

Assessment of the territorial suitability for the creation of the greenways networks: Methodological application in the Sicilian landscape context

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Abstract

The proposal to create greenways networks for the enhancement of more or less vast areas is of great importance to territory planning. The paths, which are overlaid on pre-existing linear patterns, promote the development of endogenous resources and facilitate direct learning of the territory's historical, cultural, environmental and landscaping assets. Rural areas can be strongly influenced by setting up a *greenways network*, as their use not only promotes the exchange of knowledge between users and inhabitants, but also encourages the enjoyment of various areas (agricultural landscapes, scattered cultural heritage, protected environments) that would otherwise be inaccessible due to their distance from the traditional routes. Altogether, this favours the introduction of economic activities based on their typical characteristics. This work identifies the appropriate road infrastructure, available in the former Province of Syracuse (East Sicily), for building greenways networks that will best contribute to the valorisation of their surrounding territory. This work assigns great importance to landscape features as factors of tourist and cultural attraction. We have used the multi-criteria analysis associated with geographic information system (GIS). We have weighed and mapped numerous indicators to define the territory's infrastructural, landscape, cultural, and tourist resources, meaning those able to increase the use of the territory and/or that determine attractiveness for the population. The GIS analysis allowed us to develop numerous intermediate maps, whose information helped us to draw up the final map illustrating the suitability of the existing

infrastructures that could be useful while planning of a greenway network. Such infrastructures could be the subject of specific plans or detailed projects aimed at enhancing the pre-existing resources of a rural territory. This study, although referring to a defined territory, is methodologically valid in a general sense and can be used in various contexts.

Introduction

The term greenway was introduced in 1959 in the United States by William H. Whyte. It is well known that many designers and scientists (Little, 1990; Fabos and Ryan, 2004) consider Frederick Law Olmsted the founder of the greenways movement.

From the very beginning greenways planning captured the interest of the public in the United States and Canada, and received political and academic support, showing that these networks are multi-functional, ecological, and capable of furthering social and economic objectives (Miller *et al.*, 1998; Bateman, 2006). According to Fabos and Ryan (2004) the greenway concept encompasses at least three meanings: primarily, they are *ecological corridors*, secondly they have recreational functions and, finally, they contribute to the conservation/requalification of an area's historical and cultural heritage.

Ahern (1995) proposed the following definition: *Greenways are networks of land containing linear elements that are planned, designed, and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use*; Ahern goes on to identify the key concepts within this definition: linear configuration, connection, multi-functionality and, environmental sustainability.

The explosion of the greenways concept in Europe, however, is a recent development, and the involvement of European States has been due to the organisation of seminars and conferences on the greenways and on related planning issues.

In Italy, the Italian Greenways Association (AIG) promotes and divulges the concept of greenways. Homogeneously to the previous definitions, the AIG identifies the greenways as *system of routes, good from the environmental point of view and dedicated to a non motorised traffic, connecting people with landscape resources (natural, historical, cultural, etc.) and the 'centres of life' (e.g. public offices, sport and recreational facilities, etc.), both in the urban areas and in the countryside*. It further characterises the greenways as *a system of linear interconnected territories that are protected, managed and developed in order to obtain the recreational, ecological and cultural-historical benefits*.

Transferring the greenway concept to Italy therefore requires an interpretative effort; it is necessary to adapt the very notion of a greenway to a new social and territorial context.

In Italy, and especially in Sicily, compared to the region's exigencies and its potential for an infrastructural network, very little has been done towards the planning and implementation of real green-

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ways networks. In Sicily there are some isolated greenways, which are difficult to use continuously, while a greenways network is conceived a system of interconnected infrastructures, which could be composed of towpaths, river banks, historical streets (Caliandro *et al.*, 2014), disused railways (Senes, 2004; Toccolini, 2004), country roads, trails, panoramic itineraries and bike paths, creating a non-motorised independent network, created as part of an integrated development, which promotes environmental sustainability and boosts the quality of life. This network could constitute a location for the development of an ecological corridor, connecting various isolated natural areas (De Montis *et al.*, 2016).

Therefore, the proposal to create greenways networks or green paths for the enhancement of more or less large areas is of great importance to land use planning. The paths, which would be overlaid on pre-existing linear patterns (historical roads, dismissed railways, river towpaths, trails, roads of secondary importance), would allow for the development of local resources and support direct knowledge of the area's historical, cultural environmental and landscape heritage. Rural areas can be strongly influenced by the construction of *greenways networks* as their use not only promotes the exchange of knowledge between network users and inhabitants, but also facilitates the use of areas (agricultural landscapes, cultural heritage, protected sites) otherwise inaccessible due to their distance from the traditional roads. Altogether, this favours the introduction of economic activities (agritourism, refreshment, accommodation facilities, rural tourism, selling typical agricultural and home made products). In Sicily, the main existing greenways are made on short stretches of disused railways, independent of each other and created thanks to the *Non-motorised mobility plan in Sicily*, adopted on 6 June 2005. The latter, designed as an integral part of the regional transport Plan, were developed with the aim of achieving a *regional network of alternative transportation mobility, with a low or no environmental impact ('slow' mobility), with the priority use of the disused railway lines and of other minor or side roads* (Regione Sicilia, 2005).

The Plan was designed to further the reuse of almost all the disused railway lines, but also to encourage the use of other routes situated on ancient royal country roads or on standard roads, in order to interconnect individual circuits and to create routes to and across locations of particular value.

The plan identifies two types of paths: the *ring paths*, the *linear paths*. The first are short cycle hiking courses, often with a well-defined environmental, landscaping or historical theme, which depart from and feed back into a town or road intersection. The *linear paths* are characterised by different starting and arrival points, possibly in a row, in order to allow them to be traversed in several phases throughout the regional territory. The plan is important for the public authorities' willingness to create a totally new infrastructure in the region and to consider this infrastructure as part of a network rather than as an isolated one. While the Plan highlights the region's great potential for the creation of a greenways network, it is accompanied only by a description of the functional features of the routes, and lacks an assessment of the territorial and landscape features that justify the recovery, reconversion and infrastructural adjustment on which the greenways network relies (Regione Sicilia, 2005). The guidelines Sicilian regional landscape plan (PTPR), provides even less detail, and indiscriminately identifies 6432 km of *country routes*, 838 km of disused railways, and a dense network of paths (about 4078 km) and stretches of panoramic roads (2675 km) that could be used for non-motorised traffic. It is clear that not all the kilometres indicated by the above mentioned guidelines are suitable for greenways. The selection of pathways to establish a greenway network, should take place following a meticulous territorial and landscaping analysis, which allows us to identify the attractions that can stimulate

the use of the greenways network. Various authors argue that greenways are important elements for the enjoyment and enhancement of the rural areas and that their use depends on the presence of *attractions* disseminated along the route, of the landscape-environmental type (reserves, natural areas, rivers, lakes, *etc.*), landscaping-agro-food (agricultural landscapes, cultural landscapes, selling typical products, catering based on the use of the local products, agritourism, *etc.*) (Taylor, 2015; Ottomano Palisano *et al.*, 2016). It seems appropriate, based on the regional potential and planning guidelines, to acquire the analysis and evaluation tools, that will allow for the proper planning of the most suitable greenways network to stimulate the use of the rural areas and the valorisation of the resources (landscaping, cultural, agro-food) (Riguccio *et al.*, 2015a). Therefore, the objective of this study is to develop a useful method to identify infrastructure systems capable of supporting a greenways network that can contribute to the promotion of areas of particular value. For this purpose, we will adopt the slow regional mobility plan's consideration of the greenways network as the ensemble of road structures, which favour slow travel within the area. This would include paths dedicated exclusively to non-motorised travel, roads that can accommodate both slow and motorised travel which connect the non-motorised paths, and roads reserved for motor vehicles that equipped with road signs and other useful services to reach the real greenways.

In the *Materials and methods* section, after a brief description of the reference framework, we outline the methodological steps based on a multi-criteria analysis (MCA), associated with the spatial analysis in a geographic information system (GIS) environment.

In the *Results* section we show the results of the MCA, for the preparation of the suitability maps, which highlight areas of major interest for the construction of a network.

