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TRANSHUMANCE ROUTES IN TUSCANY. CARTOGRAPHY, PLACE NAMES, VIRTUAL LANDSCAPING

Fulvio LANDI, Lidia CALZOLAI [*]

**University of Florence, Italy*
e-mail: fulviolandi.geo@gmail.com, lidia.calzolai@gmail.com

Abstract: *Transhumance routes in Tuscany. Cartography, places names, virtual landscaping.* Livestock transhumance, practiced for centuries in vast areas of the Mediterranean Europe, is a founding element in the history of many farming communities and has contributed in shaping landscape. This article presents two studies that retrace the ancient routes used by shepherds and their flocks in Tuscany (central Italy). The first study, through the use of several historical sources, has led to the creation of a transhumance route and toponym map on a regional scale. The second study, closely linked to the previous one, focuses on virtual reconstruction of the historic landscapes associated with these routes, through the extensive use of modern geographical analysis tools, such as GIS and 3D reconstruction software.

Rezumat: *Rute ale transhumanţei în Toscana. Cartografie, nume de locuri şi peisaje virtuale.* Transhumanța practicată de secole în Europa mediteraneană este un proces des întâlnit în istoria numeroaselor comunități de fermieri şi a contribuit în mod direct la transformarea peisajului natural. Acest articol prezintă două studii de caz ce refac vechile rute ale transhumanţei în Toscana (centrul Italiei). Primul studiu, prin utilizarea surselor istorice, s-a concretizat în realizarea hărții toponimelor şi a rutelor la nivel regional. Studiul secund, strâns legat de primul caz analizat detaliat, este centrat pe reconstrucția virtuală a peisajelor istorice asociate acestor rute prin utilizarea metodei GIS şi a softurilor informatice de reconstrucție 3D.

Key words: *Transhumance routes, Tuscany, Cartography, GIS, Virtual Landscaping*
Cuvinte cheie: *rute ale transhumanţei, Toscana, cartografie, GIS, analiza virtuală a peisajului.*

1. HISTORY SO FAR: FROM TUSCAN TRANSHUMANCE ROUTES TO HISTORICAL MAREMMA VIRTUAL LANDSCAPES

Livestock transhumance, a phenomenon that involved the entire Mediterranean perimeter, was also active in Tuscany until the mid-twentieth century. Here herds moved from the Apennine mountains to the Maremma planes through a warren of narrow streets that have profoundly marked the agricultural landscape over the centuries. Since the Middle Ages, livestock flows had to go through predetermined routes, where tax checkpoints were located and transit and pasture access tolls were paid for. The reconstruction of these ancient roads is not only a contribution to historical knowledge, but also an operating tool for promotional policies, it helps increasing awareness of the area's specificity and landscape economical potential as a production factor.

This article is a report on the above mentioned meticulous researches that have shed light on the extraordinary development of this practice in Tuscany. A vast project grounded on solid knowledge which has also launched a new study phase, based on a mixed methodology which combines the use of historical records with modern tools such as GIS and, above all, 3D software for creating virtual geographic environments. The first part of this essay summarizes the multi-year geo-historical survey led by Paolo Marcaccini and Lidia Calzolai, related in the book *I percorsi della transumanza in Toscana*. (Fig. 1)

Figure 1: *Cover of the book "I percorsi della transumanza in Toscana", published in 2003 (Marcaccini, Calzolai, 2003).*

After highlighting the general characteristics of this phenomenon, the main stages of the study are summarized. These steps led to the creation of a real transhumance route regional map, a network of paths and trails spread over most of the Tuscan territory. As evidence of this secular activity, the main paths used by shepherds in their journey from the mountains to the Maremma area are described, as well as the numerous toponyms still used throughout the territory, the dissemination of these latters contribute to the investigation of many aspects of transhumance society, its rules and its habits.

The second part of this article focuses on the recent collaboration between LabGeo, the Applied Geography Laboratory of the University of Florence, and the Province of Grosseto on a virtual reconstruction of some historic landscapes pertaining to the ancient transhumance routes. As a matter of fact, LabGeo is currently working again on these Tuscan routes, in the belief that they can be viewed as cultural assets and resources which will trigger a new promotion of the local rural areas.

Today, the production and knowledge dissemination through effective communication strategies, that can be used in consultation procedures for touristic development of a territory or for specific educational applications, become more and more important. In this perspective, the combined use of GIS technologies and 3D rendering software become very useful, because they enable historical data management, highlighting the transformation processes and creating immersive environments of great communicative effectiveness. Their use therefore deserves to be tested with scientific accuracy, since their potential is steadily increasing thanks to the constant progress in computer graphics and in Information Technologies in general.

The hope is that these studies, such as the one resulting from this cooperation, promote the strengthening process of territorial identity, with positive effects on system actions, such as territory care and protection, relationships between companies, citizens and local governments, social cohesion, product concept and quality control.

The results of this project are, therefore, dedicated to the entire population of the involved area, especially to companies related to the farming industry; farm hotels and ecotourism activities; local organizations and offices; insiders and tourists, with particular reference to those who practice rural, cultural and sustainable tourism; and, finally, to middle and high school students.

2. TRANSHUMANCE IN TUSCANY, GENERAL ASPECTS

Tuscany too, as many other Italian regions and the mountain areas of the Mediterranean sea, has experienced the transhumance phenomenon. The climate characteristics and the location of the mountains, have favoured the breeding of large amounts of livestock through the integration of summer pastures, set in the mountain areas, with the winter ones, located in the plains. The Apennine mountains, densely populated, were standing on an agro-forestry-pastoral economy which found in seasonal migration an essential complementarity.

In September, herdsmen moved to the Maremma area and returned to the mountains in May when the stay in the malarial plains would be too harmful to health.

The term 'Maremma' commonly evokes a dangerous place from which it is likely never to come back, as still underlined in many local proverbs, idioms and popular songs.

Herds, consisting mainly of sheep, but also horses, pigs and cattle, moved under the supervision of shepherds, boys, dogs and were followed by carts carrying household goods. In Tuscany these migrations took place mainly between the Apennines and the Tyrrhenian coast, including the Maremma area, less towards the Adriatic. The name Maremma, which today is linked to the province of Grosseto, comes from a common name: *maritima ora* (coastal area) and it represents the wreck of a broader territorial reality. Still in the eighteenth century it began North of Viareggio, and was characterized by the presence of wetlands, with high and very thick bushes, where human settlements could not be continuous due to malaria outbreaks. Land could only be used for extensive pastures or grain farming.

Several reports from the nineteenth century emphasize the interdependence of the Apennine Mountains, which were overcrowded and lacking of sufficient products on their territory to feed the entire population, and the Maremma region characterized by sparse population and therefore with ample pasture opportunities[1]. However, the environmental complementarity between poor and marginal regions in the Tuscan context is not fully explained with the role played in the past by the transhumance phenomenon, which went far beyond the simple mechanism of integration of a mountain economy, based on subsistence and with no other outlets. Transhumance has its origins in ancient times. Recent studies have, as a matter of fact, unearthed a series of pastoral settlements in caves and outdoors along the Apennine axis ascribable to the Bronze Age. In the Tuscan area the most important site is the Monte Cetona one, in the Province of Siena. At present, we know little of this phenomenon in ancient times, however, an antique inscription found in Sepino (in the province of Campobasso), refers to a flock transit entrusted to the management of *conductores* of libertine extraction. We also know that some merchant-business men, like the Roman Cato and Varrone invested in breeding transhumance and wool cloth. We are still missing transhumance reports of the High Middle Ages, although it is possible to assume a continuity of this phenomenon, favoured by the decline of coastal plain vast stretches, due to the decrease of crop cultivations and the dereliction of hydraulic regulation.

