

The agricultural heritage of Lampedusa (Pelagic Archipelago, South Italy) and its key role for cultivar and wildlife conservation

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Abstract

As occurred on many other small Mediterranean islands, agricultural activity at Lampedusa (Strait of Sicily) underwent a very strong decline in terms of surface area during the second half of the last century. In particular, cereal crops have ceased and horticulture is disap-

pearing, while vineyards still occupy a reduced area but are quickly vanishing and currently survive thanks to a small number of old farmers. Here are presented the results of a research carried out by interviewing seven farmers in order to study not only the techniques and the germplasm used in local viticulture, but also the final use of grapes and an evaluation on the connection between traditional farming and agro-ecosystems plant species-richness. Vines were grown for wine, to produce fresh and sun-dried grapes, or to preserve them in alcohol. Several names of the local varieties suggest that they might have been introduced in Lampedusa from the neighbouring territories: being fishermen and farmers at the same time, local people had trade relationships with other Mediterranean areas such as Tunisia, Malta and Southern Italy. Furthermore, local farming plays a key role in plant conservation. In fact, the disappearance of agricultural systems is leading to the extinction of 43 plant species, some of them considered rare not only on the local level, but also on the regional and national one. Because of the small size of farmland and its fragmentation, local agriculture cannot be supported by the European Community. Therefore, in order to safeguard local viticulture, special systems of assistance and new managing policies - focused on rural development plans and showing which concrete actions are necessary and feasible to protect the agroecosystems - are needed.

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Introduction

As already occurred in several other territorial contexts of the Mediterranean Basin, southern Italy and islands in particular, the agricultural areas that have survived play a crucial role not only for the preservation of dozens of cultivars, often the result of centuries of selective choices by local farmers (Hammer *et al.*, 1990, 1996, 1997, 1999; Hammer and Perrino, 1995; Laghetti *et al.*, 1996, 1998a-b, 2002; Hammer and Laghetti, 2006), but more extensively in order to maintain the overall agrobiodiversity (Spahillari *et al.*, 1999) and plant biodiversity. In fact, it has already been verified that such extensive crops and farming areas harbour a high number of plant species (Rühl, 2003, 2007), and how their disappearance and rarefaction have adverse consequences for many annual plants that have the opportunity to exploit the recently cultivated and uncultivated lands (Lampedusa: Pasta, 2001; Marettimo: Gianguzzi *et al.*, 2006; Ustica: Pasta *et al.*, 2007a).

The island systems are considered particularly vulnerable to degradation (Millennium Ecosystem Assessment, 2005). Therefore, in the last decades, much attention has been paid to the loss of traditional knowledge and biodiversity in small islands (UNEP, 1998).

Lampedusa's case is emblematic of - and very similar to - that of many other small Mediterranean islands, where a close connection between agriculture and biodiversity at different levels (landscape, specific, genetic) can be observed.

In the past, Lampedusa was almost self-sufficient in terms of crop

production, but nowadays local inhabitants import most of the plant products from Sicily. However, in few small areas of the island there still are cultivated fields, mainly vineyards and orchards. Fruit trees are uncommon and only some species are still cultivated: fig, pomegranate, peach, apricot, carob and Indian fig (the last mainly for animal feed; Hammer and Laghetti, 2006).

Notwithstanding, the agriculture of the nearby Linosa island has been studied rather thoroughly (Hammer *et al.*, 1997; Laghetti *et al.*, 1998b) and taking into account some studies on the horticultural germplasm of Lampedusa (Laghetti *et al.*, 1996), available information on the viticulture and farming systems on both the Pelagian Islands are scarce; even the historical documents lack of any evidence concerning this topic (Pasta and La Mantia, 2003).

As for the herbaceous species still cultivated on Lampedusa, there are only a few landraces of pulses (broad beans, lentils and peas), vegetables (peppers and vegetables marrows) and aromatic plants (oregano and rue) (Hammer and Laghetti, 2006). Other cultivated plants do not come from locally produced seeds.