In the *Discussion and conclusions* section we summarise the main findings and illustrate the scope for development of this research. The methodology, with appropriate adjustments, suggested by the specific contexts, can be applied to the Italian regions and more generally in territories where the same objective is pursued.

Materials and methods

Area of research

The territory considered for the development of this study, coincides with the landscape areas 14 and 17 of PTPR, located in what was previously the Province of Syracuse (and is currently a Consortium of Municipalities). This area is characterised by a surface of 2124 km² and it is delineated to the North by the Plain of Catania, to the East and South by the Ionian Sea, to the West by the Iblei mountains, which occupy a considerable part of Consortium (Figure 1).

The area boasts numerous archaeological areas (Eloro, Akrai, Tellaro, Megara Hyblea, Thapsos, Pantalica): in the landscape area 17 alone, we have 600 sites recorded by PTPR; for reference, no other landscaped area, among the 17 identified in the PTPR, exceeds 300 sites. The PTPR has recorded, in the same landscape area, 800 isolated assets of high cultural value. Both the landscape areas have about 1625 km of linear infrastructure that, in accordance with the PTPR, are well suited, to constitute part of a greenway (1210 km of royal country roads (*trazzere*), 167 km of disused railways, 248 km of trails). The rural landscape is predominantly agricultural, but crossed by streams recessed in canyons, which shape important landscapes in the Natura 2000 network (rivers Anapo and Tellaro).

The coast preserves important landscapes and natural sites, like

Vendicari reserve, the Priolo peninsula, the Plemmirio, Capo Passero, etc. despite the petrochemical area in Augusta. The Iblei Mountains, formed by volcanic and calcareous rocks, have furnished the construction materials for the most of the local buildings. The mountains form plateaus that slope down to the sea with large cliffs. The edges of the plateaus, located from 100 to 200 m above sea level, clearly delimit very different agricultural landscapes: dry crops or orchards with olive and carob trees in the plateaus, and intensive crops (vineyards, greenhouses) on the coast. Of great value and peculiarity is the agricultural landscape characterised by fields enclosed by an extended network of low dry stone walls, protecting arable land and orchards containing olive trees, almond trees in Noto district (Netino) and carob trees, with the latter two quite often found together.

The *masserie* system (rural buildings built between 1600 and early 1900) is an invaluable architectural heritage, forming a display of ancient rural edifices serving typical agricultural practices such as cereal production and livestock keeping.

Materials

The territory has been analysed using the thematic map files of the local landscape plan, developed in accordance with the Code of Cultural Heritage and Landscape (Legislative Decree no. 42 of 22 January 2004) for the landscape areas 14 and 17 of PTPR, provided by the Superintendence of Cultural and Environmental Heritage of Syracuse. We have used the thematic layers data containing the roads, rail, port and airport infrastructures, land use, the landscaping areas such as reserves, parks and Natura 2000 sites, the archaeological sites and places, the rural architecture, the historical centres, rivers and lakes. The subjects have been referred to the base map in raster format in scale 1:100,000. These files have been updated and completed by performing direct surveys and using the data acquired in the Sicily region website and in the regional geographic information system. In addition, in order to acquire the general information on the regional development guidelines and on the socio-economic, environmental and cultural potentialities of the territory, we have consulted the following documents: guidelines of PTPR; rural development plan, Sicily region 2007-2013; regional operational programme Sicily 2000-2006; list of the agricultural products *designation of protect origin* and *protected geographical indication* provided by the Ministry of Agriculture and Forestry, 2014; the Sicilian Network Ecological Guidelines 2005; Line of action 3.3.2.4 *Implementation of a regional strategic plan for the sweet and/or*



Figure 1. Location of the study area. PTPR, Sicilian Regional Landscape Plan.

non-motorised mobility, Sicily region 2009; data from the National Institute of Statistics (ISTAT), and in particular the 2011 agricultural census. We have considered the latest Google Earth® satellite images (June 2014), and its pertinent database concerning especially the location of tourist and commercial services. The cartographic data has been processed with ArcMap 9.2 software and ArcGIS 9 (Esri, Redlands, CA, USA), while the numerical calculations have been developed with EXCEL 2010. We have used 100 questionnaires to obtain the preferences of a population sample on landscape characteristics. The questionnaire model is shown in Figure 2.

QUESTIONNAIRE				
Express the importance degree that these resources could take for the landscape enhancement of the territory, by developing a greenways network (dedicated paths to slow mobility, pedestrian and cycle tracks):				
Interviewee personal data				
Age group: < 30 years; >30 <50 years; >50 years				
Education level: University degree; High school degree; Junior high school				
Town:				
Alternatives				
A1 – To establish a greenways network that can promote the development agro-Rural				
A2 – To develop a greenways network can encourage the Tourist - Cultural use				
A3 – To realize a network of greenways that can promote the use of Environmental values				
Cod.	Description	Value		
I1	INFRASTRUCTURE RESOURCES	High	Medium	Low
I1,1	Highways			
I1,2	State roads			
I1,3	Regional and provincial roads			
I1,4	Active railway tracks			
I1,5	Desused railway tracks			
I1,6	Ports and Airports			
I1,7	Paths and royal country roads			
I1,8	Parking/rest areas			
I2	NATURAL AND ECOLOGICAL RESOURCES	High	Mean	Low
I2,1	Land use and agricultural landscape			
I2,2	Natural reserve and parks, SIC/ZPS zones			
I2,3	Waterways			
I3	HISTORICAL AND CULTURAL RESOURCES	High	Mean	Low
I3,1	Archeological sites			
I3,2	Historical centers			
I3,3	Museums and eco-museums			
I3,4	Rural Architecture/ architectural landscape elements			
I4	COMMERCIAL RESOURCES AND SERVICES	High	Mean	Low
I4,1	Agricultural holdings /educational farms/agritourisms/campings			
I4,2	Hotel facilities /B & B / hostels			
I4,3	Rural and folk festivals			

Figure 2. Standard questionnaire provided to the sample of residents.

Methods

Multi-criteria analysis

Once a single objective had been identified (goal) - to identify the infrastructural system able to support the greenways network that would best contribute to the enhancement of the Syracuse territory - we have envisioned a *finite* number of *alternatives* able to justify the realisation of a greenways network. The decision-making process was then centred on the alternatives, as defined by Keeney (1992), to select the best alternative (Mauchline, 2012).

Among the various MCA, the analytic hierarchy process (AHP) is widely applied in the territorial planning field. The AHP addresses the evaluation process through several distinct phases by taking, as a general methodical rule, the division of the overall problem of choice into a series of smaller and easier solving problems. This method, at the end of the process, assigns each decision-making alternative a score, which represents the overall performance, obtained thanks to the performances the alternatives present on the individual evaluation criteria. This method, though mathematically complex, tends to simplify the interaction between analyst and decision maker, being able to deal with problems where a good part of the data is of *soft* type (qualitative type) (Saaty, 1990).

According to William Ho (2008) its wide applicability is due to its great flexibility, simplicity and user friendliness. Moreover, an advantage considered to be one of the most important to AHP is given by the ability to verify the consistency of judgments by computing the *consistency ratio*, which must not exceed 10%.

The suggested alternatives are: A₁ - to establish a greenways network that can promote agro-rural development (Russo *et al.*, 2014; Riguccio *et al.*, 2015a); A₂ - to develop a greenways network that can encourage tourism and cultural enjoyment in the area (De Montis *et al.*, 2015; Diti *et al.*, 2015; Taylor, 2015); A₃ - to realise a network of greenways that can promote ecological activities (Fichera *et al.*, 2015; Riguccio *et al.*, 2016). These proposals arise from the study of the scientific literature, from specialists' opinions and from information contained in consulted cartographic, digital and documentary sources (Marcheggiani *et al.*, 2011).

The A₁ alternative is based on the creation of greenways with rural purposes, meaning a type of infrastructure that can enhance the rural landscape and promote the development of activities related to the recovery and restoration of the rural heritage.

The A₂ alternative would establish greenways with touristic and cultural purposes, for the enjoyment of the cultural, archaeological, historical, natural, landscape resources. This use promotes the integration of the enhancement process with the provision of services and with other related productive sectors.