The oldest documents regarding this phenomenon in Tuscany date from the late twelfth century and talk about flocks coming from Garfagnana, Pistoia, and the Casentino area. News increase from the second half of the fourteenth century, when the city of Siena began to gradually replace the local lords in pasture sale.

Transhumance, actually, was not always a free passage from the mountains to the Maremma area. From the fifteenth century onwards it was regulated by a series of legal and administrative rules dictated by the state apparatus, which made a considerable profit out of it. The Republic of Siena, that replaced the City Council, which at that time ruled over the Maremma area, definitively codified the use of pastures through its lands in 1419 with the drafting of the *Primo Statuto della Dogana dei Paschi* (the First Pastures Customs Statute), which regulated the schedule and access points according to where the shepherds were coming from. The Statute also divided the territory in four pasture areas in which shepherds would have to move according to a predetermined schedule. It established a *fida* or more simply a fee for each livestock item, and established the checkpoints in which to count livestock, which were called *calla*. All this brought to the city an income of fifteen

[1] See, Moreniana Library in Florence, *Considerazioni sopra la popolazione antica e moderna delle Maremme Toscane*, Fondo Bigazzi, 85, 1.

thousand *golden florins* (ancient Florentine coin) a year, a sum «che gettava maggior frutto alla comunità e singolari persone della città e del contado di Siena» (Imberciadori, 1971)[2]. In exchange, Siena allowed shepherds to bring back all their animals, newborns included, to carry wool, skins, and cheese without paying any duties, allowing their return to their places of origin with their capital intact. Every member of the shepherd community was also allowed to open a tavern for the sale of basic necessities without having to pay taxes. These price reductions were necessary to prevent shepherds from going to other areas, such as the nearby Papal State pastures, in the Lazio region Maremma areas.
For their part, shepherds complained about the lack of profit, which ended all in taxes to pay every time they crossed feuds or communities. Despite repeated regulations designed to prevent tax evasion and frauds, it was, nevertheless, arduous to prevent shepherds' skills in circumventing laws and controls (Calzolai, 1998).

Siena ran the Maremma pasture lands for more than three centuries, from 1419 to 1776, and then the liberalization period of the Grand Dukedom of Tuscany started. With the demographic recovery of the mid eighteenth century and the rise of wheat prices, the Lorraine Regency looked at the Maremma countryside and planned on strengthening their agriculture, without dramatically damaging the ancient balance between the mountains and the Maremma area, whose economies were still highly interdependent. The ancient routes were thus preserved, but large areas of pasture were privatized, the *dogana* (customs) pastures, the collective easements, and the civic uses (perpetual pasture or forest rights reserved to members of a community) were abolished. However, livestock transhumance phenomenon did not end, but remained active until the fifties of the twentieth century. In the twentieth century the journey to the Maremma area took about 7/10 days depending on the routes. They would travel about 25 km a day, stopping for the night at farms, inns, convents or parishes. Here they would improvise an *addiaccio* (a pen to keep cattle at night) and ate dinner. In return for the hospitality, they would leave some manure for fertilization and all the milk milked during the day and that, for some taverns placed in strategic locations and particularly popular, was a real bargain.

The Land Reform, which affected all the Maremma area in the second half of the twentieth century, eliminated the latifundia, putting a definitive end to the fallow lands and nomadic farming. This is when transhumance in Tuscany ended which, as we have seen, were not only an economic phenomenon, but also a real civilization, with legal institutions, thoroughfares, eating habits, settlements, languages, and milk processing techniques (Ciuffoletti, Calzolai, 2008). (Fig. 2)

3. TRANSHUMANCE ROUTES IN TUSCANY. DECENNIAL RESEARCH SUMMARY

With a project that lasted several years, we set out to identify the roads that were covered by the transhumant population in Tuscany during the months of September and May, between the sea and the mountains, trying to bring out their continuity of use over time (MARCACCINI, CALZOLAI, 1994, 1995, 1998, 2003). This was not only done to give a vital contribution to the historical knowledge of the area, but also to provide an

[2] "which brought great benefit to the individuals and the whole community of Siena and its countryside".

operational tool for those Public Administration offices which wanted to use this information for the development of tourism, recovering these routes open to the whole community.

Figure 2: *Transhumants shepherds in Maremma make cheese outside their hut (Source: private collection, 1925).*

In Tuscany, a road network of this kind must have already existed in the Etruscan times, in relation to their intense exchanges between the cities on the Tyrrhenian coast and the Adriatic one and, in any case, with the various Apennine populations. Along some of these routes, as a matter of fact, many Etruscan archaeological finds have been unearthed: for example, the votive offering found on Lake Idoli near the river Arno source on Mount Falterona, or the so-called Sasso Scritto (written rock), which is an Etruscan inscription found on the hills of Florence. The reconstruction of these ancient routes was based on the use and integration of various documentary sources, such as historical maps, oral histories, archival and literary sources. The information thus derived was initially transferred to a cartography map on a scale of 1:25,000, kept in the Military Geographical Institute, updated by the Tuscan Region in the late nineteen seventies. From an operational point of view, this kind of mapping proved to be not an optimal one, since there often was a great scale difference when compared to the main historic cartographic sources used (such as maps of the Vecchio Catasto Terreni on a scale of 1:5,000). The fact that the used data was not updated, was another serious issue during ground investigations, as it was lacking the new road layouts and new touristic facilities. On the other hand, these obsolete maps have often helped in the track transferring, since they retained much of the old road network, even if sometimes it was reduced to path fragments and cart tracks. The research first step

involved the Province of Grosseto and was focused on tracking down the old public roads with particular regards to those streets that were used to transfer livestock. (Fig. 3)

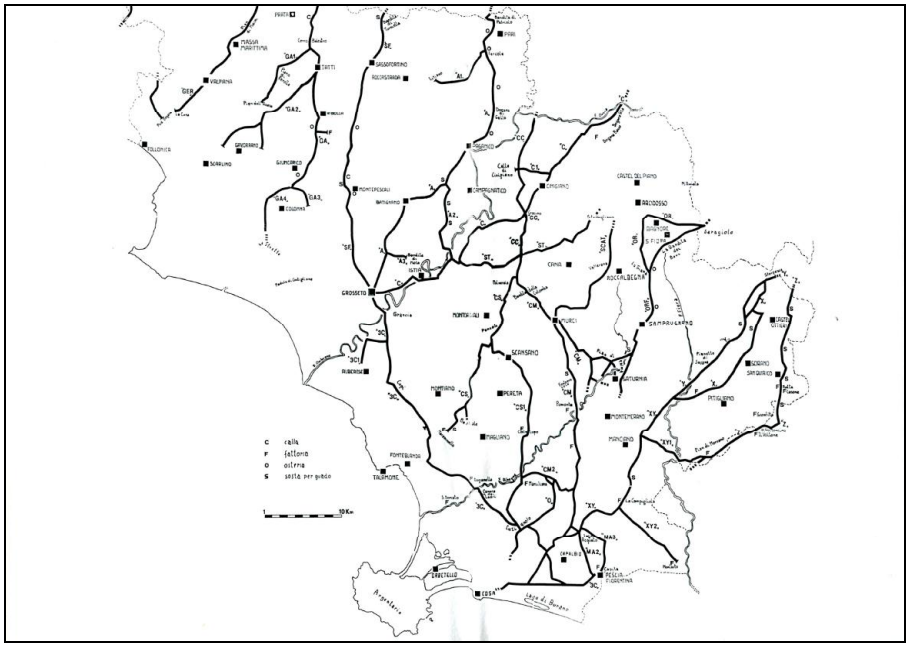

Figure 3: *Transhumance routes in Maremma, Province of Grosseto (Source: Marcaccini, Calzolai, 1994).*

The documentary source cross referencing was paired with systematic ground surveys which gathered evidence on the specific use of these ancient streets. Moreover, the identification of place names which were not reported on the official maps, but which were still used on site, has helped to bring out the pattern of the original viability used for animal transfers (Maracaccini, Calzolai, 1994).

