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The middle valley of the Sinni (Italy, southern Basilicata). Analysis of visibility between medieval fortified sites (11th-14th century A.D.)

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Abstract

Viewshed Analysis, or visibility analysis, allows you to evaluate the range of the observation area from a given location, tower, lookout, the creation of a hypothetical model of how these sites communicated and related to each other. The study, conducted as part of the author's doctoral thesis, examines the ancient medieval landscape in the middle Sinni Valley in southern Basilicata, starting from the development of the entire system of fortifications between the municipalities of Valsinni and Colobraro, in the eastern portion, with the two respective fortresses of barrage locality "Il Pizzo" and locality "Cozzo Madonne della Rocca", until you reach the innermost part in a Tyrrhenian direction westwards with the fortress of the "Castello di Seluci", now in the municipality of Lauria (PZ). In the case of fortified settlements in the hinterland of this area, a central function was carried out by Chiaromonte (PZ), the center of the county already under the Norman Clermont family during the 11th century A.D. and also during the Regency of the Sanseverino family in the 14th century A.D. With these premises it is fundamental not only to highlight the area immediately visible from each site, but also to understand the level of intervisibility that had to exist in the settlement network of this given territory between the 11th and 14th centuries A.D., the moment when the entity and future vocation of this precise territory are consolidated.

1. Introduction. Archaeological survey activities

The medieval settlement system of the Sinni valley preserves significant traces of structures, whose chronological limits take into account the central centuries of the Middle Ages, from the end of the ninth to the 15th century A.D., characterizing a geographical area with a historical picture of particular interest. The area extends from the Ionian coast in the east to the slopes of Mount Sirino in the west and is crossed by the river Sinni; inside it included the territory of Mercourion and Latinianon, particularly involved in the development of religious settlements of both Greek and Latin rite as well as being affected by the parallel phenomenon of

the encastellation that began here from the 10th to 11th century A.D. Just from the 11th century A.D. the settlement typology in this territory changed compared to the previous period, passing from a scattered rural settlement model to the intensification of the demonic settlement on the summit hills (Sogliani, 2010, pp. 171-195; Sogliani, 2017, pp. 265-312). The strong centralisation in a dominant position is indicated by the spread of the fortified settlement system in Norman times, a phenomenon in this area, as in the rest of the region, facilitated by the absence of large urban centers. Among the defensive and lookout settlements abandoned between the 14th and 15th centuries A.D. and no longer repopulated are the towns of "Catarozzo" in the municipality of Francavilla in Sinni (PZ), "Castello di Seluci" in the municipality of Lauria (PZ), "Il Pizzo" (Valsinni, MT) and "Cozzo Madonne della Rocca" near the centre of Colobraro (MT). The portion of territory being investigated by this research has already been partially examined during the years 2001-2003, by bringing together the data in the publication of the "Archaeological Map of the Sinni Valley" (Quilici and Quilici Gigli, 2001). These volumes, still indispensable for the knowledge of the elements that constituted the settlement of this area, so far represent an underestimated archaeological fact in the medieval age. The sample acquired in years of field research in the middle Sinni Valley, in terms of quantity and complexity, always leads to the same result, just as in numerous national and international experiences 1. The following considerations represent part of the research activities carried out by the author in the area between the municipality of Valsinni (MT) and the eastern limits of the municipality of Lauria (PZ) in the locality of "Castello di Seluci", on an investigated territory that extends for about 500 km^2 distributed in an area of more than 13 municipalities in southern Basilicata along the middle Sinni valley. The data were taken from the results of the author's PhD research conducted between 2015 and 2017, entitled: "Settlement systems, organization and evolution of the medieval landscape in southern Basilicata: the middle Sinni valley. The forms of secular and ecclesiastical power between the 10th and 15th centuries A.D." (Vitale, 2018). The data collection phase was divided into: 1) a surface

reconnaissance campaign; 2) repeated site inspections to acquire GPS points to check the evidence at different times of the year; 3) continuous site inspections to perform flights using RPA of the evidence identified. The opportunity to replicate the data was fundamental considering the visibility of places based on the rich vegetation in different seasons of the year. All this evidence is located in places where no agricultural activities are practised, so the surrounding land is currently used for forestry purposes and with very little visibility (Brughmans and Brandes, 2017). The experience with satellite georeferencing and positioning systems is now a well-established methodology of investigation in archaeological research. These phases were carried out with the help of a Leica GNSS GS08 Plus GPS Rover system, which made it possible to carry out the most precise mapping of the investigation. The same RPA Phantom 4 DJI used for aerial reconnaissance is equipped with a GPS sensor with accuracy between +/- 20-30 cm (the possibility of flight was guaranteed in compliance with the legal regulations for RPAS: Valentino Vitale operator RPAS for specialized critical and non-critical operations No. 9981). The shots and photoplans taken through aerial acquisition carry all the information of a ground GNSS system, allowing the implementation of the two data directly on the GIS (Campana, 2013). The possibility of earthing the hook points detected by the GNSS system has made it possible to correct the positioning error offered by the RPA and georify the orthophotos made with millimeter precision. The GNSS system allows sub-centimetric precision positioning in areas such as those surveyed with poor shrub vegetation on the crests of walls. The possibility to work with an RPA system with integrated GPS built by DJI with positioning of shots usually below 30 cm, makes it possible data to obtain results in the georeferencing phase that summed up do not reach imperfections that go beyond a couple of centimeters of error, This value can be considered optimal for the positioning works of large architectural complexes distributed, among other things, on non-flat surfaces, thickly located at high altitudes along rocky ridges. The feedback between different photographic series was of great help in identifying and understanding the

