Chapter 2
Land-use and Landscape Changes: A Methodological Proposal for the Creation of Sustainable Cultural Tourism Itineraries

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Abstract The debate on the role of itineraries as instruments of territorial valorisation is now 'mature' (Trono and Oliva 2013; Candela et al. 2005). More and more 'territories' are organizing activities to design and create new itineraries, convinced that they can act as a driving force for local development. By linking places, atmospheres or assets, they provide the keys, for understanding the 'places', and their evolution, to a growing number of 'new tourists'. It becomes, however, a priority to carry out an evaluation of the territorialization processes that characterize the areas that they 'touch' (in particular land use); this is in order to determine their impact on the state of health of the territory being 'crossed'. Current technological evolution has allowed us to go beyond the classical statistical analyses based on the calculation of indicators, integrating them with geospatial analyses capable of including what is mentioned above. Here, we propose the illustration of a case study conducted on this subject, which is presented as a working model. In 2013–2014, the research team carried out a diachronic (visual and overlay) GIS analysis. Our aim was to represent the changes taking place in the territory to the east of Verona, quantify them and evaluate the feasibility of the proposal for an itinerary in the conceptual stage, partly in the light of urban development planning. The case study has the value of substantiating the need to reflect

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on the often absent relationship between environmental and territorial research, and the development strategy related to it.

Keywords GIS analysis · Landscape · Land-use and land-cover change · Tourist routes · Planning

Conceptual References

Tourism and cultural routes—Tourism by both international and domestic visitors has grown considerably in many countries over the last few decades (Rocca 2013; WTO 2014). Mass tourism is giving way to 'slow tourism' and 'slow travel', which are in line with conceptions linked to:

- a respect for the places being visited and an appreciation of the cultures (Corna Pellegrini 2004; Stephenson 2008; Nistoreanu et al. 2011; Timms and Conway 2011; Yurtseven and Kaya 2011; Fullagar 2012) and of the typical products of the host countries (Petrini 2005; Bryant and Grillotti Di Giacomo 2007; Heitmann et al. 2011);
- the selection of smaller destinations (Radstrom 2011; Grzelak-Kostulska et al. 2011);
- the abandonment of haste;
- a propensity to savour landscapes and atmospheres;
- as well as to the use of unhurried modes of transport (Dickinson et al. 2011; Calzati et al. 2012; Calzati 2012; Georgică et al. 2013; Mogollón et al. 2012[1]; De Salvo et al. 2013).

At the same time—notwithstanding the occurrence of massive landscape changes—awareness has grown as to the extent to which natural assets as well as those due to the work of man are widespread. A pervasive process of valorisation of areas or individual sites has thus been set in motion: destinations that stand out as tourist resources of many different kinds.

As a consequence, there has been a boom in the creation of brand new itineraries (e.g. Schmude and Trono 2003) and the rehabilitation of historic ones like the network of the Via Francigena from Canterbury to Rome with a flourishing of websites and a related journey literature. Interest in the planning of long-distance tourist/cultural itineraries is very much in line with the concept of slowness and has been adopted by the European Council which, since 1987, has recognised and sustained 29 cultural routes and landscapes that are deemed to form part of the

[1] Here, the authors highlight the principal elements of demand and supply as regards slow tourism—a relaxed pace, an experience and environmental and social ethics—with references to the works of Calzati, Matos, Lumsdom, McGrath, Petrini, Dickinson and others.

common heritage of Europe[2] (Berti 2013). All of these routes, which have already been fully designed, are smart in one way or another.[3]

Moreover, the planning of prototypes for smart itineraries in both urban and extra-urban environments—and therefore more limited in scope than the ones just mentioned—has greatly involved researchers and practitioners since 2000, that is to say since ICT has become pervasive, and mobile tourism and mobile guides have established themselves in the marketplace (Smart Environments 2005; Edwards et al. 2006; Rizzo 2008; Kenteris et al. 2009; Chu et al. 2011; Fu and Yu 2013; Arnaboldi et al. 2014; Dickinson et al. 2014). Indeed, geo-technologies have become increasingly important not only because they are essential for creating routes and trails (Rizzo 2014) or their customization (Garcia et al. 2010), but also:

- to deliver or gather—during the trip—information based on the location of tourists (Nie et al. 2009) and/or to analyse tourist behaviours (Girardin et al. 2007; Asakura and Iryo 2007; Asakura and Hato 2009; Zheng et al. 2012);
- to bring tourism information to users in a more immersive manner than traditional text or maps (granting access to/providing augmented reality information at distance) (El Choubassi et al. 2010);
- as tools and settings in which to integrate, aggregate and diffuse information (and, therefore, enhance the communication of the route, e.g. via web-GIS) (Cataldo and Rinaldi 2003).

In creating itineraries, various problems have been faced up to, depending on the academic background of the researchers involved (engineering, computer sciences, geography, etc.).

Routes and regional development—The itineraries have also always been recognized as embodying a cultural value and have been attributed the ability to have an effect on local development (Rizzo et al. 2013; Dallari 2013). Examples in this regard are the numerous routes drawn up by local action groups (LAGs) throughout Europe; their design is in fact one of the operations that was financed by LEADER and—now not only for LAGs but more broadly—may be financed under the ad hoc measures of the EU rural development programmes, partly within the scope of the growth of forms of rural tourism. Today, these local or/and circumscribed itineraries may present themselves as already available and ready for use on the Web[4] or the user himself may fine-tune them as needed (D'Amico et al. 2014). Given the massive land use that exists, with often widespread sprawl phenomena (Freire et al.

[2] http://www.culture-routes.lu/php/fo_index.php?lng=fr&dest=ac_00_000&lng=en. Accessed 23 September 2014.

[3] On this subject, we refer the reader to the material produced under the CERTESS project (Capp 2012).

[4] An example is constituted by the 7 multimedial *itineraries for alternative tourism* from northern to southern Italy—from Trieste to Salerno—drawn up by various authors (2014) in Bollettino dell'Associazione Italiana di Cartografia (A.I.C.), Laboratorio GIS dell'Università di Trieste—Dipartimento di Studi Umanistici, A.I.C./Associazione Geografi Italiani (http://www.openstarts.units.it/dspace/handle/10077/9911). This work was produced by a Research Group of Italian university geographers coordinated by A. Favretto.

2009; Rizzo et al. 2014), it is worthwhile understanding whether itineraries that are currently set up or that may in future include further significant points of interest—even in areas rendered complex by past intervention—may persist or whether they will be spoiled by future interventions in the territory. This gives rise to a need for pervasive applications that take into account medium-to-long-term scenarios (Güell 2013) which consider routes—including tourist choices and scenic POIs—and the territorial planning of government institutions.