The resulting expansion of this research to the entire Tuscan region has required a more intense use of several sources. Information coming from people who have actually accomplished livestock transfers on foot proved to be particularly useful. This intel was collected during several years of interviews, and has confirmed the relatively recent use of these ancient paths. The dense network of these toll roads was, at the time of the eighteenth century liberalization, merely described and not traced, so it was not easy to locate it cartographically. Not all of these paths were in fact registered as such in the Leopold Cadastre (the aforementioned Vecchio Catasto Terreni, wrote between the second and fourth decade of the nineteenth century), which confirms an incipient process of occupation and obliteration of this road network. The final result of this long study has led to a new map georeferencing, from the initial one in 25,000 scale, to a subsequent one published in scale 1:100,000, which is a more suitable format for a regional scope analysis. (Fig. 4)

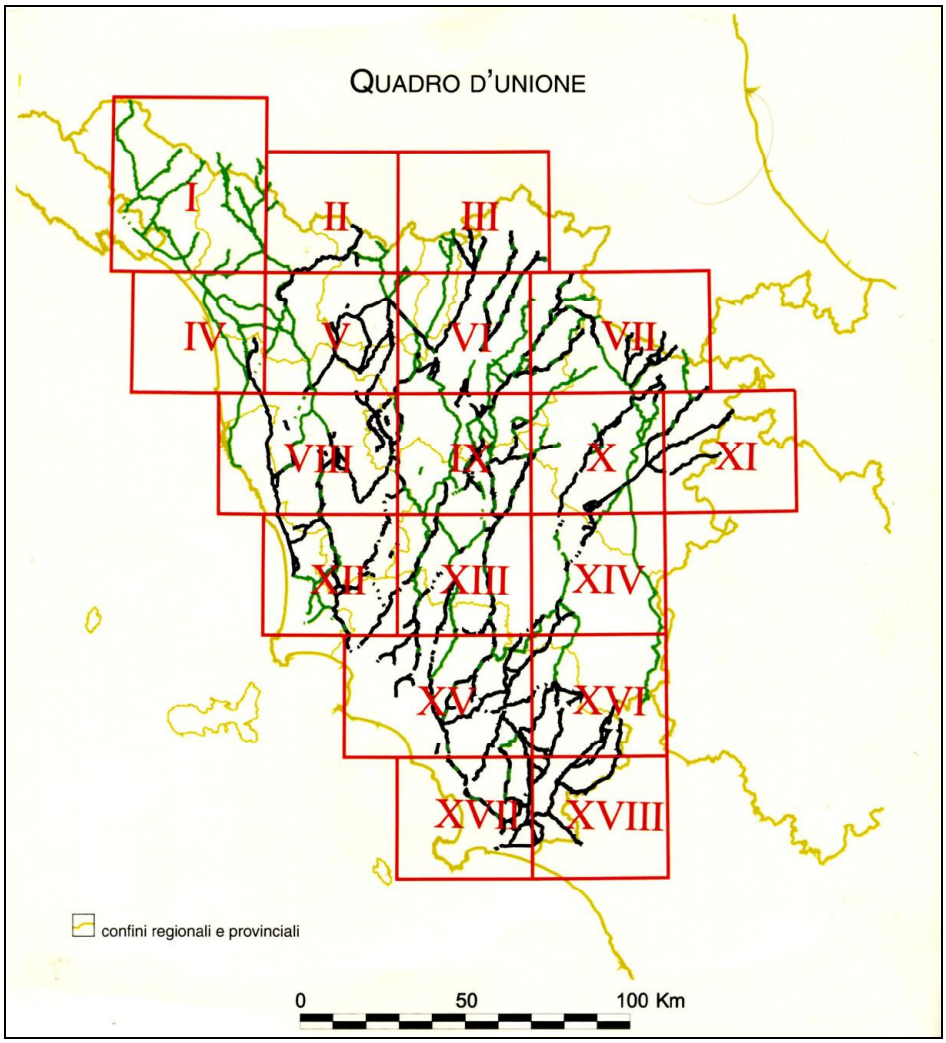

Figure 4: *Map of transhumance routes in Tuscany, overview (Source: Marcaccini, Calzolai, 2003).*

It is made of 18 charts in all, and they show pasture routes, places of interest such as churches and convents, taverns and hospitals, crossing places, customs and *calle*, archaeological sites, ferries, fords, lodging places, and resting areas. The dotted green routes show the roads discovered during the interviews of the last surviving shepherds; the black ones come from archive and cartographic sources prior to the twentieth century; the green-black ones come from old or new quotes; the simple dotted ones trace the presumed shepherd routes based on the ancient road network. (Fig. 5)

Figure 5: *Map of transhumance routes in Tuscany, chart XVII, detail (Source: Marcaccini, Calzolai, 2003).*

4. ALONG THE MAREMMA ITINERARIES: AN OVERLOOK ON THE MAIN ROUTES

The road network used for the transfer cycle consisted of a series of main roads, which branched at their ends; in correspondence of those seasonal stationing areas, as pastoral attendance had wide spatial characteristics. In the Apennine area, the main transhumance roads latched with roads from the neighbouring regions and with many local paths coming from villages located in the secondary valleys. But once out of the summer stationing basins, flows concentrated along some main roads or old abandoned roads. Livestock final destination was always the Maremma area.

Just like shepherds seasonally moved to Maremma, many other people who had to supplement the limited resources offered by the mountains they lived in, moved there. These worked as harvesters, diggers, woodcutters, coal men etc. Also, in May, *tosini* (sheep shearers) moved to Maremma and went through the various farms to carry out their jobs before returning to the mountains. (Fig. 6)Unfortunately, from the Middle Ages all the way to the Modern Age, bandits and exiled people joined the shepherd caravans, seeking impunity in the distant Maremma grasslands.Flocks came from the whole Apennine

mountains: the Lunigiana, Garfagnana, Mugello, Casentino, Val Tiberina, Montefeltro, and the Perugino areas. But they would also come from the Emilia region passing from the Cerreto and Lagastrello Pass, from the Romagna region passing from the Futa, Colla di Casaglia, Muraglione, Viamaggio passes.

Figure 6: *Sheep shearers (tosini) at work in Maremma (private collection, 1910).*

Meaning to reach the coastal areas from the large mountain range arch enclosing Tuscany, one should come down the plains crossed by the Arno river or by some of its tributaries, such as the Canale Maestro in the Chiana area. It is exactly in those locations used to cross these rivers, and especially those where it was convenient to even build bridges, that tax checkpoints were situated.

