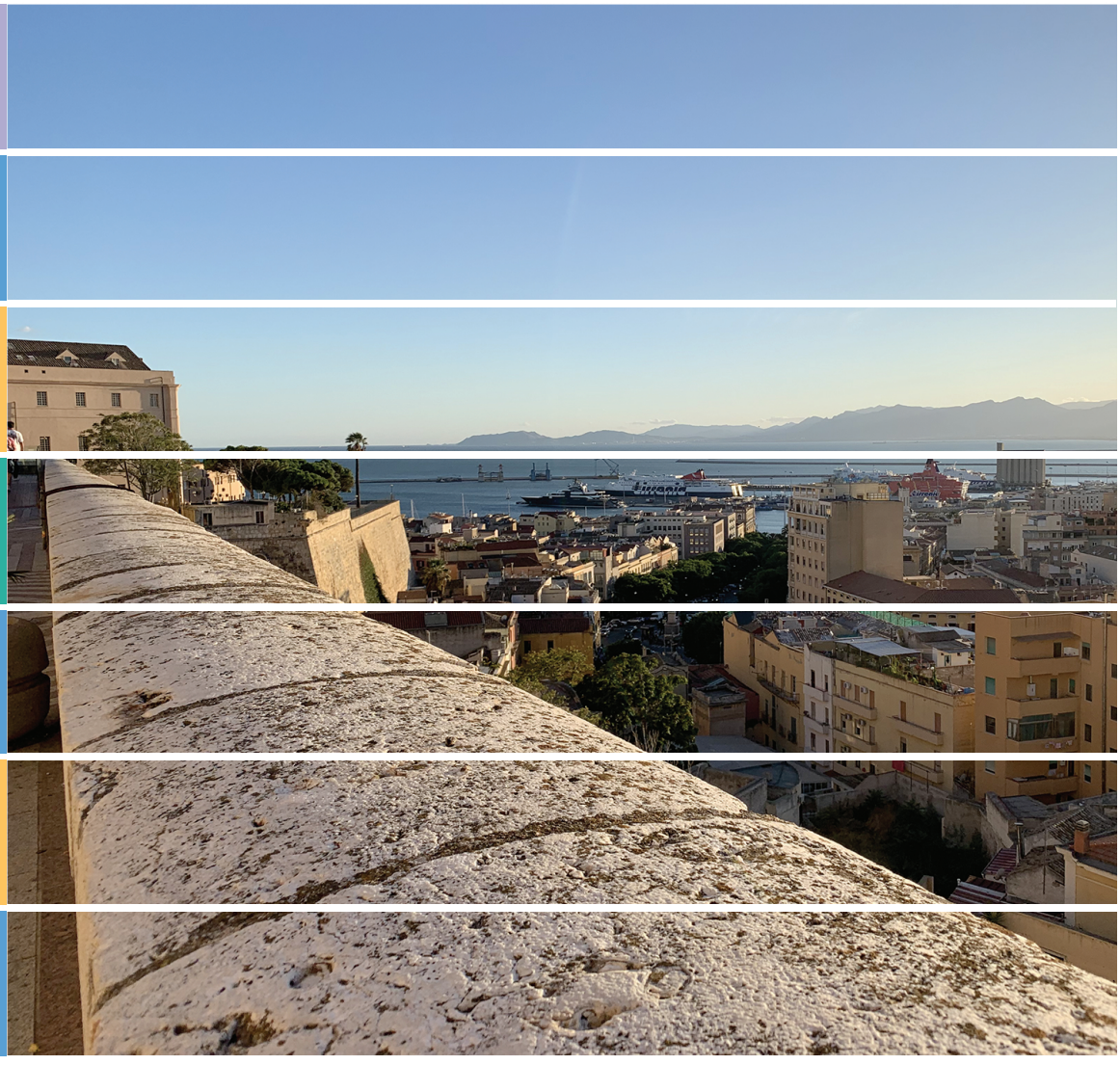
Carmela Gargiulo Corrado Zoppi
Editors

Planning, Nature and Ecosystem Services



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Smart City, Urban Planning for a Sustainable Future

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Carmela Gargiulo Corrado Zoppi

Editors

Planning, Nature and Ecosystem Services

INPUT aCAdemy 2019

Conference proceedings

Federico II Open Access University Press

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Planning, nature and ecosystem services / editors Carmela Gargiulo, Corrado Zoppi - Napoli: FedOAPress. 2019 - (Smart City, Urban Planning for a Sustainable Future. 5).

