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An Archaeological Study of the two-hundred-year-old raised structures in southern Gauteng, South Africa

Kathryn D. Croll

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A research report submitted to the Faculty of Geography, Archaeology and Environmental Sciences, University of the Witwatersrand, in fulfilment of the requirements for the degree of Master of Science

Johannesburg, 2017

ABSTRACT

This study was first and foremost a descriptive study of the so-called enigmatic raised structures found within the Suikerbosrand Nature Reserve and the neighbouring farm. The study also aimed to determine whether the raised structures could possibly be called ‘grain bin bases’, ‘grave markers’, ‘cairns’ or ‘monuments’. The study followed a quantitative methodology which involved field surveys and an exploratory GIS study of the LiDAR data by using the following variables: slope, aspect, ruggedness, elevation, viewshed area and the number of other raised structures visible from each raised structure. It is difficult to ascertain the precise function of these structures using the methods applied in this study, however, the structures do fulfil the characteristics of monumental architecture. This ties in with other research which detailed that the Group II stone walling within the Suikerbosrand area was built by the most politically stratified groups which occupied the region during the Late Iron Age.

Keywords:

GIS, LiDAR, Suikerbosrand, Group II stonewalling, Raised structures, monumental architecture

DECLARATION

I, Kathryn Deirdre Croll, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in fulfilment of the requirements for the degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Kathryn Deirdre Croll

Signed at Randburg

On the 25th day of August 2017

DEDICATION

To my mother, Jennifer Croll, without whom I would not be the person I am today and to my dogs, who made me laugh and kept me sane during this process.

ACKNOWLEDGEMENTS

I am forever grateful to my supervisor, Prof. Karim Sadr, for his unlimited patience and assistance. I am also thankful for the unconditional support provided to me by my mother, Jennifer Croll, and best friend, Mixi Perdigao.

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CHAPTER 1. INTRODUCTION

1.1 Introduction

This research is a study on fifty-two enigmatic raised structures situated in southern Gauteng, straddling the border between the Nolte farm and the Suikerbosrand Nature Reserve. These structures are sufficiently different from the surrounding stone walling to warrant an investigation. The study area has been of interest to several researchers recently in terms of classifying the patterns of stonewalling and identifying the people who occupied the area during the Late Iron Age. This study does not attempt to identify who built the raised structures under study, but rather attempts to identify possible purposes for them, and, failing that, to identify whether the raised structures could potentially be a physical expression of power in the sense of monumentality. The 52 raised structures studied here are not the only structures within this area, however they are the ones which are located in this study's 98ha study area. The distribution of the raised structures beyond this study area has not yet been reported on.

1.2 Context of the study

The Late Iron Age (AD 1300 – 1800s) was characterised by the arrival of Nguni- and Sotho-Tswana speakers into Southern Africa. These communities brought with them new ways of living, farming, building, pottery styles and living locations, among other attributes (Badenhorst 2010). However, these communities were not the first farmers to move into the region and they interacted with those who already lived in the area. Maggs (1976) notes that communities living in the southern Highveld had been living at least on the fringes of grassland areas which suggests that they were slightly experienced with forging a path in this type of environment. Also on the southern Highveld, there is a discernible difference between north-western and eastern settlements associated with different Sotho-Tswana groups (Maggs 1976). Badenhorst (2010) emphasises that the arrival of the Sotho-Tswana is concurrent with cattle herding becoming the dominant lifestyle and the intensification of farming in certain areas.

A large-scale (~8000 sq km) remote sensing survey has been completed to record and analyse the distribution of various types of pre-colonial stone walled structures (SWS) in the southern Gauteng Province (Sadr and Rodier 2012, Hunt and Sadr 2014, Sadr 2015). In the central sector of this survey area, among an approximately 200-year-old type of stone walled structure, there are anomalous raised structures constructed from large boulders and filled in with small stones. These structures seem to be restricted to this central area and their purpose is currently unknown. These anomalous stone structures can be found within a group of stone walled structures.



Figure 1.1: Map of the Province of Gauteng, South Africa, with the Suikerbosrand Nature Reserve highlighted with an arrow.

Source: Temba (2016), www.temba.co.za/southafrica/gauteng, accessed 20/03/2017

The region under study has been previously identified by several researchers (see for e.g. (Maggs 1976, Taylor 1984, Huffman 2002) as having been populated by Sotho-Tswana speaking peoples during the nineteenth century and the patterns of stone

walling which have been identified by Taylor (1979) are discussed in more detail in Chapter Two.

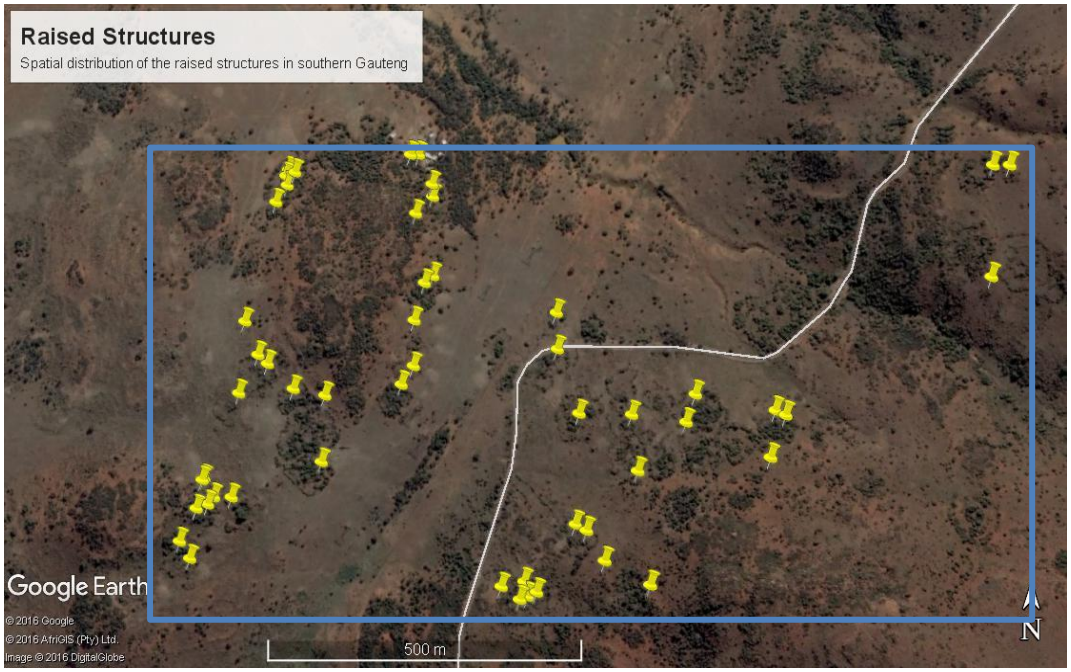


Figure 1.2: Google Earth (2016) Map of the spatial distribution of the raised structures under study, with study area outlined

The greater region within which this study is situated is known for large-scale sites such as Kaditshwene. This site is historically recorded to have contained at least 13 000 Tswana speaking people, if not more, at its zenith (Boeyens 2000). Boeyens (2000) identified that the ruins located on the border of two farms known as Bloemfontein 63 JP and Kleinfontein (or Olifantspoort) 62 JP, in the form of two large settlement units, agree with the “king’s district” and “northern district” described by the missionary John Campbell and the central and upper division described by Schapera (1943, cited by Boeyens 2000) as belonging to Kaditshwene.

Large-scale sites belong to a time period known as the Late Iron Age (AD 1300 – 1820s) – a time characterised by farming and metal-working practised by Bantu-speaking peoples (Badenhorst 2010), which began during the early Iron Age. Certain communities demarcated the space they and their livestock occupied by using stone walling. Different communities used different architectural patterns to denote their space and social hierarchies (Sadr and Rodier 2012). The study area of this research is the western part of the Suikerbosrand Nature Reserve and part of the neighbouring farm owned by the Nolte family.

The geology of the Suikerbosrand Nature Reserve was studied by Bredenkamp and Theron (1978). They found that 40% of the Suikerbosrand Nature Reserve is comprised of the Witwatersrand supergroup which is made up of mostly quartzite. The different types of geology found within the Suikerbosrand Nature Reserve are shown in Figure 1.3. The study area of this research falls on the Ventersdorp lava section.

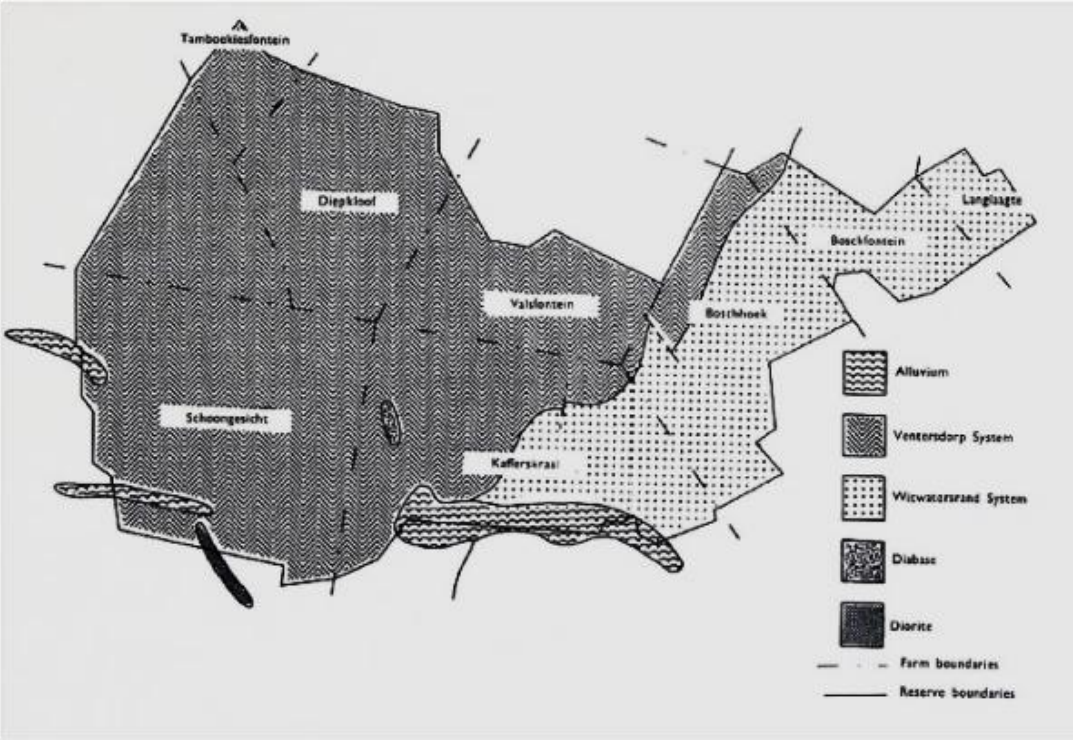


Figure 1.3: The geology of the Suikerbosrand Nature Reserve. Source: Bredenkamp and Theron (1978)

The anomalous raised structures consist of large (up to 2m tall, 4-5 m in diameter) circular structures built among the walls of the central enclosures in Group II structures. They were built using large boulders to form the outer wall and smaller stones were then used to fill the structure. Some raised structures seem to be larger and built of more imposing outer boulders, suggesting that they can be classified into more or less labour intensive structures. Walton (1956) identified several round or conical towers mostly in southern Africa, one of which, found at Machemma's Kop in the northern Transvaal can be seen in Figure 1.4.



Figure 1.4: Image of a Stone Tower in the northern Transvaal (from Walton (1956: plate 44)

1.3 Problem statement

1.3.1 Main problem

To determine the most likely purpose, through a process of elimination, of the anomalous raised structures found in southern Gauteng, South Africa.

1.4 Research Question

Several potential purposes for these raised structures have been put forward in the literature and in personal communications with experts on stone walling in southern Africa. However, it was difficult to test each of these proposed purposes, therefore, this study's research question is as follows:

- Are the raised structures a kind of monumental architecture?

The sub-questions of the study are:

- Are the raised structures associated with the type of stonewalling which has been hypothesised as the expression of the wealthiest/most powerful group to occupy the area during the Iron Age?
- Could the raised structures be a type of grain bin support structure?
- Could the raised structures have been built as a result of ritual?
- Is it possible that the raised structures are grave markers?

1.5 Delimitations of the study

This study aims to find the most likely function of the raised structures by mainly using spatial analysis. Its conclusions apply to a ca. 100 hectare area. Surveys outside of this central area are beyond the limits of this study. It is inherently difficult to elucidate the thoughts of individuals and their motivations through the use of archaeological evidence alone (Boeyens 2012), thus this study does not attempt to explain why the raised structures were built, rather just suggests possibilities.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

The architectural anomalies that have been found in the central sector of the southern Gauteng study area have rarely been described in the literature, and even then, they have uniformly been interpreted as grain bin platforms (Taylor 1984, Huffman 1996). This proposition has not been tested. Others have suggested in personal communications that the raised structures may also have been associated with initiation rituals, symbols of status, structures for observation and as grave markers.

This literature review looks at the benefits of using Geographical Information Systems (GIS) software as well as ground-truthing to determine the most likely purpose of the enigmatic raised structures and discusses some background literature pertaining to each research question, which were introduced in Chapter One.

2.2 Background discussion

Archaeologically, the rise of chiefdoms within Southern Africa can be identified using the material culture left behind by the communities who lived within this ideology. This material culture takes the form of stonewalling, ceramics, faunal remains and middens, among others. These material remains can also be used as markers of wealth and power (as evidenced by the amount of livestock/cattle remains found at sites and the size of the stone walled enclosures used to house livestock), the number of wives kept by the chief or king (reflected in the complexity of the stone walling and the size of the site), and a court (shown by large middens or in the size of the spaces adjacent to the cattle enclosure) (Evers and Hammond-Tooke 1986). Stone walling has been utilised by many farming groups that have migrated southwards into southern Africa and this stone walling is used in such a way as to form patterns which can be attributed to certain groups.

Within the southern Gauteng area, Taylor (1979) identified three types of stone walling: Group I, II and III. All three types are hypothesised to have been built by the Sotho-Tswana speakers who occupied the area during the nineteenth century. Group

I is characterised by an “elliptical wall enclosing a group of smaller enclosures in the centre”, Group II is characterised by “a discontinuous series of semi-circular walls … facing inwards towards a central ring of smaller enclosures” and Group III is characterised by “an agglomeration of circular enclosures with the outer limit marked by varying lengths of curved walls and small circular enclosures” (Taylor 1979: 10). Huffman (2002) notes that some Kwena groups lived within the Suikerbosrand and they are associated with the Group II stone walling and *Buispoort* ceramics. He also notes that near the Vaal, there is an association between the Fokeng (residing in Group III sites) and the Kwena (residing in Group II sites) which demonstrates interaction between the two groups, even though they did not merge into one group (Huffman 2002).

