One Place, Different Communities' Perceptions. Mapping Cultural Ecosystem Services in the Asinara National Park (Italy)

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Abstract. As innovative approaches emerge, the concept of Cultural Ecosystem Services (CES) is periodically revised and enhanced, presenting new value nuances. Due to their intrinsic site-specific character, CES usually call for subjective, rather than objective, perspectives. Therefore, assessing CES through alternative, non-monetary approaches, is fundamental. This issue becomes even more urgent when attempting to assess and map CES within natural protected areas, and even more so when such areas are non-inhabited, as the absence of any local communities poses additional challenges. In this study, initiated within the GIREPAM (Integrated Management and Ecological Network of Marine Protected Areas) Interreg project and developed within the NEPTUNE Interreg project, the way stakeholders perceive CES supplied by the Asinara National Park in Northern Sardinia (Italy) was investigated. Interviews and questionnaires were delivered in December 2019: more than 600 observations related to CES were mapped and recorded through a participatory GIS in order to investigate whether the different perception of CES supplied by a given natural protected area varies depending on the community. Differences were recorded among three local communities. Results show that significant differences exist in the choice of places, rather than in the perceived values of a natural protected area, and that such differences depend on the local community engaged in recognizing the various types of cultural values.

Keywords: Cultural ecosystem services · Natural protected areas · Participatory mapping · Toponyms

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1 Introduction

Ecosystem services (ES) are understood as those benefits (be they good or services) that nature provides to human beings through well-functioning ecosystems, and that contribute to human well-being either directly or indirectly. So far, various taxonomies and classification schemes have been proposed in the literature. For instance, the Millennium Ecosystem Assessment [1] categorizes ES into four groups as follows: provisioning (including, for instance, food and timber provision), regulating (among which coastal protection or carbon storage and sequestration), cultural (such as nature-based recreation, or sense of place and belonging), and supporting services (as, for instance, soil formation). A more sophisticated and hierarchical taxonomy is the one proposed by the Common International Classification of Ecosystem Services (CICES) [2], which only focuses on three groups (provisioning, regulating, and cultural): in this framework, supporting services are regarded as processes and functions that are indeed necessary prerequisites for the supply of the first three types of ES, but are not demanded and consumed by humans *per se*. Due to debates arisen on the very concept of ES, which focused on a supposedly anthropocentric perspective leading to "commodification" of nature [3, 4], in recent years the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has introduced the concept of "nature's contributions to people" [5] as complementary to that of ES, in an attempt to remark that the link between nature and human beings is heavily dependent on context, place, time, and culture.

Such dependency is of outmost importance as far as cultural ecosystem services (CES) are concerned. Defined by the Millennium Ecosystem Assessment [1, p. 58] as the "non material benefits obtained [by humans] from ecosystems", they are delivered through each person's or group's relationship with nature, be it physical, experiential, intellectual, spiritual, or emotional. Therefore, CES are intrinsically affected by individual perceptions and subjective values, which makes them the outcome of the socio-ecological system of interest. The very subjective character of CES, the emphasis on their immaterial and intangible nature [6, 7], as well as their inadequate definition leading to unclear operationalization [8], make it difficult to assess CES based on quantitative or monetary approaches, except for cultural heritage and recreation ES, for which travel cost and contingent valuation methods are widely applied (among many: [9–11]). It is therefore not surprising that a number of socio-cultural approaches to assessing CES have been proposed in academic research, including document analysis, expert-based approaches, observation approaches, in-depth interviews, focus groups, questionnaires [12]. The latter approaches are advocated as the ones that can provide a better picture of the relationship between CES and their users [7]; moreover, they can be integrated into spatially-explicit assessments of CES that often take the form of participatory mapping techniques.

Ryfield et al. [6], for instance, combined observation approaches, focus groups, and cartographical modes of knowledge to analyze a specific CES (i.e., sense of place). Cabana et al. [13] integrated qualitative research (questionnaires, stakeholder meetings, storytelling) and ecosystem mapping to develop a participatory map investigating sense of places, perceptions, and meanings that people attach to the Dublin Bay area. Plieninger et al. [14] implemented a participatory map of various CES as perceived by residents of five villages in Eastern Germany, building upon in-depth interviews and questionnaires.

Sherrouse et al. [15] developed a GIS-based application to map social values of a national forest in the United States as perceived by various groups of CES beneficiaries. Such studies highlight the absence of a one-fits-all approach to CES appraisal; to the contrary, methods and approaches must be tailored to contexts, communities, and CES that are being investigated. Building upon such approaches, we therefore aim to investigate how social values attached to ES can be elicited in a very specific context, i.e. that of a non-inhabited (yet open to the scientific community, tourists, and some economic activities) natural protected area, where the current absence of any local community poses an additional challenge to understanding how people perceive a place.

