A Visibility Analysis of Early Medieval High Altitude Fortifications in Liébana, Northern Spain

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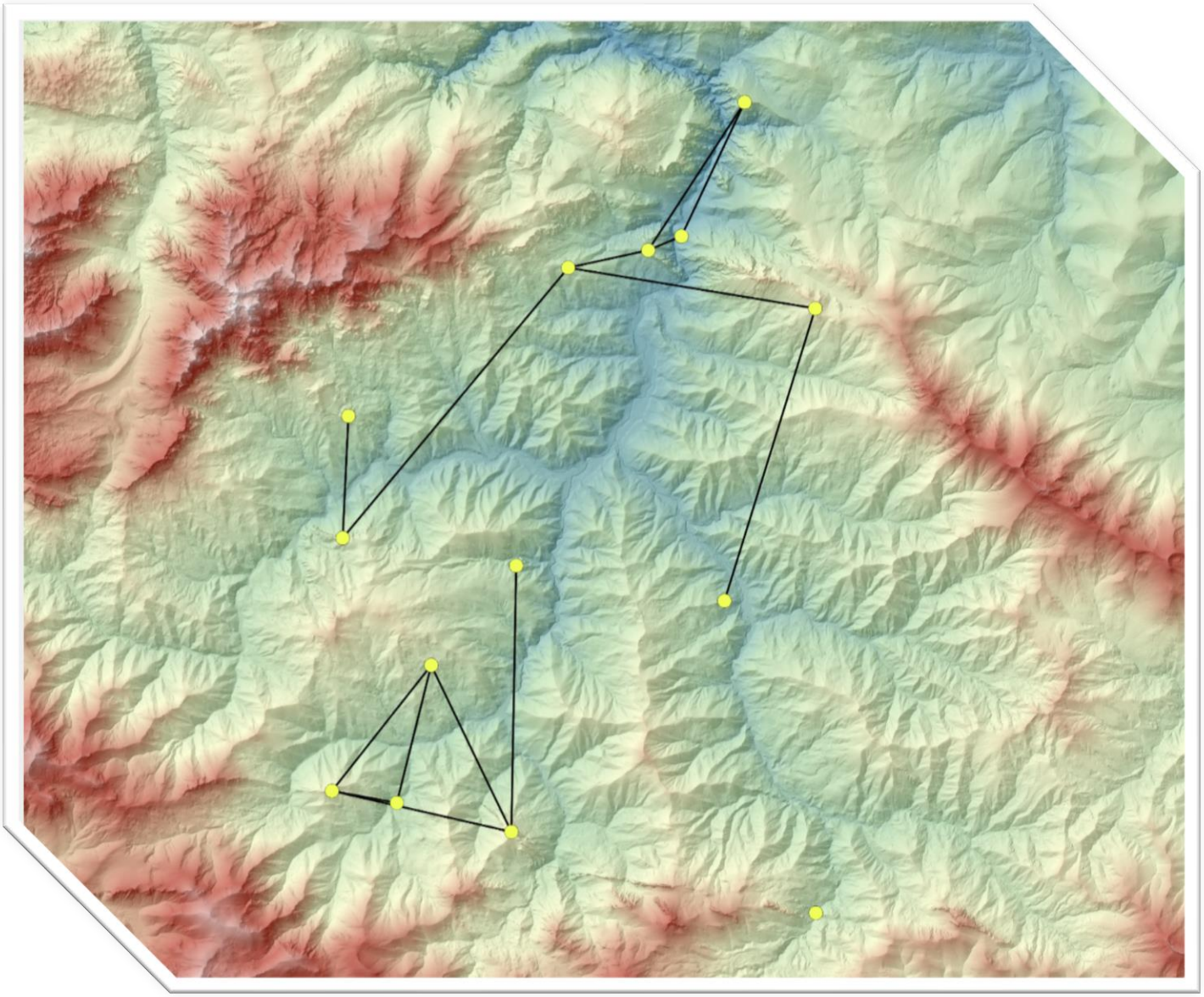

T. Jaafar

Figure by author.

A Visibility Analysis of Early Medieval High Altitude Fortifications in Liébana, Northern Spain

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1. Introduction

1.1. Background

Fourteen early medieval fortifications have been identified in relative proximity to one another in *Liébana* (fig. 1). Liébana is an area in the autonomous region of *Cantabria*, in Northern Spain. These fortifications can be found across the area on high altitude locations. These sites have been roughly dated to the early medieval period, specifically the 9th to 11th century (Marcos Martínez and Mantecón Callejo 2012, 109-10).

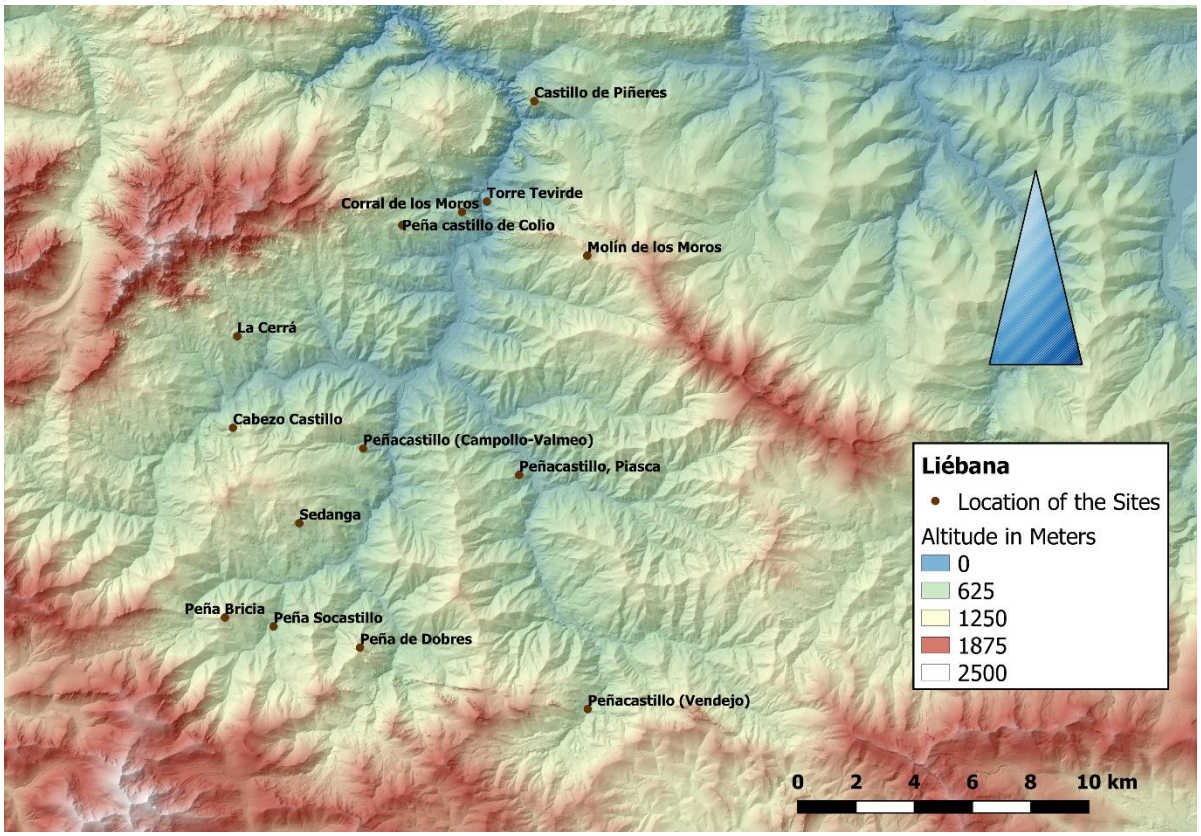

Figure 1. The 14 identified early medieval fortifications in Liébana (by author).

Other early medieval fortifications with a similar date can be identified across Northern Spain. These sites are also characterized by their location on high hill tops or mountain peaks. They can be found in Asturias, Basque Country and Galicia (Fanjul Peraza 2007, 11-16; Quirós Castillo 2017, 328-33; Sanchez Pardo and Galbán Malagón 2015, 126-9).

There are multiple explanations about the possible functions of the fortifications. Some possible functions found in the literature are for symbolic reordering of the landscape, visual control or visual communication (Marcos Martínez and Mantecón Callejo 2012, 109-11; Marcos Martínez and Mantecón Callejo 2009, 117 and Quirós Castillo 2017, 328-33). These functions depend on the broad view these fortifications had on their location.

Yet, the visibility of these sites has, until now, not been methodologically studied. This means there is fundamentally nothing to show the extend of the visibility.

J. C. Sanchez Pardo and J. Galbán Malagón presented a visibility analysis of 14 high altitude fortifications in Galicia. These sites were used in a *geographic information system (*GIS), in which they rendered an intervisibility network and a viewshed (fig. 2) (Sanchez Pardo and Galbán Malagón 2015, 126 and 149-51).

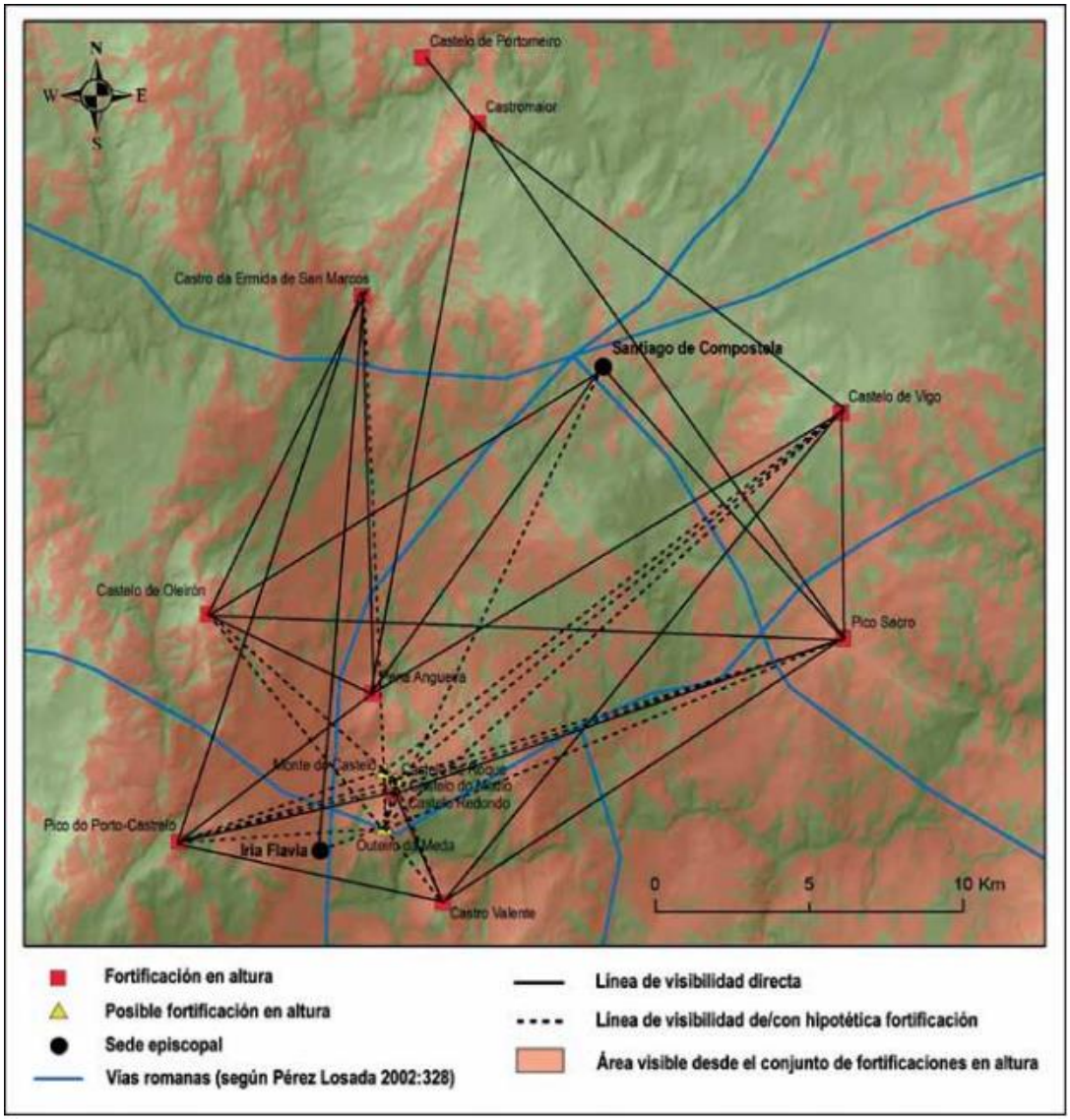

Figure 2. Map of visibility and intervisibility as presented (in Sanchez Pardo and Galbán Malagón 2015, 151). Legend translated from left to right: altitude fortification, possible altitude fortification, episcopal seat, Roman roads, direct line of visibility, line of visibility to hypothetical fortification, visible area from the fortifications together.

An intervisibility network is the extend of the line of sight between points. It is often shown as lines which represent a line of sight (fig. 2). A viewshed is a way of showing what part of a landscape is visible from one point or multiple points. This is often shown as

areas with a different colour than the map on which it is shown. These are the orange areas in figure 2.

1.2. The Research Problem

Marcos Martínez and Mantecón Callejo conclude the following about the high altitude fortifications in Liébana:

> *'Su posición es estratégica, con un Amplio dominio visual del valle desde el lugar; y a la vez visibles desde un amplio entorno territorial. (…). En todos los casos, inherente a este emplazamiento en cotas altimétricas elevadas con Amplio dominio visual del territorio, se le añade un control visual del territorio, se le añade un control visual de las rutas y caminos históricos que discurren por esa comarca.'*
> (Marcos Martínez and Mantecón Callejo 2012, 110).

They conclude that the strategic positioning of the fortifications gave them a broad visual view of the valleys, whilst remaining visible from a wide territory. The high altitude positioning of the sites would inherently give a visual control of the territory and visual control of historical routes and roads.

With the current consensus on the importance of visibility with regards to high altitude fortifications across Northern Spain (Funjal 2007 15-16; Marcos Martínez and Mantecón Callejo 2012, 109-11; Marcos Martínez and Mantecón Callejo 209, 117 and Quirós Castillo 2017, 328-33), a problem arises when there is a lack of tangible evidence regarding the specifics and extend of their visibility. Yet with the data available in their articles and geographical data available online of the area a visibility analysis, such as presented by Sanchez Pardo and Galbán Malagón, can be made. Such visibility analysis would give a new visualized way to solidify arguments for, or against, functions which are currently attributed to the fortifications in Liébana.

1.3. Aims and Research Questions

The aim of this thesis is to offer more information into the function and use of the fortifications in early medieval society in Liébana by investigating the visibility and extend of the visibility of high altitude fortifications in Liébana. And by doing so, to offer more available data which can be used in future research of early medieval high altitude fortifications in Northern Spain.

This will be investigated through answering the following research questions:

- From where in the landscape were these fortifications visible?
- What areas were visible to these fortifications?
- What fortifications are in the line of sight with one another?

1.4. Methodology

Two methodologies are used to answer the research questions and offer maps which could be used in further research. First of a viewshed will be made, which will indicate which areas are visible to the fortification and to which areas it was visible. Secondly an inter-visibility network will be made, this will indicate which fortifications could visually communicate with one another. The available data is limited, but to answer the research question with the available data, viewsheds and intervisibility networks form a useful methodology. They allow a relatively quick way of visualizing visibility on digital maps. This can be larger in scale and more time-efficient than what fieldwork would allow.

These methodologies can be applied through the *Geographic Information Systems* (GIS) program. GIS is a technology that provides tools which allows interactions with spatial data to help understand this information. It allows the visualization of spatial data through digital maps (Conolly and Lake 2006, 11-2, 16). The tools in GIS allow the visualization and mapping of intervisibility networks and viewsheds.

An intervisibility network is the principle of line of sight between selected points, as in this example the different fortifications in Liébana. The GIS program calculates which points are visible from which points. If this straight line is broken by a cell which elevation is higher than the supposed height of the line, the line is broken. This results in the site or cell not being visible (Conolly and Lake 2006, 226).

A viewshed uses the same principles as intervisibility but shows every cell which is visible from a certain point (Verhagen 2017, 17; Conolly and Lake 2006, 226). If this is done from a single viewpoint it is known as a *single viewshed*. If it does so from multiple viewpoints it is known as a *multiple viewshed*. When in the multiple viewshed the cells indicate by how many sites they are visible, it is known as a *cumulative viewshed* (Conolly and Lake 2006, 226-8).

These methodologies are possible because a *digital elevation model* (DEM) is available for Liébana. Only the coordinates of the location of the fortifications still have to be identified to be able to use the methodology in conjunction with the DEM.

1.5. Structure

To investigate the fortifications through viewsheds and intervisibility networks there first needs to be an assessment of the sites with a general background which will form chapter 2. After this assessment, the sites will have to be located as their coordinates are not yet easily available. The locating of the sites will be done in chapter 3.

In the first part of chapter 4, GIS will be discussed in combination with intervisibility networks and viewsheds. Understanding its merits and caveats is important before being able to understand why one cannot accept the results shown in the maps without a scientific discussion. In the second part of chapter 4 the results will be presented of viewsheds per site. This will allow the assessment of the location of each site and might show any inconsistencies in the data. In the third part of chapter 4 a multiple viewshed, a cumulative viewshed and an intervisibility network will be presented to show the result of all fourteen fortifications together.

In the last chapter, chapter 5, the research is brought together in a conclusion, followed by a discussion on the research.

2. The sites and their context

The goal of this chapter is to create a context for the research. To create this context firstly a background will be given of Liébana in general, followed by the historical context to which the fortifications are dated. Similarities in characteristics of the fortifications and their function as currently ascribed to the fortifications in the literature will then be discussed. Lastly the sites will then be discussed on a per site basis. Creating a context for each site specifically with figures to place them in their spatial context.

2.1. Background of Liébana

2.1.1. Liébana

Liébana is a *comarca* in Cantabria, Spain. A *comarca* is an area defined as a natural entity, often having distinct cultural features confined to that geographical area. These areas are currently often institutionalized. Liébana is the most occidental *comarca* of Cantabria. Liébana comprises multiple municipalities (Arias López 2013, 395-6 and 432). The area is surrounded by mountain ranges, with only few natural exits and entry points over or through the mountains (Cisneros Cunchillos et al. 1995, 188; Gómez Casares 2010b, 116).

The area is also well defined by three water catchments, most importantly the river *Deva*. which has two tributary streams; *Quiviesa* and *Bullón*. The river *Deva* also forms the only access route through the mountains to the north, the *Desfiladero de la Hermida*. These three rivers also run parallel along the main modern-day roads through Liébana, the N621, the CA185 and the CA184. The other routes into Cantabria are mountainous (Gómez Casares 2010b, 116). These three rivers also form the main modern-day roads (figure 3), and probably historical roads, through Liébana.

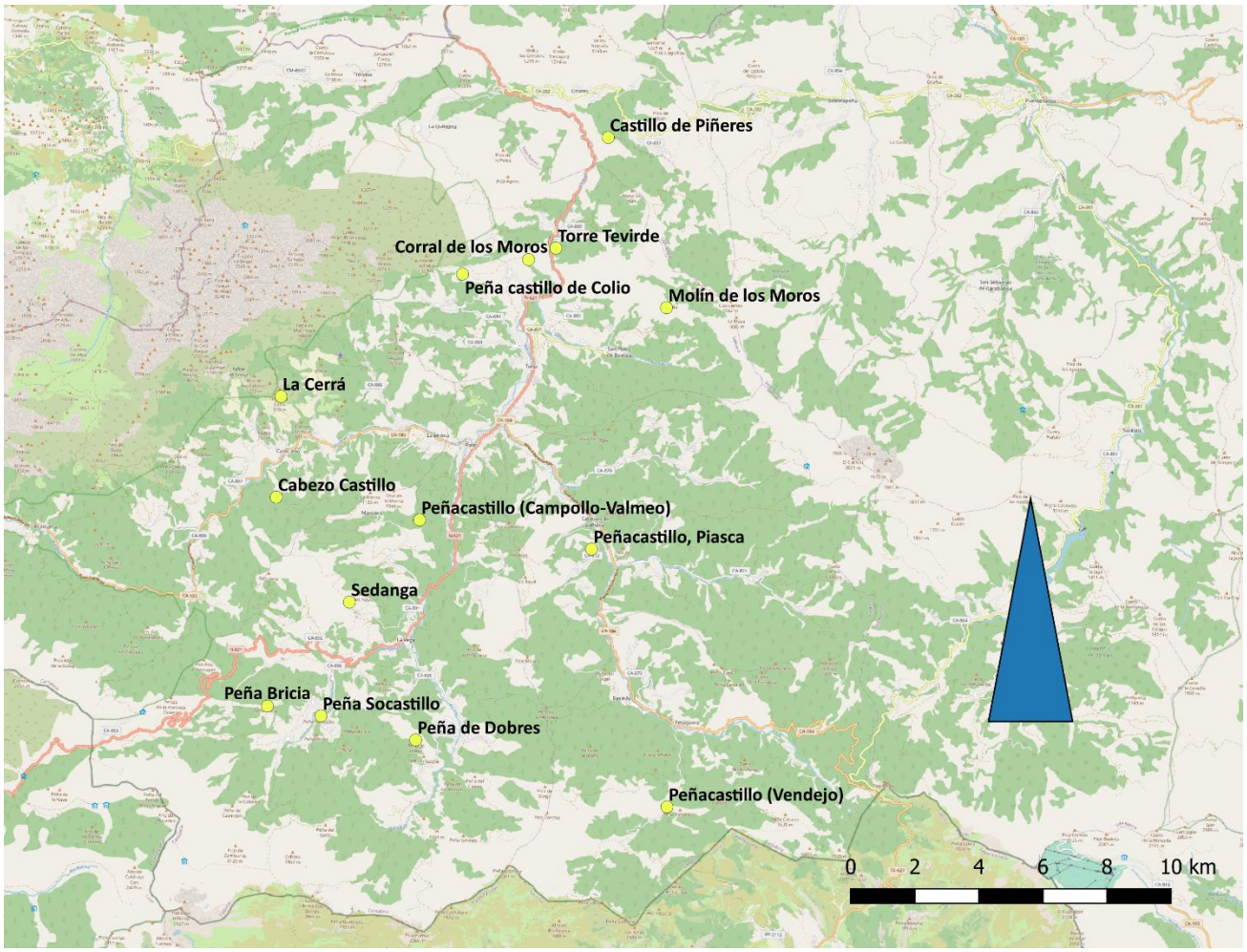

Figure 3. Liébana as seen through Openstreetview (by author).

2.1.2. Historical and Archaeological Context

Archaeological evidence, although scarce, correlate to a homogenous chronology. Material culture such as; decorated ceramics, arrowpoints and rests of mortar correlate with material culture associated with the early medieval period. This is further supported by C14 dating of rests of carbon found in the mortar. As a result the fortifications in Liébana have been dated the ninth to eleventh century. (Marcos Martínez and Mantecón Callejo 2012, 109-10). This large time frame makes it impossible to determine a specific historical event which could have caused the construction for the fortifications or let alone for a single fortification. Therefore, a global understanding of the entire timeframe and the society of Liébana during that time will be discussed.

One of the first key events was the Muslim invasion of the Iberian Peninsula in 711 (Portass 2017, 1). The Muslims controlled most of the peninsula by 720. In the north this is reflected by the garrisons placed in northern settlements such as *Lugo* and *Gijón.* Although around 740 after a Berber revolt the Northern part was abandoned. The reason for this withdrawal remains uncertain, but it is argued to be caused by the inclement conditions of the area which causes difficult communication between areas (Portass 2017, 2).

Figure 4. The political geography of the Iberian Peninsula c. 950 (in Portass 2017, 10).

In the beginning of the ninth century the Asturian kingdom came into being. Who inhabited this kingdom initially is debated. Whereas some argue Visigothic elite found refuge in the Asturian mountains, others argue it were most-likely indigenous peoples. It does seem that Liébana formed a part of the Asturian kingdom (Portass 2017, 41-2). The Asturian kingdom and the kingdom of León, which were both Christian, started to expand throughout the ninth century (Portass 2017, 4-9). These two kingdoms merged in the 910 with the capital being León. The period between 950 and 1050 can be characterized as turbulent for the Leonese Kingdom as it kept being defeated by the Cordoban Caliphate (Portass 2017, 9). A shift can be seen in the 1040's, as the caliphate

of Córdoba lost its political and cultural hegemony in 1031, and the Christian kingdoms León and Castile were united under count of Castile in 1037 (Portass 2017, 14).

The area of modern day Cantabria seems to have been Christianised during the sixth and seventh century, establishing the religion from the seventh century onward. In Liébana this is reflected by the appearance of charters in 790, the first being the *Santo Toribio* charter (Portass 2017, 43). The early-medieval society in Liébana sets itself apart from other parts of Northern Spain and Europe by a lack of a clear controlling elite throughout the early-medieval period. Apart from social climbers which must certainly have had considerable local power, their power remained very local. There was little social pressure from the elite if an elite was present (Portass 2017, 52, 65). This is also seen through the lack of appearance of distinguishing titles, within the charters, which show interactions between parties exchanging and selling land in ways which must have suited their own needs. As such, they showed plenty of agency and had their own property (Portass 2017, 50, 52-4, 83). In correlation with this historical evidence, excavations carried out in the settlements and fortifications in Northern Spain have yet to identify the existence of aristocratic residences (Quirós Castillo 2013, 330).

Both the historical and archaeological evidence give an interesting background with regards to the social community in which the fortifications were built. It suggests that an elite is lacking in early medieval Liébana. This stands in stark contrast with the paradigm of *incastellamento* which is used to describe the phenomena of the creation of fortified villages to establish dominion by the elite. This paradigm is often applied to describe large areas in southern Europe during the 10th and 11th centuries, such as France. In Northern Spain however, there is a current consensus that this paradigm is not applicable to the area (Quirós Castillo, 2013, 331). Consequently, in correlation with the historical evidence, in Liébana the lack of a visible elite suggests another phenomenon reflected in the cultural landscape than visible in other parts of Europe.

Although the paradigm of *incastellamento* might not be applicable to the fortifications in Northern Spain, the phenomenon of high-altitude fortifications in the early medieval period is not limited to Liébana. Throughout Northern Spain a similar dense network of early medieval high-altitude fortifications can be identified, such as in Asturias, Basque Country and Galicia. Throughout the mountainous valleys of Asturias such fortifications can be found, often situated on a high altitude and with small dimensions. The sites are

roughly dated to the medieval period, but this dating is problematized through the re-use of the sites throughout the history (Fanjul Peraza 2007, 111-7).

In Basque Country the fortifications: *Untzueta, Ereñozar, Aistxiki, Mendikute, Aua Gaztelu, Ocio* and *Murutegui* show similar characteristics as the sites in Cantabria. These sites are also situated on steep hilltops from which it sees large areas. The fortifications in Basque Country are also dated to the 9th, 10th and 11th century and are of similar size as the fortifications seen in Liébana (Quirós Castillo 2015, 328-9). Similar sites appear in Galicia. These sites are also broadly dated to the early medieval period and are characterized by their position on high altitude locations which provides the sites a broad view of their surrounding area (Sánchez Pardo and Galbán Malagón 2015, 126-7). The appearance of early medieval high-altitude fortifications in Liébana is thus not an isolated phenomenon, and might correlate with a broader process throughout early medieval Northern Spain.

2.2 The sites

2.2.1. Similarities

What connects the fourteen fortifications in Liébana together is twofold: their approximate dating, and their characteristics. In the literature the fortifications are described as early medieval, which for these sites specifically means anywhere between ninth to eleventh century (Marcos Martínez and Mantecón Callejo 2009, 116-117; Marcos Martínez and Mantecón Callejo 2012, 102).

The common characteristics of the sites which are pointed out are (Marcos Martínez and Mantecón Callejo 2009, 116-8):

- Same pattern of positioning, high altitude on mountains tops with at times abrupt steep cliffs and the impossibility for agriculture.
- The strategic position with clear view of the valley, also controlling entrances to the valleys. Sometimes along historical roads. Their positioning limits their direct tactical position as it is does not have direct access to roads or inhabited areas.
- Only a small force can stay in the limited habitable space. Around twenty men would be the maximum.
- The fortifications have a similar construction, existing mainly of rough unworked rocks from the local surroundings.

