HISTORICAL MAPS AND GIS ENVIRONMENT AS INTEGRATED METHODOLOGY TO REDISCOVERY OF CATTLE-TRACK LANDSCAPES. A CASE STUDY

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Abstract: *Historical Maps and GIS Environment as Integrated Methodology to Rediscovery of Cattle-Track Landscapes. A Case Study.* Transhumance represented a complex socio-economic system, cattle-tracks being its basic *infrastructure*. With the transhumance decline, the cattle-tracks have been re-used to build roads or farms, almost deleting such a network, making urgent to know it again in order to set forth recovery actions. But, how and what methods should be used? Several European projects are in progress; we present some results of three different researches applied to the Italian region Molise, since they point out the usefulness of an integrated methodology involving historical documents and GIS environment. Indeed, the starting point for the cattle-track landscapes recovery is the study of the cartographic heritage, compiled in the modern age, whilst their reconstruction can be well realised in a GIS environment through the connection between archive documents and computerized cartographic tools. These results form the basis of urban tools and are a fundamental model to rediscovery and valorise the cattle-track landscapes.

Rezumat: *Hărțile istorice și GIS în domeniul mediului ca metodologie integrată în redescoperirea peisajelor create de potecile vitelor. Un studiu de caz.* Transhumanța reprezintă un sistem socio-economic complex, potecile bovinelor reprezentând *infrastructura* sa de bază. Odată cu declinul transhumanței, potecile vitelor au fost refolosite pentru construirea drumurilor sau fermelor, aproape ștergând o astfel de rețea și făcând urgentă cunoașterea ei din nou, în scopul stabilirii unor acțiuni de recuperare. Dar, cum și ce măsuri ar trebui folosite? Câteva proiecte europene sunt în desfășurare iar noi prezentăm în studiul de față, câteva rezultate din trei cercetări diferite aplicate în regiunea italiană

Molise, deoarece acestea subliniază utilitatea unei metodologii integrate pe baza unor documente istorice și a GIS-ului aplicat în domeniul mediului înconjurător. Într-adevăr, punctual de plecare pentru recuperarea peisajelor create de potecile de vite este studiul unei moșteniri cartografice, create în epoca modern, în timp ce reconstrucția lor poate fi foarte bine realizată cu ajutorul GIS-ului aplicat în domeniul mediului prin intermediul legăturii dintre documentele de arhivă și uneltele cartografice computerizate. Aceste rezultate formează bazele uneltelor urbane și constituie un model fundamental în redescoperirea și valorificarea peisajelor create de potecile vitelor.

Key words: *transhumance, landscape, cattle track, historical cartography, GIS.*
Cuvinte cheie: *transhumanță, peisaj, poteci de vite, cartografie istorică, GIS.*

1. TRANSHUMANCE AND ITS DECLINE

Transhumance is an ancient practice which is based upon the integration of different environments and which involves the seasonal search for pasturelands, and the mobility of those concerned: shepherds and animals. The term transhumance, which is present in nearly all the neo-Latin languages, according to Sprengel (1971), is used in a scientific way by Blade in 1892 to indicate seasonal and alternative migration of groups of animals (sheep and cows), between two or more regions with different climactic conditions. In the movement from pre-history to history and in the different areas where civilization developed, two ways of living were prevalent: the settled status of farmers and the mobility of shepherds. These, who lived between the Mediterranean coastal areas and the mountains, selected routes which were subsequently used for centuries after. "Archaeological studies, sheep stables created during the Roman period, found, which indicates the existence of this practice during the Roman epoch. The cattle tracks probably extended from the Crau region and the mountain chain of the Alpes-de-Haut-Provence" (Costa, 2011, p.16). Then, paleoenvironmental studies reconstruct the history of the vegetation of an area and the ancient practices of shepherds (López Sáez et Al, 2009).

The practice of transhumance, more precisely of different kinds of transhumance, has physically altered the features of the territories of Europe from as early as the second millennium B.C. and the ancient routes which later evolved into tracks, have formed an interconnected network ranging from Spain to the Carpathians (Constantinescu-Mircești, 1976; Damianakos, 1996; Dimanche, 2002; Paone, 2006). Indeed, basic infrastructures of this complex system was the network of cattle tracks which covered thousands of kilometers and formed a series of routes used not only by shepherds, but also by merchants, soldiers and pilgrims (fig. 1).

In mountainous countries such as Greece, a continuous movement was created between pre-established areas; that is to say, towards the lowlands in winter and the highlands in summer. Its fundamental characteristic is the integration of different environments. Vertical or alpine transhumance occurred between the high mountains and the valleys below and was typical of the Pyrenees, the Alps and the Carpathians, while the horizontal transhumance exploited in alternation pasturelands situated at a considerable distance from each other, establishing itself in the Mediterranean area, in particular Italy, Southern France, Spain and Greece (Buffière, 2002, Rodríguez Pascual, 2001). For

example, in Spain, transhumance is strongly linked to the type of soil and climate of the area (García Martín, 1996; Aragón Ruano, 2006).