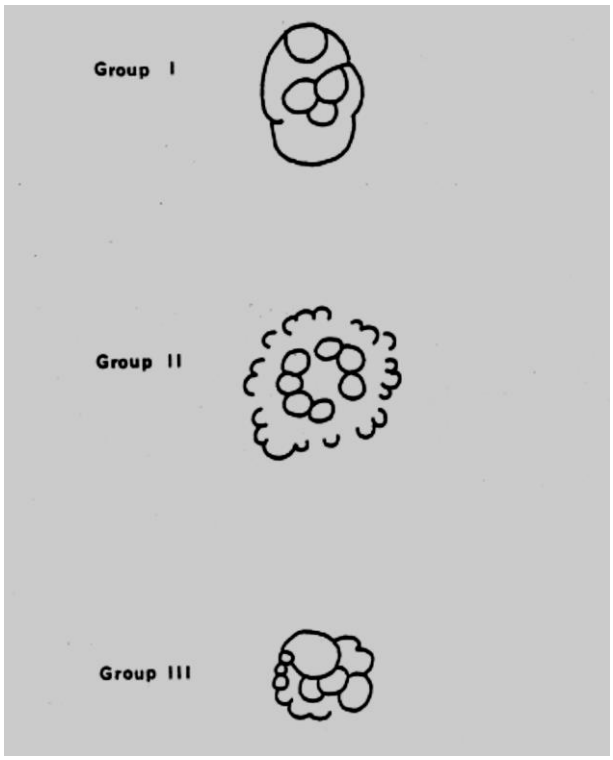


Figure 2.1: Details of the three types of stone walled structures identified by Taylor (1979: 11)

The settlement plans which groups used to organise their space are thought of by Mason (1968) as a direct effect of social organisation and these plans can be used to understand the social actions performed by past peoples. Mason (1968) also identifies seven different areas which he states are demarcated by stone walling: industrial area, cattle and livestock pens, male dining areas, areas between huts and outer walls,

small stone huts (e.g. corbelled huts) and paved cooking areas or fireplaces. It was also noted by Mason (1968) that Iron Age groups have a predilection for building their settlements on higher ground, such as the slopes of hills in the area and that the settlements can also be found in drainage areas. Similarly, Sadr's (2012) study found that the Group I settlements were spatially located throughout hills at a variety of elevations at some distance from areas which could be used for farming.

The Group II and III stone walling demonstrates a change in societal ordering, with more inner enclosures and a denser numbers of clusters, as well as a shift to lower elevations which were closer to more arable areas (Sadr 2012, Sadr and Rodier 2012). However, Group III structures are closer stylistically to Group I structures than Group II structures. According to Sadr (2012), the Group III structures are more an 'evolution' of the Group I style, with more inner small enclosures enclosed in a more "curvaceous outer wall". This evolution in style, coupled with the possibility of associated middens, represents a move to more agriculture being practised, an increase in livestock wealth and social stratification. Taylor (1979) suggested that Group I stone walled structures were built by Sotho-speaking people, that Group III stone walled structures were built by decendents of Group I builders who were influenced by contact with Group II builders and that Group II stone walled structures were built by Tswana-speaking peoples.

Group II stone walled structures are characterised by a clearly scalloped outer wall, which is often discontinuous and may mark the back of hut areas. Group II also represents a move to a larger population size which clustered in foothills close to highly arable land (Sadr and Rodier 2012). Several sites found on the Central Bankeveld, in the North West Province of South Africa, also used the same scalloped outer walling as Group II sites with central circular inner enclosures. Pistorius (2001) noted that the outer scalloped walls served as enclosing back walls to living areas and dwellings, while the inner enclosures were utilised as informal meeting spaces for men and cattle, or other livestock enclosures, which is also what Sadr and Rodier (2012) postulate the spaces were used for in Group II structures.

All of the known raised structures are associated with a type of stone walled structure (SWS) which is variably referred to as Group II or Molokwane (among other designations, see for e.g., Taylor 1984; Huffman 2007; Mason 1968; Maggs 1976).

Group II structures are thought to date to the 18th and 19th centuries, and are found spread over a large area from the Free State to southern Gauteng and into the North West Province. Several examples of Group II structures have been excavated (e.g. Taylor 1979, 1984). These excavations indicate that these SWS were homesteads of farming and herding populations, organised in fairly complex, economically and politically hierarchical societies (see for e.g.Mason 1968, Maggs 1976, Huffman 1982, 2000, 2001, Boeyens and Plug 2011)

For her Honours research report, O'malley (2013) carried out a viewshed analysis to find out which cluster of Group II SWS in the central zone of this study had the largest viewsheds and was thus most visible to others, hypothesising that such prominence might indicate hierarchical status. Her research found that of the three clusters of Group II SWS in the central zone, the central cluster had the most prominent position. The 100ha focus area of this study is located within this central cluster of SWS. Group II structures were found to be the largest of the three types of stone walling which suggests that these structures held the largest population of the three types (Sadr and Rodier 2012). Sadr and Rodier's (2012) study agreed with the hypothesis that the Group II structures were the most politically prominent of the three types – based on the size of the nearby middens and the ranked sizes of individual stone walled structures (which is indicative of a highly stratified society).

Group III stone walled structures are structurally different to Group II structures, but not dissimilar to Group I structures. According to Sadr and Rodier (2012), Group III structures have an unorganised collection of inner enclosures enclosed by sometimes scalloped, mostly curved outer walls. In addition, Group III structures contain more inner structures than Group I structures but fewer inner structures than Group II structures (Sadr and Rodier 2012). Importantly, there is some fluidity between the three types of stone walled structures found within the study area and these overlaps often occur in archaeological typologies which rely more on norms than defined boundaries (Sadr and Rodier 2012). Significant for this study, Huffman (2000) highlights that since societies are known to use architecture to define their space and social hierarchies, models of settlement patterns are useful for investigating social structure and relationships or hierarchies. Since the space is divided using architecture (in this case, stone walling), the pattern which emerges from the construction of these

stone walls can be used to understand what space was used for which activities and other social behaviours, such as the division of labour or the division of the space on hierarchical or sex-based lines (Huffman 2000).

Huffman (2007) identified two broad groups into which stone walling patterns could be grouped: the Zimbabwe Culture and the Central Cattle Pattern, whereas Maggs (1976) identified three main types of stone walling patterns in the interior of South Africa: Type N, V and Z, and Taylor (1979) identified four types in the Vredefort Dome region in South Africa: Types I, II, III, IV which have already been discussed.

According to Huffman (2007), the stone walling belonging to the Zimbabwe Culture was used to denote separate social classes. The main difference between the Zimbabwe Culture and the previous social stratification (used at sites such as Leopard's Kopje and K2) are that the "men's assembly area was not associated with the cattle byre, elite people were buried in hills rather than in the byres, the king lived on the central hill with an elaborate entourage, the royal wives lived in a separate area to [the kings'] left on the far side of the court, and the town faced west" (Huffman 1982: 142).

On the other hand, Huffman's (2007) Central Cattle Pattern hypothesis states that the stone walling was used both to separate the cattle from the people and place the cattle in a position of prominence within the society by placing the cattle holding pens in the middle of the settlement rather than on the outskirts. Badenhorst (2010) undermines this theory by offering contradictory evidence to each of the four main principles underpinning the Central Cattle Pattern hypothesis. First, he undermines the theory that large herds of cattle are needed to sustain a community by stating that small herds can also be sustainable. Second, cattle dung is often used by proponents of the CCP, however, cattle produce larger amounts of dung than do other domesticated animals and lastly, Badenhorst (2010) emphasises that it is empirically difficult to test whether cattle were not used as bridal wealth.

Maggs (1976) identified three other main types of stone walling within the interior of South Africa: Type N, Type Z, and Type V. All three types can be found within the Vaal river basin, except for Type N which extends slightly outside of the valley. Type N consists of a group of primary enclosures organised in a circular arrangement and

linked by secondary walling which allowed for the cattle to be kept in the centre of the settlement with the living areas grouped on the outside, which is also enclosed by another wall (Maggs 1976). The type V pattern emerged after an increase in population – this settlement pattern is very similar to Type N with the difference of a lack of outer surrounding wall; Type V settlements also contain corbelled stone huts. Type Z is distinct from Type N and V – the centre of the settlement is a group of primary stone walled enclosures with thickened walls by their entrances, often without secondary walling. The living areas are arranged in a loose circle around the primary enclosures. These three types found in the Free State divide the South Sotho peoples (who constructed types N & V) from the Tswana people (who constructed type Z).

Importantly, Maggs (1976) emphasises that the differences present between the three types of stone walling demonstrate that although anthropologists often classify the builders of these structures as Sotho-Tswana collectively, in reality it is not as clearly defined.

2.3 Grain Bin support structures

Taylor (1984) found a few small, circular structures within his study site and he suggested these structures were bases for communal grain bins – raising the grain bins enabled the grain to be out of reach of cattle and rodents and the people accessed them via walkways. These raised grain bins were placed in high status areas near the centre of the settlement. These areas are associated with cattle and political authority (Taylor 1984). One can postulate that the size of the raised structure would then be directly proportional to the size of the grain bin, and perhaps also proportional to the agricultural wealth of the community or its size. Homesteads can include several such raised platforms. A study by Pistorius (2001) found several ‘unidentifiable’ small circular stone structures, about 1m in diameter near some poorly preserved dwellings and in a corridor near the Upper Part (UP) slope of a site known as Mmatshetshele near Rustenburg, South Africa, which he posited, may be grain bin supports.

Grain bins have also been associated with rituals and ritual cleansings. According to Pistorius (2001), this is due to the introduction of maize as a grain to the Iron Age farmers in southern Africa. Maize was apparently seen as a pollutant and if drought

set in, the rain-makers would burn their temporary grain bins to signal to the people that their ceremony was complete. Households would also sometimes burn their own private grain bins and smoke their houses. Once the grain bins were burnt, new grain bins would be built on top of them. The archaeological remains of these ceremonies and repeated burning are that the first grain bin was often built on stone bases and the second grain bin's floor was a smooth base (Huffman 2009).

2.4 Monumental Architecture in Archaeology

Monuments have been identified as essentially public structures which are constructed to be extraordinary and conspicuously different from the surrounding landscape or features so that they stand out (Johansen 2004). Monuments are also designed to communicate symbolic meanings and messages which range along a spectrum of social, chronological and spatial situations. Even the very process of construction of the monument is considered to be a part of the transformation of the space from a prosaic area to a ritual one. This is done by using the construction as a way to give the symbolism a grounding in the material and signs used in the construction (Johansen 2004).

Monuments can be thought of as one way that communities impress their presence onto a landscape – as one way of place-making – and also as one way of ensuring that they are remembered (Rubertone 2008). It is important to recognise that not all monuments are the same and many differ from 'general' monuments in terms of scale, what they are representing and how they have been remembered. Rubertone (2008: 24) stresses that "there are differences between monuments as material representations of idealized history and memorials as expressions of local, more complicated histories, and between public celebrations and community or personal memories of place". Monuments can sometimes be found within a ritual landscape or 'symbolically important landscapes' (Robb 1998). This is especially the case if the landscape has seen ritual practices which resulted in the construction of monuments in the distant past which has now changed considerably and the monuments are now in a state of disuse (Robb 1998).

Robb (1998) also cites several studies (Cooney 1990, Fraser 1983 and McMann 1994) as having identified that intervisibility is an important aspect of a ritual landscape as it is one way of linking individual monuments with each other within a landscape. Importantly, Davies (2013) stresses that the focus on Africa's large monuments, such as the pyramids, has not been kind to the study of Africa's other monuments which were constructed on a broad continuum of scale, from individual monoliths to large fields of cairns or other dry-stone structures. Smaller monuments have also been elevated to higher status through the use of Eurocentric ideas which have obscured the meaning or symbolism that may have been attributed to the monument by its builders (Davies 2013).

Renfrew in 1973 explicitly linked monumental architecture to chiefdom-level societies. In stating that chiefdom-level societies built monuments, Renfrew did acknowledge that there are different types of chiefdoms which existed in the past in order to account for the lack of evidence at certain sites for a stratified society where monuments have also been found (Hildebrand 2013). Renfrew's argument was based on the labour required to build the monuments and the necessary leadership required to control and coordinate the labour force (Hildebrand 2013).

There are two types of historical perspectives on monumental architecture in archaeology: the energetic or thermodynamic approach and the phenomenological approach. The energetic approach was begun by Abrams in 1986 and Trigger in 1990; in Trigger's view, the elite in a society order the construction of monuments in order to show their power or wealth to the rest of that society. However, in Abrams' view the construction of the monuments in a sufficiently stratified society creates tension and enhances the social stratification (Hildebrand 2013). Maceachern and David (2013) agree with Hildebrand (2013) that assumptions of stratification have led to an unhelpful division between 'monumental' and 'prosaic' architecture which hides the middle range of architecture. They also note that researching these intermediate ranges of architecture in order to find out what these ranges might represented or symbolise as well as whether these ranges mirror competition or cooperation within or between groups or hierarchical or heterarchical social organisation is necessary (Maceachern and David 2013)

The phenomenological approach arose from studies on European megalithic structures. This approach has two main positive aspects: first, no hierarchy within the society is assumed and second, that this approach is open to taking change to the monuments over time into account when describing the monument(s) (Hildebrand 2013). However, this approach does have some negative aspects, first, each phenomenological interpretation of a site or monument could be at odds with another due to different worldviews and standpoints, hence it is important to regard these interpretations as hypotheses-in-progress which should be empirically tested, if possible. Second, that archaeologists today might project Eurocentric experiences and literature onto past cultures (Hildebrand 2013).

Several researchers have attempted to define what monuments are. Furholt (2011: 116) and Furholt and Müller (2011: 16-17) decided on four material aspects of monumentality based on the Latin Root of the word *monere* which means to remember or admonish. These four material traits are: "*colossality* (hugeness), *elaboration* (degree of effort or craftsmanship), *uniqueness* (in attributes or in position on the landscape) and *durability* (construction using materials and methods that ensure a monument's longstanding presence)". Importantly, they also include three non-material traits which are: "*surplus of meaning* (which is reminiscent of Trigger's idea that a monumental structure is built in a way that exceeds practical or functional requirements), *intentionality* (this surplus of meaning must be created on purpose) and *direction towards a collective* (it should be built with a public, not private audience)". Furholt (2011: 116-117) emphasises that the three non-material traits of monumentality are important because they allow monuments to act as creative spaces, public stages and they can strengthen collective identity within the social group. Gillespie (2013) underlines that the uncertainty among archaeologists as to what constitutes a monument is a problem. This is exacerbated by disagreement regarding minimum size, a defined range of form and function, construction material and durability.