Web link:
http://www.tema.unina.it/index.php/tema/Monographs

ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6

Selection and double blind review under responsibility of INPUT aCAdemy 2019 Conference Committee

Università degli Studi di Napoli Federico II
Centro di Ateneo per le Biblioteche "Roberto Pettorino"
Piazza Bellini 59-60 - 80138 Napoli, Italy
http://www.fedoapress.unina.it

Published in Italy

Cover and graphic project: TeMA*Lab*

This book collects the papers presented at INPUT aCAdemy 2019, a special edition of the INPUT Conference hosted by the Department of Civil and Environmental Engineering, and Architecture (DICAAR) of the University of Cagliari.

INPUT aCAdemy Conference will focus on contemporary planning issues with particular attention to ecosystem services, green and blue infrastructure and governance and management of Natura 2000 sites and coastal marine areas.

INPUT aCAdemy 2019 is organized within the GIREPAM Project (Integrated Management of Ecological Networks through Parks and Marine Areas), co-funded by the European Regional Development Fund (ERDF) in relation to the 2014-2020 Interreg Italy – France (Maritime) Programme.

INPUT aCAdemy 2019 is supported by Società Italiana degli Urbanisti (SIU, the Italian Society of Spatial Planners), Istituto Nazionale di Urbanistica (INU, the Italian National Institute of Urban Planning), UrbIng Ricerca Scientifica (the Association of Spatial Planning Scholars of the Italian Schools of Engineering) and Ordine degli Ingegneri di Cagliari (OIC, Professional Association of Engineers of Cagliari).

This book is the most recent scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT aCAdemy 2019 Conference. In detail, this publication, including 92 papers grouped in 11 sessions, for a total of 1056 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
- Federica Gaglione;
- Carmen Guida;
- Rosa Morosini;
- Floriana Zucaro.

The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

Rocco Papa
Editor of the Smart City, Urban Planning for a Sustainable Future" Book Series
Published by FedOAPress - Federico II Open Access University Press

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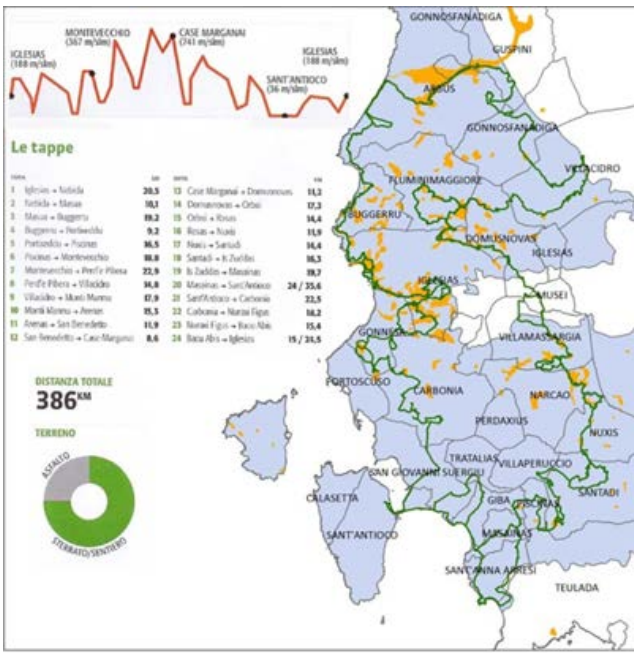

SMART COMMUNITY AND LANDSCAPE IN PROGRESS

THE CASE OF THE SANTA BARBARA WALK (SULCIS, SARDINIA)

