



Mapping Landscape Qualities in Inner Areas and UNESCO Sites in North Sicily by a GIS Multisource Geodatabase

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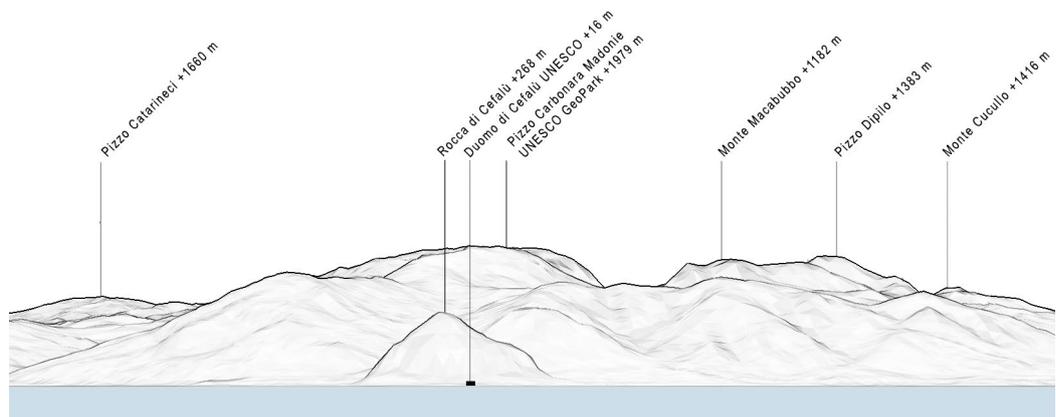
Abstract

The research aims to outline a mapping process that incorporates the use of analytic maps, synthetic maps, and diagrams to aid in the development of a strategy for sustainable tourism in the inner areas of the country. The emerging forms of sustainable tourism require a specific territorial strategy, supported by a precise knowledge and mapping process able to include minor places through the accessibility of less-beaten tracks, by creating new synergies between heterogeneous places which are only apparently unconnected with each other. Nowadays, the great availability of geolocalized information, gettable by heterogeneous web sources, enables carrying out a transversal mapping of physical landscape qualities and tourism opportunities, by linking local and global, tangible and intangible networks. The research has been centered on the northern coast of Sicily, in between the UNESCO sites of Palermo and Cefalù with its inner area of the Madonie UNESCO Global Geopark, where natural and human facts, are strongly interlaced with the landscape, creating a unique territorial configuration. The research shows how a GIS multisource geodatabase, made-up of punctual, linear, and areal entities, related to different fields of investigation, from natural to human, such as geology, nature, history, heritage, food, and culture, can support the definition of new actions in the sustainable tourism sector, in order to enhance the existing heritage. The mapping process, through visual thinking, is configured as a privileged tool for the knowledge of places and for the creation of new forms of representation.

Keywords

Mapping, Sustainable Tourism, Inner Areas Strategies, GIS, UNESCO

Perspective view oriented toward the northern coastline of Sicily between Rocca di Cefalù and Carbonara peak in Madonie Geopark performed through the digital terrain model. Graphic elaboration by the authors.



Introduction

This paper aims to outline a transversal mapping process that incorporates the use of analytic maps, synthetic maps, and diagrams to aid in the development of a strategy for sustainable tourism. The approach is centered around identifying and connecting the key touristic attractions in a specific region, where various natural, historical, and cultural highlights are present, starting from those of universal value such as UNESCO sites, which will serve as anchor points. With the aim of achieving a better balance in the way these attractions are experienced, the connection between the highlights is made by a system of 'slow routes'. These routes are designed to slow down the pace of travel, allowing visitors to fully appreciate the natural, historical, and cultural assets of the region. By doing so, the areas, often overlooked, between these main points of interest become more central. By focusing on these areas, a comprehensive and holistic approach can be set that not only enhances the visitor's experience but also helps a more balanced presence of tourism, extending the attention and accessibility to the inner folds of the landscape. These slow routes must be strictly connected in an intermodal approach to the networks of infrastructures: railways and highways with their territorial nodes (railway stations, service areas).

