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# Wild Food Thistle Gathering and Pastoralism: An Inextricable Link in the Biocultural Landscape of Barbagia, Central Sardinia (Italy)

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**Abstract:** In Sardinia, pastoralism has been at the heart of cultural identity for millennia. Such activity has shaped the landscape by sustainably managing its elements over the centuries. We conducted 30 semi-structured interviews regarding the uses of wild plants as well as their contribution to sheep breeding over the last few decades in two villages of Barbagia di Ollolai. We recorded the use of 73 taxa belonging to 35 families. Over one-third of the vernacular food taxa were mentioned as raw snacks. Specifically, 22% were used only as raw snacks, while another 22% were used as raw snacks in addition to other uses. Indeed, there is a subcategory of raw snacks represented by thistle plants, named cardu, referring to thorny herbaceous taxa. Cardu are often related to the pastoral realm in the Mediterranean Basin as they are gathered, often with the help of a knife, peeled with the blade, and consumed on the spot while grazing sheep, but ultimately, their crunchiness provides a pleasant chewing experience. In addition, cardu may have been used as thirst quenchers. We conclude that pastoral activity has significantly contributed to the development of a distinctive food heritage and cultural landscape.

**Keywords:** cultural landscape; ethnobotany; foodscape; Mediterranean; traditional ecological knowledge

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## 1. Introduction

Transhumance, a form of pastoralism rapidly declining in Mediterranean and Alpine areas, has recently been added to the Representative List of the Intangible Cultural Heritage of Humanity. UNESCO has recognized the crucial role of such traditional ecological practices and associated knowledge in shaping relationships among people, animals and the surrounding ecosystem. Indeed, pastoral societies often possess a rich variety of traditional ecological knowledge, practices and beliefs (TEK) [1–4]. In many contexts all over the world, pastoralism is often regarded not only as a primary source of livelihood, but also of identity [5,6]. In Sardinia, the second largest island of the Mediterranean Basin, pastoralism has been at the heart of local cultural identity for millennia [7–9]. This is still evident in those Sardinian inland areas, like Barbagia, where sheepherding is a daily activity for the majority of families. Barbagian communities continue to depend on pastoralism, from an economic perspective, due in part to agricultural subsidies [10], but especially from a cultural and identitarian perspective as sheepherding is a powerful symbol of Sardinian-ness [9]. Sardinian shepherds are “unaware gardeners” of the landscape, providing maintenance and care [11].

However, in addition to the importance of the TEK held by shepherds for landscape maintenance, pastoralism may also be crucial in shaping food habits. Indeed, as highlighted by Rivera et al. [12], there is a plurality of dietary patterns under the denomination of the Mediterranean Diet, and the diet developed by the pastoral societies of this area of Barbagia is part of such multiplicity.

Many ethnobotanical studies, mainly focusing on medicinal plants, have been conducted over the past 30 years in several areas of Sardinia [13–17]. However, there is no available literature on ethnobotany in the area of Barbagia di Ollolai, and there are only a few publications regarding pastoralism in Barbagia [18–20], which mainly address historical and ethnographic aspects. Nevertheless, the relationship between pastoralism and wild food has been little investigated and mainly in the Asian and African contexts. Among the few available publications, [21] found that among the Wakhi of Afghanistan, the role of the pastures is not only to represent a grazing-ground, but also they are considered as reservoirs of useful wild food plants. Indeed, pastoralism is often related to specific categories of plants. For example, in Iraq, Kurdish pastoralists were found to consume more snacks than the neighboring more horticulturalist-driven Kakei [22] and much more than Assyrians [23]. Even more specifically, Volpato and Di Nardo [24] explored the pivotal relation between the Sahrawi camel nomads and a specific savannah plant in Western Sahara. Yet, the pastoral activity, if not properly managed, can also negatively affect the presence of wild edible plants [25].

In Europe, the relationship between pastoralism and the landscape has recently been explored in the volume *Biocultural Diversity in Europe* [26]. In addition, Hungarian scholars have found that pastoralists are “walking encyclopedias of landscape knowledge” [27] (p. 16) as they hold a detailed understanding of landscape history [28] while they often do not have species-specific knowledge about wild plants [29], as of the high productivity at the landscape level as pointed out by Fernández-Giménez and Fillat Estaque [1] in the Spanish Pyrenees. Indeed, in the mountainous ecosystems of the Mediterranean context, the pastoral activity had a major role in shaping landscapes of High Nature Value [30], whilst providing cultural ecosystem services [31]. In this respect, Frascaroli et al. [32] hypothesized an ancient link between pastoralism and sacred natural sites, because of their location along transhumance routes and the high frequency of plants used for ethnoveterinary purposes in the vicinity of the shrines. However, research linking pastoral activity and specific plant uses is still insufficient to be able to understand their coevolution within rural landscapes.

In this study, we aimed to discuss the contribution of pastoralism to the shaping of landscapes through the lens of ethnobotanical knowledge related to the gathering of wild and semi-domesticated species used in food and medicinal preparations, in the context of two pastoralist societies of Barbagia di Ollolai, Central Sardinia. Specifically, our goals were:

1. to document uses of wild and semi-domesticated plants for food and medicinal preparations in Barbagia di Ollolai;
2. to describe the impact of local pastoralism-related practices on the use of wild food and medicinal plants in the study area;
3. to discuss the possible role of pastoralism in shaping local food heritage and cultural landscapes in the Sardinian context.

## 2. Materials and Methods

The study was conducted in two villages of Barbagia di Ollolai (Figure 1). Barbagia is an historical sub-region of Central Sardinia, whose main town is Nuoro. The landscape is mainly mountainous, and population density is rather low (around 37 inhabitants/km<sup>2</sup> [33]). Lodine and Teti, the two municipalities in which we conducted interviews, are only 10 km from each other, but about 28 km by road. Lodine is located at an altitude of 850 m above sea level and has around 350 inhabitants, while Teti has 680 inhabitants and lies at 750 m above sea level. Most of the inhabitants of both villages are, or used to be, shepherds, as the high altitude does not allow agricultural activities such as olive or wheat cultivation. This geographical region, called Barbagia, like most of Sardinia, was under the Spanish Crown for four centuries until 1720, when it was annexed to the Kingdom of Piedmont and then later, in 1861, to Italy. The main language is Sardinian, which is spoken all over the island, with some important differences between historical regions. In Teti and Lodine, the Nuorese dialect is spoken. However, many differences persist not only in terms of vocabulary but also in pronunciation, as a glottal stop (a stop sound made by rapidly closing the vocal cords) is present in Lodine but not in Teti.