Build-up and landscape—The need for a similar reflection becomes even more compelling when considering the spread of architectural and building forms that clearly reflect the paths of the territories, which are often problematic: examples which, documented by widespread 'crane landscapes' and omnipresent 'for sale' billboards (Bonora 2009: 23), in any case constitute a narrative of places and processes of 'reification' that characterize them. In Italy, the inability to regulate the growth (especially of built-up areas) has given a result of pervasive expressive poverty. Building modules—sometimes bizarre—often have an impact on the landscape, resulting in disharmony and deterritorialization. Landscape-related urban and rural relationships are being challenged by development models, rendering the territories being examined as incoherent realities and amalgams of fragments. Often artificializa tion/anthropization projects become 'unbalancing events', acting as obstacles to local development (when adopting a medium-to-long-term viewpoint). Despite becoming part of the fabric of places and their local economy, they in fact leave behind material evidence incoherent with the true long-term (environmental) needs of the area as well as symbolic evidence that has little to do with the identity of the territory.

Structure of the Paper

This paper seeks to illustrate the results of a study carried out in 2013–2014. In section 'Research design', we shall clarify what are its objectives and the methodology used to obtain them. In section 'Discussion of the Results', we shall discuss the results, initially presenting the route we created and on which we tested our work model (section 'Conceptual References'). Subsequently, we shall illustrate what emerged from our analysis of changes in land usage (section 'Land Use in the Area Covered by the Study. For a Quantitative Level 1 Evaluation of the Regional Data') and on the impact that these may have had on the possibility of enjoying the countryside,[5] the principal tourist resource that the itinerary aims to promote (section 'Land Use, Landscape and Visibility: Possible Negative Interactions? POI Classifications by Impact Assessment of LUCC'). Some concluding notes will follow (section 'Conclusions and Cues for Reflections'), in which we shall reflect on the subject of 'tourist itineraries, landscape and territorial planning', partly in view of renewed interest in studying the link between these aspects and the use of innovative tools and methods for building a tourist attraction.

[5] Landscapes, in particular.

Research Design

Objectives

As tourism and landscape are interrelated concepts, as we have seen, work has been carried out on developing tools for the design of tourism planning and management strategies with landscape (conservation) as a reference (de Aranzabal et al. 2009). Our work intends to contribute to the topic by adding results which look at things in a different perspective: one that also reflects on cultural landscape routes (potentially) acting as a tool allowing the tourist to gain access to sites that are linked thematically with each other as well as with the landscape 'systems' of which they form part (Rizzo and Trono 2012: 4). The implementation of marketing actions for cultural routes begins—we believe—with the identification of appropriate methods aimed at the creation of a specific tourism product. Traditionally, this is achieved *in primis* by analysing the demands of the market and of the users themselves. It must, though, also depend on the use of innovative tools capable of revealing the structural patterns of territorial processes and determine if, ultimately, they facilitate or hinder its success. The itinerary, as said, acts to coalesce and systematically reorder the available supply, in our case landscapes. As a result, it is necessary to combine the moment of its creation with careful verification of how the territorial fabric to which it refers has evolved, so as to find connotations that, over time, invest the planning of the route with coherence. To be economically viable as an engine for development, in fact, the (territorial) valorization project—aiming at helping tourists to read the signs of history in the landscape and to decompile/interpret associated collective meanings (Laurens 2007; Berti 2013)—should be long lasting. With that in mind, the identified research problem may be formulated as follows: How can innovative geospatial technologies, tools and methods enhance the capacity of territorial actors to design more sustainable routes, taking under due consideration land-use-related territorialization processes that are capable of affecting cultural landscapes and impacting on the experience a tourist can enjoy (and on his perception of it)? Therefore, the general aim is to evaluate the impact that land-use/cover changes (LUCCs) have on landscape visibility (and, thus, on 'fruition'/perception by tourists) given a planned tourist route.

The aforementioned statement of the research problem determined the following operational objectives:

1. LUCC evaluation in the area crossed by the route;
2. Assessment per point of interest (POI) of the impact that LUCCs have had on landscape fruition (visibility) within a given buffer zone;
3. Assessment of the global impact that LUCCs have had on landscape visibility within a given buffer zone considering a particular factor: the overlapping of possible effects;
4. Same as (3), but focussing only on municipalities whose territory is entirely included in a given buffer zone.

The Case Study Area: An Overview

The case study area is located in the province of Verona (Veneto Region—Italy) and in particular a hilly zone in the north-east of the province itself. It involves eight municipalities (San Martino Buon Albergo, Verona, Mezzane di Sotto, Tregnago, Illasi, Cazzano di Tramigna, Soave and Monteforte d'Alpone), whose limits are close to the regional park of Lessinia and in the cultural region that goes by the same name (Sauro 2010). The territorial setting is characterized by parallel ranges downgrading into the underlying plain. It offers different kinds of landscapes:

- an agricultural environment of intensive grapevine cultivation (sometimes fragmented by olive trees);
- small sections of rural landscape (in particular that dedicated to pastures);
- the urban context of a small walled town (e.g. the town of Soave with its medieval castle);
- the precious (heritage) landscape generated by the presence of historical Venetian Villas (e.g. the Municipality of Illasi);
- a 'sacred' landscape consisting of 'minor' religious heritage (sanctuaries, abbeys, parish churches, shrines, etc.).

The area is easily accessible by means of the provincial roads that cross transversally the five valleys of Squaranto, Mezzane, Illasi, Tramigna and Alpone. Driving along these roads allows one to appreciate the above landscapes in the typical manner of so-called slow travel (Mogollón et al. 2012)[6] passing through Wine Routes (Soave and Valpolicella), Wine Towns (Illasi, Monteforte d'Alpone and Mezzane di Sotto), Olive Oil Towns (Illasi and Mezzane di Sotto) and areas boasting the *Bandiera Arancione* of the Touring Club Italiano (Soave). All of these elements are part of RES TIPICA (Calzati et al. 2012) (Fig. 2.1).

Methodology

Data sets Used

To fulfil the objectives set, we availed ourselves of a set of data made up of the following:

1. Limits of the spatial units examined in .shp format (downloaded from the geoportal of the Veneto Region): NUT3 (province of Verona) and LAU2 (municipalities studied);
2. The POIs that identify the points of interest in .shp punctual format. Each point was located using Google Earth. Subsequently, we generated the corresponding shape file to be imported into the GIS.

[6] See table no. 1, which summarizes the main headings of the slow philosophy: slowness, experience and environmental/social ethics.

Fig. 2.1 Italy, Veneto and the Province studied. *Source* Map created by the R.G. Rizzo (2014)

3. The route of the itinerary—created ad hoc—in .shp polyline format.
4. The technical maps of the Veneto Region [scale: 1:5000, in raster (.tif) format and relating to our case study area] used to generate the digital elevation model, on which our analysis was based.
5. Data sets referring to land use and land cover:

    a. Corine Land Cover (CLC) for Italy (1990, 2000, 2006) [database downloaded from SINAnet in .shp format; scale: 1:100,000];
    b. data in .shp format on land use/cover (scale: 1:10,000) relative to the years 1983, 1996 and 2006 made available by Veneto Region and relative to the province and the municipalities studied.[7]

These data sets (5a. and 5b.) represented the starting point for all our overlay calculations and the extraction of the values of class changes, below described.