Figure 1: Areas of transhumance in Europe
(Paone, 2006)

It is, in fact, suitable for lands which are not very fertile or even marshlands, where the commercialization of cattle and dairy products or wool represented an opportunity, with the Alpine transhumance being based on cattle and that of the Mediterranean being based on sheep. From the late medieval period up to and including the entire modern age, sheep transhumance followed routes already known to the Romans[1] and was stimulated by the demand for raw wool which was one material that could carry, while the textile industry was one of the few industries was highly localized (Smith, 1974). It thus formed one of the fundamental aspects of the European economy from the XIII to the XIX centuries (Constantin, 2004), in particular in Spain and in Southern Central Italy, where it was precisely regulated (García Martín,1996). The production of wool and the commerce of cattle led to the growth of an artisan industry which produced the instruments necessary for those involved and for the trade fairs, creating a complex organization (Martìn e Ibarra, 2003). Transhumance acquired a great importance in Italy and had, with respect to the rest of Europe, a particular aspect; the presence of agricultural activity and the production of cereals, combined with sheep-farming[2].

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[1] We have many testimonies which date from the Roman era. Cattle breeding was a very profitable activity and in 111 B.C. a law relating to agriculture was issued which sanctioned the regulation of the routes for transhumance: the so-called *calles viae publicae.*

[2] It was a well-known practice among the Etruscans and the Samnites as well as being carried out by the Romans, but was only subsequently widely regulated between the second half of the Thirteenth and Fourteenth centuries (Rombai, 2002).

Between the mountainous area of central Italy, in particular of Italian regions Abruzzo and Molise, and the "Tavoliere delle Puglie" - large area in Southern Italy partially located in the historical region of the Capitanata[3] - a particular form of interdependence developed; the mountainous chains of Abruzzo and Molise were basins and highlands useful for summer grazing, while the "Tavoliere delle Puglie" was useful for the winter grazing.

The "Tavoliere delle Puglie" is the biggest valley of the Italian South (fig. 2), with very few waterways, used through the centuries for sheep farming and cereal production. Given its vastness, it drew constant attention from the different peoples who dominated the Kingdom of Naples. In 1447, King Alfonso of Aragon produced a decree defining the juridical role of the institution which had to control grazing rights, named "Dogana della mena delle pecore in Puglia" (Cialdea, 2007). With the establishment of the "Dogana" and its improvement in 1688, together with the choice of town Foggia as its headquarters, the "Tavoliere" was reorganised so to host up to almost two million cattle (Melillo, 2002).

Figure 2: *The 1845 map shows the historical region of the*
Capitanata and the "Tavoliere delle Puglie" in Southern Italy
(Luisi, 2006)

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[3] The Tavoliere, which extends from the Campanian Apennines and the Adriatic shoreline, the promontory of the Gargano and the gulf of Manfredonia, was a vast territory which can be divided into the high and low Tavoliere areas.

Everywhere, such a vast and enduring process entered into a period of crisis in the XVIII century, when an increase in population required the cultivation of the hilly areas. The promulgation of specific laws favoured the exploitation of agricultural lands. The historically documented conflict between shepherds and farmers were always resolved in favour of the latter because the economic dynamism of the XVIII century middle classes heavily emphasized the commercialisation of foodstuffs rather than the wool trade (Smith, 1974; Paone, 2006). Furthermore, different kinds of fibres for the textile industry were becoming more widespread, and the reduction of the price of wool led to a re-evaluation of the economic advantages of transhumance. Transhumance went into decline between the end of the eighteenth and the beginning of the nineteenth century due to the industrial revolution and the vast economic and social transformations which this led to. All over Europe the ancient system of integration between agriculture, sheep farming and artisanship fell in to crisis. While the cattle tracks now seemed a slow and archaic system of communication and transport compared to the modern means of transport and communication developing. In some cases, roads followed the ancient cattle track routes but transformed them radically. In other cases, roads followed totally different routes and isolated both the villages and environments which had been centres of sheep farming activity. Settled agriculture became more widespread and modernised and the work of the nomadic shepherd became archaic and unprofitable. It true that in some areas the transhumance is still a widespread practice and that it is adapted to the current economic and technological requirements (Cleary, Delano Smith, 1990; Jones, 2005; Manzano Baena, Casas, 2010), but its importance is low in Europe, while it is a fundamental activity in Africa for example[4]. However, it is an important aspect of European historical identity, as cattle tracks were the principal means of territorial identification.

2. CATTLE TRACKS YESTERDAY AND TODAY:
AN OPEN QUESTION

The cattle track network was a perfectly organised territorial system in every region of Europe (Rodríguez Pascual, 2001; García Martín, 2004; Pellicano, 2007). The grassy track which represented the cattle tracks was the backbone of the system. The size of the main cattle track ranged from 75 to 110 meters depending on the European region. In Spain these tracks were well-defined and in general were called *vias pecuarias* or more precisely, *canadas reales*, if they were larger than 75 metres, or *cordeles* if they were narrower. Alongside these, we have the minor cattle tracks, that is to say those tracks which were of lesser width, from 18 to 37 metres, while the side tracks were more limited tracks of 8 to 10 metres.

