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The landscape of transhumance. From historic maps to GIS intelligence.

Keywords: Molise (Italy); slow tourism; transhumance routes; historic maps 17th-20th centuries; georeferencing; remote sensing.

Summary: The abandonment of pastoral economy and an ever increasing competition in land use have transformed the old transhumance routes, often making the associated socio-economic space organization and pastoral landscape forms unrecognizable. But now a regeneration of the tracks, at least a part of them, is made possible by new applications for a sustainable tourism linked to the rediscovery of the ancient paths and the related cultural heritage, tangible and intangible, still present along these streets of memory.

In order to verify this potential use, a survey was conducted on the Castel di Sangro - Lucera transhumance route to assess the state of conservation in terms of heritage presence, accessibility and viability of the track. The phases of the research project have involved: digitization and georeferencing of historic maps, implementation of a geodatabase containing the points of interest recognized as transhumance heritage, geo-historical survey of the landscape crossed by the sheep track, construction of a GIS for the analysis of the state of preservation and usability of the route for itinerant tourism.

The methodology proposed in the paper represents a first step for an integrated tourism planning of the old routes of transhumance in Southern Italy, starting from the digitization of the Custom Office historic maps and passing through an urgently needed program of conservation and restoration of the tracks supported by cartography and imagery techniques.

A brief overview

The paper is intended to illustrate a method of analysis for the assessment in a GIS environment of the conservation status of the transhumance routes and the cultural heritage associated with them, as well as their potential use for cultural tourism, through the recovery of historic sources and pre-geodetic maps in association with modern cartography and remote sensing techniques.

To understand the purpose of this study the phenomenon of transhumance and livestock tracks must be concisely defined. Transhumance is often associated with the collective seasonal migration of animals and shepherds between two distinct and distant pastures connected by special routes. The territorial morphology characterizing much of Mediterranean Europe determines a gradient in the vegetation growth that favor the move between the mountain barrier of the Pyrenees-Alps-Carpathians and the Mediterranean coast (Braudel 1949). This practice is much more complex than we imagine, in fact it has had a great importance in human history with a strong impact on economic activities and influence on the social and cultural spheres of many Mediterranean populations, particularly in Central and Southern Italy (Sprenkel 1971).

Although the first written indication of this phenomenon by Latin authors dates back to the end of the Republic of Rome, archaeological evidence confirms the argument that the pre-Roman populations practiced transhumance in times farther away (Coarelli and La Regina 1984: 212). When Rome conquered the ancient transhumant peoples, this pastoral practice and the related commercial activities were adopted; indeed Rome made it one of the core activities of the economy of the Empire, as evidenced by several Latin authors, including Cato and Livy, but also by specific laws. In fiscal and market discipline, Rome subjected transhumant animals to public scrutiny and to

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taxes which were levied in compulsory passage points, which facilitated the development of towns specially equipped with an imperial tax door. The fall of the Roman Empire led to a rapid decline of transhumance also because its practice needed a reliable and safe spatial organization. In Southern Italy, to find a historic document testifying the continuation of the practice, we must wait for the Normans, who recreated the political unity in the South and re-established security conditions permitting the resumption of transhumance (Paone 1987: 21-22; 114). Generally, a true revival of transhumance occurred only in the fifteenth century, with the emergence of markets and economic well-structured organizations. In Spain, for example, a strong private association as the *Mesta* ruled the entire livestock sector (Klein 1979), while in Italy were active both the Church of Rome, who organized the transhumance between Sabina and the Roman countryside, and the Aragon, thanks to Alfonso I who relied on the Spanish experience, setting up a network between the Central-Southern companies and a public institution with administrative, tax and legal duties, the so-called *Dogana della Mena delle Pecore di Puglia* (Marino 1988)¹. Such a system, born in 1447, managed to resist until 1806, when a law abolished this institution as the economy was moving towards new productive activities.

The transhumance routes have taken specific names in the language of the different regions: *tratturi* in Italy, *cañadas* in Spain, *carraires* in France and *drumur oilor* in Romania, holding the same features and functions (Paone, 2006). Despite the recent decline of transhumance, Mediterranean countries still retain significant traces both of the tracks and of the constructions along them (taverns, fountains, churches etc.). The major routes (*tratturi*) and the connecting tracks (*tratturelli*) appear as the basic element of transhumance, arranged as a network of meridians and parallels and articulated in multiple sequences. A clear evidence of the central role played by transhumant routes in the history of the Italian peninsula can be seen in the urban and rural settlements which developed according to their direction and especially in intersections, such as in the case of Altilia in Molise (Cialdea, 2007: 23). If the length was functional to the distance between the pastures, the width depended on the demand for the transhumant livestock. In the fifteenth century Southern Italy, for example, the tracks were brought to an amplitude of 60 Neapolitan feet, corresponding to approximately 111.60 meters, in order to adapt to the economic recovery plan of transhumance, thus representing a safe and solid pathway and at the same time ensuring meadows and pastures during the livestock migration.