2.2.2. Proposed function in the literature

Throughout the literature of fortifications of early medieval Northern Spain varying functions are put forward. One function put forward in the literature is of the fortifications as symbols. The fortifications would be beacons of control in an area with a disperse population. It would thus be a permanent symbol of the ruling or dominant party (Marcos Martínez and Mantecón Callejo 2009, 117-8). This function contrasts with the current view of the area, as both historical and archaeological evidence suggests a lack of a clear elite (Portass 2017, 50, 52-4, 83; Quirós Castillo 2013, 331).

Another function is the function of organisation. The fortifications might have had an organizational function in their valleys, municipal region or territory (Bohigas, 1999: 419-425). An example of this could be as territorial or social ordering (Marcos Martínez and Mantecón Callejo 2009, 117). In this organizational function pieces of land could have been referenced according to the fortification. Thus marking a specific territory. This could also enhance communication in an already hard to traverse area, perhaps addressing the issues the Arabs had which resulted in them deciding to abandon the northern areas (Portass 2017, 2).

The altitude in which the fortifications are present do not justify a military strategic function. As the sites are situated on an inhabitable position, without a quick access route. This also would make an administrative function unlikely (Marcos Martínez and Mantecón Callejo 2009, 116) . But also inherent to their high altitude is their function of visual domination of the valleys. The fortifications can see the territory but can also be seen from the territory. Their placement shows a clear view of the historical routes (Marcos Martínez and Mantecón Callejo 2012, 109-10).

Resulting from the above named functions the two most likely functions are identified by Marcos Martínez and Mantecón Callejo as two archetypes:

- High altitude fortifications for beaconing territory.
- High altitude fortifications for controlling access routes.

The differentiating factor would be the importance of the visibility of the fortification, either focused on the route or on gaining visibility over a large area (Marcos Martínez and Mantecón Callejo 2012, 109-10). If such differentiation can be made it would be reflected in the viewsheds presented in this thesis.

It remains important to reflect that the fortifications do not have to reflect one function. It is quite possible the fortifications were built for different reasons in different times, with different perspectives in mind (Marcos Martínez and Mantecón Callejo 2009, 118).

2.2.3 Sites in their own context

It is important to give an idea of the location of each of the fortifications and their context as currently available in the literature. This chapter focuses on the sites on an individual basis. Including some locational indication and archaeological background. Their precise locations in correlation with each other are visible in figure 1.

2.2.3.1. El Castillo del Monte Subiedes (Cabezo Castillo).

El Castillo del Monte Subiedes, also known as *Cabezo Castillo,* is located on the highest peak of the mountain *Subiedes.* It exists of, perhaps an artificial, platform. The site is situated on an altitude of 1015 meters and is estimated to have a size of 1100m². On this platform a building was situated. The flanks of the platform are protected by cliffs on the northern, eastern and western side. These cliffs have an height of 215 meters (Marcos Martínez and Mantecón Callejo 2009, 105).

The most accessible route is from the southeast. Coming from this side the access is more difficult as there are cuts in the rocks creating a ditch protecting the access to the fortification (Marcos Martínez and Mantecón Callejo 2009, 108).

The fortification has a broad visual overview over the valley of the river *Deva.* With only three kilometres of distance, the fortification La Cerrá is situated in the same valley. La Cerrá lays within visual range according to Marcos Martínez and Mantecón Callejo.

Figure 5. Castillo del Monte Subiedes (www.xn--castillosdeespaa-lub.es/es/content/torre/castillo-de-monte-subiedes).

2.2.3.2. Castillo la Cerrá (Brez, Camaleño).

Castillo la Cerrá is placed on the most elevated point of the mountain, at an altitude of 912 meters. At the northern and eastern side there are steep flanks. *Castillo del Monte Subiedes* lies 3.3 kms away and in direct view of *Castillo la Cerra* (Marcos Martínez and Mantecón Callejo 2009, 118).

The fortifications itself exists out of an enclosure with a possible tower with the dimensions 9 by 7.5 meters. Around 19 meters from this enclosure an external wall is visible. This wall towards the enclosure would give the entire fortified area a dimension of 350m² (Marcos Martínez and Mantecón Callejo 2009, 118). According to Marcos Martínez and Mantecón Callejo the fortification makes use of the environmental features. Giving the fortification a strategic place with perfect views for visual control (Marcos Martínez and Mantecón Callejo 2009, 118).

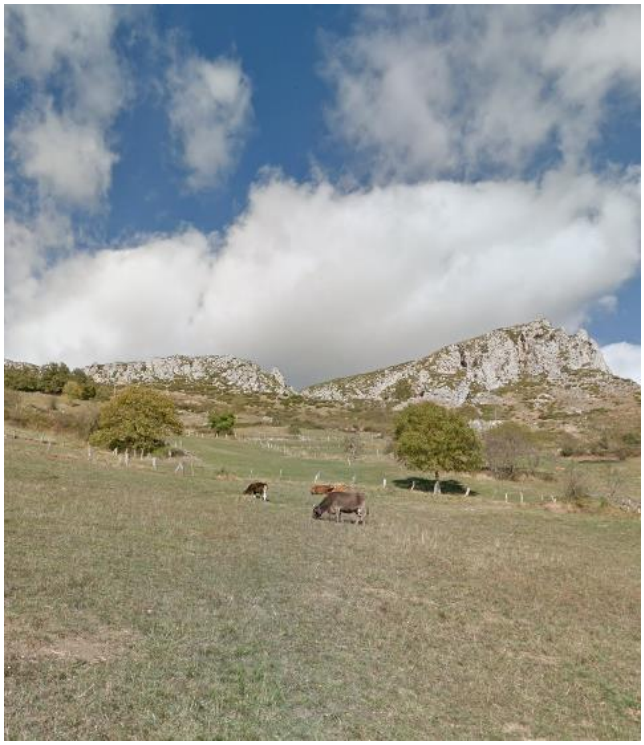

Figure 6. view of Castillo la Cerrá (www.google.com/maps/@43.1628115,4.6988521,3a,60y,358.85h,90t/data=!3m6!1e1!3m4!1s_xoTPD-LllTGbUkm16lggQ!2e0!7i13312!8i6656).

2.2.3.3. Peña Castillo (Colio, Cillórigo de Liébana).

Peña Castillo is situated on the summit of *pico Castillo*, which is close the village of *Colio* in the municipality of *Cillórigo de Liébana* (Marcos Martínez and Mantecón Callejo 2009, 119). Its altitude is 843 meters.

From the site, ceramics have been recovered with early-medieval aspects. Other finds were: pieces of lime mortar, lance point, arrow points, iron fibula, remains of mammal bones and a possible bronze tip with a prehistoric chronology (Marcos Martínez and Mantecón Callejo 2009, 119).

On the southern slope three walls can be identified, with 5 meters between each, together creating terracing or platforms. These walls were built with conglomerate stone found around the site and sandstone of various sizes. The fortification could with its dimension house a small military detachment. From its position it allows views of large parts of Liébana. Its position would also allow visual communication with other fortification such as Molín de Moros (Marcos Martínez and Mantecón Callejo 2009, 120).

The site has also been identified as a defensive site during the Iron Age. This identification as described by Gómez Casares named it *Castro de La Peñuca.* In its description it identifies the chronology of the site from the Neolithic onwards (Gómez Casares 2010a, 151).

Figure 7. View of Castro de la Peña Castillo (Colio) (www.xn--castillosdeespaa-lub.es/es/content/castro/castro-de-la-penuca).

2.2.3.4. Corral de los Moros (Pendes, Cillórigo de Liébana).

Corral de los Moros takes advantage of a platform on the crest of the peak with an altitude of 606 meters. It is situated along the *desfiladero de La Hermida* and close to *Castillo de Colio*. The footprint is rectangular and approximately 17 by 28 meters (Marcos Martínez and Mantecón Callejo 2009, 120). From its position *Corral de los Moros* can see *Peñacastillo de Colio* and *Torre Tevirde*. Both of these fortifications also lie close proximity. *Torre Tevirde* lies within 1 kilometre and *Peñacastillo de Colio* lies at 2 kilometres from *Corral de los Moros.*

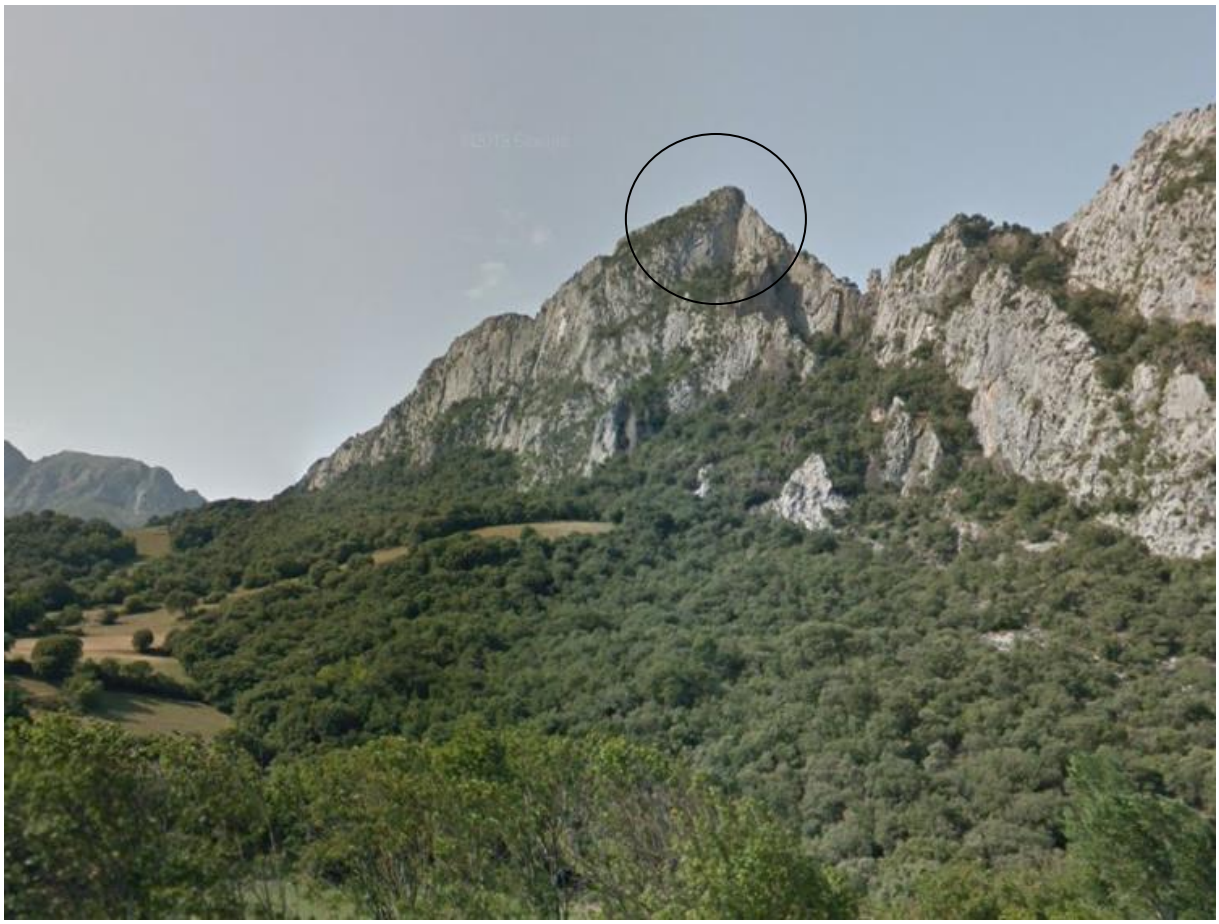

Figure 8. View of Corral de los Moros (https://www.google.com/maps/@43.1964024,-4.5941453,3a,60y,323.87h,92.03t/data=!3m6!1e1!3m4!1sJjA19cjnawTfON5SbGPtJw!2e0!7i13312!8i6656).

2.2.3.5. *Torre de Tevirde (Lebeña, Cillorigo de Liébana).*

Torre de Tevirde is situated along the *desfiladero de la Hermida* at a height of 394 meters. The platform, with a dimension of 18 by 20 meters, has signs of human impact as it forms an unnatural platform. Within this platform, at the centre, there are uncarved stones in dimensions of 10 by 12. This could correspond with another building. (Marcos Martínez and Mantecón Callejo 2009, 120).

It is visible through the historic road which enters from the north into Liébana, situated along the *Desfiladero de la Hermida.* Moreover, Marcos Martínez and Lino Mantecón Callejo point out that from this point *Corral de los Morros* and *Castillo Peñarurubia* are visible (Marcos Martínez and Mantecón Callejo 2009, 121).

Figure 9. View of Torre Tevirde from Casa rural El Agero (https://www.google.nl/maps/@43.2135463,4.592082,3a,68.6y,180.23h,101.05t/data=!3m9!1e1!3m7!1sAExdjzh2XV7xBHn1HT58A!2e0!7i13312!8i6656!9m2!1b1!2i38).

2.2.3.6. *Bolera de los Moros (Piñeres, Peñarrubia).*

On *Bolera de los Moros* some archaeological research has been done (Marcos Martínez and Mantecón Callejo 2009, 121). The site of the fortification is situated at the peak of *Monte de Santa Catalina*. It has an altitude of 752 meters. The platform it is on is 30 by 15-18 meters. The fortification has one tower situated on the western side, a courtyard in the middle, and a watchtower on the eastern side. On the south - southwestern side there is a sharp incline downwards until the *Rio Deva*. On the north - north-eastern the site is accessible. From its position sits on a crossroad of important natural access points. The more obvious road is the one along the *Rio Deva*, which is for a large part visible from above. But it also has visibility over the natural pass *Collado de Hoz*, which is a natural pass that allows communications with other interior valleys, such as *Lamasón, Nansa* and *Saja* (Sarabia Regina 2002, 269).

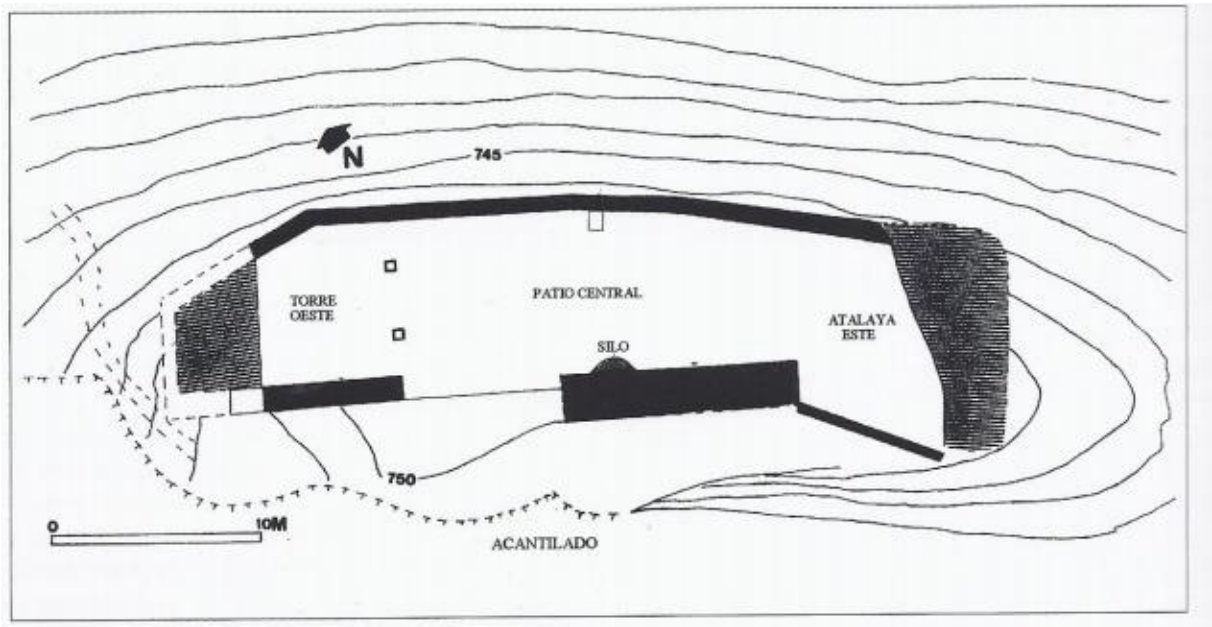

Figure 10. The ground plan of the Bolera de los Moros (Sarabia Regina 2002, 270).

Figure 11. View up from el Desfiladero de la Hermida to Bolera de los Moros (https://www.google.com/maps/@43.226018,-4.5840225,3a,75y,30.12h,107.1t/data=!3m6!1e1!3m4!1sweyxtSm3PVhYPmTjujSqqQ!2e0!7i13312!8i6656?hl=nl).

Figure 12. The view from the site down on El Desfiladero de la Hermida which enters here into Liébana (https://castillosdelolvido.com/castillo-de-bolera-de-los-moros).

2.2.3.7. Molín de los Moros (Cillorigo de Liébana).

Molín de los Moros is possibly a watchtower with a wall built around it. It is situated at an altitude of 1360 meters. It is unclear if the tower was circular or rectangular. The fortification is adapted to the irregularities of the peak. It only has limited space for housing a detachment (Marcos Martínez and Mantecón Callejo 2009, 121).

The fortification could have been an important site for the main route of communication with *Asturias de Santillana*, which goes through *Puerto de Montaña*. Furthermore, it has a large visual dominion over *Liébana*, with visual communication with other fortifications, such as *Castilllo de Colio* (Marcos Martínez and Mantecón Callejo 2009, 122).

Figure 13. Molín de los Moros (www.xn--castillosdeespaa-lub.es/es/content/torre/molin-de-los-moros-castillo).

2.2.3.8. *Peña Castillo (Piasca, Vega de Liébana).*

Peña Castillo (Piasca) has been identified by R. Bohigas. Although it is difficult to verify if there was indeed a fortification situated here, because of a lack of material evidence. Two documents from the eleventh century might refer to this fortification (Marcos Martínez and Mantecón Callejo 2009, 122).

Figure 14. View of Peña Castillo, it's supposed location is circled (https://www.google.com/maps/@43.1228176,-4.5688409,3a,75y,288.02h,97.69t/data=!3m6!1e1!3m4!1sQD7jXsKfGFJ3W1vuZNOR0g!2e0!7i13312!8i6656).

2.2.3.9. *Peña Castillo (Vendejo, Pesagüero).*

Peña Castillo (Vendejo) is situated on an altitude of 861 meters with a steep rock formation on its sides. On the peak there are rests of a possible rectangular tower with a dimension of 56m². The summit it could have been modified by humans to make construction possible (Marcos Martínez and Mantecón Callejo 2009, 123).

The placement lies along the historic route, *Puerto de Sierras Albas*, which connects *Liébana* with *Palencia* to its south-east. This might indicate a defensive purpose (Marcos Martínez and Mantecón Callejo 2009, 123).

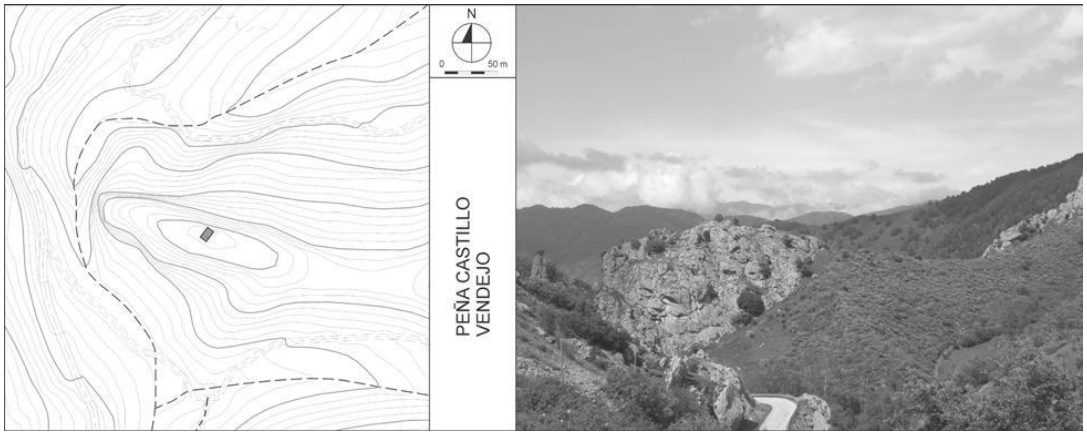

Figure 15. Peña Castillo (Vendejo), figure from the article Castillo de Monte Subiedes (Marcos Martínez and Mantecón Callejo 2009, 123).

Figure 16. Peñacastillo viewed from Vendejo, situated on the left peak/ridge (www.google.com/maps/@43.05631,-4.54481,3a,75y,177.77h,102.49t/data=!3m8!1e1!3m6!1sAF1QipNFBNRvWvyotGpa5MtUct5NjWIkZ-7jG9sXL- zT!2e10!3e11!6shttps:%2F%2Flh5.googleusercontent.com%2Fp%2FAF1QipNFBNRv WvyotGpa5MtUct5NjWIkZ-7jG9sXL-zT%3Dw203-h100-k-no-pi-0-ya194.99998-ro-0-fo100!7i10240!8i5120).

2.2.3.10. *Peña Bricia (Ledantes, Vega de Liébana).*

Peña Bricia is situated on a plateau at an altitude of 1282 meters, it is protected by cliffs with heights up to 180 meters. The entrance seems to have been through its western flank. The site had a dimension of 126m². The fortification possesses visual control of the access to Liébana from *el Puerto de San Glorio y León.* From this point Peña Castillo (Barrio), Castillo de Dobres and *castro Doberganes* are visible (Marcos Martínez and Mantecón Callejo 2009, 124).

Figure 17. A view of Peña Bricia (www.xn--castillosdeespaa-lub.es/es/content/torre/torre-de-pena-bricia).

2.2.3.11. *Peña Socastillo (Barrio, Vega de Liébana).*

Peña Socastillo is also situated on a steep mountain which stands abruptly in the landscape. It is situated at an altitude of 786 meters. It has steep cliffs on the sides. Nowadays access to the peak is difficult. On the peak there is more or less a flat platform, with a possible anthropologic origin. From this point there is visual control of a historic route which connected *Liébana* with *Guardo-río* through the *Puerto de Aruz.* According to Marcos Martínez and Mantecón Callejo it does have visual control of the surrounding space (Marcos Martínez and Mantecón Callejo 2009, 125).

Figure 18. View of Penã Socastillo (Barrio) (www.xn--castillosdeespaa-lub.es/es/content/torre/pena-castillo).

2.2.3.12. Castillo de Dobres (Vega de Liébana).

Castillo de Dobres lies close to the village *Dobres*. It is situated on the highest peak of *Peña de La Hoz* (Figure 17). The peak has dimensions of 15 by 17 meters, according to aerial photos. At 1387 meters altitude it has a visual control over *Liébana.* The route from *Guardo* into *Liébana* is also within visual control of Peña Bricia and it follows the course of *río de Requejada* (Marcos Martínez and Mantecón Callejo 2009, 125-6).

Figure 19. View of Peña de la Hoz (www.cotoyapindia.com/2019/03/pico-lezna-cucayo.html).

2.2.3.13. Sedanga (Toranzo, Vega de Liébana).

Sedanga is situated elevated above the village of Toranzo with an altitude of 1011 meters, as visible in figure 20. It takes advantage of sudden change in height caused by cliffs, as it suddenly gets steep close to the village. The estimated size of Sedanga is 192,5m². It stands over historical routes such as the route *Puerto San Glorio* through *Riofrío*. From this point visual communication exists with *las torres de Bore,* late medieval fortifications at the bottom of the valley (Marcos Martínez and Mantecón Callejo 2009, 126).

Figure 20. View from Toranzo of the fortification Sedanga (https://www.google.com/maps/@43.1052224,4.6657708,3a,75y,326.06h,108.17t/data=!3m6!1e1!3m4!1scyjLJVHUXiMC6Hgrn_R84w!2e0!7i13312!8i6656).

2.2.3.14. Peña Castillo (Campollo-Valmeo, Vega de Liébana).

Peña Castillo (Campollo-Valmeo) is situated above the village of *Valmeo* and he *Río Quiviesa* at an altitude of 690 meters. It visually controls the route which goes along the valley to the *Puerto the San Glorio* (Marcos Martínez and Mantecón Callejo 2009, 127).

Figure 21. View of Peñacastillo (Campollo-Valmeo) from the N-621 in Google Maps (www.google.nl/maps/@43.1338111,4.630256,3a,41.8y,267.33h,105.63t/data=!3m9!1e1!3m7!1sZVK7tNsq-cut4Vta94Hwrg!2e0!7i13312!8i6656!9m2!1b1!2i17).

2.3. Conclusion

Liébana is a geographically marked area with 14 early medieval fortifications dated to the 9th to 11th century, a period in which Liébana does not show a clear elite in the historical and archaeological evidence. In conjunction to Liébana, other areas in Northern Spain also show early medieval fortifications with similar characteristics. The function ascribed to these fortifications in Liébana vary from marking territory to controlling access route. Most of the ascribed functions to the fortifications focus on visibility. It is important to keep in mind how theorizing about the phenomena as whole might do injustice to the individual choices which were made in the decision-making process of people in Liébana per fortification.

In table 1 the characteristics are summarized per fortifications. Whilst looking at the site on a per site basis it is notable how altitude and size differed between the sites. This altitude does not take into account the altitude as seen to its direct surrounding, which would make altitude more relative. Comparing the size of sites however, does show a significant outlier. *El Castillo del Monte Subiedes* is at least double in its estimated size compared to the other fortifications. Furthermore, the sites show clear defensive structures.

Table 1. Sites with their characteristics according to their respective source material. A '-' indicates unknown.

Site	Altitude	(estimated) Size	Intervisibility	Source
El Castillo del Monte Subiedes	1015m	1100m²	La Cerrá	Marcos Martínez and Mantecón Callejo 2009, 105, 110
La Cerrá	912m	350m²	Castillo de Monte Subiedes	Marcos Martínez and Mantecón Callejo 2009, 118
Peña Castillo (Colio)	843m	-	Molín de los Moros, Corral de los Moros	Marcos Martínez and Mantecón Callejo 2009, 120-1
Corral de los Moros	606m	476m²	Peñacastillo de Colio, Torre Tevirde	Marcos Martínez and Mantecón Callejo 2009, 120
Torre Tevirde	394m	360m²	Corral de los Moros, Castillo de Peñarrubia	Marcos Martínez and Mantecón Callejo 2009, 121
Bolera de los Moros	752m	450m²	Torre Tevirde	Sarabia Regina 2002, 769
Molín de los Moros	1360m	-	Castillo de Colio	Marcos Martínez and Mantecón Callejo 2009, 121-2
Peña Castillo (Piasca)	-	-	-	Marcos Martínez and Mantecón Callejo 2009, 122
Peña Castillo (Vendejo)	861m	56m²	-	Marcos Martínez and Mantecón Callejo 2009, 123
Peña Bricia	1283m	126m²	Castillo de Dobres, Peña Socastillo	Marcos Martínez and Mantecón Callejo 2009, 124
Peña Socastillo	786m	-	Peña Bricia	Marcos Martínez and Mantecón Callejo 2009, 12-5

Peña de Dobres	1387m	255m²	Peña Bricia	Marcos Martínez and Mantecón Callejo 2009, 125-6
Sedanga	1011m	192.5m²	-	Marcos Martínez and Mantecón Callejo 2009, 126
Peñacastillo (Campollo-Valmeo)	690m	-	-	Marcos Martínez and Mantecón Callejo 2009, 127

3. Locating the sites

There are no pre-determined coordinates available for El Castillo de Monte Subiedes, La Cerrá, Corral de los Moros, Torre Tevirde, Bolera de los Moros, Peña Castillo (Piasca), Peña Castillo (Vendejo), Peña Socastillo and Castillo de Dobres. These coordinates are not available online nor within literature. This results in a problem in which the sites have to be located to be able to lay a foundation for further research. To obtain this crucial dataset this chapter focuses on how the coordinate points will be determined. The method that is used to determine the coordinates is discussed. After which the results will be critically compared and discussed. This is to prevent one for blindly accepting and for understanding the caveats of using the given methodology.

3.1. Methodology

The available data comes from multiple sources:

- Four coordinates of fortifications provided by *GAEM Arqueólogos* (appendix 1).
- The figures of the sites with contour lines (appendix 2, 3).
- The map of the fortifications in Liébana (appendix 4).
- An opensource map in GIS with contour lines *Cartografía de Cantabria* (territoriodecantabria.es/cartografia-sig/servicios-wmts-iig).