Livestock movements covering the Florentine countryside, could cross the Arno river only through the few existing bridges and that is where customs were located. Here the animals were counted and the *bullette* (transfer receipts) were compared with the permission to pass previously asked at Florence customs. Sure enough, in addition to herd payment, the transiting flocks were subject to duties like any other good. Those coming from the Val di Serchio or the Tyrrhenian Sea coastline had to pass from Pisa. Until the mid-twelfth century, the city had only one bridge which crossed the Arno river and it was here that herds would pass under the supervision of a *pubblico passeggero sopra il bestiame* (customs police officer). People coming from Pistoia and Modena, having paid toll in Galleno, could cross the Arno in Calcinaia or Fucecchio. The importance and the use of these places is highlighted by the presence of many taverns: Osteria Torretta, Osteria del Marmigliaio, Osteria Acqua Bona, Osteria del Malandrone. Once in the Era valley one

could finally reach the Volterranean Maremma. For those coming from the Firenzuola and western Mugello mountains, entry into the transhumance routes was at Florence gateway. Shepherds coming from the eastern Mugello area, Casentino, the Romagna valleys of Lamone and Montone, had, however, to pass from the bridge located in Rignano. The route that began from here was considered one of the most important transhumance ones in the whole region: the *Via Maestra dei Vergai*, also known as the *Strada della Dogana*. This thoroughfare crossed the Chianti side, Siena and reached Paganico, obligatory entry point into the Maremma area for shepherds coming from this way. Still in the nineteenth century, the importance of this *Via Maremmana*, also known as the *Via dei Pecorai* or *Via dei Maremmani*, was attested by the fact that it was used by almost two-thirds of the shepherds going to Maremma. The Chianti area was a converging point for numerous migration flows, which joined in this area and then, after having crossed it, diverged again. Through the Chianti side, in fact, despite the presence of numerous valley gorges, you can reach the Maremma region coming from the Mugello, Casentino, and the high Valtiberina areas always walking through mountains. (Fig. 7)

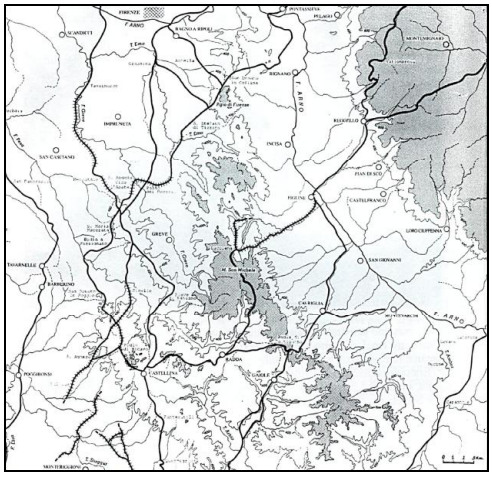

Figure 7: *Transhumance routes in the Chianti area, between Florence, Arezzo and Siena (Source: Marcaccini, Calzolai, 1995).*

In order to reduce inconveniences caused by excessive route lengthening and damage associated with flock concentration, flocks coming from Val di Bagno and the eastern Casentino area had to pass from Arezzo (the checkpoint was in the village of Ciggiano). From Arezzo you could reach Maremma through the Asso valley. Along the *Antica Strada Senese-Aretina*, also known as the *Strada Pecoreccia*; flock passage continued until the mid-twentieth century. From here definitely passed the big flocks made of thousands of items belonging to the Camaldolesi monks, which were transferred from the mountain pastures every year to their possessions in Magliano. Also from Arezzo, when the final destination was in the Lazio region pastures, which once belonged to the so-called Papal State Heritage, the followed shepherds' route was the easternmost one among the Tuscan ones. It passed through the Val di Chiana, crossed Cetona and finally reached the Viterbo Province.

Generally, these herd qualified roads enabled the passage of flocks through an additional track, this could be several meters wide to allow grazing during the transfer: the road therefore was flanked by a real herd lane which eased all transits. If this feature was slightly noticeable in the inner Tuscan routes, full of cities, and with intensive agriculture areas which had developed since the Middle Ages, it was decidedly more visible in Maremma where these extra lanes, which were real tracks, could even be a hundred meters wide. Through the different epochs, law never failed to compel pastors to select the wider streets and places *<<che si levino l'occasioni il più che si può di far dei Danni>>*"[3], even sometimes pointing out the exact route and places to be avoided because of their being intensively cultivated. All the way to the twentieth century, the tendency was to prefer, when possible, roads that crossed fallow areas or woodlands. With Leopold's late eighteenth century liberalization policy, these large track lanes, as well as the state-owned toll pastures, were all privatized. Nevertheless, in order to ensure transhumants the opportunity to make their journeys, a road network and a whole set of structures traditionally used for this purpose, were encoded together and livestock rest areas were added and usually set near the major waterway fords.

As a consequence, the roads to Maremma were no longer influenced by fixed entrance points and, thanks to the facilitation provided by the construction of new bridges over the Arno river, new routes replaced the old ones especially in the external areas. The path selection was also influenced by other factors, such as the presence of thermal baths or the presence of relatives or acquaintances along the way. Overall, routes remained fixed according to ancient customs. With the industrial revolution, also the Maremma road network was heavily reorganized: some roads were upgraded to carriageways and new streets were inaugurated.

At the same time its identification as *Via Maremmana* fell into disuse, surviving only in some cases. This is also when the secular interdependence between mountain and Maremma ended. We can still find traces of this intense bond in the lands and villages of the Province of Grosseto which are still set along these ancient paths, and where you can easily meet mountain families.

5. PLACE NAMES AND TRANSHUMANCE: DIFFUSION THROUGH THE REGIONAL AREA

Toponyms linked to transhumance were determined by the route names the flocks were to follow, by the tax checkpoints, and by pastoral life habits.Despite the sad Maremma stereotype as an area of no economic value, a place of worthless investments, bad for health; there was a considerable number of streets called *Maremmana* all over Tuscany, even far away from the seaside, clear evidence that relations between the coast and the rest of Tuscany had to be intense. This name not only expressed a geographical place but also the specific location purpose (Calzolai, 2015). For example, the *Marmana* mule track marked the beginning of the long journey to the Tuscan coast for those shepherds coming from the Emilia region. We can also find a *Strada Maremmana* just South of the town of Borgo San Lorenzo in Mugello.

[3] "let's try to minimize damage when possible". See: *Statuto della Dogana di Firenze che forma la seconda parte di quello del 1577. Pubblicato il dì 4 Marzo 1579. Ab Incarnazione,* in *Legislazione Toscana*, Part 9, page 238.

Another widely used *Via Maremmana* is the one used by shepherds from the eastern Mugello and Casentino areas. Along this route one can find the *Passo dei Pecorai* (Shepherds' Pass), by the Osteria Casprini, where shepherds crossed the Greve river. This main route connected with others coming from the western Mugello area, and they all crossed the Arno River in *Nave* (a boat) a Rovezzano (boat crossing point of the Arno River in the absence of a bridge). Those who then continued to Bagno a Ripoli crossed the Borro dell'Antella on the so-called *Ponte alle Pecore* (Sheep Bridge).

The importance of this great shepherd road was certified in 1827 by the recognition that it «serve di comunicazione a due comunità ed a quasi due terzi degli abitanti della Maremma senese che per due volte l'anno devono, con tutti i loro bestiami e masserizie, transitare per questa strada per loro indispensabile» (Casprini, Guerrini, 1989)[4]. Near the toll points, next to the *Via Maremmana* we often find names like *Via di Dogana* (customs road) or *Via delle Calle* (livestock counting checkpoint). Between Fucecchio and Galleno (compulsory transit point for shepherds coming from the Pistoia mountains) there is also a *Via del Mandriale* (herd road). More than one *Via Dogana* (also *Via di Dogana* or even *Via dei Cavallari* - herdsman) can be found between Mount Falterona and the river Arno, while in Reggello we find the names of *Strada* e *Ponte della Dogana* (customs road and bridge) as it was the route used by those coming from Mount Pratomagno. In Mount Falterona there is also a street called *Strada di Bocca Pecorina* (Sheep mouth road) that descended and joined, along the upper course of the Arno river, with the various *Strada Dogana* e *Maremmana* (Customs and Maremma Roads) (the name appears indifferently also within a short distance along the same itinerary) coming from Bagno di Romagna and the Tiber Valley.