In Italy, the definitive end of transhumance came with the three laws passed by the Italian Parliament in 1865, 1868 and 1971 with which the many limitations of the *Tavoliere* (Apulia plains) were dissolved and the lands once used for pasture, were sold (D'Orazio 1982: 8). The nineteenth century marked, therefore, the time of the transition from transhumant breeding to sedentary agriculture (Russo 1990). A similar situation was then recorded also in Southern France, Spain and in the Balkans (Paone 2006: 23-31). The twentieth century still presents traces of transhumance, even though with very different features from the times of the Aragon Customs (Palasciano 1981:48). The traditional transhumance has been replaced with a more modern and faster one by the use of trains and trucks, or it has been limited to a much narrower stretches going from the mountains to the stables built downstream (Paone 1987: 28). After the 30s, the *tratturi* entered in the enfranchisement law, which excluded only the four most important transhumant routes: L'Aquila-Foggia; Celano-Foggia; Castel di Sangro-Lucera; Pescasseroli-Candela. Agriculture thus began to occupy the space of the traditional green-ways that until then had been placed under protection by numerous regulations issued by state power. In 1977, with the Presiden-

¹ For the precise hierarchical organization the Customs Office presented and the related cartographic products, see Iazzetti (1993: 9).

tial Decree n. 616 (art. 66), routes and tracks passed under the authority of the regional governments, which operated decisions in perfect autonomy.

The transhumance historic maps in Southern Italy

The maps of the transhumance routes represented an important basis for the proper functioning of the Customs Office called *Regiae Dohanae Menae pecudum Apuliae* (the Apulia Sheep Custom) and the Administration of the *Tavoliere*, managed by the two magistrates that, from the fifteenth to the nineteenth century, ruled the agro-pastoral activities of the Italian Mezzogiorno. The tracks, together with the locations (*locazioni*), the stands (*poste*) and the sheep-pens (*jazzi*) made up the structure of the transhumance system, whose maintenance and defense from possible encroachments was guaranteed by producing and consulting cartographic material. In this regard, an important figure was that of the royal *compassatore*, a category of experts in the measurement of the territories which collaborated with the Customs Office and whose job was to distribute among tenants and farmers the field plots in the Apulia plains, to verify the boundaries, to rescue illegally occupied tilled areas, to intervene in order to settle the frequent border disputes between different interests.

The continual encroachments made it necessary to restore the original state through an operation called *reintegra* (standing for “reintegration of land”). This consisted in the measurement of the tracks on the basis of ancient documents, testimonies of older people and practices of the sites, with the subsequent placement of securities (limit stones), on which were carved the letters R. T. (*Regio Tratturo*) and the reintegration dating, thus signaling the direction and the width of the sheep track and ending with the delivery of penalties and fines against the usurpers.



Figure 1 – A 19th century limit stone with the letters RT (*Regio Tratturo*) and the dating.

For the first reintegration surveys, conducted from 1508 to 1645, it was not required to map the various situations examined. It was enough to visit the tracks, to recognize the borders and to reintegrate the soil tilled or usurped, returning everything in a written report.

The transition to cartographic representation is an important breakthrough, by which the surveyor also becomes cartographer. Although, these maps still were rudimentary compared to other coeval cartographic representations, which were much more evolved also within the same Kingdom of Naples. The reason why the mapping was so basic in this context is to be

found in the agro-pastoral dimension which mastered territories, economies and populations and let the cartographic work took on a reductive significance. This is confirmed by the permanence of an exclusive system of agricultural measures in the Tavoliere area².

During the seventeenth century, the graphic elaboration becomes more detailed, the design covers the entire surface though remaining devoid of color differentiation – an element that will characterize the maps of the next century – and the use of symbolism starts to be connected to specific situations to be represented (Iazzetti 1993). For the waterways a corrugated hatch is used, contained between two lines that demarcate the river banks; the same lines, but with thicker pattern, indicate the greens, which in other cases are represented with simple grass tufts; the natural boundaries of the fields are rendered with the clarity and brilliance of the drawing, as well as the conventional ones that connect the limit stones; buildings and infrastructures are made through a technique more defined than that of the surveyors of the sixteenth century. What is lacking is a proper perspective of the images, for example in the roofs of the buildings; sometimes, the tiles are also designed in the inverse direction.