tracks. For the aerial-photogrammetric coverage of the territories in question, reference must be made to the flights of the Basilicata Region and to the IGM. The GIS system used for the

development of research in the middle Sinni Valley includes numerous information plans, all in vector format (Figure 1).
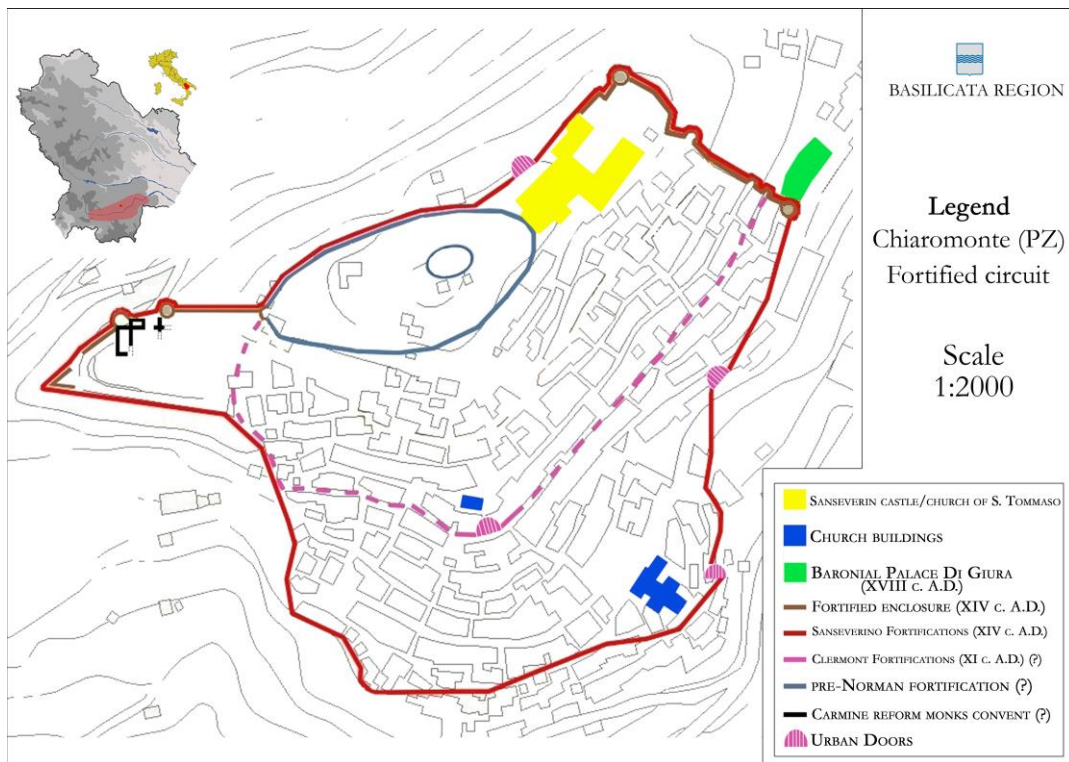

Figure 1. Chiaromonte (PZ). GIS of medieval evidence. Graphics processing by the Author.

Most of these are now available through the RSDI Basilicata portal (http://rsdi.regione.basili-cata.it/web/guest/mappe-in-linea). In particular, the latter provides cartography useful for the research work in question such as: administrative limitations; land use map; geolithological map; 2013 and 2014 orthophotos; DSM and DTM (both with a resolution of 5m); regional technical map of 2013. The sections can be downloaded in georeferenced TIFF format for orthophotos, DTM and DSM, while in vector DXF format for all the above listed types of cards and refer to the WGS 84 UTM 33 N coordinate system. A digital model of the land at 5m of the entire investigated area was generated from the level curves of the regional technical cartography 1:5.000 (CTR), thus creating the TIN (the TIN defined as "Triangulated Irregular Network" is a

digital structure used in a GIS to represent a three-dimensional surface) of the area, a model that the regional cartography (RSDI Basilicata - https://rsdi.regione.basilicata.it/) does not provide at the moment.