The A₃ alternative is based on the development of greenways with environmental objectives, such as maintaining biodiversity and facilitating the use of valuable landscape areas.

Given the objectives, the indicators (I_{mn}) or criteria selected are those reported and accompanied by their meanings in Table 1.

The indicators are part of the following territorial systems: infrastructural (I₁), agri-natural (I₂), historical-cultural (I₃), commercial (I₄), explained by the indicators: I_{1n}, I_{2n}, I_{3n}, I_{4n}. The term *system* is hereinafter used to indicate the territory components (in this case the indicators) that interact with one another in order to fulfil a specific function (infrastructural, natural, historical-cultural, commercial) (Mazzino and Ghersi, 2002).

The pairwise comparison between I_m systems and the I_{mn} indicators, executed with respect to each alternative A₁, A₂, A₃, has provided the relevant weightings. In this case the weightings were

assigned according to the Saaty scale (1990) (1-Equal importance, 3-Moderate importance of one over another; 5-Essential or strong importance; 7-Very strong importance; 9-Extreme importance). The matrices have been developed by the research team members who are experts on territory planning with many years of research experience in the specific field. We have verified the consistency of judgments by computing the consistency ratio.

Questionnaires

The evaluation of the systems and indicators also takes into account the results of questionnaires distributed to a sample of 100 inhabitants living in the Syracuse area, of heterogeneous age and level of education.

The questionnaire was distributed at meeting places (squares, cafes), shopping centres and at the Faculty of Architecture of the University of Catania at a prime time of attendance. We asked participants to assign a qualitative value (high, medium, low) to the systems of indicators under consideration, and their ability to enhance the landscape of the territory, by developing a greenways network with respect to the three proposed alternatives (A₁, A₂, A₃).

The results of the interviews were considered and the qualitative judgements were recorded on the two matrices using the symbols ++, +, + -, - and --, where the symbol ++ represents the maximum satisfaction value of the I_m system (in the first matrix) or indicator I_{mn} (in the second matrix) compared to the alternative A_n and, *vice versa*, the symbol -- represents the non-satisfaction of the I_n system or of the indicator I_{mn} compared to the alternative A_n.

Therefore, in the first matrix, we assign the qualitative weight that each system (I₁, I₂, I₃, I₄) assumes with respect to each hypothesised alternative (A₁, A₂, A₃).

In the second matrix we have given the qualitative weight that each indicator (I_{1n}, I_{2n}, I_{3n}, I_{4n}) assumes with respect to each hypothesised alternative (A₁, A₂, A₃).

The five levels of satisfaction arise from the number of high preferences given by the respondents. Although we have not considered the preferences granted by the respondents with respect to the opinions *medium* and *low*, we believe that the inclusion of these options in the questionnaire sheet, compels the respondents to a more careful consideration on the preferences to be provided, allowing them to smooth their own opinion. In the Table 2 we find the thresholds of the number of preferences corresponding to the *high* value, associated with each symbol.

The I_{mn} thresholds stem from the high number of preferences given by the respondents to each I_{mn} indicator, while the thresholds related to I_m stem from the sum of high preferences given by the respondents to the indicators of the belonging system.

Subsequently, the data contained in the matrices, has been normalised by assigning to the linguistic opinion ++ a value of 1 and to the opinion language -- a value of 0. Assigning the value 1 to an indicator means that given indicator maintains the weighting obtained from pairwise comparison in the AHP, because more than 80% of respondents assign a high value to the pertinent indicator. Assigning a 0 to an indicator, the indicator is discounted, as it collects a number of preferences lower than the minimum thresholds, as less than 20% of respondents assigned it a high value.

Therefore, to obtain the order of the alternatives, the weights obtained by the pairwise comparison have been associated to those recorded in the first evaluation matrices, multiplying the values.

The double application (matrices of evaluation and pairwise comparison of I_m systems and matrices of evaluation and pairwise comparison of I_{mn} indicators, for the alternatives A₁, A₂, A₃),

Table 1. Description of the indicators separated for systems.

Objective	System	Indicator	Description
Identify the infrastructural system able to establish the greenways network	I ₁ - Infrastructural	I _{1,1} Highway	Suburban or urban road infrastructure reserved for fast traffic, multi-lane
		I _{1,2} National road	Road of national importance managed by the State
		I _{1,3} Regional and provincial road	State-owned roads connecting the provincial capitals in the same region with each other or with the regional capital or connecting the provincial capitals or municipalities with the state network
		I _{1,4} Active railway lines	Active railway lines in the territory
		I _{1,5} Disused railway lines	Old disused railway lines
		I _{1,6} Ports/Airports	Structures for unloading goods/embarkation activities
		I _{1,7} Paths/royal country roads	Agricultural farm tracks and country roads
		I _{1,8} Parking/rest areas	Devoted cars/campers parking and picnic areas
		I ₂ - Agri-natural	I _{2,1} Land use
	I _{2,2} Areas of significant landscape and environmental interest		National and regional parks, nature reserves, marine parks and other protected natural areas; Special Areas for Conservation (SAC) and Areas for Special Protection (ASP) identified by Decree of the Office for Land and Environment of 21/02/2005 published in the Official Gazette of Sicily Region No. 42 of 7/10/2005
	I _{2,3} Waterways		Natural elements like rivers and brooks
	I ₃ - Historical-cultural	I _{3,1} Archaeological sites	Complex and minor archaeological areas, isolated settlements and structures
		I _{3,2} Historical centres	Historical centres of various origins for age and type, holding diverse roles of territorial centrality
		I _{3,3} Museums and eco-museums	Structures dedicated to the preservation and use of the historical/cultural heritage
		I _{3,4} Rural Architecture/architectural landscape elements	Architectural elements indicating the rural landscape made up of various civil, religious, defensive, productive structures, extremely diversified for historical origin and for construction characteristics
	I ₄ - Commercial	I _{4,1} Agricultural holdings / educational farms/ agritourism	Structures characterised by the integration of agricultural activity with cultural/educational/tourism activity
		I _{4,2} Hotel facilities/ B&B/hostels	Accommodation facilities
		I _{4,3} Rural and folk festivals	Habits and customs, folk festivals, rural festivals, religious events, patron saint feast days, more generally events related to the folklore and local traditions

Table 2. Thresholds of the number of preferences corresponding to the *high* value, associated with each symbol.

	for I _{nm}	for I ₁	Preferences for I ₂	for I ₃	for I ₄
--	From 0 to 19	From 0 to 152	From 0 to 57	From 0 to 76	From 0 to 57
-	From 20 to 39	From 153 to 312	From 58 to 117	From 77 to 156	From 58 to 117
+ -	From 40 to 59	From 313 to 472	From 118 to 177	From 157 to 236	From 118 to 177
+	From 60 to 79	From 473 to 632	From 178 to 237	From 237 to 316	From 178 to 237
++	From 80 to 100	From 633 to 800	From 238 to 300	From 317 to 400	From 238 to 300

I_{nm}, indicator; I₁, infrastructural system; I₂, agri-natural system; I₃, historical-cultural system; I₄, commercial system.

allows obtaining more reliable results compared to a single evaluation process.

Geographic information system mapping

In order to achieve the proposed objective we have operated using the GIS potentialities with the MCA (Riguccio *et al.*, 2015b).

We differentiate two phases. The first phase where we have constructed the data structure of the indicators in a GIS environment. We have started by creating the GIS project, inserting the basic mapping in raster format and setting up the Monte Mario Italy 2 (GCS Monte Mario) reference system. Subsequently, we have added the shape files which describe the following indicators: I_{1.1}, I_{1.2}, I_{1.3}, I_{1.4}, I_{1.5}, I_{1.6}, I_{1.7}, I_{1.8} (infrastructures); I_{2.1} (land use); I_{2.2} (areas of significant landscape and environmental interest); I_{2.3} (waterways); I_{3.1}, I_{3.2}, I_{3.3}, I_{3.4} (archaeological sites, historical centres, museums and eco-museums, rural architecture/architectural landscape elements). We have created new shape files for I_{4.1} (agricultural holdings/educational), I_{4.2} (hotel facilities/B&B/hostels); I_{4.3} (rural and folk festivals). From this stage the basic thematic maps were obtained.