Another specific focus is related to productive landscapes, which refer to a type of landscape that is managed or used for the purpose of producing goods or services. This can include agricultural land, woodlands, and other forms of resource extraction or production, including tourism. It can also refer to urban or suburban areas that are actively used for commercial or industrial purposes. It is often contrasted with a 'natural' landscape, which is not actively managed for human benefit. Productive landscapes are often characterized by a high degree of human modification and management. They can also be viewed as a balance between economic productivity, environmental conservation, and social well-being.

The research also examines the transportation infrastructure to enhance accessibility to the less frequented areas of the region, with the aim to connect them to the more popular coastal destinations. More sustainable transportation options, such as bicycle and pedestrian routes, to promote eco-friendly tourism and boost the local economy, have been analyzed. New ways of connecting inner areas to the coastline, would allow easier access for visitors to explore the region while also reducing the ecological footprint of tourism.

The methodology of analysis: a loop between analytic and synthetic mapping

The knowledge of a complex territorial system, with specific reference to open spaces and to the actions of planning and management connected to it, is based on the making of maps [Pandakovic et al. 2013, p. 217], which enables to visualize, in graphic form and with a codified language, the elements that make and delimit the space, providing a critical-selective interpretation of reality. The work of analysis takes also into consideration the main principles of the "transect" method, as a way to investigate the landscape by following a line, and exploring the transition between natural, rural, and urban environments [Duany et al. 2020]. The methodology is based on a cyclical process that combines analytic and synthetic mapping [McHarg 1961]. The analytic investigations should inform the creation of synthetic maps, which in turn should be refined and validated through further analytic implementation, in order to iteratively improve the quality and accuracy of the final synthetic map.

An analytical map is a type of map that uses precise and detailed geometric representation to display specific information about an area. This information is obtained from a variety of sources, such as historical maps, lists of natural assets like monumental trees, and recognized landmarks promoted by national or international organizations such as Fondo Ambiente Italiano (FAI), Touring Club Italiano (TCI), or UNESCO. It can also include routes recognized by communities of outdoor enthusiasts, infrastructure nodes such as stations and service areas, natural and geological features, as well as cultural and traditional places represented in art, literature, and food. Popular local food destinations may also be included, by taking into consideration food biodiversity, safeguarded by the Slow Food organization. These maps

are often created by combining spatial information performed through different techniques such as photogrammetry, GIS, satellite and remote sensing, GPS data, and social data. A synthetic map is a type of map that uses conventional symbols and schematic representations to show general and easily readable information about a geographic area. Unlike analytical maps, which use geometric representations (points, lines, surfaces) to show georeferenced data with precision, synthetic maps use a conventional symbolic language to represent the main elements of interest in the landscape and the paths that connect them. The process involves a first description of the site using an analytical map, followed by a synthetic scheme, which is then refined and verified, possibly repeating the same process cyclically, until a sufficiently clear and effective representation is achieved, also in terms of communication. Direct experience of places and mapping are crucial steps of a knowledge process based on situated cognition and visual thinking. In this sense, observation, and implementation of multisource and multi-layered geodatabases are strictly interlaced and necessary to produce effective interpretation maps that can support territorial strategies.

The study area

The study area under attention is directed towards the inner region of Madonie, which is linked to the northern coast of Sicily in-between Palermo (including Monreale) and Cefalù [Lima 1985] [Di Francesca 1985] (fig. 1). The study area has been defined by considering two UNESCO sites, as 'anchor points' of the territorial strategy. On the northern coastline, the Cefalù Cathedral is the main landmark, which is one of the nine civil and religious structures dating from the era of the Norman kingdom of Sicily, included in WHL by UNESCO. On the south of the Tyrrhenian coastline lies the inner area of Madonie, listed in the UNESCO Global Geopark Network (GGN) since 2015, characterized by the extraordinary variety, richness, and uniqueness of geologic and geomorphologic sites. The more urbanized coastline, characterized by the presence of main urban settlements, mobility infrastructures (Messina-Palermo railway, A20 motorway), and tourism facilities contrasts with the more natural inland area, characterized by a mountainous landscape, interrupted by uplands and valleys, which are spotted by small villages and hamlets (Castelbuono, Pollina, Geraci Siculo, Petralia Sottana, Polizzi Generosa, Scillato, Collesano, Isnello, Gratteri), which are witnesses of the local culture. The complex landscape of Madonie, which counts seven type formations accepted by the international scientific community and more than forty geo sites, is also characterized by woodlands, conifers, and deciduous trees, with some rare species such as the *abies nebrodensis*, which is considered a critically endangered species. The hilly areas sloping down towards the coastline define the productive landscape of agricultural lands, with olive groves, fruit groves, vineyards, and sclerophyllous vegetation, which are also of interest for the current research (fig. 1).

