowledge of the more complex forms of traditional land use and their relative rural landscapes.*

KEYWORDS

Cultural landscape, environmental history, landscape pattern, land use, agro-silvo-pastoral systems, material and non-material heritage, Sicily

INTRODUCTION

The different regions of the Mediterranean Basin show a high degree of both physical and climatic unity, despite the landscape's diversification by mountains, plateaus, and plains, especially the coast. This environmental and ecological diversity is also the consequence of the intersection of three different continents, and hence of their genetically different flora and fauna as well as their different civilisations (*e.g.* Braudel 1986; Grove & Rackham 2002; Blondel 2006). A complex 'co-evolution' has shaped the interactions between natural ecosystems and the constantly evolving human land-use practices, resulting in a mosaic of traditional landscapes which conserve many of the biological and cultural characteristics of those from the past.

These agricultural and forestry practices gradually led to complex and heterogeneous agro-silvo-

DOI: 10.1080/01433768.2014.981395

pastoral rural patterns typified by a fine-grained mosaic pattern of land use (Sirami *et al.* 2010; Cullotta & Barbera 2011). This mosaic was made up of relatively small patches and corridors, and had a great species and interspecies diversity as a consequence of the cyclical disturbances introduced by rotational grazing, cutting and coppice regimes, and fire management, as well as of cultivation and other human land-use practices (Naveh 1995). The traditional agricultural and forestry practices together are considered today in defining the agroforestry systems (Nair 1991), as the deliberate growing of woody perennials on the same area and at the same time as agricultural crops and/or fodder plants (Nair 1993). So, these systems often show different spatial and temporal combinations of land use that can be classified as: silvo-pastoral, agro-pastoral, agro-silvicultural, agro-silvo-pastoral (Nair 1993; Nerlich *et al.* 2013).

The cultivation of arable land, olive groves, vineyards, mixed crops and fruit orchards, and other multi-functional agricultural and agro-forestry systems are among the most important examples of traditional farming in the Mediterranean. Moreover, the conventional subdivision of properties into small units (especially in peri-urban areas), due to the long intervals in ownership succession and property transfers, has further augmented this structural heterogeneity, thus influencing the contemporary cultural practices regarding rural landscapes (Horden & Purcell 2000, pp. 175–230). The physical expression of land division and property ownership is visually reinforced by the presence of stone walls and other artefacts or features such as terraces, hedgerows, canals, stone heaps, etc. (Grove & Rackham 2002; Brown *et al.* 2007; Petanidou *et al.* 2008; Barbera & Cullotta 2012).

Traditional agro-silvo-pastoral Mediterranean landscapes, particularly those characterised by the presence of trees, both as strictly agricultural crops as well as in woodlands or as isolated trees, have maintained some defining characteristics regarding their composition, structure, and function during the course of their slow evolution (Antrop 1997; Vos & Meekes 1999). These features are particularly expressed in those landscapes that are characterised by complex agricultural forms, mixed agro-forestry systems and landscapes that are capable of generating and guaranteeing an articulated environmental as well as economic, cultural and social multi-functionality (Pinto-Correia & Vos 2004; Jose 2009; Jones-Walters 2008; Mascari *et al.* 2009).

Considering these more complex forms in which the tree holds a central role, a better delineation and characterisation of the role of the polyculture (literally mixed cultivation, '*coltura promiscua*') in the traditional landscape certainly seems useful or necessary. This definition is so often generically associated with the countless different systems and agricultural and agro-forestry landscape configurations that have been produced by the complex and intricate historic processes that have led to their cultural definition and evolution.

This paper traces the historic milestones of agricultural processes that have characterised these complex agricultural systems and landscapes of the Mediterranean basin in order to better define:

(i) the concept of a traditional rural Mediterranean landscape, with particular reference to that including fruit and non-fruit (wild) trees;
(ii) the concept and importance of the mixed and complex forms of agro-forestry systems and landscapes (*coltura promiscua*, *giardino Mediterraneo*) by following the historic development of this landscape, beginning with a historic description of the territory of Sicily (central Mediterranean), in which all of the most important defining features of this complex polycultural landscape come together;
(iii) their most important structural characters, configuration and elements at the landscape and stand-system level, because of its environmental complexity, multi-functionality and cultural heritage.

THE ANCIENT MEDITERRANEAN RURAL LANDSCAPE: THE HALAESA LANDSCAPE

MILESTONES OF THE PRE-CLASSICAL AND CLASSICAL TIME

The first significant impact made by humans on forests and other natural ecosystems in the Mediterranean took place before the Neolithic revolution (Terral 2000), when permanent settlements were established. Forest management through wood-cutting and coppicing, controlled burning, plant domestication, livestock husbandry, grazing and browsing, as well as through water management and terracing, has been the main tool for producing intermediate disturbance regimes for millennia (Zohary & Hopf 1993; Blondel 2006).

During its slow evolution over the millennia, the Mediterranean agricultural landscape characterised by the presence of trees, both wild and cultivated, maintained some of its initial properties from the foundation of its unique tradition:

- its peri-urban (just outside a village, or city) closed and protected location;
- its polycultural and polyspecific (mixed-crop/garden) make-up, its irrigation;
- its multi-functional character, its close relationship to culture; and
- its continuous use as a source of material and non-material heritage.

We know that a peri-urban landscape made up of cultivated fields and fruit orchards alternating with wooded areas (from Shay *et al.* 1991, cited in Blondel & Aronson 1999), such as those that can still be seen today in the various parts of the Mediterranean from the Iberian peninsula and southern France in the west (Pinto-Correia & Vos 2004; Sirami *et al.* 2010) all the way to the far eastern regions (Braudel 1986; Kizos & Koulouri 2006), was already present in the ancient polycultural landscape located in the peri-urban areas of the island of Crete during the 4th–3rd millennium A.D. This fragmented landscape is both temporally and spatially heterogeneous because of its environmental, climatic, and topographic variability and its interactions with various historic events and cultures (Naveh 1995; Pinto-Correia & Vos 2004; Blondel 2006). These interwoven seminatural and cultivated landscapes have been the cradle of man's relationship with nature for thousands of years and are real biodiversity hotspots due to their exceptional number of endemic and cultivated species. The three main crops — grapes, olives and grains (*e.g.* Terral 2000) —, are those which Braudel defined as the 'trinity born from the union between climate and history' (1986, Vol. 1, p. 242) — however, in general, there is a great diversity of crops which has determined the area's food security and ecological stability over the centuries (Loumou & Giourga 2003).