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How to cite item in APA format:
Balletto, G., Milesi, A., Naitza, S., Mundula, L. & Borruso, G. (2019). Smart community and landscape in progress. The case of the Santa Barbara walk (Sulcis, Sardinia). In C. Gargiulo & C. Zoppi (Eds.), *Planning, nature and ecosystem services* (pp. 893-903). Naples: FedOAPress. ISBN: 978-88-6887-054-6, doi: 10.6093/978-88-6887-054.6

ABSTRACT

Tourism of the paths is a phenomenon that undergone considerable development in recent years. Initially linked to religious paths (i.e. the way of Santiago in Spain or the Via Francigena in Italy), today also includes cultural, landscape, naturalistic and spiritual paths. In Italy 2016 was the 'Year of the Paths' with the aim of building and / or consolidating a "slow network in the sensitive landscape", while 2019 was dedicated to slow tourism. The slow itineraries constitute a network that flows smoothly into the territories, some of which not yet mature as tourist destinations. Opportunities offer by the new technologies create smart communities that make these destinations and travelers the undisputed protagonists, in contributing to the formation of Big Data (open and close). The objective of this study is to analyze the Santa Barbara Walk in the Sulcis area, considering its particular changing and dangerous nature, by analyzing the open (walk and bike) GPS tracks left by the Smart Community. The interest shown by the smart community through the digital traces sharing, also referring to the danger of a landscape in continuous change, proves to be of strategic importance for the use of the slow network in the Sulcis. In this sense, the role of the smart community is fundamental for the implementation of the information layer relating to risks and for the management of risks in sensitive and evolving contexts.

KEYWORDS
Smart Tourism; Slow network; Smart community

* The other author is: Luigi Mundula.

1 INTRODUCTION

In Italy there is a dense network of paths that is approximately around seven thousand kilometers, from which the numerous routes not yet exploited are excluded. In order to promote slow mobility and to enhance this dense network of paths, MiBACT - The Italian Ministry of Cultural Heritage and Activities - has established the Atlas of paths[1], an interactive map that gathers 44 itineraries to date, meeting the guidelines set by the ministerial directive. These paths can be traveled with sustainable soft mobility systems, each of which is characterized by a tourist offer connected to the geographical, environmental and historical cultural context. The network of paths of the General Directorate of Tourism is part of the national slow network, linked to the recent development of slow tourism.

The slow network activated through (known and less known) paths presents multiple motivations (religious, cultural, sport and leisure, etc.) and travel methods (walk, bike, house ride and more).

In other words, the slow network is a highly flexible network, strongly linked to places, productivity and efficiency with respect for the person and the environment. Moreover, the 'slow movement', at the base of the network, aims to redefine the concepts of time.

Slow tourism is the application of this philosophy to leisure and relaxation times and consequently cannot be a mass tourist offer and is linked to the territory through landscape and material knowledge (monuments, museums, villages), intangible (traditions, religion, taste) and new social media experience (instagram, facebook, ecc).

Slow tourism also establishes relations with the local community through bottom-up initiatives and is enriched thanks to the support of new technologies and through social networks, becoming real smart communities. In this sense the territory of the Sulcis represents a unique example for the peculiarity of its mining landscapes, from material knowledge to the immaterial.

The smart community (walk and bike) shares, through dedicated apps, GPS tracks and images, becoming the pioneer community for its main Walk, that of Santa Barbara, and for the inland areas of the Sulcis.

The remaining part of the document is organized as follow.

Paragraph 2 describes the case study of Santa Barbara walk and the context of South-Western Sardinia, where most of the route is located.

[1] http://www.turismo.beniculturali.it/home-cammini-ditalia/

ISBN: 978-88-6887-054-6
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Paragraph 3 proposes the research methodology based on the concept of the network and on the examination of its fundamental elements.
In paragraph 4 concluding remarks highlight major results and future developments of the research.

2 THE SANTA BARBARA WALK: SLOW NETWORK OF THE SULCIS IGLESIENTE

The Santa Barbara Walk, established in 2016 above the ancient mine roads of the Sulcis, presents a ring shape of about 400 km total length divided into 24 arches of 16 km each.
In 2017 the walk was inserting by the Ministry of Cultural Heritage and Activities and Tourism in the first 'Atlas of the Paths of Italy'. The walk crosses a territory characterized by a complex mining basin which constitutes the Geomineral Historical Environmental Park of Sardinia.
This territory was the most important district for national and international mining due to its large production of lead and zinc.
The crisis in the mining sector and the subsequent closure of the mines in the 1990s left a rich heritage of industrial archeology and infrastructure, as well as a unique landscape.