The second phase was devoted to GIS modelling of the alternative, among the three, that best meets the main objective of the multi criteria hierarchy tree. Therefore, at this stage, we took into account only the weights of the winning alternative indicators.

To each spatial entity of the database (georeferenced indicator)

has been associated (by the attribute grid) with the weight obtained by MCA. We asked the system to represent in raster format the weight value of each indicator. For the rasterization, we have chosen cells of sizes 500×500 m, as the punctual indicators of structural and cultural systems have been represented with their respective minimum size buffers, corresponding to the circle included in this cell. We have worked with the *raster calculator* function, to obtain, first, the weights amount of each system, by adding the weights of the afferent indicators, and consequently the amount of the winning alternative, by adding the weights of all the indicators.

Results

Multi-criteria analysis

We have constructed the pairwise comparison matrix (Pairwise comparison matrix) between I_m systems and among I_{mn} indicators, for the three scenarios A₁, A₂, A₃. The values of the priority vector and the consistency ratio are reported in Table 3.

The matrices of the first hierarchical level (pairs comparison of the systems) referring to the three scenarios, produced the following results: i) in hypothesis A₁ (rural purposes), the I₂ system is assigned more weight. In this case the natural resources are on average more important than the historical-cultural resources and

Table 3. Weights and consistency ratio obtained by the pairwise comparison.

I _n	I _{nm}	A1		A2		A3	
		P	CR	P	CR	P	CR
I ₁		0.20		0.21		0.13	
I ₂		0.32		0.30		0.46	
I ₃		0.19		0.25		0.17	
I ₄		0.29		0.24		0.24	
			0.06			0.02	0.08
I ₁	I _{1.1}	0.14		0.17		0.14	
	I _{1.2}	0.09		0.08		0.07	
	I _{1.3}	0.13		0.08		0.07	
	I _{1.4}	0.13		0.16		0.15	
	I _{1.5}	0.17		0.15		0.20	
	I _{1.6}	0.12		0.17		0.13	
	I _{1.7}	0.16		0.14		0.18	
	I _{1.8}	0.05		0.05		0.05	
I ₂			0.05		0.04		0.03
	I _{2.1}	0.66		0.24		0.26	
	I _{2.2}	0.16		0.55		0.41	
	I _{2.3}	0.19		0.21		0.33	
I ₃			0.03		0.02		0.04
	I _{3.1}	0.14		0.31		0.21	
	I _{3.2}	0.23		0.31		0.21	
	I _{3.3}	0.23		0.24		0.29	
	I _{3.4}	0.39		0.14		0.29	
I ₄			0.02		0.04		0.04
	I _{4.1}	0.50		0.26		0.43	
	I _{4.2}	0.14		0.41		0.35	
	I _{4.3}	0.37		0.33		0.22	
			0.08		0.04		0.04

I_n, systems; I_{nm}, indicators; P, priority vector; CR, consistency ratio; A1, to establish a greenways network that can promote the development agro-rural; A2, to develop a greenways network can encourage the tourist, cultural use; A3, to realise a network of greenways that can promote the use of environmental values; I₁, infrastructural system; I₂, agri-natural system; I₃, historical, cultural system; I₄, commercial system; I_{1.1}, highway; I_{1.2}, national road; I_{1.3}, regional and provincial road; I_{1.4}, active railway lines; I_{1.5}, disused railway lines; I_{1.6}, ports/airports; I_{1.7}, paths/royal country roads; I_{1.8}, parking/rest areas; I_{2.1}, land use; I_{2.2}, areas of significant landscape and environmental interest; I_{2.3}, waterways; I_{3.1}, archaeological sites; I_{3.2}, historical centres; I_{3.3}, museums and eco-museums; I_{3.4}, rural architecture/architectural landscape elements; I_{4.1}, agricultural holdings/educational farms/agritourism; I_{4.2}, hotel facilities/B&B/hostels; I_{4.3}, rural and folk festivals.

the infrastructures, but equally important to the commercial resources of rural type (agritourism, educational farms, agricultural holding, festivals and popular celebrations); ii) in the A₂ scenario (tourist-cultural purposes), in the context of a tourist purpose, the natural, historical-cultural and commercial resources, that offer services to tourists, are of considerable importance, and present valuable opportunities to promote the visit of these places; iii) in the A₃ scenario (naturalistic purpose), the system I₂ appears on average more important than the other systems, because the presence of natural reserves, parks and protected areas, becomes the fundamental element for this type of intended use.

The matrices of the second hierarchical level (pairs comparison among indicators) referring to the three scenarios produced the following results: i) in alternative A₁ the indicators concerning footpaths/royal country road (I_{1,7}), disused railway lines (I_{1,5}), land use and agricultural landscape (I_{2,1}), waterways (I_{2,3}), rural architecture and architectural elements of the landscape (I_{3,4}), agricultural holdings/educational farms/agritourism (I_{4,1}), festivals and popular celebrations (I_{4,3}) were considered extremely important; ii) in the A₂ scenario the most of the indicators concerning the infrastructure system (I_{1,1}, I_{1,4}, I_{1,5}, I_{1,6}, I_{1,7}), natural reserves-parks/European Special Areas for Conservation (SAC)/Areas for Special Protection (ASP) (I_{2,2}), archaeological sites (I_{3,1}), villages and historical centres (I_{3,2}), museums and eco-museums (I_{4,1}), agricultural holdings/educational farms/agritourism, hotels/B&B/hostels (I_{4,2}), festivals and popular celebrations (I_{4,3}), were considered extremely important; iii) in the A₃ scenario, the indicators relating to the natural system (I_{2,1}, I_{2,2}, I_{2,3}), and among the infrastructures the unused railway lines (I_{1,5}), get the highest weight. Furthermore, are very important the museums and eco-museums (I_{3,3}), rural architecture/architectural landscape elements (I_{3,4}), and some commercial facilities that provide nature-related activities (I_{4,1} - agricultural holdings/educational farms/agritourism) were considered important.

Questionnaires

A percentage of 62% of the respondents had a high school diploma, 26% graduate, 6% of secondary school. 62% of the chosen sample was under 30 years old, 30% was between 30 and 50 years old, 8% was aged more than 50 years old. The preferences of this sample are reported in Table 4.

Table 4. Preferences of the sample of residents interviewed.

Alternatives of residents	Preferences	I _{1,1}	I _{1,2}	I _{1,3}	I _{1,4}	I _{1,5}	I _{1,6}	I _{1,7}	I _{1,8}	I _{1 sum}	I _{2,1}	I _{2,2}	I _{2,3}	I _{2 sum}	I _{3,1}	I _{3,2}	I _{3,3}	I _{3,4}	I _{3 sum}	I _{4,1}	I _{4,2}	I _{4,3}	I _{4 sum}
A ₁	High	58	57	68	39	100	38	94	38	492	85	58	81	224	39	77	39	89	244	83	39	81	203
	Medium	28	26	26	43	0	47	4	36	210	11	29	12	52	36	16	37	11	100	12	35	13	60
	Low	14	17	6	18	0	15	2	26	98	4	13	7	24	25	7	24	0	56	5	26	6	37
		100	100	100	100	100	100	100	100	800	100	100	100	300	100	100	100	100	400	100	100	100	300
A ₂	High	86	85	83	82	100	81	96	80	693	59	100	79	238	96	95	91	82	364	90	98	89	277
	Medium	12	9	14	15	0	15	4	13	82	27	0	18	45	4	5	8	11	28	8	2	9	19
	Low	2	6	3	3	0	4	0	7	25	14	0	3	17	0	0	1	7	8	2	0	2	12
		100	100	100	100	100	100	100	100	800	100	100	100	300	100	100	100	100	400	100	100	100	300
A ₃	High	58	57	62	19	88	18	89	19	410	82	85	82	249	58	57	85	79	279	91	19	78	188
	Medium	34	30	29	46	8	48	11	52	258	10	15	16	41	33	35	13	18	99	6	45	14	65
	Low	8	13	9	35	4	34	0	29	132	8	0	2	10	9	8	2	3	22	3	36	8	69
		100	100	100	100	100	100	100	100	800	100	100	100	300	100	100	100	100	400	100	100	100	300