This study is organized as follows: Sect. 2 provides some background information on the chosen study area, the Asinara National Park in Sardinia (Italy) and describes the methodological approach. The results are provided in Sect. 3, and next discussed in Sect. 4, which also highlights limitations and future directions of this research.

2 Materials and Methods

In order to assess how local communities perceive CES supplied by the Asinara National Park through a qualitative approach, a social survey was implemented, by targeting the main communities that have interests in the island, for historical, geographical and institutional reasons. Such communities belong to three municipalities as follows: Stintino, Porto Torres, and Sassari (Fig. 1).

We developed two ways to involve locals in a public participatory GIS. A geographically based survey was elaborated and next delivered both in presence, during two dedicated living labs, and online. In both cases, we asked people to identify both recognized and perceived values of the Asinara Park's environment, by mapping or indicating/naming places that would come up to their minds when thinking about their experience or knowledge of the island.

During in-person activities, hosted at the National Archaeological Museum of Porto Torres and at the Tuna Factory Museum of Stintino, participants were asked to choose "their" places by pinning colored flags in a 2.5 × 1.5 m floor map. Each flag color corresponded to a specific CES; the full set of CES among which participants could choose corresponded to a set of values representing ecosystem services, following the simplified landscape values proposed by García-Martín et al. [16]. In order to enhance the composite pattern of the cultural, recreational, and emotional sphere, among the nine flag colors only one corresponded to the wilderness value as "natural" and only one concerned a specific provisioning service, identified as agricultural value, while the remaining seven are related to CES and are as follows: Historical and archaeological value; Recreational value; Existence value, understood as the psychological benefits stemming from the knowledge that a good exists and will continue to exist; Iconographic value, which accounts for landscapes and ecosystems being used as source of inspiration for arts; Scientific interest, in terms of characteristics of ecosystems that enable scientific investigation; Landscape and aesthetic value; Holiness and sacred value, resulting from people's spiritual interaction with nature. Examples of the values were provided through both facilitation and a legend to build a common understanding of the values. In this way 790 points were collected, as selected by the 100 participants involved in

the activities and coming from the three above mentioned municipalities (Table 1), here selected as the communities of interest. Next, points selected by participants who had identified themselves as tourists or as residents in municipalities other than Stintino, Sassari or Porto Torres were excluded, which resulted in a reduction of the number of valid places/values from 790 to 606.

Table 1. Communities involved in activities.

Communities	No. of participants	%
Other communities	7	8.54
Porto Torres	27	32.93
Sassari	27	32.93
Stintino	21	25.61
Total	82	100

As far as participants in the online survey are concerned, they were asked to associate values to places by using place names (toponyms). Online respondents were asked to describe values (related to ecosystem services) through a multiple-choice questionnaire; a built-in legend in the online version helped them pick their choices. Moreover, they could select as many values as they liked for each single place they chose.

In order to spur voluntary participation from the three selected local communities, both in-presence activities and online survey were promoted through articles in local newspapers, networking activities carried out by the three local authorities of Porto Torres, Sassari, and Stintino, as well as by the staff of the Asinara National Park. Advertisements in the social media pages of the GIREPAM project were also constantly posted. Finally, it is worth mentioning that this study carries over the work by Schirru et al. [17], who mapped the ecosystem types in the Asinara island, therefore establishing the ground for the assessment of CES.

2.1 Study Area

Stretching from South-West to North-East to the North of Sardinia (Italy), Asinara is an island of approximately 52 km^2 in size. The geology of the island is characterized by granitic rocks in the southern part and metamorphic ones in the northern one, with high cliffs on the western coast and smoother sandy profiles in the eastern one facing Italy's mainland. Mean annual rainfall amounts to about 480 mm, while the annual average temperature is approximately 18 °C [18]. According to Canu et al. [19], who described six isobioclimates of the island, the dominant one is the Upper thermomediterranean, upper dry, euoceanic strong, affecting more than 50% of the island; second in order of importance is the Lower mesomediterranean, upper dry, euoceanic strong isobioclimate (31%), while only 6,5% of the island is characterized by the Lower mesomediterranean, lower subhumid, euoceanic strong isobioclimate. The vegetation is characterized by