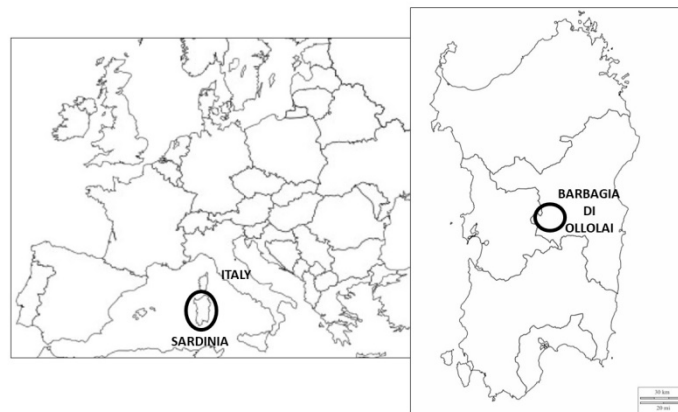


Figure 1. Map of the area.

The study area is characterized by a warm and temperate Mediterranean climate. Average temperature is around 13 °C, with the lowest peak in January (average of 6 °C) and the highest in August (average 22 °C). Precipitation is 810 mm of rain per year, and it is concentrated in the period from October to March.

### 2.1. Pastoralism in Barbagia

Pastoralism has undergone some serious changes over the last century. Older male informants reported that in their youth, they used to spend their winters in milder coastal areas and return at the end of the spring to graze their herds in mountainous areas of Barbagia before moving back to the lowlands at the beginning of autumn (the so-called “inverted transhumance”). In general, shepherds were also in charge of cheese-making and slaughtering. Nowadays, Sardinian pastoralism is sedentary, yet most of the flocks graze permanent grasslands most of the year [34]. Generally, milk is sold to local cooperatives and live animals are sold to slaughterhouses or tradesmen. Currently, the main issue is related to the fluctuation of milk prices and its low profitability due to the high dependency on local processing industries. The majority of interviewed shepherds heavily rely on EU funds, and many others breed sheep only for family consumption, as a way to keep their family tradition alive.

### 2.2. Data Collection and Analysis

Field work was carried out in June 2018 during which 30 interviews, equally distributed between Teti and Lodine, were conducted. Purposive sampling was chosen because our aim was to study the

use of wild and semi-domesticated plants by knowledgeable experts. As many knowledge holders were elderly individuals, it was not always easy to approach them in the street, so we applied the Snowball method to make contact and be invited into their homes. As the local cafes were generally frequented by men, we kindly asked the male interviewees that we met if their wives and mothers had some time to talk to us about the wild plants they used for food and medicinal purposes. The people interviewed (13 women and 17 men) ranged in age from 35 to 93 years (mean age 72 years). All the interviewees were born in the area; however, a few reported to have resided in other Italian regions for a period because of their job. The Code of Ethics of the International Society of Ethnobiology [35] was strictly followed, and prior informed consent was received orally. Interviews were undertaken in the Italian language; however, some interviewees answered mainly in Sardinian. Interviews focused on qualitative and quantitative information about local wild and semi-wild plants gathered in the past or currently, for culinary purposes, as well as recipes, plant part used and methods of preparation and consumption. We define semi-wild plants as taxa that were intentionally planted, but then abandoned (such as some fruit trees). Subsequently, informants were asked to indicate remedies for treating illnesses by naming each part of the body and related diseases. Interviews were semi-structured, and an in-depth conversation was conducted when possible. Whenever possible, informants were asked to show mentioned plants growing around the house in order to harvest voucher specimens for herbarium preparation. The mentioned species were collected, when available, and identified according to the *Flora d'Italia* [36]. Forty-three voucher specimens of herbaceous wild and semi-domesticated plants were deposited at the University of Gastronomic Sciences. Taxonomic identification, botanical nomenclature, and family assignments followed the Plants of the World Online [37], The Plant List database [38], and the Angiosperm Phylogeny Group IV [39].

As the two communities are located in the same area and share a strong pastoral background, we can assume that they are homogenous from an ethnobotanical perspective, and therefore, we merged the ethnobotanical data of Teti and Lodine. Nevertheless, they maintain an interesting phytolinguistic diversity, which is reported in Table 1.

**Table 1.** The thistle family in Lodine and Teti.

Botanical Taxa	Recorded Local Name	Parts Used	Food Use	Teti n=15	Lodine n=15
<i>Carduus pycnocephalus</i> L.	(g)ardu molentinu (T, L)	Tuber s and Stems	Raw as a snack	10	12
UNISGSAR018		Buds	Preserved with olive oil	1	2
<i>Carlina acaulis</i> L.	gardu pisiau (L)	Stems	Raw as a snack		8
<i>Carlina corymbosa</i> L.	gardu pintu (L)	Roots	Raw as a snack		3
<i>Carlina corymbosa</i> L.	gardu anzolinu (L)	Roots	Raw as a snack		5
<i>Cynara cardunculus</i> L.	gardu biancu (L)	Stems	Raw as a snack		3
UNISGSAR024	gardu varju (L)	Stems	Preserved with olive oil		4
	gardu mele (L)	Stems	Raw as a snack		1
<i>Galactites tomentosa</i> Moench	(g)ardu gureu (T, L)	Stems and roots	Raw as a snack	4	5
<i>Scolymus hispanicus</i> L.			Raw as a snack	14	11
UNISGSAR042	Sa chimma (T); gardu cuccu (L)	Stems	Soup		2

We entered the gathered data into an Excel database that included the plant's scientific name, taxonomic family, local name(s), and part(s) used, as well as the purpose of use (food or medicine), its preparation, and the number of citations per village. We considered emic categories for both medicinal and food uses of plants. We then calculated the number of food and medicinal uses.

In order to discuss the salience of thistles in Sardinia, we reviewed all ethnobotanical studies conducted in Sardinia to detect food, medicinal or veterinary uses of such plants, whose names include *gardu*, *cardu*, *cadru*, *caldu* and *canciof*<sup>†</sup>.