The making of a GIS multisource geodatabase

The analytical mapping process, which leads to the knowledge of the places, is powered by heterogeneous datasets and sources of information, which are available through the web, in different formats. Some of them are already available as geospatial data, and downloadable as open data (e.g. datasets by Territorial Landscape Plans, Monumental trees dataset by Minister of agricultural policy). Others are available as georeferenced information but need to be mined through specific tools or plugins and then processed to be embodied in a customized map (e.g. Open Street Map, Google Maps, Georeferenced photos by Google Earth, Mapillary, Strava). Others are available through specific websites and archives, which provide geographical coordinates, but they need to be converted into geospatial data (e.g. UNESCO, FAI, Slow Food, Contemporary Arts, Literature). Others are available through traditional sources of information such as the Atlante dei Tipi Geografici [AA.VV. 2004] (e.g. books, paper maps, historical maps), but they need to be georeferenced to be effectively

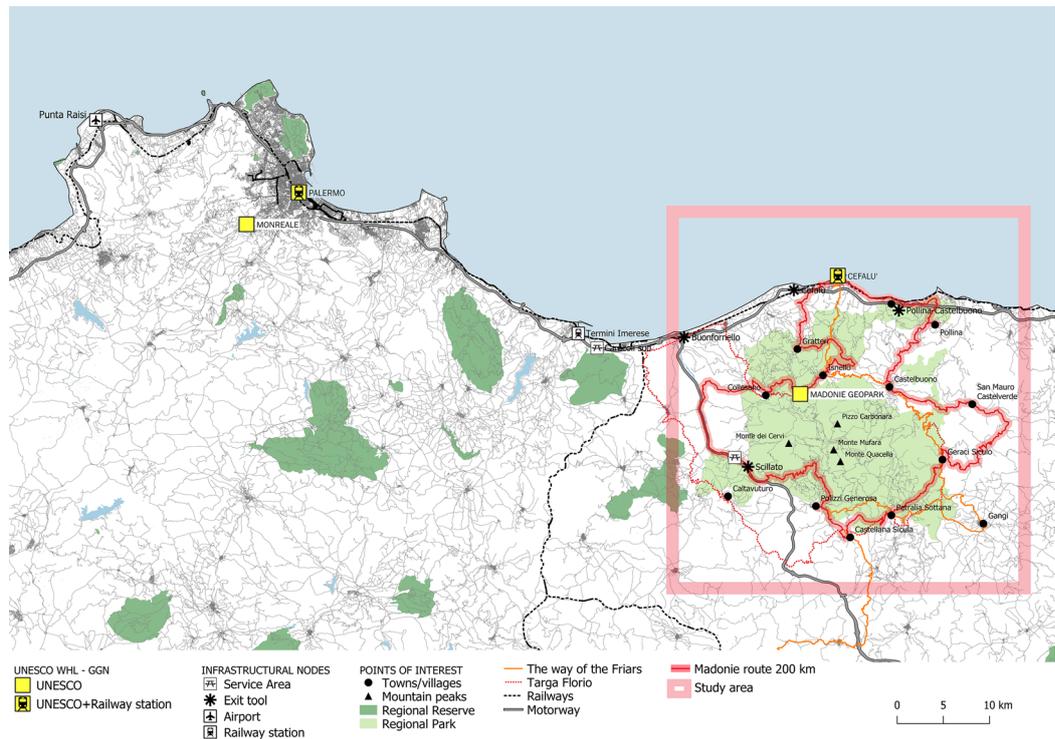


Fig. 1. Map of northern Sicily between Palermo and Cefalù, with evidence of the study area of Madonie UNESCO Geopark. Map by the authors.

used with a communication tool. The Sankey diagram highlights, on the left, the list of desired contents (targets), which are necessary for a comprehensive mapping, and on the right, the sources both traditional and digital, which power the process of analysis. The diagram visualizes the relationships between the targets and sources and shows how some sources can be considered much more relevant than others, by enabling the making of multiple contents (fig. 2).