They linked the summer pasturelands of the Pyrenees and the Cantabrian mountains with the winter pasturelands of the central *Meseta* and the Guadalquivir basin. In the same way, the southern French *carraires* linked the Alps and the Massif Central with the valley of Languedoc. The cattle track network everywhere integrated the ancient routes of land and waterways and was not only used by those involved in transhumance but also

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[4] For transhumance in Africa see Beinart, 2007, and Nyssen et Al, 2009.

by the general population. The major cattle tracks themselves were set out as meridians, while the smaller tracks and their offshoots were arranged in parallel; these formed a transport network which covered the entire territory. Along the cattle tracks, the traveller could find fountains, stone walls, stone pillars, holding pens, rest areas, taverns, different kinds of fortifications, chapels and even palaces (Graziani, Avram, 2011).

In the Kingdom of Naples, the "Dogana", above mentioned, was concerned with the regulation of the cattle track network, not only in order to ensure its viability but also to supply services to those using them: areas for both rest and sleep as well as places where water was available for both shepherds and animals (Sarno, 2011). The minor cattle tracks were particularly useful for moving from one cattle track to another or to reach the inhabited centres where the trade fairs were held. The cattle tracks Aquila-Foggia, Celano-Foggia, Castel di Sangro-Lucera and Pescasseroli-Candela were termed Royal or Alfonsin[5] cattle tracks for their extension. The "Dogana" expropriated land in order to rent it, dividing the territory in places named "poste". These were sights of rectangular form, generally on slopes, exposed to the sun and sheltered from the wind. They measured about 250x150 feet (the equivalent of 450 by 250 metres). Holding pens were placed along the network. These areas could contain hundreds of sheep as well as areas of rest and were available for those who were waiting to be assigned in "poste". Taverns were also available for the shepherds who wanted to rest. The development and arrangement of the cattle track system reorganised the territories of Southern-Central Italy to the point that it led to an increase in pasture land being available at the expense of settlements (Cialdea, 2007).

In Italy and in Europe, the function of the cattle tracks was guaranteed by regular checks and each European state of the modern age had arranged a specific form of management of the cattle tracks; the routes had to be free of any kind of impediment and were not to be usurped by the farmers. In this way, shepherds and cattle could travel freely. The decline of transhumance results in the reduction or complete elimination of any kinds of checks, consequently the cattle tracks are for the most part occupied by buildings, used for agriculture, or covered by tarmac. The areas along which shepherds moved no longer coincide with urban and territorial centres, where it develops the process of industrialisation. The construction of roads, railways and motorways throughout XX century leads to the elimination of grass covered cattle tracks. In other cases, agricultural activity or the abandonment of cattle tracks have led to their disappearance (Hubert B., 1991; Avram, 2009; Graziani, 2011).

What is today left of such a vast network? Very little, given that in 2012 a written declaration on the protection of the historical, economic, productive and cultural heritage of the Mediterranean cattle tracks was presented to the European Parliament, asking to protect the remains of this architectural heritage (European Commission, 2009). In Southern Italy, of the 3000 km which were once used as cattle tracks, only 174 km (13%) are in good condition, 113 km (8%) are in a relatively poor condition, 293 km (22%) are in a precarious condition and 765 Km (51%) are no longer visible[6]. These data are the result of a Italian survey[7] carried out about ten years ago, today the situation is probably worse and the greater part of the cattle tracks is 'disappeared'.

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[5] The name Alfonsin was a tribute to the king Alfonso of Aragon.

[6] See Camera dei Deputati, *Atti parlamentari 4759*, Roma, 1998.

[7] During the XX century, surveys have been held in different states in order to evaluate how much of this ancient network is still visible and in what condition it is to be found.

If this is the current situation, the nature of the problem is very clear: how can we save the remaining good cattle tracks and how can we repair the precarious ones? This is the principal issue. Other questions remain open, such as: what function can this heritage have today?

3. CURRENT PROJECTS

In the last decades, both institutions and associations have posed the problem of how to save the remains of this cattle track network, as well as to try to reconstruct how it was in the past. The issue has been presented in the European Parliament as well as in different European states, not to mention UNESCO. Indeed, whilst this commitment is common to all the countries of Europe, it is particularly active in Spain and Italy who are both working to obtain a recognition of the cattle-tracks as a cultural heritage endorsed by UNESCO (Sarno, 2011). The aim was to safeguard the cattle track heritage, and to reactivate agriculture, forestry and sheep farming activities, as well as the production of agricultural and food products typical of the local territory (Hubert, 1991, Garzón, 2001).
A number of different nations, from Italy to Spain and Romania, have over the past few years been implementing projects for the safeguarding and appreciation of cattle tracks. One such project is the virtual reconstruction of the cattle track network with the aim of creating virtual transhumance museums. These projects are supported by specific laws passed by each state on an ad hoc basis. The most important project of this type is the Virtual Museum of European Transhumance, promoted by the ministries of the environment of a number of different nations. The project is an integral part of the European Cattle Track and Transhumance Culture Project: a cultural and environmental European network started in 2005. The virtual museum can be visited online at the *www.minambiente.it* site as well as at *www.transumanza.eu*. It elaborates a route which presents different territories, environments and climates, from Spain to France and Italy and from Slovenia to Hungary. In these web pages, multi media theme maps allow us to discover land areas which are unique to local cultures as well as environmental and natural values. The principal aim of the project is to transmit the anthropic and environmental values of the civilisation of transhumance. European funds, dating from the mid 1990s, have been used by a number of nations with two aims: the reestablishment of the track routes and the organisation of information centres (Avram, 2009; Manzano Baena, Casas, 2010).