### 3. Results

#### 3.1. The Ethnobotany of Barbagia di Ollolai

We recorded the use of 73 taxa belonging to 35 families (see Appendix A). We found 54 plants used for food preparations, 9 for medicinal preparations and 10 for both uses. The most well-represented families were Asteraceae (13 taxa) and Rosaceae (12 taxa).

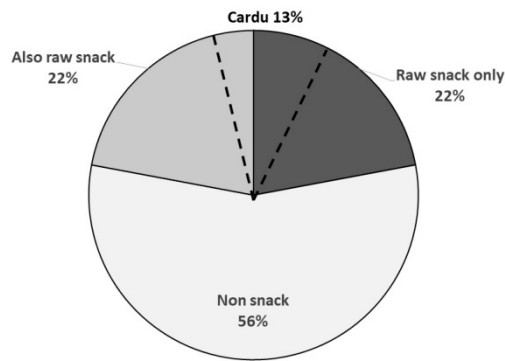
Most common plants were used for the preparation of soups (*s'erbutzu*), such as *Apium nodiflorum*, *Oenanthe pimpinelloides*, *Rumex pulcher*, and *Silene vulgaris*, and as a seasoning, such as *Mentha pulegium* and the autochthonous *Thymus herba-barona*, while others were eaten raw (*Nasturtium officinale* and *Rumex acetosa*) or simply boiled (*Asparagus angustifolius*). *Malva sylvestris* showed high versatility being used for two food (soups and salads) and twelve medicinal preparations. *Pyrus* was also very popular as pears were prepared using eight different methods, including the very traditional *sa pilarda* and *in cuffettu*. *Sa pilarda* is a way to sunder and preserve fruits and vegetables in general and pears in particular. *In cuffettu* is a preparation method which uses vinegar to preserve pears.

Regarding the most quoted uses, we found 22 plants consumed raw as a snack, and 18 used in soups. The low number of medicinal taxa may be the result of different factors, including the overlapping of nutritional and medicinal values within the same taxa, which is often expressed by the exclamation "It's healthy!" However, traditional medicinal knowledge may have also been eroded by the widespread availability of commercial medicinal products.

#### 3.2. Snacking from the Wild

Almost one-third of the recorded plants are snacks as they are consumed raw, at the place of harvest, between main meals. Often their consumption is preceded by their unintentional finding. Interviewees reported 10 taxa belonging to this group including fruits and leaves (*Rumex acetosa*) and part of the stem (*Hypochoeris*). Other taxa include flowers which are sucked such as *Digitalis purpurea*, *Oxalis* spp., and *Scrophularia trifoliata*. One interviewee referred to snacking on the roots of *Smyrniium perfoliatum* as a "child's game". These plants were mainly consumed by children, since they started to help with the herd at the age of 10. Other plant taxa were also used, although not exclusively as raw snacks, and these included mainly fruit trees such as *Corylus avellana*, *Ficus carica*, *Juglans regia*, *Morus* spp., *Opuntia ficus-indica*, *Prunus cerasus*, and *Prunus amygdalus*.

In addition, 10 vernacular names under the phytonym *cardu* were recorded and indicate thistles consumed as snacks, particularly relevant in the past when shepherds were transhumant (Figure 2). Therefore, we may refer to such a category of snacks as pastoralist snacks.



**Figure 2.** Distribution of vernacular food taxa. Percentage of raw snack taxa.

### 3.3. The Role of Pastoralism in Shaping the Cultural and Food Landscape of Barbagia di Ollolai

Shepherding plays a multiplicity of roles in traditional local ecological narration. Indeed, pastoralism permeates every sphere of life in Barbagia. Thus, traditional food habits were also shaped by such activity. Indeed, a staple food of shepherds was fresh (or rotten casu martzu) cheese and pane fresa (local dry bread). Vitamins, fiber and other nutrients were mainly introduced by wild species. As an older interviewee reported: “Sa melacra (*Rumex acetosa*) is bloody, it’s bright and makes your blood happy”.

Indeed, despite global shifts and the sedentarization of this form of pastoralism, sheep and shepherding are vital and valued in the Barbagian cultural landscape. Here, pastoralism provides several tangible and intangible services. For instance, sheep milk is made into ricotta cheese, used as filling for local dumplings called culurgiones or sabadas, into hazau de murza, another fresh cheese which is used in s’erbutzu soups, or into the famous pecorino cheese. Mutton and lamb meat is also prepared according to different recipes; however, our interviewees reported the preparation of a specific dish called sa vrente which is based on sheep blood cooked in its stomach in ash. This dish is especially relevant as it does not require the use of a kitchen, because it is still cooked directly in the field. Another distinctive recipe is sa horda which is an agglomerate of roasted intestines. Blood is not only cooked in the stomach, but it is also an ingredient for dumplings and desserts, after it has been seasoned with wild taxa such as su puleu (*Mentha pulegium*), s’armidda (*Thymus herba-barona*), or su gusathu (*Allium subhirsutum*).

In addition, sheep provide wool, which used to be a valuable raw material for handicrafts and clothes, but is now undergoing a market crisis. Some shepherds still remember some plants used for dyeing wool fibers including s’alinu (*Alnus glutinosa*), sa castanza (*Castanea sativa*), and su samucu (*Sambucus nigra*). Moreover, a local inhabitant reported the beneficial use of dirty wool for treating hair, which would grow stronger. The fat of the sheep was employed as a base for medicinal ointments, while sheepskin was used for handicrafts, especially to custom-make Carnival masks, which are another expression of the centrality of pastoralism in Barbagia di Ollolai. However, sheep also provide intangible values such as the tradition of s’ispinu, which can be summed up with the phrase “a taste for sharing”. Indeed, when refrigerators were not available and meat could not be stored for a long time, there was a rotational system for slaughtering. Every family provided the community with meat at a different time, so that every household had fresh meat available. At the moment, this tradition is no longer practiced, but persisted in the memory of our interviewees.

## 4. Discussion

### 4.1. Cardu: A Key Emic Plant Group in the Pastoral Cultural Heritage of the Mediterranean

Pastoralist snacks in Barbagia di Ollolai are mainly represented by thistles, locally named cardu, referring to thorny herbaceous taxa primarily belonging to the Asteraceae family, but also to other families such as Caprifoliaceae and Apiaceae.