The representation technique however refines, despite the lack of a metric scale: it indicates the orientation of the map through a simple apposition of the cardinal points on its sides or with the representation of a compass rose. In the second half of the seventeenth century the process of abstraction of the elements that will lead to the symbolism of the eighteenth century advances. A significant evolution in the development of transhumance cartography can be seen in the Capecelatro Atlas (1651), as part of the reintegration ordered by the Viceroy Count of Ognatte and Villa Medina. Later, new techniques were developed for cartographic rendering, such as the introduction of color in the Crivelli Atlas in 1712.

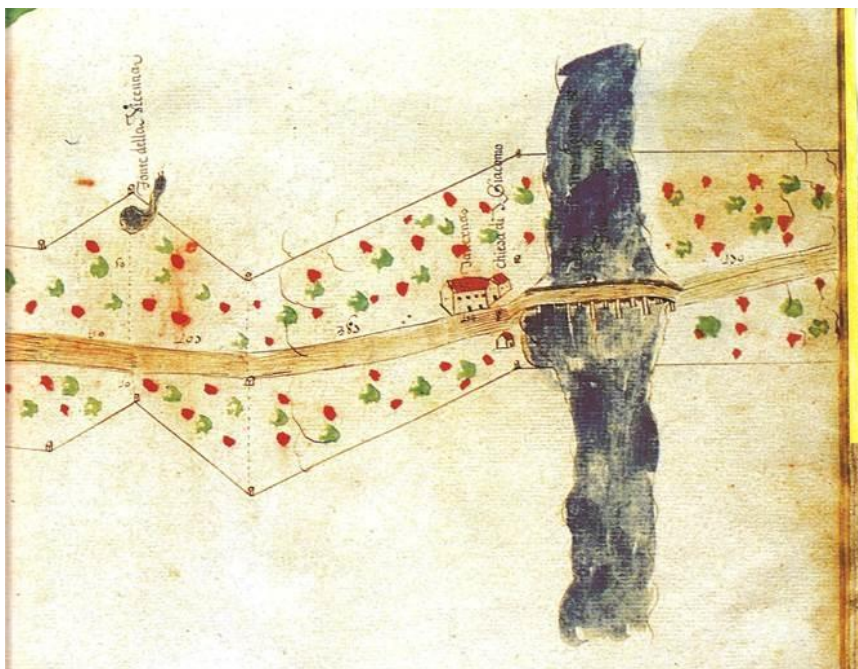


Figure 2 – A colored map from the Crivelli Atlas (1712).

² In fact, in the Kingdom of Naples there was a widespread use of different metrics that varied from place to place. The agrarian metric system which was in force in the Tavoliere area since the time of Alfonso the Magnanimous and abolished in 1840 used a length unit of up to 7 palms (equal to m 1.645690). Its multiples were the chain (10 feet) and the mile (100 feet). The *tomolo* or bushel was a surface consisting of 12 square chains, or 1,200 square palms. The *versura*, equal to 12,263.6808 square meters, was equivalent to 3 bushels, 3,600 square feet and 176,400 square palms; the wagon was worth 20 *versure*, that is 245,273.616 square meters.

With the Atlases produced by della Croce, the result of a lengthy investigation conducted between 1735 and 1760, the scale (in 1,000 Neapolitan feet) was for the first time introduced, providing a reliable technical basis. When the Apulia Sheep Custom was abolished, a new arrangement became necessary, which began in 1809 and engaged a large group of surveyors; they introduced in the mapping the geometric scale of 100 feet for the length and 60 feet for the width, with rare use of color. During the Restoration period several regulatory measures were started that gave rise to a new general reintegration in 1843, whose maps were drawn up by the Royal Land Surveyor Michele Jannantuono (Atlases n. 29-31,33-61). During the nineteenth century three reintegrations were provided, of which the second and the third in a scale of 1:5000, consisting of plates of large format each one representing the routes in specific municipal territories. The maps, besides containing historic notes on sheep tracks and on the previous reintegrations, also had an indication of the illegal occupations along with the list of occupiers and some sketches or reports in which the length of the sides and the width of the corners were given.

The cartographic representation of the French decade still recalls in some ways the eighteenth century one, while that of the following years, though still presenting errors of depiction, assumes a spatial representation which is very close to the modern one (Di Cicco 1971: 53-56). On the contrary, the transhumance cartography of the nineteenth century displays the refinement of the detection techniques and the widening of the mathematical-geometrical knowledge that enable a more accurate representation, with an encoding of the symbolism that leaves the most diverse graphic abstractions in favor of a unified definition and conventional traits (Tritto 1993: 59).

The Castel di Sangro – Lucera transhumance route in the Capocelatro Atlas

The extensive network of transhumance routes created in the past centuries, and involving many Southern Italy regions, has now almost completely disappeared. Nowadays, Molise is the region with broader historic traces of transhumance landscape, also because it was the only one to be almost fully crossed by these routes (Avram 2009: 154).