Therefore, there has been a growing and more widespread interest in cattle-tracks following a greater attention being paid to landscapes and the environment in general (Aloj, 2000; Gómez Sal, 2002; Olea, Mateo-Tomás, 2009). The commitment to the scientific study of the cattle-track network (once an imposing and economically relevant reality) is becoming fundamental to the possibility of its reconstruction and partial restoration. This objective is both cultural and practical, because these areas can attract tourism and so once again become economically relevant (Lozato-Giotart, 1995; Burgos, 2007). Local communities, on the basis of these projects, have slowly begun to reconsider the cattle track heritage and they have created local municipal plans for the re-evaluation of these tracks or have come together to plan cattle track parks. But the common problem of these projects is:

how to rediscover the ancient routes? We prove that an integrated use of archive documents and computerized cartographic tools is fundamental, referring to specific researches that are being carried out in the Italian region of Molise (Cialdea, 2007; Costa, 2011; Sarno, 2011). First, however, documents and methods are discussed, starting with the most important documentation: the historical cartography.

4. THE IMPORTANCE OF HISTORICAL CARTOGRAPHY

The first step to be taken in the restoration of tracks is to build up an historical cartography upon which any reconstruction of the cattle-track network has to be based. This reinforces the importance of historical maps for the study of the territory (Lafreniere, Rivet, 2010; Salgaro, 2013).

The cartographic heritage of the tracks is fairly substantial. Given the necessity of the time to safeguard the routes of passage of shepherds and cattle from any encroachment due to farming activity, the authorities, in modern age, insisted on the creation of maps indicating the presence of cattle-tracks as well as their condition. As concrete evidence of this we will refer to the situation of the Kingdom of Naples in the modern age. The "Dogana", above mentioned, had the task of monitoring and controlling the cattle-tracks (Pellicano, 2007). In 1447, Alfonso of Aragon ruled that the officials of the "Dogana", as well as having to collect rent payments from the tenants of the sites, had the duty of protecting and controlling the use of the sheep tracks and all the areas used for grazing. The width of the sheep tracks was established as 60 Neapolitan feet - equivalent to 111.60 metres - and stones were placed to indicate and easily locate the boundaries of the paths. Any infringement of these boundaries was punishable by death. The authorities then regularly restored the original boundaries that had been subjected to change from illegal encroachments. This activity, which began in the early sixteenth century, continued over time and consisted of presenting periodic reports on the state of the cattle-track network and in the drafting of maps. These reports are named "reintegre". They consisted mainly in taking new measurements of the cattle-tracks. The measurements were based on ancient documents as well as on the testimonies of older people who had lived long in the areas and so knew them well. Stone columns (legal indicators) were set up, on which were carved the letters R . T. (Royal Cattle- track), to mark a particular route. The reports also established the payment of penalties and fines for any usurpers of any part of the territories (DI Cicco, 2001).

The application of the "reintegre" was entrusted to Royal "compassatori", later called Royal Surveyors (Pece, 2010). They were employed by the "Dogana" and had to check the condition of the territories of the cattle-track routes. In the second half of the Eighteenth century displayed an increasing ability in map-making.

The "Dogana" therefore became the most important institution for map production and for the professional formation of map producers. The professional qualification of 'Royal Surveyor' was, in fact, obtained through the "Dogana". These technicians were thus selected and trained so as to be able to adequately carry out the task of measuring and describing the territory (Sarno, 2011). From the XVII century onwards, this cartographic production became increasingly important because it had to document the existing cattle track network in a very detailed way. This was then the basis for its restoration (Di Cicco, 2001).

The first colour maps were made later at the end of the Seventeenth century by Antonio and Nunzio Michele di Rovere for the "Atlas for the location of the Tavoliere". These maps showed lands available for rent and the location of the farmhouses. The mapping of the Royal cattle tracks, L'Aquila-Foggia, Celano-Foggia, Castel di Sangro-Lucera, occorred in 1712, during the "reintegra" ordered by the Dogana Governor, Alfonso Crivelli. Through the drafting of different atlases, the technique of representing cattle tracks was defined. This consisted of two parallel lines which ran longitudinally in the direction of the cattle track and demarcated the transit zone[8]. During the nineteenth century, when agriculture takes space to transhumance, other "reintegre" were elaborated and maps are drawn up with more and more advanced techniques (Sarno, 2011).