[7] 'The genealogy of the data produced by the Veneto Region is the following. With regard to the production process, the table associated with the data derives from the geometric processing of the database of the land use and land cover of the Veneto Region. This database, which for the urban coverage refers to the archives produced in the project GSE-Land, was implemented using the photo-interpretation of AIMA orthophotos, for the 1994 period and of the CTR, in the original 1983 edition. The sources are therefore varied: CTR from 1983 and subsequent editions; digital AIMA orthophotos from 1994; AGEA orthophotos 2006–2007; GSE-Land archives of the land use and land cover' (Rizzo et al. 2014: 23).

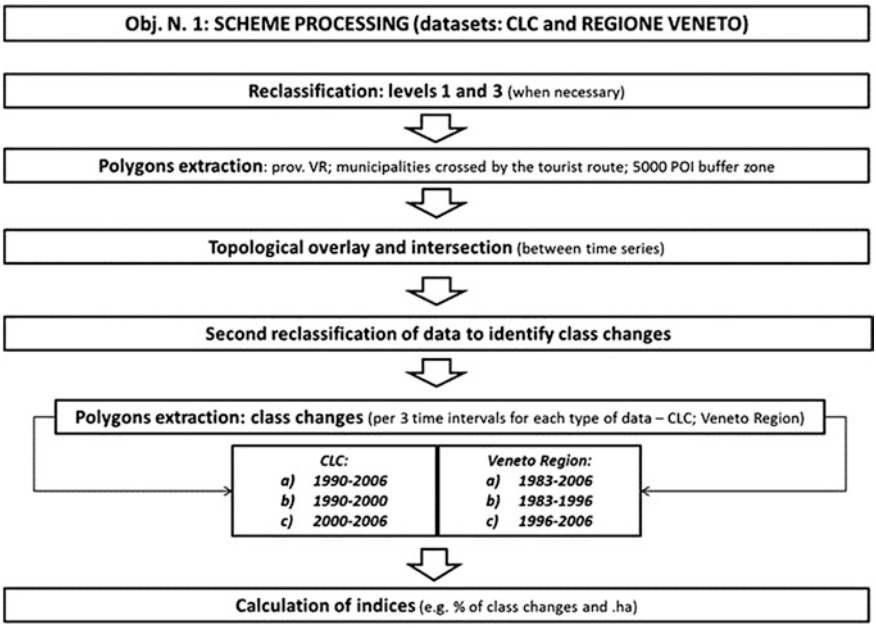


Fig. 2.2 Outline of the methodology used in Step 1–3 (polygons extraction, data reclassification, topological overlay analysis, indices calculation; datasets: CLC and Regione Veneto). *Source* Charts by R.G. Rizzo

Procedures Carried Out

Once we had obtained or produced the data, we made them converge in a GIS (specially created using ArcGIS 10.2). From the inputs above–mentioned, we implemented the following phases (Figs. 2.2 and 2.3):

1. The first step was that of creating the area of analysis of the CLC and of the data in .shp format on land use/cover of the Veneto Region (for both data sets, we carried out a clip operation using the boundaries of the province of Verona and of the municipalities studied as the clip theme);
2. Secondly, we reclassified such data sets[8] at level 1 [the CLC, one should remember, uses a hierarchical three-level classification that includes 44 subsections (Bossard et al. 2000; Gardi et al. 2010: 29). The Region's data set is in line with this. For the purposes of this study, we deemed it sufficient to concentrate our attention on the macro-classes of land use. This led to the necessity to group together elements on the basis of the '(macro) function performed'];
3. Using topological overlay (intersect), we proceeded to extract the past polygons from class 2 (agricultural areas) to class 1 (artificial areas) (respectively, from 1990 to 2000 and 2006 for the CLC and from 1983 to 1996 and 2006 for

[8] Corine Land Cover and BDCS (Banca Dati sulla Copertura del Suolo) of the Veneto Region, that is.

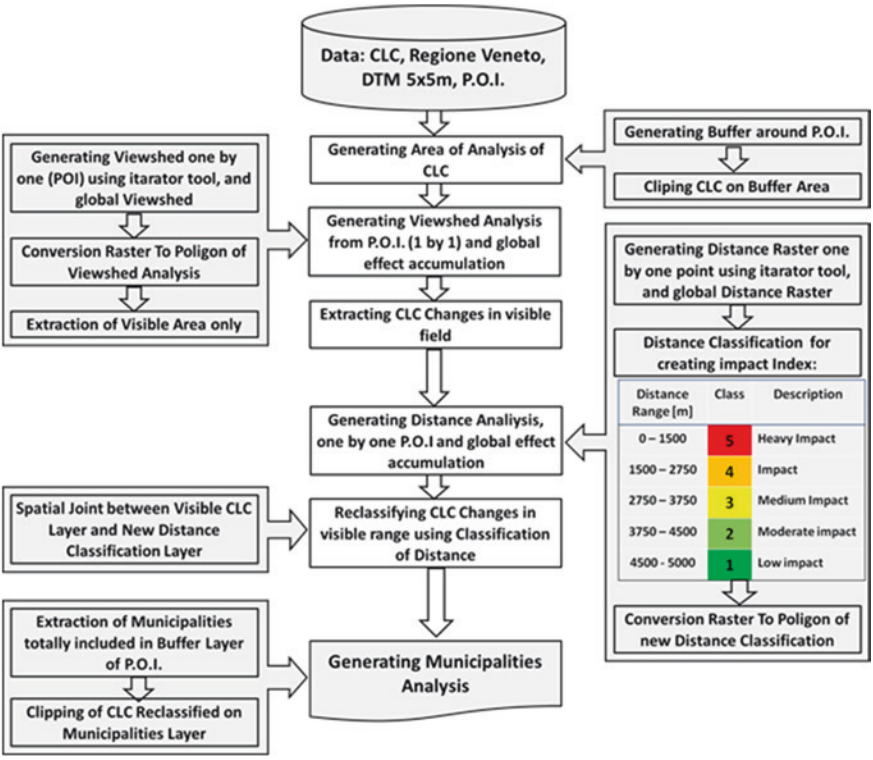


Fig. 2.3 Outline of the methodology used in Step 4–6 (viewshed and distance analysis). The example given refers to the analysis of CLC data. When analysing the dataset of the Veneto Region, the team followed the same steps. *Source* Charts by L.S. Rizzo (2014)

the regional figures). Furthermore, with regard to agricultural and viticultural practices—such as for example the new vineyard plantings on high-altitude hillsides—we used the same approach, transferring the past polygons from classes 1 and 3 (woodland territories and semi-natural environments) to class 2. This allows us to quantify the changes in the landscape. Our procedure highlights the accentuation of artificial modelling of the land or—on the contrary—its return to a natural state; moreover, it permits us to calculate indices of synthesis: the percentual rate of change (not on an annual basis but by period/interval) and its actual effects in terms of hectares.[9] Using the same approach, we analysed the changes to the third degree of detail, to which we refer the reader elsewhere for reasons of space (Rizzo et al. 2014). In order to validate the work carried out, we decided to convert into KML format the layers in shape format deriving from the overlay procedure we implemented. As is well

[9] The data sets (Corine Land Cover and BDCS of the Veneto Region) were, of course, treated separately.

known, Google Earth is capable of opening KML and KMZ files. We visualized the results of the study in 3D. Superimposing the files produced on the orthophotos uploaded in Google Earth allowed us to verify that the polygon does indeed correspond with the new registered land use.