Sometimes the names of these locations indicated the shepherds' place of origin, as *Via dei Romagnoli* (people from the Romagna area), along the Corella Alp (Dicomano, Mugello), used by those coming from Campigno (in the Marradi county, on the border with the Romagna region); or the use that some great breeder made of them, as in *Via dei Biozzi*, that is the route coming from the Marecchia Valley.

Still in the mountain areas we can find more themed names in the area between Casentino and Valdarno like: *Passo della Calla*, *Madonna delle Calle*, *Calleta* and the eponymous river (where sheep were probably counted as they climbed up to the pastures in Mount Pratomagno relating to the Castel Focognano community), *Pian delle Calle* in Raggiolo where city councillors counted the foreign livestock coming to graze on municipal property. The roads connecting internal Tuscany with the coast, once entering the Grosseto area, mainly took the name of *Vie di Dogana*. For example there is the *Via Dogana di Sassofortino* which lead to *Calla di Montepescali* and also accessed the Bruna river plain. This toll road reached the Sassofortino castle, where names like *Pozzo alle Pecore* (Sheep Well) still remembers the place where these animals were washed before shearing. It is also worth mentioning another *Strada Doganale di Porrona e Cinigiano* (Porrona and Cinigiano toll road), direct continuation of the great pastoral route coming from the Val di Chiana, leading to the *Calle di Cinigiano* (Cinigiano counting point), where there was a toll place leading first to the high pastures and then the low ones in Maremma. (Fig. 8)

[4] "connects two communities and nearly two-thirds of the inhabitants of the Siennese Maremma area who twice a year must, with all their livestock and household goods, pass from this fundamental road".

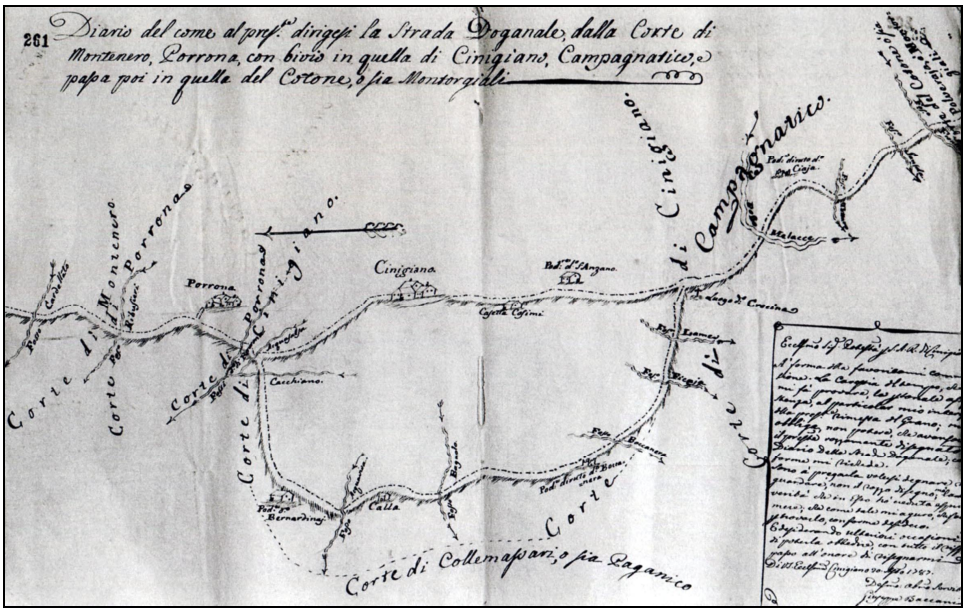

Figure 8: *Toll road Porrona-Cinigiano in a map of XVIII century, detail, Grosseto State Archives, Uffizio dei Fossi, 543, 1787 (Source: Marcaccini, Calzolai, 2003).*

Toll roads increased in the Province of Grosseto granting access to the floodplain: *Via Dogana dalla Crocina al Pian de' Meli, Via Dogana di Pancole* which brought to Pian dell'Osa, *Via Dogana da Pancole* passing from Scansano and Marsiliana, *Via Dogana da Pian de' Meli al Lago Acquato, Via Dogana da Murci a Saturnia*. We can also quote those roads leading to Sorano, Manciano and the upper Lazio region, where the pastures owned by the Church were: the *Via Antica di Dogana che da Radicofani andava a Sorano*, the *Via Dogana di San Quirico*, and the *Via Maestra di Dogana* also called *Via Pastorina*, the most important foot route of the Manciano territory. Finally, South of the Ombrone river, there was the *Strada Doganale del Malpasso*, which ran parallel to the coastline and worked as a final route to many paths coming from the inner lands.

Besides these names, we also find terms related to taxation, such as *Gabella*, *Passeggeria* and *Catena*. We know that shepherds went to great lengths to avoid paying taxes, like forcing officers to let the flocks pass without a thorough check or crossing the checkpoints at night to completely evade taxes. For this reason, the City of Florence came up with a resolution in April 1474, which required that all transit bridges were closed up with chains at night[5].

We find the name *Catena* (chain) south of the Arno River, near Ponte a Egola, where several herd roads coming from the Pistoia Apennines converged, there still is a *Ponte delle Catene* (chain bridge) in Formoli, in the Serchio Valley. The name *Gabellino* has instead survived near Tatti, in Massa Marittima municipality. Other names deriving

[5] See: Florence State Archives (ASF), *Provvisioni, Registri*, 165, 26 April 1474.

from transhumance indicate the places where flocks were stationed, like *Diaccio, Mandria, Mandriale* (livestock pen and herd) or shepherds' shelters, like *Capanna* (hut) or *Vergheria* (pastoral hut with tools for cheese processing and storage). On the Apennines between the Senio and Santerno rivers we find *I Diacci* (livestock pen), *Mulino dei Diacci* (pen mill) and also *Capanna Sicuteri* (Sicuteri Hut) (named after a family of great Mugello breeders). (Fig. 9)

Figure 9: *Livestock pen "I Diacci" on the Appennins near the Mugello valley (Source: Marcaccini, Calzolai, 2003).*

These location names become more frequent when approaching the final destination. As in *Via delle Mandriole* (Herd street), *Poggio alle Mandrie* (Herd hillock), *Diaccione* (big pen), *Diaccino* (small pen) between Cecina and Massa Marittima, where we also find a *Capanna dei Parmigiani* (Parma people's hut) proof of the passage of shepherds coming all the way from Parma.

6. THE "FROM THE MOUNTAINS TO SEA" PROJECT. VIRTUAL TRANSHUMANCE LANDSCAPES IN MAREMMA

The final and most recent phase of this transhumance in Tuscany multi-year research, focused on virtual reconstruction of some traditional historical landscapes in Maremma. This phase was possible thanks to an agreement between the University of Florence and the Rural Development Area office of the Grosseto Province, its aim is the promotion and economic development of the local territory, the construction of cultural and touristic routes, and the activation of local business networks[6].

The basic idea is that landscape represents an added asset for local economies, from there we wanted to investigate this aspect following a historical and geographical approach, through the 3D reconstruction of some ancient transhumance route sections. These paths, as a matter of fact, still cross extraordinary places and sceneries, though less known, and give the chance to appreciate high quality local foods and crafts. Maps, historical documents and photographs, agro-forestry and farming practices, rural traditions were then used for the building of a cognitive tool with which to increase awareness on the territory, of its peculiarity and its landscape economic potential as a productive asset.