Today these maps allow us to identify routes which have been ruined through both time and human activity. They have not to be used only to make reconstructions of the cattle tracks in virtual transhumance museums, but also as a basis for a practical restoration and reactivation of these routes.

5. DOCUMENTS AND METHODS

Beyond the "reintegre" which other documents are useful? The three researches (Cialdea, 2007; Costa, 2011; Sarno, 2011) have common elements in the choice of documentation and methodologies[9]. The other documents used are:
- historical maps of the Italian Military Geographical Institute (1875);
- cartography of the Italian Military Geographical Institute produced in later years;
- regional technical maps or the regional technical maps as well as those used by the Land Registry Office;
- aerial photos and orthophotos.

From the methodological point of view, historical cartography is used as a preliminary to locate the topography of cattle track routes. A continual comparison is made between the maps of the modern age and those which are considered the most precise of the Nineteenth century. In this way, albeit in a virtual manner, the entire route and all the townships along the route can be reconstructed. Furthermore, the maps of the "reintegre" use a precise series of symbols to indicate taverns, fortifications, chapels and cattle pens. So the reconstruction was carried out and it is possible to retrace the cattle track network as it once was.

The GIS environment is used to evaluate changes which have occurred up to the present day (Hu, 2010; Rumsey, Meredith, 2002). The raster maps of the Military Geographical Institute can be superimposed over the orthophotos or aerial photos orthorectified and georeferenced[10]. "It is not only information relating to the maps which can be obtained but also information regarding the geology, the morphology, the state of decay, the boundaries of the woods and the type of vegetation. Today, this technique can be developed in video format through the use of software such as G.I.S ArcView 3.2 e Arcgis

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[8] See fig. 4 and 7.
[9] See also Esposito et Al, 2012, research regarding other Italian region: Basilicata.
[10] The Aerial photos are orthorectified and georeferenced in such a way that the scale of the photograph is uniform. That is to say, they can be considered to be the equivalent of maps.

which, with their applications and extensions, will allow us to extract a great deal of data and information" (Costa, 2011, p.51).

The use of GIS environment makes feasible the photo-interpretation by video of cattle tracks and their characterization. The photo-interpretation is a technique that consists of examining images of the terrestrial surface; in the case, presented in the next paragraph, the images are analyzed according to the CORINE LAND COVER nomenclature (Cialdea, 2007; Costa, 2011). The CORINE (Coordinated Information on the European Environment) programme is used to make a precise analysis of the land[11]. More specifically, a sub-programme called Land-cover is used with the aim of obtaining data regarding the state of the environment and the resources present, by making use of photographic images of the land (Büttner et Al, 2000). In relation to programme were produced maps of the Italian territory and in different regions. The fundamental nomenclature distinguishes between urban, agricultural, forested areas and it can be used case to case. In this way, different current usages of the soil can be classified and so allow us to observe how much of the cattle tracks remain in good condition**.**

In effect, this method allows to:
- identify the cattle track routes, firstly by making use of historical cartography and then through use of GIS;
- classify the conditions of the land and consequently to be able to evaluate those parts of the cattle tracks which are still visible;
- identify those areas which it would be possible to restore and recover.

6. EXAMPLES AND EXPERIENCES

We would like to highlight how the integration of the above mentioned documents and methodologies has been applied to one of the most important cattle tracks of Southern Italy: the Pescasseroli-Candela cattle track. This Royal track is approximately 210 km long and starts in Campomizzo, north of Pescasseroli in Italian region Abruzzo. A large part of route crosses region Molise[12] ending in Candela in the district of Foggia, headquarters of "Tavoliere". It followed a natural route which had previously been used by both the Samnites and the Romans. It came close to many towns and villages which benefitted from the activity of transhumance. The figure 3 shows the entire network, including the extent of its presence in Molise.

Some parts of the cattle track will be examined in detail, comparing historical maps and recent photos. In 1778 the surveyors Nicola Conte and Vincenzo Magnacca compiled the report[13] of this cattle track and now we can see the part of the track which crossed over from Abruzzo into Molise, close to the Rionero Sannitico village. Figure 4

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[11] The use of orthophotos and GIS software allows photo-interpretations of the cattle-tracks and their descriptions from the point of view of land use. The technique of points and polygons is used where the polygons represent land use based on the Corine Land Cover programme and the points indicate the rows and stone walls which are usually found along the edges of the cattle-tracks.

[12] It crosses also some districts of Italian region Campania.