4. Subsequently, the DEM—on which in particular our visual analysis was based—was generated using the technical maps of the Veneto Region. These, dated 2005, are distributed on a scale of 1:5000, presenting an error of measurement of around 1–2 m in the *x*-*y* plane and about 2–5 m in the *z* plane. The elements that make up these maps are for the most part three-dimensional. Two-dimensional elements, such as contour lines, triangulation points, roads, waterways, and anthropic elements, such as supporting walls and discontinuity, have information regarding their elevation that is also useful for creating the model. Consequently, these were also transformed into three-dimensional elements. This process is called for two stages: (a) construction of a triangulate irregular network (TIN) model and (b) transformation from the TIN for the generation of a raster with 5×5 resolution/a 5×5 grid.
5. Remaining within the ambit of the methodology applied to the research being carried out here, we went on to make a visibility analysis[10] of the case study area in two stages: of the individual points of interest and of the route as a whole. Initially, we created a zone visible from a given position (the individual POI): the so-called viewshed. To do so, we used a DEM to calculate—by means of an algorithm—the difference in elevation of a cell (optical cell) compared to one nearby (target cell). In order to establish the visibility of the latter, one examines (for each cell) the line of sight between the observation point cell and that of the destination. At the moment when the highest value cells coincide with the target ones, one's line of sight is blocked. With regard to the destination cell, this is part of the viewshed as long as the line of sight is not blocked. If the contrary is the case, this cell is not included in the viewshed. In the study described here, this analysis was carried out with the aim of identifying which areas that have undergone land-use change form part of the visible output raster.[11] As mentioned above, two different scenarios were generated: (a) viewshed analysis referring to each individual POI; (b) analysis referring to all of the individual POIs. Masks were obtained as outputs which, in a

[10] For the visibility study, we referred to the viewshed techniques utilized over the last few decades (Fisher 1996; Llobera 2003; Štefunková and Cebecauer 2006; Qiu et al. 2011; La Rosa 2011).

[11] We should like to specify that, in this phase of our work, we decided to apply visual analysis and distance analysis only to the results of the overlay analysis carried out on the Veneto Region's data set on land use and coverage. We decided to make reference to other data sets apart from that of the CLC in order to 'correct' the lack of precision due to its low resolution. Though highlighting a growing and pervasive distribution of artificial areas, Corine does not register small changes which, however, when added together, have a definite influence on the maps produced. This finds confirmation in a reading of the metadatum: though the Regional data use the same nomenclature as Corine, the two data sets are not homogeneous.

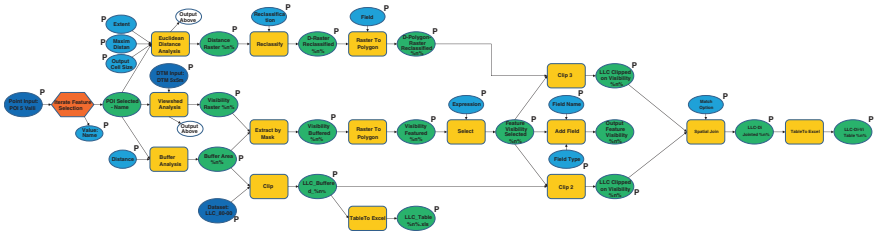


Fig. 2.4 Model builder. Example of the model created for the analysis for and from individual POIs. *Source* Chart created (in ArcGIS 10.2) by F. Smerghetto (2014)

subsequent phase, were superimposed on the elements of land-use change and on the distance from each individual POI.

6. Once we had performed out the visibility analysis, we carried out Euclidean distance analysis using Euclid's theorem that allows one to calculate adjacent cells with respect to a given observation cell (starting point for the process of analysis). This allowed us to identify at what distance the various land-use elements[12] were located with respect to the individual POIs. We then proceeded to carry out a reclassification based on putative impact on the field of vision. This reclassification refers to distances. Considering a buffer zone of 5 km,[13] we identified the classes of impact as a descending hyperbolic function, as shown in the figure.

All of the analyses—reclassification of the data associated with topological overlay, as well as visibility and distance analyses—were carried out using the Model Builder tool, the use of which is briefly described hereafter (Fig. 2.4). By means of an iterative process for each POI, we obtained an initial visibility analysis from which to generate the mask of the visible areas. It was necessary to transform

[12] Such as those on which the changes in land use we registered are based.

[13] The decision to have a 5-km buffer zone derived from the 'combination' of the concepts of visibility and slow tourism. The analysis of intervisibility, often used to determine the impact that major works/buildings have on the territory, considers both short- and long-range visual perception. The field of vision of the human eye varies according to the physical, chemical and environmental conditions prevailing in a given moment. This—usually depending on distance, on the altitude of the observer and on clarity (often influenced by the humidity of the particles suspended in the air)—may vary from a minimum of 3000 m to a maximum of 250,000 m. Slow tourism, on the other hand, has as its objective to move around the territory in a relaxed and attentive manner (Babou and Callot 2009). Priority is given to observing perceptible details in the vicinity rather than to allowing one's gaze to 'wander' into the deeper recesses of the landscape and of what is visible on the horizon. Our choice therefore fell on a (relatively short) distance to which we could rigorously apply a visibility analysis that allowed us to give greater emphasis to perceptible details. Also, we should like to remind the reader that we are dealing with entities which, in the municipalities being studied, are not particularly high. Therefore, if one is thinking in terms of taking advantage of the countryside, one's 'view' is affected more by a change in colour than by the obstruction of one's field of vision by elements of considerable size (e.g. wind farms).

the above-mentioned area into a polygon and extract just the visible areas. Subsequently, we created the distance with a buffer limit of 5 km, reclassified that raster according to the classes of impact we had established and converted it into a polygon. By means of clipping operations, we thus extracted those areas where visibility was significant with regard to land-use change. Finally, by means of a spatial join, we attributed impact values related to the distances and the elements of land-use change. An analogous procedure was performed for the analysis carried out on the various municipalities included in the area under examination.

The implementation of the steps mentioned allowed us to produce appropriate thematic cartographies.