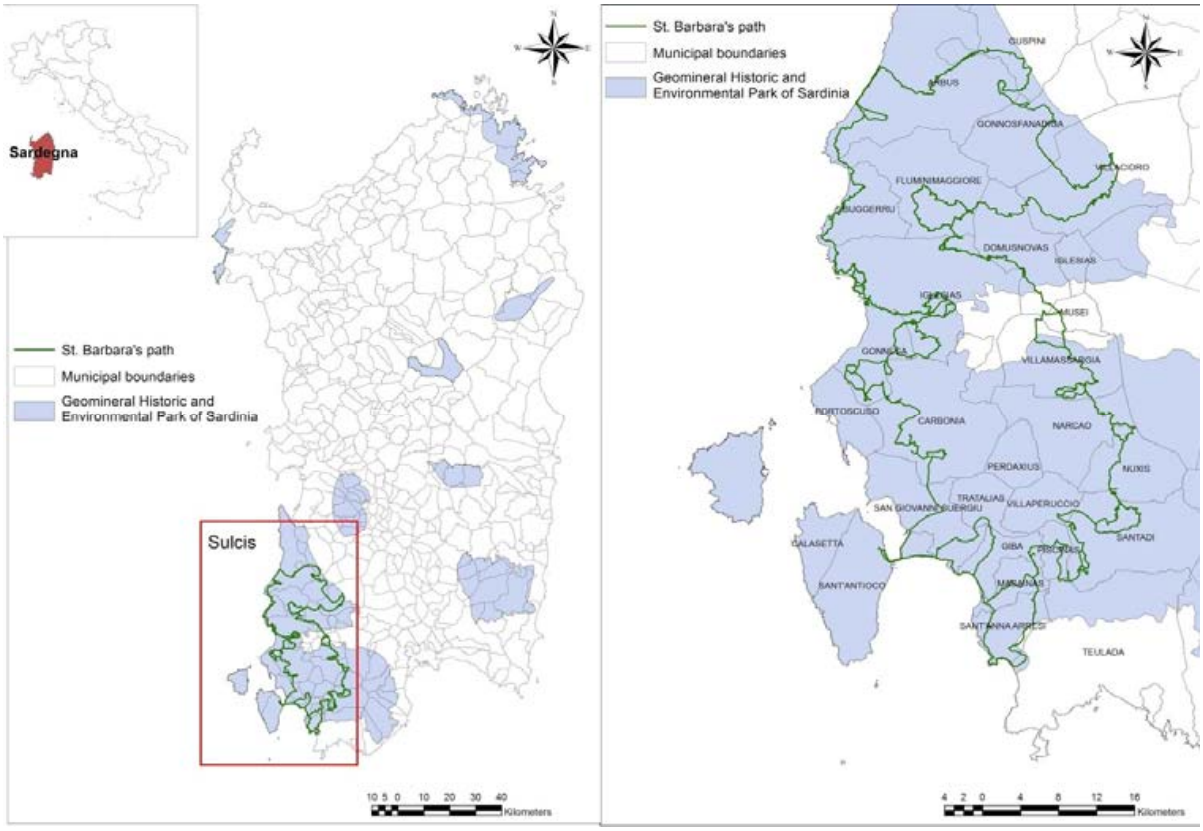

Fig. 1 Territorial framework

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The context of South-Western Sardinia, where most of the route is located, is geologically set on Cambrian-early Ordovician rocks, dating back to about 550 million years ago. Starting from the bottom, the geological succession shows the terrigenous sediments (mostly sandstones) of the Nebida Formation, followed upwards by the thick carbonate successions (dolomites and limestones) of the Gonnesa Formation, up to the fine-grained slates of the Cabitza Formation, which in the whole region are unconformably covered by the conglomerates and other coarse-grained siliciclastic sediments of the middle-late Ordovician Monte Argentu Formation ("Puddinga" Auct.: Servizio Geologico d'Italia, 2015).

