



Scholarly vs. Traditional Knowledge: Effects of Sacred Natural Sites on Ethnobotanical Practices in Tuscany, Central Italy

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Abstract

Sacred Natural Sites (SNSs), found in all inhabited continents, are cultural landscapes of spiritual significance for local communities. As they are believed to influence Traditional Ecological Knowledge (TEK), we documented the use of wild and semi-domesticated plants for food and medicine in four villages located at different distances from SNSs in Central Italy. Results may indicate that SNSs, which have been managed and inhabited for centuries by monastic communities, have had a restrictive impact on local TEK, as the communities located near SNSs reported fewer traditional uses for plants than those living further from the same SNSs. One possible explanation is that the Scholarly Knowledge (SK) held by the monastic communities of SNSs competed with the TEK of the surrounding villages and this resulted in a smaller body of plant-related folk knowledge, practices and beliefs retained by the people living in the vicinity of SNSs. Further studies should address the past and current mechanisms of competition and/or osmosis between TEK and SK in terms of both daily practices and beliefs/theoretical knowledge.

Keywords Ethnobotany · Ethnomedicine · Traditional ecological knowledge · Sacred natural sites · Tuscany, Italy

Introduction

Traditional cultural landscapes in the Mediterranean Basin are the result of centuries-long evolution of social-ecological systems (Fischer *et al.* 2012; Plieninger and Bieling 2012). Sacred Natural Sites (SNSs) are cultural landscapes defined as “portions of land or water holding spiritual significance for people and communities” (Wild and McLeod 2008). SNSs can be found in all inhabited continents (Hughes and Chandran 1998) and sacred groves date back to pre-agricultural times (Gadgil and Vartak 1982). Sacred Natural Sites encompass a wide range of rituals, socio-cultural systems, faiths, and beliefs (Verschuuren 2010). Dafni (2007) classified sacred places into artificial and natural objects, citing Turner (1979), who describes them as the meeting points

of realms “set in a vertical dimension as ladders, poles and pillars, trees and hills.” The division proposed by Dafni (2007) is somewhat ambivalent as in modern environments differentiation between natural and artificial is a matter of perspective. SNSs were well known in polytheistic religions as locations of interaction between the human and the divine (see also Dafni 2007). Some well-established SNSs were later claimed as Christian sites in order to promote religious conversion (see Jonuks 2013 and references therein).

Many studies related to SNSs have been carried out in Asia (Mody 2018 and references therein) and sub-Saharan Africa (Agyeman *et al.* 2016; Alohou *et al.* 2017; Daye and Healey 2015; Doffana 2017; Nganso *et al.* 2012), while only a few, although a growing number of publications focus on the Mediterranean Basin, including Greece (Avtzis *et al.* 2018; Stara *et al.* 2015), Morocco (Agyeman *et al.* 2016; Deil *et al.* 2005), Cyprus (Lardos and Heinrich 2013), and Italy (Frascaroli 2013; Frascaroli *et al.* 2014; Schmid *et al.* 2015).

The majority of the studies carried out in the Mediterranean Basin address the importance of SNSs as reservoir of biodiversity, whereas Frascaroli *et al.* (2014) examined the historical connection between SNSs and pastoralism. Frascaroli and Verschuuren (2016) highlight the role of SNSs in sustaining TEK. However, the relationship between SNSs and TEK remains underexplored in Mediterranean contexts. While Lardos and Heinrich (2013) partly explored the relationship

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between SNSs and knowledge related to wild food plants in Cyprus, the relationship between SNSs and knowledge related to medicinal plants has as yet been little discussed in other geographical contexts.

Teklehaymanot *et al.* (2007) examined the medical plant knowledge of people living close to an Ethiopian Orthodox monastery and found that local herbalists acquired their knowledge and use of medicinal plants from the monastic community, where this knowledge was passed down secretly from one generation to the next through illustrated codices often influenced by the writings of Hippocrates (c.460-c.375 BCE) and Galen (129-c.210 CE), crucial sources for monastic medicine (Lardos and Heinrich 2013; Mađra Gackowska *et al.* 2018; Medeiros and de Albuquerque 2012; Niederer 2005). This medicinal knowledge was then adapted to local conditions (Dal Cero *et al.* 2014). This transmission of knowledge was perpetuated through the centuries by the close contact maintained among neighboring monastic communities (Lardos and Heinrich 2013) and fostered by regular pilgrimages that played a major role in the spread of knowledge, especially during the Middle Ages (Kristjánsdóttir *et al.* 2014).

Against this background, we investigated the influence of two Tuscan SNSs (Madonna del Faggio in Pieve Santo Stefano and Monte Oliveto Maggiore in Asciano) on traditional ecological knowledge related to wild and semi-domesticated plant food and medicinal preparations. Tuscany has an important religious heritage due in part to its proximity to the Vatican, and it is, in fact, crisscrossed by

many old pilgrimage routes such as the Via Francigena, which in medieval times connected Canterbury to Rome.

On the basis of our hypothesis that SNSs inhabited by monastic communities influence the TEK related to wild and semi-domesticated plants for medicinal and food preparations of the communities living in the surrounding area, our specific goals were:

- to document the uses of wild and semi-domesticated plants for food and medicinal preparations of two communities located close to and distant from the selected SNSs;
- to collate the collected ethnobotanical information in order to evaluate the influence of these selected SNSs on the traditional ecological knowledge of the communities living in the vicinity.

This research was conducted within the framework of the PRIN project titled “Biodiversity and ecosystem services in Sacred Natural Sites” (BIOESSANS), which includes as one of its main aims the investigation of a sample of SNSs in Italy in order to explore their possible relationship with local biodiversity and traditional environmental knowledge.

Study Area

We conducted this study in two areas of Tuscany, Central Italy, whose capital city is Florence (Fig. 1). Climatically,