Following on this uncertainty, Gillespie (2013: 304) identified four main questions: "is social hierarchy a prerequisite for monumentality?... If, as the archaeological record demonstrates, a political elite with control over economic and social resources is not a pre-condition for monumentality, then what were the various motivations for and

functions of monumental constructions?... If monumentality can be achieved in non-hierarchical societies, what role might it have played in the subsequent development of social complexity?... How important are design and intention in considering the causes and consequences of monumentality?". In attempting to answer these questions, Gillespie (2013) notes that the construction of the monuments was just as important as the ideas they symbolise – the construction rather helped to create or emphasise social stratification. Importantly, the reuse of certain monuments, in terms of adding stones to cairns for example, creates a lasting attachment to a certain place and adds to the place-making of a society, even if the meaning attached to that monument has changed over time.

However, Higuchi (1983: 183) defined four visual dimensions which could be used to identify whether the architecture under study is in fact, monumental in the landmark sense. These four dimensions are: "clarity of form, contrast with background, prominence, and sufficiency of mass to emphasise presence" (Johansen 2004: 319). Johansen (2004) noted that Moore (1996) used these four dimensions to qualitatively evaluate monuments and how they can be used to demonstrate meanings about the societies that constructed them due to their scale, visual prominence and functional unity. Johansen (2004), however, emphasises that the past meanings attributed to monuments can only be read when the researcher has access to the social context within which the monuments were constructed and within which the meanings would have been understood.

Following Moore (1996), Johansen (2004) used five variables in the identification of potential monuments: permanence (the length of time which the builders thought it would be used for or remain standing for), scale (the size of the structure(s) in relation to nearby ordinary structure or dwellings), centrality (how centrally located the structure is in relation to ordinary structures or dwellings), ubiquity (the universality of the structure measured using frequency in the settlement) and visibility (prominence on the landscape).

2.5 Symbols of power and/or status

Researchers have correlated large Iron Age ash middens with locations of political and/or economic power (Boeyens and Plug 2011). Such middens are distinct from household middens where daily rubbish was deposited. The large middens accumulated as a result of activities that involved the town's senior men who were involved in the political business of the settlement (Boeyens and Plug 2011). In the major Sotho-Tswana settlement, Kaditshwene, there were two large cattle kraals with two court spaces next to them and each court space had its own midden (Loubser 1985, Boeyens and Plug 2011).

As well as Kaditshwene, the Group II SWS could be compared with the mega-site of Molokwane. This site has been studied by Pistorius (1992). This settlement has been dated to the early eighteenth century and is associated with the Sotho-Tswana (Pistorius 1992: 56). This site was built in the style of what Pistorius labels as Class 9, which is similar to the mega-site Kaditshwene. Class 9 is also very similar to Group II SWS. Pistorius (1992) identified that the Bakwena, who occupied both Molokwane and Selonskraal, held a formidable position in a landscape which allowed them to lead an agro-pastoralist life, much like the occupants of the Group II SWS in the Suikerbosrand.

2.6 Structures built for ritual purposes

Rituals have been used as a way of communicating using social and cosmological authorities by using meaningful activities which have been approved and made ordinary through a general agreement by the society to grant the activities elevated status (Johansen 2004). These actions are a way of communicating social relationships and are often objectified using constructed spaces (architecture) and material culture (e.g. statues, ceremonial objects). In terms of the use of architecture, the architecture is generally created so as to be easily distinguishable from the surrounding spaces. However, due to the non-static nature of society, these architectural forms may sometimes be incorporated into the ordinary space and become blurred in the archaeological record (Johansen 2004). Fortunately, the repeated use of such spaces even if there are intervening periods of disuse, mean

that there are some archaeological aspects which researchers can use to identify monuments.

It has been noted by Huffman (2014) that groups separate their environment into different spaces, each with different functions, and that these spaces are created by and interact with politics, beliefs and practices (be they social or religious). The structures that have been identified as having been purpose-built as part of a ritual or rituals are the cairns built as part of initiation rituals practiced by several agro-pastoralists.

In eastern Africa, Davies (2013) noted that several types of stone cairns exist, each type constructed slightly differently. Many of these types of cairns are thought to cover burials or be a result of field clearing for farming purposes. However, several researchers have not found burials underneath these cairns, which could mean that these cairns may be symbolic of death or of memorialisation (Davies 2013). The types of cairns identified by Davies (2013) are: simple cairns, which are almost circular piles of stone without support, between 2 and 20m wide and about 1m high, they often conceal burial pits; kerbed cairns, which are similar to simple cairns except that there is a ring of larger stones or standing stones intentionally built to contain the pile of stones; elongated and ring cairns, these are less common than simple and kerbed cairns and they are not necessarily round (in the case of elongated cairns) or they have no stones in the centre (in the case of ring cairns); rectilinear cairns, which are stones laid out in a rectangular or nearly square shape; faced cairns, which may be the results of field clearing and are sometimes constructed using faced stone to contain the pile of stone; stone ring cairns, which are piles of stone encased by standing stones, these also often cover burial pits and lastly, cairns with monoliths which could be considered similar to or a type of stone ring cairn (Davies 2013).

It is important to recognise that some cairns are revisited, rebuilt or added to over time which suggests that these cairns form part of a group's 'place-making' which can also change over time. This temporal continuity means that the construction of these cairns forms part of the social process and may help to create a sense of order. According to Davies (2013: 237-238), "the active process of monument construction over the end result and recognises this as an ongoing process, whereby constructing new features

and observing and interacting with existing features through time creates new meanings and worldviews across generations".

The Timbisha Shoshona of Death Valley, discussed by White (2008), impressed their occupation of the area in the form of stone cairns built on the edges of their territory. White (2008) associates these cairns with processes which elevated individual rights to resources over the community's rights and symbolised European ideals of land and resource ownership. These monuments became a new way of memory keeping for the Timbisha Shoshona (White 2008).

In the Zimbabwe Culture, the physical remains of circumcision lodges have distinguishing features such as: they are often located outside the main settlement, they do not have daga floors within and without the main lodge which would indicate a more permanent residency, and they are often associated with a field of stone cairns (Huffman 2014). (Huffman 1985, 2014) notes that Sotho-Tswana speakers erected stone cairns as memorials to boys' initiation schools, which are a form of military initiation, and that similar cairns have been found in association with Zimbabwe style building, however they are often found in locations impossible for settlement, farming or burial. Pitje (1950), in a discussion on initiation ceremonies among the Pedi and similar language groups, noted that *Phiri* and *Phisana* monuments or cairns are constructed using slabs of rocks and remain as permanent markers of where the initiation school once stood – they are also representative of markers of the length of a chief's reign (marked by how many initiation schools occurred during his reign). These cairns often resemble cairns erected over graves, but they represent the rebirth of the initiates (Huffman 2014).

2.7 Grave markers

Important people in ancient Sotho-Tswana society were buried at the entrances to kraals and the walls near the entrances were widened and heightened over the burials (Walton 1958). Sometimes the wall builders used orthostats to mark the entrance to the kraals (Walton 1958). According to Boeyens and Plug (2011: 4), when Campbell visited Kaditshwene in 1820, one of the watercolours which he painted he described "as an 'extensive inclosure [sic]… surrounded by a stone wall, except at the gate by

which [they] entered' [where] 'some strong posts, ten or twelve feet high, were driven into the ground'" and the same sketch also illustrates a monolith near the entrance to a kraal which Campbell thought served as a symbol of political power. Boeyens (pers. comm. 2015) hypothesised that the raised structures could be likened to the monoliths marking the entrances. One example of a kraal burial can be found in a site on a hill in the Maphutseng Valley, Lesotho. The right hand side of the entrance to the main enclosure of the site terminates in a circular structure 2.7m in diameter and is constructed from a pile of rubble held in place by a number of orthostats (Walton 1958).

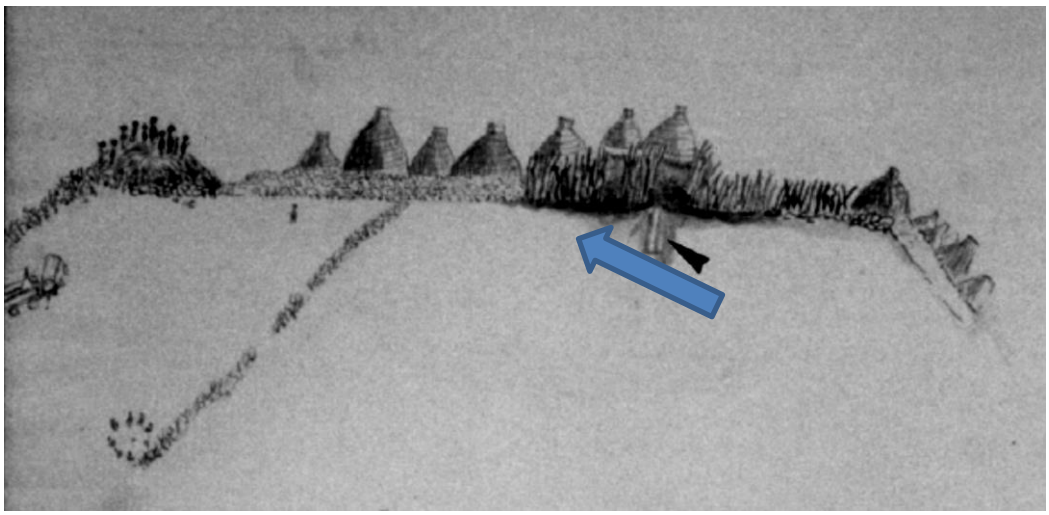


Figure 2.2: Part of Campbell's (1820) sketch of the kgotla as adapted from Boeysens and Plug (2011) with arrow showing the monolith near the entrance



Figure 2.3: Fokeng Grave, Basutoland (photo by A. W. Crompton) (from Walton (1956: plate 18))

In Kenya, northern Tanzania, north-eastern Uganda, South Sudan, southern Ethiopia and southern Sudan, stone cairns and monoliths have been identified as monuments even though they are not very large in size. These cairns and monoliths have been associated with burials and memorial or commemoration. These stone structures are also associated with more-or-less egalitarian agro-pastoralists (Davies 2013).

Specifically in the southern part of the Kenya Rift Valley, Posansky (1968) excavated five stone cairns in Olorgesailie. The study found that even though the Masai have resided in the region for over 200 years, they probably did not construct all the stone cairns and the cairns could belong to a prehistoric culture. Posansky (1968) found that only two of the five excavated cairns had remnants of burials which had been moved. The study concluded that the loose structure of the construction of the cairns made it relatively easy to move and rebuild, at least in the case of two of the cairns. In the case of the other three cairns, they could possibly be memorials to the dead.

2.8 Geographical Information Systems

Geographical Information Systems (GIS) can be thought of as a useful way to interpret cases of human behaviour and physical remains of material culture. GIS can also provide convenient and efficient ways to store, retrieve, manipulate and display the spatial information regarding said human behaviour and material culture. This spatial information can be used to describe objects in terms of a position in a coordinate system; non-spatial attributes and the spatial relations between objects (Ebert 2004).

This software has enabled archaeologists to handle and interpret large spatial data sets (Conolly and Lake 2006). In archaeology, spatial data is stored in maps, aerial photographs and databases and GIS enables archaeologists to link raw data to maps that can be manipulated to answer certain research problems (Neubauer 2004). Neubauer (2004: 161) defines GIS as a system of computer hardware, software and geographical data that can be used in the "identification, distribution, manipulation, analysis and storage of all possible types of geographically referenced information". GIS can also be used to determine relationships between features on a map in order to identify certain characteristics of a site (Neubauer 2004). The advantage of using GIS is its potential for the analysis of the spatial relationships between features (Neubauer 2004).

According to Ebert (2004), there are three layers to GIS applications: first, visualisation, which entails the simple use of GIS products as map-making tools and little-to-no analysis. Second, management, which is the layer used by heritage managers and those in the CRM industries; this layer is geared towards the management of landscapes and sites rather than the analysis of human behaviour. The third and highest layer of GIS applications is analysis – this application requires high-level processing and analysis of the spatial data regarding human behaviour and material culture (Ebert 2004)

The data used in this study was gathered from LIDAR (Light Detection and Ranging) scans of the study area. LIDAR is an active remote sensing technique which transmits signals along a narrow range of frequencies and the sensor then receives the reflected signal from the landscape being surveyed (Campbell and Wynne 2011). LIDAR uses lasers to scan the landscape – lasers are a form of coherent light comprised of narrow

bands of light wavelengths. Due to the light form being coherent, it can be transmitted over large distances without running into much distortion (Campbell and Wynne 2011). Most imaging LIDAR systems use wavelengths in the visible light spectrum. LIDAR systems operate using a series of mirrors and clusters of fibre optic cables (Campbell and Wynne 2011). The oscillating motion of the mirrors means that the beam is transmitted in a side-to-side motion. Because many LIDAR scanners are fitted with geographical positioning systems, inertia measuring units and other systems, the images captured can be tied to specific points on the Earth's surface (Webster *et al.* 2006, Campbell and Wynne 2011). Most LIDAR systems are mounted with two sets of fibre optic cables, one of which transmits the signal and the other receives the reflected signal. Given that most LIDAR systems have advanced computational abilities, the receivers are able to operate at high speeds and are capable of calculating the distance between pulses. This timing capability allows for the accurate calculation of distance and elevation within an image (Campbell and Wynne 2011).

LIDAR data is acquired in parallel strips with some overlap in order to accumulate a whole image. This data, in its raw form, shows higher elevations as lighter grey tones and lower elevations as darker grey tones (Campbell and Wynne 2011). This raw data can be polished using hill-shading techniques. An important aspect of image processing is differentiating between primary and secondary returns from pulses. The primary return is often from the first object the signal hits, while the secondary return is from the echoes from the other, lower objects, differentiating between these two layers enables researchers to identify the actual terrain surface or the overlying vegetation cover or man-made structures.

The most important aspect of using LIDAR data is the ability to create digital elevation models (DEMs). The DEMs from LIDAR data are highly spatially accurate and are able to differentiate between bare-earth level from upper levels (in terms of height) (Campbell and Wynne 2011). Raber *et al.* (2007) identified that there are several factors that contribute to the accuracy of DEMs created from LIDAR data, one of these is to have nominal or negligent spacing between flights (known as post-spacing); this contributes to the increase or decrease in the vertical error. One way to account for this or to ensure nominal post-spacing is to increase the number of flight paths used to ensure some overlap between paths (Raber *et al.* 2007).