Mediterranean maquis with some degraded areas. Endemic flora has been described by Bocchieri and Filigheddu [20], by Pisanu et al. [21], and by Drissen et al. [22]. The island was inhabited by shepherds' and fishermen's families until 1885,when they were forcefully removed to build first a *lazzaretto* (i.e. a sanatorium to isolate people with contagious diseases) and next an agricultural penal colony (i.e., an open-air prison where inmates were forced to work in the fields); during this period, the environment of the island was largely affected by the presence of farming activities carried out by convicts [23, 24]. Later, in the early 70s', abandonment of farming activities carried out by prisoners led to land degradation due to the overgrazing by cattle and other rewilded animals, together with frequent forest fires across the island, as summarized also by Mantilla-Contreras et al. [25]. In 1997 the Asinara National Park was established, and this marked the beginning of a new era for the island, which turned into a great important biodiversity hotspot, due to the presence of several rare, threatened, endemic marine and terrestrial habitat and species.

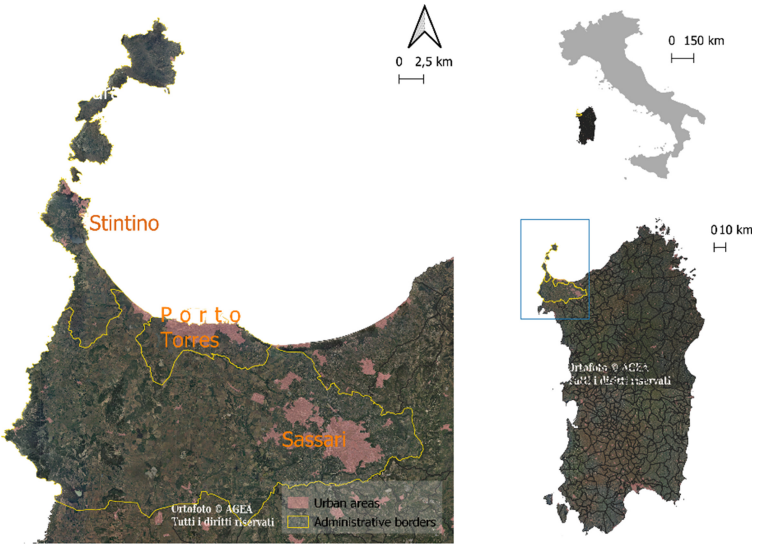

Fig. 1. To the left: Asinara and its gulf, with the municipalities of Stintino, Porto Torres and Sassari in a satellite image; to the right: its location within Sardinia.

2.2 Methodology

More than a hundred people participated in a two-day event, held on the 7th and the 14th of December 2019. A total of one hundred answers were collected either during these in-presence meetings or through an online survey, and through such replies a total of 770 geolocated dots related to Asinara's valued places were collected. Next, 164 dots were filtered out because they had been identified by tourists, hence people who do not belong to the communities of interest in our study (i.e., residents of Porto Torres, Sassari and

Stintino), which left us with 606 valid geolocated dots (each corresponding to a value) distributed across the island. Geolocated dots were next converted into a shapefile and analyzed in a GIS environment, in order to investigate the spatial distribution of values across the island. The dots are represented in Fig. 2, Fig. 3, and Fig. 4.

3 Results

Table 2 provides an overview of each community's recognized value in terms of percentage of total dots placed by members of that community. Interestingly, historical and archaeological values dominate across the three communities, while holiness and sacred values consistently get the lowest number of recognitions. In between, some distinctive aspects appear. For instance, productive values are quite significant for Stintino residents, but not so much for the other two communities, where natural and recreation values prevail. Detailed figures of recognized values, grouped by communities and associated to Asinara toponyms, are provided in Table 3.

Table 2. Recognized values and related communities concerning Asinara (%).

	Values	Porto Torres [%]	Sassari [%]	Stintino [%]	Total [%]
HAV	Historical and archaeological values	19.74	21.13	16.97	19.47
NV	Natural values	17.54	15.96	13.94	16.01
RV	Recreational values	12.28	12.68	12.12	12.38
PV	Productive (agricultural) values	8.33	7.98	16.97	10.56
EV	Existence values	12.28	6.57	12.12	10.23
IV	Iconographic value	10.96	9.39	7.88	9.57
SI	Scientific interest	8.77	10.80	7.27	9.08
LV	Landscape and aesthetic values	5.26	9.86	6.67	7.26
HV	Holiness and sacred values	4.82	5.63	6.06	5.45
	Total	100.00	100.00	100.00	100.00

Following García-Martín et al.'s methodology [16], a chi-squared (χ^2) test was next performed, to understand whether any significative difference in value recognition across the involved communities could be detected (Table 4). This test allows for comparisons among groups and detects statistically significant differences between the observed and the expected frequencies; in other words, it detects "unexpected" values, as well as the distance between unexpected and expected values. Finally, we also calculated a global χ^2 for Asinara toponyms chosen by each community's respondents as vector of the sum of values, as shown in Table 5 and Table 6 (ordered by rank).