This diversity in the Mediterranean was created by history (with the main contributions being, in brief, the pre-Classical and Classical introduction of Asiatic species, the Islamic 'agricultural revolution', the introduction of American species and finally the introduction of the species that arrived via the activities of plant collectors and European scientific institutions) and by the Mediterranean's heterogeneous environmental characteristics. However, the Mediterranean landscape was unified by a climate perfectly adapted to wild and cultivated tree and shrub species (Bevilacqua 1996).

The most famous garden of the Mediterranean landscape tradition from the classical age is that of Alcino, in the Odyssey:

> Outside the gate of the outer court there is a large garden of about four acres with a wall all round it. It is full of beautiful trees — pears, pomegranates, and the most delicious apples. There are luscious figs also, and olives in full growth ... Pear grows on pear, apple on apple, and fig on fig, and so also with the grapes, for there is an excellent vineyard ... In the furthest part of the ground there are beautifully arranged beds of flowers that are in bloom all the year round. Two streams go through it, the one turned in ducts throughout the whole garden, while the other is carried under the ground of the outer court to the house itself, and the town's people draw water from it (Homer, trans. Butler 1900).

Another Homeric garden is that of Laertes, Odysseus's father — a 'great orchard' (*ibid.*) surrounded by a dry stone wall.

For example, in the Italian landscape (which is very representative of the entire Mediterranean area's geography, environmental variability and history), the presence of fruit trees is generally celebrated with authoritative testimonies by the geoponic Latin writers: Columella, Pliny the Elder and Terrenzius Varro. In *Rerum Rusticarum,* Varro symbolically asks: 'Is not Italy so covered with fruit trees that it seems one vast orchard?' (Varro, trans. Fairfax 1918, p. 59). Fruit trees can be effectively identified as the most distinctive trait showing environmental diversity as well as the complex course of human history so clearly legible in the traditional Mediterranean landscapes.

The Greek model — an enclosed polyspecific garden, with a regular planting distance between trees — is also found in the Roman landscape in the form of small fruit and vegetable gardens (*hortuli*), which surround the city where temporary dwellings (*tabernae*) house worshippers of the sacred Lares (Grimal 2000). The economic and territorial growth of the Roman Empire led to the adoption of Oriental paradise garden models, containing both useful and ornamental species and a strong architectural and monumental component that would mark the style of the Renaissance as well as the later Neoclassical gardens in future centuries.

The mixed fruit crops of the *hortuli* would be the hallmark of what would be the Italian agricultural landscape *par excellence*, that of the *coltura promiscua* which combines trees with grains, combining permanent crops with temporary herbaceous crops and natural patches (forest, woodlot, Mediterranean maquis, etc.), and occurring in a variety of forms. One of the most complex, for example, being the *alberata* (Desplanques 1959) in central Italy, a mixed-cultivation system that trains grapevines on living trees (Agnoletti 2013). In southern Italy, extraordinary examples of *coltura promiscua* which still survive are the terraced almond orchards of Gargano (Apulia) and the carob orchards of the province of Ragusa (south-east Sicily).

According to Sereni (1961), in typically Mediterranean regions, such as Sicily and southern Italy, the origins of the Mediterranean cultivated fruit trees can be found in the Classical period, with the colonisation of Magna Graecia, as much as in the subsequent Arabic colonisation (between the ninth and twelfth centuries), and enriched in the following centuries.

For example, in Sicily, the Caliphates (IX–XI century) and the Norman kings (XI–XIII) adopted Islamic landscape character styles and agricultural systems as privileged sites for the introduction of new species and techniques. *Citrus sp.* would begin to spread throughout the peri-urban lands, gardens and parks of the Mediterranean, increasing the species biodiversity as well as the Mediterranean land-mosaic (Barbera 2000). Once more, the polyspecific and polycultural Mediterranean landscape would increase its biodiversity again when new species were brought in by the discovery of the American continent. One of the most important new species for its effect on the composition and function of the traditional complex Mediterranean landscape would be the cactus pear (Barbera *et al.* 1992).

This shows how multi-temporal and complex the evolutionary process that shaped the Mediterranean agricultural and agro-forestry landscape was.

AN ANCIENT CASE-STUDY: THE *HALAESA* RURAL LANDSCAPE DESCRIPTION

For the first time in landscape literature, Sereni (1961) retraces the elements of such mixed and complex forms of agro-forestry systems and landscapes, named *giardino Mediterraneo*, starting with the forms and functional characteristics found in the *Tavola di Alesa* (literally: Stele of *Alesa*) (Fig. 1), a Greek colony founded in 403 B.C., and the plan based on it drawn by Sicca (1924) which provides schematic information on the land use and landscape structure of the city of *Halaesa* (Fig. 2a) (near the present Tusa) on the Tyrrhenian coast of Sicily (Barbera & Cullotta 2014), between the second half of III to I A.D., during the establishment of Roman rule

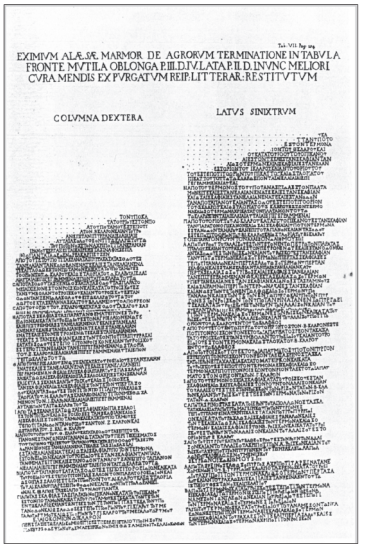

Fig. 1. The '*Tavola di Halaesa*' (Stele of Halaesa) that describes the Greek colony founded in 403 B.C., N-Sicily.

and following a probable redistribution of land. A reconstruction similar to that one, although more lean but with the same elements, can be seen in the two drawings made by Arangio Ruiz & Olivieri in 1925 (Fig. 2b), which graphically portray the information found on both of the columns of the marble epigraph (in total three marbles discovered in different moments: 1558, 1885 and 1958; the first citation by Fazello 1558) published by Torremuzza in 1753 (Burgio 2008). The text and drawings allow a first reading of the area, but to arrive at its more precise definition, in as much as it is a cultural landscape derived from an encounter between natural characteristics, human history and perception, the reading by Belvedere (2008, pp. 1–10) of the epigraph based on the historical and archaeological findings, and literary references to the area is fundamental.