Some advantages to using LIDAR data are the precise identification of coastal elevation by using the spatially accurate LIDAR data available to researchers (Haile and Rientjes 2005, Gesch 2009). This data enables the accurate identification of different elevations which enables researchers to determine different features of their research area – in this case, the difference between a stone wall and a raised structure. LIDAR data can also produce images with a height precision of 15cm and a spatial resolution of 1cm, depending on the topography of the landscape (Haile and Rientjes 2005). More advantages are: speedy collection of data and the ability to repeat flights over areas which may change topographically over time (Haile and Rientjes 2005).

Some advantages to using GIS in archaeological studies include the ability to provide geographical and spatial data which can then be used to associate other information with spatial features on a map or to discover new relationships and patterns which can be used to describe previously unknown characteristics of a site, or archaeological structures (Neubauer 2004). GIS data, in conjunction with archaeological data, ethnographical data and historical data can provide a way to prove or disprove both new and old concepts as well as provide new ways to investigate old concepts (Neubauer 2004).

Viewshed analyses have become more popular in recent years due to more interest in landscape studies. Viewshed analysis entails two main aspects: line of sight (can one point see another point?) and viewshed (a map of locations that are visible or not visible from a given location) (Ebert 2004). Viewsheds essentially calculate which locations or objects are or are not obstructed by topography and are therefore visible from a specified location (Llobera 2003).

In comparing GIS based viewshed analyses to field based visual analyses, Fry *et al.* (2004) identified several benefits to using GIS based visual analyses such as, the removal of vegetation which allows researchers to focus on topographic qualities which may have been missed during field work; the accurate calculation of distances on the landscape; ready-made digital maps which can be instantly compared with other digital maps and viewshed maps can be modified to show different scenarios. However, they also noted that GIS based visual studies may neglect to account for parts of the landscape which may interrupt views (Fry *et al.* 2004). Similarly, Ogburn

(2006) points out that human visual perceptions and accuracy, atmospheric conditions and how different objects or monuments are seen from their surroundings all affect current researchers' ability to test visibility in past landscapes.

Viewsheds and viewshed analysis are limited by the same limitations affecting the DEM used to calculate them. Those limitations are: altitude errors, curvature of the earth, absence of detailed coverage due to vegetation and the effect of atmospheric conditions (Llobera 2003: 29). Viewshed analyses have other methodological problems. Ebert (2004) identified five main methodological problems associated with viewshed analysis. First, that there may be a difference between the calculated viewshed and what can be seen by an observer, this is enhanced by the so-called tree-effect which is due to the viewshed being created without taking vegetation into account. This first problem can be alleviated by either raising or lowering the observer height during the viewshed analysis.

Second, the edge-effect may affect the viewshed analysis, this effect comes into play if the viewshed extends further than the study area for which there is spatial data. The third methodological problem is the question of significance which considers whether there is a difference between the viewshed from an archaeological site and the viewshed from an ordinary location (Wheatley and Gillings 2000, Ebert 2004). Fourth, there is a decrease in visual impact the further the distance is and lastly, viewshed analyses can be affected by technical and data quality errors (Ebert 2004).

Several pragmatic issues with viewsheds were raised by Wheatley and Gillings (2000). These issues are: palaeo-environment, the difference between the object and its background, the mobility of the people, temporal dynamics, intervisibility levels and simplification. First, the palaeo-environement is an issue which researchers should consider because most viewsheds are calculated using the modern landscape, mostly with no vegetation. These analyses do not take past vegetation into account when calculating viewsheds (Wheatley and Gillings 2000). This problem of vegetation which might get in the way for the viewsheds was referred to by Wheatley (1970, as cited by Wheatley and Gillings 2000: 5-6) as the 'tree factor', which is basically that "past patterns in the presence and absence of trees and other vegetation could have had a dramatic effect of patterns of visibility and invisibility".

Second, as Wheatley and Gillings (2000) phrase it, the ‘object-background clarity’ is important to consider in studies concerning visibility because most visibility studies work on people being ‘theoretically’ able to see a specific object is different from them actually being able to see these objects in reality. One way to account for this issue is to create fuzzy viewsheds which are viewshed maps which show that clarity of vision changes with distance from the original point (Wheatley and Gillings 2000).

Third, the issue of mobility. This issue holds that the viewshed itself changes depending on the person who is viewing the objects’ position in the landscape (Wheatley and Gillings 2000). In other words, that the view point is static within the landscape. When performing visibility studies, researchers need to remember that it is important to understand that viewsheds are dependent on the viewer physically facing in one direction and having a contained point of view (Wheatley and Gillings 2000). Fourth, time, in the form of seasons and other temporal cycles, has an impact on visibility – for example, the different seasons may have an impact on the amount and type of vegetation which could impact the amount of visibility (Wheatley and Gillings 2000).

Fifth, researchers need to be aware that all points within a given viewshed may not be able to see the viewpoint from which that viewshed is generated. However, Wheatley and Gillings (2000), view this as an opportunity for enhanced research and analysis of viewsheds rather than a problem for viewshed analyses. Lastly, researchers often collect monuments or objects into groups for the purposes of viewshed studies rather than considering that the monuments may not have existed together on the same temporal plane (Wheatley and Gillings 2000).

2.9 Conclusion of Literature Review

This review of the literature covered archaeological GIS applications, literature on cairns as burial markers and markers of ritual activity, grain bin support structures, the types of stone walling found in southern Gauteng and what constitutes monumental architecture.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research methodology

This study used a quantitative methodology to achieve the research objectives. A quantitative research methodology involves objective, statistical testing of the data under study. Maree and Pietersen (2009: 146) define quantitative research as “a process that is systematic and objective in its ways of using numerical data from only a selected subgroup of a universe (or population) to generalise the findings to the universe that is being studied”.

3.2 Research Strategy

This study utilised a non-experimental research design which involved survey research (Maree and Pietersen 2009). This type of research was chosen because the relationships between the variables under study were important and no intervention by the researcher was done (Welman and Kruger 1999). Survey research involves firstly planning the survey content and reviewing the available literature. Secondly, a survey plan is developed to give structure to the data gathering, then arrangements are made to collect the data. Once the data has been collected, it is then analysed and interpreted and a final report is compiled (Welman and Kruger 1999).

3.3 Sample

3.3.1 Sample and sampling method

The sampling method of the quantitative data involved using LiDAR scans of the research area to determine which parts of the stone circles were more raised than others, then going into the field to measure and photograph the parts which were previously identified. This process ensured that the researcher was able to differentiate the stone structures from piles of rocks, mounds or corbelled stone huts. Next, the neighbouring 49ha LiDAR was added and investigated for raised structures and stone circles. Some of these identified raised structures were not investigated in the field due to heavy vegetation during the summer months. The researcher also

classified the stone structures using a scale based on the size of the stones used in the structures' construction, and the size of the connecting or surrounding stone circles and any other special features that are nearby.

3.4 The research instrument

The research instruments used was QGIS and field surveys. QGIS is a GIS program which is available for download, for free. QGIS allowed the research to load the LiDAR data acquired, process it and analyse the results both within QGIS and with SPSS. The field surveys that were conducted, used a standard measuring tape and metre sticks to attempt to measure the raised structures.

3.5 Data collection

The quantitative data was collected using LiDAR surveys of the research area (next to and partially within the Suikerbosrand Nature Reserve), which was then analysed using QGIS, field measurements of the stone structures by third year students and photographs taken by both the students and the researcher. Only the raised structures which lie within the farm neighbouring the Suikerbosrand Nature Reserve were measured in the field. These measurements are, however, limited as the students noted that many of the raised structures were too collapsed or overgrown to obtain accurate height and width measurements. Due to these issues, the height and width measurements that were obtained using the LiDAR data and the profile tool in QGIS were used for statistical analysis.

3.5.1 Ground Survey

Several visits were made to the area under investigation within the Suikerbosrand Nature Reserve and the neighbouring farm. The first of these visits was made at the beginning of 2015 to establish that the raised structures identified using the LIDAR data were in fact the raised structures in question – this visit showed that two 'raised structures' which were identified using the LiDAR data, were actually piles of bricks and dirt that were not from the Late Iron Age at all.

The second and third visits to the area were specifically to the neighbouring farm with third-year students. The purpose of the two visits was to photograph and measure (as best as possible) the raised structures which had been identified using the LIDAR data. The students used standard measuring tapes and metre sticks for the photographs. These visits proved useful because several raised structures were located and identified which were not initially identified using the LIDAR data. As well as this, a thorough search of the area located several surprising features (such as very low 'doorways' and corbelled huts). During these two visits, GPS locations of the raised structures found were logged and processed, but proved to be inaccurate and difficult to work with, possibly because the students may not have ensured that the handheld GPS devices were connected to at least three satellites before logging the waypoint. Unfortunately, even though both these visits were made during September 2015 (late winter/early spring), some of the raised structures were too overgrown to properly photograph and measure, which is a disadvantage to the ground survey.

A fourth visit was made to the Suikerbosrand Nature Reserve in late July or early August 2015 to photograph the raised structures identified within its boundaries using the LIDAR data. On this visit a couple of raised structures and the very large midden were photographed without a meter stick, so they lack a reference point for measurement.

The fifth visit was again to the Suikerbosrand Nature Reserve in November 2016 to photograph the raised structures which were not photographed during the previous visit. Again, no metre stick was used for the photographs. A final visit to the Suikerbosrand Nature Reserve was made in January 2017 to photograph the remaining structures – however, due to it being the height of summer, the stone walling and the raised structures were hard to identify and photograph due to large amounts of overgrown vegetation.

3.5.2 QGIS Data Collection

At the beginning of the data collection, the point data acquired from the company who performed the LIDAR scan of the area was loaded into QGIS. The original LiDAR survey was performed by the company called Southern Mapping Geospatial, which

performed an aircraft borne LiDAR scan of an 11km^2 survey area (Sadr 2016). The LiDAR scanner used is known as an Orion M200 LiDAR scanner. The classification into ground and non-ground points was automatically performed by TerraSolid's TerraScan software (Sadr 2016: 97). This point data was of an initial 49-hectare area encapsulating part of the southern part of the Suikerbosrand Nature Reserve and the neighbouring farm. This 49ha area's point data was divided into 49 squares measuring 1ha by 1ha. From these total 49 squares, hillshade and interpolation raster layers were created, the hillshade layers were then merged, from which a Digital Elevation Model (DEM) was created. The interpolation layer was created using the standard settings available in QGIS. The vector shapefile containing the point data of the researcher-identified raised structures was then loaded into QGIS. These layers and all other layers were loaded with a projection called "ZANGI:ZANGI:HBKNO29, South African CRS: HBK_NO29".

The second part of the data collection involved loading the neighbouring 49ha collection of point data and creating the hillshade, interpolation and DEM raster layers from the point data. This data was also divided into squares which were used to create the hillshade layers which were also merged. Interpolation layers for both sections of the study were again created, this time specifying that QGIS should run the analysis using a cell size of 0.33 for both the X and Y values – this produced 2121 rows of data which created a smoother and more detailed interpolation layer from which a clear hillshade could be created.

The researcher then created a vector point shapefile to identify and mark the potential raised structures visible on the DEM layer. The researcher also created a vector line shapefile to identify where the stonewalling visible on the DEM layer was located.

The researcher then proceeded to draw the profiles of the identified raised structures using a plugin called "profile tool". This tool produces graphical representations of the profile of each raised structure. The researcher used this tool to measure the height and width of the structures. This was done by drawing a line using the profile tool horizontally over the raised structure, then by using one of the settings within the plugin which enables the researcher to match where they are on the line drawn on the map and where they are on the graph, the researcher measured the height (on the y axis of the graph) where they had estimated the raised structure to be and the height at the

highest point on the graph. This procedure was repeated with a line drawn vertically over the raised structure. This data was entered into an excel spread sheet and an average from the four measurements was calculated.

Measuring the width of the raised structures, however, presented a problem as it was often not clear from the profile where the raised structure began and ended and thus from which point on the x axis of the graph drawn using the profile tool could be used to measure to the next point on the x axis. This was initially done and the difference between where the researcher estimated the raised structure began and ended on the map and where it began and ended on the graph was large. In order to avoid this heavy bias, contour lines of 5m were created from the DEM of both areas, in order to enable the researcher to better judge the width of the raised structures. Smaller contour intervals produced contour maps which were too dense to be helpful. The researcher used the contours to measure the width of the structures by finding the two points along the line drawn by the profile where the contour lines either started spacing out more or they changed direction or intersected with the line drawn using the profile tool.

However, as useful as using the contour lines to identify where the raised structures were, the profile created using the profile tool often did not match with the image produced by the contour lines. For a few of the raised structures, the researcher was unable to use both a horizontally and vertically drawn profile to measure the width which created a problem in terms of creating an average width. Given all the above problems, the researcher additionally created three categories to indicate width: “large”, “medium” and “small”. “Large” structures were deemed to be those over 6m in width, “medium” those between 3m and 6m and “small” those under 3m. The same was done with height – “medium” structures are between 1.5m and 2.15m, large structures are more than 2.15m.

The structures were also divided into five classes, according to their judged state of preservation. Class 0 was designated to structures which were not photographed and not seen. Class 1 was designated to structures which had a large amount of collapse. Class 2 was designated to structures with at least 1/3rd of the retaining wall still standing. Class 3 was designated to structures with at least 2/3rds of the retaining wall still standing and Class 4 was designated to structures which had little or no collapse

evident. These Classes were designed based on the photographs taken of the structures on the various trips which means that the state of preservation analysis was subjective and based on arbitrary standards decided by the researcher. The structures which were designated Class 0 were not photographed and seen by the researcher due to large overgrowth by vegetation due to the season during which the site was revisited.

A viewshed analysis was conducted using a clipped section of the whole LIDAR scan performed. This clipped section extended approximately 1.5km north, 3km east, 8.5km south and 5.5km west of the study area in order to fully test the extent of the possible viewshed from each raised structure. This viewshed analysis was performed using GRASS GIS viewshed with the standard settings and the output was selected as 0 = not visible and 1 = visible to produce a black and white image of the area. An intervisiblity analysis between all the raised structures was also performed using the QGIS viewshed plugin to determine which structures could be seen from other structures.

A cleaned point data layer for the total study was used to create slope, aspect and ruggedness maps for the study area. The point shapefile of the location of the raised structures was added to these maps and the slope, aspect (aspect is measured in degrees which directly related to the direction faced, i.e. 360° = North, 90° = East, 180° = South and 270° = West), ruggedness and elevation for each raised structure was recorded in the master table.

An analysis of the volume of two raised structures was attempted, however, due to the ruggedness and slope of the terrain, the results were unreliable and discarded. However, there are high-resolution LiDAR techniques which could be employed to create a high-resolution 3D image of the raised structures which could then be used to calculate the volume of the raised structure.