These rocks shaped the landscapes of the Iglesiente and Sulcis, where the sea and the mountains merge, and where, for millennia, men have fought against the adversities of nature to extract a large underground wealth of ore deposits, profoundly modifying the morphological aspect of the territory.

The landscapes of South West Sardinia are in fact deeply marked by the consequences of mining activities, with the presence of large open-air and underground excavations, mine adits, tunnels and numerous mine wastes. These latter are constituted by accumulations of different types of waste rocks and tailings from mines and processing/metallurgical plants. All these elements highlight the vastity of mining operations carried out in the main mining places of the district, such as the great mines of Monteponi, San Giovanni and Masua, and their related processing plants and handling systems, as the historical Laveria Lamarmora and Porto Flavia plants.

The Santa Barbara Walk then crosses a landscape rich in natural and anthropogenic elements (landfills, mine muds and abandoned buildings), but at the same time mutable, because its vulnerability. This condition of changing landscape (or landscape in progress) it's so linked to a potential GeoTourism that "*provides economic, cultural, relational and social benefits for both visitors and host communities".* (Gordon, 2018).

3 METHODOLOGY AND SLOW NETWORK ANALYSIS

The authors analyzed the behavior of the smart community (walk and bike) in the Sulcis, also in relation to the recent definition of the Santa Barbara Walk.

The analysis developed was based on the concept of the network and on the examination of its fundamental elements. In fact, taking up the basis of the network analysis, the territorial elements considered relevant were considered, classifying them in points (or nodes) and lines (or arcs), zones (or areas) according to their punctual, georeferenced nature and the connections between these elements.

The analysis of network structures has, in fact, the advantage of understanding the organization of the territory in an "oriented" manner, independent from hypotheses of

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homogeneity of space. In the case in question, the movements of people for the reasons related to tourism in the area take place along paths, the linear elements of the network, and the connectors between these act as privileged places such as origin, destination and flow interchange.

As part of this work, the network analysis focused on the classification and representation of nodes, arcs and zones; proceeding with a first analysis on the spatial distribution of these and trying to highlight the more "dense" areas - in the present research following a 'visual' approach - as regards the various ways of using the territory.

Following a lack of official data concerning the number of people accessing the path in its different segments and on preferences about ways of enjoying it, the authors decided to rely on a 'smart community' of users, as in "Neogeography" approach (Turner, 2006), relying on the user-generated contents by means of GPS - enable portable devices. In particular, the authors have investigated the traces left freely on the web by walk and bike tourists who have visited the Sulcis.

These data currently represent the only data available regarding the Santa Barbara Walk.

The digital application used for data collection was Wikiloc, which allows the user to record in real time, save and share GPS tracks related to their itineraries (Battino S., Lampreu S., 2018). In addition to the track it is possible to save and georeference the photographs as well as comment, evaluate and report particularities along the route. The Wikiloc community is made up of over 4 million users who share about 11 million tracks and 20 million photos.

The data download operation was performed manually, using the geographic search option made available by the website, applying search filters. Following the identification of all the tracks, we proceeded with the homogenization of the data, transforming the paths into shape files and implementing the database with some fields obtained directly from the user data registration (path length, name of path, upload date, number of views and number of downloads).

In particular, starting from January 20, 2019 until January 29, 2019, the 230 walk tracks were identified and downloaded from the Wikiloc website, and from January 21, 2019 to February 3, 2019 the 230 bike tracks were identified and downloaded from the Wikiloc website (Fig. 2)[2].