With the dataset the following methodology will be used to pinpoint the coordinates per fortification. In the first step the available figures with contourlines in appendix 2 and 3 will be compared to the contourlines in the *Cartografía de Cantabria* which is similar. On basis of this comparison the coordinate point will be set. After which the coordinates of the sites which are already identified by GAEM *Arqueólogos* will be compared to the results the methodology. In figure 22 and 23 an example is shown of how the contour lines are similar and can be used to identify the location of the site.

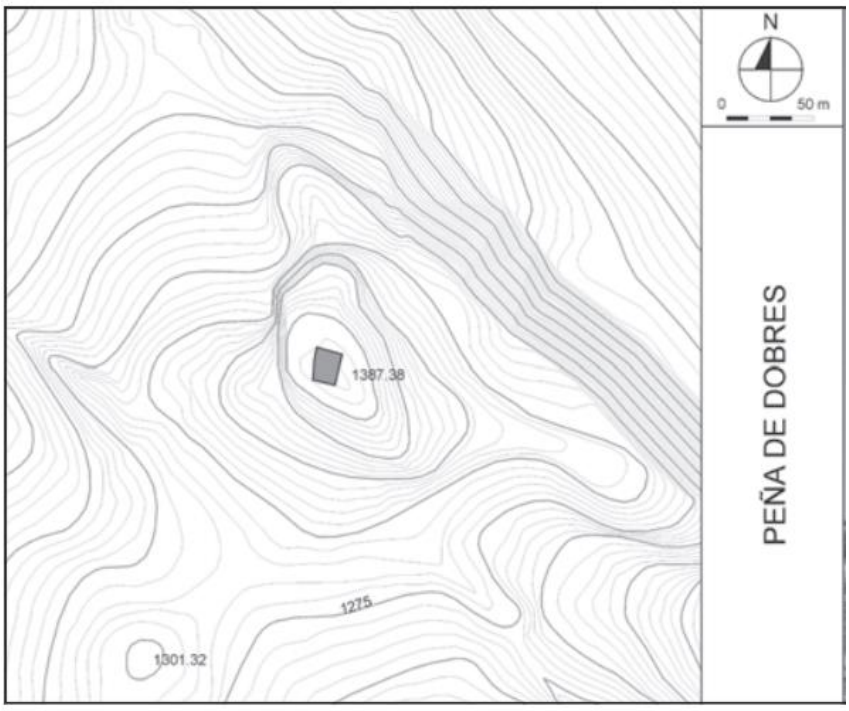

Figure 22. Contourlines as presentend in Marcos Martínez and Mantecón Callejo 2009, 125.

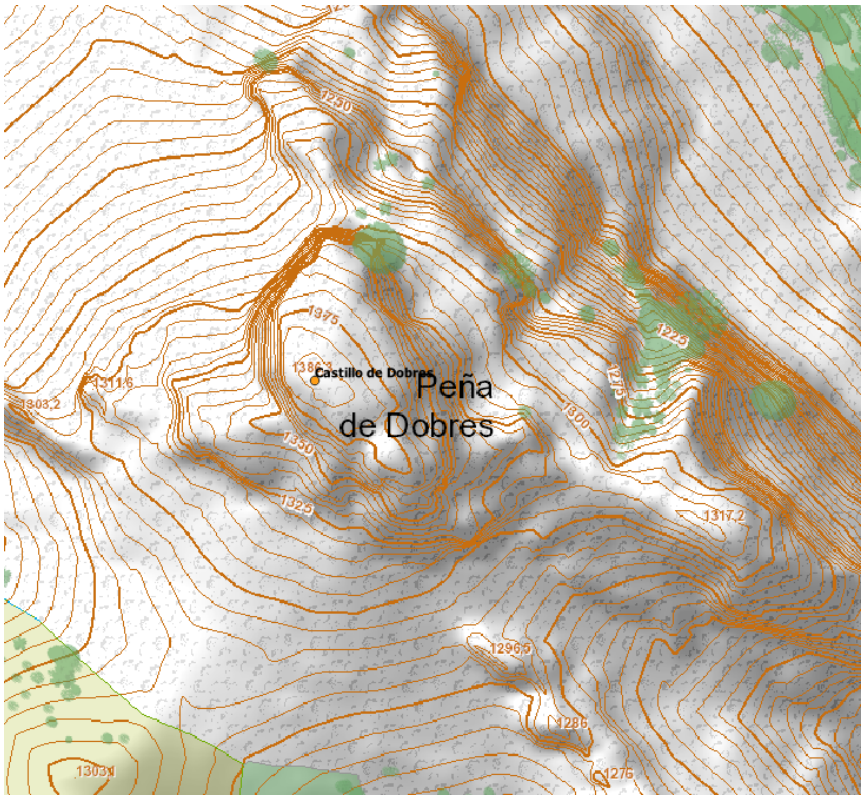

Figure 23. Castillo de Dobres pinpointed according to contourlines as visible in QGIS with Cartografía de Cantabria from Terrenodecantabria.es. and the location name (by author).

3.2. Results

The final coordinates are in the *European Terrestrial Reference System* 1989 (ETRS89). It results in the following table:

Table 2. Coordinates per fortification in ETRS89.

Name	X-coordinate	Y-coordinate
Cabezo Castillo	361.907	4.777.535
Castillo de Piñeres	372.267	4.788.760
Corral de los Moros	369.782	4.784.948
La Cerrã	362.055.	4.780.678
Molín de los Moros	374.085	4.783.445
Peña Bricia	361.630	4.771.015
Peña castillo de Colio	367.721	4.784.499
Peña de Dobres	366.272	4.769.979
Peña Socastillo	363.302	4.770.708
Peñacastillo (Campollo-Valmeo)	366.380	4.776.823
Peñacastillo (Vendejo)	374.102	4.767.867
Peñacastillo, Piasca	371.748	4.775.915
Sedanga	364.189	4.774.258
Torre Tevirde	370.638	4.785.309

To verify the accuracy it is compared to the coordinates as provided by GAEM Arqueólogos. This comparison is put in the following table:

Table 3. Coordinates by GAEM Arqueólogos compared to the coordinates established through the methodology.

Name	X by GAEM	Found X-coordinate	Y by GAEM	Found Y-coordinate
Peña Castillo (Colio, Cillorigo de Liébana):	367.716	367.721	4.784.499	4.784.499
Molín de los Moros:	374.085	374.085	4.783.455	4.783.445

Peñacastillo (Campollo, Vega de Liébana):	366.345	366.380	4.776.909	4.776.823
Sedanga:	364.191	364.189	4.774.277	4.774.258

Peña Castillo (Colio), Molín de los Moros and Sedanga have coordinates which are similar to the coordinates by GAEM Arqueólogos. The small deviations can be attributed to the coordinate being one point in the larger dimension of the site. As a result this can vary several meters between the chosen point as the coordinate for the entire site. Peñacastillo (Campollo) does however deviate 92 meters from the coordinates by GAEM Arqueólogos. This is due to the lack of a figure with contour lines for this specific site. Yet the given coordinates are not logical given the description. These coordinates show a point on a steep hillside instead of the mountain peak with easy access as described (Marcos Martínez and Mantecón Callejo 2009, 127). As visible in figure 24 the site is situated on the peak with an access route to its south. Therefore it is chosen to use the identified coordinates opposed to the coordinates provided by GAEM Arqueólogos.

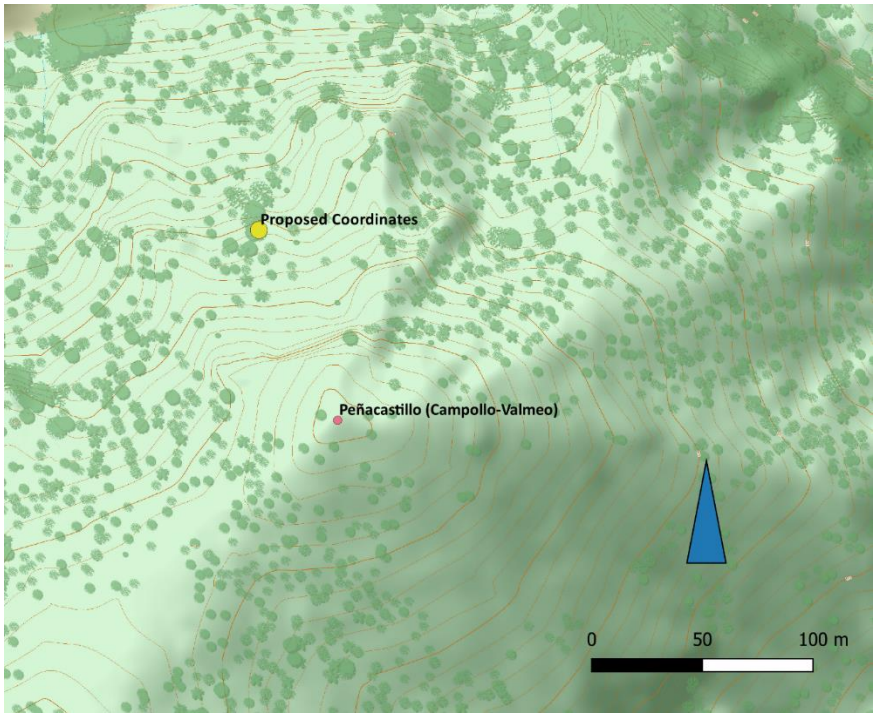

Figure 24. Proposed coordinates in yellow, chosen coordinates in pink (by author).

3.3. Conclusion

In conclusion, the methodology does give a representative result for the sites. Although with small deviations and one outlier, the differences are small and understandable given the dimension of the sites. The coordinates (table 2) are thus usable for the rest of the thesis.

4. Visibility

In this chapter the visibility of the early medieval fortifications in Liébana will be explored. First the nuances and methods will be discussed with its functions and drawbacks. After establishing the terms and methods, the dataset will be determined to which the results will adhere. When these parameters are set, maps will be made with the given parameters. The maps are the result of the given parameters and the coordinates of chapter 3. These results are split up on maps on a per site basis, and 2 parts showing a completer overview. The results will be discussed per site and map, with lastly a conclusion discussing possible significance of the maps.

4.1. GIS and visibility analysis

4.1.1. GIS

Geographic Information Systems (GIS) can be understood as a technology which allows the interaction and understanding of spatial data. Its application goes further than simply creating a map, it provides the tools to order spatial data which can result in new insights (Conolly and Lake 2006, 11). It is a type of software which unifies these tools and connects data through their spatial relation (Wansleeben and Verhart 1997, 54-5). The chosen software for this thesis is QGIS. QGIS is an open source GIS. QGIS is constantly in development, growing in its capabilities and stability (QGIS.org). This software is chosen because it does need an extra budget to use, and because of prior experience using QGIS.

4.1.2. Visibility analysis

The study of visibility has become more popular with the rise of GIS. It is now widely used by archaeologists to explore visibility, non-visibility and intervisibility. Investigating visibility gives the possibility studying how humans perceived their space (Paliou 2018, 65-6). Visibility analysis is basically a visual representation of which point is visible from another point in a straight line (Verhagen 2017, 17).There are two types of visibility analysis which are also applied in this thesis: intervisibility networks and viewsheds.

To be able to make an in-depth visibility analysis a visibility analysis plugin needs to be installed in QGIS as the base software is limited in regards of its implementation of visibility analysis. The plugin used is freely available in the QGIS plugin list as: Visibility Analysis by Zoran Cuckovic (http://www.zoran-cuckovic.from.hr/QGIS-visibility-analysis).

4.1.2.1. Intervisibility Network

An intervisibility network is the principle of line-of-sight between selected points, as in this example the different fortifications in Liébana. The GIS program calculates which points are visible from which points. If this straight line is broken by a cell which value is higher than the supposed height of the line, the line is broken. This results in the site or cell not being visible, and thus not showing a line-of-sight (Conolly and Lake 2006, 226). The intervisibility network will be used to determine the visibility of the fortifications amongst each other. The lines give a clear indication of a line-of-sight, and thus is a useful representation when determining intervisibility between the fortifications in Liébana.

4.1.2.2. Viewsheds

A viewshed shows every cell which is within the line-of-sight of a certain point, within the chosen radius. As a result if from one site a visibility radius of five kilometres is chosen, it will show every cell which would be directly visible from that point of origin in a five kilometre radius (Verhagen 2017, 17; Conolly and Lake 2006, 226). When done from a single viewpoint it is known as a *single viewshed*. When done from multiple viewpoints it is known as a *multiple viewshed*. When in the multiple viewshed the cells indicate from how many points of origin they are visible it is known as a *cumulative viewshed* (Conolly and Lake 2006, 226-8).

This method of showing visibility through viewsheds is useful as it shows the connection of the fortification with its surroundings. This method helps in identifying its reach and chosen importance of visibility. It is also very comprehensive when showing a viewshed from a single point because its view can easily be identified. Furthermore, such a visualization can show irregularities or slight shortcomings in the chosen parameters. Therefore in this thesis, every identified fortification will have a viewshed.

There are two viewsheds made per site. One map will show from which points in the landscape the sites were visible. This is to indicate from what areas sites were visible which can show its potential mark it left in the cultural landscape of early medieval Liébana. The other map made will be reflecting the active control the fortification might have had. Its parameters will indicate from which distance it could identify humans, with which it could actively observe human activity. This could for example show its control over access routes.

Multiple and cumulative viewsheds will also been shown. This can show the entirety of visibility within Liébana. Although because of its size it is less comprehensive, it can show where gaps fall in the system on a macro scale. This in turn could show areas in which there is an increased chance of encountering an archaeological site similar as those discussed in this thesis.

4.1.2.3. Issues regarding visibility analysis

It should be kept in mind that through GIS visibility can be visualized, but this should not be the goal of using visibility in GIS. GIS has to be used as a means to an end. Furthermore, visibility might be theoretically possible from point A to point B but the research surrounding visibility should not stop there as visibility is not dependant on just straight line of sight, and visual communication such as smoke could circumvent this (Gillings 2017, 122).

Conolly and Lake distinguish four different concerns regarding visibility analysis: computational, experimental, substantive and theoretical. The *computational issues* are the way different GIS programs calculate visibility differently, which results in different results per program. The algorithm or calculation of elevation might be different. Also, some programs do or do not take into account earth curvature (Conolly and Lake 2006, 228-9). QGIS is used in this thesis with a specific plugin allowing further visibility analysis in the software, if another program was being used other results can be expected.

The *experimental issues* are the way different renderings differ because of the choice of parameters. Things such as the target height or observer height can sometimes have a huge impact on visibility analysis results. Therefore it is important to try different parameters to see how they impact the results (Conolly and Lake 2006, 229-30). An example this issue is for example choosing the height of the fortifications.

The *substantive issues* regards factors which influence and determine the choice of parameters. Such as the average height of the observer which can vary, whilst GIS only accepts one value. Or features in the landscape with a high contrast which make them stand out more from the landscape. Which is for example the case with the fortifications, as they stand out from the mountain peak, and thus do not merge into the mountain from certain viewpoints (Conolly and Lake 2006, 229-232). Fortifications on mountain peaks as seen in Liébana, would have stood out against the sky with their contour and contrast clearly visible.

4.2. Dataset

To be able to create a visibility analysis the locations of the sites are necessary with a digital elevation model. The location of the site is necessary as the viewshed of intervisibility has to come from a single point. In chapter 3 the site locations have been discussed and pinpointed. For the analysis the coordinates presented there will be used.

It is important to note that the sites shown are only the sites which have been identified over the years. Given some fortifications have been fairly recent discoveries, such as Peñacastillo (Campollo-Valmeo) in 2005 by Gaem Arqueólogos (Marcos Martínez and Mantecón Callejo 2009, 127), it would be preliminary to suggest that these were the only sites relevant for the dataset. More might be discovered as research continues. Furthermore, historical sites apart from fortifications such as episcopal complexes and villages are also not added within the dataset. Although these would add more perspective with regards to the positioning of the fortifications, it would go beyond the scope of the thesis.

With the locations pinpointed in chapter 3 a digital elevation model is needed to place the coordinates in their spatial context.

4.2.1. Digital Elevation Model

The national project *Plan Nacional de Ortofotografía Aérea* (*PNOA*) was started in Spain in 2009. This project mapped Spain with LiDAR. Cantabria was part of the first covering and was mapped in 2012. In 2015 the first covering of Spain was finalized and published (Pnoa.ign.es). *Light detection and ranging* (LiDAR) uses laser pulses to measure discrete distances (Chase et al. 2017, 89). It does so by calculating the time it takes for the light to go to the surface and back. These lasers can be shot by a variety of platforms (pnoa.ign.es). The basic result of LiDAR data is a *digital elevation model* (DEM). This result is an elevation raster existing out of an x, y and a z (Chase et al. 2017, 92). This raster-file is a file type which exists out of a grid of cells in which each cell has its own value. In the case of this thesis it is an elevation raster, and thus every cell has an x, y and z value. A result of PNOA is such a DEM file. This digital model is without obstacles such as vegetation and buildings and shows the elevation of each cell. Every cell within this DEM is a size of 5 by 5 meters.

Figure 25. An example of the cells when zoomed in. Every cell is 5 by 5 meters (by author).

In PNOA the entirety of Spain has been mapped. Liébana has been cut into 4 rectangular areas giving 4 separate raster files. Within the method used in PNOA the squares in which Liébana lies are numbered 56, 57, 81 and 82. These files are available for download at centrodedescargas.cnig.es. To create a single file from the separate files they have been merged together to create a DEM for the use in this thesis.

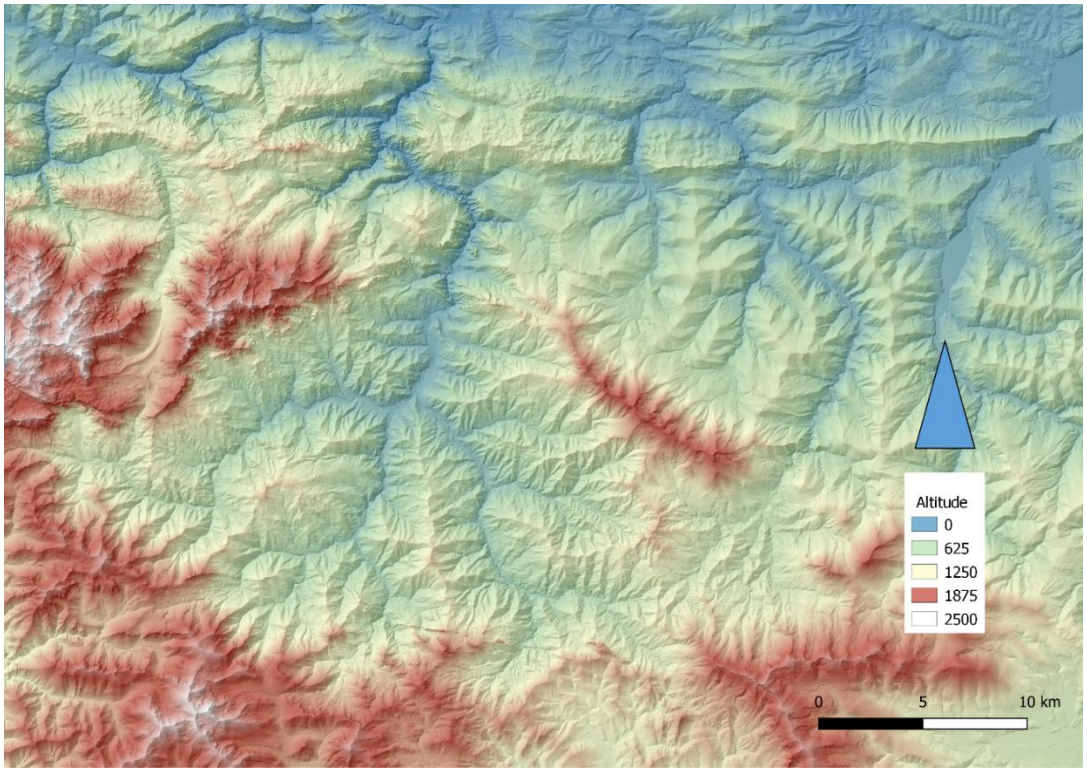

Figure 26. The result of merging the maps, attributing colour to their altitude and adding a transparent map with attributed shades (by author).

The coordinate system used for the maps on the Iberian Peninsula is ETRS89. As a result it is also the chosen coordinate system in this thesis. It lays in the UTM zone 30 N, this together with ETRS89 results in using EPSG:25830. EPSG:25830 uses the European coordinate system ETRS89 and projects it in the UTM zone 30 N in which Cantabria is situated. Furthermore, in the map a raster file of 5x5 meters is chosen as a smaller raster size would impact rendering time and a bigger raster size would result in less accurate results (Lock and Pouncett 2017, 133).

4.3. Parameters

The parameters chosen for the visibility analysis are impactful on the results given by QGIS. For the visibility analysis the following parameter have to be determined:

- Observer height
- Target height
- View radius
- Earth curvature

4.3.1. Observer height

The observer height is the height from which the viewer sees the landscape. It is the eye height of the observer. If the average height of early medieval people in Liébana was 1.60 meters the height would thus be around 1.60 meters. However, there are more aspects influencing observer height. In the case of this thesis the observer height would be significantly higher as archaeological evidence suggests towers and walls being present. The total observer height would thus be determined by the accumulation of the tower or wall height and observer height.

However, these towers are associated with later phase in the chronology of these fortifications (Marcos Martínez and Mantecón Callejo 20012, 110). Choosing the height of the towers is problematic as it could thus only reflect the later phases of these fortifications. Also problematic is the lack of hypotheses or arguments which give a possible height for the towers. Even less so an average which could be representative for all fortifications in Liébana. Searching for examples of fortifications with a representative height gives a highly variable result, and these examples are also associated with later phases in the sites occupation. Two of these examples are *Torre de Mogrovejo* and *Torre de Ruerro*. *Torre de Mogrovejo* is a 13th century tower which is 21 meters in height (www.xn--castillosdeespaa-lub.es/es/content/mogrovejo-torre-de), whilst the 14th century *Torre de Ruerro* in *Valderredible* is 12 to 13 meters in height

(https://web.archive.org/web/20070416221316/http://personales.mundivia.es/flipi/Cuadernos/Cuaderno_9/Torres_medievales.htm#11). Both examples from later periods show a high variability in tower height.

The choice made for the height of the tower for the early medieval fortifications in Liébana is 8 meters. This choice is made with the assumption that it is an achievable size, yet higher than fortified walls. If the tower size would have varied between the fortifications it could be anywhere between the 5 and 12 meters. This gives 8 meters a spot in which it could represent both without having a significant impact on the results.

The average height of a person comes less precise as a few centimetres increase or decrease in height would not influence the outcome the results. The scale on which this visibility analysis takes place is too large in size for that to have a significant impact. Literature indicates an average height of adult males in Northern Europe during the 9-11th centuries to be 173.4 cm (Steckel 2004, 216). Northern Europe is unfortunately not the right indication for Spain, where through the Muslim invasion large regional differences might have been prevalent. More recent 20th century average male height in Spain ranges from 168 cm in 1935 to 176 cm in 1975 (Spijker et al. 2012, 279). This indicates a fast change in average height during the 20th century. Given these fluctuations in height, the average height used in this thesis will be 170 cm.

4.3.2. Target height

The target height is the height of the object being viewed by the observer. If the target height is 0 the observer is looking only at things at exactly the ground level. When the observer is looking for humans in the area the target height could be the average height of a human.

In the intervisibility network the target height would be close to the observer height. As it focuses on the intervisibility between the sites. This is however, not entirely the same, as it would mean when the head of the target sticks out above a mountain top it would be visible at a larger distance as if it was as recognizable as the tower itself. This is not simple to avoid because within an intervisibility network a line is drawn to show line of sight. If from one side the site is visible it would automatically mean, through a line, that from the other site the site looking is also visible. The target does not necessarily see the observer and vice versa. This is even clearer over long distances. For this thesis the target height equals observer height within the intervisibility network. But it is important to keep in mind the problems with regards to line of sights.

In viewsheds however, it has to be chosen what the target height is. As here it might give a difference in results. To show the visibility of fortifications from the area itself, a target height of 170 cm would be viable. As it would show from which cells within the landscape the fortifications are visible for persons which are 170 cm tall. But looking at the area which a fortification could actively control a larger part of the person has to be visible. As on a larger distance just a head wouldn't be visible. Also, a choice has to be made what the goal was of the fortifications in actively controlling, human movement or also for example cattle.

The assumption is that one function of these fortifications was to actively observe human movement. As a result of this assumption other movements, such as that of cattle or carts, could also be observed as these were larger objects in the landscape. To avoid only the head being visible of the target, the target height in this viewshed will be 100 cm. This could then also include the view on cattle within the viewshed and leaves 70 cm to be visible of humans to be seen by the observer. This also matters when watching the other way around, from within the landscape towards the tower. In this case the target will be 170 cm as it is practically the observer and the tower will be 700 cm to account for the fact a part has to be visible for it to be visible over a long distance.

To investigate the possible changes in results of the viewshed by choosing the parameters 700 cm as observer height and 170 cm as target height, opposed to the observer height being 970 and target height being 170 cm, figure 27 is made. The figure shows the difference from which areas the site would have been visible with regards to the different parameters. Although very similar results are visible with both parameters, it does make a small difference. This difference becomes more visible when zooming in. To try to give an image as accurate as possible of the visibility it is thus relevant to use these specific parameters.

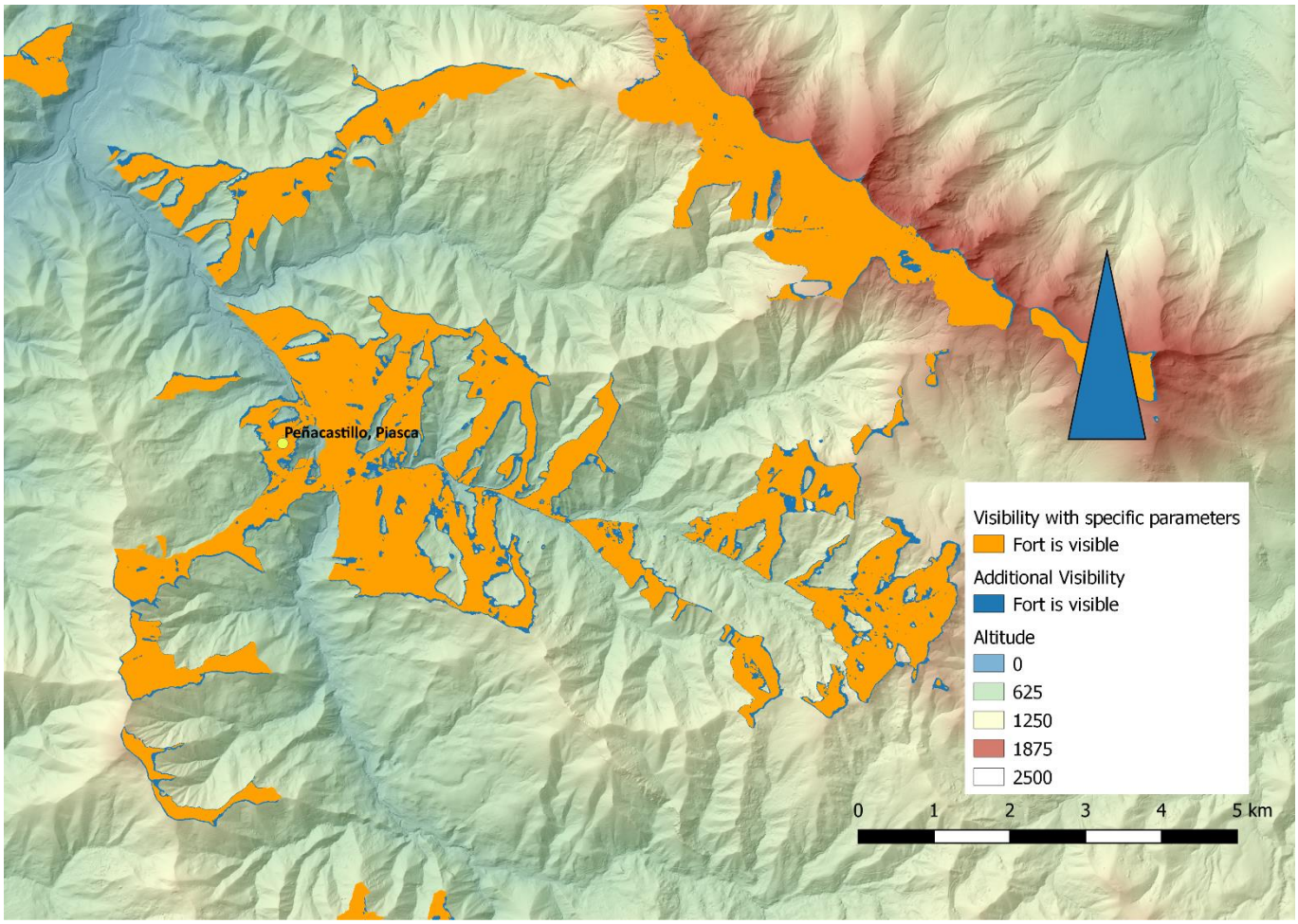

Figure 27. This map shows a viewshed of Peñacastillo (Piasca) in which the positions from which the fortification would be visible with the parameters 7 meters and 1.7 meters is marked in orange. The blue area is what would be additionally visible when using the parameters 9.7 and 1.7 meters (by author).