Among the species still cultivated in Lampedusa the only noteworthy crop is the grapevine. The survey carried out during this research has established the peculiarity of the viticulture of Lampedusa, particularly that of the utilized germplasm, but also the extreme fragility of the agro-ecosystem linked to this land use.

Materials and Methods

Environmental characteristics

Lampedusa is located 205 km from the Sicilian coast and 113 km from the African one, and it looks like a triangular plateau which northern coast forms an almost continuous steep cliff and which slopes gently decline southwards, where the coastline shows a very uneven appearance due to the presence of several canyons. Local agriculture has developed inside these canyons thanks to the make up of dry stonewalls. Lampedusa is subject to a climate ranging from the semi-arid Mediterranean of Southern Sicily to the arid of North Africa and, according to the classification of Rivas-Martínez (2004), should be referred to the infra-Mediterranean type (Sferlazzo, 2009). Local wind regime strongly influences the environment and, thus, agriculture, as it has been already underlined by Calcara (1846). Therefore, agriculture was measured with these limits, with a very irregular and low rainfall (less than 320 mm/yr), and a rather wide temperature range (minimum winter values fluctuate between 9 and 14°C, maximum summer ones between 24 and 30°C). Therefore, significant extensions of relatively deep brown soils can be found exclusively in areas protected from wind erosion, in particular within valleys.

Survey on viticulture

The field investigation was carried out by interviewing local farmers through a standard questionnaire containing the following data: date of the interview, name of the interviewers, name of the interviewed; GPS coordinates of the plants collected; location, altitude (m a.s.l.), slope (°), aspect; name of still or previously cultivated varieties, origin and year of introduction (if known), characteristics (colour, shape, size, etc.) of the grapes, use of the grapes, cultivation techniques, number of individuals; notes.

Up to now (spring 2010) seven of the eleven farmers who still cultivate vines have been interviewed; thus, the data shown here may be considered representative of the whole island.

Species richness census

The data presented here come from field relevés carried out by the authors during the spring season of 2009 and 2010, from the most recent contributions to the knowledge of Lampedusa's vascular flora (Bartolo *et al.*, 1990; La Mantia *et al.*, 2009) and from the floristic and phytosociological relevés (Braun-Blanquet, 1964) carried out during the past 15 years, while investigating the natural and agricultural territory of Lampedusa in order to write the management plan for the Pelagic Islands (La Mantia *et al.*, 2009) and to evaluate the diffusion and the degree of threat of native plant life (La Mela Veca *et al.* 2003; La Mela Veca and Pasta, 2006). Moreover, the effect of the decreasing grazing pressure on scrubland and grassland (Pasta and La Mantia, 2006, Pasta *et al.*, 2007b) and the effect of different techniques of reforestation on the dynamism of local vegetation (Pasta and La Mantia, 2001) were taken into consideration.

Results and Discussion

Viticulture

In Lampedusa island, this crop characterizes only a few hectares, approximately 30 according to our estimates, while approximately 10 ha have been recently abandoned according to Ravello (2007), who describes five varieties still cultivated on the island: *Moscato d'Alessandria* or *Zibibbo*, white *Moscato*, *Catarratto*, *Insolia*, *Nocera delle Isole* or *Noceron* (dark grape). Despite the reduced area, local viticulture still has an extraordinary interest due to the variety richness. In fact, through the interviews to local farmers 18 varieties have been found: *Bertuccio*, *Calabrisi*, *Catarratto*, *Catarratto Nero*, *Funciachiatta*, *Funciachiatta Rosella*, *Gallipoli Bianca*, *Gallipoli Nera*, *Inzolia*, *Inzolia Maltese*, *Minna di Vacca*, *Nave*, *Nivureddu*, *Paradiso*, *Pizzutella Bianca*, *Sfaghessina*, *Squagghiamucca*, *Zibibbo*; some of them appear to be new to the Sicilian variety heritage (Carimi *et al.*, 2010). Only three varieties, i.e. *Nivureddu*, *Catarratto* and *Catarratto Nero* are common in Lampedusa, while four of them are uncommon (*Zibibbo*, *Inzolia*, *Inzolia Maltese*) and 13 even rare (*Bertuccio*, *Calabrisi*, *Funciachiatta*, *Funciachiatta Rosella*, *Gallipoli Bianca*, *Gallipoli Nera*, *Minna di Vacca*, *Nave*, *Nivureddu*, *Paradiso*, *Pizzutella Bianca*, *Sfaghessina* and *Squagghiamucca*). Several of them are now present with very few individuals; their past use is probably due to previous economic links between the inhabitants of Lampedusa and Tunisia or other territories where they had established trade relations along the Adriatic coast. All this patrimony is disappearing without leaving its mark in history. This risk is already going on: in his recent paper, Ravello (2007) only mentioned four white and one black grape varieties, neglecting many other varieties. Along with the local varieties, also traditional uses connected to their peculiarities tend to disappear. Only one farmer, for example, still cultivated the variety called *Funciachiatta*, of Tunisian origin, which was used to produce grapes in alcohol.