From this multi-disciplinary reading, and analysing in detail the information reported in the two columns (*columna dextera* and *latus sinixtrum*) of the marble epigraph (see Fig. 1), the territory

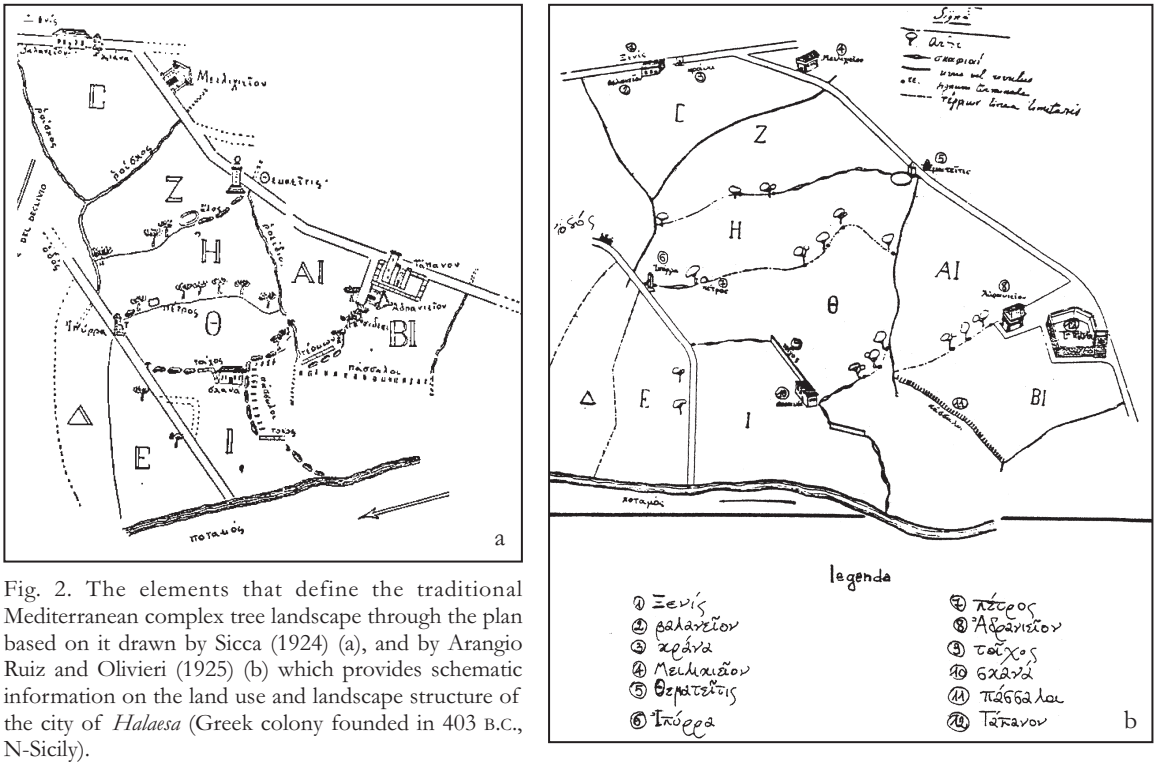

Fig. 2. The elements that define the traditional Mediterranean complex tree landscape through the plan based on it drawn by Sicca (1924) (a), and by Arangio Ruiz and Olivieri (1925) (b) which provides schematic information on the land use and landscape structure of the city of *Halaesa* (Greek colony founded in 403 B.C., N-Sicily).

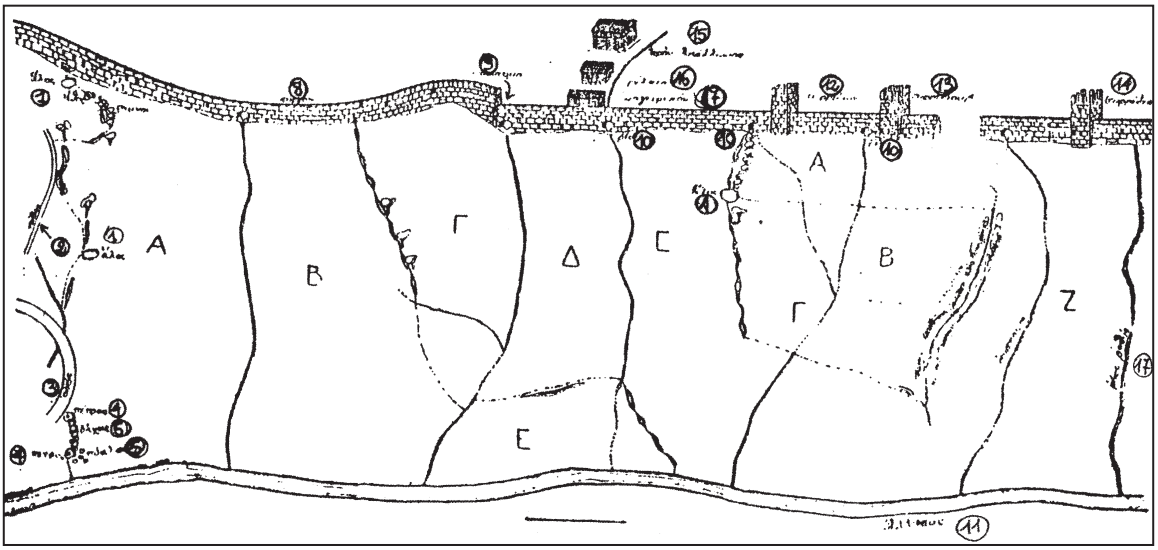

Fig. 3. Landscape characters of the sub-urban slopes located between the city walls (top) and the today 'Tusa' river (lower). Plan based on the *Alesa* marble epigraph information, drawn by Arangio Ruiz & Olivieri (1925).

in question is defined by what appears to be a highly fragmented and heterogeneous agro-silvo-pastoral land-use mosaic pattern.