The interviewees in Teti and Lodine could not fully agree on the correspondence between local names and samples of the plant. Indeed, most of them are called cardu—cardoon—followed by an adjective, such as “of the donkey”, “white”, etc. This under-differentiation, also highlighted by Paulis [40], may be due to the isolation of shepherds in their daily lives, and thus, the lack of a precise definition. However, it may also be due to mobility and thus, to different names depending on the location, or to the current ongoing erosion of TEK related to those plants. Table 1 reports the names and uses of records belonging to such a phytonym mentioned in Lodine and Teti, where we can trace back the ten local phytonyms to five taxa belonging to the Asteraceae family.

Cardu are generally consumed raw, although some (such as gardu varju and (g)ardu molentinu) can be cooked to be preserved with vinegar. Both men and women are able to name some cardu, probably due to their abundance as well as to childhood memories; however, it is likely that men eat them more because of the time they spend on a daily basis in the pastures where cardu grow abundantly. In most cases, the names reported in Teti and Lodine differed, indicating the (linguistic) individuality of each Barbagian village, despite the short distances between them.

Review of the ethnobotanical data regarding the phytonym cardu in Sardinia revealed its cultural relevance all over the island. We found 10 publications reporting 16 taxa and 25 local phytonyms distributed across Sardinia (Table 2). Specifically, we found 25 food uses, 33 medicinal uses and 8 veterinary uses, including fodder and nectar for bees. Of the food uses, in the majority of cases, cardu stems, tubers or young inflorescences are consumed raw, sometimes they are boiled or blanched, and rarely, they are preserved in olive oil, or used in soups, omelets and liquors. Medicinal uses of cardu are usually administrated as decoctions (mainly of roots) but also as infusions.

**Table 2.** Review of thistle taxa used in Sardinia.

Taxa	Local Name	Site	Use	Reference
<i>Carduus pycnocephalus</i> L. (Asteraceae)	Gardu pissianculu	Dorgali	F: Raw stems	Camarda (1990)
<i>Carlina corymbosa</i> L. (Asteraceae)	Gardu anzoninu	Dorgali	V: As fodder	Camarda (1990)
<i>Chamaeleon gummifer</i> (L.) Cass. (Asteraceae)	Gardu prantarrittunu	Dorgali	V: Melliferous	Camarda (1990)
			V: As fodder	Camarda (1990)
<i>Centaurea benedicta</i> (L.) (Asteraceae)	Cardu santu	Laconi	M: The whole plant before flowering is a perspirant	Ballerio et al. (1997)
			M: The whole plant before flowering is an anti-catarrhal	Ballerio et al. (1997)
			M: The whole plant before flowering is a diuretic	Ballerio et al. (1997)
<i>Cirsium scabrum</i> (Poir.) Bonnet and Barratte (Asteraceae)	Gardu 'e vrunzu	Dorgali	F: Raw stems	Camarda (1990)
<i>Cynara cardunculus</i> L. (Asteraceae)	Cadru gureu	Santadi	F: Liquors	Capriola (unpublished)
			F: Tender stems and inflorescences are blanched and preserved with olive oil	Capriola (unpublished)
			F: Soups	Capriola (unpublished)
	Canciofa	Flumini maggiore	M: Decoction of the whole plant for liver health	Ballerio et al. (2001)
		Laconi	M: Root infusion for jaundice	Ballerio et al. (1997)
			M: Leaf decoction for liver colic	Ballerio et al. (1997)

	Cancioffa	Sarrabus	M: Leaf decoction as a blood depurative	Palmese et al. (2001)
			M: Leaf decoction as a hypocholesterolaemizant	Palmese et al. (2001)
		Arzana	M: Stem infusion as an intestinal antispasmodic	Ballero et al. (1994)
			M: Stem infusion as a digestive	Ballero et al. (1994)
	Cardu	Villagrande Straisaili	M: Leaf infusion for liver health	Loi et al. (2004)
		Villagrande Straisaili	M: Stalk decoction for digestion	Loi et al. (2004)
	Cardureu	Gesturi	M: Leaf decoction as a choleric	Loi et al. (2002)
			M: Leaf decoction as a diuretic	Loi et al. (2002)
			M: Leaf decoction for liver health	Loi et al. (2002)
			M: Leaf decoction for jaundice	Loi et al. (2002)
	Gardu leu	Dorgali	F: Young leaves in omelets	Camarda(1990)
			V: As fodder	Camarda(1990)
			F: Young inflorescences boiled	Lancioni et al. (2007)
	Gardu reju	Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)
			F: Infused in alcohol	Lancioni et al. (2007)
			M: Root decoction as a diuretic	Lancioni et al. (2007)
<i>Dipsacus ferox</i> Loisel (Caprifoliaceae)	Cadru 'e pastori	Santadi	F: Raw or blanched	Capriola (unpublished)
	Gardu cannella	Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)
<i>Dipsacus fullonum</i> L. (Caprifoliaceae)	Cardu aresti	Laconi	M: Root infusion for diseases	Ballero et al. (1997)
			M: Water harvested on the plant to treat red spots on the skin	Ballero et al. (1997)
		Campidano	M: Leaf and root decoction as a digestive	Bruni et al. (1997)
<i>Eryngium campestre</i> L. (Apiaceae)	Cardu tingiosu	Laconi	M: Decoction of non-lignified root contributes to chloride elimination	Bruni et al. (1997)
			M: Decoction of non-lignified root helps to reabsorb edema	Bruni et al. (1997)
			M: Decoction of non-lignified root is a diuretic against calculi	Bruni et al. (1997)
<i>Eryngium maritimum</i> L. (Apiaceae)	Cadru de mari	Sarrabus	M: Root decoction as a spasmolytic	Palmese et al. (2003)
			M: Root decoction for colic	Palmese et al. (2003)
<i>Galactites tomentosus</i> Moench (Asteraceae)	Cadru piscia	Santadi	F: Stems raw or blanched	Capriola (unpublished)
	Gardu pintu	Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)
		Dorgali	V: Melliferous	Camarda (1990)
			V: As fodder	Camarda (1990)
<i>Onopordum illyricum</i> L. (Asteraceae)	Gardu aininu	Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)
<i>Scolymus hispanicus</i> L. (Asteraceae)	Gardu mele	Dorgali	V: Melliferous	Camarda (1990)
			V: As fodder	Camarda (1990)
			F: Stems and roots eaten raw	Camarda (1990)
		Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)
<i>Silybum marianum</i> (L.)	Cadru mulenti	Santadi	F: Stems raw or blanched	Capriola (unpublished)
			F: Young leaves in salads (boiled or raw)	Atzei et al. (1991)