Our research has therefore addressed the Castel di Sangro – Lucera transhumance route, which almost entirely falls within the Molise region and is considered as the best preserved track of the original network. It originates from the route Pescasseroli – Candela, more precisely from the Zittola bridge and the Tavern Vallesalice in the territories of Castel di Sangro (Abruzzo), and ends in Lucera (Apulia) where it joins the Celano – Foggia route. As we can read in the account written by the surveyor Bonaminici at the end of the nineteenth century³, historic sources do not report a precise dating about its origins, and the first reliable source is obtained with the Viceroy Toledo, while all subsequent events are well documented in the atlases of various reintegrations that have interested the route. Figure 3 shows the path of the route, almost completely falling in the territory of Molise; figure 4 summarizes the reintegrations undertaken on this route.

³ E. Bonaminici, *Tratturo Lucera- Castel di Sangro, verifica nella provincia di Campobasso dal 16 settembre 1881 al 16 Luglio 1883, Decreto Ministeriale del 17 Marzo 1875. Storia del Tratturo Castel di Sangro – Lucera*, Archivio di Stato di Campobasso, foglio 3.



Figure 3 – The Castel di Sangro – Lucera transhumance route (green) and the communes of Molise (yellow).

Year	Customer	Surveyor
1574		Doganieri Fabrizio Di Sangro
1600		Uditore della Dogana Lelio Ricciardi
1651	Filippo IV Re di Spagna	Doganieri Ettore Capecelatro
1712		Avvocato Fiscale Alfonso Crivelli
1810-11		Compassiere del Tavoliere Francesco Saverio De Cesare
1843	Cav. D. Domenicantonio Patroni (Intendente di Capitanata)	Doganieri Pasquale Balestrieri
1881-83	Ministero delle Finanze (Direzione Generale del Demanio)	Uff. dell'Ispr. Forestale di Foggia (Eduardo Bonamici, Filippo Vallone e Geom. Carlo Ciampi)

Figure 4 – The Custom reintegrations of the Castel di Sangro – Lucera transhumance route.

The study focused on the Capecelatro Atlas, a very detailed and accurate document in relation to the time of production. The operations began in 1651 and ended in 1652. It is in fact the first major reintegration document involving the whole Southern Italy transhumance system with a consistent production of maps, as well as a detailed description of the routes. The Capecelatro Atlas comprises 552 maps measuring 350x240 mm (164 mm back); inside, preceded by two indexes (one contemporary, the other of the nineteenth century), there are reports on the reintegrations of the various tracks followed by their monochromatic drawings; the signature on the maps is by Giuseppe De Falco, who is supposed to be a designer specifically instructed to draw up the tables of the Atlas. The technique used, although elementary, is rich in details and landscape representation. The reason why he chose such a basic illustration lies in the need to respond to administrative needs and to draw pictures immediately recognizable even by people with little experience. In this regard, the representation focuses mainly on the pathway, while the remaining elements function as reference points for the orientation ensuring better reading and interpretation of the track. The purpose is to return an essential vision of the transhumance route, easy to read through an elementary abstraction of reality based on analogy and with a simple sketch of the localities crossed by the track. The maps are

characterized by a rich toponymy: place names recur for each location, wood, river, infrastructure or any other feature designed.

Although no metric scale is used, the regular distance of the two lines that delimit the track allows to assume the use of a fixed measure. Often, the lines of demarcation are joined by a dotted line showing the width of the track in 60 feet, while on the top margin are reproduced the limit stones bearing the letters T and R. The length is shown in the upper part of the pathway between fixed points, while a dirt trail is shown in the central part, on which the passage of flocks is presumed to concentrate, in order to give an idea of the concavity of the route. Interesting is the representation of the waterways, as they are made with full design; the buildings and inhabited places are also represented by very simple pictures in front perspective view or, in rare cases, in bird's-eye view.

These representations make use of two methods of reproduction which blend and in some way remedy the poor technique, giving essential but effective information. The first method consists in representing the path from the perspective of those traveling, in this case the landscape elements take their positions on the map in relation to the orientation of the track. The second method is to orient towards the reader the main prospect of significant buildings along the track or the skyline of the towns situated nearby, in this way the main façades of the buildings are turned towards the observer of the map.

The map in figure 5 shows both imaging techniques. To give the idea of the traveler's point of view, the towns are placed in consideration of their original position with respect to the track: coming from Castel di Sangro and going to Lucera, Civitanova del Sannio and Civitavecchia (the present Duronio) are on the left of the track, while St. Benedict monastery is on the right. On the same map the second representation technique is also evident; the buildings are represented frontally with respect to the map's observer, as well as the bridge so as to allow the illustration of its arches and consent an easy interpretation of the type of infrastructure.