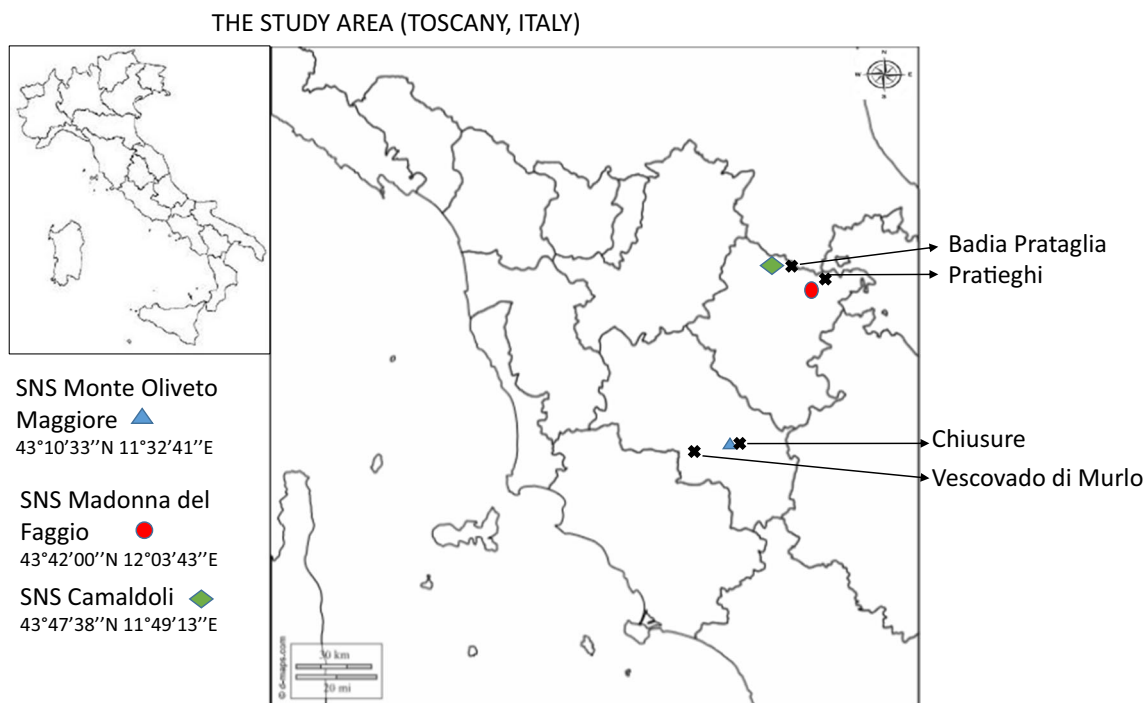


Fig. 1 Map of the study area

the two study areas are located in different zones. The study area of the SNS of Madonna del Faggio in Northern Tuscany has a temperate climate with rainy summers and cold winters (1–2 °C average temperature in January), while the study area of the SNS of Monte Oliveto Maggiore is characterized by a temperate climate with dry summers and mild winters (6 °C average temperature in January).

The SNS of Monte Oliveto Maggiore is located in a hilly landscape in Southern Tuscany, in the municipality of Asciano. Benedictine monks built a monastery here in the fourteenth century that they have inhabited since then. Benedictines living in such communities devote their lives to prayer and work (*Ora et labora*). The monastic community must be economically self-sustaining and all monks must work to help support the monastery. This abbey had a sizeable portion of land devoted to agricultural activities such as viticulture and horticulture. Moreover, monks used to produce medicinal preparations and liquors, although this production ended around 1950. However, it is still possible to buy some goods produced by the monks, including wine, liquor, grappa, chickpeas, spelt, and olive oil; medicinal preparations are also available but they are the products of other Italian monastic communities.

Chiusure is a village of around 200 inhabitants located at 400 masl and only 2 km away from the SNS. Many elderly people of the village worked for the monks in some capacity, as both farmers and employees. Nowadays Chiusure is a tourist destination with numerous cafés and restaurants. In contrast Vescovado di Murlo is a village of 800 inhabitants located at 300 m asl, 13 km away, as the crow flies, from the Abbey of Monte Oliveto Maggiore. The toponym attests to the fact that it formerly belonged to the Archbishop of Siena (in Italian “*vescovo*”). As it is the main village of the municipality of Murlo, it has many services such as minimarkets, bakeries, cafés, and restaurants.

The SNS of Madonna del Faggio is located in the mountainous landscape of Northern Tuscany, in the municipality of Pieve Santo Stefano. It has never been the home of a monastic community, rather a hermitage was built in the sixteenth century after the Virgin Mary appeared to a young girl and offered her some strawberries. According to the inscriptions on the building, this apparition occurred in 1516. At present, the hermitage is located in a hunting reserve, although it is accessible via some pathways. It is very small and surrounded by a few *Fagus* trees, from which its name likely derives.

Pratieghi is a peripheral village of less than 50 inhabitants located 6 km from the SNS of Madonna del Faggio. The local community consists of a large number of retired people, and, seasonally, some Tuscan tourists. The village is located 850 masl in the Tusco-Emilian Apennines and its economy is based on agricultural activities. A local family manages the café, minimarket, restaurant, and hotel in the center of the village. The village name derives from the Italian “*prati e*

laghi” meaning meadows and lakes, due to the availability of both grasslands and water, which made this place suitable for pastoral activities and animal breeding.

Badia Pratalda is a peripheral village of about 600 inhabitants. It is located 19 km as the crow flies from the SNS of Madonna del Faggio. It used to be a popular mountain tourist destination in the last century, due to its proximity to the Adriatic coast and the Po Plain. The village lies within the Foreste Casentinesi, Monte Falterona, Campigna National Park at an altitude of 835 masl. The name means “the abbey of the meadow” since in the center of the village there is an abbey founded in 986 by Benedictine monks from the Abbey of Montecassino, in Latium, built a few years before the well-known Camaldoli hermitage (1023), which lies just a few kilometers away (see below).

Material and Methods

Data Collection and Analysis

Fieldwork was carried out between September 2017 and April 2018 and we conducted a total of 61 interviews around the two SNSs. We used purposive and snowball sampling methods in the selection of informants. We interviewed 17 women and 14 men at the SNS of Madonna del Faggio, while at the SNS of Monte Oliveto Maggiore we conducted interviews with 20 women and 10 men, mainly elderly individuals at both sites. The Code of Ethics of the International Society of Ethnobiology was strictly followed, and prior informed consent was received orally. Interviews were conducted in the Italian language; however, some interviewees responded in a local dialect. We collected qualitative and quantitative data about local wild and semi-wild plants gathered now or in the past for culinary purposes, as well as recipes, plant parts used, and the modes of preparation and consumption. Subsequently, we asked informants to indicate remedies for treating illnesses by naming each part of the body. Interviews were semi-structured, and an in-depth conversation was conducted when possible. Whenever possible, informants were asked to show mentioned plants around the house in order to harvest voucher specimens for herbarium preparation. The mentioned species were collected, when available, and identified according to “Flora d’Italia” (Pignatti 1982). Vouchers bear the numbers UNISGTOS001–038 and are deposited at the University of Gastronomic Sciences. Taxonomic identification, botanical nomenclature, and family assignments followed the Flora Europaea (Tutin *et al.* 1964), The Plant List database (2013), and Angiosperm Phylogeny Group IV (Stevens 2015). Data were assembled in an Excel database and structured in the form of detailed use reports.

Research Framework

Within the framework of the PRIN project titled “Biodiversity and ecosystem services in Sacred Natural Sites” four research institutions contributed to different aspects of this topic. Therefore, together with the other partner institutions we selected two SNSs in Tuscany in order to study the influence of SNSs on the TEK of the communities living in the surrounding area, while the work of other groups addresses the influence of SNSs on biodiversity (Table 1). However, when conducting the initial fieldwork at Madonna del Faggio, we realized that individuals of the two communities (Pratieghi and Badia Prataglia) were often referring to SNSs other than the one we had selected, especially to that of Camaldoli. Indeed, the area has numerous important SNSs such as the Franciscan sanctuary of La Verna (Chiusi della Verna), the sanctuary of Santa Maria del Sasso (Bibbiena), the hermitage of Cerbaiolo (Pieve Santo Stefano), and the hermitage and shrine of Camaldoli (Poppi). The famous Camaldoli shrine and hermitage was quite significant to our interviewees, as it lies just 4 km away from Badia Pratalda and 23 km away from Pratieghi. Therefore, we decided to also consider this SNS to serve as a comparison to Monte Oliveto Maggiore, as both sites are millennium-old shrines managed by Benedictine monks. The Camaldoli shrine was founded in 1012, and since then a community of Benedictine monks has lived in the area. The pharmacy of Camaldoli was (and still is) renowned, as was the hospital, which treated people living in the surrounding area and wayfarers for many centuries. Currently, this SNS is an important religious point and tourist attraction. The monastic community of Camaldoli produces a wide variety of goods, mainly medicinal and cosmetic.