Discussion of the Results

The 'Chosen' Route: Five Valleys in the Eastern Hills of the Province of Verona.[14] *A Short Description*

Once the area had been chosen—and after having finalised the evaluation process of its resources—it was decided to use the route just traced by R.G. Rizzo and available in the Internet. It is important to specify that it runs mostly through hilly areas. Their surface is characterized by little villages and isolated houses in a rural landscape. The route crosses the five ranges of the Lessinia region and also reaches flat territories such as the plains of the valleys at Mezzane di Sotto, Tregnago and Soave. The scenic driving or walking route starts from San Martino Buon Albergo and ends in the walled town of Soave. It passes through seven municipalities and the sites of (1) San Martino B.A., (2) Ferrazze, (3) Montorio (Verona), (4) Pian di Castagnè, (5) Postuman, (6) Mezzane di Sotto, (7) Mezzane di Sopra, (8) Tregnago, (9) Marcemigo, (10) Illasi, (11) Costeggiola, (12) Castelcerino, (13) Fittà, (14) Monteforte d'Alpone and (15) Soave. It covers about 100 km in the Squaranto, Mezzane, Illasi, Tramigna and Alpone valleys. With 29 multi-thematic POIs, it crosses a landscape of vineyards and olive groves, but also of heritage villages, Venetian Villas, castles and ancient churches. The whole territory is quiet and dotted with wineries and small restaurants serving typical local food, and it is well served by winding bike trails and footpaths (Fig. 2.5).

[14] Route no. 3 stretching for 100 km by R.G. Rizzo *Le 5 valli nelle colline orientali veronesi* in http://www.openstarts.units.it/dspace/handle/10077/9911. The route with 29 POIs (see the photographs of the buildings and landscapes) can be seen in the maps using: Google Streets, Google Maps, Bing Maps or Bing Satellite.

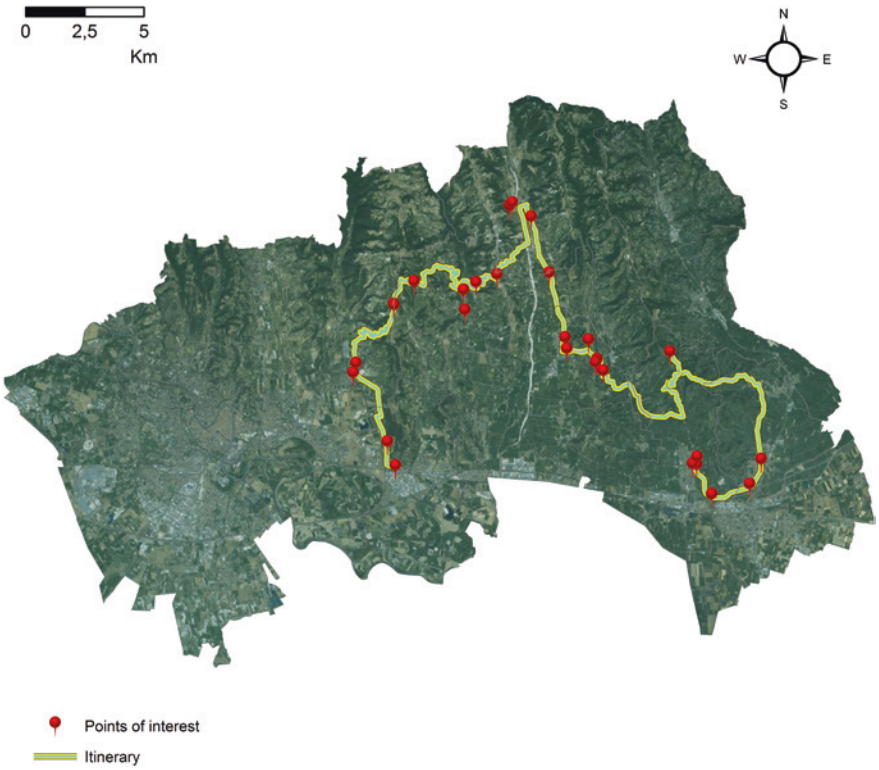


Fig. 2.5 Tourist route traced in 2013–2014 by R.G. Rizzo and available in Internet (http://www.openstarts.units.it/dspace/handle/10077/9915). *Source* Map created by R.G. Rizzo (2014)

Land Use in the Area Covered by the Study. For a Quantitative Level 1 Evaluation of the Regional Data

The results obtained will be discussed, first focusing on the province of Verona, then on the municipalities listed above and—lastly—on the buffer area at 5000 m. The provincial data will 'function' as a benchmark against which the performance of the municipalities will be 'weighed' and to determine the virtuosity of the trajectory made by the territories or, conversely, the regressive character of the same.

The province of Verona—The landscape profile and the land use appears to be affected by a significant change. The analysis has therefore aimed to do the following: (a) verify how much of the surface has changed its intended use; (b) understand which classes have favoured from this and which have been disadvantaged. It was then decided to further analyse both the period 1983–2006 and the two intervals 1983–1996 and 1996–2006. This was done at level 1 and at level 3 of the classification, both for the CLC and for the data produced by the Veneto Region. Only the latter, however, is reported here.

The implementation of the topological overlay procedures on the total years covered by the database reveals that the change which took place particularly favoured the macro-class 1. A total of 8016 ha changed their intended use between 1983 and 2006 and have been classified as 'artificially modelled territories'. The class that has been replaced, however, has been class 2 (99 % of the total changed hectares). Conversely, a small number of hectares (48) were 'lost' in favour of classes 2, 3[15] and 5.[16] A study that takes into account the two sub-intervals (1983–1996 and 1996–2006) highlights that the most pronounced change regards the first period (57 % of the total, when considering the hectares that switch to class 1). However, the phenomenon is also evident (43 % of the total) in the second period. For literature on the modes of dissemination of the urbanization from Verona—the capital city of the province—to the municipalities of the first belt and then of the second urban belt, especially along the radial lines of communication that come out of it, and with phenomena of building growth within the same ranges in recent years (see Robiglio and Rizzo 2009). Over the years, industrialization has been established, especially with the phenomenon of industrial clusters, a commercial tertiary and of various services—even quaternary—and logistics for the transport and exhibition nodal role of Verona at the national and European level (Robiglio 1996, 2009). Added to this is the tourism function of Verona city, UNESCO. Built-up areas are also taken into account, due to expanding tourism in the Verona side of the internationally acclaimed Lake Garda (over 11 million overnight visitors in 2013), with a lakeside tourism, along with theme parks, and tourism based on culture, wellness, food and wine.

The level 1 analysis only gives a small indication of the changes in the land use and cover that occurred between 1983 and 2006. It was then made a more in-depth analysis. By disaggregating the data at level 3, details have emerged that we believe are noteworthy. For example, when there is a change in intended use in favour of the 'artificially modelled territories' class, it was found that the sub-classes involved are 1.1.2 (discontinuous urban fabric) and 1.2.1 (industrial or commercial units) at 30 and 40 % of the hectares, respectively. It was also noted that this occurs mainly at the expense of the sub-classes 2.1 (Arable) and, in a much less pronounced manner, 2.2 (permanent crops).

Focus on the seven municipalities in the itinerary and on the buffer at 5000 m—Focusing on the territory of the seven municipalities crossed by the tourist itinerary has allowed the clear illustration of how the changes are often not contained and mainly affect the following areas: the municipalities of Verona, San Martino Buon Albergo and Soave. The analysis of the three thresholds at level 1 enables the outlining of the following profile: approximately 1400 ha switch from class 2 to class 1 (non-negligible figure, given that it represents 20 % of the total change detected at the provincial[17] level and represents almost the totality of

[15] Forested territories and arable land.