Gaertner. (Asteraceae)	Tempio Pausani a	M: Leaf infusion for digestion	Atzei et al. (1991)	
		M: Leaf infusion for liver health	Atzei et al. (1991)	
	Caldu asininu; Caldu di Santa Maria	Luogosa nto	F: Young leaves in salads (boiled or raw)	Atzei et al. (1991)
		Arzache na	F: Young leaves in salads (boiled or raw)	Atzei et al. (1991)
		S. Teresa di Gallura	F: Young leaves in salads (boiled or raw)	Atzei et al. (1991)
	Cima de cardu	Telti	F: Young leaves in salads (boiled or raw)	Atzei et al. (1991)
			M: Decoction of whole plant as a hypocholesterolaemizant	Ballero et al. (1997)
			M: Decoction of whole plant against hemorrhage	Ballero et al. (1997)
			M: Decoction of whole plant as a perspirant for chronic pneumonitis	Ballero et al. (1997)
	Gardu Iloche	Dorgali	M: Decoction of whole plant as a diuretic	Ballero et al. (1997)
F: Raw stems			Camarda (1990)	
Gardu mola	Orune	F: Young inflorescences eaten raw	Lancioni et al. (2007)	
		F: Young inflorescences preserved with olive oil	Lancioni et al. (2007)	
		M: Root decoction as a diuretic	Lancioni et al. (2007)	

In Sardinia, cardu are believed to contribute to diuresis and digestion and they are especially good for the liver. These ethno-medicinal findings are in accordance with scientific evidence indicating that *Carduus* species are associated with several nutraceutical properties such as antibacterial activity, being beneficial for the liver, as well as being a digestive, a diuretic, and an antioxidant, antispasmodic, anti-inflammatory, anticancer, and antiviral agent [41]. These thorny wild plants are traditionally used not only in Sardinia, but across the whole Mediterranean [41]. Indeed, this group of plants is well known for both food and medicinal preparations in Western Mediterranean cultures [42]. For instance, when looking at the words “cardo” or “cardu” in Spanish ethnobotany [43], we found similar results in terms of both uses and taxa belonging to such a phytonym, whose most important representatives are *Cynara cardunculus*, *Scolymus hispanicus* and *Silybum marianum*. It is worth noting that some local phytonyms mentioned use by shepherds (e.g., cadru ‘e pastori for *Dipsacus ferox* in Sardinia) or cheese-making (e.g., cardo cuaja-leches in Spanish or card per a formatjar in Catalan for *Cynara cardunculus*), but also some local phytonyms are quite similar in different languages (e.g., cadru mulenti, caldu asinine, cardu mola in Sardinia, and cardo borriquero, cardo burrero, alcachofa de burro, alcarcil borriquero in Spanish for *Silybum marianum*). Indeed, the artichoke may have been domesticated in Roman times in Sicily and later spread by Arabs all over the Western Mediterranean Basin [44,45]. The food use of thistles among pastoral societies has been found not only in Sardinia, but also in other inland Mediterranean areas such as Central Italy [46], Spain [47,48], and NE Greece [49]. Moreover, in a few pastoralist communities of the Mediterranean Basin, cardu species have been used as plant rennet in the cheese-making process underlining the long-term link between these species and pastoral activity [50,51].

Interestingly, in strongly horticulturalist-driven societies of the Mediterranean Basin, thistles are not much used; also since their ecology does not match the main foraging areas in these communities that are represented normally by anthropogenic environments close to vineyards or olive tree orchards. In these communities (as pointed out by [52]), thistles are sporadically consumed boiled or fried (e.g., [53] in Apulia and [54] Sicily, Italy, [55] in Catalonia, Spain), yet, in no case are they eaten raw as snacks on the spot. This suggests that, in the Mediterranean Basin, the consumption of thistles is especially relevant among the (historically) pastoral society, yet, can be used also by an agriculture-driven society, yet after cooking. Indeed, in Sardinia, cardu are gathered, often with the help of a knife (due to their thorniness), peeled with the blade, and consumed on the spot, possibly as a way to pass the time while grazing sheep, but ultimately, their crunchiness provides a pleasant chewing experience. Indeed, the texture of the plant may have contributed to the shaping of food preferences

in the pastoralist context [22]. In addition, cardu stems or tubers are often watery and may have been used as thirst quenchers, especially in late spring and the beginning of summer when the plants are more turgescient. Indeed, tubers have been reported to be important thirst quenchers and to be loved by shepherds [56,57]. Finally, in Barbagia di Ollolai, the bitter taste has not prevented the consumption of cardu. This may be due to two different reasons: preference for the crunchy texture despite the bitter taste and the widespread perception that bitter plants are healthy (as also reported in [58]). Indeed, the number of medicinal plants recorded during this study is much lower than the number of medicinal taxa generally mentioned in other Italian ethnobotanical studies. In contrast to findings in other European contexts [59], pastoral activity in Sardinia was mainly carried out by men, while women used to take care of the domestic realm. Deiana et al. [60] highlighted the exceptional male longevity in the inner areas of Sardinia and thus, pastoral activity and its diet might have contributed to this. This hypothesis may be strengthened by the fact that pastoralism was often an important male activity in the areas where extreme longevity was found [61], yet, other factors should be preponderant, as other pastoral societies do not share this exceptional male longevity.