It is located in a suburban area, as is demonstrated by its proximity to the city walls, and is situated on the slopes interrupted by plateaus next to the river and stream beds (Fig. 3). These, along with the springs present, constitute a dense hydrographical network which also involves aqueducts formed by clay channels and pipes as well as drains which come out from the walls. The fragmented nature of the mosaic is also determined by the network of various-sized roads (Fig. 2) — at least two connecting routes between the coast, the city and the interior as well as side roads and private unpaved pathways. These access ways link the sacred areas and important buildings together with some rural constructions presumably used for housing agricultural products or gear. Farmyards (for threshing too) are also present. The main crop grown is the olive, as shown by the frequent presence of cultivated specimens, along with ones growing wild in the maquis, those that have sprouted from the coppicing, and those that were abandoned after being planted. Some trees are located on boundaries and have the double function of acting as a marker. The importance of olive trees and oil production is shown, not only by the widespread presence of the species throughout all of the areas described, but also by the existence of a nursery or, according to a different hypothesis, an oil press. The olive tree is probably also present as a sacred tree. The crop system in areas with a lower slope is that of arable land and wooded pastures following a simple system of fallow fields. The presence of hydraulic structures, found during archaeological investigations, has made it possible to imagine the presence of irrigated orchards. Some of the other tree species present are: figs, pomegranates, pears, and plums. They are certainly grown in *coltura promiscua* but are also used as hedges or grow wild, especially plums and pears. The latter is also used to mark the plot boundaries. Even briars and palisades, stone walls and boulders contribute towards scoring and marking the boundaries by integrating the subdivisions marked by the hydrographical network and roadways. The grapevine is also cultivated. The soil, due to the slope's gradient, had to be at least partially terraced. The livestock present are sheep,

TABLE 1. LANDSCAPE PATCHES AND ELEMENTS, GROUPED IN MAIN LANDSCAPE ECOLOGY ASPECTS, REPORTED IN THE *COLUMNA DEXTERA* (DX) AND *LATUS SINIXTRUM* (SX) OF THE *TAVOLA DI ALESA* (GREEK COLONY FOUNDED IN 403 B.C., N-SICILY), THAT DESCRIBES THE LANDSCAPE BETWEEN THE SECOND HALF OF III TO I A.C.

Landscape elements reported in the **Column Dx**	Landscape elements reported in the **Column Sx**
Shape of patches	
/	Irregular and twisted division of field plots
Patchiness and crops	
• olive groves all around the main sectors of • the city and presence of olive nursery vineyard, fruit trees (pear, pomegranates, figs) • sheep-caprine livestock arable land and mixed arable-olive systems • grazing lands	• patched land mosaic and closed fields • olive groves all around the main sectors of the city and presence of olive nursery • grapes, olive groves, pomegranates, figs, • fruit orchards, vegetable gardens, closed fields • grain growth • arable land and mixed arable-olive systems • sheep-caprine farm (livestock) • pasturelands
Core areas and buffer areas	
/	• Cork oak (patches of different size) • other woodlots and shrublands • Mediterranean maquis
Corridors and ecological network	
• *river (the today Tusa river)* • Mediterranean riparian vegetation	• Streams, rivers and riparian Medit. vegetation
Linear and point elements	
• small stream • hedgerows, plums & pears (wild and cultivated) • wild pears and thorn hedgerows (*rhamnoi*) (as field boundary) • holes (natural) and trenchs (artificial) • boundary rocks	• small streams, creeks, springs, holes (natural) and trenchs (artificial) • aqueduct lines • wild pears and hedgerows (*rhamnoi*) (as field boundary) • other wild trees and fruit trees as boundary (big olive, pomegranates, figs) • sacred trees
Rural architecture & other stone-made artefacts	
• rural buildings • fortified walls (*pyrgos*) • public fountains, laundry, drinking trough • viability network • terraces • trench (artificial)	• rural buildings • fortified walls (*pyrgos*) • sheds & storerooms for agronomic cultivation tools • tower • canals (of 'U'-shape of cutted stone or *terracotta*; *terracotta* tubes) • public fountains, laundry, drinking trough • sacred areas • stone pathways and vias • stone-made terraces • stone-paved farmyards
other	
	• poles for grapes

goats and pigs. These were kept free-range and also fed cork oak acorns, which were also used to tan leather. The forest and maquis saw grazing, hunting, as well as traditional wooden and non-wooden production. These latter natural patches contributed to the landscape mosaic of the area.

In Table 1 all the detailed information reported in the two columns of the marble epigraph are given for this case-study, and grouped according to the following main aspects of the landscape ecology (*e.g.* see Farina 2000): the shape of patches, patchiness, crop types, core areas and buffer areas, corridors and the ecological network, linear and point elements, rural architecture and other stone-made artefacts. It is possible to allocate these main landscape elements to the different lots (about twelve) in which the *Alesa* landscape is divided. Thus, while the left column of the marble describes the city's lots located on the north-eastern side of the area, the western and south-western part is described in the right column (see Table1). The information reported in this last column describes a more complex and structured land-mosaic compared with the other part of the city and its surroundings. Each lot is described in detail by both natural and artificial boundary lines of fields and patches (small streams, creeks, holes, trenches, rocks, trees, woodlots, stone pathways and roads, sacred areas, urban walls, etc.) (Table1), although no details are given about its dimension and shape.

The long-lasting historical landscape of *Alesa* shows its polycultural character still today. Through the centuries and the succeeding historical and cultural processes, this landscape was able to conserve the characters of its foundations, later on to be enriched by additional and traditional crops and land uses. Plate Ia reports a present-day view of the *Alesa* polycultural and agro-forestry landscape character. The landscape is still complex and irregularly patched; with crops, fields and natural cover types expressive of a traditional agro-silvo-pastoral Mediterranean landscape. Currently, the olive grove is still the most important cultivation. Most important veteran trees, especially olives, are still today used as historical land-marks, for instance as boundary trees between land properties and fields. The historical rural architecture and artefacts are currently marked by the archaeological site and evidence of the *Alesa* city: small settlements, rural buildings, stone-made boundaries, terraces, enclosures, pathways, aqueducts, etc. (Pl. Ib).