[13] This map like that of the figure 7 is part of the report drawn up by Vincenzo Magnacca and Nicola Conte in 1778. This report as other is available at Archives of Foggia et Campobasso.

shows the part of the track which crossed over from Abruzzo into Molise, close to the Rionero Sannitico village. The track is illustrated according to the specific method of the "Reintegre" of the modern age: two parallel lines which run longitudinally along the direction of the route and indicate the area of transit. The brown line, which indicates an absence of vegetation due to continual usage, is further flanked by two other parallel lines indicating the maximum width of the track. These two lines are green in colour, indicating the presence of vegetation (Sarno, 2011). The surveyors also indicate on the maps their proximity to inhabited centres which can be found along the route, although they do not show the distance according to a specific scale. The sketch of Rionero, a small hamlet at the top of a hill, is placed in a close and central position to the cattle track. In the distance, sketches of another hamlet are indicated. As it can be noted, the surveyors give to the cattle track a central position in the map and they show its full extent.

Figure 3: The Pescasseroli-Candela cattle track, indicated in the map, crosses Southern Italy. (www.entroterra.org)
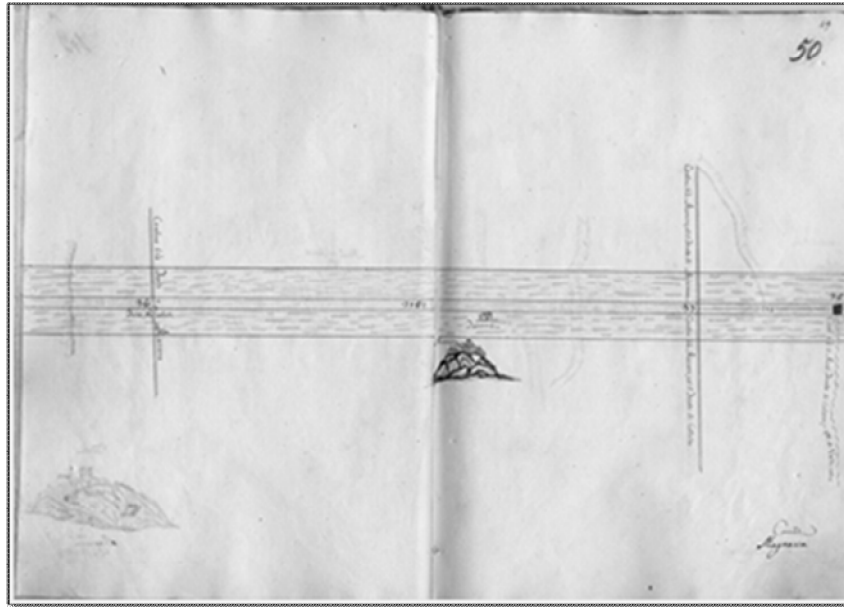
Figure 4: *The Pescasseroli-Candela cattle track near Rionero Sannitico village in the 1778 map. The track is illustrated through two parallel lines which run longitudinally along the direction of the route (Archives of Foggia)*

But what happens in the twentieth century when this cattle track, together with the others, is being used less and less by shepherds? Thanks to the methods illustrated in the preceding paragraph, the 1954 aerial photo, orthorectified and georeferenced, and the 1997 orthophoto, permit the observation of the current situation (figs. 5-6)**.** In the 1994 photo, the cattle track is still visible even though the surrounding vegetation no longer exists, and it is crossed by an irregular path.

In the 1997 photo, the track is covered over by roads and the entire area is now used for agricultural purposes. Consequently, the ancient cattle track is no longer visible. What has happened with this cattle track is an example of the destiny of the tracks in general and the elimination of the track near the Rionero Sannitico village is typical of what happened to other parts of the Pescasseroli-Candela cattle track, as well as others.

Figure 5: The Pescasseroli-Candela cattle track near Rionero Sannitico village in the 1954 aerial photo: the route is still visible even though the surrounding vegetation no longer exists (Cialdea, 2007)

Figure 6: The Pescasseroli-Candela cattle track near Rionero Sannitico village in the 1997 orthophoto: the route is covered over by roads (Cialdea, 2007)

The analysis has not stopped with the tracks which have disappeared but also deals with those few tracks which are still visible. Along the above mentioned cattle track, a part has remained very well preserved, it is the tract near the territory of Sepino village. We always consider the map dating back to 1778 (fig.7), in which this particular part of the cattle track is very clearly visible.
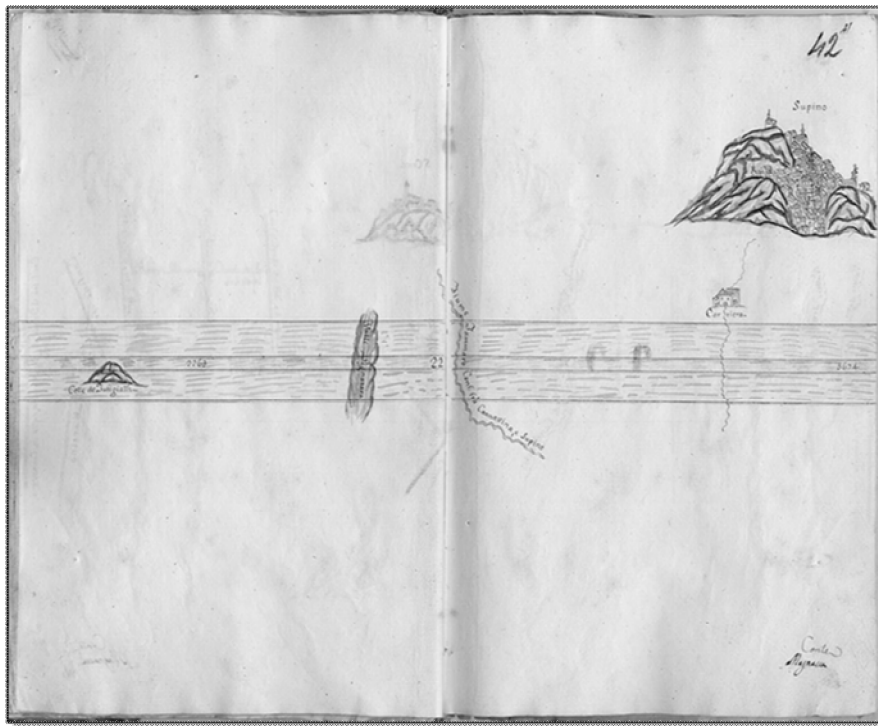