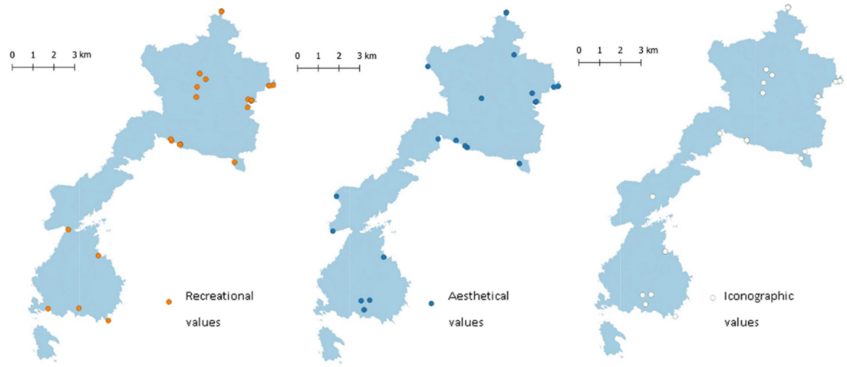

Fig. 2. Asinara maps for Recreational, Landscape-aesthetic, and Iconographic values.

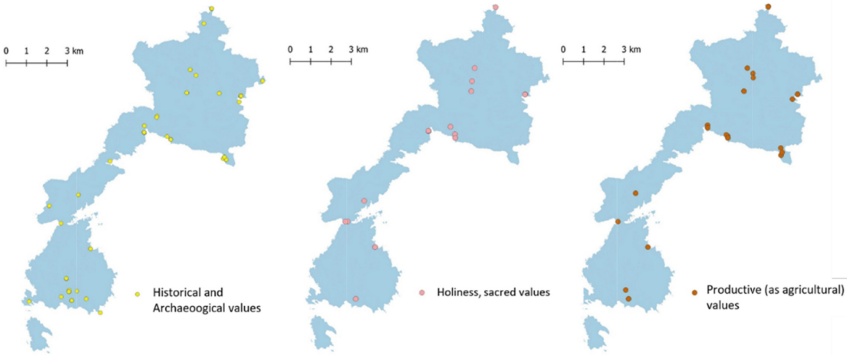

Fig. 3. Asinara maps for Historical and archaeological, Holiness and sacred, and Productive (agricultural) values

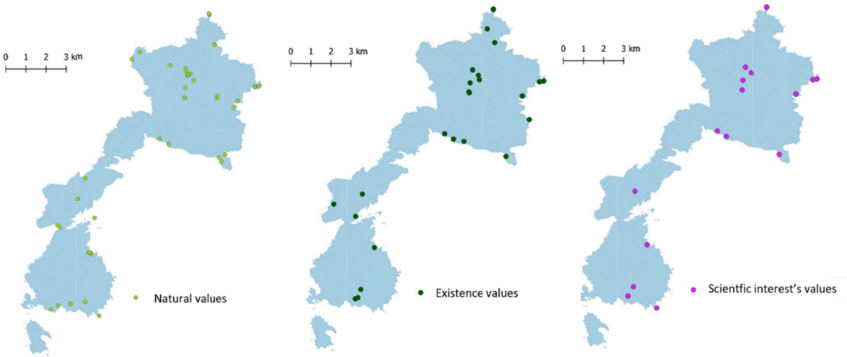

Fig. 4. Asinara maps for Natural, Existence, and Scientific interest values.

Table 3. Number of spots associated to each Asinara toponym, per community (**Com**) and per value (**RV:** Recreational value; **IV:** Iconographic value; **LV:** Landscape and aesthetic value; **HAV:** Historical and archaeological value; **PV:** Productive (agricultural) value; **HV:** Holiness, sacred value; **NV:** Natural value; **EV:** Existence value; **SI:** Scientific interest.