A very interesting feature is that local grapevines are not grafted and show no damage caused by *Phylloxera*, although damages have been reported in the past (Ravello, 2007). Concerning pathogens, the local high levels of air humidity force vineyard growers to use traditional treatments such as lime and sulfur to prevent powdery mildew.

Viticulture becomes important even for landscaping purposes; the abandonment of vineyards, in fact, often is followed by the degradation of these small plots of land that become landfills or are invaded by xenophytes (Pasta and La Mantia, 2008). Connected to these phenomena is land degradation: when land is no longer managed and preserved by the maintenance of dry stonewalls, it rapidly undergoes erosion processes.

Along with the abandonment of the vineyards, also local agronomic techniques disappear; for centuries these techniques (e.g. cultivating

plants in holes in order to reduce water loss) allowed the vines to live and produce under difficult climatic conditions. As regards local climate, during last years rainfall events became more and more irregular and intense (year 2007: 174,51 mm in 62 days; year 2008: 171,45 mm in 51 days; year 2010: 493,06 in 69 days: <http://www.tutempo.net/clima/Italia/IT.html>); for example, the autumn-winter 2009-2010 rainfall was almost entirely concentrated in just one day (i.e. about 216 mm from midnight of September 22 to midnight of September 23, 2009), causing severe damage to many agricultural areas. The soil management techniques of are greatly simplified; in fact, only few treatments are performed in order to prevent powdery mildew and downy mildew with sulfur and copper-based products. Moreover, soil management is implemented performing a few annual working with rotary tiller. Usually, farmers do not use herbicides and this has a great impact on biodiversity.

The key role of agriculture in maintaining local plant biodiversity

The existence of agro-pastoral practices play a key role not only for the preservation and recovery of local cultivars but also for maintaining the plant biodiversity on the island, which have experienced a strong numerical regression of the number of species present. In fact, from the historical data of the first floristic censuses (Gussone, 1832-1834, 1839) up to the present day, there are almost 150 entities that are extinct on Lampedusa, of which almost one third (43) were typical of local agro-ecosystems (Table 1).

Among the above mentioned taxa, *Silene behen* and *S. muscipula* figure in the regional red lists compiled by Conti *et al.* (1997), being indicated respectively as VU (vulnerable) and EN (endangered), while *Vicia monantha* subsp. *calcarata* and *Carthamus lanatus* subsp. *baeti-*

Table 1. Overview on the extinct vascular plants of Lampedusa.