A₁, to establish a greenways network that can promote the development agro-rural; A₂, to develop a greenways network can encourage the tourist, cultural use; A₃, to realise a network of greenways that can promote the use of environmental values; I₁, infrastructural system; I₂, agri-natural system; I₃, historical, cultural system; I₄, commercial system; I_{1,1}, highway; I_{1,2}, national road; I_{1,3}, regional and provincial road; I_{1,4}, active railway lines; I_{1,5}, disused railway lines; I_{1,6}, ports/airports; I_{1,7}, paths/royal country roads; I_{1,8}, parking/rest areas; I_{2,1}, land use; I_{2,2}, areas of significant landscape and environmental interest; I_{2,3}, waterways; I_{3,1}, archaeological sites; I_{3,2}, Historical centres; I_{3,3}, museums and eco-museums; I_{3,4}, rural architecture/architectural landscape elements; I_{4,1}, agricultural holdings/educational farms/agritourism; I_{4,2}, hotel facilities/B&B/hostels; I_{4,3}, rural and folk festivals. In italics preferences considered.

Regarding the scenario A₁ (greenway network for rural purposes), all the indicators belonging to the four considered systems (I₁, I₂, I₃, I₄) have received a number of preferences of high quality in the numeric range 178 ÷ 632 (symbol +). The infrastructural system allows reaching the areas of rural use; furthermore the presence of commercial port facilities promotes the export of the agricultural products (De Montis *et al.*, 2016). The natural system (I₂) has a positive view of course, as well as the I₃ system that contains the isolated rural assets and the landscape architectural elements; the I₄ system is positive as well, because the farms and the educational agricultural holdings, folk festivals, contribute to the production/promotion of the characteristic local products and to the contact with rural activities.

The A₂ scenario (greenway network for tourism-cultural purposes), has reported that more than 80% of respondents considered of high importance all indicators (the sum of preferences is between 238 and 800). The infrastructural system is of great importance for the tourism sector because it allows a place to be reached more or less quickly by various transport means (car, bus, train, plane) and because the roads could be considered as a secondary network to support the greenways.

The A₃ scenario (greenway network for environmental purposes) has collected the lowest number of preferences with high classification rate, while remaining on large numbers. The natural system I₂ has been considered extremely important; the I₃, which contains the ecological museums, are quite important and the I₄, composed of commercial structures as well, that promote activities in contact with nature (agricultural holding/educational farms/agritourism).

Table 5 shows the qualitative and normalised weights pertinent to the systems (I_m), indicators (I_{mn}) and referring to the three alternatives (A₁, A₂, A₃).

The weights obtained by the pairwise comparison, weighed with those obtained from the interviews, indicate the alternative A₂, tourist-cultural purposes, as the most suitable to evaluate the potential of the territory in the Syracuse province, by developing an integrated system of greenways (Table 6).

Geographic information system mapping

The indicators of the infrastructural system (I₁) show the presence of important infrastructures like the highways (110.00 km)

Table 5. Qualitative and normalised weights pertinent to the systems (In) and indicators (Imm), referring to the three alternatives (A1, A2, A3).

Systems	Indicators	Alternatives								
		A1			A2			A3		
		a)	b)	c)	a)	b)	c)	a)	b)	c)
I ₁		492	+	0.75	693	++	1.00	410	+-	0.50
	I _{1,1}	58	+-	0.50	86	+	0.75	58	+-	0.50
	I _{1,2}	57	+-	0.50	85	+	0.75	57	+-	0.50
	I _{1,3}	68	+	0.75	83	+	0.75	62	+	0.75
	I _{1,4}	39	-	0.25	82	+	0.75	19	-	0.25
	I _{1,5}	100	++	1.00	100	++	1.00	88	++	1.00
	I _{1,6}	38	-	0.25	81	++	1.00	18	-	0.25
	I _{1,7}	94	++	1.00	96	++	1.00	89	++	1.00
I _{1,8}	38	-	0.25	80	+	0.75	19	-	0.25	
I ₂		224	+	0.75	238	++	1.00	249	++	1.00
	I _{2,1}	85	++	1.00	59	+-	0.50	82	+	0.75
	I _{2,2}	58	+-	0.50	100	++	1.00	85	++	1.00
	I _{2,3}	81	++	1.00	79	+	0.75	82	++	1.00
I ₃		244	+	0.75	364	++	1.00	279	+	0.75
	I _{3,1}	39	-	0.25	96	++	1.00	58	+-	0.50
	I _{3,2}	77	+	0.75	95	++	1.00	57	+-	0.50
	I _{3,3}	39	-	0.25	91	++	1.00	85	++	1.00
	I _{3,4}	89	++	1.00	82	++	1.00	79	+	0.75
I ₄		203	+	0.75	277	++	1.00	188	+	0.75
	I _{4,1}	83	++	1.00	90	++	1.00	91	++	1.00
	I _{4,2}	39	-	0.25	98	++	1.00	19	-	0.25
	I _{4,3}	81	++	1.00	89	++	1.00	78	+	0.75

a) Number of preferences corresponding to the *high* value; b) symbol weight; c) normalised weight; A₁, to establish a greenways network that can promote the development agro-rural; A₂, to develop a greenways network can encourage the tourist, cultural use; A₃, to realise a network of greenways that can promote the use of environmental values; I₁, infrastructural system; I₂, agri-natural system; I₃, historical, cultural system; I₄, commercial system; I_{1,1}, highway; I_{1,2}, national road; I_{1,3}, regional and provincial road; I_{1,4}, active railway lines; I_{1,5}, disused railway lines; I_{1,6}, ports/airports; I_{1,7}, paths/royal country roads; I_{1,8}, parking/rest areas; I_{2,1}, land use; I_{2,2}, areas of significant landscape and environmental interest; I_{2,3}, waterways; I_{3,1}, archaeological sites; I_{3,2}, Historical centres; I_{3,3}, museums and eco-museums; I_{3,4}, rural architecture/architectural landscape elements; I_{4,1}, agricultural holdings/educational farms/agritourism; I_{4,2}, hotel facilities/B&B/hostels; I_{4,3}, rural and folk festivals.

Table 6. Weights obtained by the pairwise comparison, weighed with those obtained from the interviews and priority values.

In	I _{nm}	P	A1			P	A2			P	A3		
			MV	Priority In (P*MV)	Priority Inm (P*MV)		MV	Priority In (P*MV)	Priority Inm (P*MV)		MV	Priority In (P*MV)	Priority Inm (P*MV)
I ₁		0.20	0.75	0.15		0.21	1.00	0.21		0.13	0.50	0.07	
	I _{1,1}	0.14	0.50	0.07	0.17	0.75		0.13	0.14	0.50		0.07	
	I _{1,2}	0.09	0.50	0.05	0.08	0.75		0.06	0.07	0.50		0.04	
	I _{1,3}	0.13	0.75	0.10	0.08	0.75		0.06	0.07	0.75		0.05	
	I _{1,4}	0.13	0.25	0.03	0.16	0.75		0.12	0.15	0.25		0.04	
	I _{1,5}	0.17	1.00	0.17	0.15	1.00		0.15	0.20	1.00		0.20	
	I _{1,6}	0.12	0.25	0.03	0.17	1.00		0.17	0.13	0.25		0.03	
	I _{1,7}	0.16	1.00	0.16	0.14	1.00		0.14	0.18	1.00		0.18	
I _{1,8}	0.05	0.25	0.01	0.05	0.75		0.04	0.05	0.25		0.01		
I ₂		0.32	0.75	0.24	0.30	1.00	0.30		0.46	1.00	0.46		
	I _{2,1}	0.66	1.00	0.66	0.24	0.50		0.12	0.26	0.75		0.20	
	I _{2,2}	0.16	0.50	0.08	0.55	1.00		0.55	0.41	1.00		0.41	
	I _{2,3}	0.19	1.00	0.19	0.21	0.75		0.16	0.33	1.00		0.33	
I ₃		0.19	0.75	0.14	0.25	1.00	0.25		0.17	0.75	0.13		
	I _{3,1}	0.14	0.25	0.04	0.31	1.00		0.31	0.21	0.50		0.11	
	I _{3,2}	0.23	0.75	0.17	0.31	1.00		0.31	0.21	0.50		0.11	
	I _{3,3}	0.23	0.25	0.06	0.24	1.00		0.24	0.29	1.00		0.29	
	I _{3,4}	0.39	1.00	0.39	0.14	1.00		0.14	0.29	0.75		0.22	
I ₄		0.29	0.75	0.22	0.24	1.00	0.25		0.24	0.75	0.18		
	I _{4,1}	0.50	1.00	0.50	0.26	1.00		0.25	0.43	1.00		0.43	
	I _{4,2}	0.14	0.25	0.04	0.41	1.00		0.25	0.35	0.25		0.09	
	I _{4,3}	0.37	1.00	0.37	0.33	1.00		0.25	0.22	0.75		0.17	
Tot In			0.75			1.01				0.83			
Tot I _{nm}				3.11				3.44				2.96	