The ancient paths were rebuilt and represent today the red thread that allows, once again, to promote territory excellence, its traditions, its touristic and cultural value.The study focused mainly on some specific itinerary sections along the whole province and characterized by different landscape features: like the *Via Montana da Arcidosso a Roccalbegna* in its passage across Mount Labro, on the Southern Mount Amiata spur (in the Arcidosso and Roccalbegna municipalities); the *Via Dogana Maremmana* at the river Fiora ford, in the ancient tuff Etruscan *Vie Cave* lands (in the Sorano and Manciano municipalities); *Via dalla Marsiliana a Capalbio* in the Conicchio area, a rural area close to the seaside nestled in wooded Mediterranean scrub hills (Capalbio municipality).

Along these routes, already travelled by eighteenth century shepherds and actively used until the mid-twentieth century, some areas of specific interest have been outlined, and their historic landscape was reconstructed in three dimensional detail (Fig. 10).

The proposed service accomplished a series of cartographic information layers on the analysed routes, the generation and population of three virtual environments relating to each one of the studied areas, and to a series of rendering (in the form of images and films) which properly illustrate the whole virtual reconstruction. The results of this study were presented by the Province of Grosseto to EXPO 2015 (Fuori Expo Toscana, 2-7 June 2015) and will be hosted within the web portal of Centro METE, the Cultural Enogastronomic Maremma Center (http://centromete.netspring.it/home/), which is dedicated to the spread of the many assets of the Maremma territory and to the strengthening of those local economic activities connected to this heritage.

[6] This agreement is part of the activities related to the "TERRAGIR 2" Project, within the cross-border cooperation "EN-FR MARITIME 2007-2013" program, which involved various Italian and French regions and provinces of the Mediterranean area.

Figure 10: *Boundary of the three itinerary sections chosen for the project (Source: Google Earth, 2015).*

7. 3D RENDERING OPERATIONAL PHASES

The survey on selected historic transhumance route landscapes has used a set of sources of different origin, acquired, analysed and processed with the appropriate tools, in order to synthetically reproduce the appearance of the studied area during the nineteenth century. Cartography and iconography are often one of the best historical documentation tools when it comes to reconstructing features and local land use. Moreover, they also help locate specific place names and geographical facts still existing in the current landscape. These documentary productions require, though, for a proper usage, an assessment of the "thousand wires" that connect them to society, local knowledge, and its practices. Therefore, this study paid special attention to the production process context affecting the selected iconographic sources (commissioning, production purposes, choices made in the graphical depiction of the territory), through their placement in a wider documentary series able to provide useful information for a correct interpretation of the same frame in which sources are located.

Among the cartographic sources used, the main one was definitely the General Tuscan Land Cadastre. Also known as "Vecchio Catasto Terreni", "Catasto Particellare Lorenese" or, more simply, "Catasto Toscano". This modern cadastre of geometric parcel nature, was built between the second and fourth decades of the nineteenth century and consists of large-scale maps (1:5,000, 1:2,500) in which the regional territory is divided into plots (*Particelle*) identified by a serial number and by registers, in which parcel data as shown in the map is reported (*Campioni*, sorted by owner and *Tavole indicative*, organized by parcel).

The whole set of documents is an inexhaustible resource for the history of agriculture in Tuscany during the nineteenth century, providing detailed information on agricultural landscape framework and regional land arrangement before the great twentieth-century transformations. The great importance of this documentary heritage is heightened by the fact that the data is represented on a large-scale map of considerable geometric precision through which it is possible to reconstruct crop spatial distribution along the territory. (Fig. 11) The most interesting data deduced from this documentary source concerned parcel subdivision and the specific land use of those areas crossed by the selected routes. This information formed the starting point for landscape reconstruction, on which was then based all the following processing. All consultation of this important heritage was carried out through the CASTORE portal – Tuscan Region Historical Regional Cadastre, in which are digitally reproduced, cataloged and georeferenced over 12,000 nineteenth century plats (http://web.rete.toscana.it/castoreapp/). Instead, the actual acquisition of land registry maps and their explicatory tables took place in the Grosseto State Archives. Besides the cadastral mapping, we also used the Topographic Map of Italy at 1: 100,000 of the Military Geographical Institute (IGM). This map, made in the second half of the nineteenth century, derives directly from scale 1: 25,000 measurements, and shows the orography of the area though tone down and contour lines with 50 meter equidistance, showing State boundaries as well as regional and provincial administrative boundaries of the time. In the specific we used "Paper 129 - Santa Fiora" and "Paper 135 - Orbetello" in order to properly frame the retrieved cadastral mapping and the reconstructed areas in a broader territorial context than just the Southern Tuscan Maremma.

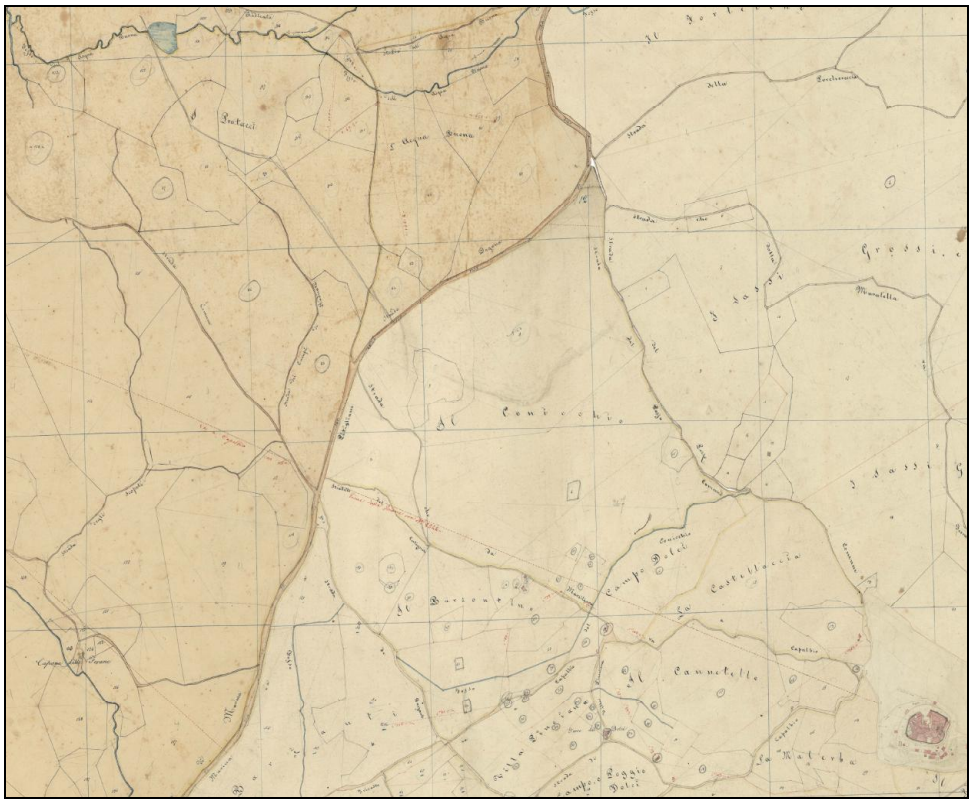

Figure 11: *The Conicchio rural area (Capalbio municipality) in the maps of General Tuscan Land Cadastre, XIX century (Source: Landi, 2015).*

Places, activities and tools typical of transhumance culture are also portrayed and fortunately witnessed by a valuable photographic and iconographic documentation dating in between the late nineteenth and early twentieth century. This was used in the detailed reconstruction of the selected virtual scenarios. This allowed us to significantly enrich and "animate" the historic landscapes, shaped following the retrieved map information, by enriching them with three-dimensional model buildings and traditional structures which no longer exist today. (Fig. 12)

Starting from this documentation, the selected route virtual reconstruction was carried out according to a specific methodological approach structured in two specific operational phases. Firstly it was necessary to reconstruct historical uses and land scope. The selected areas were found on the GIS environment following our cartographic sources. Secondly, focus shifted on 3D reconstruction of these "scenarios", enriched by buildings and typical strictures thanks to the photographs and iconographies in our possession. These operations were possible thanks to the combined use of specific software dedicated to collected data acquisition, digitization, organization and rendering.