The researcher then created a master table containing the following information regarding each raised structure: height and width measurements from the honours students, height and width measurements from the profile tool in QGIS, photograph numbers, slope index, aspect, ruggedness index, viewshed area, how many other raised structures are visible, a categorisation of how large the stone used to construct

the raised structures are (large, medium, small) which was judged using photographs, a description of each raised structure and the contour map of each raised structure.

The researcher also visually compared the raised structures in terms of height, width, slope, aspect, ruggedness, elevation and viewshed area by changing the symbol used in QGIS to show either larger circles (for height and width) or lighter or darker hues of blue (for the other measures). This enabled to researcher to determine patterns to statistically test using SPSS.

The researcher also calculated the area within each stone walled structure by using the following ground rule: a cluster of stonewalling was defined by a more or less continuous scalloped outer wall with central structures. These are henceforth known as settlement units. The length of walling contained in each cluster defined using the same rule as the one above was also calculated.

3.6 Data analysis and interpretation

The data gathered using field surveys and QGIS was collated into an Excel spreadsheet which can be found in Appendix A. This data was then imported into SPSS for analysis. Spearman's correlation analysis was performed between the height, width, slope, aspect, ruggedness, elevation, viewshed area and the degree of intervisibility of the raised structures. These correlations were done as both one- and two-tailed tests. These measurements were also mapped out using QGIS in order to determine whether there were any spatial patterns which were evident. Buffer zones were also created in order to determine whether there are any spatial clusters of raised structures. The raised structures were also spatially divided using the drainage area between the Suikerbosrand Nature Reserve and the neighbouring farm – this divided data was also used to perform Spearman's correlations. The viewshed analysis was performed using the GRASS GIS tool in QGIS. The viewshed area was calculated by using a polygon to sample and count the points calculated as visible, this amount was then multiplied by the cell size. The intervisibility between the raised structures was calculated using the intervisibility plugin tool. The above data was interpreted using the literature related to monumental architecture and literature related to the initial hypotheses posed.

In terms of statistical analysis, descriptive statistics were used because this is foremost a descriptive study of the raised structures. This study also sought to identify any differences within the sample and any possible relationships formed within the sample.

3.7 Limitations of the study

The following are the study's limitations:

- This study did not conduct excavations because it was a locational analysis and a descriptive study of the raised structures.
- This study also could not accurately test for validity or reliability due to not investigating inter-analyst variations.

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

The results presented in this chapter are grouped as follows: descriptive statistics of the raised structures and the surrounding stone walling, statistically significant correlations found when testing the data associated with the raised structures, nearest neighbour analysis, the results of the viewshed analysis and buffer zone analysis.

Figure 4.1 shows the stone walling within which the raised structures were built, the road which runs through the Suikerbosrand Nature Reserve as well as the main drainage area which runs through the study area.

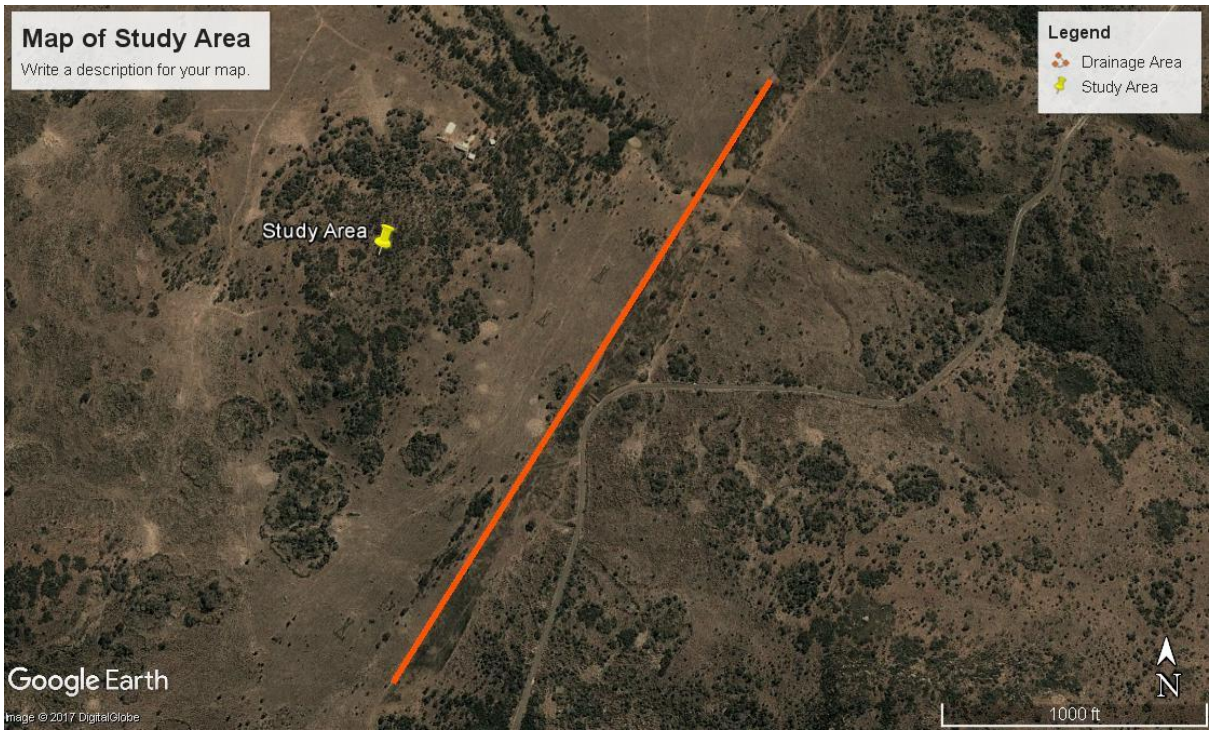


Figure 4.1: Map of the study area with the stone walling shown and the drainage area dividing the site into East and West sections

4.2 Descriptive Statistics of the Raised Structures

Table 4.1 contains the descriptive statistics of the raised structures. The Width and the Height were calculated using the contour lines and profile tool as described in the

methodology section. These measurements were used because the students were not able to take accurate measurements of the raised structures they measured while in the field due to issues discussed in section 3.5.1 and 3.5.2. No statistically significant correlation was found between the students' measurements and the measurements taken using QGIS. The standard deviation of the width of the raised structure (σ = 1.8m) shows that there is a sizable amount of variance within the sample in terms of width, as can be seen when the width of the raised structures is mapped out (Figure 4.3).

Table 4.1: Descriptive Statistics of Raised Structures

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Actual Height (m)	52	1.89	2.55	2.1819	.19881	.040
Actual Width (m)	52	1.91	9.85	5.8029	1.78655	3.192
Valid N (listwise)	52					

The grouping of height and weight were described in Section 3.5.2 and are mapped out in Figures 4.2 and 4.3.

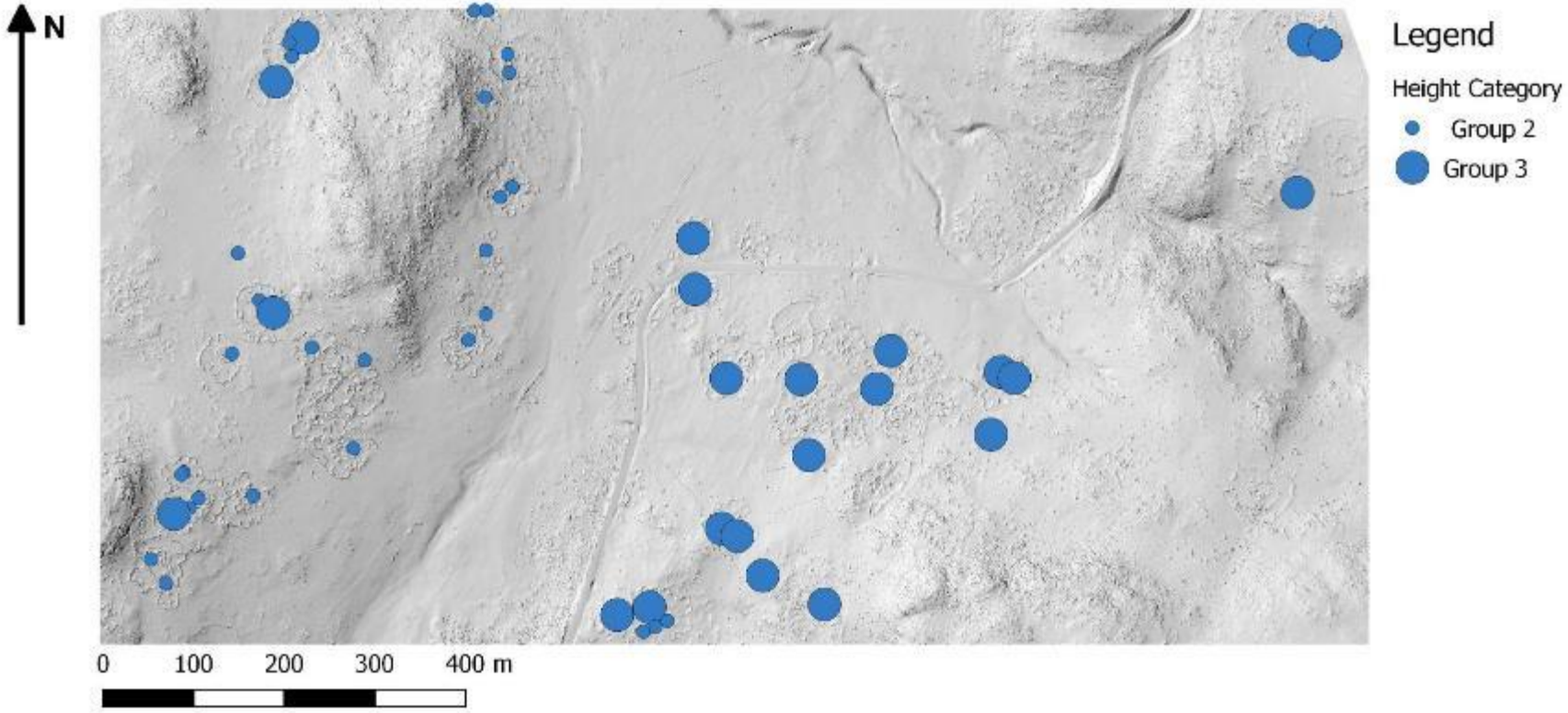


Figure 4.2: Map showing the height category of each raised structure

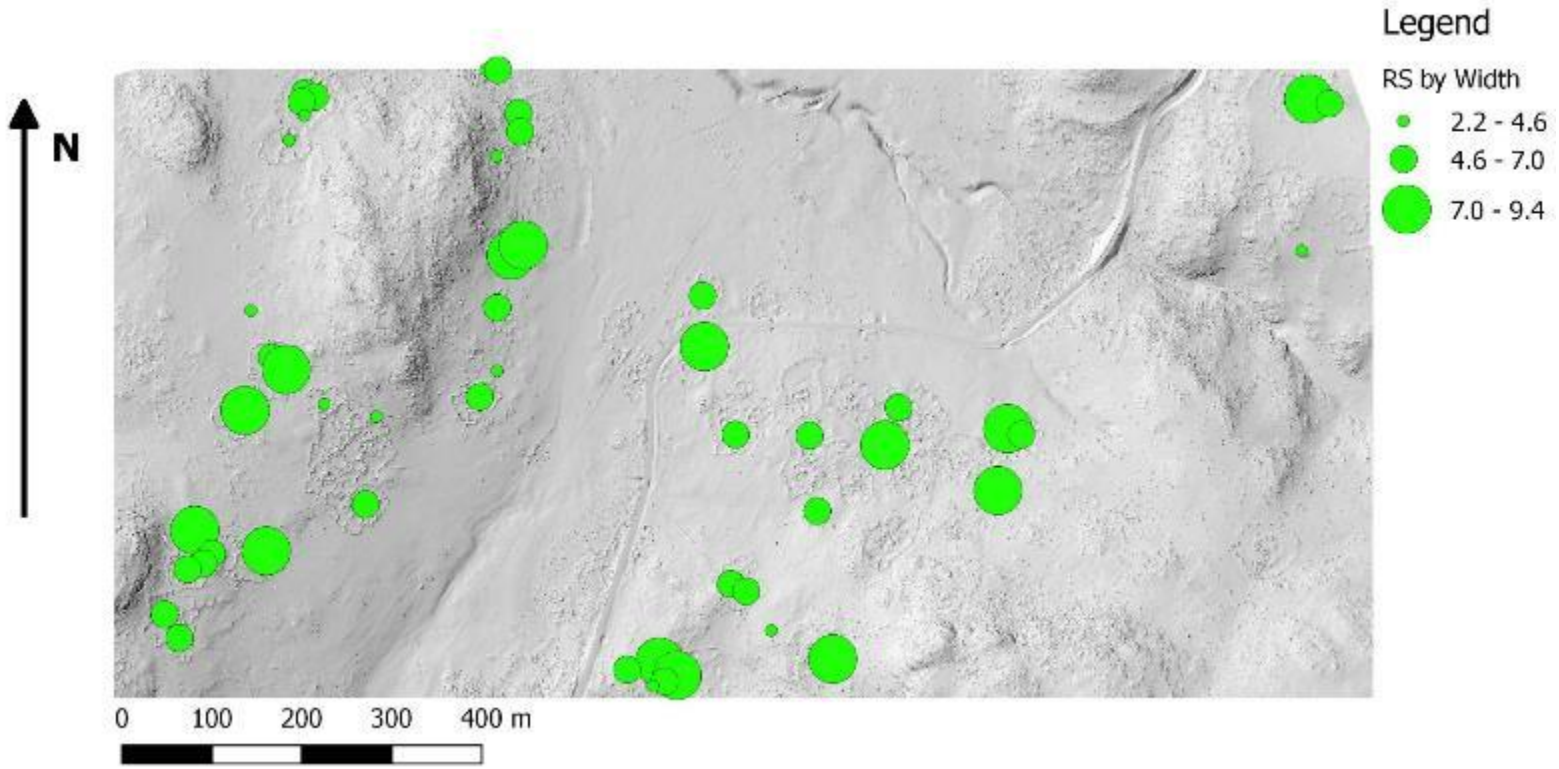


Figure 4.3: Map showing the width category of each raised structure

The three groups into which the height of the raised structures was divided were: Small (0.5 to 1.49m), Medium (1.5m to 2m) and Large (2.15 and above). Table 4.2 below shows that of the three groups which height was divided into (small, medium and large), the small group was not represented, the medium group formed 55.8% of the sample and the large group formed 44.2% of the sample.

Table 4.2: Frequency table for the groups height was divided into

		Frequency	Percent
Valid	Medium	29	55.8
	Large	23	44.2
	Total	52	100.0

Table 4.3 shows the frequency table for the groups the width measurements were divided into as detailed in the methodology chapter. Those raised structures that fell into the “Small” category measured under 3m, those that fell into the medium category measured between 3m and 6m, and those that fell into the large category measured over 6m. Table 4.3 shows that the small group was the most under-represented in the sample (21.2%), the medium group formed 50% of the sample and the large group formed 28.8% of the sample.