PATTERN VARIABILITY OF THE COMPLEX MEDITERRANEAN POLYCULTURAL LANDSCAPE CHARACTERISED BY THE PRESENCE OF TREES

The delineation of the Mediterranean, specifically Italian, rural landscape derived from the historic development described above are attributable to a landscape that is so complex and diverse that it includes several of the major Mediterranean agricultural landscapes that have been catalogued and described to date (*e.g.* Meeus 1995; Pinto-Correia & Vos 2004). In it, the coexistence of spaces dedicated to agriculture, forest and pasture refer back to the Latin categories of *ager*, *saltus*, and *silva*. Geographers such as Vidal de la Blanche (1922, cited in Claval 2007, pp. 7–23) or, more recently, historians like Aymard (1992, pp. 123–44) and landscape ecologists such as Pinto-Correia & Vos (2004) still consider these categories relevant, especially considering that the *ager* not only includes crops but also shrub and fruit orchards, that the *saltus* mainly concerns aspects of *maquis* and *garrigue* scrublands affected by grazing, while the *silva* is made up of woodlands (where different traditional silvo-pastoral uses are practiced). These are all polycultural systems, composed of agricultural and agro-forestry patches (Barbera & Biasi 2011) which, through wood cutting, felling and the use of branches as animal feed, controlled fires, crop cultivation, livestock and their transhumance, water control and terracing, define the prerequisites — or 'the golden rules' (Blondel 2006) — of the ancient Mediterranean agro-silvo-pastoral systems.

Emilio Sereni's *History of the Italian Agricultural Landscape* (1961, trans. Lichfield 1997) attributes the characteristics of the traditional complex Mediterranean rural tree landscape to the landscape of the mixed cultivation and agro-forestry

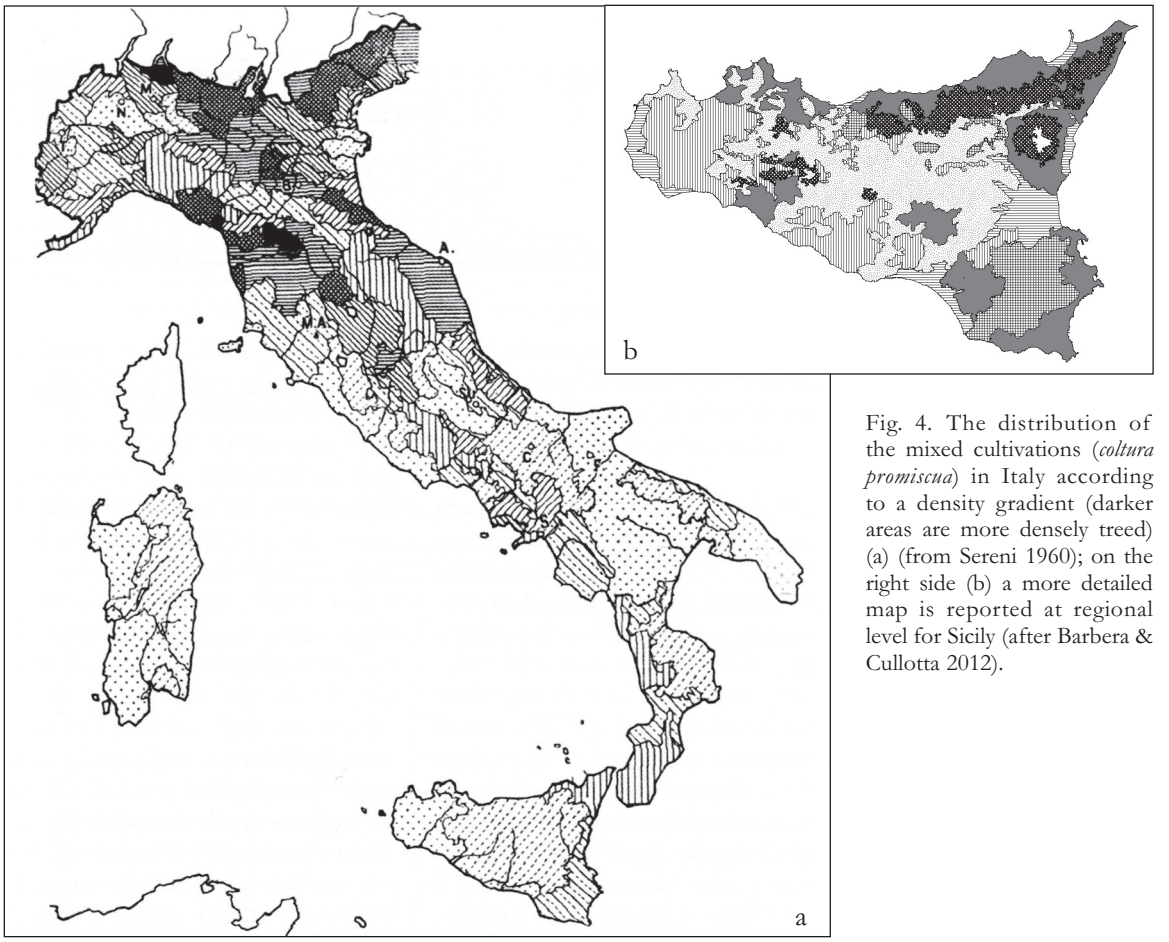

Fig. 4. The distribution of the mixed cultivations (*coltura promiscua*) in Italy according to a density gradient (darker areas are more densely treed) (a) (from Sereni 1960); on the right side (b) a more detailed map is reported at regional level for Sicily (after Barbera & Cullotta 2012).

systems (including different aspects and gradient of the *coltura promiscua*) (Fig. 4a and 4b), and shows how those characteristics are maintained all the way through time — from the Greek colonisation to the post-war agriculture following WWII — remaining well defined and long-lasting with regard to their formal structure and functional biotic and abiotic elements, their ecological and geographical context, their plurality of functions, their social uses and economic determinants (Sereni 1961).