Figure 12: *A shepherd with his flock near the main hut of a vergheria (Source: private collection, 1910).*

The precise historical map geolocation and the proper handling of acquired themes are guaranteed by the potential offered by the QGIS open source software. The digitization of cadastral information concerned parcel shapes, with their corresponding width, buildings, river and "road" network. (Fig. 13) For the first two identified areas (Monte Labro pass and river Fiora ford), being these explicit transit zones, the digitization of cadastral information (parcel shape and corresponding scope) was done through the formation of a buffer 200 meters around the linear shapefile made by the identified route section. For the third identified area (Conicchio countryside near Capalbio), which was more sedentary, we opted for a greater perimeter scope: this was in fact one of the shepherds' arrival points, with large areas devoted to flock grazing and to *vergheria* (pastoral hut with tools for cheese processing and storage) building construction.

The resulting areas thus produced were then populated through the digitization of the involved cadastral parcels. Then, for each one of them the corresponding land use was acquired and registered in the layer feature table. This procedure has allowed the creation of a specific set of information on land cover during the mid-nineteenth century, strictly necessary for further processing. In the complex process of three-dimensional historic landscape reconstruction the LUMION (Educational License) software was used. This is an application dedicated to the creation of elaborate 3D renderings. Firstly all selected area DEMs were imported into the virtual environment, in order to make this reconstruction "backbone" as realistic as possible.

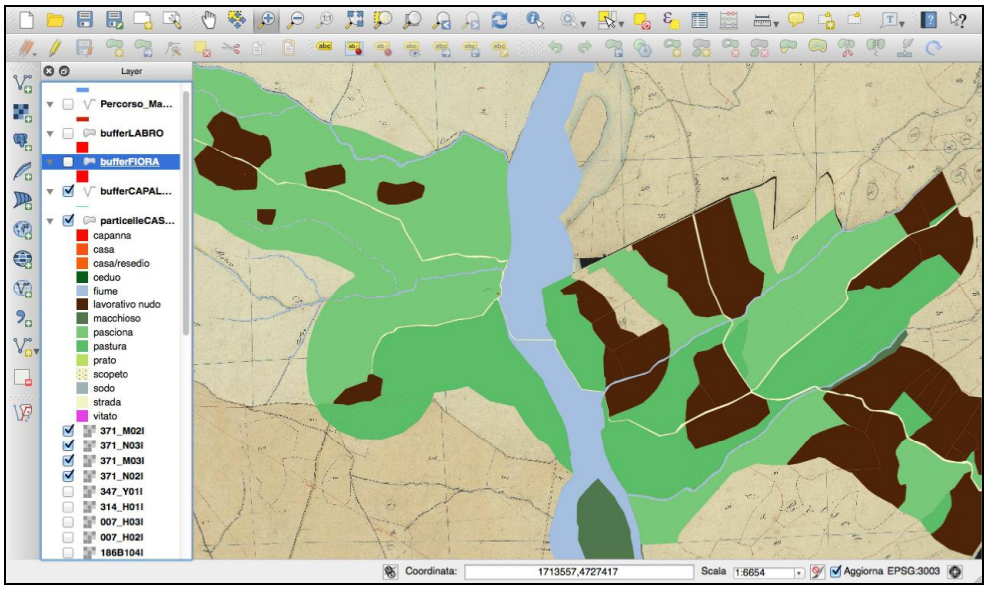

Figure 13: *The digitization of cadastral information about river Fiora ford (Source: Landi, 2015).*

The resulting models were subsequently draped with themes previously extracted from the above mentioned historical sources: in addition, specific data on land use and vegetation cover, information on buildings, on the existing road and hydrographic network was resorted. Based on the achieved results, we then proceeded to add the virtual population of the area through a territory and landscape historical reconstruction according to the information derived from documentary sources.

The models thus generated in three dimensional form were then "dressed" with photorealistic textures through texture-mapping operations, which result in a considerably more engaging and believable virtual representation. A separate mention must go to the building and structure reconstruction, which were created within the SKETCHUP software, which focuses on architectural design, urban planning, civil engineering and connected professions. SKETCHUP models are essentially created combining lines, which become the sides of the object that we are creating; faces are instead automatically processed, as soon as three or more lines/sides are on the same level, that is when they become coplanar and define a closed structure. Later, these can be combined to create complex three-dimensional models (Collada files). (Fig. 14) Subsequently the created buildings and objects were imported on the LUMION environment, which has a high quality graphic rendering which is ideal for hosting models and projects previously made on SKETCHUP.

Finally, through the selection of specific framings, placed at various strategic locations of the reconstructed areas, and the use of various special post-production effects (choice of natural light, atmospheric elements, camera effects, etc...) we created the rendering models, that is to say we generated three-dimensional sets through the processing algorithms of the used program. (Fig. 15)

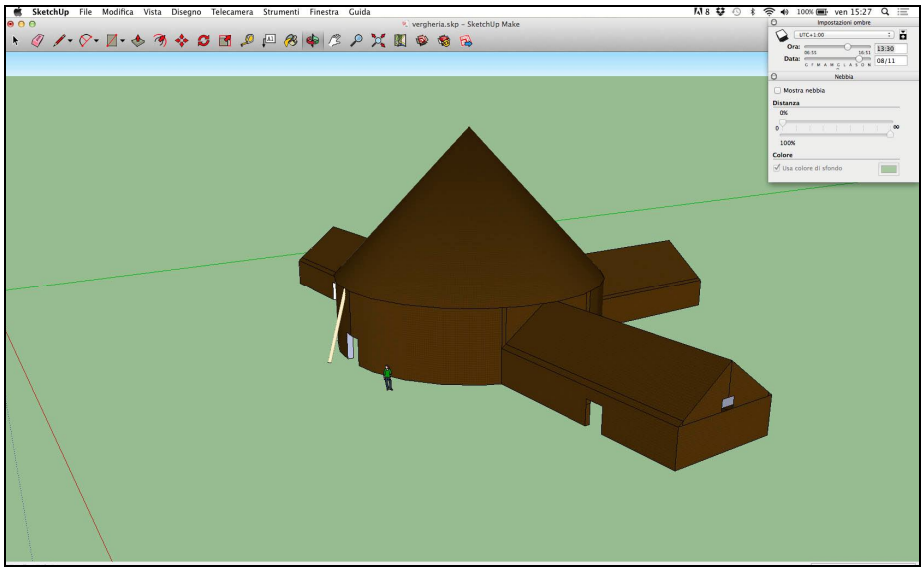

Figure 14: *The 3D model of the main hut of a vergheria created with SKETCHUP (Source: Landi, 2015).*

Figure 15: *A flock of sheep along the Via Montana stationing at Mount Labro pass, Arcidosso and Roccalbegna municipalities, XIX century (Source:Landi, 2015).*