4.3.3. View radius

The view radius is the view distance. If the view radius is chosen to be 15 kilometres it means only things withing a 15 kilometres radius will be within sight. Regardless of obstructions, everything beyond the 15 kilometres will not be visible. The view distance is impacted by the dynamic nature of the world, which are not yet able to be visualized in static programs such as QGIS. Examples of aspects which might affect view radius are: weather conditions, the eyesight of a person (Conolly and Lake 2006, 232) and time of the day (Ogburn 2005, 406).

The broadness of the object being viewed also impacts the distance in which it is visible. Ogburn determines that with a 6/6 vision, which is seen as 'normal' eyesight, an object of 1 meter is visible over a distance of 3440 meters. This also takes into account the decline of vision to some extend through the atmosphere (atmospheric refraction). Under these ideal circumstances the view distance would be (Ogburn 2006, 406 and 410):

x(width of object in meters) * 3440 meters = view distance

Given the variable sizes of the fortifications and the length of the walls the result of this formula would vary per fortifications. An excavation at *Bolera de los Moros* determined that the western tower had a length of 5,5 meters (Sarabia Regina 2002, 271). Using the formula for this size would give a view distance of 18920 meters. Given the lack of other excavations on sites the information of *Bolera de los Moros* is the most representable at present for the other fortifications. As the fortifications are situated on peaks it could have been plausible on perfect circumstances to make out the fortifications over such a long distance as it would have stood out against the sky. The vegetation surrounding the fortification could have made it stand out even more as it would have contrasted with colour and form of the vegetation. As such 18920 meters will be used for the inversibility network presented in this thesis.

Viewsheds however, would not give an accurate representation when using the same view radius as the intervisibility network. Viewsheds show the visibility for every cell. Using the same view radius would suggest every cell would thus have something of 5,5 meters of width would could be made out. However, it would show from which points in the landscape the tower could have been visible from within the landscape. To circumvent this duality two viewsheds will be made. One showing from which parts in the landscapes the site would be visible and one which shows on a per site basis what area could actively be visually seen.

The view radius in which the fortifications could positively acknowledge humans is variable. Especially as it depends on the vegetation and contrast. A human walking in an open field would contrast with the field and thus be visible, especially when looking from above, from a larger distance than when the human stands near a tree line.

Assuming that the human width would be around 50 cm it would mean:

0,5(width of object in meters) * 3440 meters = 1720 meters

This suggests under near ideal circumstances with 6/6 vision for humans to be visible to some degree to the fortification in a distance of 1720 meters. In this thesis 1720 meters will be used as active control of the fortification.

4.3.4. Earth curvature

Because of the earth's curvature objects might disappear behind the horizon as the distance increases between the observer and the target. When the observer is 1.60

meters a road can disappear after 4.5 km. The observed object will slowly subside under the horizon (Faijer 2017, 6). The QGIS plugin used offers an option which takes into account the earth's curvature. It does so through the following formula:

z adjusted = z-(Dist² / Diam Earth) * (1 – Refraction)

In this formula the *z* is the height of the cell. *Dist* is the distance between the observation point and target point. *Refraction* is the refractivity coefficient of light. *Diam* is the diameter of earth estimated as equatorial radius + polar radius. These values are taken from the projection system assigned to the raster by QGIS (zoran-cuckovic.from.hr). As refraction is already accounted for to a limited extend it will be 0 in the formula. This leaves the formula as:

z adjusted = z-(Dist² / Diam Earth)

The earth curvature will be taken into account as the view radius is a large distance in which the few meters in difference of the tower might impact if it is visible or not.

4.3.5. Conclusion

As discussed in this chapter the chosen parameters impact the results. Another research could have used other parameters based on other assumptions and data. No research would be able to show the variable nature of visibility in reality. The chosen parameters are based on assumptions and data available, and will give a possible interpretation of visibility within Liébana. In the table below the parameters are summed up. These parameters take into account that 100 cm is necessary for a site to be visible.

Table 4. Chosen parameters per type of visibility analysis.

	Intervisibility network	Viewshed of fortification visibility	Viewshed active control of the fortification
Observer height	970 cm	700 cm	970 cm
Target height	970 cm	170 cm	100 cm
View radius	18920 m	18920 m	1720 m
Take into account earth curvature	Yes	Yes	Yes

4.4. Viewshed per site

4.4.1. El Castillo del Monte Subiedes (Cabezo Castillo)

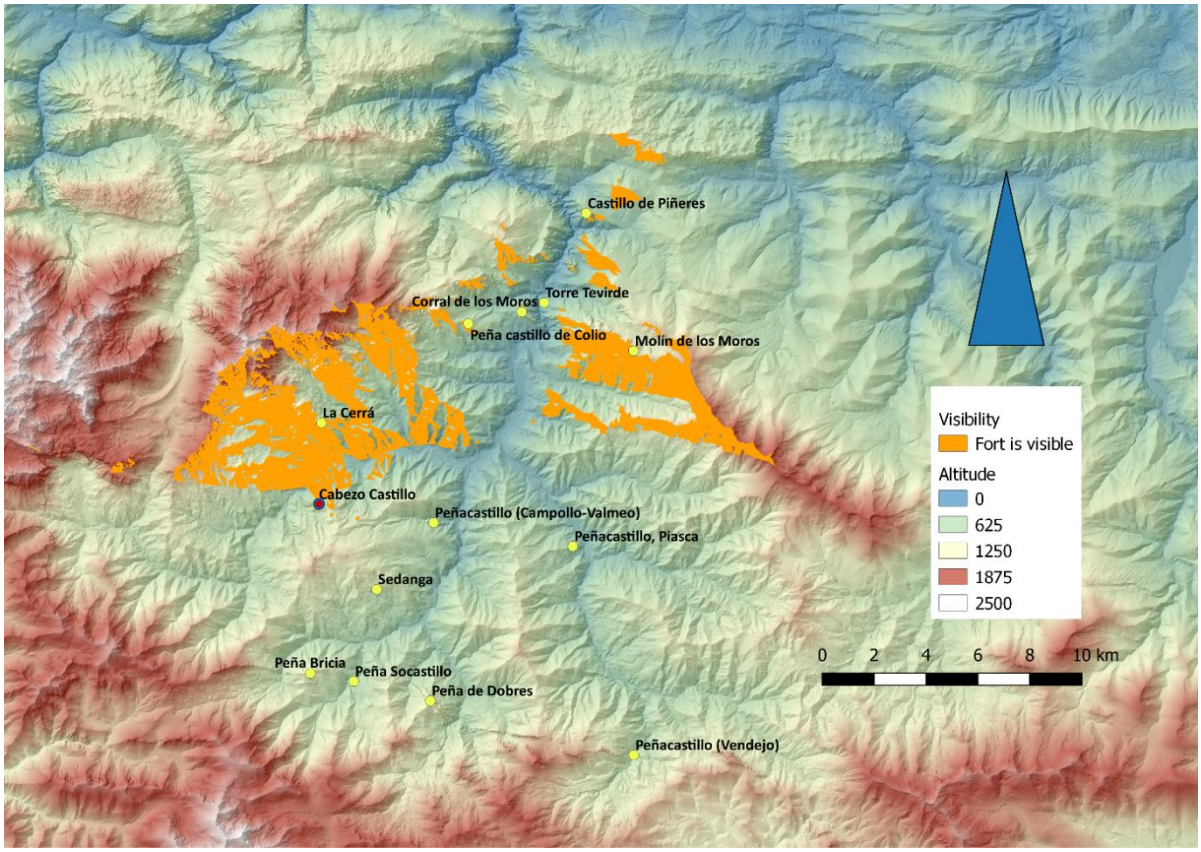

Figure 28. Visibility of Castillo del Monte Subiedes, identified as Cabezo Castillo (by author).

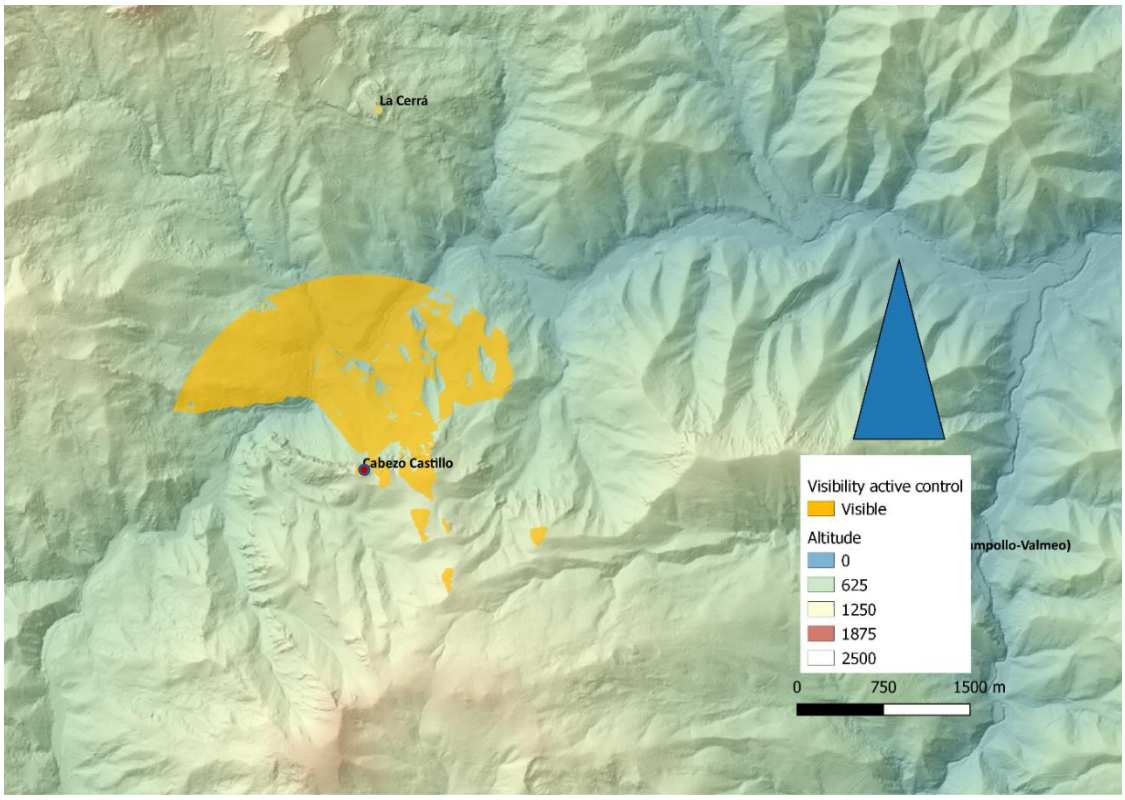

Figure 29. Active control of el Castillo del Monte Subiedes, also known as Cabezo Castillo (by author).

The viewshed results of Cabezo Castillo is interesting in several ways. First of all, it shows a uniform viewshed to its north. Meaning that crevices or hills would not provide hiding from its view to its north. This is both reflected in its active control and own visibility. Secondly, the viewshed shows a clear cut in its viewshed to its south, west, and partially east. Why is not clear, but it is probably caused by to the rigid nature of choosing one point to determine the entire visibility of a site. A person on the site would have been able to walk around the site and thus be able to circumvent some of the rigidness. Nevertheless, it can also be possible that the view is clearly blocked. To determine this some fieldwork has to be done.

Cabezo Castillo would have had clear active control of the area below. The *Río Deva* lies within its view, and from Cabezo Castillo a person could actively observe what was going on below. Although its control is still limited to its northern side. Looking at the visibility of Cabezo Castillo itself it shows a clear visual link with La Cerrá and its surroundings. From which Cabezo Castillo would have been visible from all over the area.

4.4.2. Castillo la Cerrá (Brez, Camaleño)

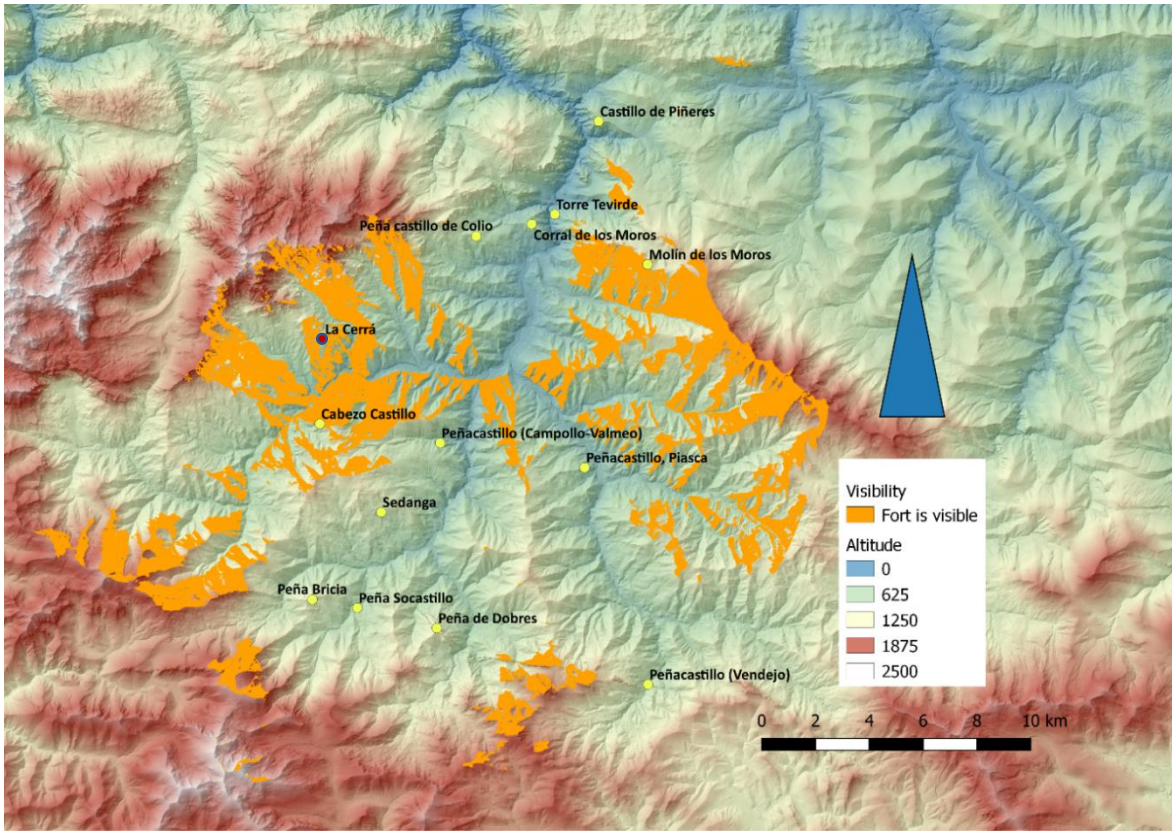

Figure 30. Visibility of Castillo la Cerrá (Brez Camaleño) (by author).

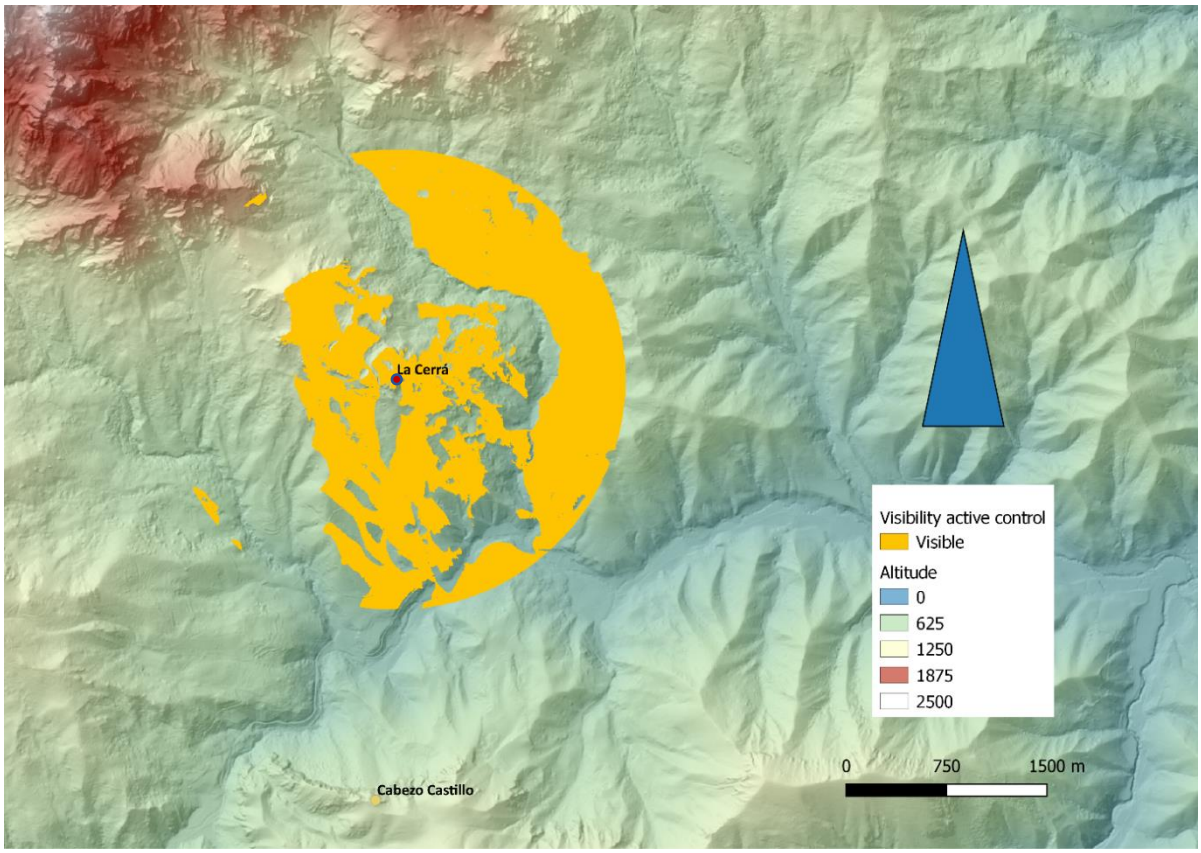

Figure 31. Active control of la Cerrá (Brez, Camaleño) (by author).

La Cerrá would have been visible from all along the *Río Deva*. On ideal circumstances it would be visible from the other side of Liébana in the east. Whilst that being the case, fortifications further to the north fall outside of the area showing the visibility of La Cerrá.

An interesting aspect of its active control is its connection with the viewshed of Cabezo Castillo. Both fortifications look down on a similar part of the *Río Deva,* yet with the current parameters the viewsheds barely cross. Indicating that the active control almost seemingly crosses over between the two fortifications.

4.4.3. Peña Castillo de Colio (Colio, Cillórigo de Liébana)

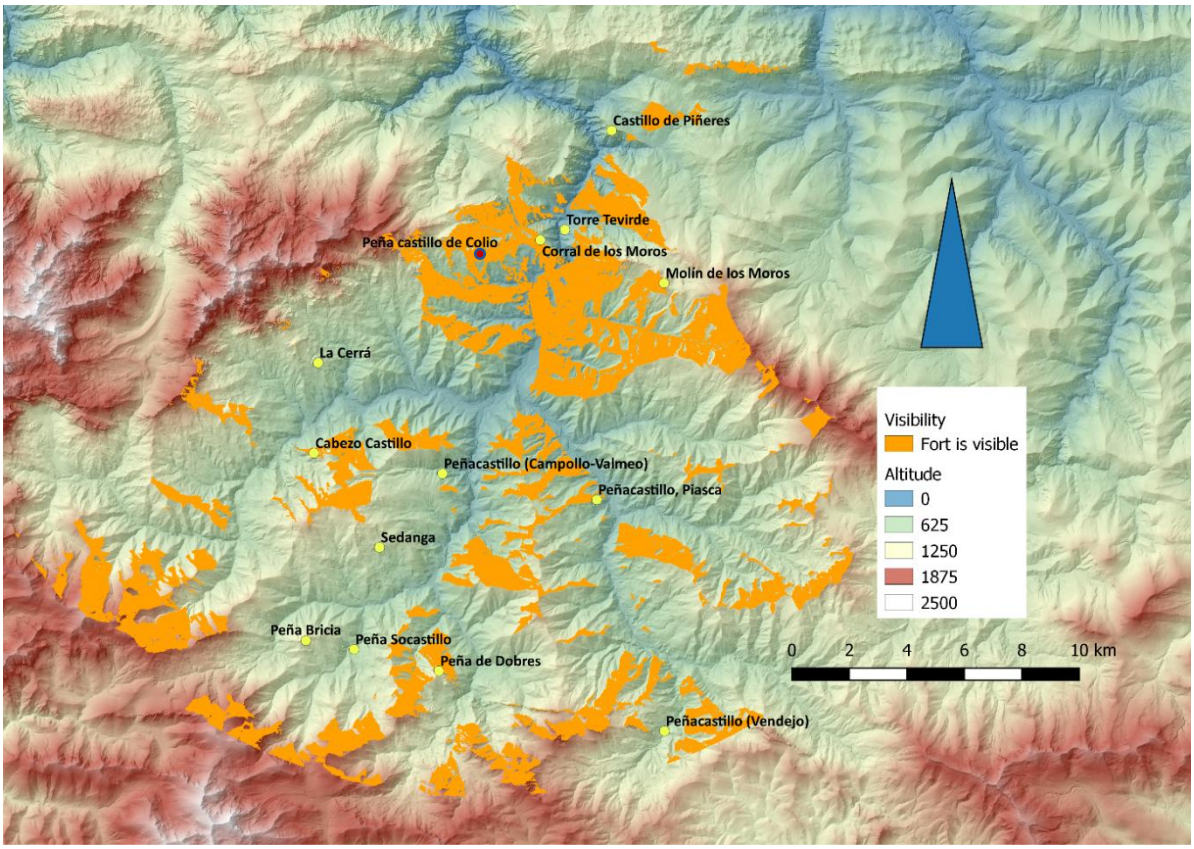

Figure 32. Visibility of Peña Castillo de Colio (Colio, Cillórigo de Liébana) (by author).

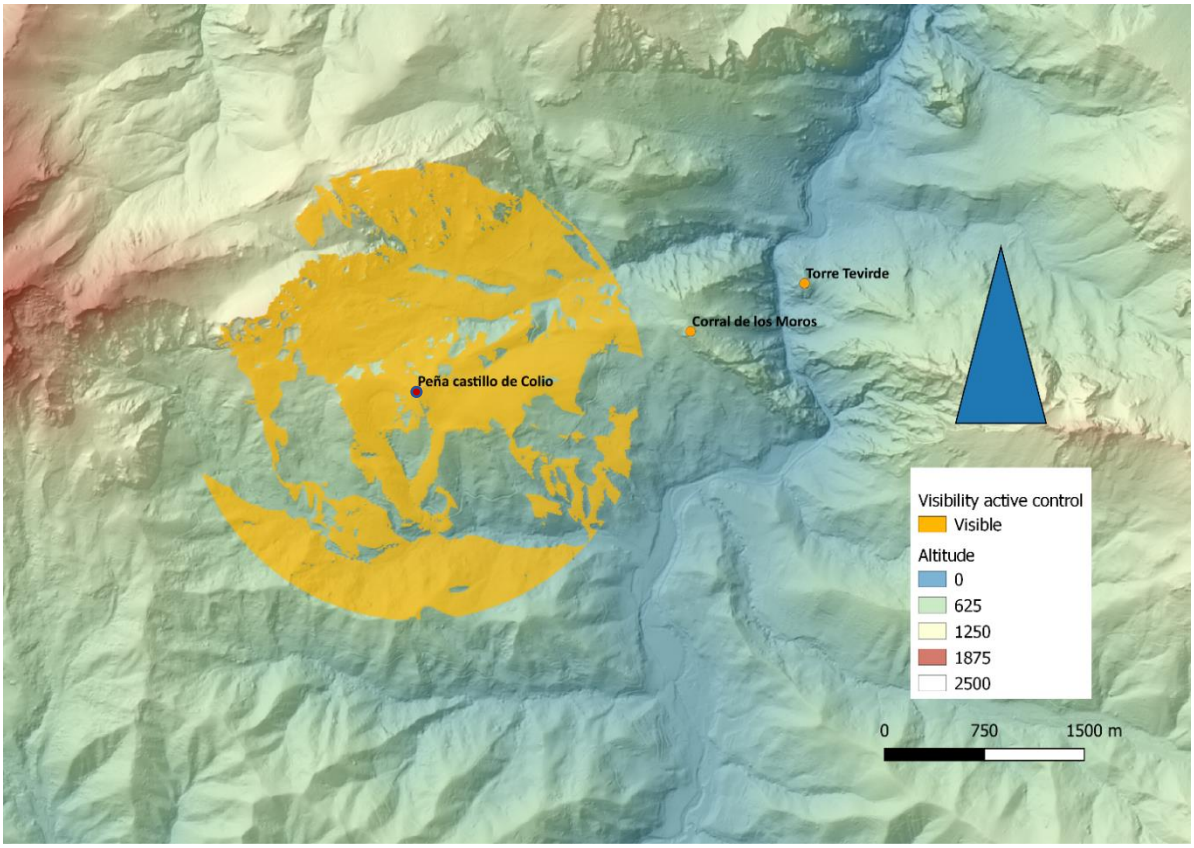

Figure 33. Active control of Peña Castillo de Colio (Colio, Cillórigo de Liébana) (by author).

Peña Castillo de Colio was visible from large parts in Liébana. Most notably is the fairly seamless viewshed in the northern part of Liébana. In this area Peña Castillo de Colio was visible from most areas.

Furthermore, figure 33 shows it had direct visibility and observation possibilities of its direct surroundings. To its north lies a small stream called the *Arroyo de la Mata* and to its south lies *Rio la Sorda*. These are visible in the map as the lower altitude areas running through the active control viewshed.

4.4.4. Corral de los Moros (Pendes, Cillórigo de Liébana)

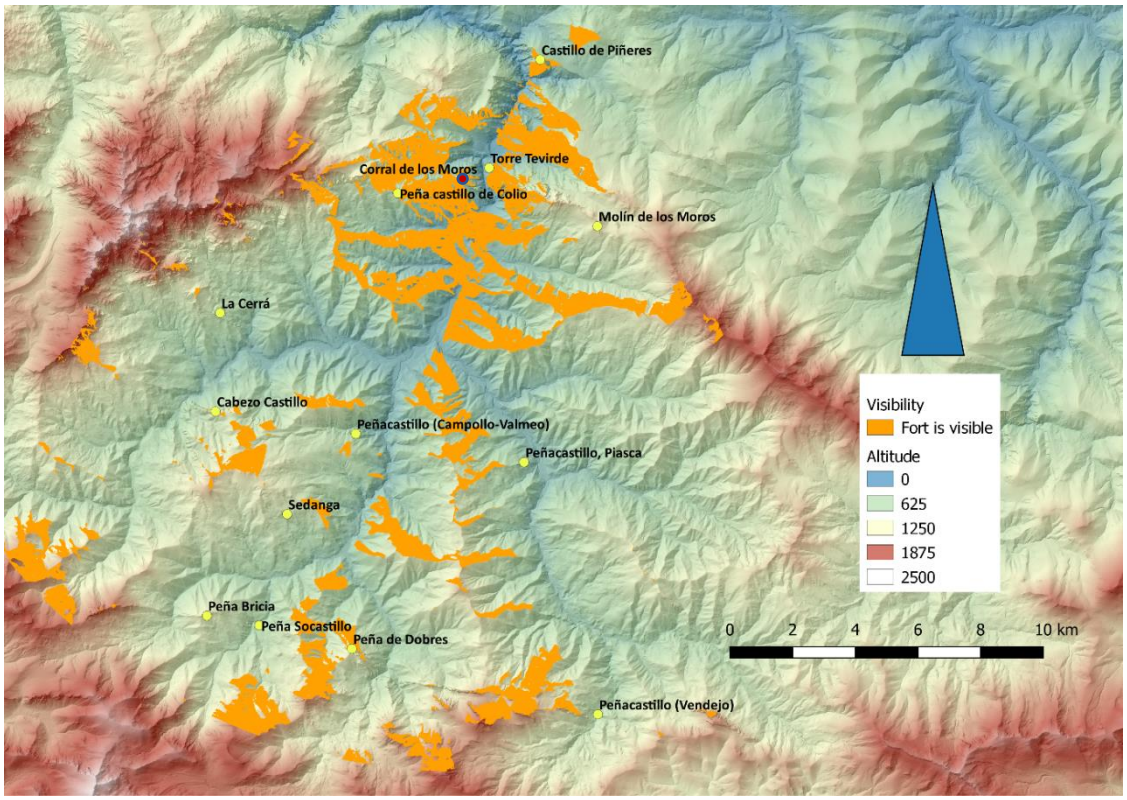

Figure 34. Visibility of Corral de los Moros (Pendes, Cillórigo de Liébana) (by author).