Family	Taxon	Main habitat
Apiaceae (3)	<i>Ammi majus</i> L.	Cereal crops, fallows
	<i>Ammooides pusilla</i> (Brot.) Breistr.	Cereal crops, fallows
	<i>Bifora testiculata</i> (L.) Roth	Cereal crops
Asteraceae (3)	<i>Anthemis arvensis</i> L. subsp. <i>arvensis</i>	Cereal crops, fallows
	<i>Calendula arvensis</i> L. subsp. <i>arvensis</i>	Cereal crops, fallows
	<i>Carthamus lanatus</i> L. subsp. <i>baeticus</i> (Boiss. & Reuter) Nyman	Fallows, grazed grasslands
Brassicaceae (2)	<i>Brassica tournefortii</i> Gouan	Horticulture, fallows
	<i>Raphanus sativus</i> L.	Horticulture, fallows
Caryophyllaceae (3)	<i>Silene behen</i> L.	Horticulture, fallows
	<i>Silene gallica</i> L.	Horticulture, cereal crops, fallows
	<i>Silene muscipula</i> L.	Horticulture, fallows
Convolvulaceae (1)	<i>Convolvulus tricolor</i> L. subsp. <i>tricolor</i>	Horticulture, cereal crops, fallows
Euphorbiaceae (1)	<i>Euphorbia terracina</i> L.	Fallows
Fabaceae (14)	<i>Lathyrus ochrus</i> (L.) DC.	Horticulture, fallows
	<i>Medicago italica</i> (Mill.) Fiori subsp. <i>italica</i>	Horticulture, fallows
	<i>Melilotus elegans</i> Ser.	Fallows
	<i>Melilotus indicus</i> All.	Fallows
	<i>Trifolium cherleri</i> L.	Fallows
	<i>Trifolium glomeratum</i> L.	Fallows
	<i>Trifolium nigrescens</i> Viv. subsp. <i>nigrescens</i>	Fallows
	<i>Trifolium stellatum</i> L.	Fallows
	<i>Trifolium suffocatum</i> L.	Fallows
	<i>Trifolium tomentosum</i> L.	Fallows
	<i>Vicia angustifolia</i> L.	Fallows
	<i>Vicia benghalensis</i> L.	Fallows
	<i>Vicia monantha</i> Retz. subsp. <i>calcarata</i> (Desf.) Romero Zarco	Fallows
<i>Vicia peregrina</i> L.	Fallows	
Fumariaceae (2)	<i>Fumaria densiflora</i> DC.	Horticulture
	<i>Hypecoum procumbens</i> L.	Horticulture, fallows
Malvaceae (1)	<i>Malva sylvestris</i> L.	Fallows
Orobanchaceae (1)	<i>Orobanche crenata</i> Forssk.	Horticulture
Poaceae (9)	<i>Bromus diandrus</i> Roth	Fallows
	<i>Bromus tectorum</i> L.	Fallows
	<i>Catapodium hemipoa</i> (Sprengel) Lainz subsp. <i>hemipoa</i>	Fallows
	<i>Cynosurus echinatus</i> L.	Fallows, grazed grasslands
	<i>Dasypyrum villosum</i> (L.) Borbás	Fallows
	<i>Phalaris aquatica</i> L.	Fallows
	<i>Phalaris brachystachys</i> Link.	Cereal crops, fallows
	<i>Vulpia ciliata</i> Dumort.	Fallows
	<i>Vulpia ligustica</i> (All.) Link	Fallows
Resedaceae (1)	<i>Reseda luteola</i> L.	Fallows
Scrophulariaceae (1)	<i>Veronica arvensis</i> L.	Cereal crops, horticulture, olive groves, etc.
Urticaceae (1)	<i>Urtica pilulifera</i> L.	Grazed grasslands, fallows

cus are extremely rare and in decline at a regional level (Raimondo *et al.*, 1994).

Moreover, taking into consideration all the up-to-date information obtained through the recent check of local vascular flora (La Mantia *et al.*, 2009), over 100 of the approximately 450 taxa still present on the island are exclusively or preferentially linked to the last patches of the local agro-pastoral landscape, surviving in horticultural crops, in terrace cultivations destined for cereal and/or in uncultivated pastures. Some of them, unprotected by any national law or direct protective measure - because they do not fall within the natural reserve *Isola di Lampedusa*, or within the Site of Community Importance *ITA0040002 Isola di Lampedusa e Lampione* - are now close to extinction, an event which would result in the disappearance not only at a local, but also provincial or even regional level. Among the most endangered plants with a certain phytogeographic value or considered extremely rare and threatened with extinction that are worth mentioning are *Eruca sativa* Mill. subsp. *longirostris* (Uechtr.) Jahand. & Maire (as far as we know, Lampedusa's fallows give hospitality to its only Italian population), *Marrubium alysson* L., where Lampedusa hosts the only known Sicilian population, recently confirmed (Pasta *et al.*, unpublished data) some 50 years after the first finding (Di Martino, 1958), *Silene turbinata* Guss., *Glaucium corniculatum* (L.) J.H. Rudolph, close to extinction on a national and regional level, respectively, and *Calendula bicolor* Raf., *Calendula tripterocarpa* Rupr., *Carduus argyroa* Biv. and *C. australis* L. fil. subsp. *marmoratus* (Boiss. & Heldr.) Kazmi, *Heliotropium dolosum* De Not. and *Mantisalca duriaei* (Spach) Briq. & Cavillier. The above mentioned species are quite rare on the Italian territory.