Figure 7: *The Pescasseroli-Candela cattle track near*
the Sepino village in the 1778 map
(Archives of Foggia)

The track is facing the Sepino village, lightly shaded and in a lateral position, given that it is a small inhabited area of medieval origin. The surveyors seem to highlight the two gates which gave access to the ancient Roman-Samnite site. This ancient area was no longer inhabited in the XVIII century, but it was still an transit area. The map can be compared with another dated 1887 which delineates the perimeter of the ancient site and shows the cattle track which crosses through it (fig. 8).
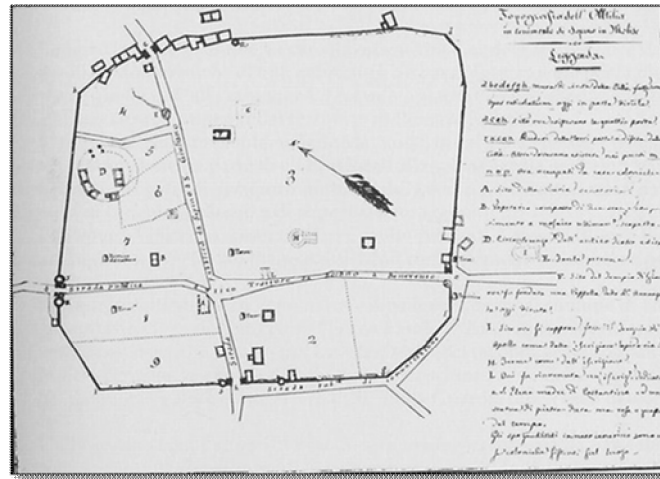
Figure 8: *The 1887 map delineates the perimeter of Sepino*
ancient site and shows the cattle track which crosses through it (horizontal line)
(Archives of Campobasso)

Now if we make a comparison with the photos of 1954 and 1997, we can see a particular situation (figs. 9-10).

Figure 9: *The Pescasseroli-Candela cattle track near Sepino village*
in the 1954 aerial photo: the route appears faded but still visible
(Cialdea, 2007)

Figure 10: *The Pescasseroli-Candela cattle track near Sepino village in the 1997 orthophoto: the route is evident (Cialdea, 2007)*

In the 1954 aerial photo, orthorectified and georeferenced, the cattle track appears faded but still in existence whereas in the 1997 ortophoto the track is even clearer and the surrounding vegetation is greener. What has happened? This archaeological site, one of the most important in Italy, has been an object of renewed interest and the cattle track which crossed it has been safeguarded and protected too.

 The comparison between images is effective for analysing each zone.   If we consider the track in its entirety to see in what condition it is in, is useful the photo interpretation of the use of land following the CORINE nomenclature, referred in the preceding paragraph.

This interpretation was applied to the Pescasseroli-Candela cattle track and the results are presented in figure 11. They indicate a notable presence of grassland, bushes and woods, which threaten the cattle track and its surrounding areas. Indeed, "The types of soil, of which the cattle track is currently composed are as follows: 31% is grassland (321 C.L.C.), 3% is arable land (211 C.L.C.), 25% is woodland (311 C.L.C.), 13% is made up of small bushes (322 C.L.C.), 7% is roads (122 C.L.C.), 2% is fragmented territory (112 C.L.C.) and 1% is constituted by riverways (511 C.L.C.)" (Costa, 2011,p.75).