As it is visible in the diagram, much of the spatial information is available in planning tools, such as Territorial and Landscape plans that, at different scales, provide the base for any strategy to protect and develop the main landscape features. Other data sources of spatial information are Google Maps and Open Street Map which, in a different way, provide georeferenced information about the places. Furthermore, detailed information on specific topics, such as food biodiversity, events, local culture, shared tracking information, and art is available through dedicated websites that, in some cases provide geo-coordinates about places, but in others need to be mined and codified as geospatial data.

Mapping, as a process that starts from the interpretation of reality, enables through Geographic Information System (GIS), on the one hand, the making of a multisource database that collects geo-information, and on the other hand to spatialize and visualize the layered objects in the map, to which are linked spatial attributes which define their meaning [Cicalò et al. 2021, pp. 20-24]. The map (fig. 3), as a visual device, reveals the power of 'where' information is localized. Furthermore, the mapping goal is not mirroring reality [Corner 1999, p. 213], but, in a creative way, can reveal the hidden potential of reality and make possible new relationships between heterogeneous entities, across the tangible and intangible worlds [Abrams and Hall, 2006, pp.12-13]. The map, as a visual device, shows how the information gathered in the geodatabase, within the process of analysis, is shaped in the territory in the form of geometrical entities (points, lines, and surfaces). To better define territorial development strategies, geographical entities are grouped and mapped according to four different clusters: physical landscape, local points of interest, global points of interest, and intangible points of interest.

The first cluster includes a group of physical elements of the landscape, which enable the comprehension of structural and functional aspects of the study area (e.g. morphology, hydrography, mountain peaks, infrastructures, urban settlements, agricultural lands and wood-