[16] Water bodies.

[17] It should be noted that the Province of Verona comprises 98 municipalities.

Table 2.1 Province of Verona and the 7 municipalities: sealed area and LUCCs (1983–2006). *Source* Data processed by L.S. Rizzo (2014)

Admin. unit		Indices				
		Sealed area: % on tot. (ha)		Var % 2006–1983 (CL. 1)	Class change (1983–2006)	
		2006	1983		% on tot. (ha) of the admin. unit	ha
Prov. of Verona		13.6	11.0	23.4	2.6	8063.5
Municipality	*All together*	*23.4*	*19.5*	*20.0*	*4.0*	*1417.0*
	San Martino B.A.	20.2	16.7	21.0	3.5	122.1
	Mezzane di Sotto	7.9	5.9	33.1	2.0	38.5
	Tregnago	6.6	6.0	10.7	0.6	23.9
	Illasi	11.0	9.2	19.9	1.8	45.4
	Soave	*16.1*	*10.7*	*50.9*	*5.4*	*123.2*
	Monteforte d'Alpone	14.0	10.9	28.1	3.1	62.7
	VERONA	32.1	27.1	18.3	5.0	1001.0

hectares that become artificial areas). When other changes are revealed, towards class 3 and/or 5, for example, the values considered, in hectares, are negligible. Overall, the growth rate of the built-up areas stands at +20 %, with peaks of 50 % in the case of Soave, and 33 and 28 % when considering the dynamics expressed by the Municipality of Mezzane di Sotto and of Monteforte d'Alpone (Table 2.1).

A study that considers the two sub-intervals (1983–1996 and 1996–2006) reveals that the processes that have transformed the territory were mainly deployed in the first period: it refers to 70 % of the hectares that have changed intended use. The figure—of which the Municipality of Mezzane stands out (85 %), although in line with the provincial trend—occurs in a more pronounced manner with respect to this. The drive to land consumption—despite still being considerable—seems, however, to be slowing down (probably due also, and above all, to the economic crisis). Where there are changes of intended use that artificially shape the land and change the landscape, this is still to the benefit of the sub-classes 1.2.1—which on average stands at 40 % of the total (except for Mezzane)—and 1.1.2 ('discontinuous urban fabric'), to the detriment of 'agricultural' sub-classes (as expected). Switching to class 1.1.2—on average 24 % of the hectares that are transformed into built-up areas—is equal to almost 50 % of the hectares affected by the change in the municipalities of Monteforte d'Alpone and Soave.

The area covered by the buffer at 5000 m, last but not least, stood at 39,500 ha. Within this, 1220 ha have been lost, which have changed their intended use to favour class 1. A quantity that represents 86 % of the total shown above refers to the municipalities crossed by the route. A quick examination shows that the phenomenon was particularly evident in the period 1983–2006 and that it is characterised in line with what has already been described (Fig. 2.6).

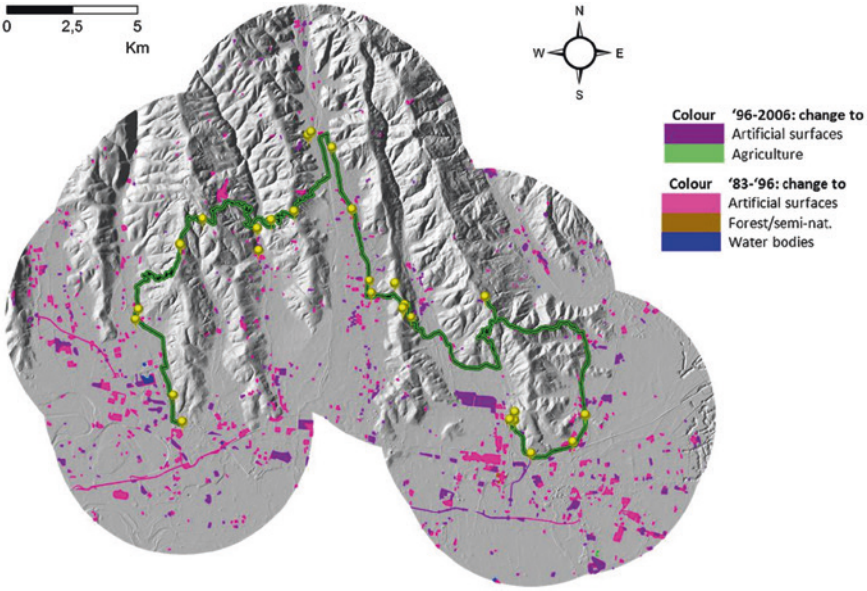


Fig. 2.6 5000 m buffer area: LUCCs 1983–1996 and 1996–2006. *Source* Map created by R.G. Rizzo (2014)

Land Use, Landscape and Visibility: Possible Negative Interactions? POI Classifications by Impact Assessment of LUCC

The analysis from and for individual POIs has provided intervisibility evaluation and the classification of the visual impact as a function of the changes in land use. It allows one to rank all POIs in terms of how problematic their (individual) relation with LUCCs is in terms of landscape fruition. For space reasons, though, it is not possible to analyse the full impact on each POI (Fig. 2.7). For a fuller account, we refer the interested reader to the authors' work. This short article is confined, for space reasons, to some essential points emerging from the remaining two levels of analysis.

Global effect (*POIs*)—The extension of the analysis area was—as said—a total of 39,435.5 ha. Within this, the area affected by the changes in land use consists of 1220 ha, equal to 3 % of the total analysis. If considering the area affected by the visual impact that falls within the 5-km buffer, it is 6,140 ha (about 16 % of the total area). What remains is the extraction of the areas of the land-use field falling within the visible areas. These amount to 178.5 ha: 3 % compared to the visible area and 0.45 % with respect to the buffer area. Now, examining the classification carried out, the predominant class observed is 5 (the class with the greatest impact). In fact, it occupies a surface of 83 ha within the area of visual impact, equivalent to 1.5 %. The other classes, from 4 to 1, respectively, occupy 55, 24, 13 and 2.7 ha or rather 0.8, 0.3, 0.2 and 0.04 %. These percentages do suggest that the zones are affected by the change to the territory that is taking place.