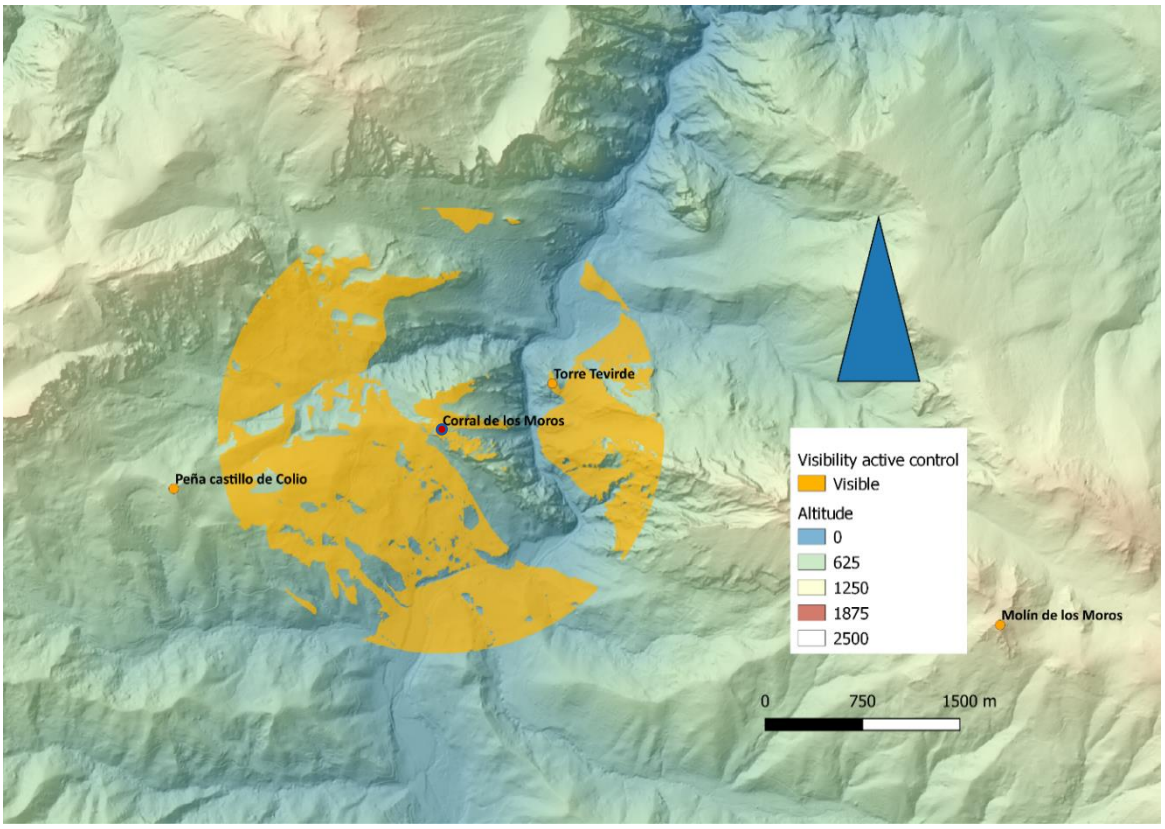

Figure 35. Active control of Corral de los Moros (Pendes, Cillórigo de Liébana) (by author).

Corral de los Moros shows a similar viewshed with regards to its own visibility as Peña Castillo de Colio. Although a bit more limited in its visibility in the north, its more visible following the *Rió Deva* south.

Its active control shows the proximity of Torre Tevirde and Peña Castillo de Colio. These sites could observe one another clearly. Lower lying area on the south is also visible to the site.

4.4.5. Torre de Tevirde (Lebeña, Cillorigo de Liébana)

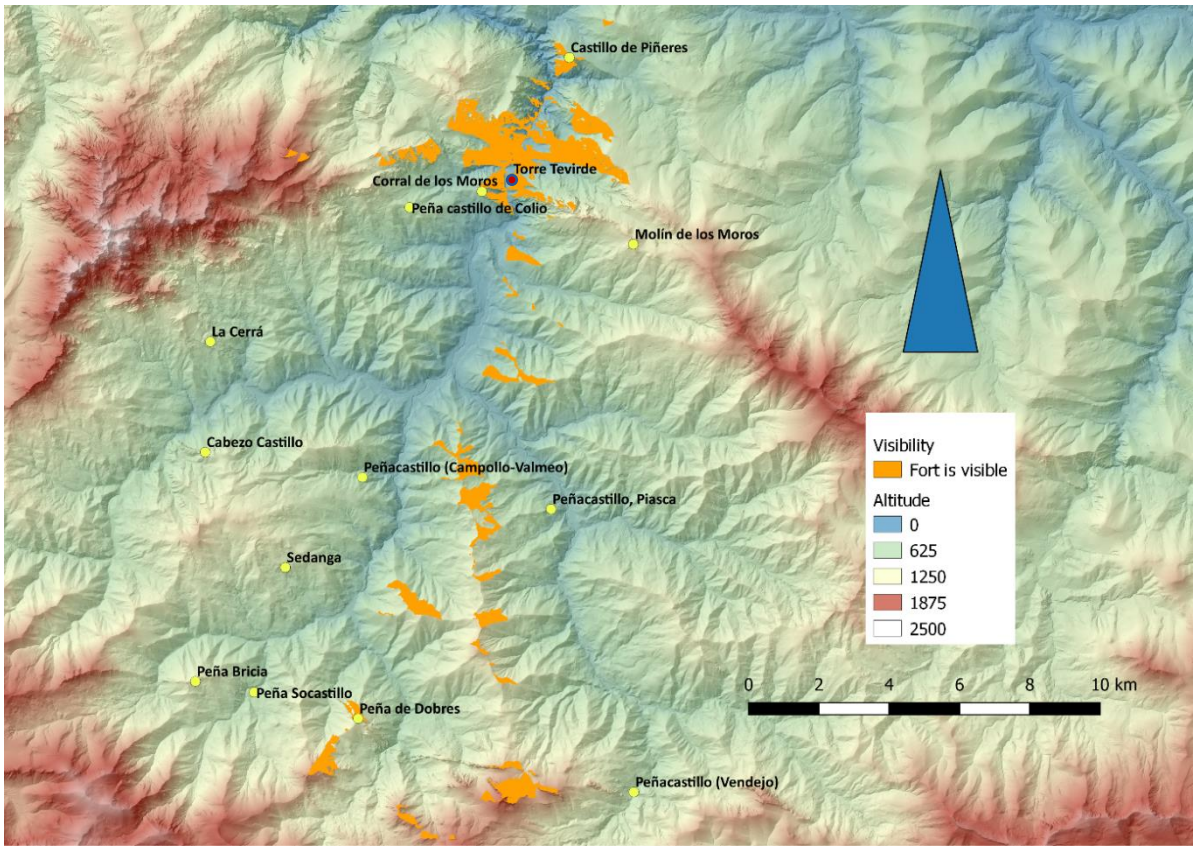

Figure 36. Visibility of Torre Tevirde (Lebeña, Cillorigo de Liébana) (by author).

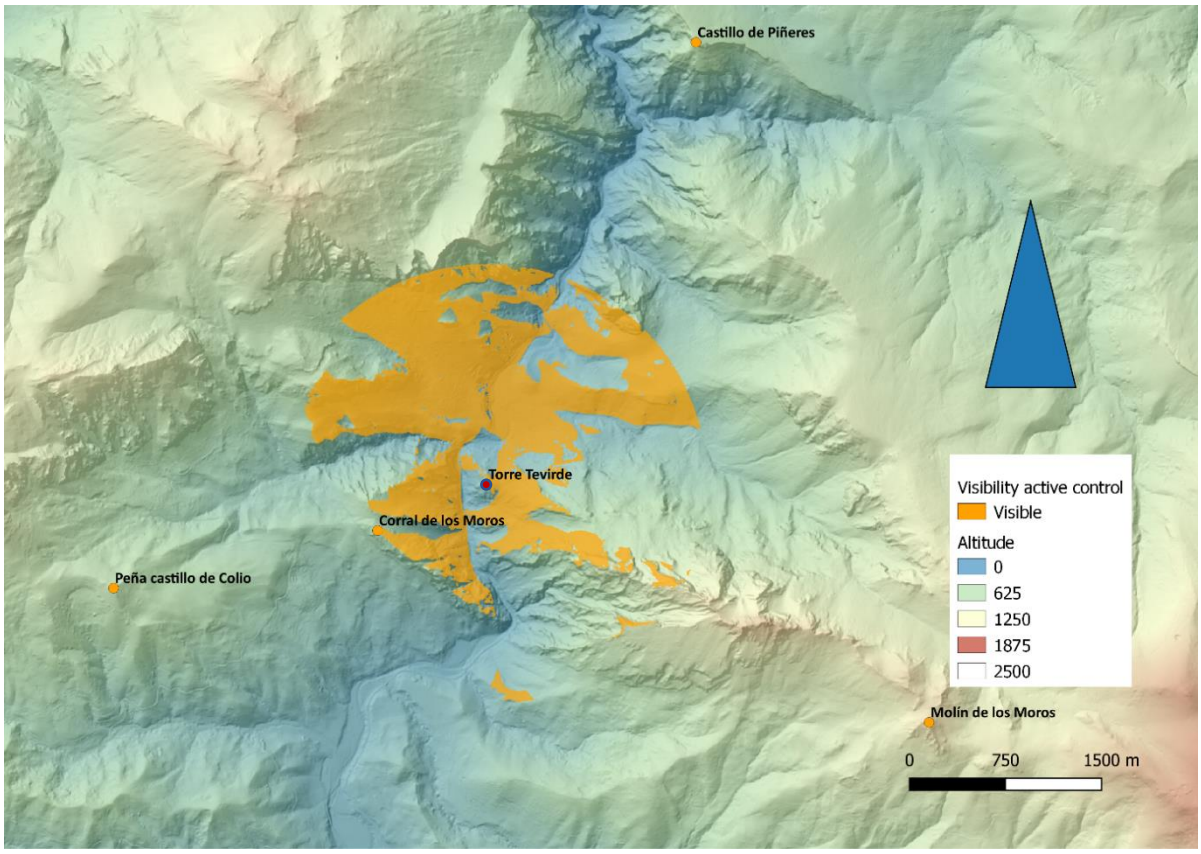

Figure 37. Active control of Torre Tevirde (Lebeña, Cillorigo de Liébana) (by author).

Torre Tevirde shows different viewsheds from the sites named above. The visibility of the fortification itself does not reach far. The viewshed showing its own visibility is very similar in scope of impact as the viewshed showing its active control. This shows it was not able to view far off distances due to its geographical location.

Although its far off view and visibility is limited, Torre Tevirde has clear visibility of what goes in and out along the *Desfiladero de la Hermida* from the north. This shows a perhaps different function from the fortifications which have longer distance impact.

4.4.6. Castillo de Piñeres/Bolera de los Moros (Pendes, Cillorigo de Liébana)

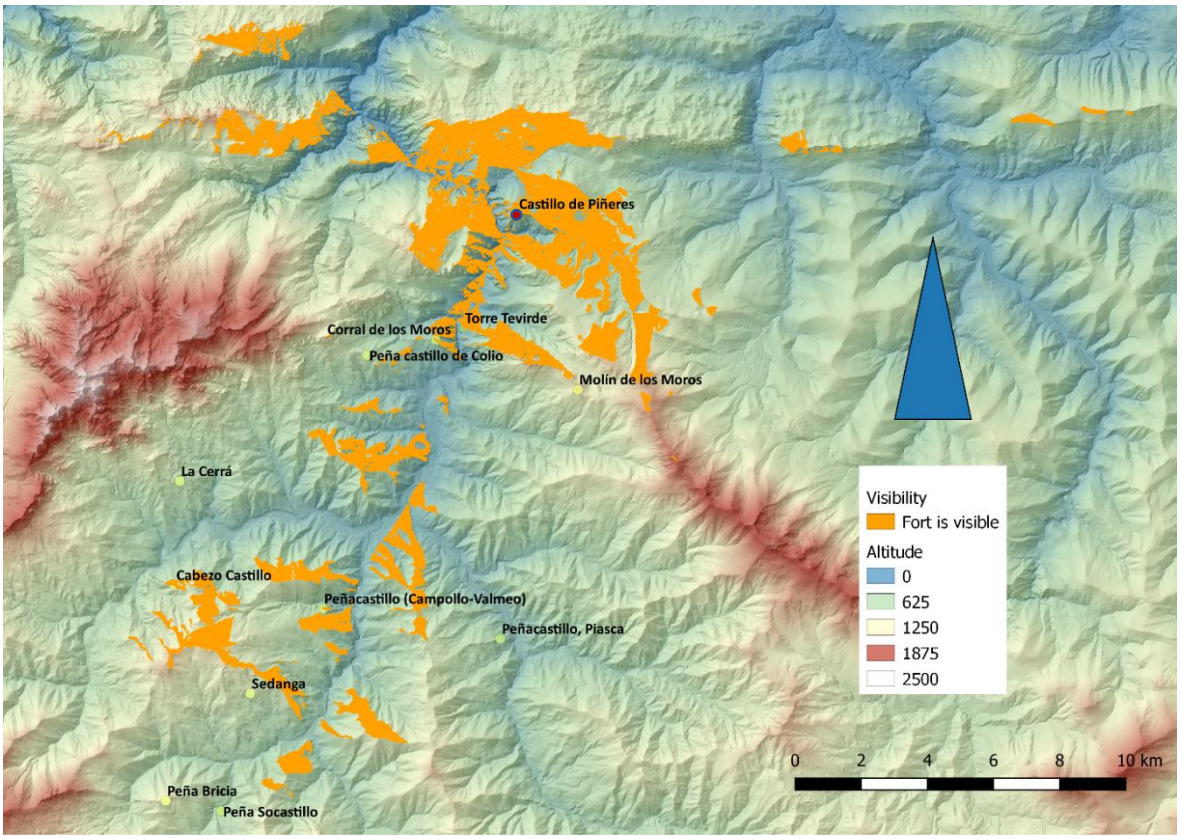

Figure 38. Visibility of Castillo de Piñeres/Bolera de los Moros (Pendes, Cillorigo de Liébana) (by author).

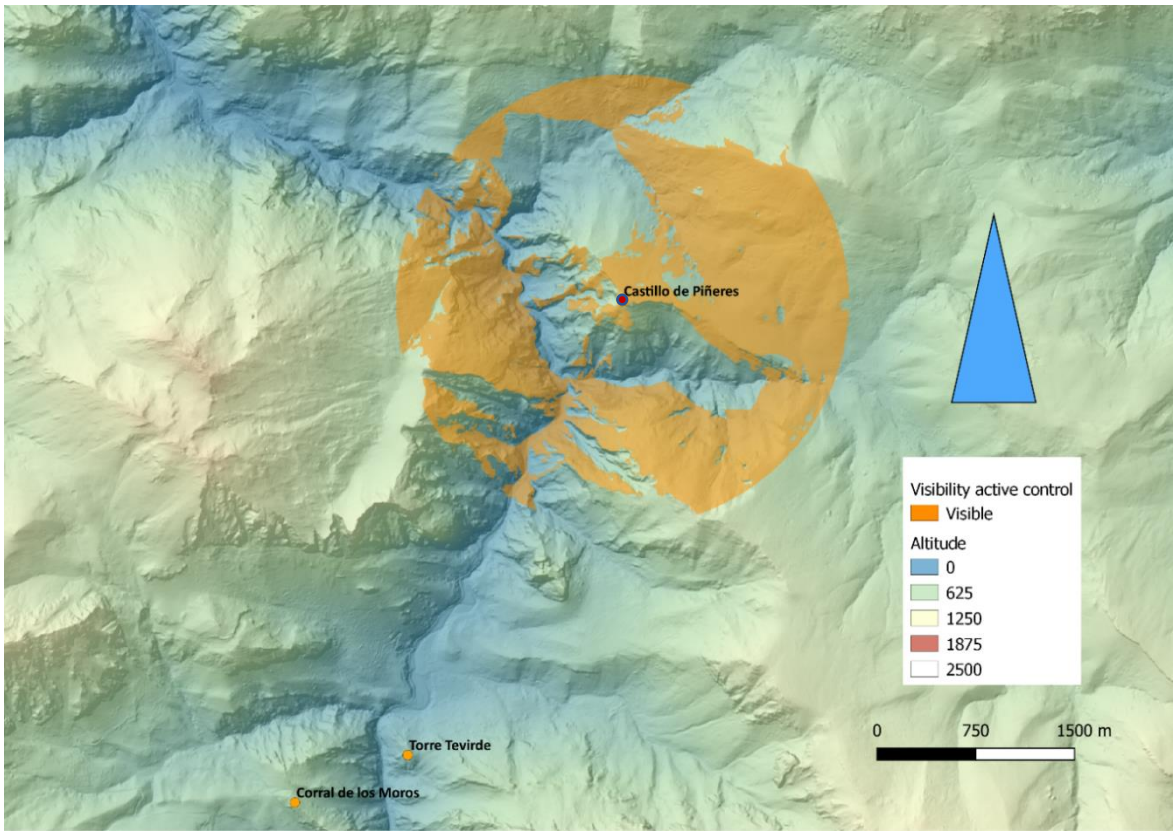

Figure 39. Active control of Castillo de Piñeres/Bolera de los Moros (Pendes, Cillorigo de Liébana) (by author).

Castillo de Piñeres is located on the corner of the *Desfiladero de la Hermida*. This is reflected in its viewsheds. It shows it could have actively seen anyone passing through the valley, and was also visible when passing through the valley.

The area to its north east shows a fairly low relief which gives a clear overview of the area. But despite the views and active control, the visibility of the fortification is limited. Only being visible in the surrounding area, with the notable exception of a straight line through the *Desfiladero de la Hermida* into Liébana.

4.4.7. Molín de los Moros (Cillorigo de Liébana)

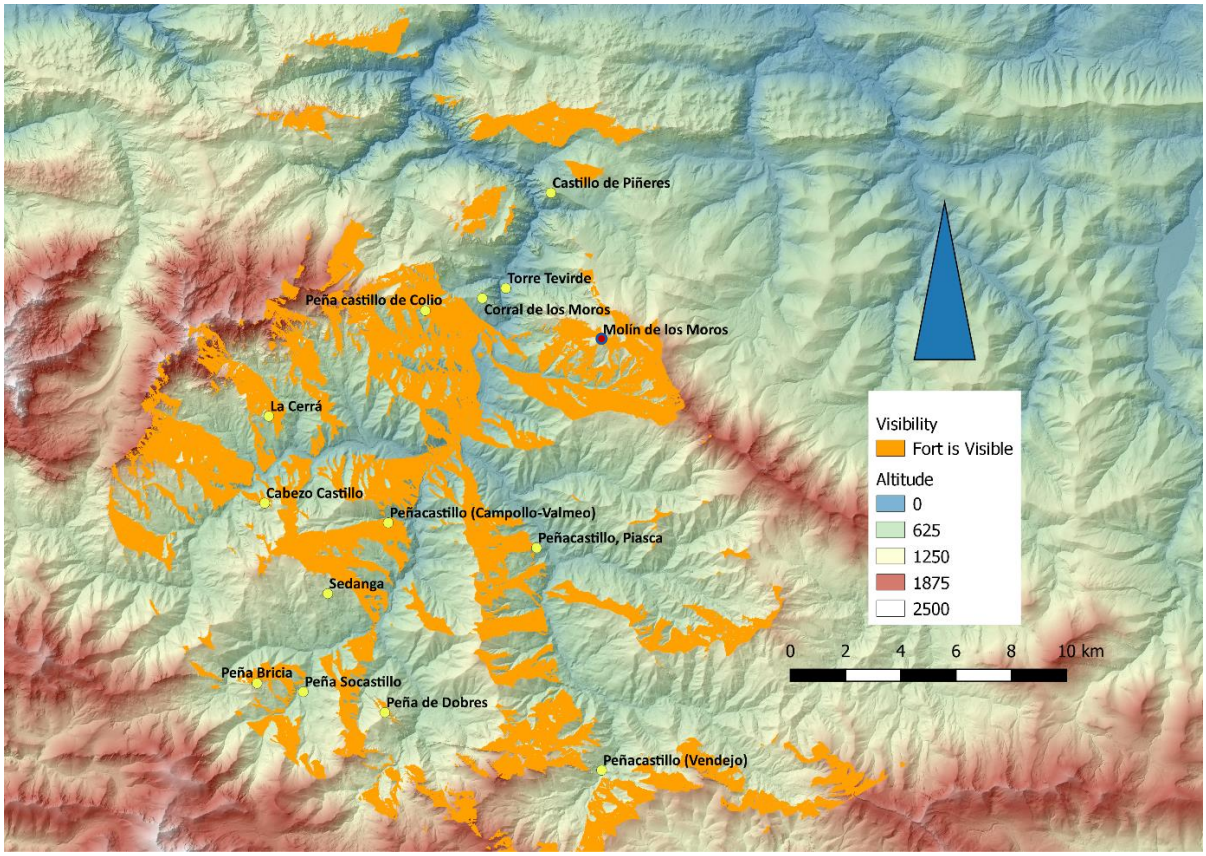

Figure 40. Visibility of Molín de los Moros (Cillorigo de Liébana) (by author).

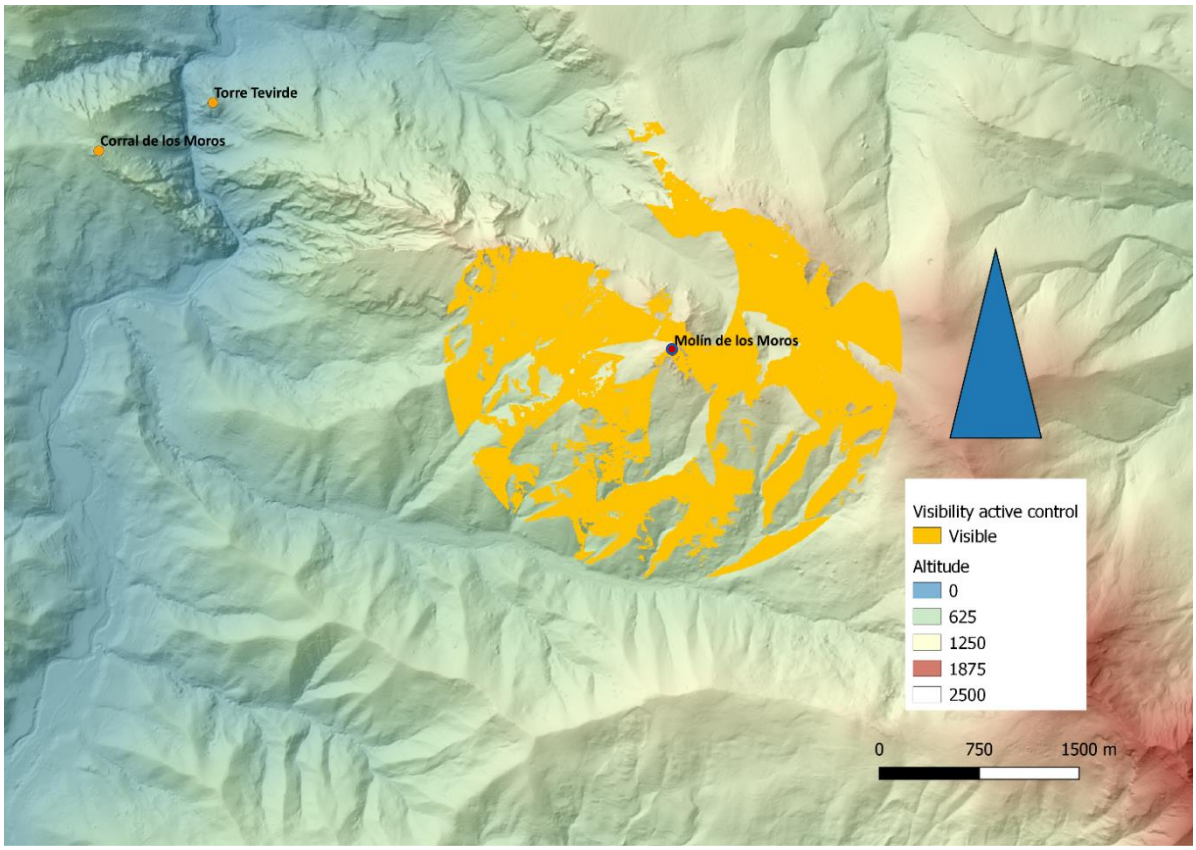

Figure 41. Active control of Molín de los Moros (Cillorigo de Liébana) (by author).

Molín de los Moros is situated in high altitude. The viewshed reflects that, with the site being visible through large parts of Liébana. Also notable is the way the active control viewshed demarks between the viewshed of active control by Corral de los Moros in the west and the high mountain chain (in red) on the east side of Molín de los Moros.

From throughout the three main valleys in Liébana it could have been possible to make out Molín de los Moros in a far off distance. Interestingly the sites viewshed are limited the boundaries of Liébana, and do not reach further north.

4.4.8. Peña Castillo (Piasca, Vega de Liébana)

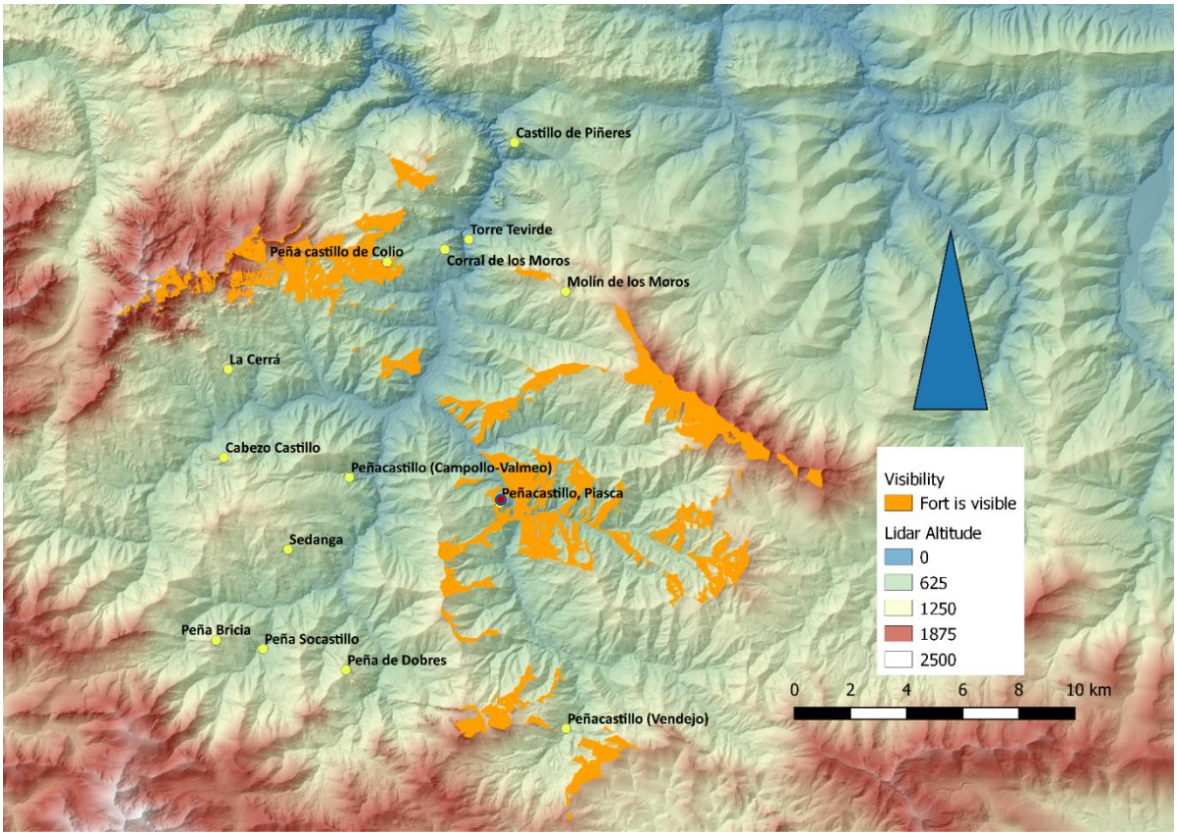

Figure 42. Visibility of Peña Castillo (Piasca, Vega de Liébana) (by author).