2. Viewshed Analysis between fortified sites: questions of method

The interest in the medieval world in the middle Sinni valley, in the problems related to the management and organization of the territory, a place of contact between different people and cultures, makes it possible not only to know the historical / settlement of this territory but to understand a series of pieces of evidence that are clearly recognizable on the territory in their primary vocation in the historical period between the 11th and 14th

centuries A.D., not yet fully clarified in its diachrony and local development. In recent years, numerous archaeological cartography projects have been born in Italy both at urban level, and at the broader territorial level, in line with the dictates of landscape archaeology, a discipline that aims to reconstruct ancient landscapes, through the recognition of the traces left by nature and man over time (Cambi, 2011; Salzotti, 2012). The study in the field of landscape archaeology and themes linked to topography, archaeology and architecture of the medieval landscape, new technologies applied to archaeological research, was decisive. The study, conducted as part of the author's doctoral thesis, examines the ancient medieval landscape in the middle Sinni valley in southern Basilicata, starting from the development of the entire system of fortifications between the municipalities of Valsinni (MT) and Colobraro (MT), in the eastern portion, with the two respective fortresses of barrage locality "Il Pizzo" and locality "Cozzo Madonne della Rocca", until you reach the innermost part in the Tyrrhenian direction towards W with the fortress of "Castello di Seluci", today in the municipality of Lauria (PZ) (Figure 2).
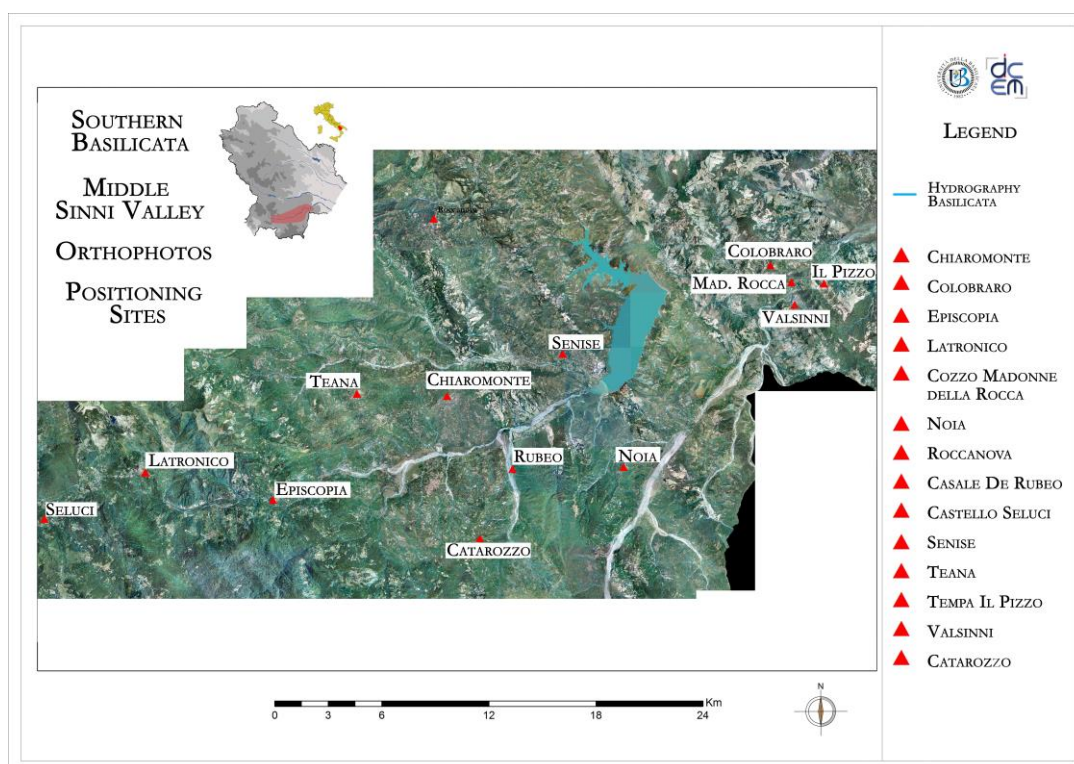

Figure 2. Sinni Valley: orthophoto 2013 with positioning of 11th-14th century A.D. sites. Graphics processing by the Author.