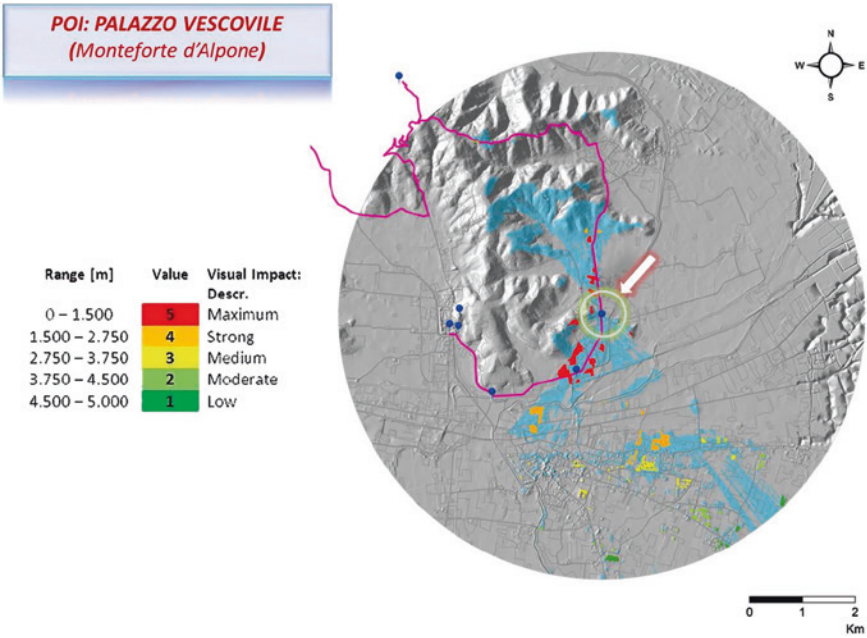


Fig. 2.7 Impact of LUCCs in the (blue) area visible from the POI "Palazzo vescovile" in Monteforte d'Alpone, within the 5 km buffer zone (all LUCCs refer to a switch to class 1 of the CLC classification adopted in the dataset of the Veneto Region). *Source* Map created by L.S. Rizzo (2014)

A study of the data according to sub-interval (1983–1996; 1996–2006) reveals a trend consistent with what was discussed in the previous paragraph. In the first interval, at 109 ha, the model attributes a notable impact on the perception that the tourist may have of the landscape (52 ha fall within class 5; 43 in class 4; and 14 in class 3). In terms of total hectares, the phenomenon is less pronounced in the subsequent period. Comparing the two intervals, it can be seen that there is an increase in the weight of the POIs that fall within class 5, in relative terms: that is, which is associated with the maximum impact (which switches from 44 to 52 %). Conversely, the distribution of the remaining classes is more homogeneous (class 2 increases—which expresses a moderate impact—of three percentage points and class 3—medium impact—of five). Furthermore, class 4 drops by 17 % points (Fig. 2.8).

Analysis per municipality totally included within the buffer area examined—The analysis developed in the municipal territory was carried out on those communes that are totally included within the 5-km analysis buffer zone. This decision was dictated by the desire to avoid any error that might be linked to the proportional analysis defining the relationship between the area of impact within the commune and the total area of the municipality. The changes we found fall within impact level 5, which comprises a total area of 46.47 ha; we also registered 6.49 ha with an impact of 4, 0.68 ha with an impact level of 3 and 0.63 ha with class 2 impact. Such a scenario goes to show that the changes have influenced areas in the vicinity of landscape resources or points with panoramic views. One

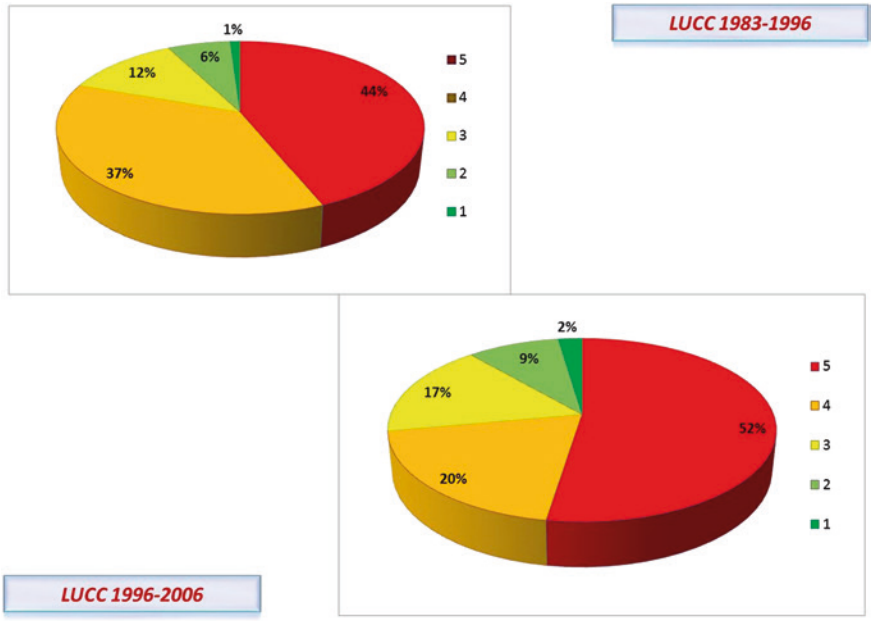


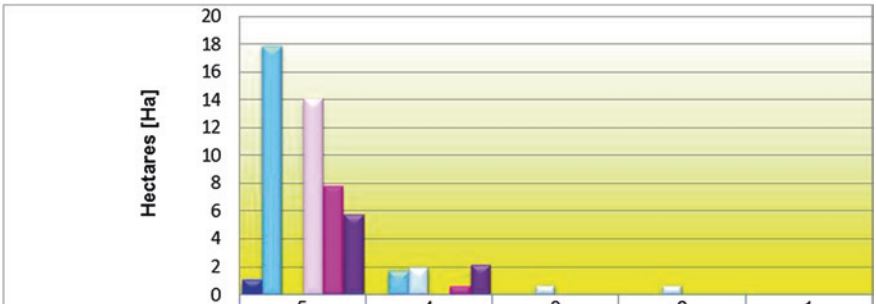
Fig. 2.8 LUCCs 1983–1996 and 1996–2006: hectares (in percentage) associated with the classes of impact. *Source* Data processed by F. Smerghetto (2014)

finds, moreover, that these impacts are to be noted mainly in flat areas. Passing on to the relationship defined earlier, we note that class 5 considers a rapport of 0.4 %, while the others are considered as practically of zero value. Considering the details with regard to the municipalities, one can carry out two evaluations: (1) by area and (2) by level of impact. With regard to the area devoted to change in land use, the most virtuous municipalities are Monteforte d'Alpone and Soave, with 1.03 and 2.23 ha, respectively. The commune with the greatest variation in its territory is Lavagno with 19.65 ha, followed by Illasi with 14.06 ha. Taking the level of impact in examination, Soave is the most virtuous, followed by Monteforte d'Alpone. Lavagno and Illasi remain unchanged with alterations in land use falling in impact class 5 virtually throughout their territories (Figs. 2.9 and 2.10).

Conclusions and Cues for Reflections

The work has aimed to test methods and identify tools that can be used synergistically and immediately by collective players, interested in operationally reasoning on the link between land use, landscape and tourism planning.