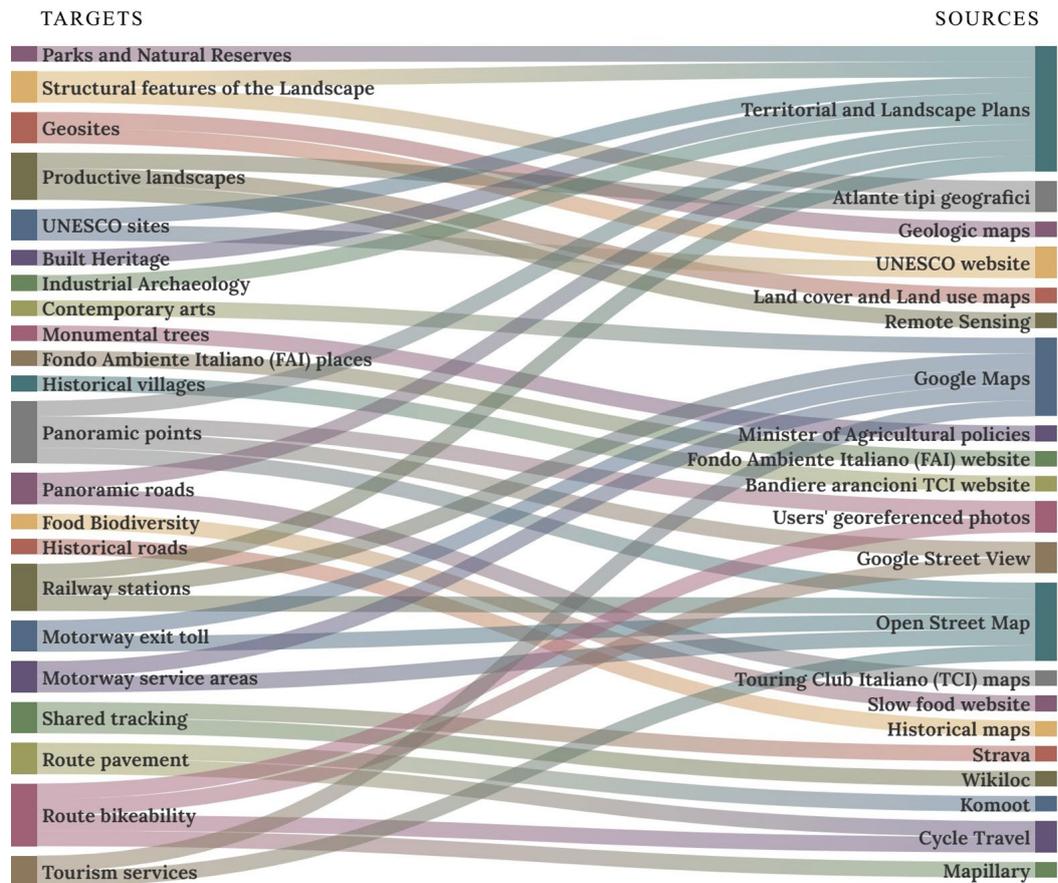


Fig. 2. The Sankey diagram highlights the relationships between the list of contents named targets and the main sources of information, which are necessary for a comprehensive mapping. Diagram by A. Scandiffio.

lands); this section enables to understand the three-dimensional structure of the landscape, by considering relief elevation, slopes, water distribution, and valleys configuration, but also to select the mountain peaks which can be eligible as visual references. The map shows the massif of Madonie with three main mountain peaks (Pizzo Carbonara, Monte Cervi, and Monte Quacella), of which the rocky outcrop of Cefalù represents the outpost on the coastline. The mapping of the main infrastructures (motorways and railways), with evidence of points of interfaces (railway stations, service areas, and exit tolls on the motorways) enables exploring of accessibility issues of the study area, but also to think about new travel patterns to reach the inner areas, both for daily and recreational activities, considering the infrastructure as a necessary component of the landscape that has to be treated in a positive sense, and therefore carefully designed and integrated into the landscape itself. In this region accessibility is ensured by the A20 motorway and railway Messina-Palermo on the north, and by the A19 motorway Catania – Palermo, through the Scillato exit toll on the southwest. The mapping of agricultural lands (e.g. vineyards, olive groves, and fruit groves) provide spatial information about the productive landscape, which correspond to the areas where local productions originate. The mapping of urban settlements allows an understanding of where the main services are localized and which kind of strategy can be established to better connect them. In the case of Madonie, the distribution of towns and villages, in the ring form, all around the massif of Madonie is an interesting territorial configuration, to plan new sustainable ways to access the natural area of the Geopark.

The second cluster of geo-information represented in the map includes a selection of points of interest that are mainly related to the local dimension, but that at the same time reverberate on a broader scale, at least regional. This section is represented by local built heritage, minor heritage, industrial archeology, panoramic points, thematic hiking paths, historical and panoramic roads, regional parks, natural reserves, but also local event, and religious festivals. In the study area, many points of interest are present and deserve to be geo-localized. One