Com	Toponym	**RV**	**IV**	**LV**	**HAV**	**PV**	**HV**	**NV**	**EV**	**SI**	*Tot*
Porto Torres	*Cala d'Arena*				1				1		*2*
	Cala dei Detenuti	1						1			*2*
	Cala di Sgombro di Dentro								1		*1*
	Cala d'Oliva	3	4	2	9	3	1	1	4	3	*30*
	Cala Reale	7	6	1	9	4	2	1	5	3	*38*
	Cala Sabina	2						4	1	1	*8*
	Cala Sant'Andrea	1		1				5	1		*8*
	Campo Faro						1				*1*
	Campo Perdu				2	2					*4*
	Castellaccio	1	2		3			1	1	1	*9*
	Elighe Mannu	2		1				7	2	2	*14*
	Fornelli	5	7	6	12	6	2	8	7	6	*59*
	Il Pecorile							2			*2*
	Mare di fuori							1			*1*
	Ossario				1		2				*3*
	Punta Scomunica		1					1	1		*3*
	Punta Scorno	3	4	1	4	2	2	2	2	1	*21*
	Stretti	1					1				*2*
	Trabucato	1	1		2	1		1	1	1	*8*
	Tumbarino				1	1		3		2	*7*
	-	1			1			2	1		*5*
Porto Torres total		***28***	***25***	***12***	***45***	***19***	***11***	***40***	***28***	***20***	***228***
Sassari	*Cala d'Arena*							1			*1*
	Cala d'Oliva	3	3	1	5	3	2	2	1	3	*23*
	Cala Reale	2	2		7	3	2	3		3	*22*
	Cala Sabina	1	1	1				2	1	1	*7*

(*continued*)

Table 3. (*continued*)

Com	Toponym	**RV**	**IV**	**LV**	**HAV**	**PV**	**HV**	**NV**	**EV**	**SI**	*Tot*
	Cala Sant'Andrea		1		1		1	1		1	*5*
	Campo Perdu	1	1		2	1	1	2			*8*
	Case Bianche	1		1		1		1	1	1	*6*
	Castellaccio	1	1		1			1			*4*
	Elighe Mannu	1		1				1	1	1	*5*
	Fornelli		3	5	11	2	3	4	1	2	*31*
	Punta Barbarossa	1		1				1		1	*4*
	Punta Maestra Serre	1		1			1	1	1	1	*6*
	Punta Scomunica	1	2	1	1		1	2	1	1	*10*
	Punta Scorno	11	6	8	15	6	1	8	6	5	*66*
	Trabucato	1		1	1	1		1	1	1	*7*
	Tumbarino	1			1			2		1	*5*
	n.d	1						1		1	*3*
Sassari total		***27***	***20***	***21***	***45***	***17***	***12***	***34***	***14***	***23***	***213***
Stintino	*Baddiggiu di lu diauru o Badde Lunga*							1			*1*
	Cala d'Arena					1		1			2
	Cala di Luzzu/ Lutzu (Saline)				1						1
	Cala di Sgombro di Dentro	1	1			1					3
	Cala di Sgombro di Fuori					1		1			2
	Cala d'Oliva	4	1	1	4	4	3	1	3		21
	Cala Reale	3		2	5	2		2	1	3	18
	Cala Sant'Andrea			1		2	1	5	1	1	11

(*continued*)

Table 3. (*continued*)

Com	Toponym	**RV**	**IV**	**LV**	**HAV**	**PV**	**HV**	**NV**	**EV**	**SI**	*Tot*
	Campo faro						1				1
	Campo Perdu				1	1					2
	Cannapilo								1		1
	Case Bianche					1					1
	Castellaccio		1		3			1	1		6
	Elighe Mannu	1		1	1	1		1	1	1	7
	Fornelli	5		2	4	5		4	5	2	27
	Il pecorile				1						1
	Lu Lioni		1								1
	Monsignore		1								1
	Monte Tumbarino				1				1		2
	Ossario		1	1	2		3				7
	Ovili Punta Ruia								1		1
	Punta Barbarossa				1						1
	Punta Crabara							1			1
	Punta Scomunica	2	2	1	1	2	1	2	2	2	15
	Punta Scorno		2	1	1	2	1	3	1	2	13
	Secca del Cavallo /dei Cavalli	1									1
	Spalmatore	1									1
	Strada Pagliaccetto		1								1
	Stretti	1			1	1		1			4
	Tamburi di Mizioni		1								1
	Trabucato	1		1	1	4					7
	n.d		1						1	1	3
Stintino total		***20***	***13***	***11***	***28***	***28***	***10***	***23***	***20***	***12***	**165**
Grand total		***75***	***58***	***44***	***118***	***64***	***33***	***97***	***62***	***55***	***606***

Table 4. Perceived values as summarized by the communities involved in the survey, through the χ^2 value. Freedom degrees = 16; critical limit = 26.30.