In the case of fortified settlements in the hinterland of this area, a central function was held Chiaromonte (PZ), the centre of the county already under the Norman Clermont family during the 11th century A.D. and also under the Regency of Sanseverino in the 14th century A.D. (Vitale and Lista, 2015; Vitale, 2014, pp. 215-233; Vitale, 2015, pp. 11-22). With these premises it is fundamental not only to highlight the area immediately visible from each site, but also to understand the level of intervisibility that had to exist in the settlement of this given territory between the 11th and 14th centuries A.D., when its future entity and vocation are consolidated. Visibility analyses, or more commonly, "Viewshed Analysis", refer to the more general category of digital spatial analysis and allow the identification of areas visible from

a given point of view, which can be seen from one or more observation points (Pecere, 2006, pp. 177-213; Wheatley, 1995; Wheatley, 1996, pp. 75-103), allowing the assessment of the range of the control area from a given position, tower, lookout, settlement or other eminent point within a given territory, generating a hypothetical model of how these sites communicated and related to each other. In fact, the visibility aspect of a place was, at least until mid-14th century A.D., one of the fundamental elements taken into account by communities in the preference for territories on which to establish a settlement, highlighting a greater peculiarity as regards the choice of fortified sites (Nutsford et al., 2015, pp. 1-7). The systematic survey of the entire area was fundamental, with an initial positioning of the evidence, an activity that allowed us to understand the spatial location of the sites and the underlying motivations for their position, often dictated by the vocation of the centres in the management of the defence of the territory on which they were created for the management and governance of the same. Topographic reading and positioning of evidence through GNSS has allowed the creation of most of the cartography, functional to a specific analytical approach such as the analysis of visibility of the areas identified. It was possible to distinguish fortified sites that existed at the same time in history, to give them a very precise weight as regards their strategic function and the importance of their position, and to try to obtain through the various spatial analyses a map dedicated to the theme of research. From the first inspections carried out, thanks to the subsequent aid of cartographic analyses, it was possible to obtain an overview and the underlying motivations for the foundation of a site in one place compared to another, as well as to ascertain in which communicative relationship they are between themselves. An example is the "barricade" naturally constituted by the position in which the two torrazzi of locality "Cozzo Madonne della Rocca", near Colobraro (MT), and "Il Pizzo" in the municipality of Valsinni (MT); eminent in terms of the position on which they rise, they constitute the first closure for those who arriving in these lands from the sea directly from the Ionic side of Lucania want to access the Sinni valley. The physical closure of a highly strategic

and spontaneously strategic place like this, consisting of a natural narrowing of the same valley between the two slopes rising towards higher altitudes, had already been a prerogative during previous historical periods with the case of Monte Coppolo and the other contemporary settlement "Timpa del Ponte" located further downstream and consisting of the plain still visible in the middle of the river Sinni (today the place so called has been considerably reshaped and destroyed because of the quarry works which took place in the years before the imposition of archaeological constraints). The area's vocation as a barrier and defence site for the river valley is confirmed by the discovery of these two fortified sites dating back to the Middle Ages, in close connection with the nearby castles of Colobraro and Valsinni. This system of four fortified bastions, placed in a position of immediate visual control, is set up in a highly strategic area for the management of temporal power in southern Lucania. The evidence found in the "Castello di Seluci" locality, now in the municipality of Lauria (PZ), is mirror-like, but in the opposite direction. Located in the western part of the middle Sinni valley, the architectural complex is made up of fortified structures placed at an imposing altitude compared to the surrounding territory (from 945 m a.s.l. to 975 m a.s.l. at the top, while the neighbouring valley slopes down to 700 m a.s.l.). The latter, too, in carrying out its tasks of barrage and lookout, was placed in a predominant position and in perfect visual communication with the nearby fortified centre of Latronico (PZ), managing access from the Mercure valley to the hinterland. The data emerges powerfully from the spatial analyses of visibility conducted in these two precise areas, allowing us to understand some of the motivations underlying the foundations of these entities, which would otherwise have been useless in harsh territories poor in springs where it was difficult to lead everyday life. Similar positions have guaranteed the survival for centuries of places such as Chiaromonte as the center of the County, also placed in a position of predominance and control over the surrounding territory, providing a wide view practicable over long distances under the power of the Norman Counts (it is a fact that the human eye cannot distinguish objects perfectly that are more than

15-18 km away, although it must be taken into account that from places like Chiaromonte you can actually see the coasts lapped by the Ionian Sea along the Gulf of Taranto), favored in this perspective by the immediacy and fertility of arable areas with the presence of springs placed immediately behind the rocky hill summit. The system created between high altitude nerve centres within an impervious territory and crossed by the Sinni in its narrow river valley has allowed the recognition of at least 10 nerve centres for the defence of the territory, located to create and manage a fortified network in close visual and communicative connection. The system was managed visually thanks to a reference of stations from one position to another so that, from the physical closure of "Cozzo Madonne della Rocca" until arriving at "Castello di Seluci", the body of defence and government of this extensive mountain area was complete. These stations are located as the crow flies at an average distance of no more than 8-10 km, ensuring fast communications for good control of the territory.