Furthermore, through the use of the G.I.S. system[14] were obtained following results of the altitudinal belts of the cattle track: 68% of the Pescasseroli-Candela cattle

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[14] For this analysis is used the DEM, Digital Elevation Model, which is representation of the distribution of the shares of a territory. Between 0 and 200 metres above sea level, the first range of altitudes corresponding to the lowlands has been identified. Between 200 and 600 metres a.s.l. is the second level which corresponds with the hills. Between 600 and 900 metres a.s.l. is the third level which refers to sub-mountainous areas, and at levels of 900m and above we have the mountain levels.

track crosses hills, 25% crosses sub-mountain ranges and 7% crosses mountains. This explains the development of undergrowth (fig. 12). To sum up, only some part of the cattle track route, such as that found near Sepino, is both visible and in good condition.
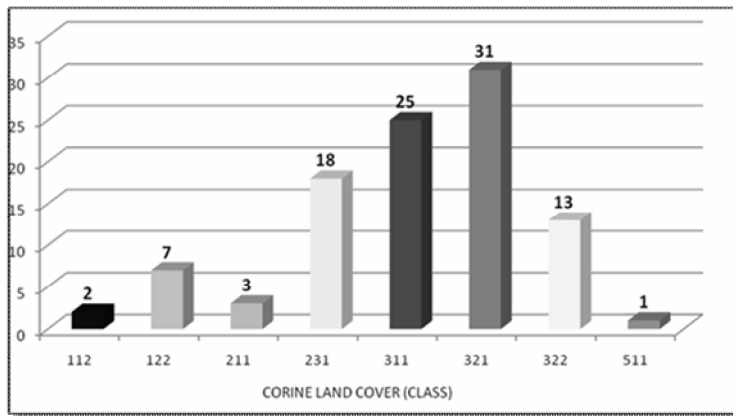

Figure 11: Analysis of the Pescasseroli-Candela cattle track, following the CORINE nomenclature, indicates a notable presence of grassland, bushes and woods (Costa, 2011)
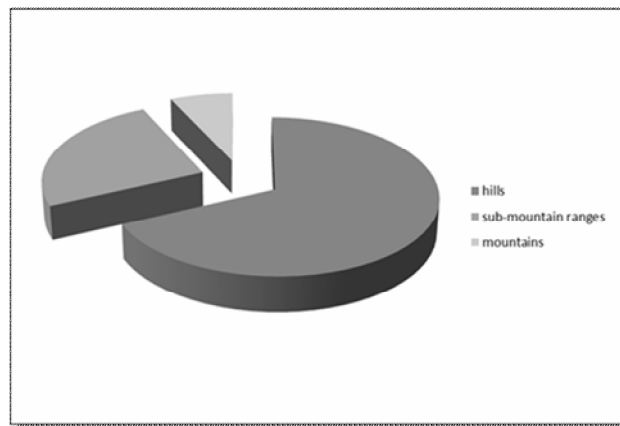

Figure 12: The altitudinal belts of the Pescasseroli-Candela cattle track (Costa, 2011)

7. FROM THE ANALYSIS TO A RECOVERY MODEL

These kinds of analysis are essential in order to obtain a clear vision of cattle track routes and represent a sound basis for the safeguarding of those parts of the tracks which are still visible and the recovery, albeit partial, of those which are not visible.

These studies and research form the basis of specific urban tools, which can be utilised   to valorise the cattle track landscape in municipal and inter-municipal projects. They have the following objectives:

- Put the cattle track routes in order by re-integrating those areas which were occupied and/or illegally fenced of;
- Create where possible protected foot and cycle paths;
- Create, along the cattle track routes, well-equipped rest areas;
- Place information signs along the routes;
- Acknowledge the value of anything of historical, archaeological, architectural and botanical importance, as well as the landscape, which are to be found along the cattle track routes.

A reading of the cattle tracks, according to the CORINE programme, above mentioned, becomes the starting place to establish which areas are to be recovered and in what way. In the case of the Pescasseroli – Candela cattle track, some sections covered by woodland and bushes can be recovered through a careful deforestation which, however, carries a cost. Such a heavy financial burden can only be faced if the cattle tracks were able to be used for tourism. Other cattle tracks territories have been used principally for agriculture. Consequently, having established their use for this purpose, the municipalities can make use of plans to expropriate those parts of the cattle track used in this way and reconvert them to cattle track land. If the tracks become a tourist attraction, can be restored partially, while the visible parts must be protected. So that, it is not necessary to recover the entire network, but simply those sections which would be of use to visitors. In addition, it would be possible to sow the original plants along the routes so that the environment can be recreated as it once was. Even the original ancient structures – stone walls, taverns and fences – could be recreated. In this way, visitors would be able to experience transhumance as it once was. These interventions have to be part of other plans and projects related to the development of local products, such as food and wine products. This would make the cattle tracks economically viable. A much more ambitious project would be to create a "network of 'organic pathways' within the protected areas, with the aim of linking the conservation of nature with the development of local commerce, promoting organic products, artisanship and new forms of hospitality" (Aloj et Al, 2007). Briefly, it is not just the cattle tracks that need to be recovered but the whole territory through which they cross, creating parks, using funds from local, national and European sources.

If such methods of intervention are applied, the cattle tracks will not just be used in a virtual sense, but more directly, as a place of culture and tourism (Aloj et Al, 2005). Even though today there is a renewed interest in cattle rearing, the cattle tracks of various European countries can represent an important factor for agri-tourism within the protected areas, with the aim of linking the conservation of nature with the development of local

commerce (Oteros-Rozas et Al, 2013). In this way, the cattle track landscape will find the new value.

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