Results

Ethnobotany of the SNS of Monte Oliveto Maggiore

Eighty taxa belonging to 41 families were mentioned by individuals from the two communities in the near and distant surroundings of the SNS of Monte Oliveto Maggiore (Table 2). Specifically, the inhabitants of Vescovado di Murlo and Chiusure reported the use of 68 and 52 species, respectively. Most of the taxa are common to the two communities; however,

the interviewees from Chiusure mentioned around 22% fewer taxa than did those from Vescovado di Murlo.

In Vescovado di Murlo, we recorded 20 food uses and 28 medicinal uses while in Chiusure we recorded 16 food uses and 18 medicinal uses - 20% fewer food uses and 35% fewer medicinal uses compared to the more distant location. The most common food preparations in both Vescovado and Chiusure include plants eaten raw in salads, raw plants used as seasoning, and fruits used for making jams (Fig. 2). In each community, at least seven taxa were dedicated to these uses. In addition, in Vescovado di Murlo there were two other popular categories, namely taxa used to make liquors and those for making omelets (seven species each). These taxa were not that important in Chiusure as liquor was only made with *Juglans regia*, and omelets were prepared with *Urtica dioica*, *Ruscus aculeatus*, *Rubus ulmifolius* and *Clematis vitalba*.

Regarding medicinal uses, the most common preparation in both communities was infusion: we recorded 18 different infusions in Vescovado di Murlo and 13 in Chiusure. Poultice was another preparation common to the two communities. Other medicinal preparations include topical application (*Plantago lanceolata*), maceration in olive oil (*Hypericum perforatum*), oral administration (*Allium ursinum*), and “carried in the pocket” (*Cupressus* spp. and *Aesculus hippocastanum*) in Vescovado di Murlo, and decoction (*Equisetum arvense* and *Malva* spp.), ointment (*Arundo donax*, *Olea europaea*, *Rubus ulmifolius*) and fomentation (*Rosmarinus officinalis*) in Chiusure.

Ethnobotany of the SNS of Madonna del Faggio

Overall, 58 taxa belonging to 31 families were mentioned by interviewees in the two communities (Table 3). Specifically, the inhabitants of Pratieghi reported the use of 45 species while in Badia Prataglia 36 species were used. The majority of the taxa are common to the two communities; however, the interviewees of Badia Pratalda mentioned around 25% fewer taxa than those from Pratieghi.

In Pratieghi 13 food uses and 13 medicinal uses were mentioned, while interviewees from Badia Prataglia reported 10 food uses and 12 medicinal uses. The most common food uses in the two communities include taxa used to make jam or liquors, and taxa boiled or eaten raw. At least six taxa were mentioned in each community for each

Table 1 The studied communities and Sacred Natural Sites

SNS	Close community (<10 km from SNS)	Distant community (10 km < x < 20 km from SNS)
Madonna del Faggio (Pieve Santo Stefano, AR)	Pratieghi (Badia Tedalda, AR) 16 interviews	Badia Pratalda (Poppi, AR) 15 interviews
Abbazia di Monte Oliveto Maggiore (Asciano, SI)	Chiusure (Asciano, SI) 15 interviews	Vescovado di Murlo (Murlo, SI) 15 interviews

Table 2 List of recorded taxa and detailed use-reports for the villages of Chiusure (close) and Vescovado (distant) in the province of Siena; *Past uses

Botanical taxon, family, recorded name	Parts used	Chiusure	Vescovado di Murlo	Chiusure <i>n</i> = 15	Vescovado di Murlo <i>n</i> = 15
<i>Aesculus hippocastanum</i> L. (Sapindaceae) Castagno d'India	Fruits		M: In the pocket to treat hemorrhoids; In the pocket to treat flu		4
<i>Allium sativum</i> L. (Amaryllidaceae) Aglio selvatico	Bulbs and leaves		F: Seasoning		3
<i>Allium ursinum</i> L. (Amaryllidaceae) Aglio ursino	Aerial parts		M: Oral administration to lower blood pressure		2
<i>Arbutus unedo</i> L. (Ericaceae) UNISGTOS019 Albatrella, Baciulle	Fruits and leaves	F: Raw as a snack	F: Raw as a snack; Jam; Liquor	3	10
<i>Arundo donax</i> L. (Poaceae) UNISGTOS027 Canna	Bark and roots	M: To make ointment for burns; Infusion with other taxa to treat kidney stones	M: Infusion to treat the liver	4	1
<i>Asparagus acutifolius</i> L. (Asparagaceae) UNISGTOS026 Asparago	Stems	F: Cooked in risotto or pasta	F: Cooked with eggs or in omelets; Boiled; Cooked in risotto or pasta	5	11
<i>Bellis perennis</i> L. (Asteraceae) UNISGTOS033 Margheritine	Leaves		F: Raw in salads		1
<i>Beta vulgaris</i> L. (Amaranthaceae) Bietta selvatica	Aerial parts	F: Mixed soups; Boiled	F: Boiled	5	2
<i>Borago officinalis</i> L. (Boraginaceae) UNISGTOS028 Boraggine	Aerial parts	F: Batter-fried M: Infusion to treat colic	F: Batter-fried; Raw in salads; Boiled and eaten in salads; Soups	1 1	8
<i>Calendula officinalis</i> L. (Asteraceae) Calendula	Flowers and leaves		F: Raw in salads		2
<i>Campanula rapunculus</i> L. (Campanulaceae) Raponzolo	Aerial parts or roots	F: Raw in salads		5	
<i>Capparis spinosa</i> L. (Capparidaceae) Cappero	Fruits	F: Seasoning	F: Seasoning	3	1
<i>Ceterach officinarum</i> Willd. (Aspleniaceae) Erba dei muri; Spaccapietre		M: Infusion to treat inflammation	M: Infusion to treat the kidneys and kidney stones	2	3
<i>Chamaemelum nobilis</i> All. (Asteraceae) Camomilla romana	Aerial parts		M: Infusion as mild sedative		1
<i>Cichorium intybus</i> L. (Asteraceae) UNISGTOS010 Radicchio, Cicoria, Lattuga selvatica	Aerial parts and roots		F: Boiled and stir-fried; Raw with chili pepper M: Infusion to refresh the liver		2
<i>Clematis vitalba</i> L. (Ranunculaceae) UNISGTOS008 Vitalba	Shoots and flowers	F: Omelets	F: Omelets M: Flower in the nostrils to treat headache	3	8 1
<i>Clinopodium nepeta</i> (L.) Kuntze (Lamiaceae) Nepetella	Aerial parts	F: Seasoning	F: Seasoning	2	2
<i>Cornus mas</i> L. (Cornaceae) UNISGTOS034 Corniolo	Fruits		F: Raw as a snack		1
<i>Corylus avellana</i> L. (Betulaceae) Nocciola	Fruits	F: Raw	F: Raw	3	1
<i>Crataegus monogyna</i> Jacq. (Rosaceae) Biancospino	Fruits and flowers	F: Raw in salads M: Infusion as a sleep inducer	F: Raw in salads	2 1	1
<i>Cupressus sempervirens</i> L. (Cupressaceae) Cipresso	Fruits		M: In the pocket to treat flu		1
<i>Crepis sancta</i> (L.) Bornm. (Asteraceae) Mestolino	Aerial parts	F: Raw in salads		1	
<i>Cynara scolymus</i> L. (Asteraceae)	Leaves			5	1