I_n, systems; I_{nm}, indicators; P, weighs obtained by the pairwise comparison; MV, weights obtained by the weighted evaluation matrix; A₁, to establish a greenways network that can promote the development agro-rural; A₂, to develop a greenways network can encourage the tourist, cultural use; A₃, to realise a network of greenways that can promote the use of environmental values; I₁, infrastructural system; I₂, agri-natural system; I₃, historical, cultural system; I₄, commercial system; I_{1,1}, highway; I_{1,2}, national road; I_{1,3}, regional and provincial road; I_{1,4}, active railway lines; I_{1,5}, disused railway lines; I_{1,6}, ports/airports; I_{1,7}, paths/royal country roads; I_{1,8}, parking/rest areas; I_{2,1}, land use; I_{2,2}, areas of significant landscape and environmental interest; I_{2,3}, waterways; I_{3,1}, archaeological sites; I_{3,2}, Historical centres; I_{3,3}, museums and eco-museums; I_{3,4}, rural architecture/architectural landscape elements; I_{4,1}, agricultural holdings/educational farms/agritourism; I_{4,2}, hotel facilities/B&B/hostels; I_{4,3}, rural and folk festivals.

and railways (100.00 km), in addition to the national roads (240.00 kilometres), an extensive network of provincial roads (1243 km), country roads (800.00 km) and trails (760.00 kilometres) (Figure 3A). The airport is absent, at the moment this gap is filled by the presence of two nearby airports, located in other provinces (Catania and Ragusa). We have the presence of port facilities,

especially for tourist purposes.

The indicators of the agro-natural system (I₂) show large extensive cultivated areas (about 461.15 km² of arable land and 173.76 km² of lawns and pastures) and intensive (about 362.77 km² of agricultural woody crops). Numerous are the values associated with the presence of some exceptional historical and environ-

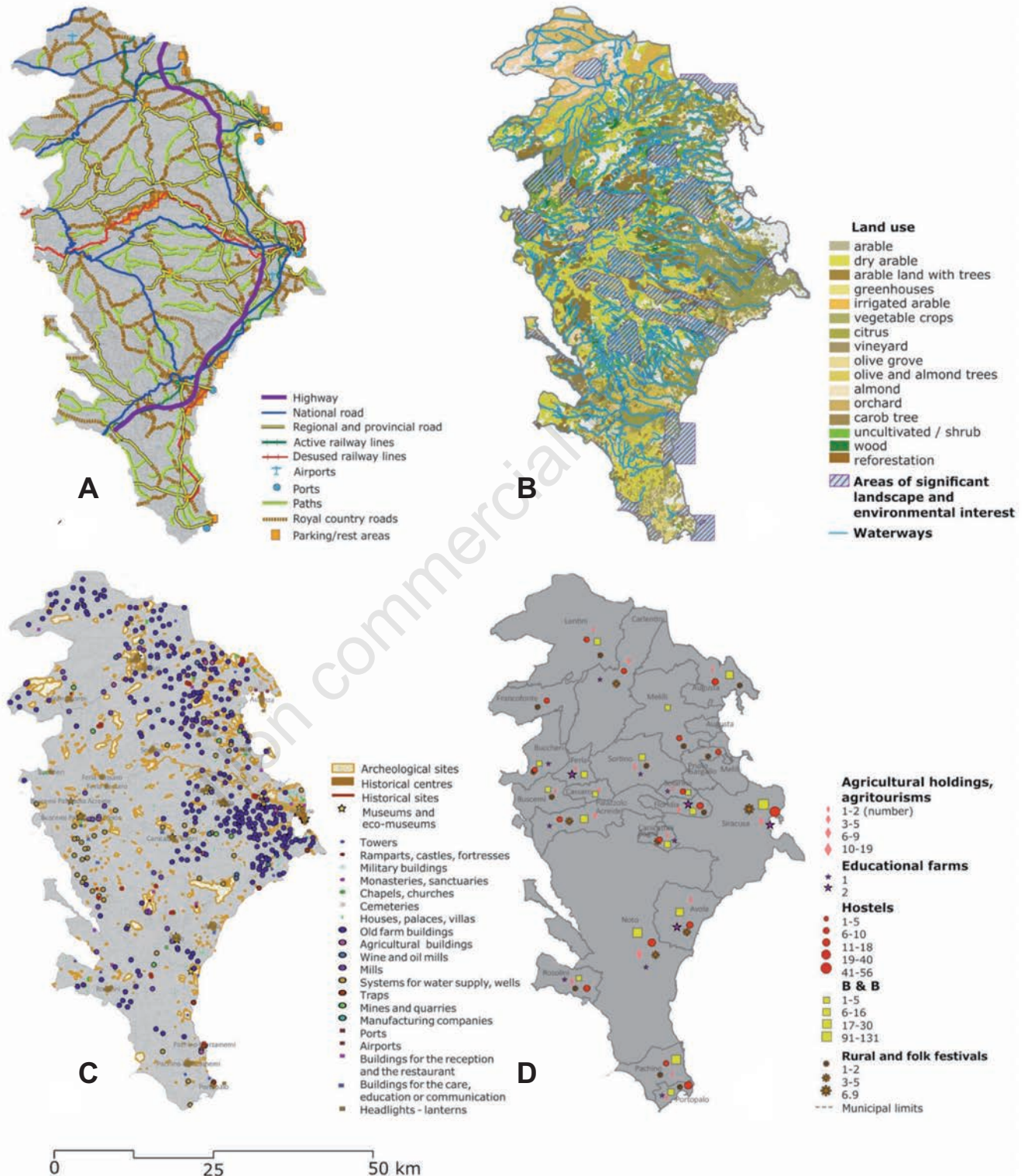


Figure 3. Indicators' maps: A) infrastructural system; B) agro-natural system; C) historical-cultural system; D) commercial system.

mental value areas (Oriented Natural Regional Reserve Pantalica, Valley Stream and dell’Anapo Cavagrande, Natural Reserve Ciane and Saline of Syracuse, Natural Reserve Cavagrande of Syracuse, Nature Reserve Wildlife Oasis Vendicari Plemmirio Protected Area); there are 30 sites Nature 2000 and 297 streams of great

importance (the Anapo river which spreads 52.00 kilometres, the Ciane river is around 37.00 km long, the river Cassibile is around 50.00 km long, the river Tellaro is around 48.00 km) long (Figure 3B).