Table 4.3: Frequency table for groups width was divided into

		Frequency	Percent
Valid	Small	11	21.2
	Medium	26	50
	Large	15	28.8
	Total	52	100.0

The structures are, on average, 2.18m high and 5.8m wide, with 55.8% of the sample of raised structures falling between 1.5m and 2.15m high and 50% of the sample falling between 3m and 6m wide.

Once the raised structures were classified according to their State of Preservation, Spearman's correlational analyses were performed between the State of Preservation and the height, width, slope, aspect, ruggedness, elevation and viewshed area of the raised structures, in order to look for any patterns or relationships between the variables, however no statistically significant correlations resulted. However, between the height of the raised structures and the state of preservation, the correlation showed a weak, negative relationship implying that there is a slight association between the two measures – i.e. that the better-preserved structures were shorter than the others. This was surprising, as one generally expects that taller structures would be better preserved, due to not being collapsed and hence taller. The state of preservation analysis resulted in the following map:

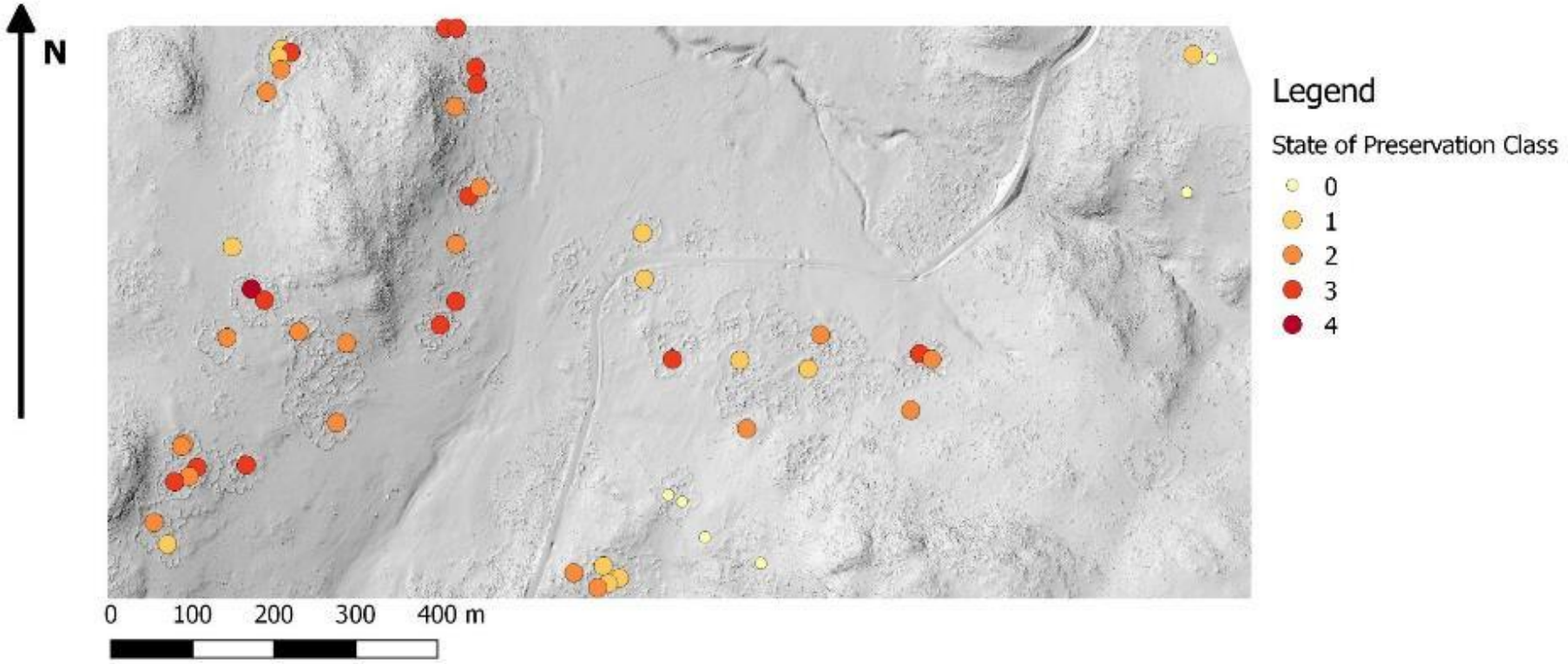


Figure 4.4: Map showing the raised structures classified according to their State of Preservation

4.3 Descriptive Statistics of the Stone walled Structures

Table 4.12 below shows the settlement units' allocated number, its area and the number of raised structures which can be found within the boundaries of the unit. Figure 4.5 is a map of the footprints of the settlement units. The division of settlement units was decided as being where a continuous scalloped wall was found, however, in the case of SWS 14 and 15, these were divided because the road which runs through the Suikerbosrand Nature Reserve has divided this settlement unit and it would be difficult to define a footprint for this settlement unit.

Table 4.4: Table showing the total area and number of raised structures within each grouped stone walled structure.

SWS #	Area	# of RS within		SWS #	Area (m^2)	# of RS within
1	5299	5		18	1996	0
2	3152	2		19	2322	2
3	1998	1		20	2263	0
4	10777	3		21	1726	0
5	2466	1		22	1214	0
6	4446	5		23	4327	1
7	3195	2		24	2316	0
8	1601	1		25	2337	2
9	2353	2		26	5850	5
10	928	1		27	5299	2
11	4050	2		28	7326	0
12	1132	0		29	2544	2
13	1136	0		30	3436	0
14	1038	1		31	5173	0
15	1436	1		32	1253	2
16	3795	1		33	788	1
17	2310	0		34	3447	1

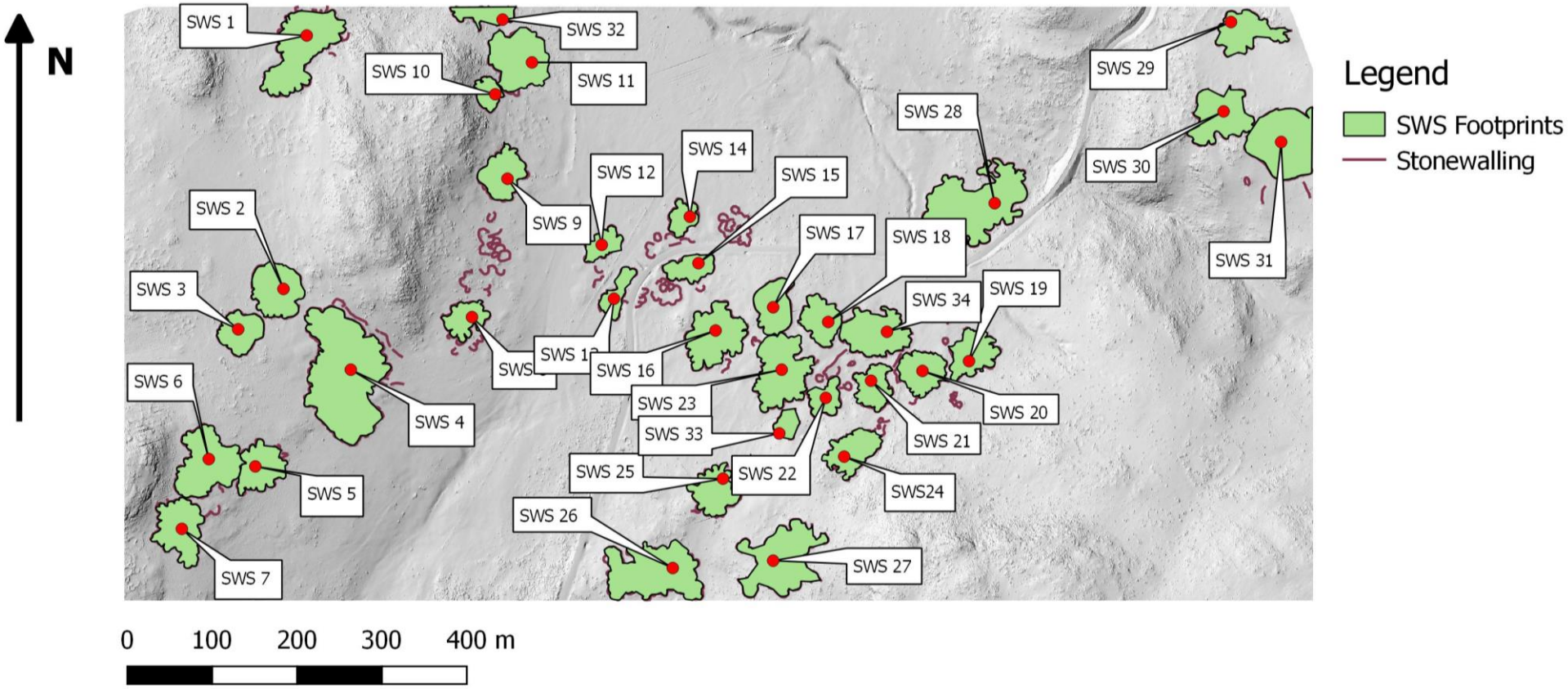


Figure 4.5: Map of the Stonewall Structures' Footprints

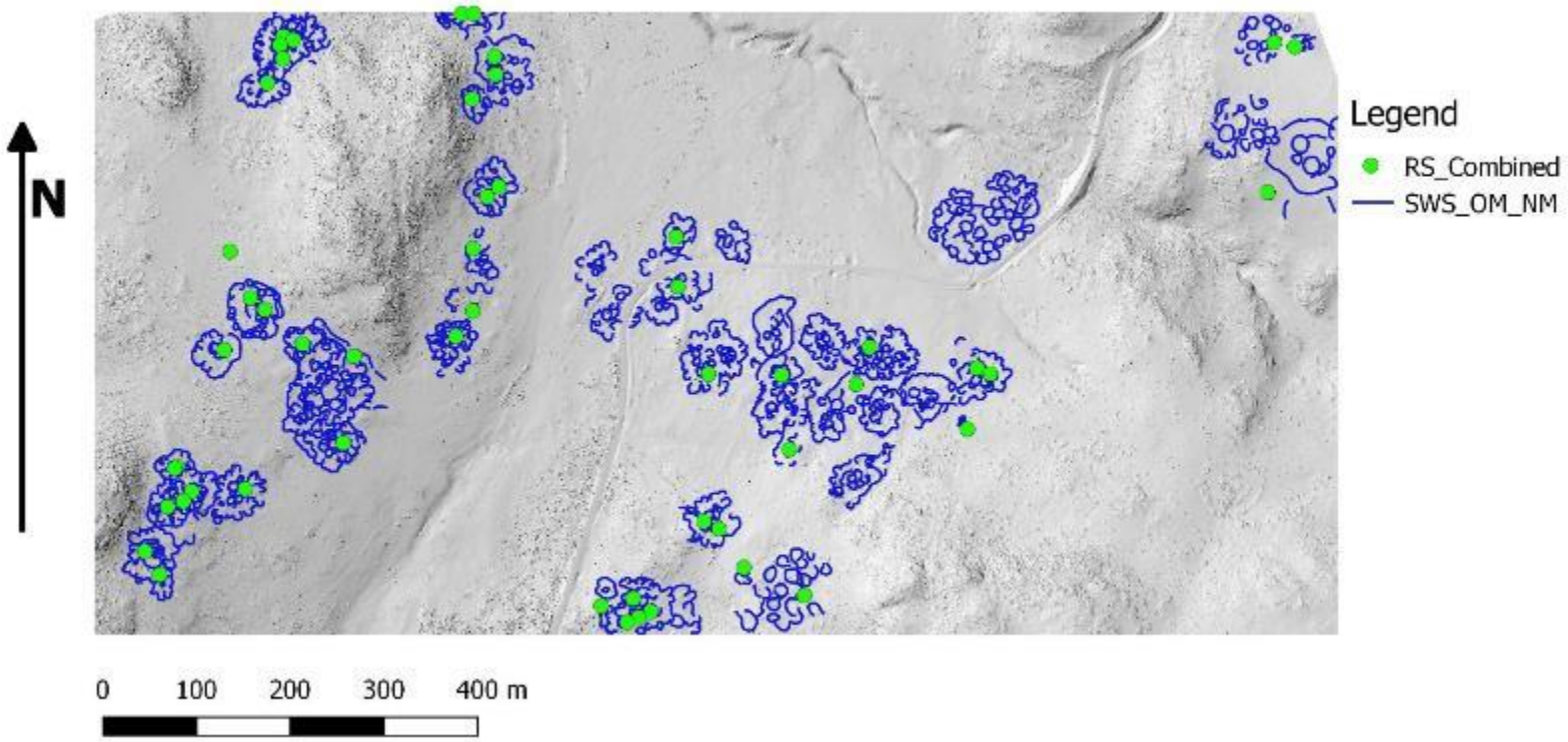


Figure 4.6: Map showing the location of the raised structures within the stone walled structures

Table 4.5: Spearman's Correlation of the Area covered by a settlement unit and the number of raised structures found within those boundaries

Correlations

			SWS Area	Number of RS within
Spearman's rho	SWS Area	Correlation Coefficient	1.000	.436**
		Sig. (2-tailed)	.	.010
		N	34	34
	Number of RS within	Correlation Coefficient	.436**	1.000
		Sig. (2-tailed)	.010	.
		N	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.5 shows Spearman's rho correlation between "Area of Stonewalling" and "Number of Raised Structures". The correlation coefficient is significant at the 0.01 level for a two-tailed test. The coefficient shows a medium strength positive relationship between the total area of stone walling and the number of raised structures which can be found within that group ($\rho = 0.436$, $p \leq 0.01$, $n = 34$) – i.e. generally the larger settlements (defined by area), the more raised structures contained within the boundaries of the settlement units.

4.4 Spatial details of Raised Structures

The measurements calculated for the raised structures can be found in Appendix A. The slope, aspect, elevation, viewshed area and intervisibility were calculated for each raised structure. Figure 4.7 shows the raised structures grouped in terms of slope, Figure 4.8 shows the raised structures grouped by aspect, Figure 4.9 shows the raised structures grouped by ruggedness and Figure 4.10 shows the raised structures grouped in terms of elevation.

The maps show a trend of the raised structures which have the higher values for slope, aspect, ruggedness and elevation, by and large, fall within the Suikerbosrand Nature Reserve rather than on the neighboring farm (as shown in Figures 4.7 to 4.10). However, there is some spatial randomness associated with each of the above

measures, which can be seen on the same maps. Another trend that shows up is that the clustered structures also seem to have the higher values of the above measures.