Thanks to the use of this methodology it is possible to recognize places where hypothetically there could be watchtowers to allow communication between sites: for example, between Chiaromonte and Roccanova, which rose up in positions where the necessities of both did not directly foresee particular communicative needs, there are precise positions where to concentrate the research and to evaluate this hypothesis. The opportunity to combine the results of individual visibility analyses, making what was seen from one point comprehensible compared to all those that stood nearby, allows us to make further hypotheses on the possibility of locating abandoned areas with settlement vocation that have not yet been found.
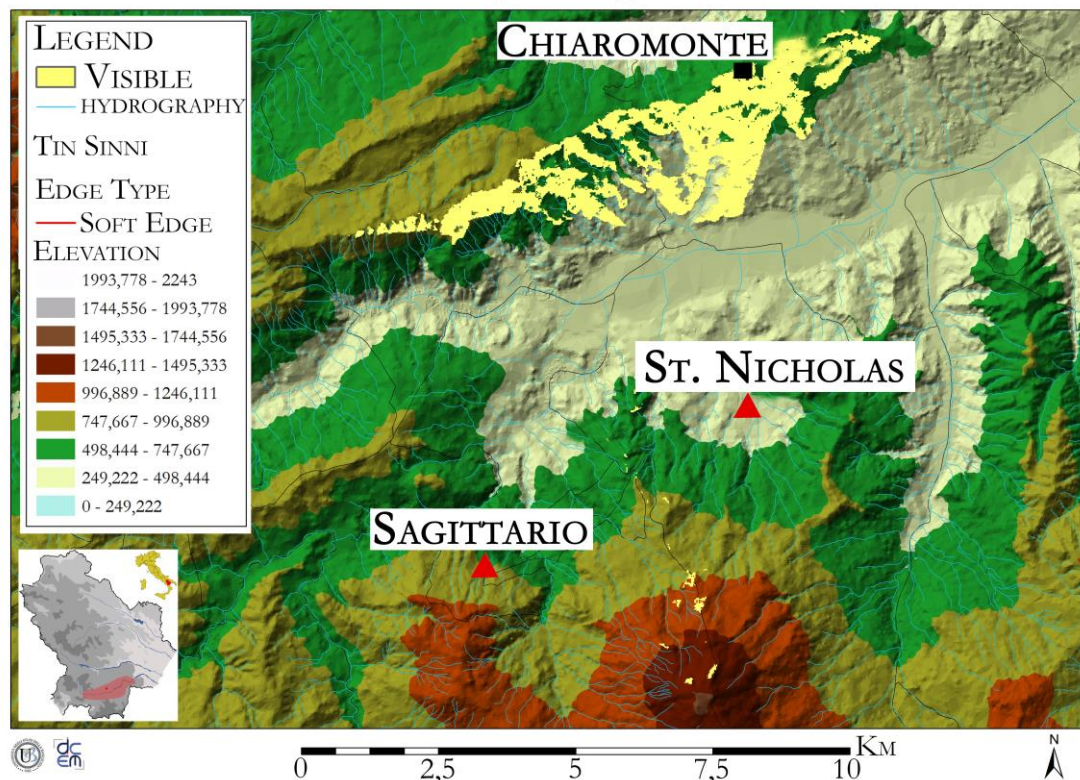

Figure 3. Viewshed Analysis between the monasteries of "San Nicola in Valle" and "S.M. of Sagittario" with respect to Chiaromonte (PZ). Graphics processing by the Author.

The dynamics of the settlement of the monastic and religious complexes, which arose in the immediate vicinity of the centres with greater political and economic power on which they depended, were different. These religious communities have often been the direct result of the emanation of central power, rising in places destined for them with different purposes such as the defence of the territory, the regeneration and revitalization of uncultivated areas. There is no doubt that monks have a strong vocation to cultivate wooded or completely abandoned areas, based on their practical and theoretical knowledge. This is the case of the monastery of "Santa Maria del Sagittario", a Cistercian subsidiary of the distant monastery of Casamari in Lazio, strongly desired in the places where its ruins are preserved by the Norman comitology family of Clermont; at the end of the 14th century A.D., in order to reduce its hegemonic claims, the Sanseverino family (who succeeded the power in Chiaromonte) opposed the Carthusian monastery of "San Nicola in Valle" to it (Figure 3).

Crossing the greenhouses and valleys to the south of the Sarmento and to the north of the Serrapotamo, we encounter different monastic entities that are also part of this complex system of political management. This is the case of the monastery of SS. Elia and Anastasio or the monastery of "Kyr-Zosino" (both of Greek worship) from which the two centres of Carbone and Cersosimo would be born by aggregation respectively. In this perspective, the distinction of power between Latin and Greek centres of worship must always be kept in mind, in a system of division of the territory that is distinct from each other. It is no coincidence that the power established here over the centuries has not allowed the Greek rite foundations to interfere in predominant positions but has found a place along two of its tributaries, in more marginal and neighboring positions.

Figure 4. Photographic restitution of the evidence of the monastery of "San Nicola in Valle" (RSDI geoportal of Basilicata). Graphics processing by the Author.