It is a landscape with irregular closed lots defined by 'the polygonal irregularity of contours' (Sereni, trans. Litchfield 1997, p. 27), that is fragmented, twisted, squashed, and formed by a 'tangle of little wooded plots divided by walls or hedges' (*ibid.*, p. 178). Until the eighteenth century, this landscape was mainly 'restricted (to) suburban or coastal zones. It was thus still isolated amid vast extents of uncultivated land or open fields' (*ibid.*, p. 176). It was 'an agricultural landscape of closed fields, vineyards, …gardens, and fruit trees' (*ibid.*, p. 67), and often even of arable and pasture land 'imprinted with a suburban physiognomy by dividing walls and the contiguous placement of houses and rustic storage sheds' (*ibid.*, p. 329). 'Terraced arrangements became the chosen location for the most valuable crops, and particularly for trees and shrubs' (*ibid.*, p. 98).

The above reported concepts and descriptions of the traditional Mediterranean polycultural (mixed-cultivation) landscape in practice generate

a

b

Plate I. A today view of the *Alesa* area: (a) the polycultural agro-forestry landscape of the Tusa municipality is still today dominated by olive groves (ancient and modern), various fruit trees and orchards, open and semi-open pastureland, remnant paths of Mediterranean maquis and woodlots; (b) archaeological elements related to the management of water as a Roman spring and aqueduct still survive and are used by farmers.

different spatial combination (*i.e.* configuration) of the *coltura promiscua*. In fact, according to the presence and location of the plant promiscuity (at least one of them is a tree species), we have different landscape patterns: in the same field (intra-plot) or between fields (inter-plot) (Pl. II). Moreover, this heterogeneity is reinforced by the land mosaic patchiness (*i.e.* more fragmented or coarser) (Pl. II).

Polyculture is an agricultural system using multiple crops in the same space, in imitation of the diversity of natural ecosystems, and avoiding large stands of single crops, or monoculture. It includes multi-cropping and inter-cropping systems. The '*coltura promiscua* intra-plot' is a multiple cropping system, *i.e.* the practice of growing two or more crops in the same space during a single growing season. *Vice versa*, the practice of growing two or

Plate II. Type of Mediterranean mixed cultivations and agro-forestry systems at stand and landscape levels: (a) intra-plot mixed cultivation (*coltura promiscua*) at stand level with cultivated and wild plants (olive, wine, walnut, chestnut, herbaceous crops, oaks, dry-stone walls) (Sicily); (b) inter-plot *coltura promiscua* landscape with fine-grained land-use mosaic (terraced wineyards, fruit orchards, remnant oak woodlands, isolated rural buildings) (Sicily); (c) inter-plot *coltura promiscua* landscape with coarser-grained land-use mosaic (vineyards, olive groves, remnant woodlands, forests, small rural settlements) (Tuscany).

more crops in proximity (*i.e.* the intercropping system) is the expression of the '*coltura promiscua* inter-plot' (Plate II).

LANDSCAPE ECOLOGY, MULTI-FUNCTIONALITY AND CULTURAL HERITAGE OF THE COMPLEX MEDITERRANEAN AGRO-SILVO-PASTORAL LANDSCAPE

The *Halaesa* landscape is the result of a polycultural agro-silvo-pastoral system which, observed under the lens of landscape ecology, highlights the features that the available information allows us to assess very positively in terms of complexity and richness with reference to specific and intra-specific biodiversity, and the ecosystem's structure. The temporal and spatial complexity manifests itself in the economic productivity and environmental services that participate in that multi-functionality belonging to complex Mediterranean agricultural and agro-forestry systems (Barbera *et al.* 2004, pp. 481–92; Pinto-Correia & Vos 2004; Blondel 2006; Kizos & Koulouri 2006; Brown *et al.* 2007, pp. 395–415; Biasi *et al.* 2012; Otero *et al.* 2013; Agnoletti 2013). Agricultural production and forestry, such as animal breeding, are carried out in a context of environmental protection that comes from the high biodiversity and the complex structure of the fields and their relationship in a network of connectivity with the woodland and scrub areas.

The patches were enclosed by hedges and groups of trees and shrubs, or by non-living barriers (walls, palisades) or separated from natural or semi-natural areas by buffers. Linear structures in the form of ecological corridors — rivers, ditches, aqueducts, living and non-living barriers and terraces — are additional elements that diversify the ecosystem by functioning as ecotones. Further biodiversity comes from large boulders, piles of stones, and isolated trees, which not only provide agricultural products but also ensure shade and shelter from the rain for humans and animals alike, and act as micro-sites with the function of stepping zones for a countless number of plants and animals.

The water cycle is assured by the territorial hydrographical and hydraulic structures that contribute, with the terraces, to protect the soil and slope stabilisation. The organic matter cycle is guaranteed by the presence of mixed crops and the integration of crops/livestock/woodlots. These landscape material elements and characters are visually (at least, but many other functional aspects are involved) reinforced by the presence of stone walls and other artefacts or features such as: countless types of rural buildings (country residence, storeroom for fruit conservation, wine cellar, storeroom for agronomic cultivation tools, terraces, hedgerows, canals, stone towers, stone heaps, etc. (Grove & Rackham 2002; Brown *et al.* 2007, pp. 395–415; Kizos & Koulouri 2006;

Barbera & Cullotta 2012; Riguccio *et al.* 2013).

Along with multi-functional and environmental production, these spaces also have a cultural production shown by indirect literary references (Theocritus, *cf.* Belvedere 2008), and more generally contribute to the complex and rich non-material heritage (dialects, music, narratives, toponyms, etc.) (Scazzosi 2004; Moreira *et al.* 2006; Cullotta & Barbera 2011; Otero *et al.* 2013) and the appeal that is characteristic of polycultural Mediterranean agricultural systems. All of these aspects, especially historical features, traditional crops, land use and the permanence of agricultural practice, and the presence of architecture related to agricultural activity, are particularly important for the UNESCO action toward rural landscapes, assigning them a very high value (Gullino & Larcher 2013).

CONCLUSIONS

The highly diversified land-use patterns and agro-silvo-pastoral practices in Mediterranean cultural landscapes are the results of the long historical development and of the complex cultural process that affected all the Mediterranean Basin. The long-lasting, complex and mixed forms of agro-forestry systems and landscapes, such as the *coltura promiscua*, is ascribable and can be associated with different and innumerable agricultural land uses and different kinds of landscape configurations (intra- or inter-plot polycultures), as well as the land mosaic patchiness.