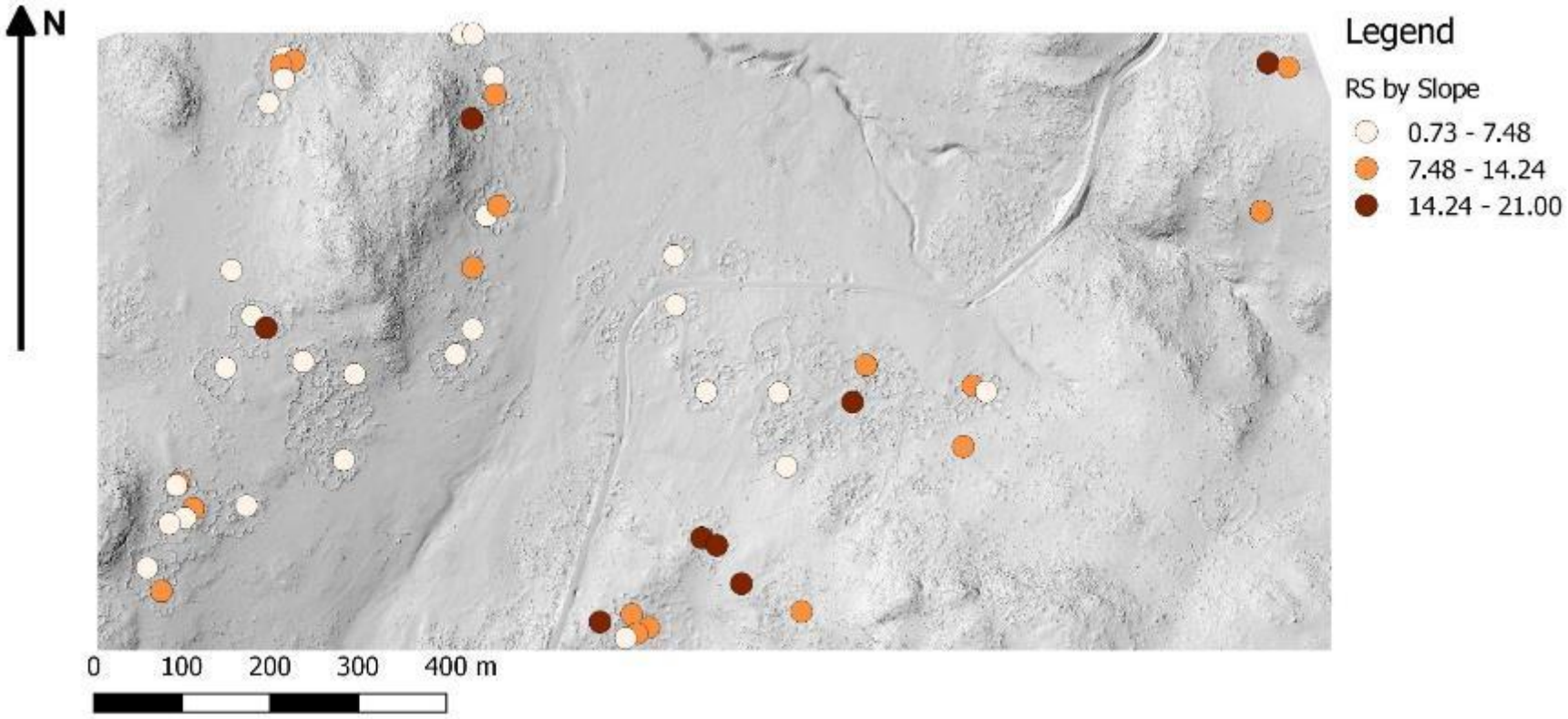


Figure 4.7: Map showing the raised structures in terms of slope

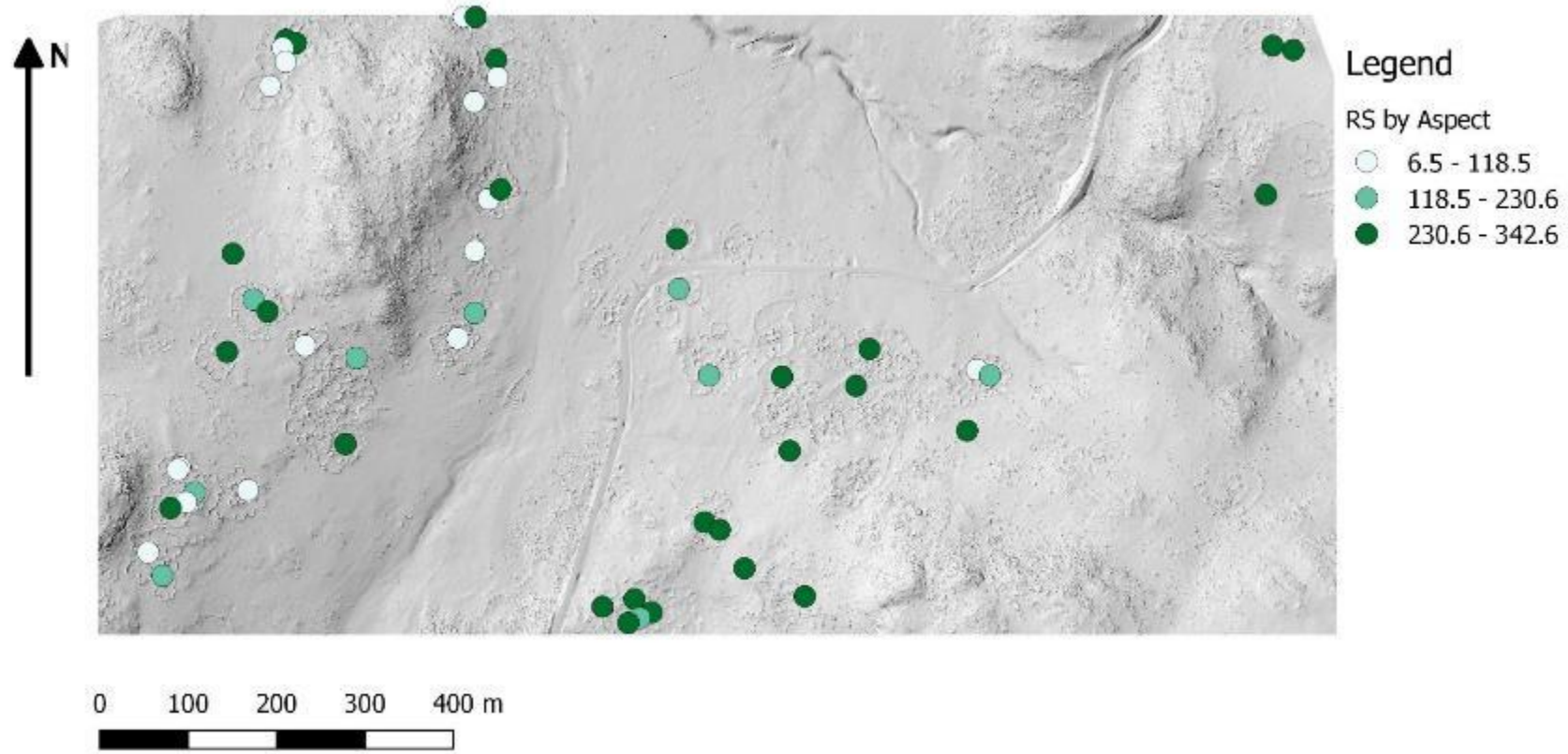


Figure 4.8: Map showing the raised structures in terms of Aspect

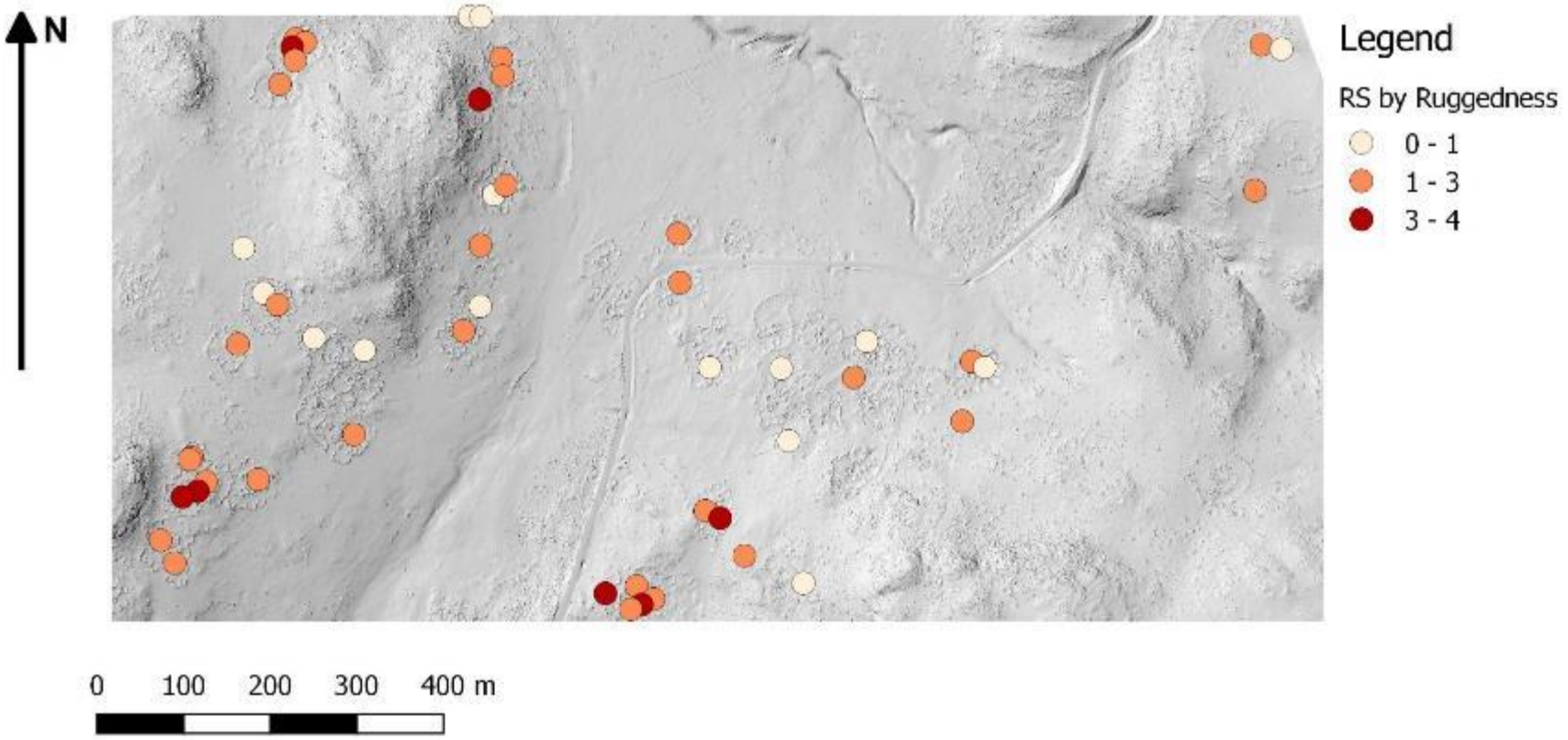


Figure 4.9: Map showing the raised structures in terms of Ruggedness

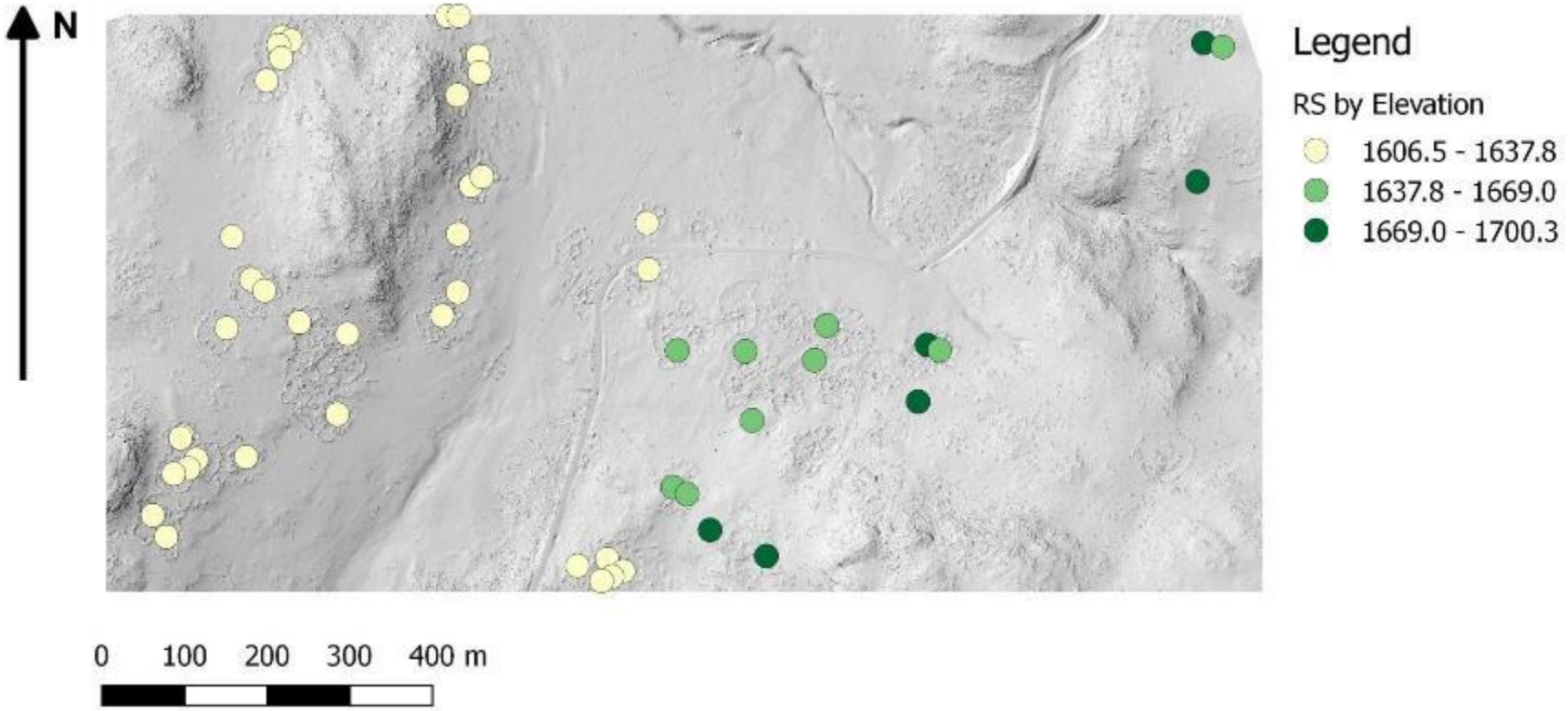


Figure 4.10: Map showing the raised structures in terms of Elevation

4.5 Correlations related to Raised Structures

The following tables show the Spearman's rho correlations performed between the height of the raised structures and the slope, aspect, elevation and viewshed area. Correlations were also performed between the width of the raised structures and slope, aspect, ruggedness, elevation and viewshed area, however, no significant correlations arose. Unless otherwise stated, correlational analyses performed were two-tailed tests. The correlation between height and ruggedness also produced no significant correlation.