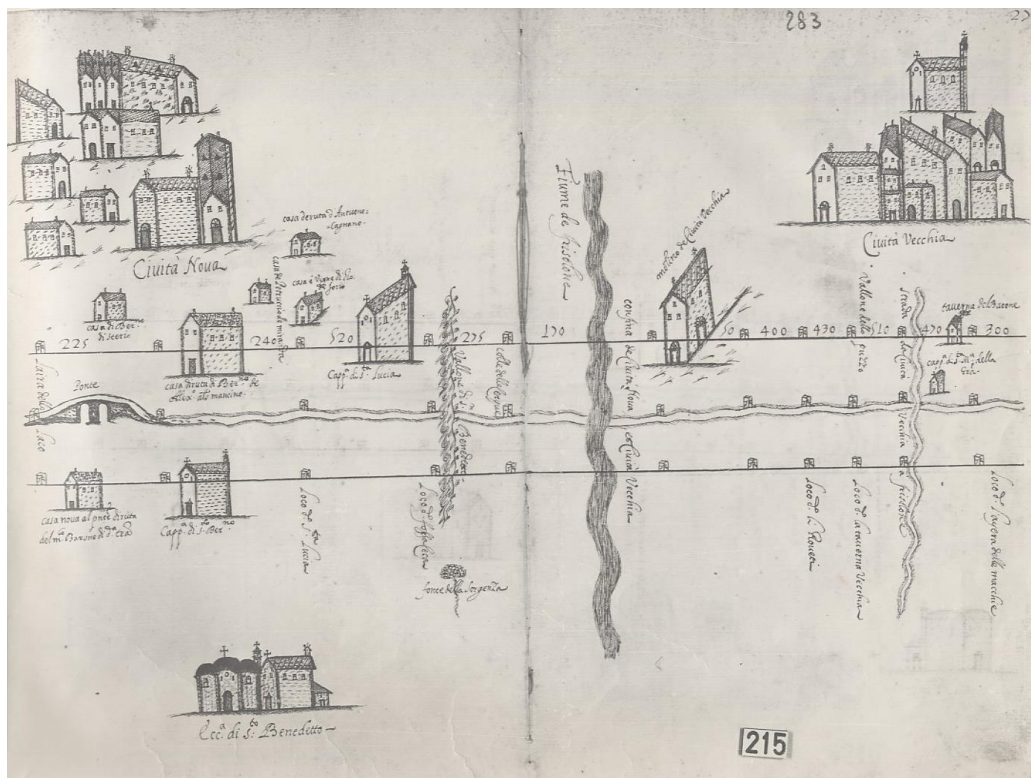


Figure 5 – A map in the Capecelatro Atlas representing the track between Civitanova del Sannio and Duronio.

The effectiveness of details in the maps produced by De Falco can also be seen in the illustration of the structures temporarily used by shepherds and farmers. The simplicity of the representation is moreover evidenced by the symbols used: for example, the tree for the woods, the tufts of grass for pasture, while relief depiction – such as uplands on which villages, forts and places of worship stand – is rendered mainly by means of hill profiles.

The attention for details on what is set along the track and in the immediate neighborhood is an essential source for an appraisal of long-lasting landscape elements as well as for virtual relocation, centuries later, of sites and material evidence now disappeared.

From historic maps to GIS, for a tourist enhancement of the transhumance legacy

Today, despite having a configuration quite restricted due to continual usurpations, the Castel di Sangro – Lucera transhumance route has preserved clear continuity of the trail and is still characterized by the presence of many examples of environmental and cultural heritage, thus becoming a symbol of the transhumance civilization. The aim of our research is to arrive at a mapping of this legacy along the Molisian route of the sheep track, thus identifying the parts of greatest interest in terms of heritage preserved and enjoyment of the landscape traversed. The requalification of the tracks, at least part of them, may in fact make sense if it leads to a tourist product structured so as to meet the new demands of itinerant tourism linked to the re-discovery of the ancient paths as well as to the cultural heritage found along these roads of memory⁴.

The techniques of digitization of historic maps associated with those of remote sensing combined in a geographic information system have allowed the recognition of the path still existing and the analysis of its state of conservation in terms of accessibility and usability. Below we illustrate the stages of the study already carried out.

For the investigation of the testimonies which exist along the route of the sheep track a database was first built containing data and information provided by the descriptions made in the 1651 reintegration and by the Capecelatro Atlas. These findings were compared with those collected by Georg Liebetanz during his journey along the same track between 1989 and 1990, with reference to the landscape of transhumance reported in the IGM topographic maps of 1957. In this way it was possible to carry out a first systematic comparison of the route in the seventeenth and in the twentieth centuries, also highlighting the material elements that are identifiable as historic legacy of great value and potential enhancement.