At the same time we proceeded to construct the information layers attributable to the elements characterizing the mining landscape of the Sulcis (in ESRI Shapefile format, tab. 01), using the following categories taken from the official site of the Sardinia Region:

[2] Dott. G. Cosseddu collaborated in downloading data

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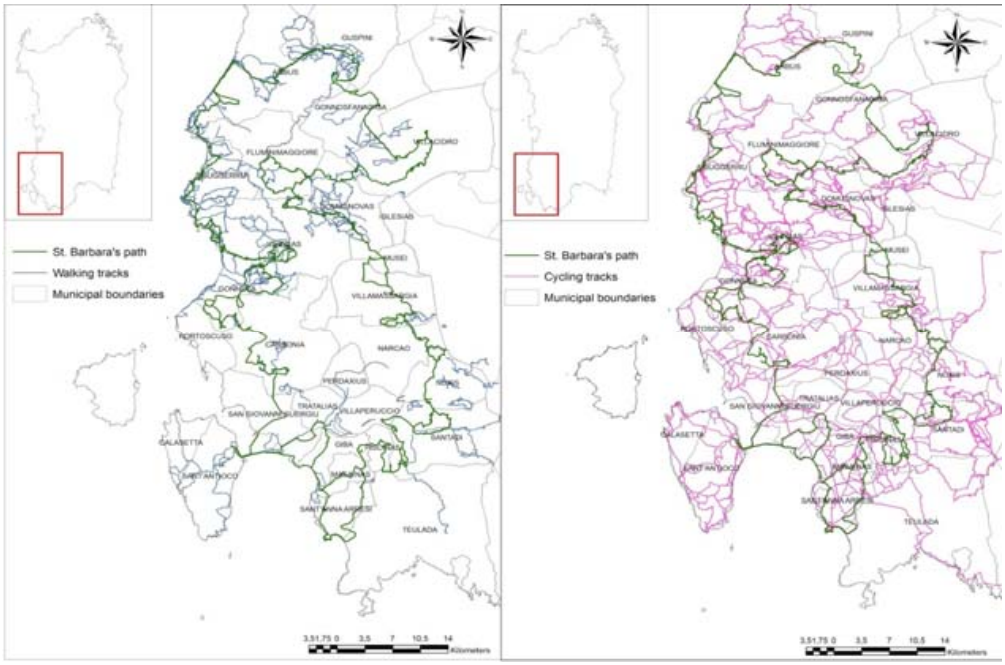

Fig 2 On the left St Barbara's path and walking tracks, on the right St. Barbara's path and cycling tracks

- Past mining areas: the mining sites of Sulcis-Iglesiente and Guspinese districts have been for a long time the real economic and cultural driving force of their territories. Indeed, many of the existing urban centers in these areas were created to support mining. The activities initiated from the II millennium BC and carried out until the late 1990's left positive and negative inheritances. While the mining industry has brought economic prosperity and cultural growth, it has certainly left a hard legacy of environmental degradation, geomorphological instability and widespread pollution.
- Points of interest (POI): the points of interest, related to historical and cultural sites, and to sites of environmental and landscape interest (published within the Geoportal of the RAS- Autonomous Region of Sardinia http://webgis2.regione.sardegna.it/), have been overlaid on the map in order to analyze the relationships between the position of these elements and the paths taken by users.
- Geomorphological and hydraulic hazards: data on geomorphological and hydraulic hazard published in the RAS Geoportal were downloaded and overlaid. The data have been shaped on the area of interest and thematized on the basis of hazard and risk classes. This phase evidenced the incompleteness of the available data, as the territories of Sulcis-Iglesiente and Guspinese have been only partially studied, regarding the aspects of hydraulic and geomorphological risks. However, the presence of instability phenomena, both natural and deriving from human activities, is marked and evident throughout the territory. In the study area, these phenomena include physical and mechanical instability of mine wastes and excavations and phenomena related to the

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sinking of the soil better known as Sinkholes, studied with increasing attention over the last few years.

- Sinkholes**:** Data about these phenomena, linked to sudden land collapses, have not yet been made public in vectorial format, therefore it was not possible to proceed with the precise identification and location of related sites. As described by Mureddu A (2015), the general setting of these phenomena refers both to large outcrops of Paleozoic limestones in Sulcis Iglesiente, subject to natural sinking of the overlying alluvial detrital covers, (e.g. Cixerri, Narcao-Nuxis and S. Anna Arresi plains), and to areas of past mining affected by sinkhole-type landslides and collapses. These latter are generated by sudden failure of roofs due to the decrease of geomechanical properties of rocks at the sides of deep mining voids. A comparison with the Hydrogeological Planning Plan (PAI) of the Sardinia Region highlighted that out of 247 measured subsidence phenomena 214 (85%) occur in areas outside the PAI boundaries and may not be classified as landslide risk sites. From a comparison with the Landslide Phenomena Inventory in Italy (I.F.F.I. Project), it emerges that 175 sites among those surveyed (71%) by the technical table have not been inventoried. In many areas of the territories of South-West Sardinia, particularly those lacking adequate vegetation and soil cover, past mining activities greatly enhanced the rock stability problems deriving from the natural presence of steeply sloping slopes set on fractured rocks.