The monasteries of the middle Sinni, Sarmento and Serrapotamo valleys went on to develop a system they managed, divided into satellite centres such as "grancie" and fortified houses, which would in turn manage distant territories full of important economic and political interests. In the cases of the monasteries of Latin origin and their appurtenances, the visibility analysis method allowed the recognition of a spatial distribution order directly under the centre of Chiaromonte, as a headquarters. The spatial analyses have recognised the direct visual contact of the Sagittarius Monastery and the Charterhouse of St Nicholas with the County Centre, but not directly between them and their appurtenances. For example, the Cistercian monks, on whom the Ventrile grance depended, had no direct connection with this, while both are clearly visible from Chiaromonte (Vitale and Bruno 2012, pp. 371-376; Vitale, 2018). The same applies to the Carthusian monasteries, to which at the beginning of the 15th century Count Wenceslas entrusted the management of territories once managed by the so-called "Castello di Rubeo" (Figure 4).

3. Conclusions

In the introduction it was underlined how when this study was started the archaeological research in the Sinni valley was basically based on the original scheme of the Archaeological Map of Quilici (Quilici and Quilici Gigli, 2001), and therefore on the traditional methods of ancient topography: analysis of written sources, surface reconnaissance and reading of vertical aerial photographs. During this investigation this was all joined by others such as remote sensing via "RPA georeference", but above all, spatial analyses such as Viewshed Analysys were conducted between the different sites investigated (Wheatley and Gillings, 2000, pp. 1-27; Wheatley and Gillings, 2002). The cartography presented is by no means the complete census of the archaeology currently present in this geographical area. It is true, however, that the results reached in quantitative and qualitative terms can be projected at a regional level as a model for establishing an estimate of the medieval archaeological potential and the dynamics of transformation along the 5 river valleys of Lucania. Increasing visibility and systematically searching within adjacent spaces with new investigative tools will also allow us to find what does not exist today. The spatial distribution of the settled areas follows dynamics of positioning purely in defensive areas in high rise positions (Figure 5).

All the fortified places of emanation of central power rise on rocky spurs easily defensible from which by agglutination the respective historical centres develop. The lookout positions, which were built in places even harsher than the first, indicate the lack of development beyond the 14th century A.D., when their definitive abandonment can be attested. As such, they have continued to deteriorate in their conditions until today, to indicate the specific function of the building moment, which is no longer recovering for obvious reasons in the change of the political and defensive strategies of the area. Therefore, the tops of the ridge along the two sides of the Sinni river and its streams, such as the Serrapotamo and the Sarmento, are preferred. Along these, a whole series of centers still existing today develop, from the satellite function with respect to the center of the Chiaromonte County, which arose in the position of greatest visibility of the area from which to be able to entirely dominate the territory that the Counts had to manage. The wide radius visible from this place makes it possible from the same point to cover considerable distances, reaching the coasts of the Ionian Sea between Scanzano and Policoro towards E, and allowing communication with all the fortified centers of the area. It is therefore possible to distinguish three precise moments in the development and abandonment of some fortified centers.
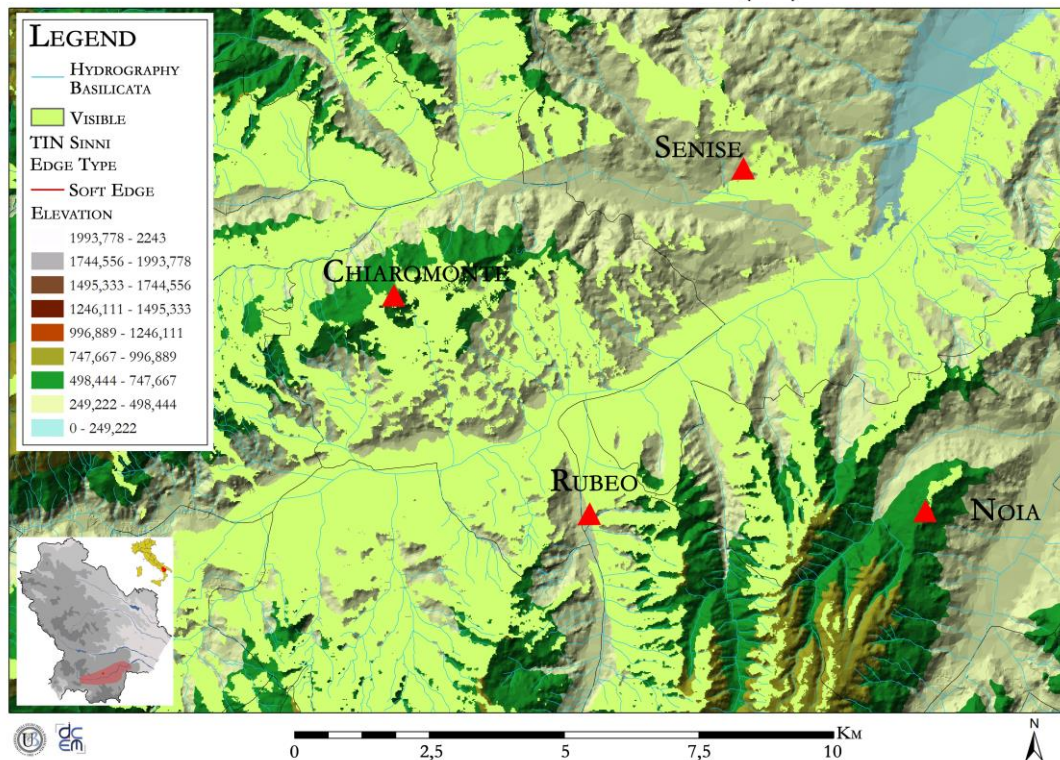
VIEWSHED ANALYSIS CHIAROMONTE (PZ)