Recent advances at the level of representation systems and spatial analysis, together with the development of theoretical approaches that reflect on the concept of territory, have enabled the development of a synthesis. The outcome is the



	5	4	3	2	1
Monteforte d'Alpone	1,03	0,00	0,00	0,00	0,00
Lavagno	17,91	1,74	0,00	0,00	0,00
Soave	0,00	1,93	0,67	0,63	0,00
Illasi	14,05	0,01	0,00	0,00	0,00
Mezzane di Sotto	7,79	0,66	0,00	0,00	0,00
Cazzano di Tramigna	5,69	2,15	0,01	0,00	0,00

Fig. 2.9 Total change (ha) within the municipalities wholly comprised in the 5 km buffer zone. *Source* Data processed by F. Smerghetto (2014)

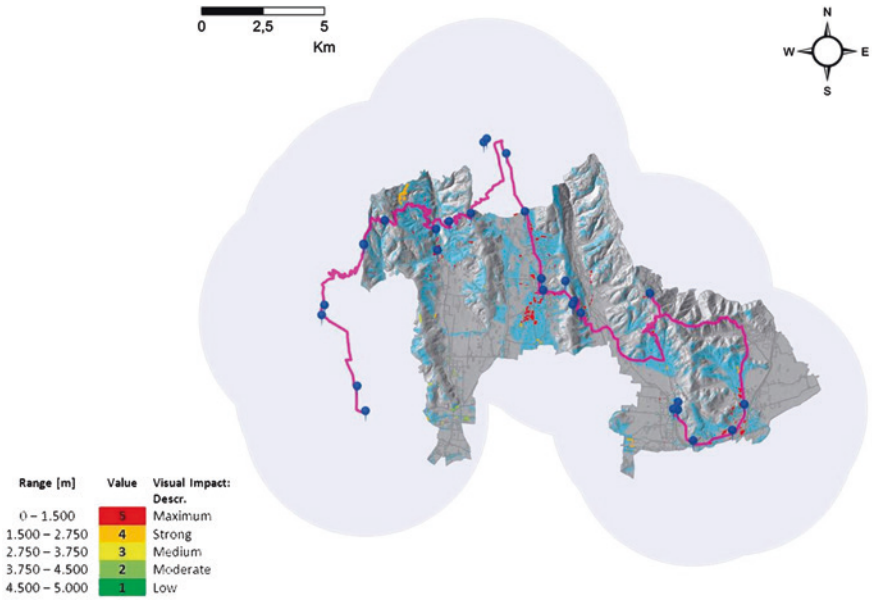


Fig. 2.10 Visible LUCCs (in blue) within the municipalities totally comprised in the 5 km buffer zone: classes of impact (all LUCCs refer to a switch to class 1 of the CLC classification adopted in the dataset of the Veneto Region). *Source* Map created by L.S. Rizzo (2014)

proposal of a model through which the reflective contribution of the cartography can primarily emerge, to promote a more sustainable exploitation of the landscape assets in complex territories, and long-term management of their enhancement. This model helps us to identify spatial relationships between the route under construction and land-use-related processes. A by-product is the identification of weaknesses in the valorisation strategy (i.e. the proposed POI), on which local communities are able to intervene. The methodology is certainly innovative when applied to the field of tourism. It could instead be partly reinforced when considering the uses that could be made of it—especially at the level of visual analysis—to evaluate the impact that large buildings have on the landscape.[18]

The identification of a more appropriate scale of impact will be the subject of subsequent reflections by the research team. The work presented here aims to act as a first step. It requires refinement, in order to find solutions that solve the risk of an otherwise approximate assessment. In this study, the scale of impact was based on the distance factor, limited to the meaning expressed in Euclidean terms. The need that is perceived is that of refining the model in a way that takes into account the multiple factors that contribute to 'defining' the complexity of the impact of changes in land use, subject of the study. Potential 'catalysts' on which to reflect for designing a tool for comprehensive evaluation, in addition to the distance as defined above, are identified in the range of geometric and topological factors, such as shape, layout and fragmentation.

No less important is the analysis of the territory, incorporating georeferred data into the model relative to the approved transformability (parts of the urban and territorial planning, or created by ad hoc editing). For the present work, the planning information has not currently been made available by the institutions. Applying the model to them—both the developed one and its more elaborate version—would allow projection of the analysis into the future and to produce scenarios that can diachronically reflect, in greater depth, on the rate of transformation of the territory and the direction that it expresses. It could have, in fact, positive or negative implications, where it is orientated towards greater naturalness or towards a growing artificialization that may not be adequately controlled in the results and that outlines the establishment of:

- an increasing geometrization and homogenization of the landscape;
- (conversely) a random territorial development;
- a marked differentiation of the natural and landscaped components.

All of these are aspects which, when considered through an impact index that is capable of reading them, could generate evaluations with diametrically opposite results in different analytical situations.

Beside top-down decisions (to which our model could contribute), the fruition of rural countryside landscapes could increasingly benefit also from the adoption of a bottom-up approach. The creation of participatory maps based on community

[18] For example, wind turbines for energy production.

perceptions—despite its actual known limitations (Mather 2000)—could complement the traditionalGIS-based route building, furthering the identification of relevant POIs (landscape-wise). Integrating the 'official' spatially referenced data making use of information possessed—and delivered—by community groups or project-affected people could allow to access yet untapped sources of precious local spatial knowledge (Vajjhala 2005; Dunn 2007). Despite not being our focus, we are well aware of how the above could complement the tools tested by the research team.

Acknowledgements The contribution is a result of authors' joint work. Luca S. Rizzo, though, wrote: *Routes and regional development and Build-up and landscape* and ***Structure of the Paper*** in paragraph **Conceptual References**; ***Objectives*** in paragraph **Research Design; Procedures Carried Out (points: 1–3)** in sub-paragraph ***Methodology*** (also in paragraph **Research Design**); Focus on the seven municipalities in the itinerary and on the buffer at 5000 m in sub-paragraph ***Land Use in the Area Covered by the Study***. ***For a Quantitative Level 1 Evaluation of the Regional Data***; Global effect (POIs) in sub-paragraph ***Land Use, Landscape and Visibility: Possible negative interactions? POI Classifications by Impact Assessment of LUCC*** (in paragraph **Discussion of the Results**).

Raffaela G. Rizzo composed: Tourism and cultural routes in paragraph **Conceptual References**; ***The Case Study Area: An Overview*** in paragraph **Research Design**; ***The 'Chosen' Route: Five Valleys in the Eastern Hills of the Province of Verona***. ***A short description*** in paragraph **Discussion of the Results**; The province of Verona in sub-paragraph ***Land Use in the Area Covered by the Study***. ***For a Quantitative Level 1 Evaluation of the Regional Data*** in paragraph **Discussion of the Results**.

F. Smerghetto wrote: **Data sets used** and **Procedures carried out (points: 4–6)** in sub-paragraph ***Methodology*** in paragraph **Research Design**; Analysis per municipality totally included within the buffer area examined in sub-paragraph ***Land Use, Landscape and Visibility: Possible negative interactions? POI Classifications by Impact Assessment of LUCC*** (included in paragraph **Discussion of the Results**). In addition, the paragraph **Conclusions and Cues for Reflection** is by all three authors. All the maps created were produced with ArcGIS 10.2.

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