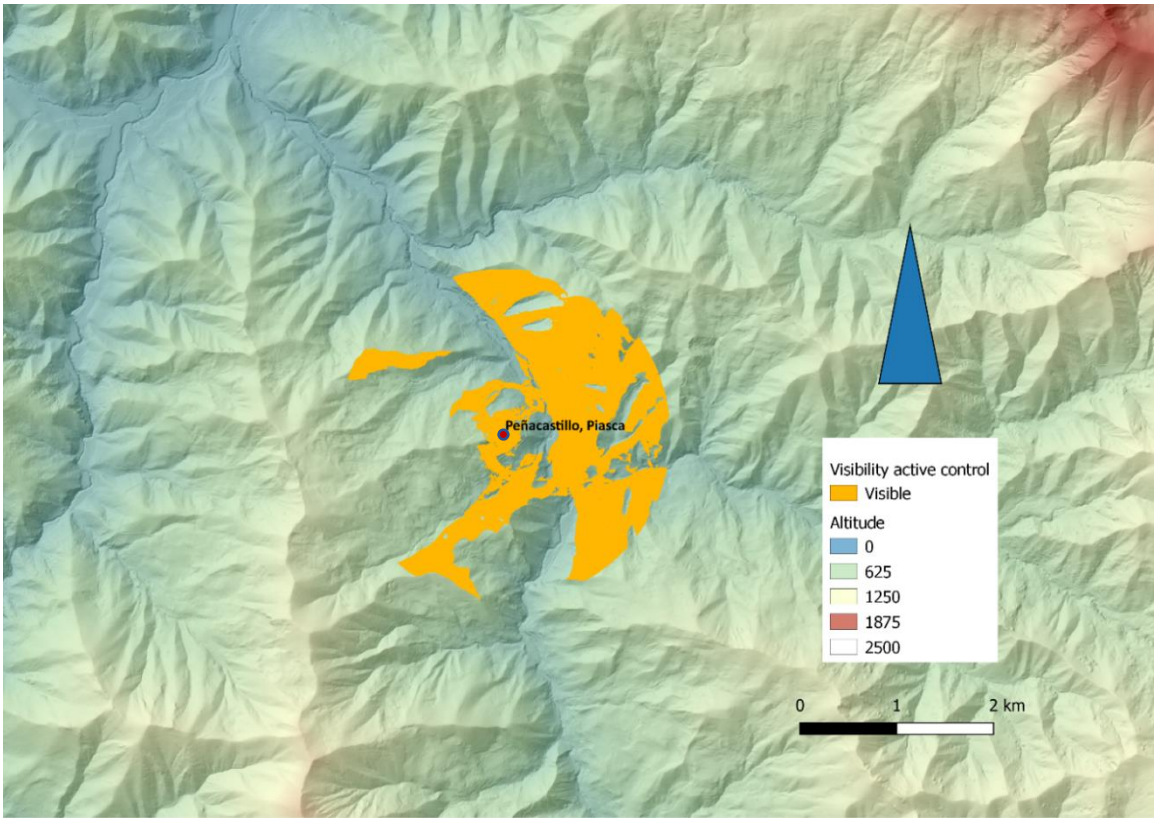

Figure 43. Active control of Peña Castillo (Piasca, Vega de Liébana) (by author).

Peñacastillo (Piasca) shows similar characteristics as observed in Torre Tevirde with regards to its viewsheds. The active control viewshed with its parameters give a similar result as its own visibility viewshed.

Its own visibility is also limited to the area along the *Río Bullón* and its tributary *Riega de Lebanes to the east*. The site looks partially into the lower lying area created by *Riega de Lebanes*.

4.4.9. Peña Castillo (Vendejo, Pesagüero)

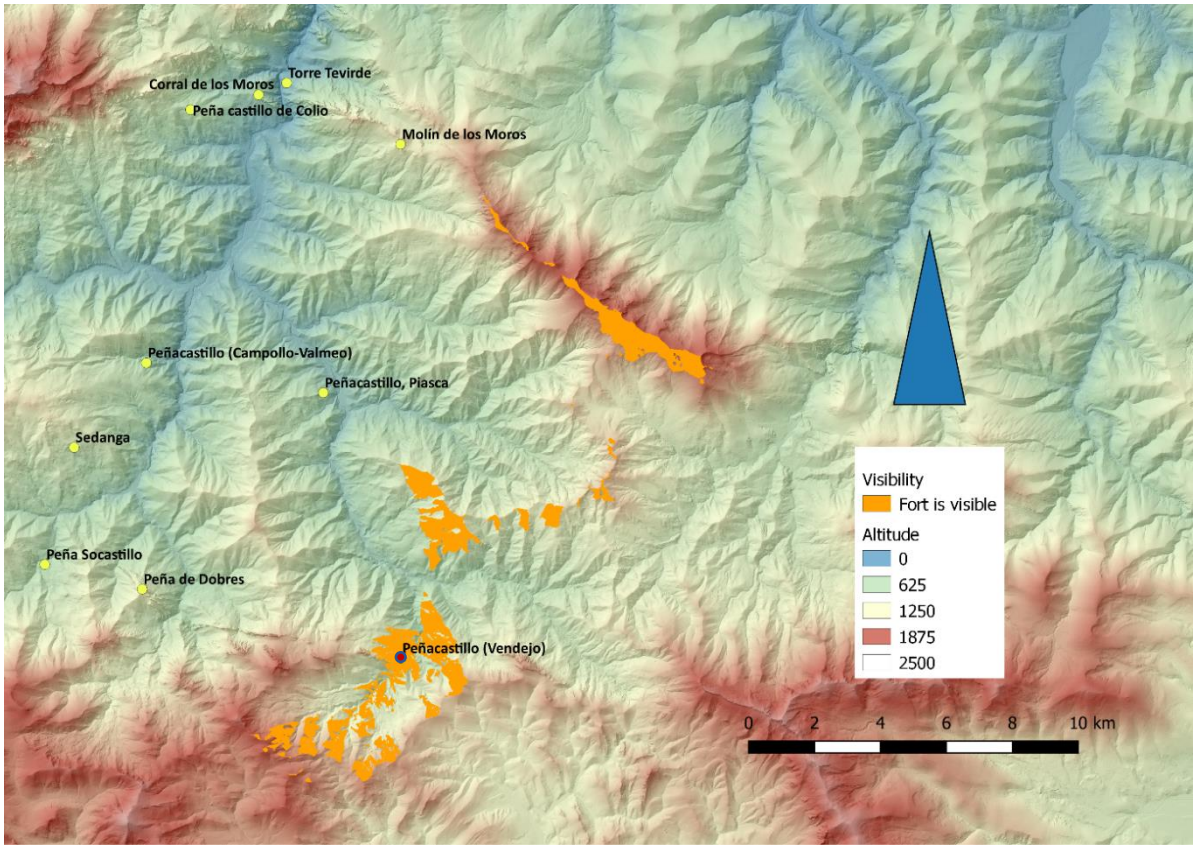

Figure 44. Visibility of Peña Castillo (Vendejo, Pesagüero) (by author).

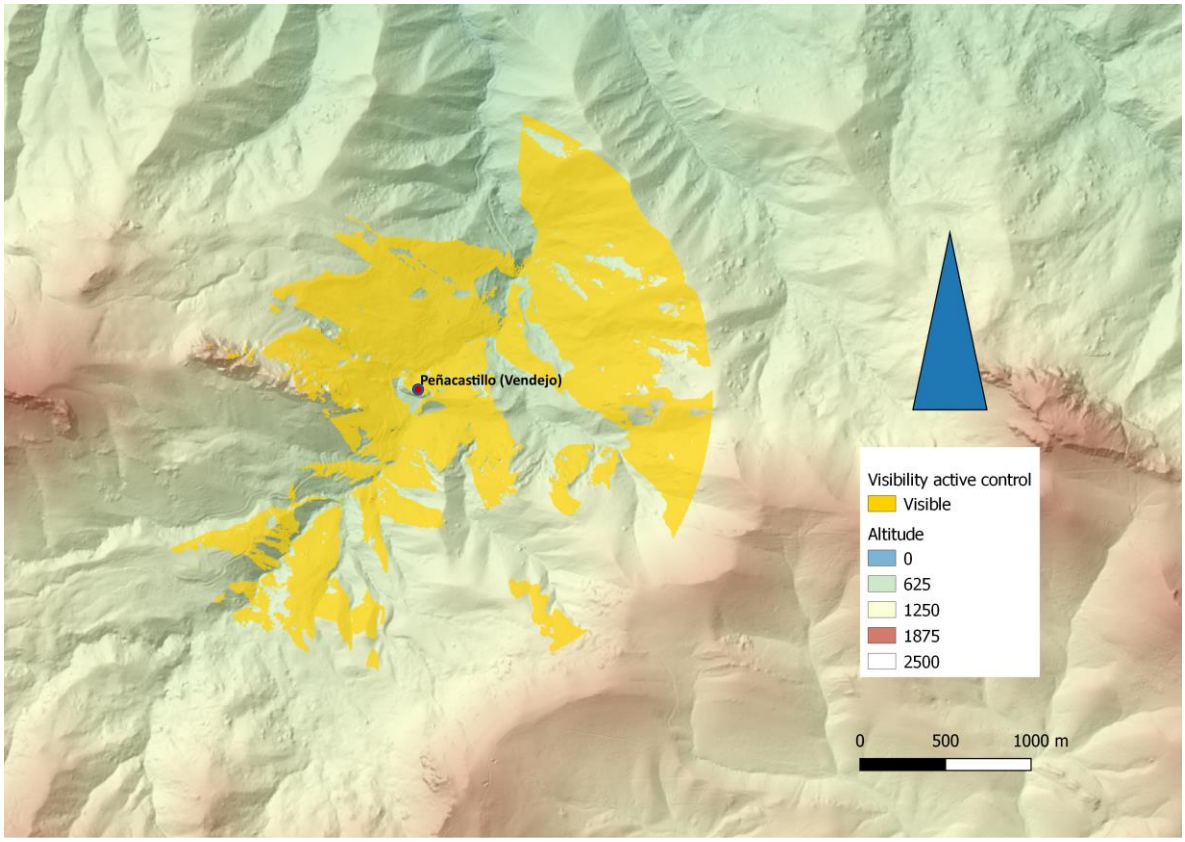

Figure 45 Active control of Peña Castillo (Vendejo, Pesagüero) (by author).

Peñacastillo (Vendejo) is not visible throughout Liébana, and is limited in the valley in which its present. Its active control also matches up with the visibility of the fortification itself. Which lays the focus of this site on active control, and not on its own visibility.

4.4.10. Peña Bricia (Ledantes, Vega de Liébana)

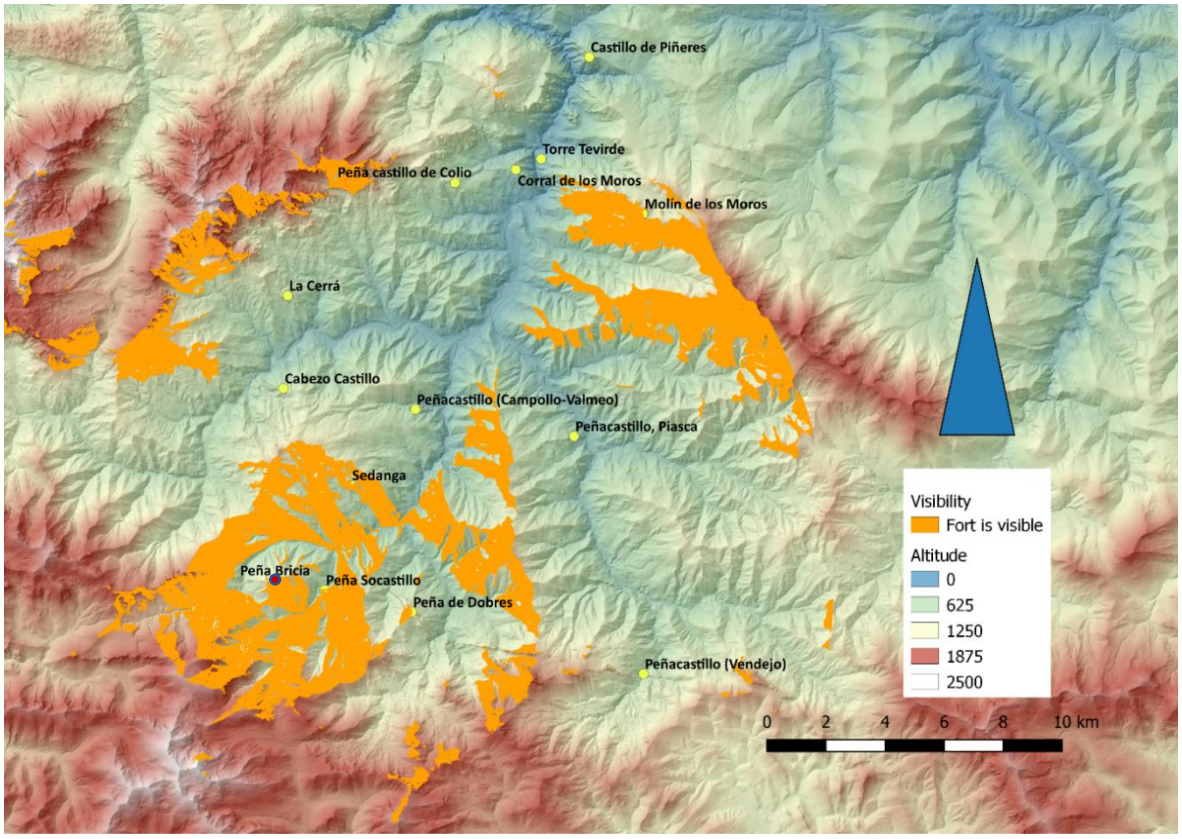

Figure 46. Visibility of Peña Bricia (Ledantes, Vega de Liébana) (by author).

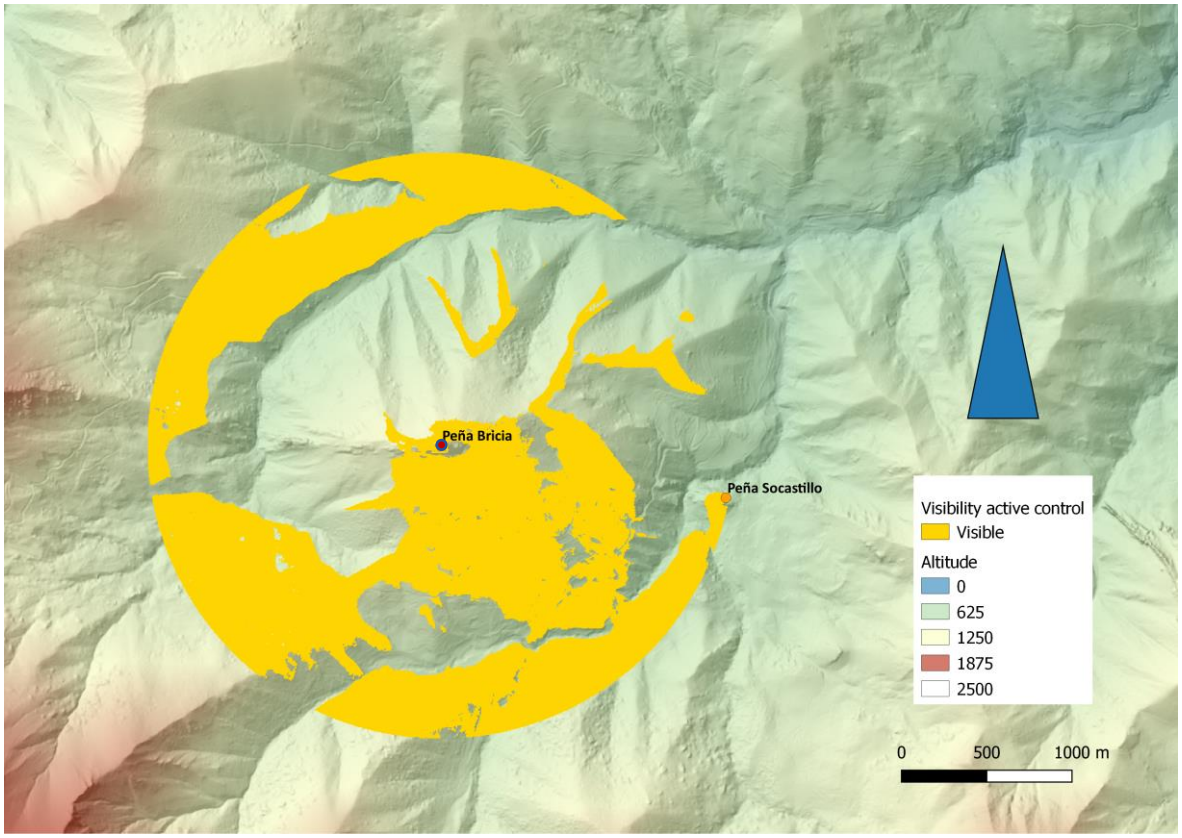

Figure 47. Active control of Peña Bricia (Ledantes, Vega de Liébana) (by author).

Peña Bricia is visible throughout a radius of 4 km. Beyond that radius its visibility is limited, with some exceptions with high mountain ranges to its north and east. In this 4 km radius there are 3 other fortifications present.

Its active control indicates the lower lying area on all sides being visible, with exception of the north eastern side. The gaps within the viewshed surrounding Peña Bricia can be explained by the lack of flexibility when using one point as viewshed.

Furthermore along its northern side a modern-day road is situated following the mountainside. This leads to the *Puerto San Glorio*. The road falls within the range of the active control by Peña Bricia and follow the edges of the sphere of visual control.

4.4.11. Peña Socastillo (Barrio, Vega de Liébana)

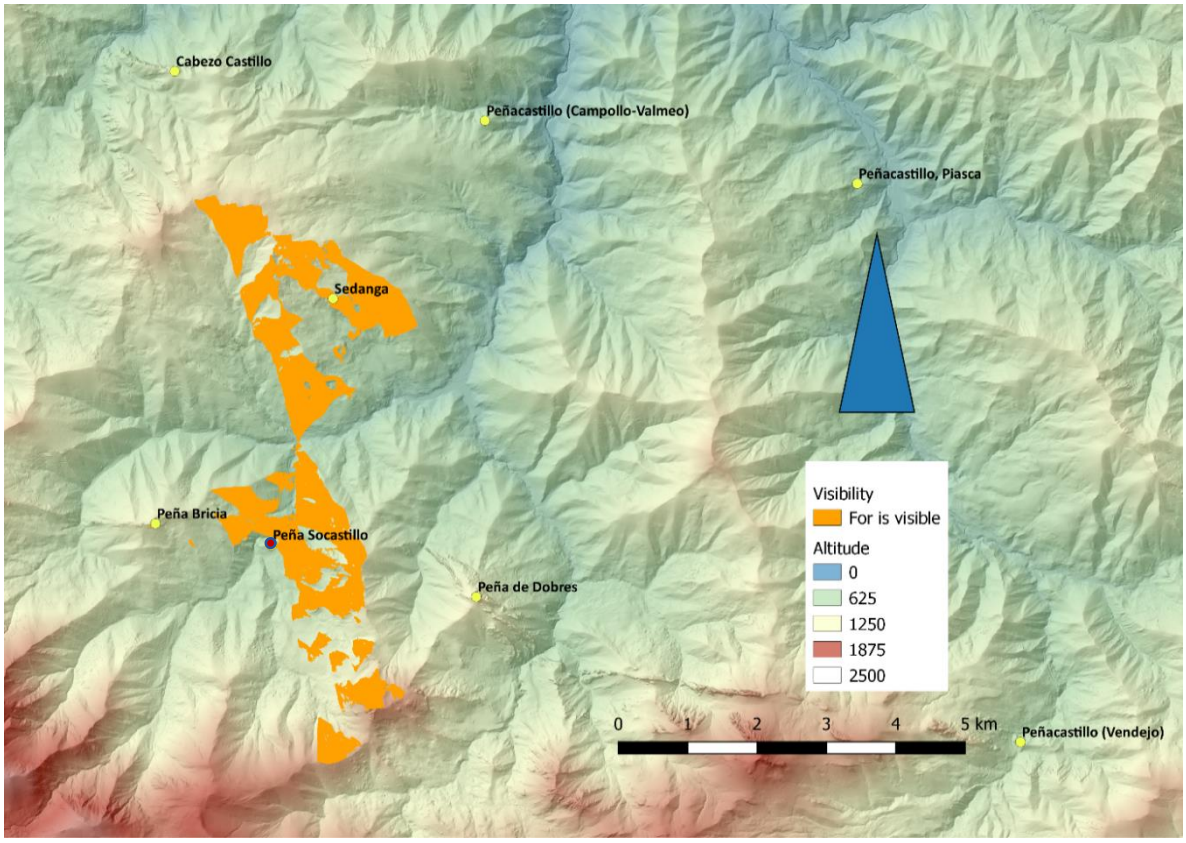

Figure 48. Visibility of Peña Socastillo (Barrio, Vega de Liébana) (by author).

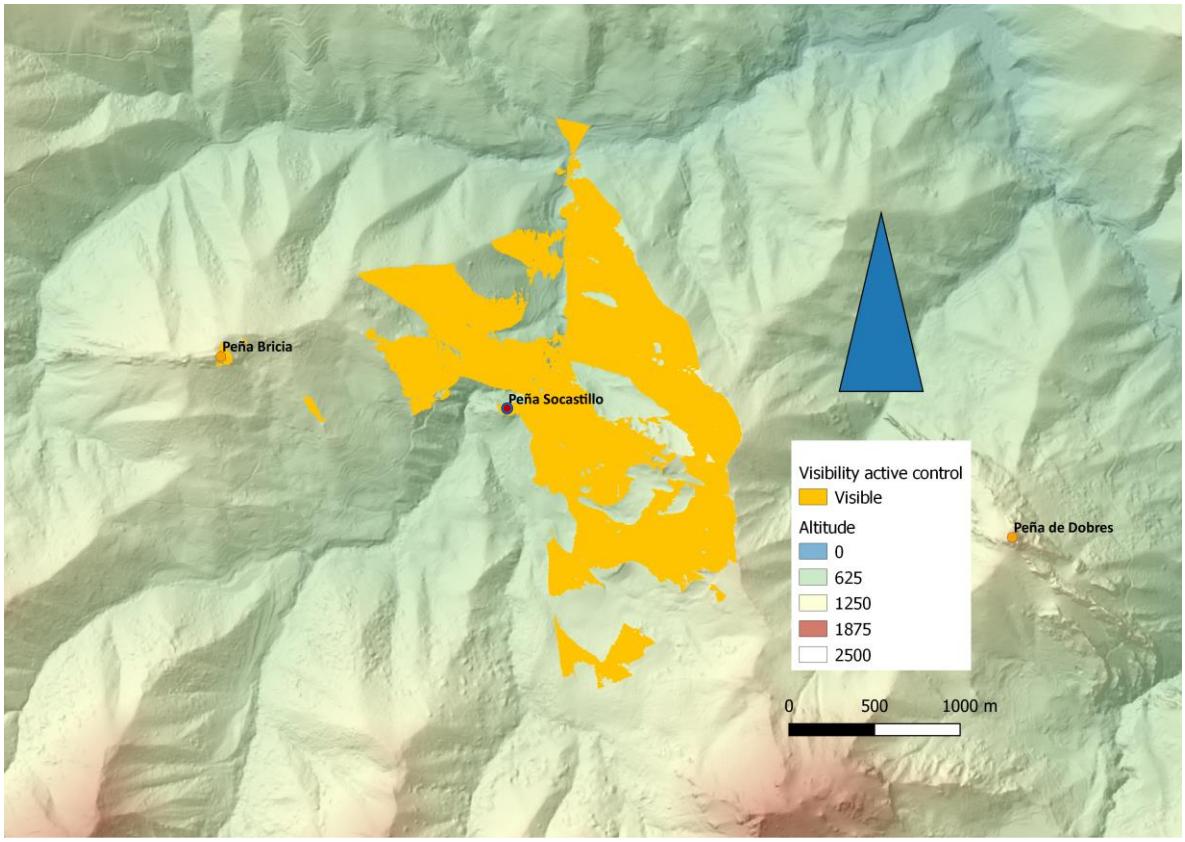

Figure 49. Active control of Peña Socastillo (Barrio, Vega de Liébana) (by author).

Peña Socastillo lies lower than the sites surrounding it. Which is visible in the viewsheds as its views are blocked and limited. Interestingly Peña Bricia and Sedanga fall within its viewsheds. Its function must have been focused on short distance observation or control.

Zooming in to its active control it shows how the northern low lying area is clearly visible. Yet to its south/south east, it does not indicate any visibility. This could again be explained by the position of the precise coordinates, causing its view to be blocked.

4.4.12. Castillo de Dobres (Vega de Liébana)

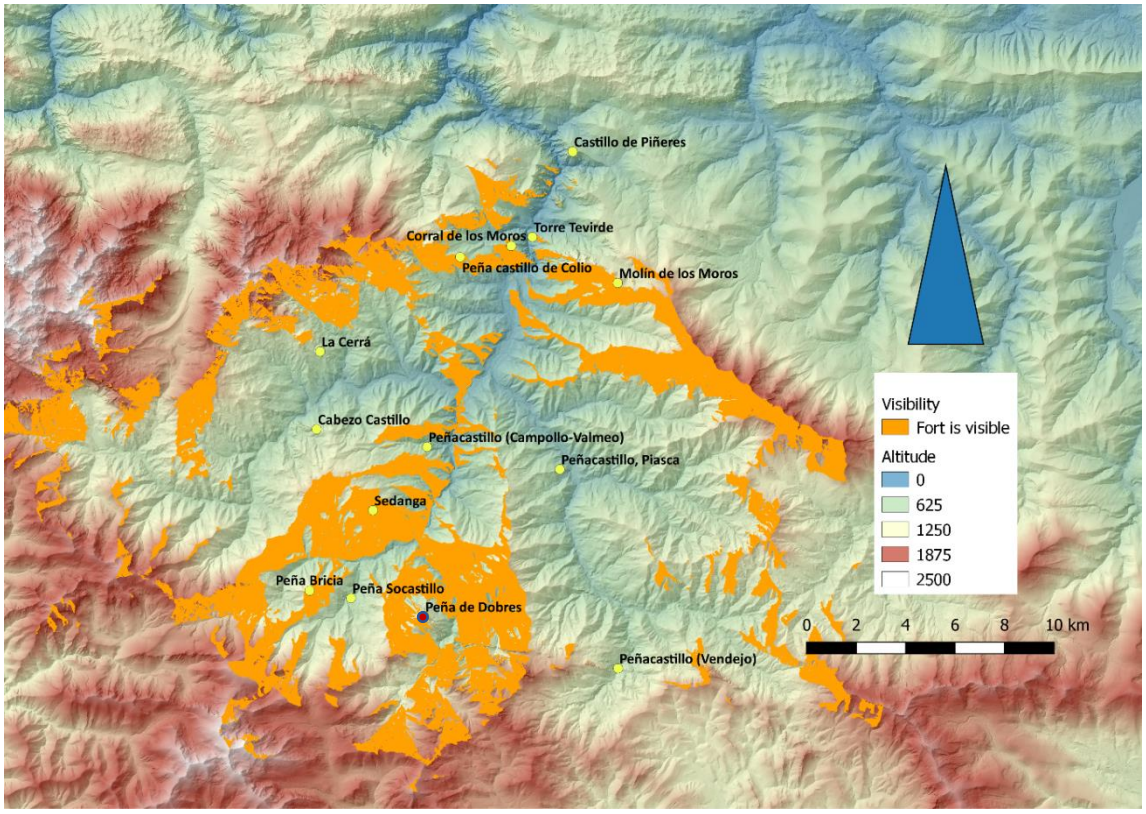

Figure 50. Castillo de Dobres (Vega de Liébana) (by author).