To assess the relevance of the elements still present as signs of the conservation of the landscape and the associated cultural heritage, recourse was made to the Capecelatro Atlas with a precise identification of the elements that today can be considered cultural heritage. The analysis focused not only on the trail but also on the landscape along the route, or the material el-

⁴ Many actions can be carried out to promote the heritage of transhumance. Among these: educational activities for schools, young people, local institutions and stakeholders; artistic initiatives (movie and show productions); development of local handicraft linked to the pastoral world; economic measures, by using European financial programs to enhance European transhumance heritage, tourism and knowledge between European countries that have pastoral traditions; environmental actions, by spreading the knowledge of biodiversity of the pastoral culture and protecting its territory and landscape; social actions, by improving the living conditions of the shepherds, and organizing voluntary services to support educational, tourist, artistic actions; tourist activities through the development of museums in the area, guided excursions on sheep tracks, tasting of local gastronomy (Avram 2009: 155).

elements of the landscape traversed by it and due to the past economy of transhumance: taverns, churches, limit stones and so on. In this regard both the descriptions of Capecelatro (1651) and Liebetanz (1990) were compared and processed; then the elements mentioned were georeferenced, that is located in a GIS environment, taking as a basis the IGM topographic maps. Subsequently, the historic maps have been implemented in the GIS as iconographic information material.

The first phase of the research has therefore been dedicated to the creation of a database with the collection and classification of basic information such as:

- municipalities crossed by the route;
- distances in Neapolitan feet with the relative transposition in meters;
- place names of the localities crossed;
- infrastructures (roads, bridges, fountains), buildings (churches, farms, villas, taverns) and limit stones;
- text descriptions of both the track and the material evidence that there insist;
- historic iconography of the local landscapes.

After cataloging, the next phase saw the use of IGM (1957) topographic maps (1:25,000) in three different fields in the following sequence (figure 6):

1. checking and georeferencing of POIs (Points Of Interest, related to buildings, infrastructures, localities, limit stones) based on the correspondent information found on the IGM maps;
2. positioning of the POIs that do not have a correspondence on the IGM maps through the measurements in meters from definite reference points;
3. creation of a feature called "tratturo" representing the path indicated on the IGM maps.

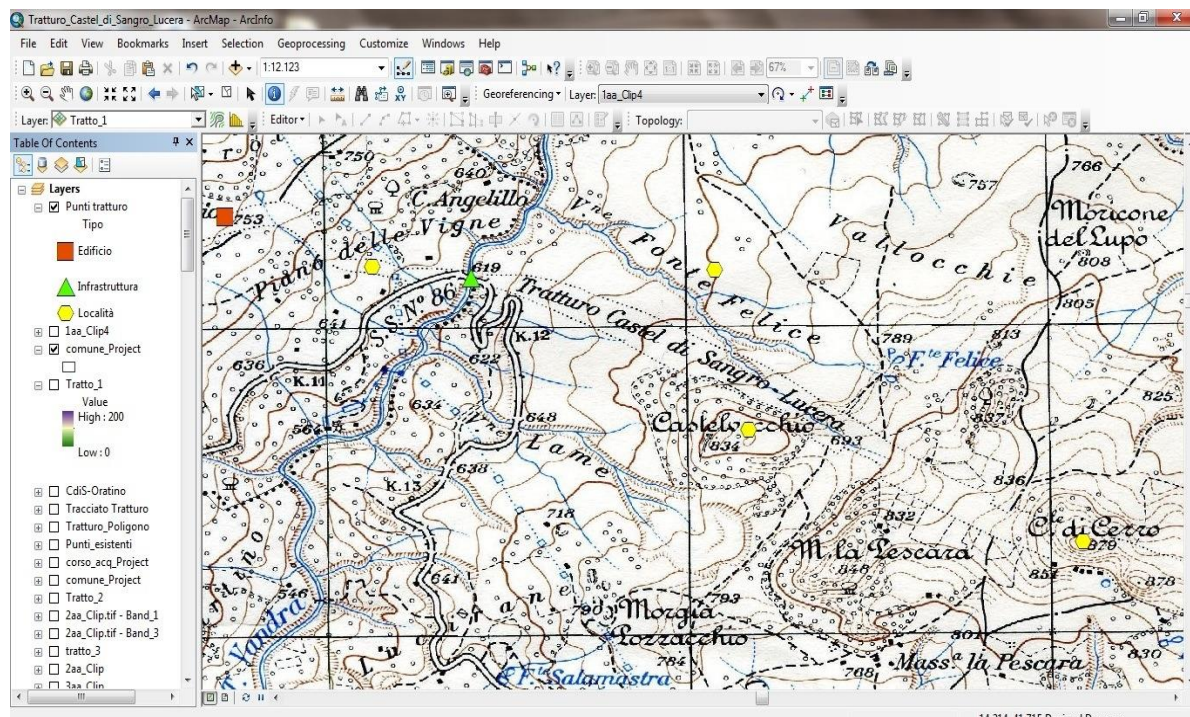


Figure 6 – GIS view with IGM topographic map and POIs.