#### 4.2. Sardinian Cultural Heritage and Pastoral Foodsystems

Pastoralism in Barbagia di Ollolai, and Sardinia in general, has had an important role in shaping identity from different perspectives [8,62]. One of those perspectives is represented by the landscape. Indeed, the Sardinian landscape preserves valuable evidence of pastoral activity such as drystone vernacular constructions which are the result of traditional knowledge developed in a close dialectic relationship with the surrounding environment [63,64]. Particularly, pastoral activity has developed *sos pinnettos* (“a truncated cone shape, realizing a dome (tholos) that recalls—with extraordinary typological continuity—the ancient Nuragic construction, fitting harmoniously into the landscape” [65] (p. 468) and *sas barracas* (with quadrangular base), which are temporal multipurpose buildings for storing tools, milking sheep, and sheltering [66]. Such facilities, as well as the *camminos*, transhumance pathways surrounded by stone walls, are included in the cultural heritage according to the Regional Landscape Plan of Sardinia [65]. Moreover, pastoral activity has contributed to the maintenance of flora and microflora biodiversity [67,68] and thus, preventing the degradation of valuable landscapes. Finally, landscapes shaped by pastoralism are “one of the strongest manifestations of the historical identity of the Sardinian landscape and its peculiar biodiversity” [69] p. 539.

However, pastoral activity has also developed rituals and practices and particularly, dietary habits. Indeed, pastoralism and food habits have coevolved over centuries. For instance, we observed that *cardu*, when cooked, are often associated with other pastoral products such as milk or sheep meat, as in the case of the renowned local recipe “stewed sheep and *cardu*”. Moreover, as reported by our interviewees, *pane fresa*, the local bread (very dry and thin), used to be rectangular, and not round, to better fit the saddle pack of donkeys which used to follow the herd during transhumance. In addition, *cardu* were also important plants for curdling as they were used as vegetable rennet (they are quite evident in the Spanish and Catalan names reported for *Cynara cardunculus*). Indeed, such food is intangible biocultural heritage, an undervalued resource which embodies different historical and cultural processes that have occurred over centuries. Biocultural heritage and specifically, edible biocultural heritage, reflects the geographical characteristics of the place as well as the human creativity to modify its habitat by managing the surrounding landscape and its elements [70]. Therefore, pastoral gastronomy is a biocultural heritage resulting from the inextricable link between humans and nature which coevolved over time.

## 5. Conclusions

The overall gathered data show the contribution of pastoral activity in shaping the cultural and gastronomic heritage of Barbagia di Ollolai. Indeed, it is quite significant that over one-third of the food taxa are used as a snack. Even more significant are the use of *cardu* as pastoral snacks, being evidence of the long time spent by shepherds far from home and therefore, from the domestic realm and its cultivated gardens. Gathered narratives reported the importance of wild plants and sheep

products, suggesting that such pastoral food is a salient, intangible cultural heritage which embodies different historical and cultural processes. Pastoral food is, therefore, a biocultural heritage resulting from an inextricable link between humans and nature, coevolved over time, through a sustainable use of rural landscapes. Promoting typical (and often neglected) pastoral foods is a crucial strategy for sustaining the local economy, maintaining traditional practices and values, and supporting invaluable complex landscape mosaics.

Our study calls for further field surveys in other Mediterranean regions, aimed at exploring the complex relationship between pastoral activity, local food heritage, and rural landscapes.

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## Appendix A

**Table A1.** Recorded taxa in Teti and Lodine, Barbagia di Ollolai, Central Sardinia. (T = Teti; L = Lodine; n = number of interviewees).

Botanical Taxon/a and Family	Recorded Local Name	Parts Used	Food Use	Medicinal Use	Teti n = 15	Lodine n = 15	
<i>Allium subhirsutum</i> L. (Amaryllidaceae) UNISGSAR003	Gusathu (L)	Bulb and Aerial parts	Seasoning (for sausage)			14	
<i>Allium triquetrum</i> L. (Amaryllidaceae) UNISGSAR010	S'apara (T, L)	Bulb and Aerial parts	Boiled and stir-fried		1		
			S'erbutzu			12	
<i>Alnus glutinosa</i> (L.) Gaertn. (Betulaceae)	S'alinu (L)	Leaves		To allow foot transpiration (to be put in the shoes)		1	
<i>Apium nodiflorum</i> (L.) Lag. (Apiaceae) UNISGSAR012	Su lau (T); Su benale (L)	Aerial parts	Raw in salads		11	15	
			S'erbutzu			7	
<i>Arbutus unedo</i> L. (Ericaceae)	Sa mela e lidone (T, L); Su lidone (L)	Fruits	Raw as a snack		7	6	
			Jam			7	
			Liquor		3	1	
<i>Asparagus acutifolius</i> L. (Asparagaceae) UNISGSAR015	Sparau (T); S'isparagu (L)	Stems	Omelets		14	2	
			Boiled with eggs		12	5	
			Cooked with pasta		3	1	
			Boiled and then put in salad		2	1	
			Frittelle			3	
Preserved with olive oil		1	4				
<i>Asphodelus ramosus</i> L. (Asphodelaceae)	S'iscraria (L)	Tubers		Poultice of pressed tubers to treat pimples		4	
<i>Beta vulgaris</i> L. (Amaranthaceae) UNISGSAR016	S'eda (T); Sa veda (L)	Aerial parts	Stir-fried		8	2	
			Boiled and then put in salad		5	1	
			Ravioli filling		1	3	
			Soup		1	2	
			Omelets		1	5	
<i>Borago officinalis</i> L. (Boraginaceae)	Sa mata de sa sucuridda (T)		Omelets		1		
<i>Castanea sativa</i> L. (Fagaceae)	Castanza (T); Hastanza (L)	Fruits	Dried and smoked		4	4	
			Sundried		4	5	
			Baked			1	
			Roasted			1	
			Boiled			2	
	S'erba lattosa (L)	Leaves	Boiled and stir-fried			3	