Table 2 (continued)

Botanical taxon, family, recorded name	Parts used	Chiusure	Vescovado di Murlo	Chiusure <i>n</i> = 15	Vescovado di Murlo <i>n</i> = 15
Carciofo		M: Infusion to treat inflammation	M: Infusion to treat inflammation; Infusion to treat the liver		
<i>Cynodon dactylon</i> (L.) Pers.(Poaceae) UNISGTOS005 Gramigna	Roots	M: Infusion to treat inflammation; Infusion to treat the kidneys and cystitis	M: Infusion to treat inflammation; Infusion as a detox	5	6
<i>Cydonia oblonga</i> Mill. (Rosaceae)	Fruits	F: Jam	F: Jam	3	1
<i>Dioscorea communis</i> (L.) Caddick and Wilkin. (Dioscoreaceae) UNISGTOS003 Tamice	Roots		M: Rubbed on joint to reactivate blood flow to treat articular pain		1
<i>Eucalyptus</i> spp. (Myrtaceae) Eucalipto	Leaves		M: Poultice applied on the chest to remove catarrh		1
<i>Equisetum arvense</i> L. (Equisetaceae) UNISGTOS001 Setolino	Aerial parts	M: Decoction to treat the kidneys		2	
<i>Ficus carica</i> L. (Moraceae) Fico	Fruits	F: Raw; Dried; Jam	F: Raw; Dried; Jam	8	8
<i>Foeniculum vulgare</i> Mill. (Apiaceae) UNISGTOS025 Finocchietto, Finocchiello		F: Seasoning (for finocchiata and fegatelli) M: Infusion to treat abdominal pain; Infusion as a diuretic	F: Seasoning (for finocchiata and fegatelli); Raw in salads; Stir-fried M: Infusion to treat bronchitis; Infusion to treat cough; Infusion to treat abdominal pain; Infusion as a diuretic; Infusion as a refresher; Infusion to treat the kidneys	13 4	10 8
<i>Fragaria vesca</i> L. (Rosaceae) UNISGTOS013 Fragolina	Fruits		F: Raw		2
<i>Helichrysum italicum</i> (Roth) G. Don (Asteraceae) UNISGTOS002 Fiori gialli	Aerial parts		M: Infusion to treat cough; Infusion to treat inflammation; As a panacea*		6
<i>Humulus lupulus</i> L. (Cannabaceae) Luppolo selvatico	Shoots		M: Infusion as a sleep inducer		2
<i>Hypericum perforatum</i> L. (Hypericaceae) UNISGTOS018 Iperico	Aerial parts		M: Maceration in olive oil to treat burns		2
<i>Juglans regia</i> L. (Juglandaceae) Noce	Fruits	F: Raw; Filling for dried figs; Seasoning; Liquor	F: Raw; Liquor	5	6
<i>Juniperus communis</i> L. (Cupressaceae) Ginepro	Berries	F: Seasoning	F: Seasoning	1	6
<i>Knautia arvensis</i> (L.) Coult. (Caprifoliaceae) Socere	Roots	M: Infusion with other taxa to treat kidney stones		4	
<i>Lactuca serriola</i> L. (Asteraceae) Lattughina	Leaves	F: Boiled	F: Raw in salads	4	7
<i>Laurus nobilis</i> L. (Lauraceae) UNISGTOS035 Lauro, Alloro	Leaves	F: Seasoning M: Infusion as a detox	F: Seasoning	4 1	1
<i>Malus</i> spp. (Rosaceae) Mela	Fruits	F: Raw	F: Raw	3	1
<i>Malva sylvestris</i> L. (Malvaceae) UNISGTOS007 Malva	Fresh or dried aerial parts and roots	F: Cooked with pasta M: Infusion to treat the intestine; Infusion to treat inflammation; Infusion to treat sore throat; Infusion to treat the kidneys; Decoction as a panacea; Infusion for personal cleansing; Mouthwash	M: Infusion to treat inflammation; Mouthwash; Poultice applied on the chest to remove catarrh; Infusion to treat bronchitis; Infusion as a detox	1 12	12

Table 2 (continued)

Botanical taxon, family, recorded name	Parts used	Chiusure	Vescovado di Murlo	Chiusure <i>n</i> = 15	Vescovado di Murlo <i>n</i> = 15
<i>Matricaria chamomilla</i> L. (Asteraceae) UNISGTOS004 Camomilla	Aerial parts	M: Infusion to treat the stomach; Infusion and locally applied to treat the eyes	M: Infusion as a mild sedative; Infusion to treat inflammation F: Recreational tea	10	14
<i>Melissa officinalis</i> L. (Lamiaceae) Melissa	Aerial part	M: Infusion as a detox	M: To keep mosquitos away	1	1
<i>Mentha arvensis</i> L. (Lamiaceae) UNISGTOS006 Menta, Mentuccia	Leaves	F: Seasoning	F: Seasoning; Recreational tea; Liquor	1	5
<i>Mespilus germanica</i> L. (Rosaceae) Manzeolo	Fruits		F: Raw		1
<i>Morus nigra</i> L. (Moraceae) Mora d'Olmo	Fruits		F: Jam; Raw		3
<i>Myrtus communis</i> L. (Myrtaceae) Mirto	Fruits		F: Liquor*; Seasoning		1
<i>Nasturtium officinale</i> R.Br. (Brassicaceae) Crescione d'acqua	Aerial parts		F: Raw in salad		1
<i>Olea europaea</i> L. (Oleaceae) Ulivo	Leaves	M: Ointment with other taxa to treat burns	M: Infusion as a detox	2	1
<i>Oxalis acetosella</i> L. (Oxalidaceae) UNISGTOS023	Aerial parts		F: Raw in salads		2
<i>Papaver rhoeas</i> L. (Papaveraceae) UNISGTOS017 Rosolaccio	Aerial parts		F: Omelette; Raw in salads; Boiled and eaten in salads		8
<i>Papaver somniferum</i> L. (Papaveraceae) * Rosolaccio	Seed pods		M: Sleep inducing*		1
<i>Plantago lanceolata</i> L. (Plantaginaceae) UNISGTOS009 Orecchie di lepre	Leaves		F: Raw in salads M: Locally applied as an anticoagulant		1
<i>Polypodium vulgare</i> L. (Polypodiaceae)* Felci che fanno di liquirizia	Roots		M: Infusion to treat inflammation		2
<i>Prunus cerasus</i> L. (Rosaceae) Ciliegio	Fruits	F: Jam	F: Jam; Preserved with alcohol; Liquor	5	6
<i>Prunus domestica</i> L. (Rosaceae) Prugno, Susino	Fruits	F: Jam; Raw	F: Jam; Raw	8	5
<i>Prunus dulcis</i> (Mill.) D.A. Webb (Rosaceae) Mandorlo	Fruits	F: Raw		4	
<i>Prunus persica</i> (L.) Batsch (Rosaceae) Pesca	Fruits	F: Jam; Raw		4	
<i>Pyrus</i> spp. (Rosaceae) UNISGTOS012 Pera	Fruits	F: Raw; Jam		3	
<i>Quercus</i> spp.* (Fagaceae) Quercia	Acorns		F: Boiled and ground to make bread		1
<i>Reichardia picroides</i> (L.) Roth (Asteraceae) UNISGTOS036 Terracrepoli Tornacrepoli	Aerial parts	F: Raw in salads	F: Raw in salads	13	9
<i>Robinia pseudoacacia</i> L. (Leguminosae) UNISGTOS030 Acacia, Robinia	Flowers Bark and flowers	F: Batter-fried	F: Batter-fried; Sauce for pasta; Recreational tea M: Infusion to reduce fever	5	8
<i>Rosa canina</i> L. (Rosaceae) UNISGTOS020 Rosa Canina	Fruits and shoots	F: Jam	F: Omelets M: Decoction ("it's healthy")	1	3
<i>Rosmarinus officinalis</i> L. (Lamiaceae) UNISGTOS032 Ramelino	Aerial parts	F: Seasoning M: Fomentation to treat flu	F: Seasoning	6 2	8
<i>Rubus ulmifolius</i> Schott (Rosaceae)	Fruits	F: Jam; Raw	F: Jam; Raw	8	13