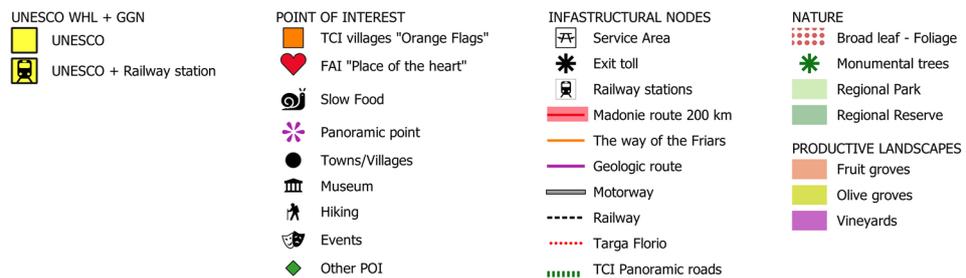
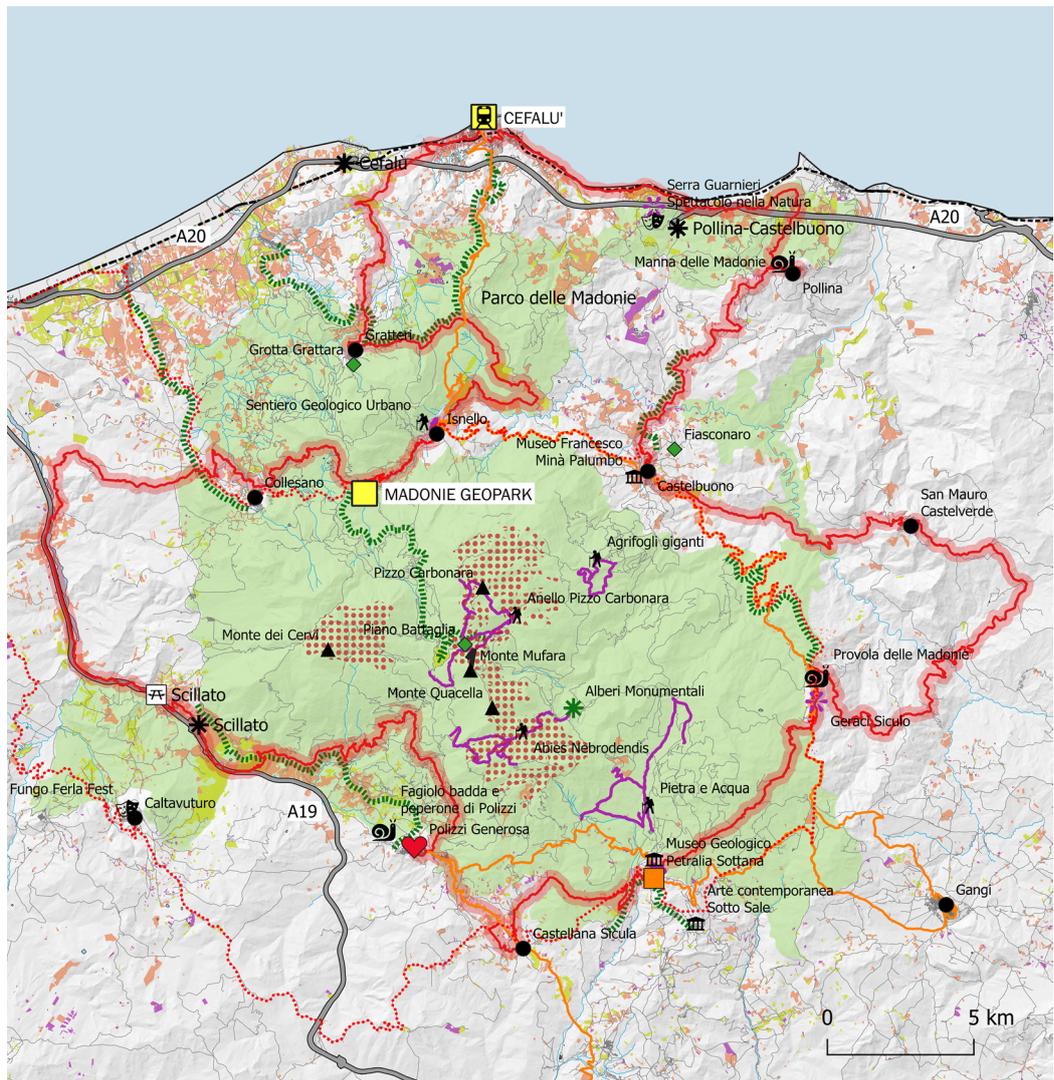
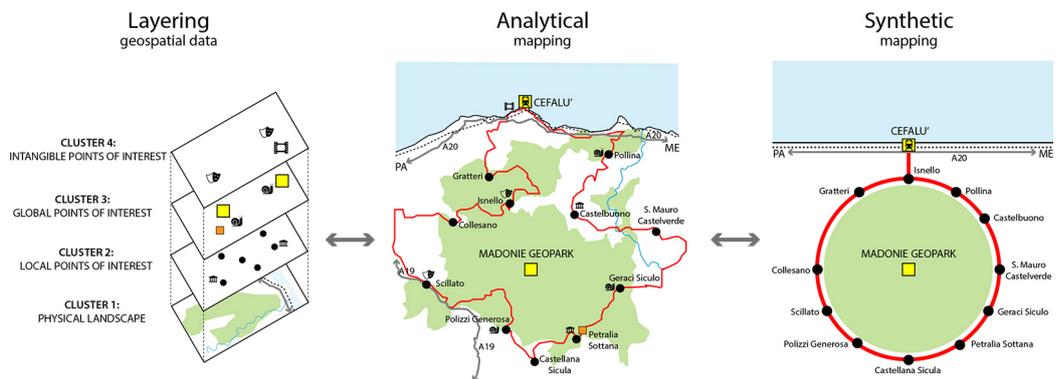