The GIS thus created then allowed, through the overlaying of the IGM maps and satellite images, to define and delimit the original route that is currently free, so viable. In fact, through

careful observation of satellite images, you can see how cultivated fields or natural vegetation form a kind of natural border, delimiting the path. This allowed us, through attentive examination, to identify the track's course and limits even if these were not marked in the topographic map (figure 7).

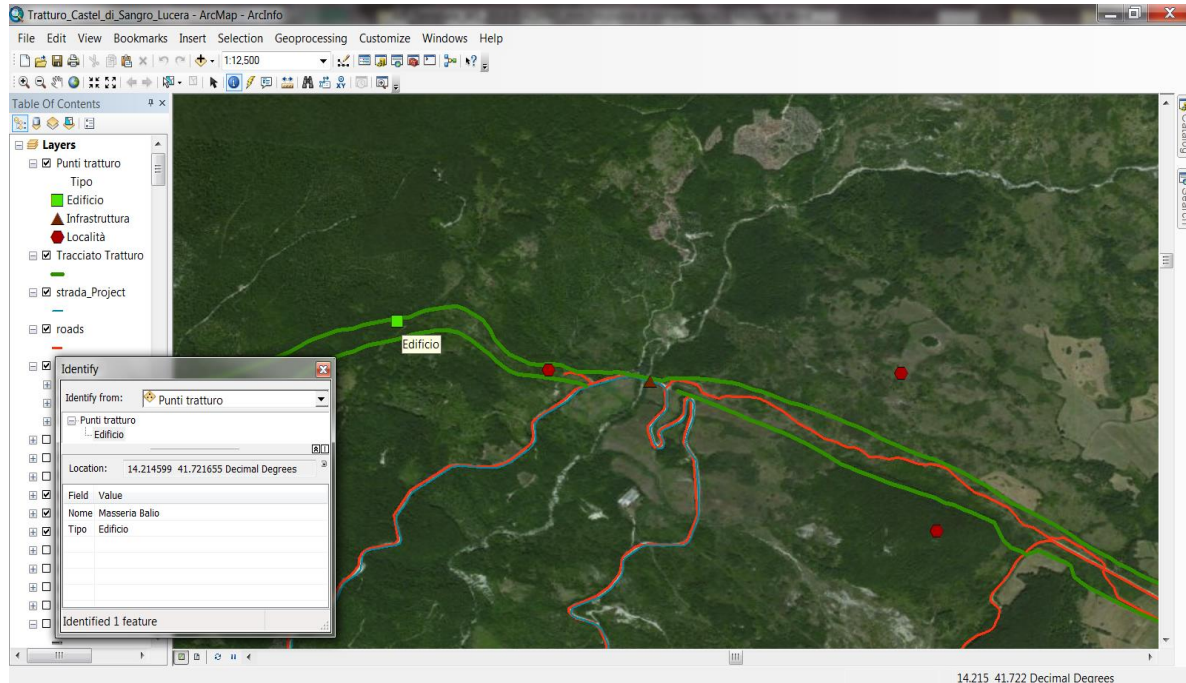


Figure 7 – GIS view with satellite imagery, the new feature “tratturo” and info on the POIs.

The permanent abandonment of the transhumance practice has resulted in a progressive reduction in the amplitude of the track, not only because of the vegetation grown spontaneously but also for the misappropriation of collective space for private or public use, as demonstrated by the presence of asphalt roads, settlements or even soccer fields right on the path of the sheep track. The use of remote sensing images has proved to be very effective for the identification of the existing tracks, especially where the abandonment of the land has produced a spontaneous growth of the wooded area, and the limits of the transhumance route are now recognizable only through vertical photo-interpretation.

After identifying the track we have dealt with the analysis of the state of preservation and usability. The concept of accessibility has been applied in a double vision: internal and external. Internal accessibility means the actual viability in a perspective of slow tourism, that is a type of sustainable tourism very close to the concepts of ecotourism and geotourism, so tourists are encouraged to visit locations where it is possible to establish a true relationship with the landscape and the local community: the routes are then covered by walking, cycling or horse riding. External accessibility regards instead the possibility to reach the access points to the circuit through major communication routes by fast means of transport, in order to integrate the local slow mobility with the long-haul tourist circulation.