Table 2 (continued)

Botanical taxon, family, recorded name	Parts used	Chiusure	Vescovado di Murlo	Chiusure <i>n</i> = 15	Vescovado di Murlo <i>n</i> = 15
UNISGTOS033 Rogo	Shoots	F: Omelets M: To make ointment for burns	F: Omelets	2 4	3
<i>Rumex crispus</i> L. (Polygonaceae) UNISGTOS022 Rombicione	Roots	M: Infusion with other taxa to treat kidney stones		2	
<i>Ruscus aculeatus</i> L. (Asparagaceae) UNISGTOS015 Pungitopi	Stem	F: Omelets; Boiled	F: Omelets; Boiled	3	5
<i>Ruta graveolens</i> L. (Rutaceae) Ruta	Leaves		F: Liquor M: Anti-helminthic*		2 1
<i>Salvia</i> sp. (Lamiaceae) Salvia	Leaves	F: Seasoning; Batter-fried M: Infusion to treat stomach pain; Infusion to treat mouth inflammation	F: Seasoning; Batter-fried M: Infusion to wash hair; Infusion as a detox; Infusion with lemon to treat sore throat; Infusion to treat mouth inflammation	6 8	11 10
<i>Sambucus nigra</i> L. (Adoxaceae) UNISGTOS031 Sambuco	Leaves and flowers	F: Batter-fried; Raw in salads	F: Recreational tea; Seasoning; Juice	4	4
<i>Sanguisorba officinalis</i> L. (Rosaceae) Pimpinella, Nociarella	Leaves	F: Raw in salads	F: Raw in salads	5	1
<i>Sonchus oleraceus</i> (L.) L. (Asteraceae) Crespino	Aerial parts	F: Raw in salads	F: Raw in salads	11	10
<i>Sorbus domestica</i> L. (Rosaceae) <i>Spartium junceum</i> L. (Leguminosae) Ginestra	Fruits Flowers	F: Raw F: Batter-fried		5 1	
<i>Taraxacum campyloides</i> G.E.Haglund (Asteraceae) UNISGTOS038	Aerial parts	F: Boiled and then stir-fried; Raw in salads	F: Boiled and then stir-fried; Raw in salads	5	8
Insalata matta, Piscialetto, Cardella	Roots	M: Infusion to treat inflammation	M: Infusion to treat inflammation	1	1
<i>Thymus</i> spp. (Lamiaceae) <i>Tragopogon pratensis</i> L. (Asteraceae) UNISGTOS024 Barba becco	Aerial parts Aerial parts	F: Raw in salads	F: Seasoning	5	1
<i>Trifolium pratense</i> L. (Leguminosae) UNISGTOS029 Trifoglio	Flowers		F: Raw as a snack		1
<i>Ulmus</i> spp. (Ulmaceae) Olmo	Gall		M: Infusion as an antibiotic to disinfect wounds		1
<i>Urtica dioica</i> L. (Urticaceae) Ortica	Aerial parts	F: Cooked in risotto; Ravioli filling; Omelets M: Poultice to wash hair	F: Cooked in risotto; Ravioli filling; Omelets; Soup	5 1	9
<i>Valerianella</i> spp. (Valerianaceae) Ceciarelli	Roots Aerial parts	F: Raw in salads	F: Sauce for pasta F: Raw in salads; Boiled	14	1 12

category (Fig. 3). In addition, the use of seasoning plants (six taxa recorded) was important in Pratieghi, whereas in Badia Prataglia only *Mentha* spp. and *Juniperus communis* were utilized for this purpose.

In regard to medicinal uses, we recorded nine different infusions in Pratieghi but only six in Badia Prataglia. Also, two recipes for decoctions were mentioned in each

community. Topical applications (*Matricaria chamomilla*), syrups (*Fragaria vesca* and *Rubus idaeus*) and leaf chewing (*Malva* spp.) were reported in Badia Prataglia, while maceration of *Hypericum perforatum* in olive oil was used in Pratieghi.

There were not many taxa used for both medicinal and food purposes. In both areas, many taxa were consumed raw, either

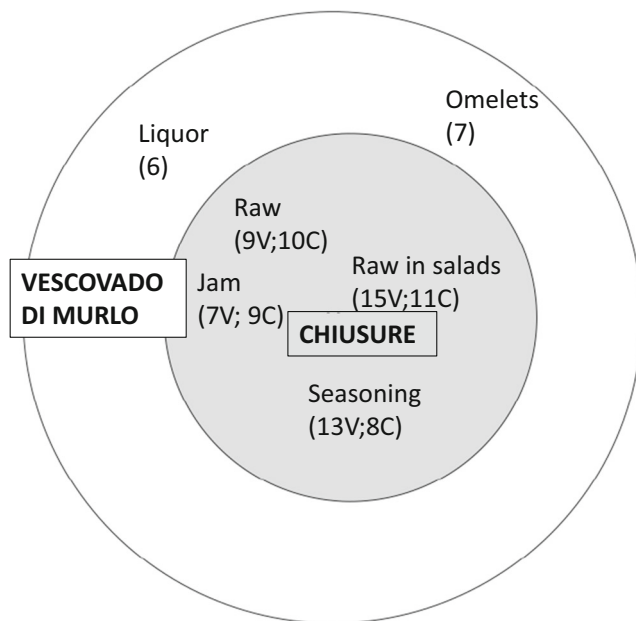


Fig. 2 Mentioned taxa with at least five uses reported close to and distant from the SNS of Monte Oliveto Maggiore (number of uses per village are reported in brackets; V = Vescovado, C = Chiusure)

in salads or as a snack. However, some taxa were also made into jams, and sometimes liquors or ravioli fillings. In Badia Prataglia syrup of wild forest fruits was also mentioned.