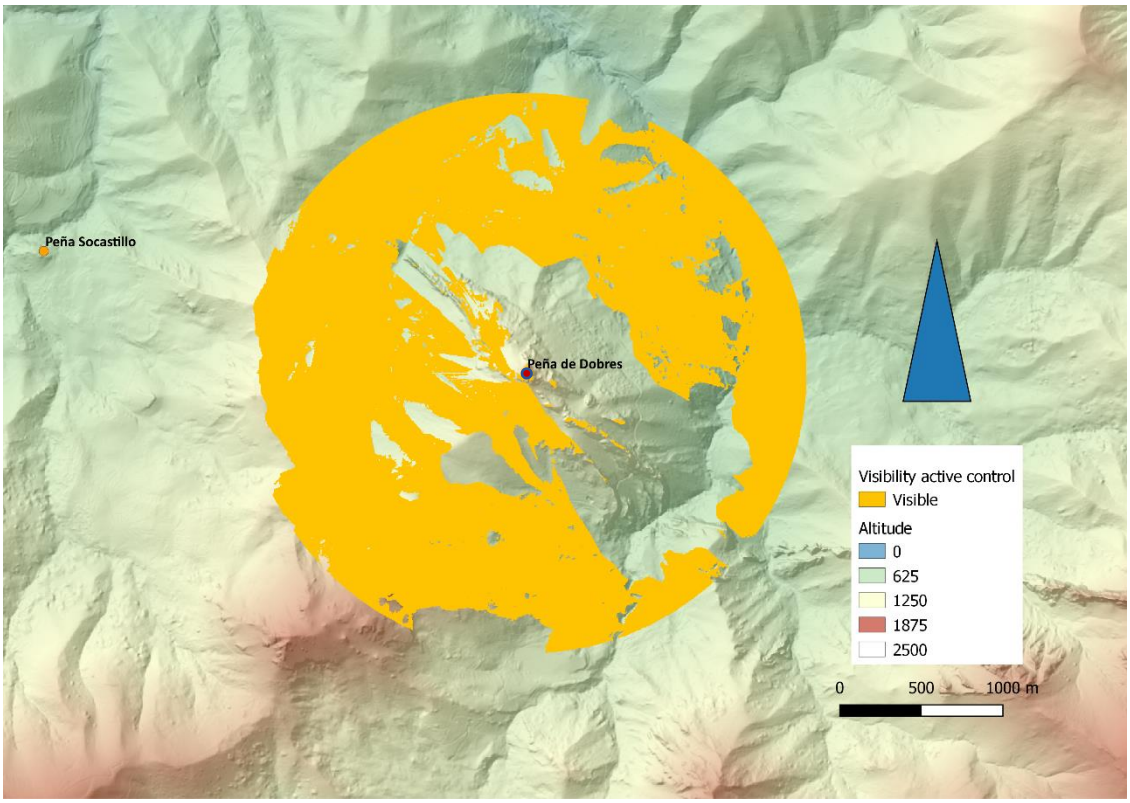

Figure 51. Active control of Castillo de Dobres (Vega de Liébana) (by author).

Peña de Dobres must have been visible from large parts of Liébana, especially when entering Liébana. Given the notable peak of Peña de Dobres, a building on top of it would have contrasted with the sky, and thus be more notable over larger distances.

The area of control is also characterized by gaps which possibly could have been circumvented by the possible viewer through walking around. *Río Bo* and the *Río Frío* fall within its visibility, so does the low lying area. These rivers are situated both east and west of the site.

4.4.13. Sedanga (Toranzo, Vega de Liébana)

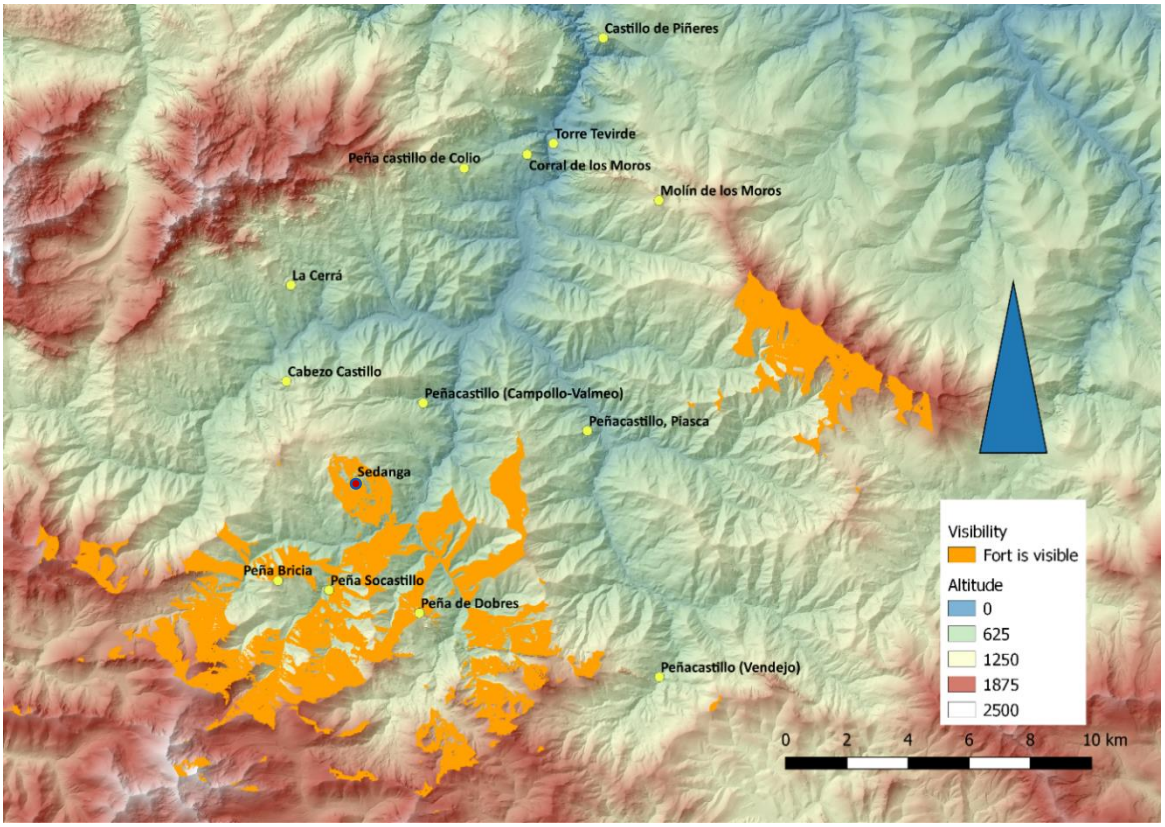

Figure 52. Visibility of Sedanga (Toranzo, Vega de Liébana) (by author).

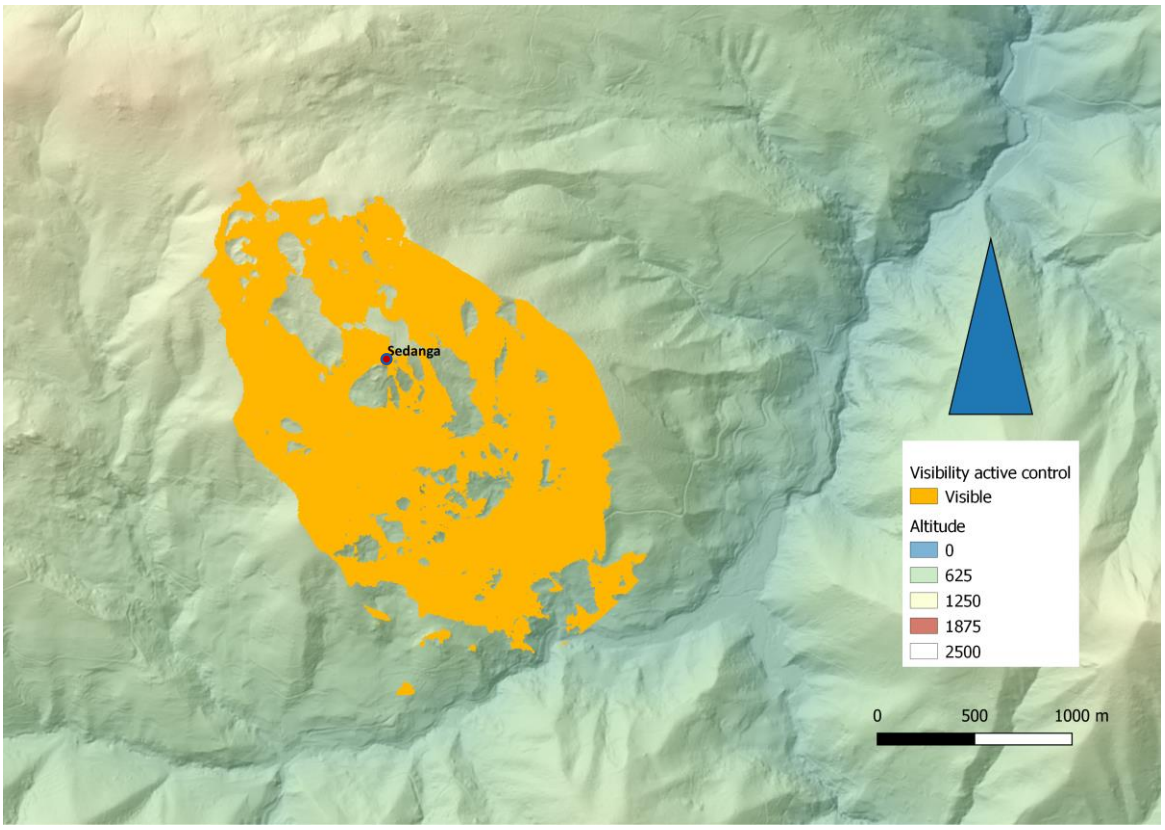

Figure 53. Active control of Sedanga (Toranzo, Vega de Liébana) (by author).

Sedanga is visible from large parts of Liébana to its south, but it is visually cut off from its northern side. This cut off does not seem to be caused by it being a static point, it is possibly caused by its chosen position as site. It is visible from all three fortifications to its south, Peña Bricia, Peña Socastillo and Peña de Dobres.

Its visibility barely reaches the *Río Quiviesa*, which marks the lower lying area to its south and east. This is also due to the chosen parameters. If the view radius was slightly bigger the river would easily fall within the viewshed. It is thus not unlikely to think under some circumstances it would have been within its active control.

What characterized the viewsheds of Sedanga the most is its position from which it can be observed by all 3 fortifications to its south.

4.4.14. Peña Castillo (Campollo-Valmeo, Vega de Liébana)

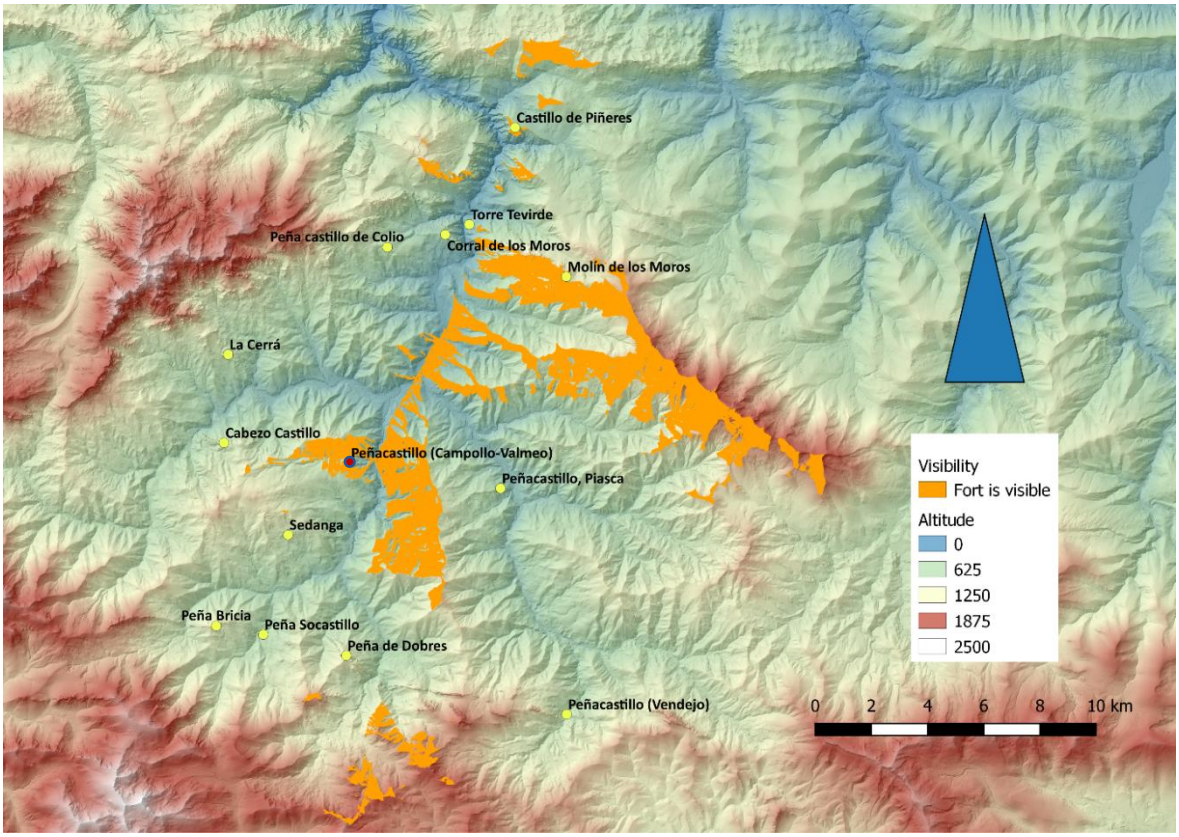

Figure 54. Peña Castillo (Campollo-Valmeo, Vega de Liébana) (by author).

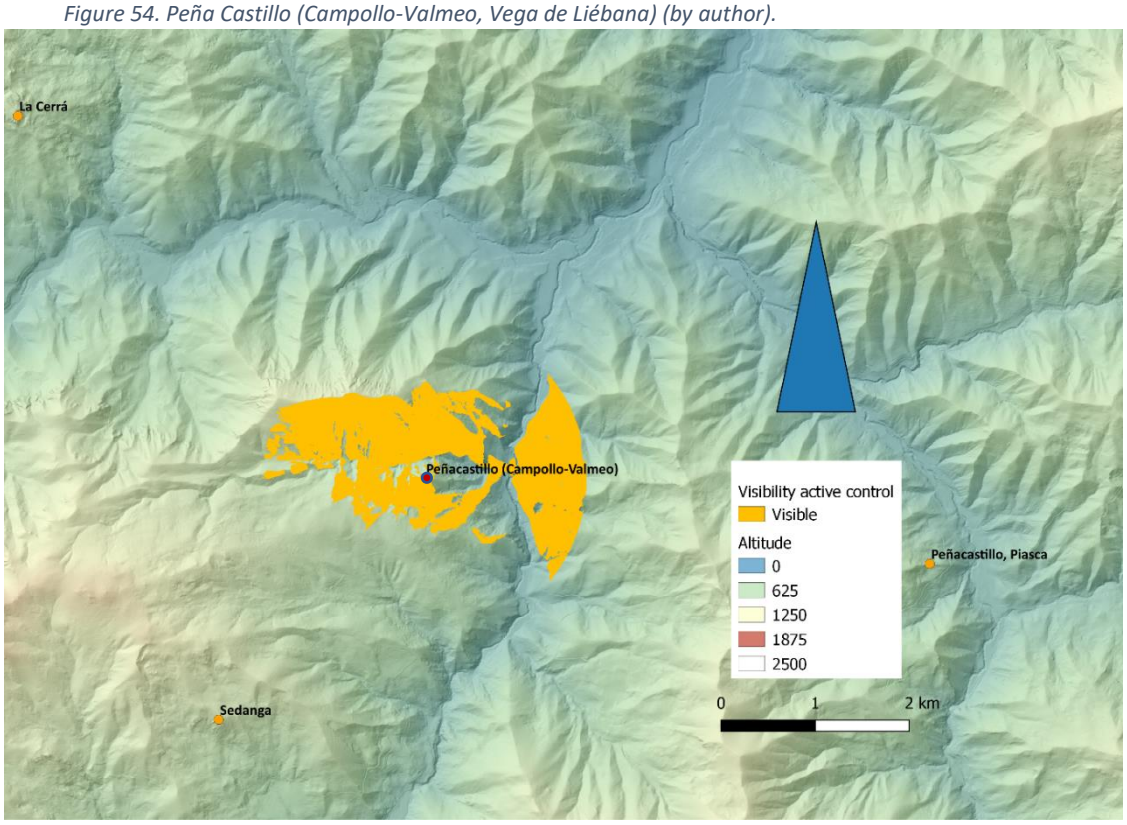

Figure 55. Active control of Peña Castillo (Campollo-Valmeo, Vega de Liébana) (by author).

Peñacastillo (Campollo-Valmeo) is not visible from the western part of Liébana. Although this is also true for the rest of Liébana, it is interesting how the fortification remains visible throughout the lower lying area to its north and partially to its south.

Its active control is also characterized by the higher areas obscuring its view to its north and south, but with a clear visibility on the *Río Quiviesa* to its east. This aspect together with its limited visibility also suggests a focus on a fairly local function.

4.5. Intervisibility network

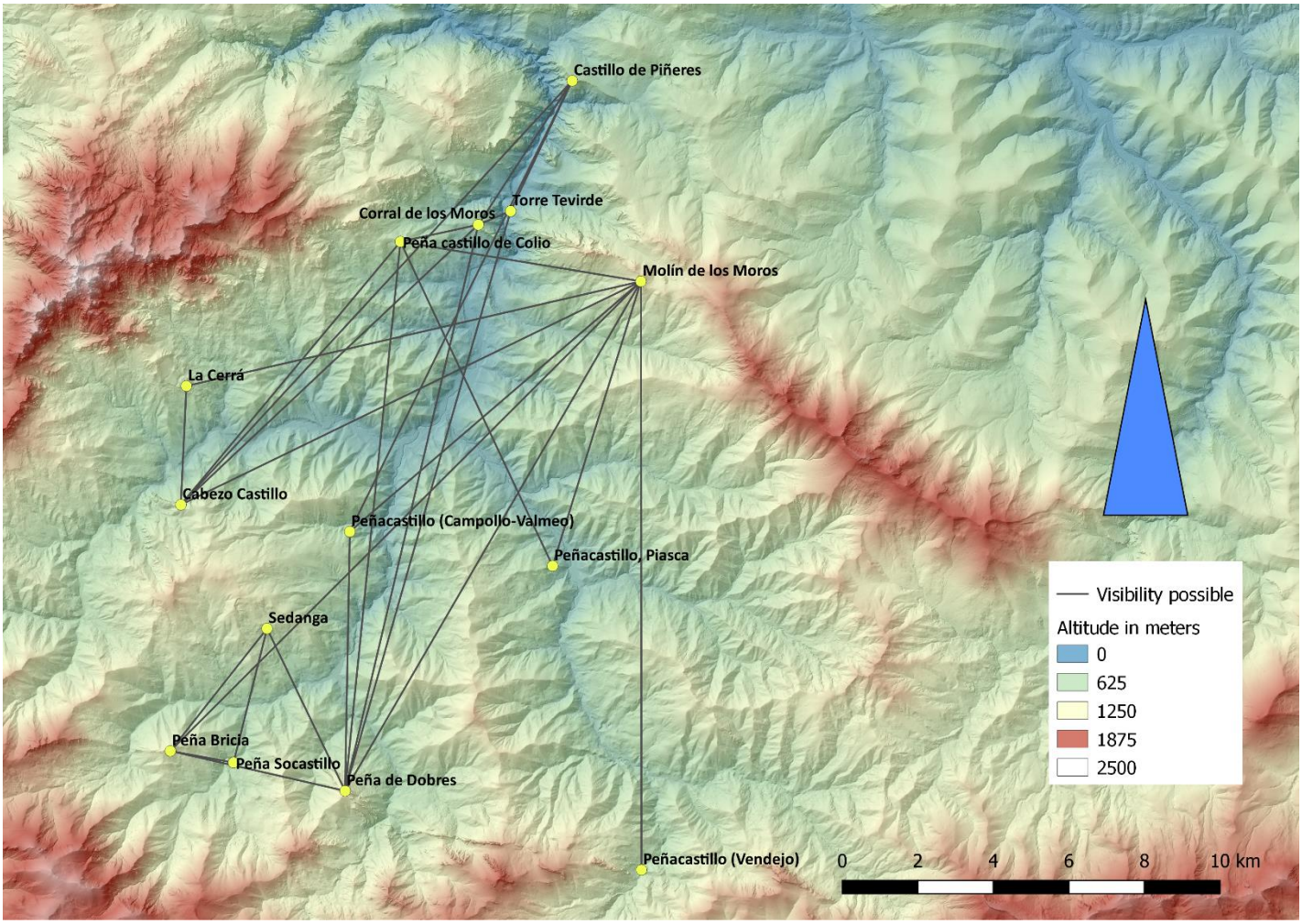

Figure 56. Intervisibility network under ideal circumstances (by author).

Under ideal circumstances within the given parameters the results are as seen in figure 56. Given these results the following table can be made showing the number of visible fortifications per site:

Table 5. Number of visible fortifications per site under ideal circumstances.

Molín de los Moros	8
Peña de Dobres	7
Cabezo Castillo	5
Corral de los Moros	5
Peña Castillo de Colio	5
Castillo de Piñeres	4
Peña Bricia	4
Peñacastillo (Campollo-Valmeo)	3
Sedanga	3
Torre Tevirde	3
La Cerrá	2
Peña Socastillo	2
Peñacastillo (Piasca)	2
Peñacastillo (Vendejo)	1

Observing these results show that in the ideal circumstances the view radius gives an almost unrestricted view distances in this case. Which results in every unobstructed line of sight to be marked as visible. This is further shown by the outliers; *Molín de los Moros* and *Peña de Dobres*. Because of their high altitude locations, 1.360 meters and 1.387 meters (Marcos Martínez and Mantecón Callejo 2009, 121 and 126), the sites have an almost unrestricted line of sight to most sites. Under these circumstances figure 56 shows an extensive intervisibility network. In this case, every fortification is included into the network. Excluding the possibility of yet unidentified fortifications missing in the network.

To see how these results hold up in less favourable conditions the same parameters will be used but with a smaller view radius. In this case the view radius will be halved (Ogburn 2006, 410). This results in a view radius 9460 meters. This will be named as *less favourable conditions.* Under less favourable conditions the following table (6) is the result of the intervisibility network:

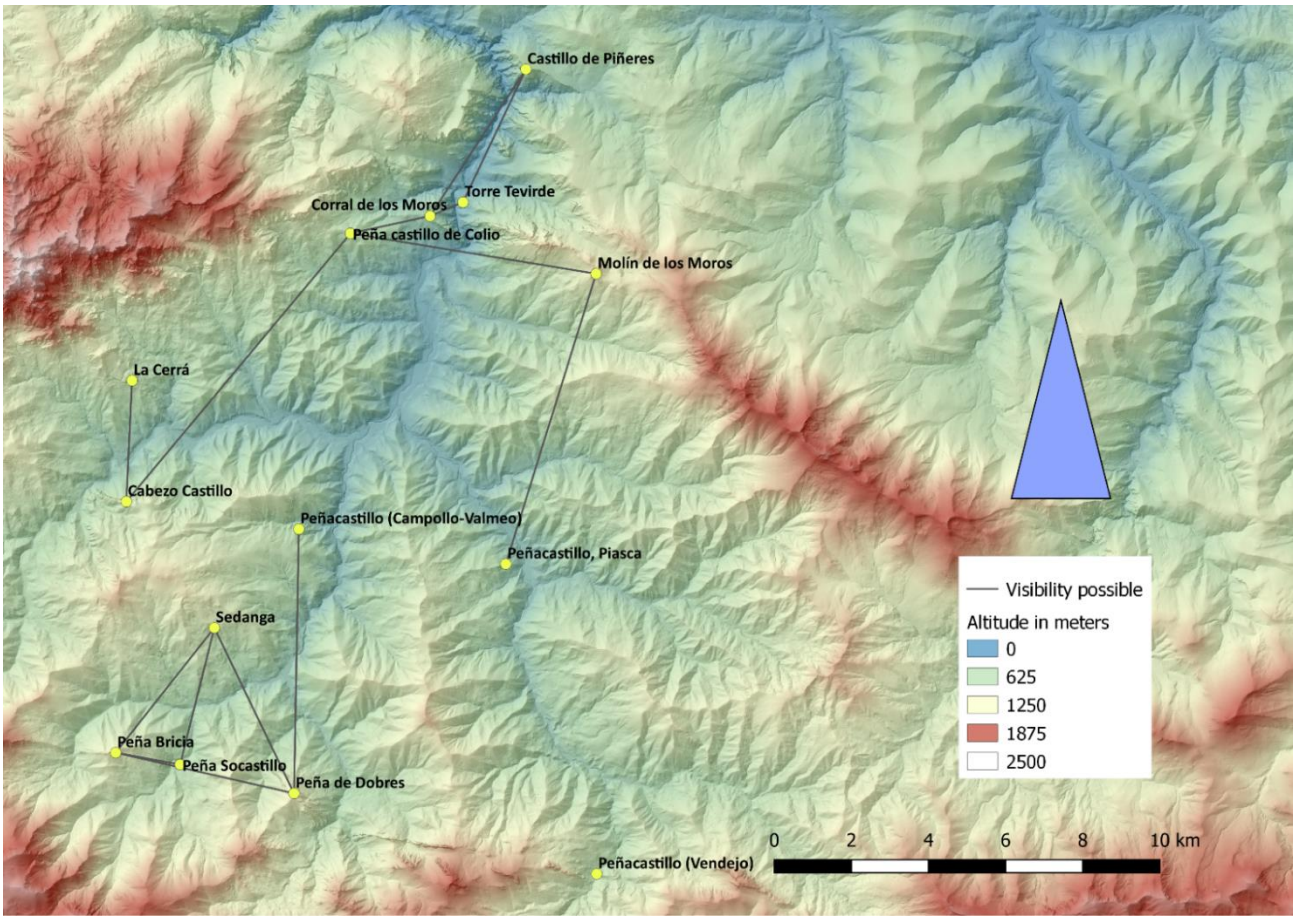

Figure 57. Intervisibility network under less favourable conditions (by author).

Table 6. Number of visible fortifications per site under less favourable conditions.

Corral de los Moros	3
Peña Bricia	3
Penã Castillo de Colio	3
Peña de Dobres	3
Sedanga	3
Cabezo Castillo	2
Castillo de Piñeres	2
Molín de los Moros	2
Peña Socastillo	2
Torre Tevirde	2
La Cerrá	1
Peñacastillo (Campollo-Valmeo)	1
Peñacastillo (Piasca)	1
Peñacastillo (Vendejo)	0

Noticeably because of the more restricted view radius there are no outliers with considerably more possible fortifications in sight than others. The intervisibility network still holds up to some extend compared to the ideal circumstances.

In the vacuum of only these fortifications being connected in an intervisibility network it is noteworthy that *Peñacastillo (Campollo-Valmeo)* lies just over 10 km from *Molín de los Moros*. If the view radius of the less favourable conditions would have been 11 km an intervisibility between these sites would have been possible, resulting in the southern sites being connected visually with the other sites. This is an indication of the limitations of a binary approach within QGIS. It is either visible or not, there is no in between.