The high historical, archaeological, architectural and land-

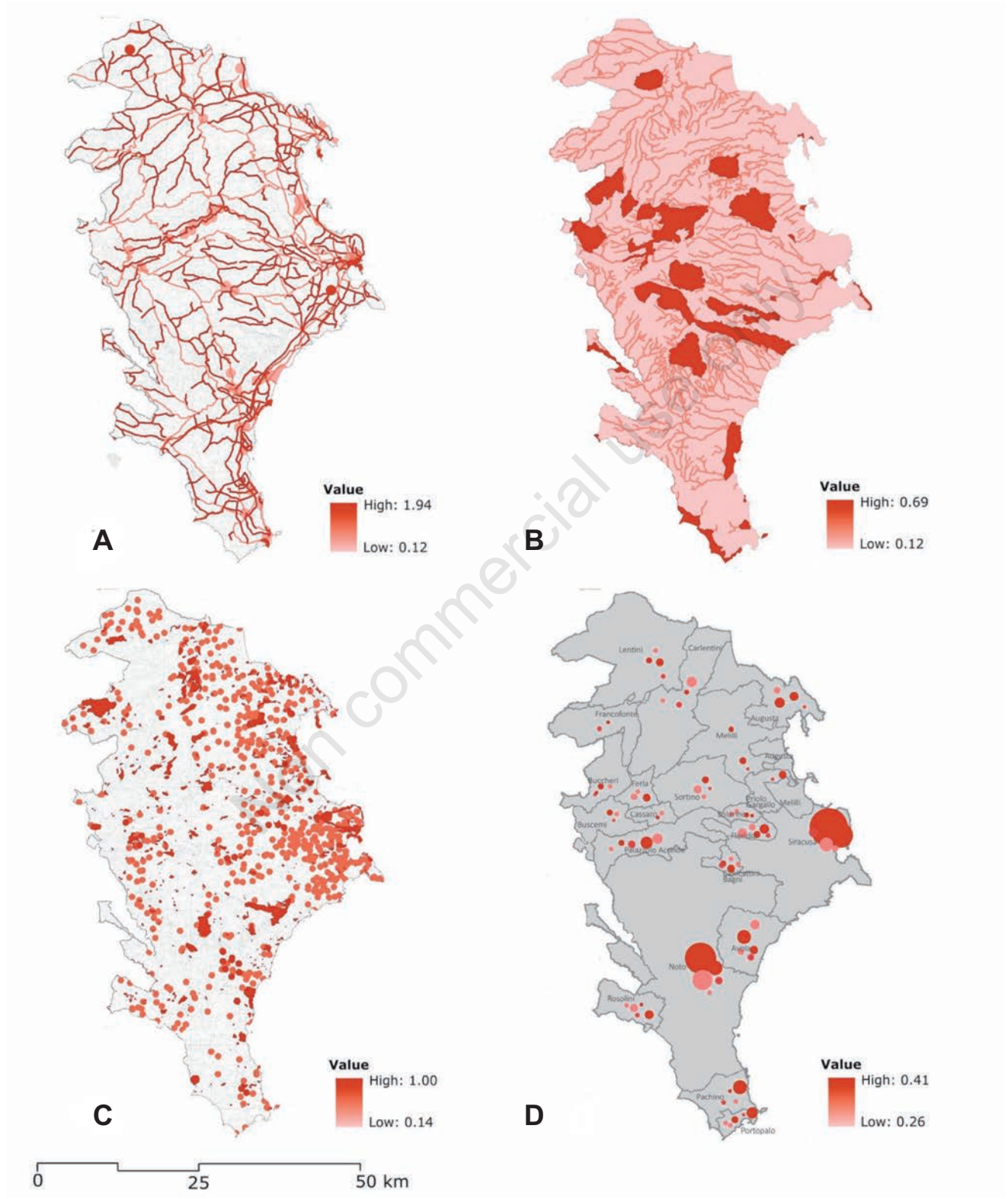


Figure 4. Weighted thematic maps: A) infrastructural system; B) agro-natural system; C) historical-cultural system; D) commercial system.

scape profile of the territory emerges (historical-cultural system I₃). We have to remember the following presences: 296 farms, 518 areas/archaeological sites (including the prehistoric settlement of Pantalica), the Baroque historic towns of Syracuse and Noto, the latter declared part of the UNESCO cultural heritage in 2005 (Figure 3C).

The indicators of the commercial system I₄ show a good distribution of the activities related to trade and tourism. There are accommodation and commercial facilities (140 hotels, 308 B&B, 62 agritourism, 17 educational farms) concentrated mainly in the coastal area and along the main infrastructures (Figure 3D).

The GIS value of the weights, obtained by associating the weight carriers and the qualitative evaluation, has produced the following results.

In the weighed map of the infrastructure system (Figure 4A), the value of the cells is very high in the elements that consider the disused railway lines (located in the central and in the south-east part of the territory) and the paths/royal country roads (distributed uniformly in all the whole territory), the highways (located in the north and south part of the provincial territory), and finally the ports (located mainly in the central/south area).

In the weighed map of the agro-natural system (Figure 4B), the value of the cells is very high in the central and southern swathe of the Syracuse territory, for the presence of natural reserves, parks

and SAC/ASP areas with a 0.41 weight, prevails over all others.

In the weighed map of the cultural system (Figure 4C), we find the maximum values in the archaeological areas and in the areas that identify the historical centres. In addition, we report the presence of a large number of isolated assets disseminated in the territory.

In the weighed map of the commercial system (Figure 4D), we note how almost all the considered indicators have a high value. The accommodation facilities (hotels, B&B and agritourism) and commercial resources, are distributed mainly in the central and southern swathe (especially in the towns of Syracuse and Noto; further south, in the coastal zone, near Porto Palo, Marzamemi and Pachino).

The sum of the weighed maps of the four systems (Figure 5) produces the map of alternative A₂.

The maximum extended areas with the utmost values (dark red) are present in the central and southern part of the territory. The greatest importance is determined by the concomitant presence of most of the indicators, but primarily those with greater weight: nature reserves, parks and Natura 2000 sites, historical infrastructures, archaeological areas. Two of these areas are crossed by disused railways, while the many *dark red* islands are connected to each other by infrastructural tracks of intermediate tone, but anyhow important for the creation of the greenways network.

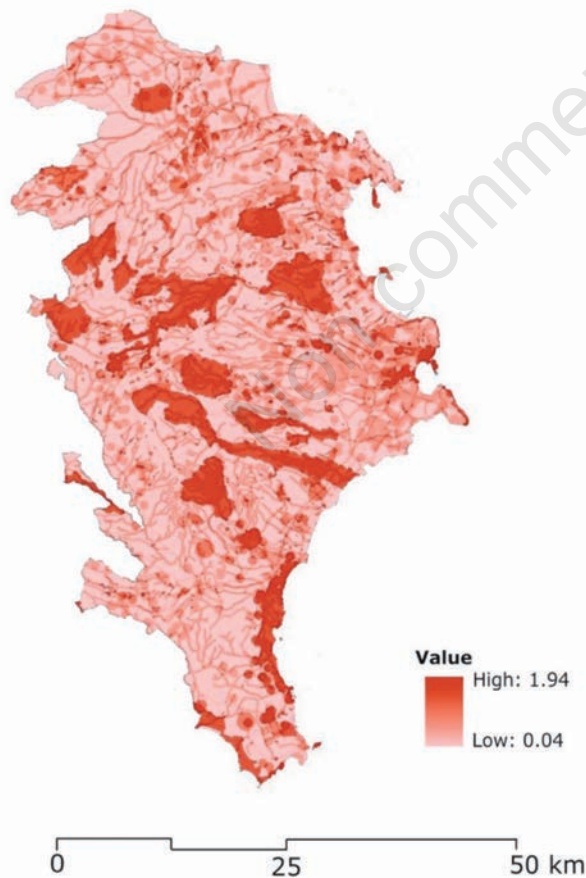


Figure 5. Sum of the weighted thematic maps in the alternative A₂.