Discussion

Our results provide evidence for the influence of the selected SNSs on the TEK of the communities living in the surrounding area. The case of Monte Oliveto Maggiore, a SNS continuously inhabited for over a millennium, indicates that there is a negative correlation between proximity to SNSs and richness of TEK. That is, communities living closer to SNSs inhabited by a monastic community have more limited TEK than communities living further away. This is also demonstrated by the analysis of the SNS of Camaldoli. Interviewees from Badia Prataglia, the closest village, which lies only a few kilometers away, reported around 25% fewer taxa compared to that of Pratieghi (about 20 km away). This phenomenon may be due to the fact that people living in the vicinity of a SNS have relied on the monastic communities for both medical treatment and food, which in turn has led to an abandonment of time-consuming and sometimes knowledge-intensive practices, such as foraging for wild plants and their food and medicinal preparations. Indeed, our case study sheds light on the management of SNSs. It is important to note, however, that the existence of SNSs per se does not have a direct

influence on the TEK of local communities. It is rather the long-term management of the monastic communities living in such SNSs that actually affects the TEK of local communities.

Sacred Natural Sites, especially those characterized by centuries-long continuous management, have been able to preserve rare texts and documents (Egea *et al.* 2015). As a result, through the study of these documents and in particular botanical and medicinal texts, monks (in our case, for example, the Benedictines) have been able to prepare medicinal preparations based the work of both Hippocrates and Galen (Mađra Gackowska *et al.* 2018; Medeiros and de Albuquerque 2012). Monastic communities, therefore, used to produce medicinal preparations following the principles of scholarly knowledge (SK), which we define as a corpus of knowledge obtained through the study of historical written sources (mainly in Latin) and implemented in practice within monastic life and for the surrounding community. On the other hand, communities living in the surrounding area do not have access to such sources (due to both restricted physical access and the inability to read Latin), and thus their knowledge is generated through trial and error and then handed down orally from generation to generation (Berkes 1993). Therefore, monastic communities living at SNSs base their practices on SK, while surrounding communities base their practices on TEK. Thus, in contrast to (Frascaroli *et al.* 2014), we claim that, in the Catholic Mediterranean Basin, SNSs can be bastions of biocultural diversity but not TEK. We argue that SK not only does not contribute to TEK but actually competes with it. This competition occurs asymmetrically since in Italy religious power has often played a crucial role in society as well. Indeed, medical care provided by monastic communities played a crucial social role in providing therapeutic aid to the communities living in the vicinity of the SNSs (Mađra Gackowska *et al.* 2018; Medeiros and de Albuquerque 2012). Therefore, the medicinal TEK of local communities and the medicinal SK of monastic communities came to compete. On one hand, the monastic medicinal preparations made using access-restricted knowledge, ingredients, and technologies were passed on secretly within the SNS. On the other hand, TEK was based on largely accessible knowledge, ingredients, and technologies. In fact, TEK encompasses a body of knowledge, practices, and beliefs, while SK comprises mainly knowledge and some practices. In addition, TEK knowledge is primarily transmitted orally held by local communities, locally situated and highly variable, whereas SK is largely written, held by specific sectors of the population, and global and highly homogenized (Table 4).

During fieldwork, we discovered that there was a close relationship between the villagers of Chiusure and the Abbey of Monte Oliveto Maggiore. Indeed, the shrine also

Table 3 List of recorded taxa and detailed use-reports for the villages of Pratieghi (close) and Badia Prataglia (distant) in the province of Arezzo; * Past uses

Botanical taxon, family, recorded name	Parts used	Uses in Badia Prataglia	Uses in Pratieghi	Badia Prataglia	Pratieghi
<i>Abies</i> spp. (Pinaceae) Abete	Resin	F: "Lacrima di Abeto" liquor made by Camaldoli monks M: Resin for making skin softer		4 2	
<i>Arctium lappa</i> L. (Asteraceae) Bardana	Leaves		M: Decoction with mint: "it is healthy"; Decoction for hair and dandruff; Decoction with nettle and dandelion: 'it is healthy'		3
<i>Asparagus acutifolius</i> L. (Asparagaceae) UNISGTOS026 Asparagi selvatici	Stems	F: Omelets; Boiled		3	
<i>Atropa belladonna</i> L. (Solanaceae)* Belladonna	Aerial parts		M: Medicinal and poisonous.		2
<i>Borago officinalis</i> L. (Boraginaceae) UNISGTOS028 Borragine	Flowers		F: Raw in salads		3
<i>Campanula rapunculus</i> L. (Campanulaceae) Raponzolo	Roots		F: Raw		1
<i>Carlina acaulis</i> L. (Asteraceae) Carlina	Roots	F:Boiled	F: Boiled	1	1
<i>Castanea sativa</i> Mill. (Fagaceae) Castagna	Fruits and leaves	F: Boiled to make the local bread called Baldino		6	
<i>Cichorium intybus</i> L. (Asteraceae) UNISGTOS010 Radicchio	Young sprouts	F: Minced in salads	F: Minced in salads	1	5
<i>Clematis vitalba</i> L. (Ranunculaceae) UNISGTOS008 Vitalba	Sprouts	F: Omelets; Ravioli fillings	F: Omelets; Soups	8	7
<i>Cornus mas</i> L. (Cornaceae) UNISGTOS034 Comiolo	Fruits	F: Jam	F: Liquor	1	3
<i>Corylus avellana</i> L. (Betulaceae) Nocciola	Fruits	F: Raw as a snack	F: Raw as a snack	2	3
<i>Crataegus laevigata</i> (Poir.) DC (Rosaceae) Biancospino	Fruits		F: Liquor		3
<i>Dactylorhiza sambucina</i> (L.) Soó * (Orchideaceae) Panciachino	Bulbs	F: Raw "as a snack"		1	
<i>Equisetum arvense</i> L. (Equisetaceae)* UNISGTOS001 Coda di cavallo	Aerial parts		M: Infusion, "it's healthy"		2
<i>Foeniculum vulgare</i> Miller (Apiaceae) UNISGTOS025 Finocchio selvatico	Leaves and seeds		F: Seasoning		1
<i>Fragaria vesca</i> L. (Rosaceae) UNISGTOS013 Fragoline	Fruits	F: Liquor; Syrup	F: Jam; Raw as a snack	6	9
<i>Fraxinus</i> spp. (Oleaceae) Frassino	Flowers	M: For treating skin		2	
<i>Helichrysum italicum</i> (Roth) Don (Asteraceae) UNISGTOS002 Pepolino	Leaves		F: Seasoning		1
<i>Humulus lupulus</i> L. (Cannabaceae)* Luppolo selvatico	Sprouts	F: Omelets; Boiled		1	
<i>Hypericum perforatum</i> L. (Hypericaceae) UNISGTOS018 Iperico	Flowers		M: Preserved in olive oil and locally applied to treat skin burns		1
<i>Juglans regia</i> L. (Juglandaceae) Noce	Fruits and wood	F: Liquor; Dessert	F: Liquor can be made green (when fruit is not ripe) which is more traditional or white (when the walnut is ready and with only the kernel)	6	11

Table 3 (continued)