Figure 5. Viewshed Analysis of the Chiaromonte County Centre (PZ). Graphics processing by the Author.

The first refers to the central centuries of the Middle Ages between the 10th and 11th centuries A.D., when the Norman Clermont family established themselves and centers that were already in existence upon their arrival, such as Chiaromonte and Senise, were reborn (Corrado, 2001, pp. 227-254; Manzelli, 2001, pp. 113-152). The reconstructive hypotheses of the landscape of those centuries and the documentary and archaeological attestations to which it has been possible to refer indicate the presence of at least 4 most important centers: Chiaromonte, Senise, Teana and Noepoli. The presence of monasteries of Greek origin, such as the monastery of St. Elias of Carbone, was a counterbalance. The 11th century became the moment of contact between the Greek monasticism of Mercurion and the arrival of Latin monasticism of Latinianon. The next phase, where the birth and foundation of structures dictated by the new Norman government in the middle Sinni valley are attested, was defined between the 12th and 14th

centuries, owing to the homogeneous characteristics of the settlement typologies, the uniformity in the architectural and constructive planning and to the homologous choice of places to be installed for the government and the organic management of the whole valley.

The 4 centers mentioned for the previous phase are joined by new buildings and the restoration of other sites, probably already partly inhabited. The reference goes to Latronico, Episcopia, Roccanova, Colobraro and Valsinni, while lastly the defences and the closure of the central sector of the Sinni valley are prepared with the foundation of the so-called Castello di Seluci in W and E with the two fortified towers of "Cozzo Madonne della Rocca" and "Il Pizzo". The three watchtowers will be the emblem of the fortification system of Norman management in the territory, since with their political decline they themselves will suffer a slow decline culminating in their abandonment during the 14th century A.D. (Figure 6).

Figure 6. Oblique drone photo: "Cozzo Madonne della Rocca" in the foreground; on the left of the frame "Il Pizzo"; in the background "Tempa del Ponte" and Monte Coppolo; Valsinni (MT) on the left. Photo: V. Vitale.

This was the moment when the major monastic centers with Latin rite in the area were built, partly supplanting the power of the orthodox rite cenobi, such as that of Carbone. The abbey of Sagittario was founded during the 12th-13th century A.D. with a series of "grancie" and appurtenances distributed throughout the territory (Figure 7).

Strongly desired by the central power, this foundation will manage and organize the teniments and the countryside of the county of Chiaromonte, in the dichotomy born later with the arrival of the Carthusian monastery of San Nicola in Valle arriving in these lands at the end of the 14th century A.D. Their power will be one that will heavily affect Greek monasticism, making it like a small enclave during these centuries destined to shrink more and more. The archaeological and topographical researches carried out in the Sinni valley have been conveyed for their own vocation in the project called "ARCHEO MAPPA. OPEN DATA CHIAROMONTE (PZ)", carried out thanks to a grant from the Basilicata Region to the writer. The project has had as objective the reconstruction of the historical events of the medieval County of Chiaromonte (PZ), through what is the recognition of the pivotal points of the Middle Ages in the valley and the possibility of interaction with the local population. The idea set with the realization of the project "Archeo

Mappa" was to build a tourist, naturalistic and historical route inserting everything in a cultural itinerary that reveals the medieval archaeological evidence still surviving in relation to the surrounding landscape. All this, thanks to the creation of a dedicated website and the integration of data retrieved within a GIS platform, has allowed a wide audience to understand the archaeological and architectural potential of the valley in the medieval historical diachrony, starting a process of general awareness aimed at cultural heritage.

Figure 7. Oblique drone photo of the monumental complex of Ventrile, Chiaromonte (PZ). Photo: V. Vitale.

References

1. Brughmans T. and Brandes U., "Visibility network patterns and methods for studying visual relational phenomena in archaeology", *Frontiers in Digital Humanities: Digital Archaeology*, 4, 17, 2017.
2. Cambi F., *Manuale di Archeologia dei Paesaggi*, Rome, Carocci, 2011.
3. Campana S., *Carta archeologica della provincia di Siena. Montalcino*, Vol. XII, Perugia, Grafica Diemme, 2013.
4. Corrado M., "Manufatti altomedievali da Senise: riesame critico dei dati", in Quilici L. and Quilici Gigli S. (Eds.), *Carta archeologica della Valle del Sinni, Fascicolo 4: zona di Senise*, Rome, L'Erma di Bretschneider, 2001, pp. 227-254.