INFORMATION LAYER	CODE	DESCRIPTION	SOURCE	REFERENCE DATE
Network	NW 01	St. Barbara's path	https://www.camminominerariodisantabarbara.org/	2019
	NW 02	walk tracks	https://it.wikiloc.com/	2019
	NW 03	bike tracks	https://it.wikiloc.com/	2019
Point of interest	POI 01	historical and cultural point of interest	http://webgis2.regione.sardegna.it	2015
	POI 02	points of landscape interest	http://webgis2.regione.sardegna.it	2015
Mining areas	MA 01	Abandoned mining areas	http://webgis2.regione.sardegna.it	2015
	MA 02	Historical environmental geo-mineral park of Sardinia	http://webgis2.regione.sardegna.it	2015
Risk areas	RA 01	Hydraulic hazard	http://www.sardegnageoportale.it	2018
	RA 02	Geomorphological hazard	http://www.sardegnageoportale.it	2018

Tab.1 Information layer slow network of Sulcis.

The three networks (NW 01, NW 02, NW 03) were then associated with the points of interest (POI 01, POI 02), with the mining areas (MA 01, MA 02) and with the areas at risk (RA 01

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and RA 02). All these information layers have shown distribution and concentration in the abandoned mining areas (MA 01 - Abandoned mining areas).

From the analysis of the walk tracks we can see how the mine areas (MA 01 and MA 02) constitute the main areas crossed by users, (Fig. 3).