Botanical taxon, family, recorded name	Parts used	Uses in Badia Prataglia	Uses in Pratieghi	Badia Prataglia	Pratieghi
<i>Juniperus communis</i> L. (Cupressaceae) Ginepro	Berries	F: Liquor; Seasoning (meat)	F: Seasoning (wild boar)	3	5
<i>Malus sylvestris</i> Mill. (Rosaceae) Mela	Fruits	F: Jam; Raw; Dessert	F: Jam; Raw	6	3
<i>Malva</i> spp. (Malvaceae) UNISGTOS007 Malva	Aerial parts	M: Decoction to treat toothache; Infusion to refresh; Chewed to treat toothache	M: Infusion for toothache; It is refreshing and it relieves inflammation	7	7
<i>Matricaria chamomilla</i> L. (Asteraceae) UNISGTOS004 Camomilla	Flowers	M: Infusion as a calmative	M: Infusion for sleeping and treating abdominal pain	3	4
<i>Mentha arvensis</i> L. (Lamiaceae) UNISGTOS006 Menta	Leaves	F: Seasoning (meat)	M: Infusion for headache	2	2
<i>Mespilus germanica</i> L. (Rosaceae) Nespolo	Fruits	F: Raw	F: Liquor	1	3
<i>Origanum majorana</i> L. (Lamiaceae) Maggiorana	Leaves		F: Seasoning		1
<i>Origanum vulgare</i> L. (Lamiaceae) Origano	Leaves		F: Seasoning		1
<i>Papaver rhoeas</i> L. (Papaveraceae) UNISGTOS017 Rosolaccio	Sprouts		F: Boiled		2
<i>Pinus</i> spp. (Pinaceae) Pino	Buds	M: Bud decoction for cough		3	
<i>Plantago lanceolata</i> L. (Plantaginaceae) UNISGTOS009 Orecchie di lepre	Leaves		F: Boiled		1
<i>Sanguisorba officinalis</i> L. (Rosaceae) Pimpinella	Aerial parts and seeds	F: Raw in mixed salads	F: Seasoning	1	2
<i>Primula vulgaris</i> Huds. (Primulaceae) Primule	Flowers and leaves		F: Raw in salads with lemon/vinegar and olive oil		2
<i>Prunus avium</i> L. (Rosaceae) Ciliegie selvatiche	Fruits		F: Jam; Raw		5
<i>Prunus cerasus</i> L. (Rosaceae) Amarena	Fruits		F: Jam; Raw		3
<i>Prunus domestica</i> L. (Rosaceae) Prugna	Fruits	F: Jam; Raw	F: Jam; Raw	2	7
<i>Prunus spinosa</i> L. (Rosaceae) Prugnolo	Fruits	F: Liquor*	F: Liquor	1	7
<i>Pyrus communis</i> L. (Rosaceae) UNISGTOS012 Pera cocomerina/mezza	Fruits	F: Raw	F: Raw	1	1
<i>Pyrus piraster</i> Burgsd. (Rosaceae) Pera	Fruits	F: Jam; Raw	F: Raw	6	2
<i>Rosa canina</i> L. (Rosaceae) UNISGTOS020 Rosa canina	Fruits		F: Jam; Raw M: Infusion for treating flu and diarrhea		1 2
<i>Rubus idaeus</i> L. (Rosaceae) Lampone	Fruits	F: Jam; Raw; Liquor; Refreshing syrup M: Medicinal syrup (good for sore throat)	F: Jam; Frozen; Raw	9 3	10
<i>Rubus ulmifolius</i> Schott (Rosaceae) UNISGTOS033 More	Fruits Leaves	F: Jam; Raw; Liquor M: Boiled leaves for treating skin infections	F: Jam; Raw	12 2	11
<i>Rumex acetosa</i> L. (Polygonaceae)* Erba salina	Leaves	F: Raw as a snack		2	
<i>Rumex acetosella</i> L. (Polygonaceae) Romice	Leaves		M: Infusion for treating hemorrhoids		3
<i>Sambucus nigra</i> L. (Adoxaceae) UNISGTOS031 Sambuco	Flowers and fruits	F: Jam; Liquor M: Infusion (“it’s healthy”)	F: Flowers are batter-fried; Fruits for jam	4 1	5
	Sprouts	F: Ravioli fillings		3	11

Table 3 (continued)

Botanical taxon, family, recorded name	Parts used	Uses in Badia Prataglia	Uses in Pratieghi	Badia Prataglia	Pratieghi
<i>Silene vulgaris</i> (Moench) Garcke (Caryophyllaceae) UNISGTOS011 Strigoli; Minuto			F: Ravioli and pasta sauce or filling; Boiled		
<i>Sonchus arvensis</i> L. (Asteraceae) UNISGTOS037 Graspigna	Leaves		F: Boiled		1
<i>Sorbus domestica</i> L. (Rosaceae) Sorbo	Fruits	F: Raw		1	
<i>Taraxacum campylodes</i> G.E.Haglund (Asteraceae) UNISGTOS038 Tarassaco	Roots and leaves	F: Boiled; Raw in salads	F: Minced in salads with olive oil and lemon; In ravioli fillings with chard and nettle M: Boiled roots for liver detoxification; Decoction with <i>Arctium lappa</i> (and dandelion): “it’s healthy”	1	6 2
<i>Thymus serpyllum</i> L. (Lamiaceae) Timo	Leaves		F: Seasoning M: Infusion for treating flu and the intestine		1 1
<i>Tilia cordata</i> Mill. (Malvaceae) Tiglio	Flowers	M: Refreshing infusion		1	
<i>Tragopogon</i> sp. (Asteraceae) UNISGTOS024 Tragopone	Roots		F: Boiled		1
<i>Urtica dioica</i> L. (Urticaceae) Ortica	Sprouts	F: Ravioli fillings	F: Ravioli filling (with spinach or chard and <i>Silene</i>); In ravioli fillings with chard and nettle, spinach, or chard and <i>Silene</i> M: Decoction with <i>Arctium lappa</i> (and dandelion): “it’s healthy”; They cook it with turkey: “it’s healthy”	9	8 3
<i>Vaccinium myrtillus</i> L. (Ericaceae) Mirtillo	Fruit Leaves	F: Raw; Jam* M: Infusion for treating eye problems		3 1	
<i>Verbena officinalis</i> L. (Verbenaceae) Verbena	Leaves		F: Centerbe liqueur		1
<i>Viola odorata</i> L. (Violaceae)* <i>Viola mammola</i>	Flowers	M: Infusion as a refresher; For cough and sore throat		1	

owns many hectares of agricultural fields that have been cultivated for centuries by the inhabitants of Chiusure under the supervision of the Benedictine monks. This tie is still strong and many local inhabitants referred to the use of the “miraculous plaster” of the monks, a compound of beeswax used to treat the skin and particularly to remove thorns. This SNS has mainly been devoted to agricultural activities and it established a pharmacy (which is now closed) only in the late sixteenth century. Therefore, the very small number of taxa reported in Chiusure may be partially due to the “food and medicinal security” ensured by the presence of the monastic community living at the SNS. Notably only one liquor preparation was mentioned by only one individual living close to the SNS (the widely known liquor of walnuts) while in

Vescovado di Murlo six taxa were mentioned for this purpose. Indeed, since the SNS of Monte Oliveto Maggiore produces a famous liquor, the inhabitants of Chiusure probably did not feel the need (and/or did not have the adequate technology) to make it themselves. This somewhat contradicts the findings of Teklehaymanot *et al.* (2007), who showed, in a different cultural and geographical context, that the knowledge of the people living close to the monastic community was higher than those further away as they acquired such knowledge from the monastic community. However, as they did not succeed in interviewing the monastic community and there were numerous herbalists in those villages who also had social influence and possessed extensive knowledge, it may be that the presence of the monastery simply influenced the