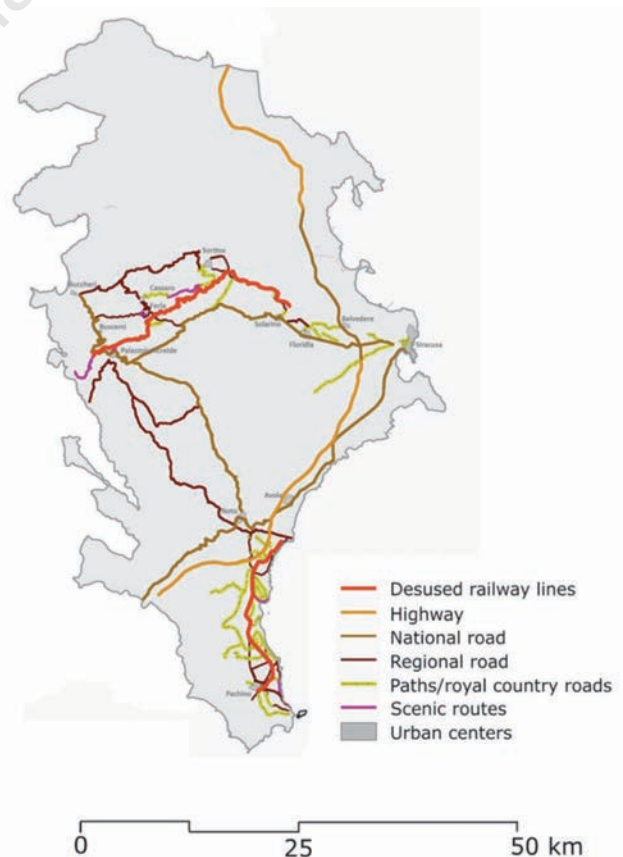


Figure 6. Main infrastructures that can fit a greenways network.

The Figure 6 shows a hypothesis of infrastructural network suitable for this purpose. The network may consist of 55.50 kilometres of disused railways, 80.00 kilometres of royal country roads/rural paths, 22.00 kilometres of scenic routes, 184.00 kilometres of national roads, 135.00 kilometres of regional roads and it will also allow the rehabilitation of n. 24 historic railway buildings (stations, signal boxes, warehouses) (Table 7). The disused railways are those mostly suitable not only for its own characteristics, but also because cross-important Natura 2000 sites and for the high attractiveness along the route. Therefore, it is particularly useable for tourist use (Taylor, 2015).

Discussion and conclusions

The research, initially, had been planned to locate the appropriate infrastructure network for the construction of greenways in the whole territory of Sicily region. The goal was to offer, the governing, territory and landscape management bodies, a bunch of knowledge to support the agro-touristic-cultural development policies, to integrate and complete the 2005 slow mobility plan. Subsequently, while keeping the initial objective, we have decided to direct our research to the study of a part of the regional territory, whose characteristics and potentialities could justify the commitment of financial resources to realise the greenways. The chosen PTPR landscape areas, n. 14 and n. 17, are among the most rich in natural and environmental resources, prehistoric and archaeological sites, well known around the world, in monumental and historical-artistic heritage, in towns of historical interest. The area also

Table 7. Dimensional characteristics of infrastructures for the establishment of a network of greenways.

Infrastructures	Medium width (m)	Length (km)
Disused railway lines	2.50	55.00
Syracuse - Vizzini	2.50	33.50
Noto - Pachino	2.50	21.50
National road	6.45	184.00
SS124 Syracuse - Buccheri	5.30	74.00
SS287 Palazzolo Acreide - Noto	6.00	28.00
SS115 Syracuse - Rosolini	7.50	47.00
SS114 Agnone - Syracuse	7.00	35.00
Regional road	5.95	135.00
SP52 Florida	6.80	7.00
SP 29 Sortino - Buccheri	5.30	15.00
SP 24 Palazzolo - Noto	5.00	30.00
SP 35 - SP 34 Noto - Calabernardo	6.90	7.50
SP 19 - Noto - Pachino - Marzamemi	6.70	17.00
SP 84 - 97 Marzamemi - Pachino	7.50	4.00
SP 7 Buscemi - Cassaro	4.50	11.00
SP 10 Cassaro - Ferla - SP 29 - Buccheri	5.80	17.00
SP 85 Pachino - Marzamemi	5.00	4.50
SP 59 Lido di Noto	6.00	11.00
SP 80 Palazzolo Acreide	5.90	11.00
Paths/royal country roads	3.00	80.00
Scenic routes	3.00	22.00

has a great variety of quality agricultural productions, of typical quality agro-food products, a strong local cultural identity illustrated by various and numerous popular presentations and a qualitatively adequate system of reception and services.

The used method, the MCA associated with the potential of GIS, is widely applied in the field of territory planning and several scientific papers illustrate its versatility (Fichera and Modica, 2007; Mirakyan and De Guio, 2013; Comino *et al.*, 2014). This synergy has been proper for achieving the objective.

The direct survey has been a valuable support to the research, helping to make more objective the definition moment of the relative importance of the elements, included in the complex issue, avoiding that this phase were only attributed to the actors involved in this research.

The implementation of the multi-criteria phase, when takes into account residents' preferences, reduces the personal contribution in assigning the values in the pairwise comparison matrices. For assigning the values in the pairwise comparison, residents' preferences have been considered in a holistic way, considering the three levels (high, medium, low). The following weighting phase has allowed us to reduce further the personal contribution. The elaboration of respondents' choices only with high preference (to be read as the most positive expression to each alternative), has allowed strengthening weights' objectivity, resulting from the pairwise comparison.

We have not encountered any specific problem in applying the method, since it has already been adopted in other landscaping-territorial researches by the same authors (Riguccio *et al.*, 2015b; Russo *et al.*, 2013), whilst, the database accomplishment has been very laborious and has required the harmonisation with the multi-criteria model and the geo-referencing of inconsistent data arriving from different sources. This last action has made the transfer of the weights obtained from the MCA and the subsequent acquisition of the weighted cartography easy in a GIS environment.

We have identified the scenario that can make best use of the creation of a greenways network among the three considered scenarios (A₁ - rural purposes, A₂ - tourist/cultural purposes, A₃ - environmental objectives): the A₂ scenario - tourist/cultural purposes has obtained a greater weight, both in the evaluation of the systems and in the evaluation the numerous indicators. The results agree with Taylor's statement (2015).

The Figure 5 map shows, in dark red tones, the areas of greatest interest for the construction of the network. Within these areas, all the considered infrastructures play a significant role in building the network, since they have been evaluated with regard to the presence of spatial and landscape resources. This does not mean that all infrastructures can be reconverted or adapted to greenways. The choice of the infrastructures for this purpose, must be addressed during the network planning phase, when the intrinsic characteristics of the roads, which indicate the adaptability or the conversion (width, slope, hazard, *etc.*) are considered in detail, but this part is not an objective of this study (Toccolini *et al.*, 2006).

The tracks form the preferential axes of territory portions, where it is possible to start planning and management activities aimed at the improvement and use of the landscape, archaeological, historical and cultural property: it will be possible to manage and enhance the natural and man-made landscapes and the historical-architectural heritage in the territory, creating a fruition network composed of tourist-cultural itineraries.

This scenario, being mainly suitable for the tourist-cultural fruition, simultaneously offers many opportunities for the development of the agro-food and environmental components (Riguccio *et al.*, 2017).

Figure 6 shows a possible greenways network, presented considering the high concentration of resources. Certainly, not all the chosen infrastructures have intrinsic features suitable for slow paths, but all the infrastructures with appropriate signage or linked in computerised communication systems (mobile phone applications), in a network logic, can play an important role for the use and/or connection of the real greenways routes. For example, although a motorway, with no doubt, is not useable by pedestrians or cyclists, it is however important, to easily reach areas dedicated to non-motorised use, such as greenways on dismissed railroad tracks.

This study results could represent the basis to start extensive studies on specific sections of the network, in such a way to provide guidelines for the adjustment of the various infrastructure types, or detail projects.

Moreover, the study could be extended to the entire region if the territory government bodies show a real interest. The hope is that in future we can create greenways in the whole region, formed by a network of public slow mobility infrastructure, connected to each other and connecting natural spaces, places of historic and artistic interest, and facilitating a conscious and responsible approach by network users.

If we consider that the survey results of the population preferences, which has committed remarkable human resources, are of public utility, and that can be considered valid for the whole region - considering the cultural and social homogeneity - the necessary resources to extend the research to the regional territory are only those related to data collection, to their harmonisation and to the application of the method, therefore activities to be largely carried out in the laboratory. Data and calculations could converge and enrich WebGis of the Sicily region.

The obtained results may be viewed as a demonstration of the validity of this study, and we hope they will be of interest for the regional bodies.

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