These landscapes have developed from the intricate historic processes that have produced their cultural identification and evolution over the passage of time. The pre-Classical and Classical introduction of Asiatic species, the Islamic 'agricultural revolution', the introduction of American species, the introduction of the species that arrived via the activities of plant collectors and European scientific institutions were most important historic milestones in this long-lasting process. In addition the Mediterranean's heterogeneous environmental characteristics increased this diversity within which the cultural processes were inserted. The analysed *Halaesa* landscape, located in the geographic centre of the Mediterranean Basin, as one of the first historical detailed description of a complex Mediterranean cultural landscape, is the result of a polycultural agro-silvo-pastoral system which guarantees complexity and richness (in terms of structural and biological diversity), as well as with reference to others environmental, cultural and economic aspects.

The presence of historical features, of traditional crops and land uses, of traditional land management, and the conservation of the rural architecture and other features of the material cultural heritage related to agricultural activity (*i.e.* historical rural monuments, rural country houses and settlements, terraces, stone walls and related rural artefacts, agricultural and forestry tools and machines, manuscripts, poems, paintings and pictures), as well as the non-material cultural heritage (*e.g.* dialects, music, narratives, etc.), are particularly important aspects considered by international and European organisations towards their valorisation and conservation.

The conservation of these traditional landscapes is now an issue of growing importance. Over the last few decades, profound social changes relative to the development of a production-oriented agriculture and land use have subjected these complex landscapes to strong changes that risk wiping out their characteristics in a not too distant future.

A preliminary inventory is an essential reference for acquiring full knowledge of the consistency and variability of landscapes in a given area, either within a nation or throughout Europe. The European Landscape Convention of Florence 2000 goes precisely in this direction: in contrast with past endeavours, it hints at the need for an overall knowledge of the European landscape. In addition, a multi-disciplinary characterisation, as holistic as possible, needs to be developed with the aim of identifying and planning strategies that conserve the landscape's characteristics, complexity, functions, and identity. Their constitutive complexity and multi-functionality should be dealt with from different points of view so as to reflect their overall inter-cultural value.

ACKNOWLEDGEMENTS

The research was supported by the Italian Ministry of Research and University Education's PRIN 2010–2011 Project 'Traditional agricultural landscapes in Italy: a multi-disciplinary and multi-scale assessment for the development of an integrated model for landscape planning and management' (prot. 2010LE4NBM).

BIBLIOGRAPHY

Agnoletti, M., 2013. *Italian Historical Rural Landscapes: dynamics, data analysis and research findings* (Dordrecht).

Antrop, M., 1997. 'The concept of traditional landscapes as a base for landscape evaluation and planning', 'The example of Flanders region', *Landscape Urban Plan,* 38, pp. 105–17.

Arangio Ruiz, V., & Olivieri, A., 1925. *Inscriptiones Graecae Siciliae et infimae Italiae ad jus pertinentes* (Milan).

Aymard, M., 1992. 'Spazi', in *Il Mediterraneo. Lo spazio, la Storia, gli uomini, le tradizioni* , ed. F. Braudel (Milan), pp. 123–44.

Barbera, G., 2000. *L'Orto di Pomona. Sistemi tradizionali dell'arboricoltura da frutto in Sicilia* (Palermo).

Barbera, G., Carimi, F., & Inglese, P., 1992. 'Past and present role of the Indian-fig prickly-pear (Opuntia ficus-indica (L.) Miller, Cactaceae) in the agriculture of Sicily', *Econ Bot*, 46, 10–20.

Barbera, G., Cullotta, S., & Pizzurro, G., 2004. 'Agro-forestry systems of Mt Etna, Italy: biodiversity analysis at landscape, stand and specific level', in *Monitoring and Indicators of Forest Biodiversity in Europe – From Ideas to Operationality*, ed. M. Marchetti, European Forest Inst Proc 51 (Joensuu, Finland), pp. 481–92.

Barbera, G., & Biasi, R., 2011. 'I paesaggi agrari tradizionali dell'albero: il significato moderno di forme d'uso del suolo del passato', *Italus Hortus*, 18, pp. 23–40.

Barbera, G., & Cullotta, S., 2012. 'An inventory approach to the assessment of main traditional landscapes in Sicily (Central Mediterranean Basin)', *Landscape Res*, 37, pp. 539–69.

Barbera, G., & Cullotta, S., 2014. 'La complessità del paesaggio agrario del "giardino mediterraneo" a partire dalla tavola di Alesa', in *Paesaggi in trasformazione teorie e pratiche della ricerca a cinquant'anni dalla Storia del paesaggio agrario italiano di Emilio Sereni*, ed. G. Bonini, & C. Visentin (Bologna), pp. 242–45.

Belvedere, O., 2008. 'Paesaggio catastale, paesaggio letterario e archeologia del paesaggio. Tre percezioni a confronto', in *Il paesaggio agrario nella Sicilia ellenistico-romana. Alesa e il suo territorio*., ed. A. Burgio, (Rome), pp. 1–10.

Bevilacqua, P., 1996. *Tra natura e storia. Ambiente, economie, risorse in Italia* (Rome).

Biasi, R., Botti, F., Barbera, G., & Cullotta, S., 2012. 'The role of Mediterranean fruit tree orchards and vineyards in maintaining the traditional agricultural landscape', *Acta Horticolturae*, 940, pp. 79–88.

Blondel, J., 2006. 'The "design" of Mediterranean landscapes: a millennial story of humans and ecological systems during the historic period', *Hum Ecol*, 34, pp. 713–29.

Blondel, J., & Aronson, J., 1999. *Biology and Wildlife of the Mediterranean Region* (Oxford).

Braudel, F., 1986. *Civiltà e imperi del Mediterraneo nell'età di Filippo II* (Turin).

Brown, R.D., Lafortezza, R., Corry, R.C., Leal, D.B., & Sanesi, G., 2007. 'Cultural patterns as a component of environmental planning and design', in *Landscape Ecological Applications in Man-Influenced Areas: linking man and nature systems*, ed. S. K. Hong, N. Nakagoshi, B. J. Fu, & Y. Morimoto (Dordrecht), pp. 395–415.