8. CONCLUSIONS: COMMUNICATE TRANSHUMANCE CIVILIZATION KNOWLEDGE

Based on the experience gained so far (LANDI, 2013, 2014), it is possible to make some initial evaluations on the use of GIS technologies and 3D when recreating transhumance historic landscapes. It seems evident that the use of virtual environments produces and disseminates knowledge through valid transmission strategies, based on strong communication effectiveness guaranteed by the generation of immersive environments, while maintaining proper management of the selected historical data. Thus, generally speaking, the results that can be achieved are very positive, as long as we meet some necessary conditions. (Fig. 16)

Figure 16: *A flock of sheep along the Via Montana near Mount Labro, Arcidosso and Roccalbegna municipalities, XIX century (Source:Landi, 2015).*

First of all, the efficiency of these instruments when producing scientific historical contents is extremely linked to the quantity and quality of the available documentary sources. In this sense, it is vital to carry on using some traditional research aspects: such as the archive survey or the correct setting of the retrieved sources in the specific historical context. Actually, it is precisely the consolidation of these different methodological approaches that becomes essential for the development of such technologies in this specific research context. Other positive contributions may of course be reached through a more friendly usability approach of state archives and private collections, and through the completion of digital acquisition and indexing operations and the subsequent logging to single documents. Basically, thanks to their versatility, virtual environments can be very useful tools in the transmission of this important cultural heritage. This is possible both for tourism purposes, favouring an efficient promotion of the territory; and for educational

purposes, involving the younger generations maybe directly at school.The photorealistic reconstruction of historic transhumance landscapes, in fact, through the creation of a sort of "simulated direct observation" phenomena, and thanks to its strong communicative ability, has the advantage of facilitating the study of land evolution processes while improving its understanding. (Fig. 17) As long as you have the adequate technological tools, this kind of observation has many positive aspects. For instance, during an excursion or an indoor lesson, it allows to have certain categories of landscape at disposal, which can be repeatedly revised and interpreted according to need. One can even combine together different landscape types traveling fast both in space and time.

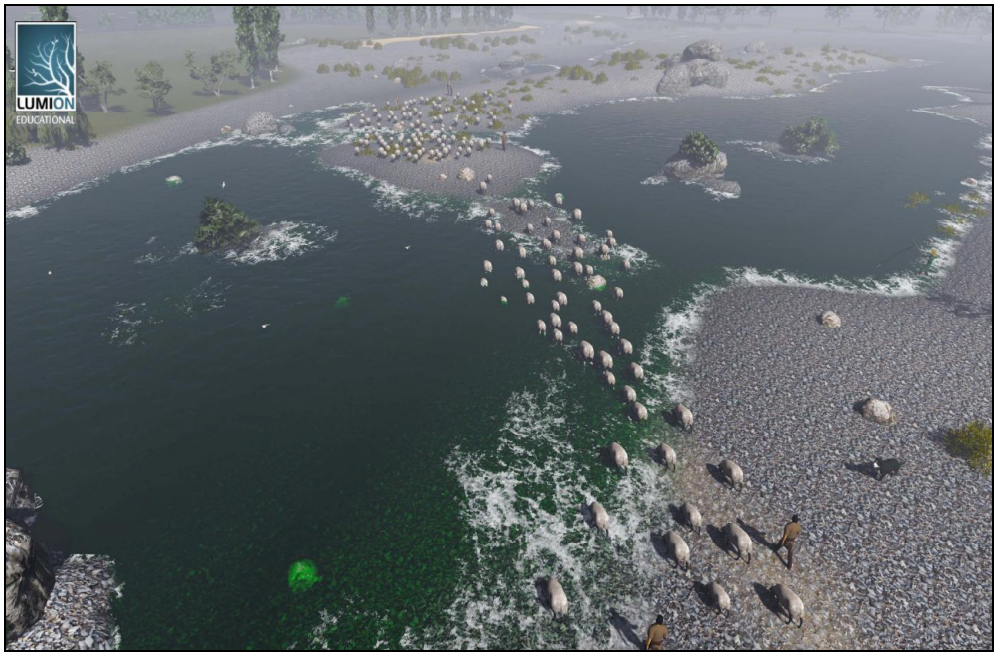

Figure 17: *Sheep crossing the river Fiora ford, Sorano and Manciano municipalities, XIX century (Source: Landi, 2015).*

One can also have the chance to use this variety of tools, when reflecting over key issues concerning territory knowledge, such as the perception and evaluation of a landscape good. Combining significant three-dimensional reconstructions with specially assembled reflections and questions, is possible not only to highlight those landscape aspects connected to the simple visual perception, but also, and above all, it is possible to highlight all those phenomena that, although often determinant, are no longer physically visible. (Fig. 18)

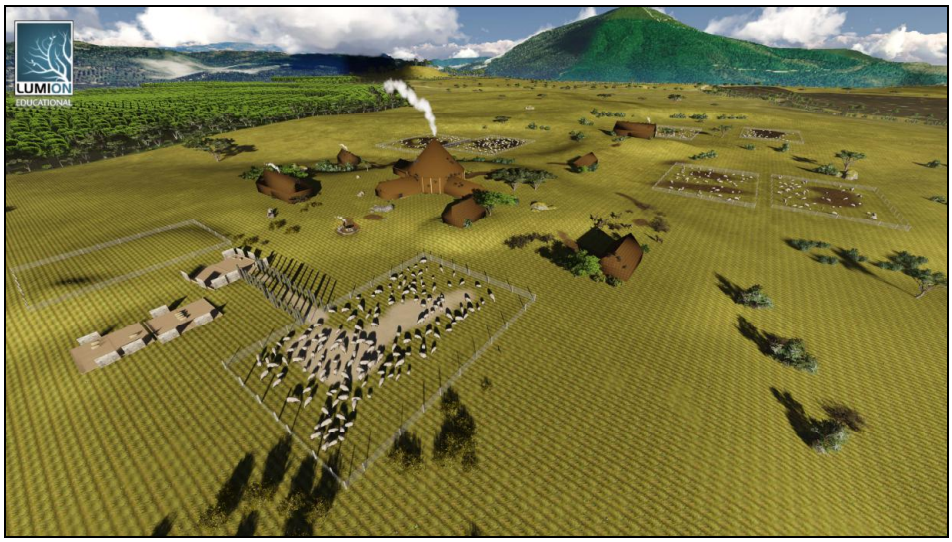

Figure 18: *A vergheria in the Conicchio rural area, Capalbio municipality, XIX century (Source: Landi, 2015).*

For example, let's think about the symbolic value of some places in a culture strictly linked to the territory such as the transhumance one, or about all those daily practices that have helped in landscape shaping. Today these traditions, albeit important, are gradually getting disconnected from local uses and end up becoming increasingly unfamiliar to wide population segments (such as those related to touristic flow). But there's more. Such work if conducted in schools where children or young adults, as well as being the communication recipient, can also “interview” parents and relatives, allowing perhaps the collection of more information useful in improving tradition knowledge of a given territory. Like in the case of those artefacts (churches, mills, markets, places used for special rites, etc.) that today risk to fall into oblivion. Allowing, on one hand, to increase the involvement of younger generations within the territory of origin; and on the other, to educate them on the importance of the protection of sites and traditional landscapes for those who inhabit them.

The scope and quality of the collected data could fill important spaces within the development of a territory information system. Moreover, this type of land investigation would also become a privileged route through which produce operating and expendable knowledge closely linked to the local territory government.

We could also hope for a repetition of this knowledge acquisition and dissemination process, in the many Mediterranean communities which were once affected by transhumance. One could imagine the building of a "global" research project covering not only Europe. A network on transhumance civilization helped by the increasing digitization of historical data, the ease of its use and its strong communicative effectiveness. A research contribution to the growing need to highlight the synergistic relationship between territory, environment and traditions; which will also give proper emphasis to our common history.

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