<i>Chondrilla juncea</i> L. (Asteraceae) UNISGSAR013			Raw in salad		3
			Mixed soup (S'erbutzu)		3
<i>Cichorium intybus</i> L. (Asteraceae) UNISGSAR020	Cicoria (T), Sicoria (T), Zicoria (L)	Aerial parts	Raw in salad	13	3
			Mixed soup (S'erbutzu)		2
			Boiled and stir-fried	6	1
<i>Convolvulus arvensis</i> L. (Convolvulaceae)	Convolvolo (T)	Shoots	Boiled and then put in salad	1	
			Omelets	1	
			Dessert	6	11
<i>Corylus avellana</i> L. (Betulaceae)	Ninzole (T, L)	Fruits	Oil for dessert	1	
			Raw as a snack		4
			Raw as a snack	4	4
<i>Crataegus laevigata</i> (Poir.) DC. (Rosaceae) UNISGSAR022	Calavrighe (T), Calavie (L)	Fruits	Infusion as a depurative	1	
		Thorns	Liquor	1	
			Fomentation to treat a bad tooth		1
<i>Crepis vesicaria</i> L. (Asteraceae) UNISGSAR002	Cicoria (T), Sicoria (T), Zicoria (L)	Aerial parts	Raw in salad	13	3
			Mixed soup (S'erbutzu)		2
			Boiled and stir-fried	6	1
<i>Crocus minimus</i> Redouté (Iridaceae)	Zafaranu agreste (T)		Ravioli filling	1	
			Dried	1	
			Boiled with sugar to treat flu	1	
<i>Cydonia oblonga</i> Mill. (Rosaceae)	Mela chidonza (T), Sa mela 'e donza (L)	Fruits	Liquor	1	
			Boiled		3
			Cooked in ash		2
			Jam	1	4
<i>Digitalis purpurea</i> L. (Plantaginaceae)	Sa poddigale (T)	Flower	Sucked as a snack	9	
<i>Diplotaxis</i> spp. (Brassicaceae) UNISGSAR027	Rucola (L)	Leaves	Raw in salad	4	3
			Pizza topping		1
<i>Euphorbia</i> spp. possibly including <i>E. characias</i> L. (Euphorbiaceae)	S'erva e Santu Franziscu (L)	Sap	Locally applied to treat the skin (warts)		2
<i>Ficus carica</i> L. (Moraceae)	Fichi	Fruits	Raw as a snack	8	
			Dried as a seasoning (for pork sanguinaccio)		4
			Jam		4
	Fenucheddu burdu (T); S'inucru agreste (L); S'enucru (L)	Aerial parts	Soup	4	4
			Seasoning	1	4

<i>Foeniculum vulgare</i> Mill. (Apiaceae) UNISGSAR029				Frittelle	1	2
				Boiled		1
				Infusion as a diuretic	1	
Seeds				Seasoning (for sausage)	1	8
<i>Helichrysum italicum</i> (Roth) G. Don (Asteraceae) UNISGSAR032	S'erva du Santu Zubanne (L)	Aerial parts		Poultice to treat warts		2
<i>Hypochoeris radicata</i> L. (Asteraceae) UNISGSAR033	S'ortezone (T), Su gurtezone (L)	Aerial parts	Raw in salad		4	
			Mixed soup (S'erbutzu)			9
UNISGSAR009	Cozzoniddu (T)	Part of the stem	Raw as a snack		1	
<i>Juglans regia</i> L. (Juglandaceae)	Nughe (T); Nue (L)	Fruits	Raw as a snack			8
			Dessert		6	9
			Liquor		1	2
			Gnocchi		1	
<i>Lathyrus</i> spp. L. (Leguminosae)		Fruits	Raw as a snack		4	2
<i>L. articulatus</i> L. UNISGSAR007	Sa bizzuledda (T), Su ghirthalu (L)	Flower	Sucked as a snack			6
<i>L. latifolius</i> L. UNISGSAR036						
<i>Laurus nobilis</i> L. (Lauraceae) UNISGSAR011	Su laru (T)	Leaves	Seasoning		2	1
			Infusion as an expectorant		1	
			Infusion to treat menstruation pain		1	
<i>Malus</i> spp. (Rosaceae)	Mele (T, L)	Fruits	Raw		5	4
			Sa pilarda		5	
			Jam			6
			Raw as a snack			7
<i>Malva sylvestris</i> L. (Malvaceae) UNISGSAR014	Sa navrighedda (T); Sa marma, sa marmachedda (L), Sa marmarutza (L)	Leaves (sometimes dried)	Soup		1	3
			Boiled and then put in salad			2
			Infusion to treat abdominal pain		10	7
			Infusion to disinfect		3	5
			Infusion to treat flu		4	
			Poultice with pork fat to treat infections		4	
			Poultice to treat toothache		5	
			Infusion locally applied to treat the eyes		5	

				Infusion to treat canker sores	4	
				Infusion to treat bad breath	1	
				Infusion to treat constipation	8	
				Poultice to treat burns	3	
				For washing hair	2	
				Fomentation to treat flu	1	
				Infusion to treat abdominal pain	8	
<i>Matricaria chamomilla</i>				Infusion as a tranquilizer	1	
L. (Asteraceae)	Camomilla (T, L)	Aerial parts		Infusion to treat the eyes	1	1
UNISGSAR023				Infusion to induce sleep		1
				To treat stomach pain	4	
<i>Mentha</i> spp.				Seasoning (fava beans)	5	1
(Lamiaceae) <i>M.</i>				Ravioli filling		2
<i>aquatica</i> L.				Liquor		1
UNISGSAR021	S'amenta (T, L), Sa menta agreste (L)	Leaves		Seasoning (sanguinaccio, especially sheep)		7
<i>M. arvensis</i> L.				Fomentation to treat toothache		3
UNISGSAR017						
<i>M. x piperita</i> L.						
UNISGSAR026						
<i>Mentha pulegium</i> L.				Seasoning (for sanguinaccio and pork meat)	9	9
(Lamiaceae)	Su puleu (T, L)	Aerial parts				
UNISGSAR019						
<i>Morus alba</i> L., <i>Morus nigra</i> L. (Moraceae)	Sa murighessa (T, L)	Fruits		Raw as a snack	6	6
<i>Myrtus communis</i> L. (Myrtaceae)				Liquor	5	1
UNISGSAR028	Sa murta (T, L)	Fruits		Raw as a snack	4	
				Seasoning	1	6
<i>Nasturtium officinale</i> R. Br. (Brassicaceae)	Su nastrutzu (T); Su martutzu (L)	Aerial parts		Raw in salad (with some cheese)	11	8
<i>Oenanthe pimpinelloides</i> L. (Apiaceae)	S'urulia (T); S'ungra, S'ungredda (L)	Aerial parts		Mixed soup (S'erbutzu)	14	15
				Boiled and then put in salad	1	
<i>Opuntia ficus-indica</i> (L.) Mill. (Cactaceae)	Figu moriscu (T)	Fruits		Raw as a snack	1	
				Dessert	1	
<i>Oxalis</i> spp. (Oxalidaceae)	Campanelle (L)	Flower		Sucked as a snack		1
<i>Petroselinum crispum</i> (Mill.) Fuss (Apiaceae)	Perdusemmene (T, L)	Aerial parts		To treat constipation	2	1
<i>Pimpinella anisum</i> L. (Apiaceae)	Matafalua (T)	Seeds		Seasoning (sausages and dessert)	1	