For the analysis of the state of preservation, we chose to proceed by calculating a Vegetation Index (Meini et al. 2013) by applying an experimental method and limiting ourselves to one sample area of the sheep track. The method proved to be effective; so it was possible to identify the best-preserved parts on which to focus our study visits, which aim to identify more exactly the degree of conservation and usability of the track as well as of the environmental

and cultural heritage. The surveys will in fact be conducted for the parts and elements of the landscape that emerge as potential attractions. During the visits, still in progress, a photographic campaign is carried out, which will implement the geodatabase previously prepared.

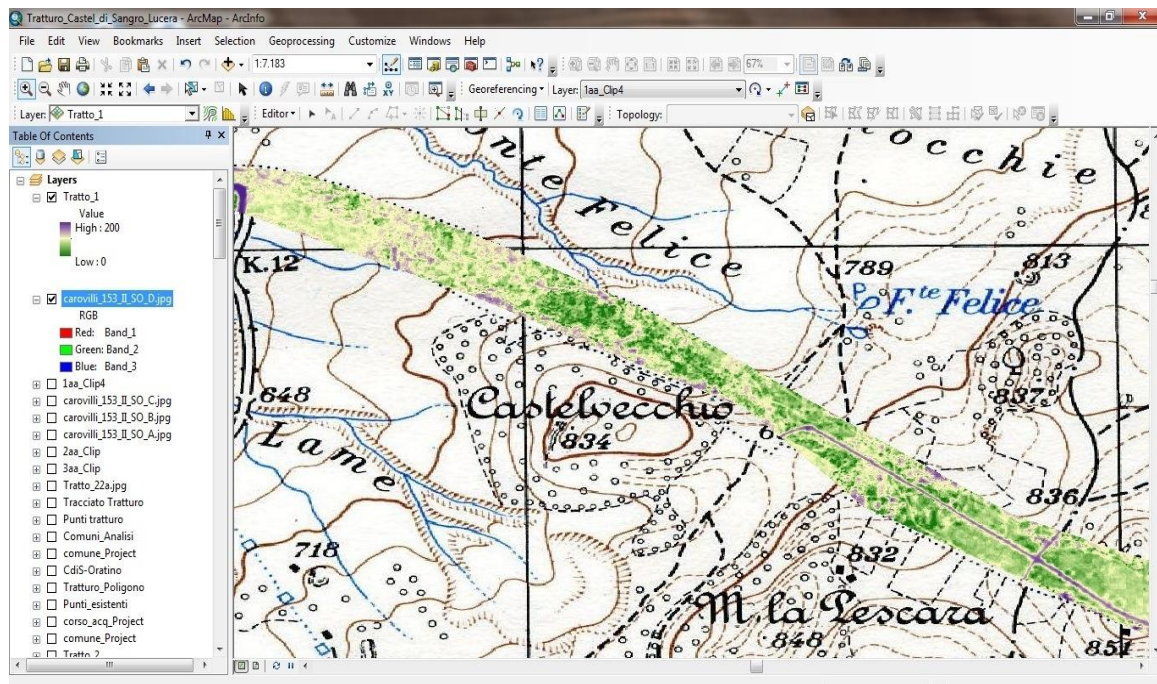


Figure 8 – The result of the Vegetation Index analysis for automatic assessment of conservation status.

Conclusion

The paper presented a methodology for the assessment of the conservation status of the transhumance routes and their potential reuse for tourism, through an application to the *tratturo* Castel di Sangro – Lucera which falls almost entirely in the Molise region. The methodology proposed is a first step for an integrated tourism planning and management of the old transhumance routes in Southern Italy, in which not only the tangible assets are to be considered, evidence of this ancient practice, but also all those cultural and social aspects of the past and present that relate to this type of economy. This ancient heritage is now widely recognized both by local people and authorities and its value is considered as an important factor to attract a niche but growing tourist flow.

The historic Custom Office maps provide the basis to define a path of knowledge of the environmental and cultural heritage related to the transhumance civilization that is still present in the landscape and is susceptible of tourist enhancement. To this end, a GIS was built providing a knowledge base which can be immediately used to launch an urgently needed program of conservation and restoration of the track. The GIS can then be implemented with themes related to other components present in the regional economy that can integrate with the tourist economy, with particular reference to the residual pastoral system, the dairy supply chain, the manufacturing and marketing of DOP cheeses, as well as the preservation of ancient handicrafts, to provide visitors with a more articulated information and communication system and assist them in a satisfactory experience.

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