Burgio, A., 2008. *Il paesaggio agrario nella Sicilia ellenistico-romana. Alesa e il suo territorio* (Rome).

Claval, P., 2007. *About Rural Landscapes: the invention of the Mediterranean and the French school of geography* (Berlin), pp. 7–23.

Cullotta, S., & Barbera, G., 2011. 'Mapping traditional cultural landscapes in the Mediterranean area using a combined multidisciplinary approach: method and application to Mount Etna (Sicily, Italy)', *Landscape Urban Plan*, 100, pp. 98–108.

Desplanques, H., 1959. 'Il paesaggio rurale della coltura promiscua in Italia', *Rivista Geografica Italiana*, pp. 29–61.

Fairfax, H., 1918. *Roman Farm Management, the treatises of Cato and Varro done into English with notes of modern instances by a Virginia farmer* (New York).

Farina, A., 2000. *Landscape Ecology in Action* (Dordrecht).

Fazello, T., 1558. *De rebus Siculus decades duae* (Palermo).

Grimal, P., 2000. *I giardini di Roma antica* (Milan).

Grove, A. T., & Rackham, O., 2002. *The Nature of Mediterranean Europe: an ecological history* (New Haven).

Gullino, P., & Larcher, F., 2013. 'Integrity in UNESCO World Heritage Sites. A comparative study for rural landscapes', *J Cult Heritage*, 14, pp. 389–95.

Homer, trans. S. Butler, 1900. *The Odyssey*. Available at: http://www.gutenberg.org/ebooks/1727 [Accessed 14.03.2013]

Horden, P., & Purcell, N., 2000. *The Corrupting Sea. A study of Mediterranean history* (Oxford), pp. 175–230.

Jones-Walters, L., 2008. 'Biodiversity in multifunctional landscapes', *J Nat Conserv*, 16, pp. 117–19.

Jose, S., 2009. 'Agroforestry for ecosystem services and environmental benefits: an overview', *Agrofot Syst*, 76, pp. 1–10.

Kizos, T., & Koulouri, M., 2006. 'Agricultural landscape dynamics in the Mediterranean: Lesvos (Greece) case study using evidence from the last three centuries', *Environ Sci Policy*, 9, pp. 330–42.

Loumou, A., & Giourga, C., 2003. 'Olive groves – The life and identity of the Mediterranean', *Agriculture Human Values*, 20, pp. 87–95.

Mascari, G.F., Mautone, M., Moltedo, L., & Salonia, P., 2009. 'Landscapes, heritage and culture', *J Cult Herit*, 10, pp. 22–9.

Meeus, J. H. A., 1995. 'Pan-European landscapes', *Landscape Urban Plan*, 31, pp. 57–79.

Moreira, F., Queiroz, A. I., & Aronson, J., 2006. 'Restoration principles applied to cultural landscapes', *J Nat Conserv*, 14, pp. 217–24.

Nair, P. K. R., 1991. 'State-of-the-art of agroforestry systems', *Forest Ecol Manage*, 45, pp. 5–29.

Nair, P. K. R., 1993. *An Introduction to Agroforestry* (Dordrecht).

Naveh, Z., 1995. 'Interactions of landscapes and cultures', *Landscape Urban Plan*, 32, pp. 43–54.

Nerlich, K., Graeff-Hönninger, S., & Claupein, W., 2013. 'Agroforestry in Europe: a review of the disappearance of traditional systems and development of modern agroforestry practices, with emphasis on experiences in Germany', *Agroforestry Systems*, 87, pp. 475–92.

Otero, I., Boada, M., & Tàbara, J. D., 2013. 'Socio-ecological heritage and conservation of Mediterranean landscapes under global change. A case study in Olzinelles (Catalonia)', *Land Use Policy*, 30, pp. 25–37.

Petanidou, T., Kizos, T., & Soulakellis, N., 2008. 'Socio-economic dimensions of changes in the agricultural landscape of the Mediterranean Basin: a case study of the abandonment of cultivation terraces on Nisyros Island, Greece', *Environ Manage*, 41, pp. 250–66.

Pinto-Correia, T., & Vos, W., 2004. 'Multifunctionality in Mediterranean landscapes – past and future', in *The New Dimensions of the European Landscape,* ed. R. H. G. Jongman (Wageningen).

Riguccio, L., Russo, P., Scandurra, G., & Tomaselli, G., 2013. 'Cultural landscape: stone towers on Mount Etna', *Landscape Res*, DOI: 10.1080/01426397.2013.829809.

Scazzosi, L., 2004. 'Reading and assessing the landscape as cultural and historical heritage', *Landscape Res*, 29, pp. 335–55.

Sereni, E., 1961. *Storia del paesaggio agrario italiano* (Bari).

Sereni, E., 1961, trans. Litchfield, B., 1997. *History of the Italian Agricultural Landscape* (Princeton).

Shay, C. T., Shay, J. M., & Zwiazek, J., 1991. 'Paleobotanical investigations at Kommos, Crete', in *Plant Animal Interactions in Mediterranean-type Ecosystems*, ed. C. Thanos (Maleme, Crete), pp. 382–9.

Sicca, U., 1924. *Grammatica delle iscrizioni doriche della Sicilia* (Arpino).

Sirami, C., Nespoulousa, A., Cheyland, J. P., Martya, P., Hvenegaarda, G. T., Geniezh, P., & Martina, J. L., 2010. 'Long-term anthropogenic and ecological dynamics of a Mediterranean landscape: impacts on multiple taxa', *Landscape Urban Plan*, 96, pp. 214–23.

Terral, J. F., 2000. 'Exploitation and management of the olive tree during Prehistoric times in Mediterranean France and Spain', *J Archeol Sci*, 27, pp. 127–33.

Vidal de la Blanche, P., 1922. *Principes de Géorgraphie Humaine* (Paris).

Vos, W., & Meekes, H., 1999. 'Trends in European cultural landscape development: perspectives for a sustainable future, *Landscape Urban Plan*, 46, pp. 3–14.

Zohary, D., & Hopf, M., 1993. *Domestication of Plants in the Old World* (Oxford).