Values	Porto Torres	Sassari	Stintino	Total
Historical and archaeological values	0	0.3	0.52	0.82
Wilderness/natural values	0.34	0	0.44	0.78
Recreational values	0	0	0	0
Productive (agricultural) values	1.1	1.34	6.5	8.94
Existence values	0.95	2.8	0.57	4.32
Iconographic value	0.47	0	0.5	0.97
Scientific interest	0.02	0.71	0.6	1.33
Landscape and aesthetic values	1.23	1.95	0.08	3.26
Holiness and sacred values	0.16	0	0.11	0.27
Total	*4.27*	*7.1*	*9.32*	*20.69*

Table 5. χ^2 test values for the main locations emerging from the survey. "Other places" represent aggregations of locations (toponyms) cited fewer than five times, in order to better perform the χ^2 test (freedom degrees = 22; critical limit: 33.92).

Toponym	Porto Torres	Sassari	Stintino	Total
Cala d'Oliva	0.17	0.35	0.04	0.56
Cala Reale	2.6	1.06	0.5	4.16
Cala Sabina	1.03	0.55	4.1	5.68
Cala Sant'Andrea	0.11	1.38	3.12	4.61
Campo Perdu	0.32	1.96	0.85	3.13
Castellaccio	0.51	1.09	0.12	1.72
EligheMannu	1.8	1.85	0	3.65
Fornelli	5.11	2.63	0.75	8.49
Punta Scomunica	5.36	0	7.21	12.57
Punta Scorno	7.33	27.2	7.41	41.94
Trabucato	0.01	0.06	0.17	0.24
Other (less frequent) places	1.68	1.27	7.87	10.82
Total	26.03	39.4	32.14	97.57

Results of the χ^2 test show that no statistically significant differences among recognized values can be detected across the three communities, as shown in Table 4. In Table 5 some interesting findings are shown and, in order to make the significant difference clearer, for p-value < 0.05 and degrees of freedom $= 22$ (critical limit $= 33.92$), in

Table 6 toponyms are ranked, per each interested community, according to the χ^2 value from the lowest to the highest value. Moreover, for a better understanding of preferences concerning places, the number of choices per places was standardized, as shown in Fig. 5.

Table 6. Asinara toponyms ranking according to communities' choices, ordered according to the χ^2 value.

Ranking	Porto Torres		Sassari		Stintino	
1)	*Trabucato*	0.01	*Punta Scomunica*	0.00	*Elighe Mannu*	0.00
2)	*Cala Sant'Andrea*	0.11	*Trabucato*	0.06	*Cala d'Oliva*	0.04
3)	*Cala d'Oliva*	0.17	*Cala d'Oliva*	0.35	*Castellaccio*	0.12
4)	*Campo Perdu*	0.32	*Cala Sabina*	0.55	*Trabucato*	0.17
5)	*Castellaccio*	0.51	*Cala Reale*	1.06	*Cala Reale*	0.50
6)	*Cala Sabina*	1.03	*Castellaccio*	1.09	*Fornelli*	0.75
7)	*Other places*	1.68	*Other places*	1.27	*Campo Perdu*	0.85
8)	*Elighe Mannu*	1.80	*Cala Sant'Andrea*	1.38	*Cala Sant'Andrea*	3.12
9)	*Cala Reale*	2.60	*Elighe Mannu*	1.85	*Cala Sabina*	4.1
10)	*Fornelli*	5.11	*Campo Perdu*	1.96	*Punta Scomunica*	7.21
11)	*Punta Scomunica*	5.36	*Fornelli*	2.63	*Punta Scorno*	7.41
12)	*Punta Scorno*	7.33	*Punta Scorno*	27.20	*Other places*	7.87

4 Discussions and Conclusions

If the number of participants in the public participatory GIS activities is considered, respondent sample groups were balanced across the three communities, and well balanced were also the values recognized by respondents and associated to places across the Asinara National Park (Table 2). No significative differences emerge through the chi-squared test; however, an in-depth reading concerning percentage of expressed values can help build a narrative about possible differences across the concerned local communities in perceiving Asinara's CES.

A first consistent narrative concerns Historical and archaeological values, which dominate in all of the three involved communities (Sassari 21.13%, Porto Torres 19.74%, and Stintino 16.97%). This fact can be explained by the presence of the remains of various human settlements spanning across time from prehistory up to the XX century, which marked the landscape with a rich heritage comprising ruins of a castle, a monastery, towers, houses, a main village and scattered rural infrastructures. More recent historic remains, such as the sanatorium, the prisoners camp built during World War I, the war cemeteries, and the most iconic ones, that is the buildings that hosted the inmates when the whole island was an agricultural penal colony, are also of interest.