Conclusions

The ecosystems must have the ability to respond to unexpected change, to remain functional and healthy. There is common agreement on the concept that biodiversity loss and ecosystem degradation put at risk human well-being, now and in the future, and that biodiversity is necessary to keep open options to secure future to human well-being (Mace *et al.*, 2010). Farmer attitudes and social networking are critical for the improvement and preservation of biodiversity in agricultural landscapes. Fast changes in land use, food systems, and livelihoods require social-ecological systems that maintain multiple options open and prepare for future unpredictability. Incentives are crucial if agrobiodiversity is to provide benefits to future generations (Jackson *et al.*, 2010).

Local participation remains widely seen as a central condition for sustainable management of ecosystems landscapes.

The decision No. IX/1 *In-depth review of the programme of work on agricultural biodiversity* of the Convention on Biological Diversity (CBD, www.biodiv.org) on the 9th Meeting of the Conference of the Parties (COP 9) held at Bonn, Germany, from 19 to 30 May 2008, explicitly recognizes the key-role of *local communities, including farmers and livestock keepers, in the conservation and sustainable use of agricultural biodiversity* and underlines the importance of improving the *policy environment to support local-level management of agricultural biodiversity* (<http://www.cbd.int/decision/cop/?id=11644>).

However, the agriculture on the island of Lampedusa actually does not nor can it receive any support because of the small size and their fragmentation. Given the ceased grain cultivation (barley was still cultivated few years ago and wheat some decades before) and the extremely reduced horticulture, viticulture still survives on a few tens of hectares thanks to a few elderly farmers who still practice agriculture. With the intense competition for land use linked to tourism, the survival of farming in general makes viticulture even more precarious. In some cases, the vines are replaced by olive trees, as they require less

care and therefore, their cultivation results less expensive. Nevertheless, it is clear the peculiarity of this system: the vines are free of foot, grown in a difficult environment due to the strong drought, ensured a product used to produce wine but also for the direct consumption as a fresh or dried product. More detailed investigation like those having been carried out on other circumsicilian islets (Di Lorenzo and Lo Vetere, 2006) could highlight further peculiarities.

Agro-pastoral activity as a whole ensured the survival of unique habitats, where a high number rare plant and animal species live; many of them are now disappearing due to the elimination of these land use systems: this is true not only for all the above mentioned plants, but also for some birds such as the Greater short-toed lark (*Calandrella brachydactyla*) (Massa and La Mantia, 2010). The wealth of knowledge and the amount of germplasm that remains today is the legacy of the history of the people of Lampedusa: farmers in the winter and fishermen in the summer that would go to fish for sponge in Tunisia and trade with other areas of the Mediterranean, North Africa, and also Malta, Sicily, and the rest of Italy.

The example of Lampedusa is representative to show how the lack of planning at multiple scales puts agrobiodiversity, human well-being, and ecological systems at risk. The problems of agriculture in Lampedusa are common with other small islands in the Mediterranean basin and for these realities specific measures should be planned and taken in order to help and preserve this heritage. In this regard, the Millennium Ecosystem Assessment (2005), declared *The long-term development objectives of islands also need to be considered. Despite physical and natural resource limitations, important consideration will need to be given to integrated planning, social cohesion, increased attention to managing biodiversity (in particular, invasive species), and a strengthening of territorial planning if islands are to become economically, socially, and ecologically resilient and self-sufficient.*

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