<i>Pistacia lentiscus</i> L. (Anacardiaceae)	Listincu (T), Lentisco (T, L)	Fruits	To make oil	5	
<i>Portulaca oleracea</i> L. (Portulacaceae)	Erba procreddina (T)	Aerial parts	Raw in salad	1	
<i>Prunus armeniaca</i> L. (Rosaceae)	Su piricocco (T)	Fruits	Dried	2	
<i>Prunus cerasus</i> L. (Rosaceae)	S'eresia (L)	Fruits	Raw as a snack	3	5
			Jam		4
			Infused with alcohol		3
			Preserved with sugar		1
<i>Prunus domestica</i> L. (Rosaceae)	Pruni (T)	Fruits	Raw	7	
			Sa pilarda	5	
<i>Prunus amygdalus</i> Batsch (Rosaceae)	Sa menduledda (T), S'amendula (L)	Fruits	Raw as a snack	1	2
			Dessert		2
			Confetto		1
<i>Prunus prostrata</i> Labill. (Rosaceae)	Prunitza (L)	Berries	Liquor		3
<i>Prunus spinosa</i> L. (Rosaceae)	Sa prunishedda (T, L)	Fruits	Raw as a snack	2	1
			Raw	13	6
			Sa pilarda	5	4
			Liquor	1	
<i>Pyrus</i> spp. (Rosaceae)	Sa pira, Su pirastru (T); Sa piracra, Sa pire (L)	Fruits	Preserved with water and vinegar (en cuffetu)		9
			Jam		4
			Preserved with alcohol		3
			Baked		1
			Boiled		3
			<i>Quercus</i> spp. (Fagaceae)	Quercia	Phloem
Leaves	Boiled as a poultice to treat warts				4
<i>Raphanus raphanistrum</i> L. (Brassicaceae) UNISGSAR035			Boiled and stir-fried	7	1
			Omelets	4	
<i>R. raphanistrum</i> subsp. <i>landra</i> (Moretti ex DC.) Bonnier and Layens UNISGSAR001	S'ambularza (T); S'ermulantza (L)	Aerial parts	Mixed soup (S'erbutzu)	8	4
	Sa mamalucca (L)	Aerial parts	Raw in salad		1



<i>Reichardia picroides</i> (L.) Roth (Asteraceae)				Soup		3		
<i>Rosa canina</i> L. (Rosaceae) UNISGSAR034	Sa rosa burda (T) Piscaliddu (fruit, T), Sa rosa agreste	Fruits		Liquor		5		
					Good for the kidneys		1	
				Raw as a snack		2		
<i>Rubus ulmifolius</i> Schott (Rosaceae) UNISGSAR030	Sa mura (T), S'orribu (T), S'amura (L)	Fruits	Shoots	Omelets		1		
				Raw as a snack		6	7	
				Liquor		1		
				Jam		1	8	
				Dessert		1		
<i>Rumex acetosa</i> L. (Polygonaceae) UNISGSAR025	Sa mariola (T); Sa melacra (L)	Leaves		Raw as a snack		11	11	
<i>Rumex pulcher</i> L. (Polygonaceae) UNISGSAR037	Su lampartzu (T); Su lampathu (L)	Aerial parts		Mixed Soup (S'erbutzu)		12	15	
<i>Salvia</i> spp. (Lamiaceae) UNISGSAR038	Sa salvia (T, L)			Seasoning			3	
<i>Salvia rosmarinus</i> Spenn. (Lamiaceae)	Rosmarino (T, L)			Seasoning		1	4	
<i>Sambucus nigra</i> L. (Adoxaceae)	Sambucu (T); Samuhu (L)	Flowers			Poultice to treat bronchitis in children	4		
					Poultice to treat the eyes		4	
					Poultice to treat the joints		4	
					Infusion to treat abdominal pain		3	
					Infusion to treat headache		3	
				Berries	Frittelle		1	
		Liquor		1				
<i>Scrophularia trifoliata</i> L. (Scrophulariaceae) UNISGSAR005a UNISGSAR005b	No name	Flower		Sucked as a snack		2	3	
<i>Sedum</i> spp. possibly including <i>S. dasyphyllum</i> L. (Crassulaceae) UNISGSAR004	Erba di Santa Maria (L)	Leaves		Plaster to treat the skin			2	
		Aerial parts		Mixed Soup (S'erburtzu)		13	8	

<i>Silene vulgaris</i> (Moench) Garcke (Caryophyllaceae) UNISGSAR040	Su crapicheddu (T); S'apricheddu (L)	Seeds	Raw in salad	1	
			Frittelle		1
			Seeds on ash and then inhaled to treat toothache		4
<i>Smyrniium</i> <i>perfoliatum</i> L. (Apiaceae) UNISGSAR006	No name	Root	Raw as a snack	2	
<i>Sonchus oleraceus</i> (L.) L. (Asteraceae) UNISGSAR043	Graminzone (L)	Aerial parts	Soup		4
<i>Thymus herba-barona</i> Loisel. (Lamiaceae) UNISGSAR039	S'armidda (T, L)	Aerial parts	Seasoning (for sanguinaccio or goat/sheep meat)	7	15
<i>Urtica</i> spp. (Urticaceae) <i>Urtica</i> <i>atrovirens</i> Req. ex Loisel.  UNISGSAR041	Sa pistiolu (T); Su pistiori (L)	Leaves	For washing hair	5	5
			Boiled and then put in salad		7
			Infusion to treat canker sores		4
			Infusion to treat stomach ache	5	
			Infusion to treat abdominal pain		5
			Infusion as a depurative for the kidneys		4
<i>Vinca difformis</i> subsp. <i>sardoa</i> Stearn (Apocynaceae)	Pruinca (L)	Leaves	Poultice to treat bronchitis in children		2
N.D. Lichen	Sa pedda 'e arbole	Aerial parts	Locally applied as a hemostatic		4

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