The second place consistently concerns Natural value (Porto Torres 17.54%, Sassari 15.96%, and Stintino 13.94%). Natural characteristics and assets of the Asinara island are directly related to the National Park environmental protection status due to its richness in biodiversity [21, 22]. This is further confirmed by the fact that Natural values are more recognized in Porto Torres, where the headquarter of the managing institution and administration offices of the National Park are located.

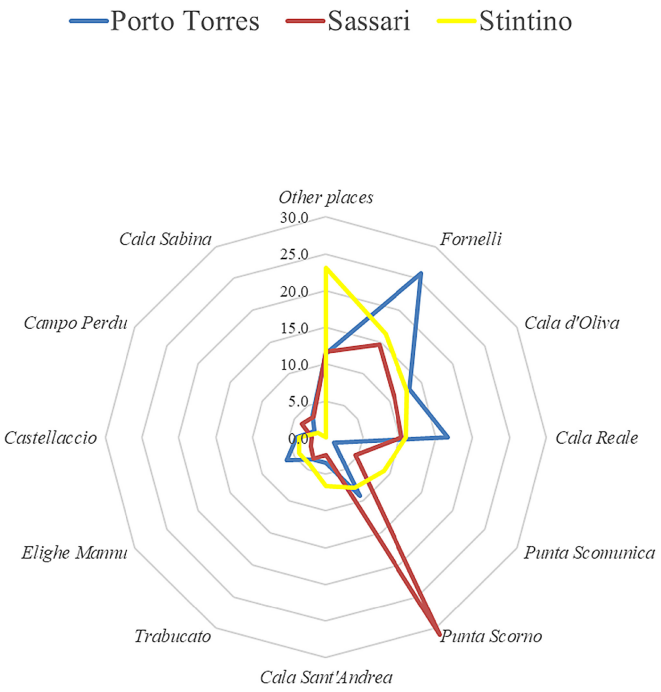

Fig. 5. Cumulative choice by places and by communities**.**

Recreational values come consistently third across the three communities (Sassari 12.68%, Porto Torres 12.28%, Stintino 12.12%): nature-based recreation is the most common way to explore and enjoy the island, and, even more important for the three communities, it provides a significant opportunity for the economic development of their territories, since tourism-related economic activities (accommodation, boat services, diving, etc.) are not located within the island but in the surrounding areas.

A special remark concerns Productive (agricultural) values, which are very significant in the Stintino case, where the score (16.97%) matches that of Historical and archaeological values, while Porto Torres and Sassari only score 8.33% and 7.98%, respectively. Under this category, both farming and fishing are comprised, and, unlike the previous value, they are only partly connected to the experience of the island and the way its landscape is perceived. Currently, the only agricultural activity in the island

is a cosmetic farm and laboratory that produces niche cosmetics from the island spontaneous vegetation (such as *Helichrysum italicum*, *Pistacia lentiscus*, *Rosmarinus officinalis*, or *Lavandula stoechas*), while the former olive grove in Trabucato has recently been restored with a view to bringing back the production of olive oil. Notwithstanding the current marginality of agriculture in the island, respondents could still mention signs of rural activities from the past or from memories, sometimes even memories passed by older relatives. Vineyards and vine-making activities, and olive and oil productions, both in Trabucato area, animal farming activities in Campo Perdu or in Santa Maria and Fornelli, are productive "*geni loci*" imprinted in the landscape, and date back to the times when the island was an agricultural penal colony. Even though the χ^2 test did not show statistical significance, among Stintino's respondents the Productive (agricultural) value returned a very high score. Personal and family memories play here a strong role, since the town was founded in the 1880s, to host the former inhabitants of the island when it was transformed into a sanatorium and a penal colony [26].

As for Existence values, their recognition is much higher in Porto Torres and Stintino (12.28% and 12.12% respectively) than in Sassari (6.6%). A possible explanation could be linked to place attachment and identification of intangible values of the landscape, since the island has remained unpopulated after the dismissal of the agricultural penal colony in 1997, and only temporary residents working for the National Park or for environmental agencies are allowed.

With reference to Scientific interest, respondents from Sassari expressed higher preferences than those from Porto Torres or Stintino (respectively, 10.80%, 8.77%, 7.27%). This might be due to the fact that Sassari, as the main city in north Sardinia, is home to a university and to various research centers. Moreover, another possible explanation could lie in the respondents' profiles, since respondents from Sassari included people affiliated to the local university or to research centers, which could imply higher familiarity of these respondents with this specific ecosystem service.

Respondents from Sassari were also more prone to appreciate Landscape and aesthetic values, compared to Stintino and Porto Torres (respectively: 9.86%, 6.67%, 5.26%). Finally, Holiness and sacred values scored the lowest percentage of preferences among the three communities (Stintino 6.06%, Sassari 5.63%, Porto Torres 4.8%).