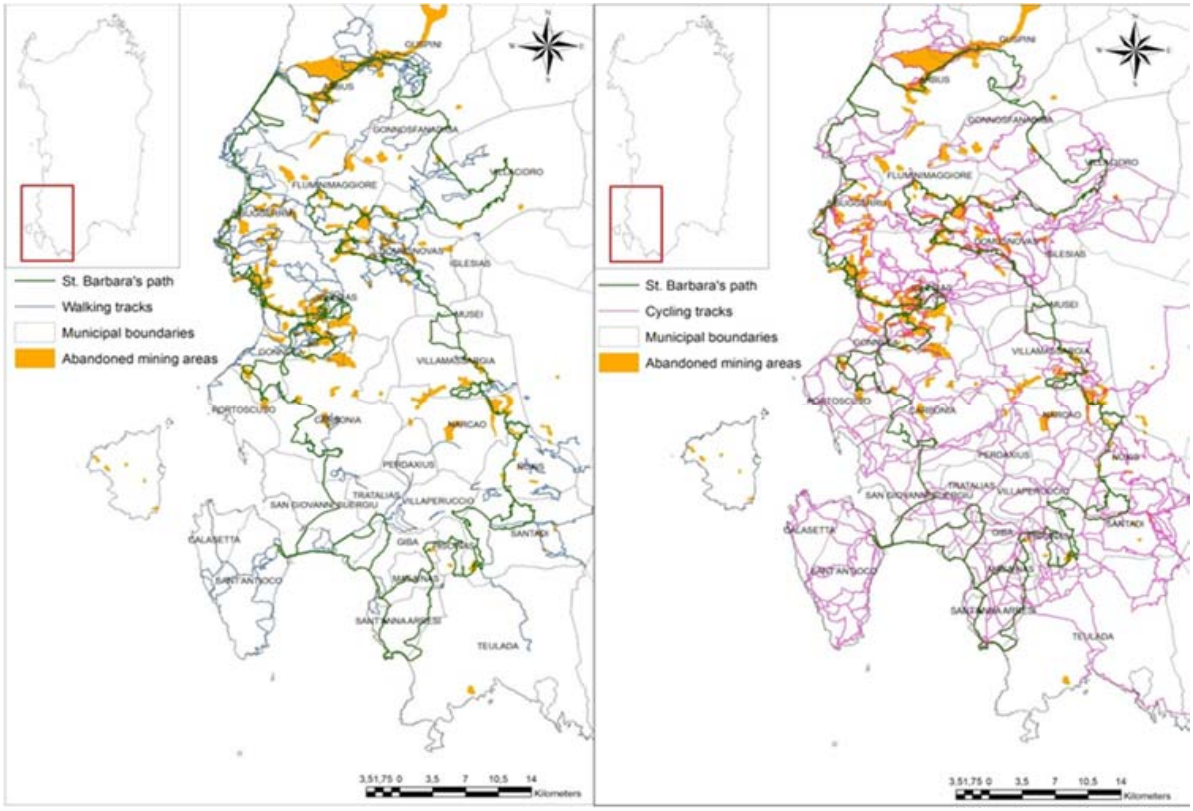

Fig. 3 On the left NW 01, NW 02 and MA 01, on the right NW 01, NW 03 and MA 01

As shown in Fig. 3 the walk tracks are developed in areas characterized by abandoned mining landscapes and therefore in contexts in evolution (Varrica, D. et al, 2018), while the bike tracks seem to be connected to sports motivation.

The mining landscape is constantly changing also due to the phenomena of hydrogeological instability, however it is recognized by the smart community as a landscape of particular interest and beauty (Balletto et al, 2016).

Moreover, in Sulcis not all the remains of a mine can be reclaimed, environmentally requalified and rebuilt, because the low population rate does not allow to balance costs and benefits.

In this sense, the knowledge of the risks is therefore the necessary condition to guarantee the protection and development of the Sulcis tourism development.

This is why the risk reports coming from the smart community (walk, bike and others) are strategic and enrich the user tracks of important information.

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4 CONCLUSIONS

From the analysis of the spatial distribution of the elements of the slow network of the Sulcis, it possible to observe how the walk community mainly crosses the abandoned mining sites, highlighting a cultural motivation, while the bike community is distributed over the whole territory of the Sulcis, according to a sporting motivation.

The evolution of the mining landscape of the Sulcis is correlated to the danger deriving from the ordinary and extraordinary geological instability connected to the abandonment of the mines.

In this sense, the smart community plays and can play an important role also in reporting dangerous situations to allow an immediate knowledge of the most significant environmental changes. For this particular evolutionary condition of the landscape, the authors in agreement with the National Research and Innovation Roadmap on Smart Communities (2016), aim to promote and consolidate the slow network in the Sulcis, even with the recent Santa Barbara Walk, considering that the management of risks based on voluntary information is of particular importance.

Following these guidelines and ideas, further step of the present work, in accordance with the protocol between Dicaar Department of the Cagliari University, DMI Department of Trieste and the Foundation of the Santa Barbara's Walk (December 2018), will be the development of an application that allows to signal the dangerousness of the places and at the same time to update the information layers related to the hydrogeological risks, to better govern the danger of the evolving landscape of the Sulcis and of the path of Santa Barbara in particular. More in detail, the idea is to propose the creation of a sort of 'digital hub' able to collect the information deriving from the different already existing social networks to share not only the available information but even the request of information, among the smart community users of the Santa Barbara Walk.

NOTE

This paper is the result of the joint work of the authors. In particular: paragraph 2, have been jointly written by the authors G. Balletto; A. Milesi and L. Mundula; paragraph 3, have been jointly written by the authors G. Balletto, A. Milesi, S. Naitza, G. Borruso; paragraph 1 and conclusion have been jointly written by all authors.

ACKNOWLEDGEMENTS

This study is supported by RE-MINE - Restoration and rehabilitation of abandoned mining sites, funded by the Foundation of Sardinia (Grant CUP F72F16003160002) and TSULKI -

ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6

Tourism and Sustainability in the Sulcis (Sardinia- Italy) SULCIS-821319, funded by Region of Sardinia, Fundamental or basic research projects for implementation of interventions in the field of research for the 'Sulcis Plan'.

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ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6

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