Fig. 3. The map shows the process of analysis oriented to the selection of heterogeneous elements of the landscape, which have been mapped by different data sources. The geodatabase has been set by considering the different dimensions of points of interest. Map by the authors.

of the distinctive features of the area is related to the geologic and geomorphological sites, which are accessible through a network of thematic geological paths, mapped by the Madonie Regional Park. Panoramic points and panoramic roads, mapped by TCI, enable the perception of the landscape in a privileged way. The walking path named 'the way of the Friars', from Caltanissetta to Cefalù, across the Madonie, is an unusual way to discover inner Sicily by walking. Even museums, such as the one dedicated to the naturalist Francesco Minà Palumbo in Castebuono, the Geologic Museum in Petralia Sottana, the contemporary art museum, named *Sotto sale* in Petralia Soprana, and other places such as the XIXth settlement of Serra Guarnieri close Pollina, are of interest, because of their capacity to tell unusual stories of the territory and enable unexpected experience through local culture.

Fig. 4. Diagram which highlights the mapping process, from layering geospatial data to analytical and synthetic representations. The Madonie slow route, as a ring that crosses the UNESCO Geopark, with connections to the infrastructural bundle that runs along the coast, between the Punta Raisi airport, Palermo, and the UNESCO sites of Monreale and Cefalù. Scheme by A. Scandiffio.



To the local points of interest cluster, it can be added the network of places that are recognized by national or international organizations. This third cluster grouped places such as UNESCO sites, National Parks, monumental trees, and places related to specific programs of enhancing Italy's historical, artistic, and landscape heritage, FAI, TCI, Slow Food (e.g. Polizzi Generosa has been recognized as 'place of the heart' by FAI, while Petralia Sottana has been recognized by TCI in the 'orange flags' villages). The study area counts the UNESCO WHL of the Cefalù Cathedral and the Madonie Geopark; other places of interest are included in the Slow Food network for food biodiversity (e.g. the producers of Badda beans and pepper at Polizzi Generosa, Manna at Pollina and Provola delle Madonia at Geraci Siculo); other food products, which are globally recognized, are included as a point of interests, even though they are not part of a specific network (e.g. Fiasconaro in Castelbuono).

The fourth cluster includes places that are related to the intangible cultural sphere, such as literature, cinema and others. In this section are listed places that outline unusual perspectives of the territory, and which get added value, whether is told in the real site (e.g. film set, like for the *Nuovo Cinema Paradiso* by Giuseppe Tornatore in Castelbuono and Cefalù or other places narrated in the literature). The study area is also crossed by the route of La Targa Florio, that was one of the oldest endurance car race in the world, through the area of Madonie.

All clusters have been used as sources of information for mapping the Madonie slow route (200 km long), as a ring that connects points of interest, infrastructural nodes, and productive landscapes with the aim of enhancing the territories in-between UNESCO sites in a sustainable development perspective.

Conclusion and future developments

The research has shown how the mapping process, by performing analytical and synthetic representations, supported by a multisource geodatabase, can lead up the cognitive process from data to information, and from information to the knowledge of a specific territory, by exploiting the potential of geolocalization as a procedure to select information critically and visually according to the purposes of the research (fig. 4). Further development of the research could be addressed to test the effectiveness of the territorial strategy by creating dedicated initiatives which involve local actors and stakeholders. The analysis performed through the maps is a fundamental step for the definition of the territorial strategies which can support the sustainable development of inner areas of the country, considering their fragility and with particular reference to UN SDGs 3, 9, and 11, by exploiting the extraordinary tangible and intangible resources which characterize the Italian landscapes.

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Credits

Author Contributions: all the authors shared the principles and the research topics presented in the article. However, the paragraph titled 'Introduction' was written by A. Rolando, the paragraph 'The methodology of analysis: a loop between analytic and synthetic mapping' was written by both authors, the paragraphs titled 'The study area' and 'The making of a GIS multi-source geodatabase' were written by A. Scandiffio, 'Conclusion and future development' was jointly written by both authors.

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