As for toponyms, respondents from Stintino named 31 places, many more than those from Porto Torres (20) or from Sassari (16), which reveals how the three communities developed different geographic maps for the island, Stintino being the more accurate possibly again due to family memories carried on from ancestors from the XIX century who had actually lived within the island. Not only is the town of Stintino the closest human settlement to the Asinara island (approximately nine miles from Stintino to Fornelli), but also many residents are descendants of fishermen and shepherds that once lived on the island, in the former Cala d'Oliva village. Still today roads and streets in Stintino are named after places in Asinara, hence carrying on the memory of the ancestors' land.

Results from the chi-squared test shown in Table 5 highlight that the higher statistically different values are those concerning Punta Scorno, for which Sassari peaks at 27.00, against Stintino and Porto Torres that sit around 7 (respectively, 7.41 and 7.33). While it is hard to provide a firm explanation for this difference, we could speculate

that it has to do with the peculiar character of this place: Punta Scorno is located to the northern part of the Asinara island (i.e., the farther apart from Sardinia) and hosts an ancient lighthouse (built in 1854), suspended among the rocks towards the sea and owned by the Italian Marine Army, which until 2006 hosted a meteorological station. For the Stintino community only the cumulative value associated to "Other places" (7.87) is higher than that of Punta Scorno, which highlights the fragmented values of the many toponyms enlisted by its respondents.

The second position in ranking order for significant χ^2 values is that of Punta Scomunica (scoring 7.21 for Stintino and 5.36 for Porto Torres), the highest peak of the island with its 408 m above the sea level. From this place, the whole Asinara island can be viewed, together with the namesake gulf in north Sardinia and the French island of Corsica.

Fornelli lands the third place, but only for the Porto Torres community, which is surprising since it is the main boat mooring place for those who leave Sardinia from Stintino. It might have something to do with the fact that in the recent past (i.e., at the end of XX century) Fornelli hosted a high security prison, infamous because of its many important convicts, comprising high-profile mafiosi, kidnappers and terrorists. Another possible explanation could lie in the past uses of the Fornelli area, as the biggest farm was located there during the times of the penal colony, as well as a shepherd scattered settlement in the pre-sanatorium and pre-penal colony times.

Fourth in ranking is Cala Sabina, but for the Stintino community only. Since the two main beaches in Asinara (i.e., Cala d'Arena and Cala Sant'Andrea) are nature reserves, where access is forbidden, Cala Sabina is currently the first beach of the island in terms of tourist attendance. Its ancient name is Cala dei Ponzesi, an homage to people coming from the Ponza island (which lies in front of the Italian peninsula, at a latitude approximately in between Rome and Naples), expert fishermen who settled in Cala d'Oliva prior to the 1884 eviction and the subsequent establishment of the village of Stintino.

The fifth χ^2 value is associated to Cala Reale, for Porto Torres locals only. This place hosts the headquarter of the National Park of Asinara on the island and is the main mooring place for ferries departing from Porto Torres, which could explain why it is more important for this community than for the other two. Cala Reale is also the place where the main buildings of the sanatorium (quarantine stations) were built, and it has always been the main harbor and institutional center of the island.

Lower values concerning places are lower not merely due to a lesser importance of those places; in all likelihood, lower values are associated to their lesser "familiarity" and "normality" compared to other places. Moreover, Stintino and Porto Torres response patterns differ from Sassari ones, with Stintino expressing the most complex relationship with the environment of the island; such relationship reflects the complexity of a biocultural object such as this little island, currently a National Park that has inherited (and has also got rid of) a dense past of nature and human interactions.

The analysis of places through toponyms made it the exploration of community values and relationships between places and communities possible in a way that no quantitative analysis of cultural ecosystem services would have allowed. By reflecting on their experience and feelings about Asinara, respondents let their inner values emerge, together with their personal way of "living" the island, be it through the lens of their

communities' memories, or by applying, even subconsciously, the conservation schemes of the Asinara National Park, with its biodiversity hotspots, functional areas, or no-entry no-take areas. Hence, the analysis of the evidence collected from the responses has helped not only in building a multifaceted perspective of CES supplied by the island, but also in identifying multiple, and overlapping, identities of the island, which could further be expanded in future research by investigating tourists' perceptions.

A limitation of this study can be related to the limited sample of respondents; notwithstanding, because the approach is simple and easily replicable, as well as effective in identifying connections between value-ridden ecosystem services, as the CES are, and local communities, we regard it as a pilot study that we hope to reproduce in the future with a larger dataset.

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