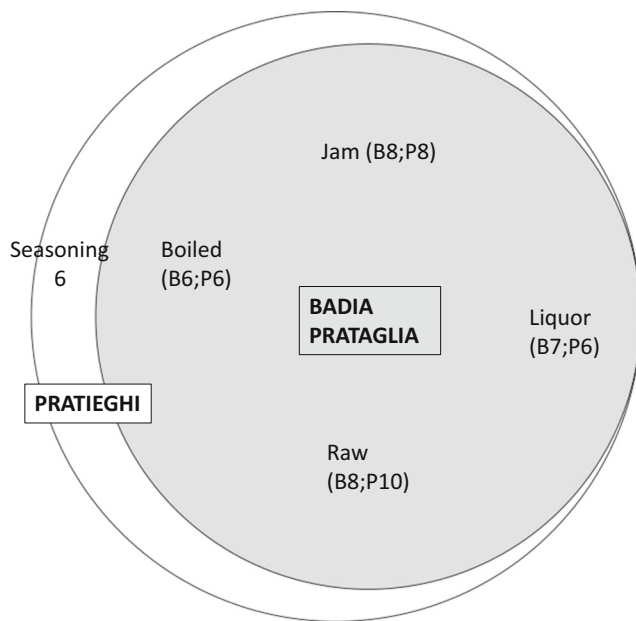


Fig. 3 Mentioned taxa with at least five uses reported close to and distant from the SNS of Monte del Faggio (number of uses per village are reported in brackets; B = Badia Prataglia, P = Pratieghi)

awareness of the use of medicinal plants and villagers did not directly borrow taxa and uses from the monks.

The SNS of Camaldoli is solely devoted to healing activities, as it also possesses a small hospital, dispensary, and pharmacy. This specialization may also be a consequence of its location in the middle of the forest, which did not allow for the establishment of extensive agricultural activity. The healing specialization of this SNS is also reflected in the TEK of the inhabitants of Badia Prataglia. Only nine medicinal taxa were reported (mainly prepared as infusions). This is probably due to the proximity of the SNS, which provided local inhabitants with medical care. Medicinal preparations by monastic communities greatly differ from those reported by our interviewees (see also Egea *et al.* 2016). Indeed, SK often applies

the use of allochthonous plant taxa, as also demonstrated in other contexts (Salick *et al.* 2006). These plants are generally cultivated and preserved within the shrine expressly for the preparation of medicinal remedies. In addition, SK made great use of alcohol-based solutions (e.g., grappa, liquors, see also Egea *et al.* 2015), as was also found in our study, and this is in contrast to the water-based solutions used by TEK holders (e.g., infusions, decoctions). Populations living close to the SNS rarely had access to expensive alcohol and they did not have the knowledge and technology for distilling it. Nevertheless, the relationship between TEK and SK has often been unequivocal. Monastic communities could draw TEK from local communities, while local communities could not always implement the knowledge originating from monastic communities due to their lack of access to many raw ingredients, technologies, and adequate knowledge/education. However, a process of knowledge transmission can also be sometimes observed. Four interviewees living in the vicinity of the SNS of Monte Oliveto Maggiore reported the unusual and quite complex preparation of an infusion made from the roots of *Arundo donax*, *Rumex crispus*, *Knautia arvensis* for treating liver and kidney stones. When asked from whom they learned this recipe, the oldest interviewee claimed that in the past there were some families of specialized “herbalists,” while another interviewee exclaimed “Of course they made that recipe; they had books!” Both these claims might refer to the presence of the SNS, despite no longer being remembered by the local inhabitants. Therefore, as in the village of Chiusure, many people used to work in the monastery farm and some SK may have been transmitted to the local inhabitants over the time, which was later assimilated into TEK.

A particular example of knowledge transmission is the case of “lacrima d’abeto,” a liquor made from several plants including *Abies alba*, *Piper nigrum*, *Thymus serpyllum*, *Elettaria cardamomum*, *Curcuma domestica*, *Pimpinella anisum*, *Angelica archangelica*, *Citrus aurantium*, and *Vanilla planifolia*, that is produced by the Camaldoli monastic

Table 4 Definition and characteristics of SK and TEK

	SK	TEK
Definition	Corpus of knowledge obtained through the study of historical written sources (mainly in Latin) and implemented in its practice in monastic life	Corpus of knowledge, practices and beliefs obtained through empirical observation and the accumulation of facts by trial-and-error (Berkes 1999)
Transmission	Written sources	Orally (Berkes 1999)
Accessibility (physical)	Low	High
Language	Ancient literary sources mainly in Latin and Greek	Local language (Berkes 1999)
Technology applied	High and not accessible	Low and accessible
Ingredients used	Allochthonous and autochthonous	Autochthonous (Salick <i>et al.</i> 2006)
Diffusion	Punctiform	Ubiquitous

community. When some inhabitants of Badia Prataglia were asked about liquors they prepare, the interviewees responded “Monks make lacrima d’abeto!” as indeed most of the ingredients of that liquor come from allochthonous taxa, not available to the local community. As we did not interview members of the monastic communities we do not have examples of transmission from TEK to SK, from local to monastic communities. Nonetheless, Lardos and Heinrich (2013) argue that such knowledge transmission could be the result of either a combination of SK learnt in monastic life and the TEK acquired in childhood or close contact with the surrounding communities.

However, this asymmetry mainly applies to medicinal knowledge as wild food knowledge has often been excluded from the “high” corpus of knowledge managed by monastic communities. During the Middle Ages, it was believed that God created plants to serve humankind, and thus herbalism was an often an intrinsic element of monastic life (Mađra Gackowska *et al.* 2018). In fact, the reason for a smaller number of food taxa reported close to SNSs may be found in the welfare services offered by the monastic communities and not in the competition between SK and TEK. Indeed the foraging of wild food plants requiring intensive practical knowledge within specific ecological conditions may be abandoned in favor of (cultivated) products that are provided or knowledge of plant uses that has been acquired from the monastic community.

Conclusions

Our study discussed the possible influence of three Tuscan SNSs on TEK related to wild and semi-domesticated plants for food and medicinal preparations. We found that SNSs managed and inhabited for centuries by monastic communities may have had a restrictive impact on the TEK of communities living in the surrounding areas. The communities situated close to SNSs report less TEK related to wild and semi-domesticated plants for food and medicinal preparations than those living further away. Indeed, SK held by monastic communities has surely diffused into the surrounding TEK over the centuries, but it may have also resulted in a smaller corpus of plant-related knowledge, practices, and beliefs with respect to what would have been reasonable to expect. In addition, we found that certain natural ingredients managed within the monastic communities living in the SNS could also have contributed to shape the TEK of the surrounding populations. We conclude that, despite the well-recognized importance of SNSs as biodiversity reservoirs, they may also have been detrimental to the surrounding TEK, acting as agents of “homogenization”, possibly in addition to other historical processes that normally restrict the variability and resilience of local, place-based TEK (i.e., industrialization, urbanization, globalization), especially for that concerning wild medicinal plants.

Further studies should better address the mechanisms of competition and/or osmosis of TEK and SK from a historical perspective and how this contributed to the current TEK of people living in the vicinity of inhabited Sacred Natural Sites.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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