5. Manzelli V., "La zona di Chiaromonte", in Quilici L. and Quilici Gigli S. (Eds.), *Carta archeologica della Valle del Sinni, Fascicolo 5: da Castronuovo di S. Andrea a Chiaromonte, Calvera, Teana e Fardella*, Rome, L'Erma di Bretschneider, 2001, pp. 113-152.

6. Nutsford D., Reitsma F., Pearson A.L. and Kingham S., "Personalising the viewshed: Visibility analysis from the human Perspective", *Applied Geography*, 62, 2015, pp. 1-7.

7. Pecere B., "Viewshed e cost surface analyses per uno studio dei sistemi insediativi antichi: il caso della daunia tra X e VI sec. A.C.", *Archeologia e Calcolatori*, XVII, 2006, pp. 177-213.

8. Quilici L. and Quilici Gigli S. (Eds.), *Carta Archeologica della Valle del Sinni*, Rome, L'Erma di Bretschneider, 2001.

9. Salzotti F., *Carta archeologica della provincia di Siena Volume XI. Finalità, metodi, strumenti*, Siena, NIE, 2012.

10. Sogliani F., "Il mondo rurale della Basilicata nel medioevo. La lettura archeologica della compagine insediativa, delle modalità di controllo e sfruttamento territoriale dei sistemi socio-economici delle campagne tra X e XIII secolo", *Archeologia Medievale*, XXXVII, 2010, pp. 171-195.

11. Sogliani F., "L'archeologia medievale in Basilicata: progetti di ricerca e cantieri di scavo", in Panarelli F. (Ed.), *Alle fonti della Basilicata medievale: edizioni, progetti e cantieri*, Bari, Adda, 2017, pp. 265-312.

12. Wheatley D., "Cumulative viewshed analysis: A GIS-based method for investigating intervisibility and its archaeological application", in Lock G. and Stancic Z. (Eds.), *Archaeology and GIS: a European Perspective*, London, CRC Press, 1995, pp. 171-185.

13. Wheatley D., "The Use of GIS to Understand Regional Variation in earlier Neolithic Wessex", in Maschner H.D.G. (Ed.), *New Methods, Old Problems. Geographic Information Systems in Modem Archaeological Research*, CAI Occasional Paper 23, Carbondale, Ilinois, 1996, pp. 75-103.

14. Vitale V., "La Contea di Chiaromonte (Basilicata): fonti documentarie e persistenze archeologiche. Materiali per la ricostruzione storico-insediativa dall'età normanna al basso medioevo", in Meo F. and Zuchtriegel G. (Eds.), *Siris Herakleia Polichoron. Città e campagna tra antichità e medioevo*, Siris, 14, 2014, pp. 215-233.

15. Vitale V., "La Contea di Chiaromonte: persistenze archeologiche dai Clermont (XI sec. d.C.) ad oggi", in Vitale V. and Lista M. (Eds.), *La Contea di Chiaromonte. Ceti sociali ed istituzioni ecclesiastiche tra XIV e XVIII secolo d.C.*, Lagonegro, Grafiche Zaccara, 2015, pp. 11-22.

16. Vitale V., "Sistemi insediativi, organizzazione ed evoluzione del paesaggio medievale nella Basilicata Meridionale: la media valle del Sinni. Le forme del potere laico ed ecclesiastico tra X e XV secolo d.C.", PhD Thesis, Università degli Studi della Basilicata, Dipartimento DiCEM, Matera, 2018.

17. Vitale V. and Bruno B., "La valle del Sinni in età medievale. Il monastero di San Nicola del Ventrile (Francavilla in Sinni – PZ): primi dati", in Redi F. and Forgione A. (Eds.), *VI Congresso Nazionale di Archeologia Medievale* (L'Aquila, 12-15 September 2012), 2012, pp. 371-376.

18. Vitale V. and Lista M. (Eds.), *La Contea di Chiaromonte. Ceti sociali ed istituzioni ecclesiastiche tra XIV e XVIII secolo d.C.*, Lagonegro, Grafiche Zaccara, 2015.

19. Wheatley D. and Gillings M., "Vision, perception and GIS: Developing enriched approaches to the study of archaeological visibility", in Lock G. (Ed.), *Beyond the Map. Archaeology and Spatial Technologies*, Amsterdam, IOS Press, 2000, pp. 1-27.

20. Wheatley D. and Gillings M., *Spatial Technology and Archaeology. The Archaeological Applications of GIS*, London-New York, Taylor and Francis, 2002.