4.6. Multiple and cumulative viewsheds

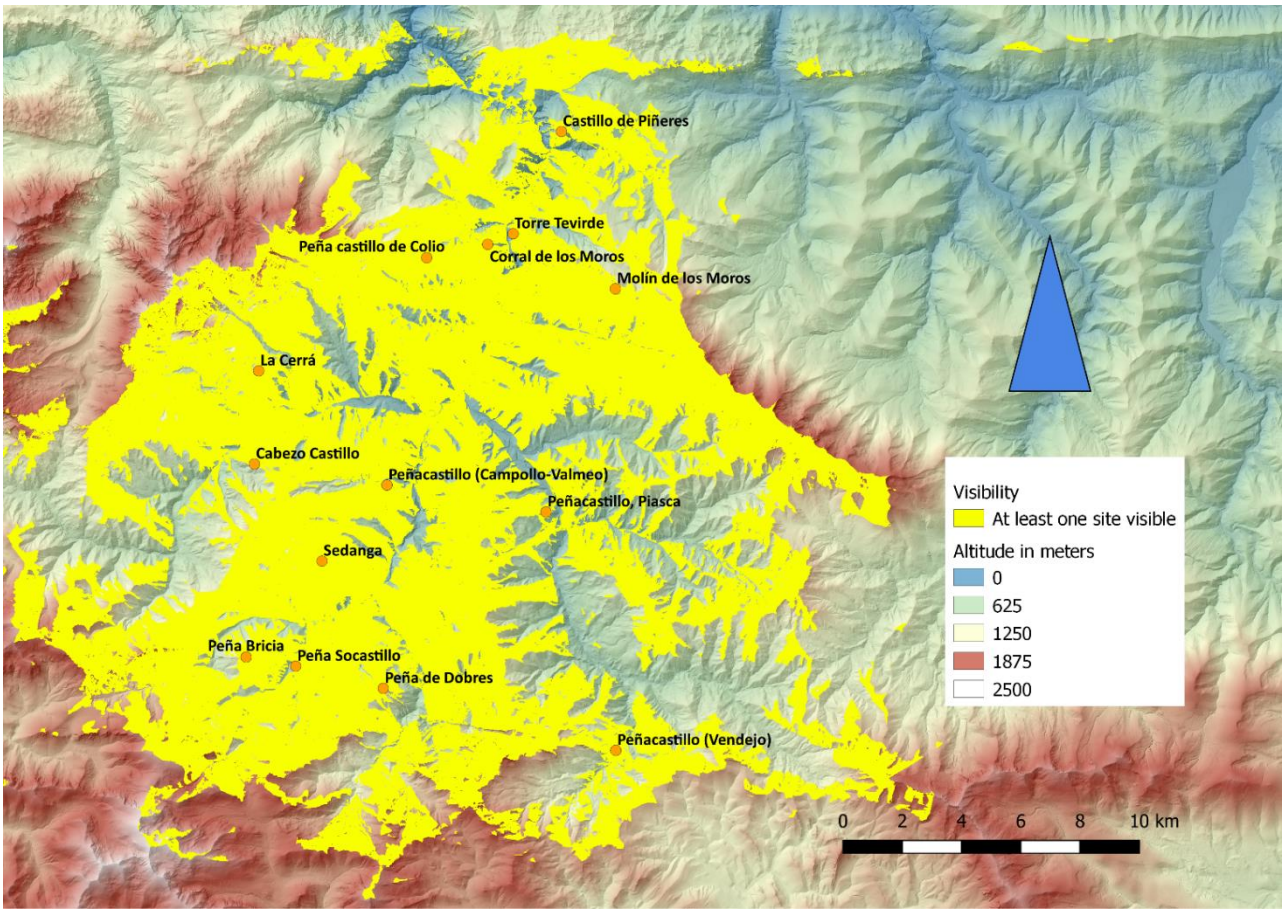

Figure 58. Multiple viewshed under ideal circumstances (by author).

With the parameters under which the map is generated it shows that over almost all of *Liébana* at least one site is visible. Some notable exceptions are the areas southwest of *Cabezo Castillo* and north of *Peñacastillo (Vendejo)*. When zooming in to *Cabezo Castillo* it is clear that it only has visibiilty to its north. Completely leaving out the southern side. This is most likely due to the placement of the viewpoint. As its placement clearly blocks

the view southwards. Only being there in the field would directly show if this is indeed the case of just an error to the static nature of this methodology.

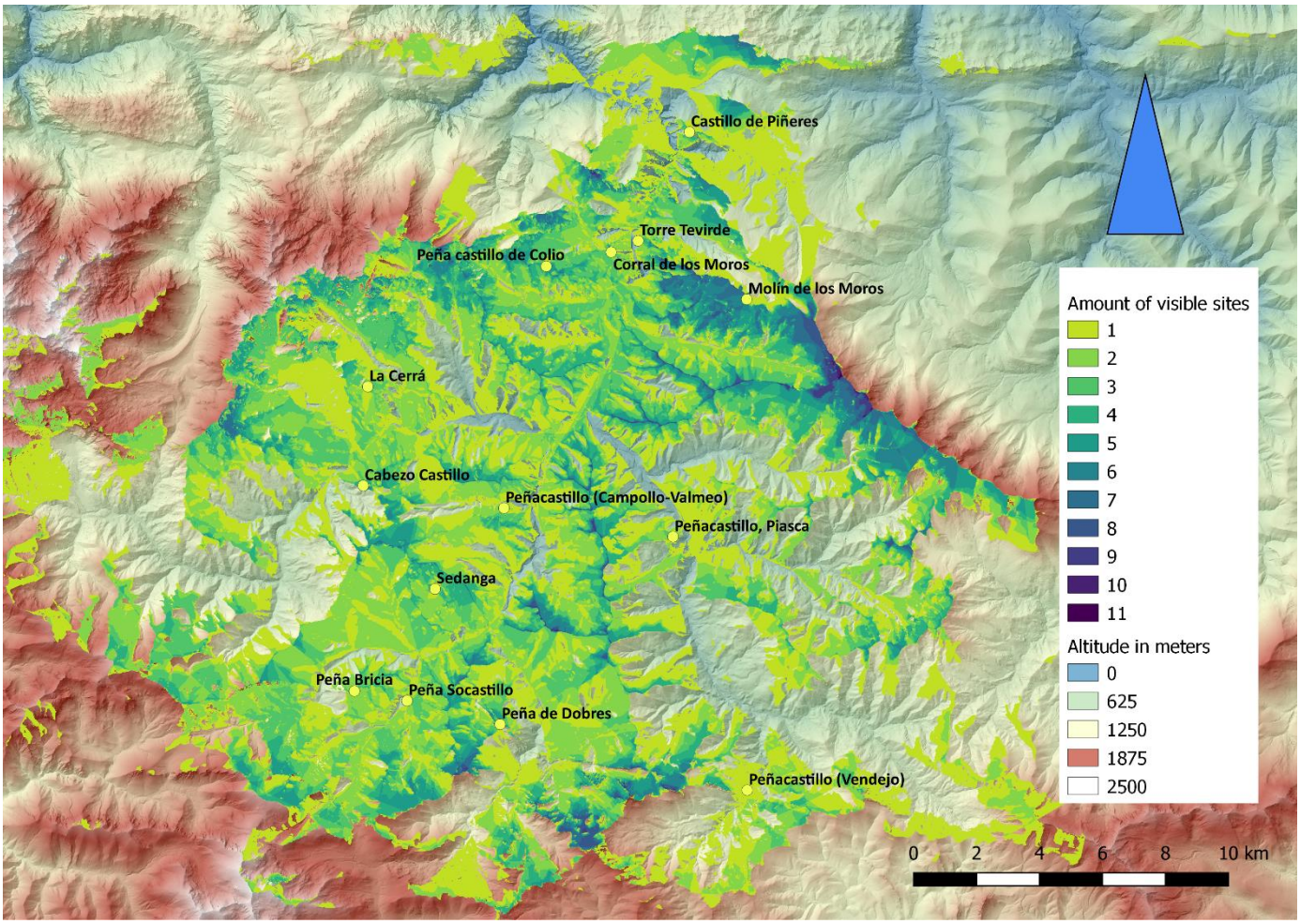

Figure 59. Cumulative viewshed under ideal circumstances (by author).

The higher altitude areas within Liébana have an increased number of visible fortifications. Which is a logic result as the higher the area is to the rest, the less obstructed the line-of-sight is. Along with this it is clear from many points within *Liébana,* multiple fortifications are visible. Also, it is interesting to note how the visibility of the fortifications is limited to the geographical features of Liébana. This is logic given it is surrounded by mountain chains, but it also emphasises the fact this was possibly a delimitation for early medieval society in Liébana.

The map also shows the higher the density of fortifications the higher the chance of perceiving multiple fortifications, also in the lower altitude areas. Such as along the *Desfiladero de la Hermida,* near *Corral de los Moros.*

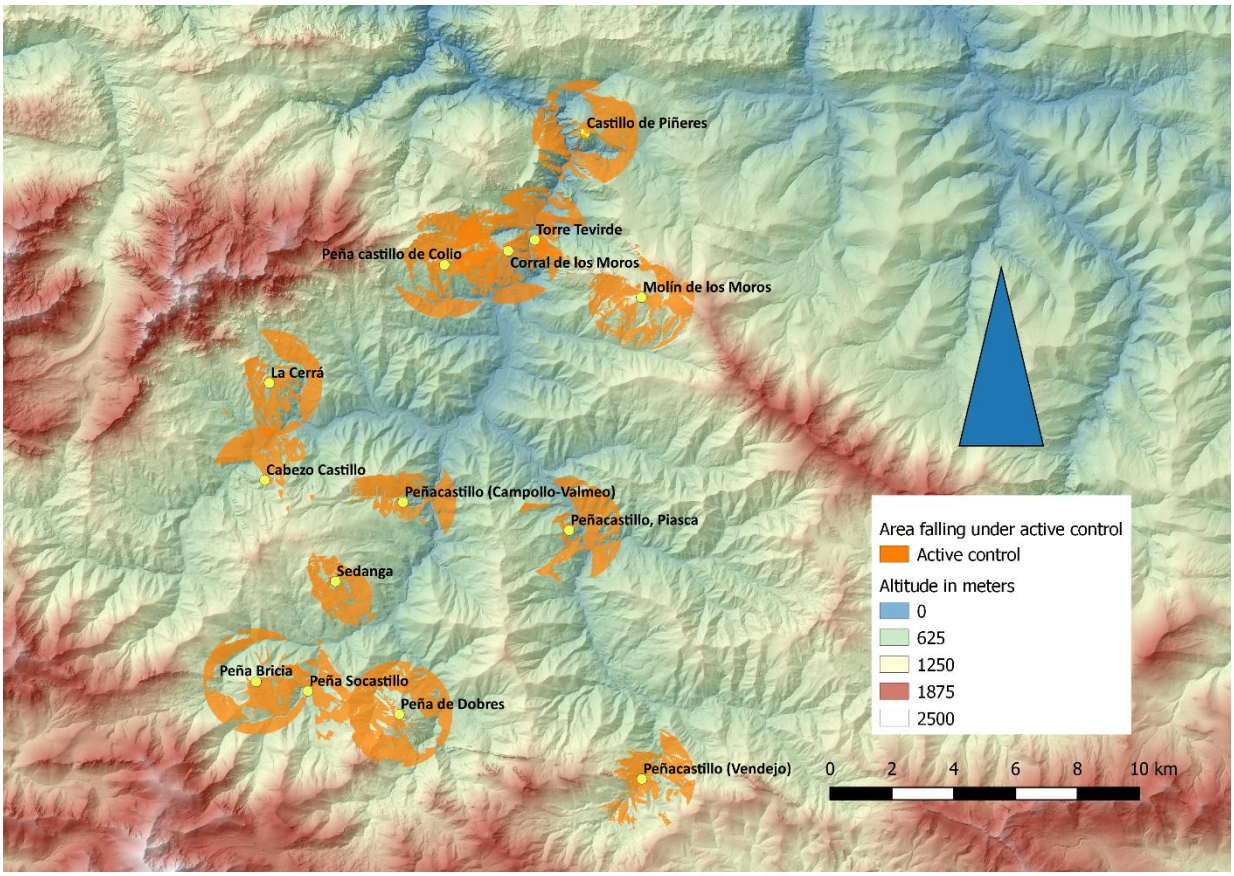

Figure 60. Multiple viewshed of 'active control' (by author).

Under the parameters of 'active control' some aspects are more emphasised. Especially the relative proximity of the sites to the lower lying area, and as a result of the rivers and historical routes. Most fortifications are situated in such a proximity that the lower lying area falls under 'active control'. Another aspect emphasised by the visualization of the chosen parameters is the relative proximity of two clusters of fortifications. The Northern forms a clear cluster in which their 'active control' overlaps. In the southern area this aspect is shown similarly. Also visible is the lack of 'active control' in the central lower lying area of Liébana, whilst all lower lying areas associated with routes are at least to some extend within 'active control' of at least one fortification.

4.7. Conclusion

Looking at all sites separately through viewsheds gives some similar results between sites:

- Some sites are not as visible as others through their geological locations. This shows when the active control viewshed is indicative for the viewshed of the visibility of the site.

- Some sites are more visible throughout Liébana than other sites. Where Castillo de Dobres is visible form large areas, Peñacastillo (Vendejo) is not that visible.
- Almost all sites have a river or stream within their/or on the boundaries of active control as determined by the chosen parameters.
- The chosen coordinate points as viewpoints within the viewsheds leads to some results which could not be representative for the actual visibility.

Based on these observations it can be concluded that the archetypes described Marcos Martínez and Mantecón Callejo have some merit on the basis of the viewsheds. The two archetypes described by them were (Marcos Martínez and Mantecón Callejo 2012, 109-10):

- High altitude fortifications for beaconing territory.
- High altitude fortifications for controlling access routes.

Although one archetype does not exclude the other, some fortifications have significantly less visibility than others. Which leads to their own visibility to be very similar their active control visibility. This means they do not beacon territory as effective as those fortifications which are visible over larger distances. This may suggest that the fortifications which have limited visibility ay have been focused on controlling access routes instead. On this basis the following table is made. It shows the fortifications which would fall under the archetype *beaconing territory* or *controlling access routes* on the basis of their viewsheds.

Table 7. Fortifications in their possible archetype.

Wide visibility (*Beaconing Territory*)	**Limited visibility (*Controlling Access Routes*)**
El Castillo del Monte Subiedes	Torre Tevirde
La Cerrá	Castillo de Piñeres
Peñacastillo (Colio)	Peñacastillo (Piasca)
Corral de los Moros	Peñacastillo (Vendejo)
Molín de los Moros	Peña Socastillo (Barrio)
Peña Bricia	Peñacastillo (Campollo-Valmeo)
Castillo de Dobres	
Sedanga	

Eight sites could be seen as *beaconing territory* whilst six could be seen as *controlling access routes.* This determination is binary, and therefore lacks nuance. Some

fortifications, such as Castillo de Piñeres, could in some aspects also fall under beaconing territory. Some sites could also fall under both. Beaconing territory could also have been done with a limited view. As long as it is in view of the area which it is supposed to beacon. Even if such area is smaller than the whole of Liébana.

Yet, it should not be ignored that some fortifications do have a very limited visibility. Peña Socastillo, Peñacastillo (Vendejo) and Torre Tevirde are the 3 fortifications which have a very limited visibility. This is reflected in their placement, in the middle of the valley, yet still on a peak. Given the natural access routes these valleys formed, these sites are situated on an excellent spot for controlling these routes.

When looking at all the sites as a whole it shows when entering Liébana an observer would at least be able to make out one fortification. On many occasions even 2 or more. Although the viewshed covers most of Liébana the observation of the gaps is also telling. On the wester/southwestern part of Liébana there seems to be a vacuum in which no already identified fortification sits. This also counts for the east Liébana. East of both Peñacastillo (Piasca) and Peñacastillo (Vendejo) lay valleys in which no fortification was visible. This might indicate more fortifications are yet to be identified.

The intervisibility network show a consistent result with the literature, but also expands upon the literature. Under varying distances the sites remain connected, although in varying extend. Under ideal circumstances all sites could possibly visually communicate with each other in a chain. Especially the clusters with several fortifications in the north, and in the south, show that under every circumstance they would be visually connected as they are situated in a tight group with line of sigh to each other. The fortifications thus form a very tight defence system if past societies chose to use them as such. More so when taking into account the disregard of the context in which these fortifications were situated. Churches and villages, among other landmarks, would also have been an important aspect in the surroundings of the sites. If such places would have been taken into account the intervisibility network would surely be expanded upon.

These cluster are even more interesting when taking into account modern-day access routes through Liébana. The northern cluster forms around the *Desfiladero de la Hermida*, which in the past also must have been the main access route from the north. The southern cluster forms around the *Puerto San Glorio*.

In conclusion, there is a difference between sites and their function when merely looking at its active control and its visibility. Also, under varying circumstances sites

would still be able to visually communicate. Lastly, the two important entryways into Liébana are also in the area in which a cluster of sites is present and falls within active control of multiple of the fortifications.

5. Discussion and Conclusion

The aim of this thesis was to offer more insight into the function and use of the fourteen identified fortifications in early medieval society in Liébana through a visibility analysis of the sites. The 3 research questions which were used to support this aim were:

- From where in the landscape were these fortifications visible?
- What areas were visible to these fortifications?
- What fortifications are in the line of sight of one another?

This chapter discusses to what extent the aim of the research is achieved by answering the three research questions and concluding with the implications the results could have for the early medieval society in Liébana. After this conclusion, a reflection on the research as a whole will be discussed, followed by suggestions for future research.

5.1. Conclusion

The results presented show the following answers to the research questions respectively:

- The identified fortifications would have been visible all over Liébana, with an exception of the south west and the east in which some areas have no fortification in sight. Some fortifications were more visible than others. The viewsheds suggest some fortifications were mainly focused on controlling access routes, as their visibility in the landscape was limited. This leads to the affirmation of the two archetypes as put forward by Marcos Martínez and Mantecón Callejo: beaconing territory and controlling access routes (table 7).
- The visibility of these fortifications depended on their location. The highest concentration of fortification is along the two main entryways, the *Desfiladero de la Hermida* and the *Puerto San Glorio.* Also, most sites are placed with a visibility on the three main rivers through Liébana, the *Río Deva,* the *Río Quiviesa* and the *Río Bullón*.
- The intervisibility network of fortifications would allow visual communication throughout Liébana. An especially resilient intervisibility network is present in the north and in the south. Their intervisibility network stays in tact under varying circumstances that could influence visibility (table 5, 6).

These results could imply several things for the early medieval social community of early medieval Liébana, namely:

- Liébana was clearly beaconed by an elite who used the fortifications as symbolic markers of control. Given that throughout Liébana the fortifications are visible it is possible, but both archaeological and historical evidence is lacking to further support this claim.
- Liébana was fragmented under several social communities who tried to beacon their own territory. Perhaps more plausible, as an elite is lacking from both the historical and archaeological evidence. Yet, historical sources do not describe internal conflict.
- The fortifications could have functioned, regardless of their intended function, as territorial markers for reference. The social community could use the fortifications to indicate where what was situated. Making the cultural landscape, which is marked with natural relief, more readable for the community.
- The fortifications are in their 'active control' bound to the lower lying area. These areas would have been extensively used by locals to navigate through Liébana. Especially routes leading into Liébana could most likely not circumvent the area of 'active control'. As a result, when needed, the local community could use the fortifications to keep an eye on any threats that might enter Liébana.
- Identified threats could then also have been communicated with the hinterland, as shown in the intervisibility network.
- This defensive network could have been the response of the local community to the period of 950 – 1050, which can be described as turbulent for the kingdom of León (Portass 2017, 9).

The results show that visibility of the fortifications was extensive. As a result, it must have influenced the early medieval society in Liébana in varying ways. Although the size of this influence is hard to determine. Perhaps most importantly, the results do not disprove the current emphasis by scholars on visibility of the early medieval fortifications in Liébana as important part of their function.

5.2. Reflections on research

The unfortunate consequence as a result of choosing to use all fourteen fortifications for a visibility analysis is the lack of depth in any specific site. Its surroundings cannot be sufficiently studied, which leaves other possible characteristics out of the analysis. This also caused by the lack of research with regards to early medieval archaeology within

Liébana. Also, the setup of the research is already somewhat biased to the fortifications being contemporary, as it portrays all fourteen sites as contemporary. This does not have to be the case. The thesis however, does sufficiently hold up if some sites would not be contemporary. Only further research will lead to more clarity.

When reflecting back on the results of this research, some results seem dubious. This is shown in the coordinates of the sites differing, such as is the case with Peñacastillo (Campollo-Valmeo). This is also the case looking at the viewsheds, which seem to leave out large areas which might have been visible, as was the case with Cabezo Castillo and Peña Socastillo. These results cannot be completely circumvented as long as no field work is done with regards to all fortifications.

Furthermore, the visibility maps are binary and do not reflect the infinite possibilities with regards to view distance. This thesis also disregards vegetation which might have impacted visibility in various scenarios. Both points indicate the inflexibility of the visibility analysis made in this case. The results should thus always be seen together with their parameters.

Given these reflections it is key to remain critical to the results and conclusions drawn from these results. The results however, are data which can be a stepping stone for future research because the broad data reflected here has not yet been bundled together before. It offers data for both further research into all the fortifications, together or singular. It does so by offering data such as coordinates, maps and background.

5.3 Suggested future research

For more definitive answers more studies have to be done regarding early medieval archaeology within Liébana. This would give a broader archaeological context to the fortifications. Specifically, fieldwork with regards to early medieval settlements and episcopal complexes would help put early medieval fortifications in their historical spatial context. Further archaeological fieldwork on early medieval fortifications of Liébana are also necessary to narrow down the broad chronological frame which is currently in place for the sites. This fieldwork could also verify to some extend the questions raised by the results of Castillo del Monte Subiedes, and could answer if its view is cut off in reality as is shown in the viewsheds. The produced multiple viewshed also shows certain gaps in Liébana, such as north of Peñacastillo (Vendejo). A methodological survey could verify if more fortifications were situated on the peaks that

currently do not have an identified fortification present, or if it is limited to the sites currently already identified.

With regards to the historical spatial context, it would be helpful if a spatial analysis was done on a specific site. A spatial analysis could go into depth on a more site specific basis, touching upon more aspects than just visibility. It could draw natural features, usable agricultural land and water catchments into the broad overview of a site. Together with already done archaeological fieldwork, it could further investigate possible functions and implications of the fortifications. This would in turn create a completer image on early medieval fortifications in Liébana, and its implication on the early medieval social community of Liébana.

Abstract

In Liébana, an area in Norther Spain, one can identify fourteen (14) early medieval fortifications. Each of these fourteen fortifications can be found on high altitude locations. Current research emphasises that visibility from and between these fourteen fortifications is an important aspect. However, no methodological study has been done previously to substantiate visibility as a key characteristics of the fortifications. This research therefore aims to establish an overview of the visibility of the fortifications to create more insight in their use and function in the early medieval society of Liébana. The research makes use of GIS to examine the extend and characteristics of visibility methodologically by creating different viewsheds and an intervisibility network. In order to make this work, a DEM file is created to and coordinates of the fortifications are established. The results of this research are presented in maps. The maps indicate that fortifications were visible throughout the landscape whilst the fortifications could at the same time actively control the main access points into Liébana. The results presented in the maps in addition show how the fortifications could visually communicate under varying circumstances throughout Liébana. This research therefore shows that visibility is indeed a key characteristic of the high altitude fortifications.

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Figures

Tables

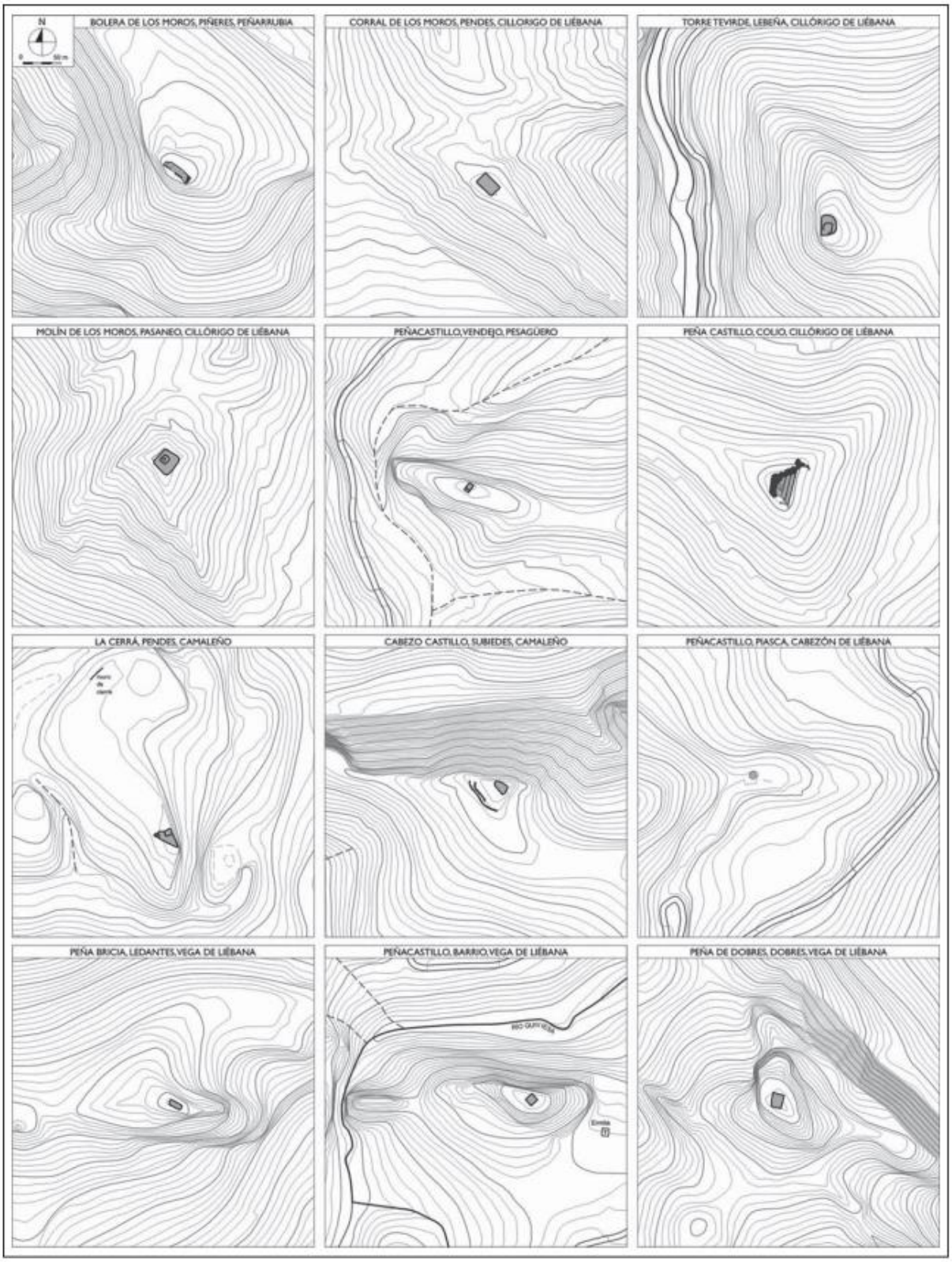
Appendices

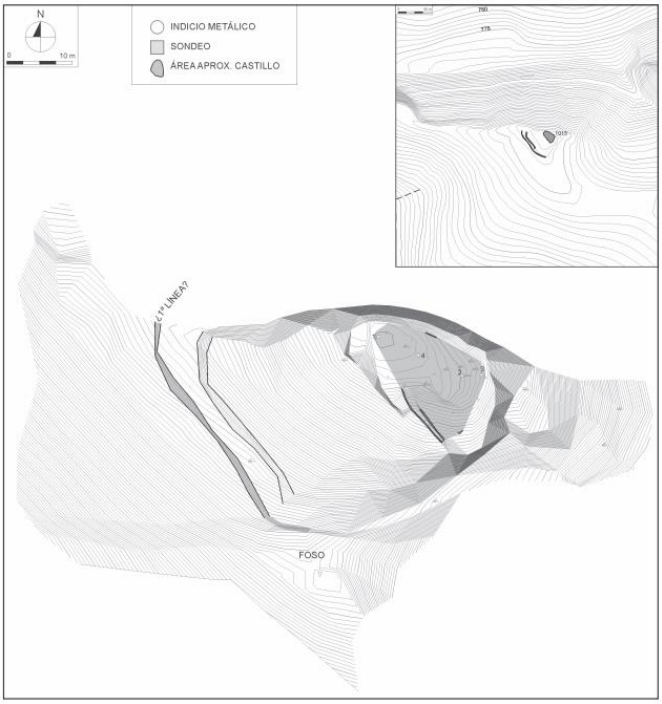
Appendix 1. Table with coordinates of four fortifications in Liébana provided by GAEM Arqueólogos on 17-6-20.

Peña Castillo (Colio, Cillorigo de Liébana)	367.716 / 4.784.499
Molín de los Moros (San Pedro de Bedoya, Cillorigo de Liébana)	374.085 / 4.783.455
Peñacastillo (Campollo, Vega de Liébana)	366.345 / 4.776.909
Selanga (Toranzo, Vega de Liébana)	364.191 / 4.774.277

Appendix 2. The fortifications with their contour lines as presented in (Marcos Martínez and Mantecón Callejo 2012, 112)

Appendix 3. the Castillo del Monte Subiedes and its contour lines (Marcos Martínez and Mantecón Callejo 2009, 106).





Appendix 4. Map of the fortifications in Liébana (Marcos Martínez and Mantecón Callejo 2009, 215).