Table 4.6 shows a weak positive correlation (0.312) between the height of the raised structures and the slope. This correlation is significant at the 0.05 level.

Table 4.6: Spearman's rho correlation between Height and Slope

Correlations

			Actual Height	Slope
Spearman's rho	Actual Height	Correlation Coefficient	1.000	.312*
		Sig. (2-tailed)	.	.024
		N	52	52
	Slope	Correlation Coefficient	.312*	1.000
		Sig. (2-tailed)	.024	.
		N	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.7 shows the correlation between the height of the raised structures and the aspect. The table shows a medium positive relationship between height and aspect (0.574) which is significant at the 0.01 level.

Table 4.7: Spearman's rho correlation between Height and Aspect

Correlations

			Actual Height	Aspect
Spearman's rho	Actual Height	Correlation Coefficient	1.000	.574**
		Sig. (2-tailed)	.	.000
		N	52	52
	Aspect	Correlation Coefficient	.574**	1.000
		Sig. (2-tailed)	.000	.
		N	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.8 shows that the calculated Spearman's rho for the relationship between the height and elevation of the raised structures is a strong positive relationship at 0.640 which is significant at the 0.01 level.

Table 4.8: Spearman's rho correlation between Height and Elevation

Correlations

			Actual Height	Elevation
Spearman's rho	Actual Height	Correlation Coefficient	1.000	.640**
		Sig. (2-tailed)	.	.000
		N	52	52
	Elevation	Correlation Coefficient	.640**	1.000
		Sig. (2-tailed)	.000	.
		N	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.11 is of a scatter plot between height and elevation with a straight line showing where the linear relationship lies. The two lines on either side of that line are set at a 95% confidence interval. The scatter plot shows that there is a general, positive relationship between height and elevation – the taller raised structures are generally found on higher elevations.

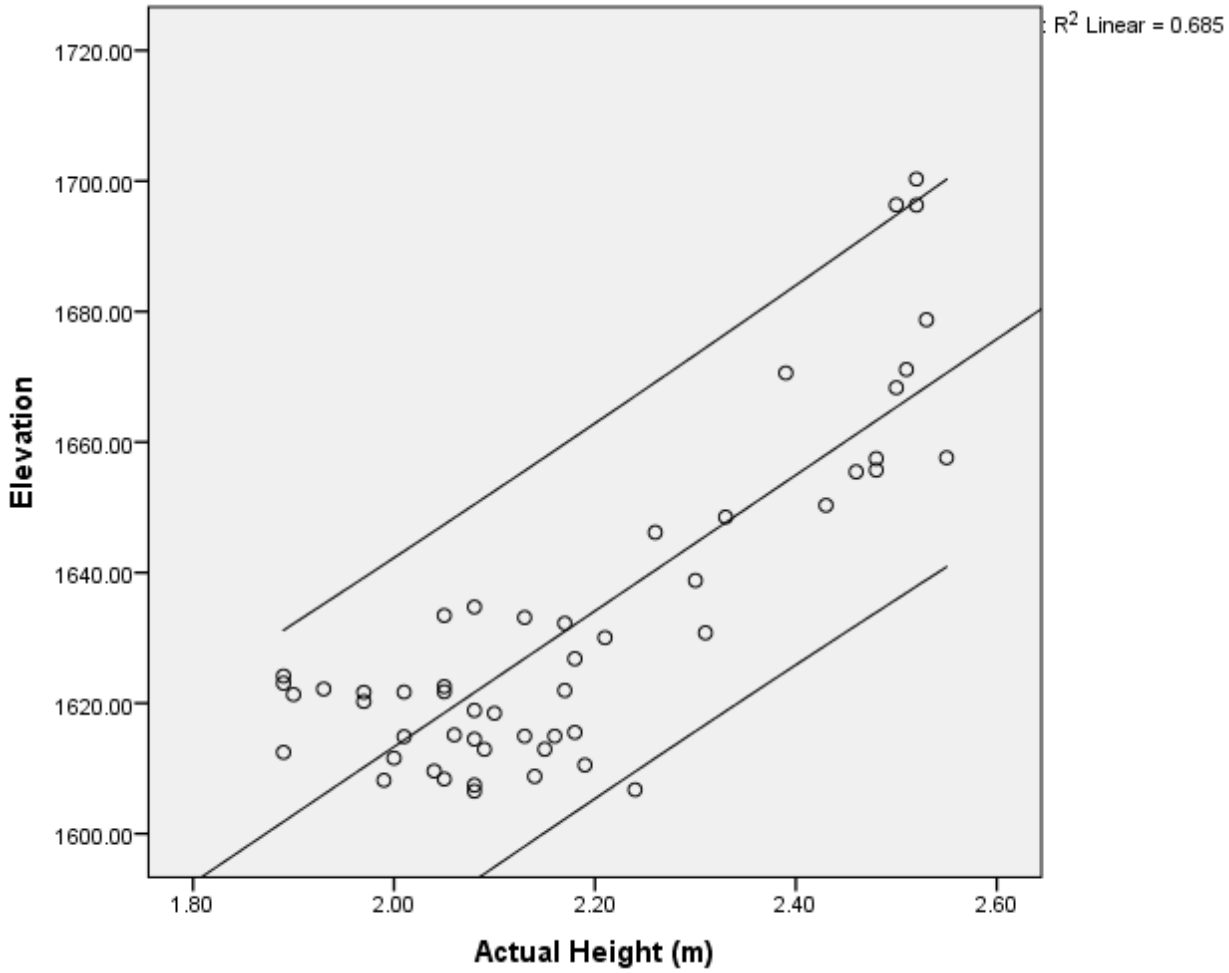


Figure 4.11: Scatter plot graph between height and elevation

Table 4.10 shows that the relationship between height and the viewshed area from the raised structures is a medium positive relationship which is significant at the 0.01 level.

Table 4.9: Spearman's rho correlation between Height and Viewshed Area

Correlations

			Actual Height	Viewshed area
Spearman's rho	Actual Height	Correlation Coefficient	1.000	.447**
		Sig. (2-tailed)	.	.001
		N	52	52
	Viewshed area	Correlation Coefficient	.447**	1.000
		Sig. (2-tailed)	.001	.
		N	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

The following tables detail the Spearman's rho correlation which was calculated between Slope and Ruggedness, Slope and Elevation, Elevation and Aspect, and Elevation and Viewshed Area. Table 4.8 shows an almost medium strength, positive relationship between Slope and Ruggedness at 0.381 which is significant at the 0.01 level.

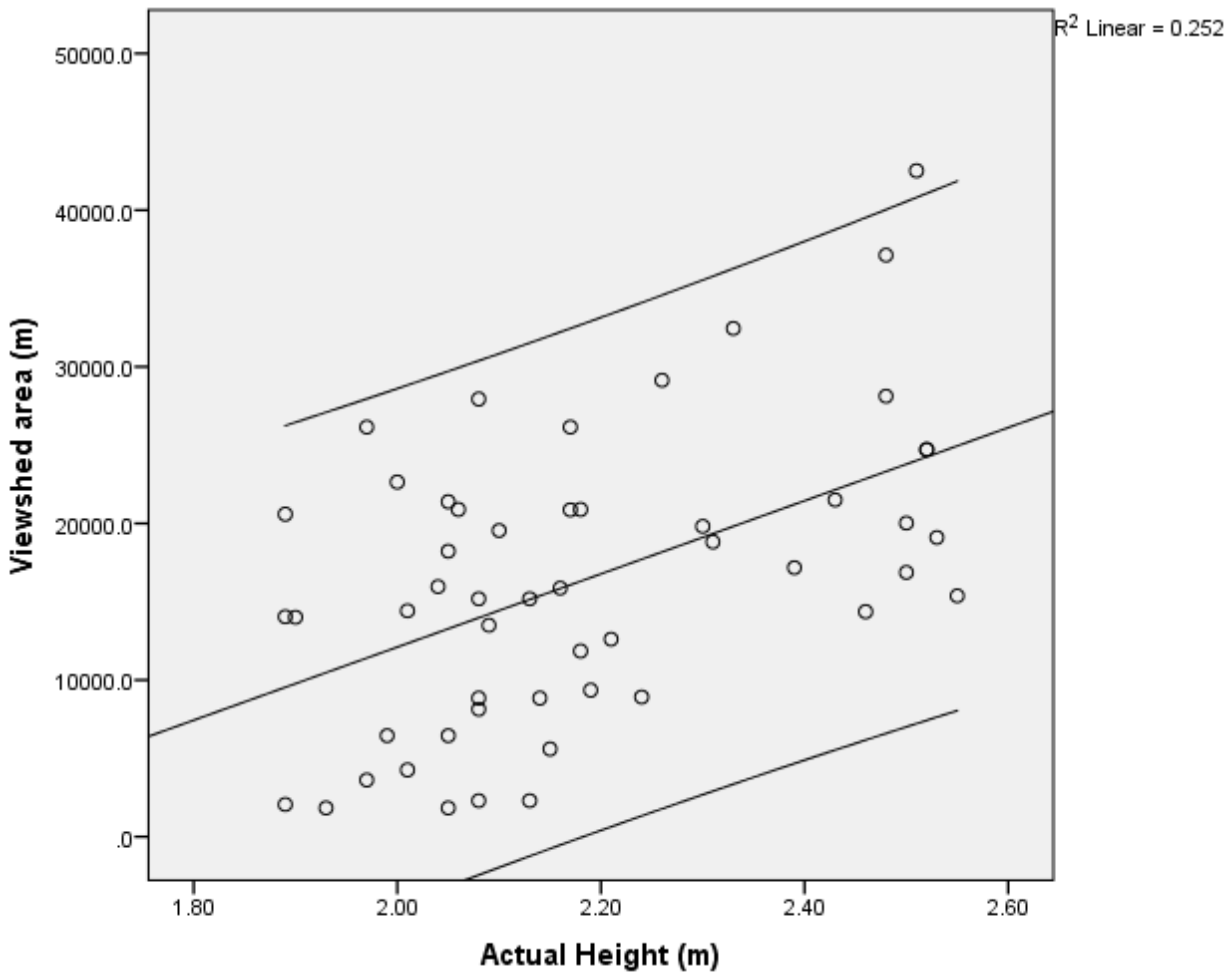


Figure 4.12: Scatter plot between height and viewshed area

The scatter plot graph shows the relationship between height and viewshed area with a regression line = 0.252. The two lines on either side of the regression show a confidence level of 95%. The graph shows that the relationship between height and viewshed area is a linear one – as height increases, viewshed area increases.

Spearman’s rho correlations performed showed that the relationships between the height of the raised structures and slope, aspect, elevation and viewshed area are mostly medium to strong relationships which are significant. These relationships are interesting because they tell us that the taller raised structures can be found in areas with steeper slopes, a north-west or west-north-west aspect, higher elevation and have larger viewshed areas – all of which could reveal possible reasoning behind their construction.

The following correlations were obtained from dividing the data regarding the raised structures using the natural drainage line within the study area. Raised structure numbers 1-30 fall into the “west” category and raised structure numbers 31-52 fall into the east” category. Here again, unless otherwise stated, all correlational analyses performed were two-tailed tests.

Table 4.10 details the correlation between the height of the raised structures of the east and west categories ($\rho = -0.445$, $p < 0.05$). This correlation reveals a moderate, negative relationship between the heights of the raised structures, in other words, that the raised structures found on the east side of the drainage area are taller than the raised structures on the west side of the drainage area.

Table 4.10: Spearman's rho correlation between the heights of the east and west raised structures

Correlations

			West RS Height	East RS Height
Spearman's rho	West RS Height	Correlation Coefficient	1.000	-.445*
		Sig. (2-tailed)	.	.038
		N	30	22
	East RS Height	Correlation Coefficient	-.445*	1.000
		Sig. (2-tailed)	.038	.
		N	22	22

*. Correlation is significant at the 0.05 level (2-tailed).

The Spearman’s rho correlation between the height and elevation of the raised structures found to the west of the drainage area was calculated. This correlation

shows a weak, negative relationship (ρ = -0.367, p < 0.05, n = 30) between the height and elevation of the westerly raised structures which means that the taller structures can sometimes be found on lower elevations to the west of the drainage area.

Table 4.11 shows a contrasting correlation to Table 4.12 in that the correlation found between the height and elevation of the eastern structures is a very strong, positive relationship (ρ = 0.860, p < 0.01, n = 22). This means that the taller raised structures to the east of the drainage area can, more often than not, be found on higher elevations.

Table 4.11: Spearman's rho correlation between the height and elevation of the eastern raised structures.

Correlations

			East RS Height	East RS Elevation
Spearman's rho	East RS Height	Correlation Coefficient	1.000	.860**
		Sig. (2-tailed)	.	.000
		N	22	22
	East RS Elevation	Correlation Coefficient	.860**	1.000
		Sig. (2-tailed)	.000	.
		N	22	22

**. Correlation is significant at the 0.01 level (2-tailed).

As well as the strong relationship between the height and elevation of the eastern raised, there is also a strong, positive correlation (ρ = 0.797, p < 0.01, n = 22) between the height and intervisibility of the eastern raised structures. Together this means that the taller, higher elevated raised structures on the eastern side of the drainage area also show a larger amount of intervisibility.

Table 4.12: Spearman's rho correlation between the height and intervisibility of the eastern structures

Correlations

			East RS Height	# of other RS seen
Spearman's rho	East RS Height	Correlation Coefficient	1.000	.797**
		Sig. (2-tailed)	.	.000
		N	22	22
	# of other RS seen	Correlation Coefficient	.797**	1.000
		Sig. (2-tailed)	.000	.
		N	22	22

**. Correlation is significant at the 0.01 level (2-tailed).

There was a moderate, positive correlation between the height and intervisibility of the western raised structures ($\rho = 0.470$, $p < 0.01$, $n = 30$). This means that wider raised structures to the west of the drainage area have a greater degree of intervisibility.

The correlation between the slope and ruggedness of the western structures was moderate and positive ($\rho = 0.393$, $p < 0.05$, $n = 30$) and the correlation between the slope and ruggedness of the eastern raised structures was also moderate and positive ($\rho = 0.461$, $p < 0.05$, $n = 22$). This means that for both geographical groups, the raised structures were built in areas with steeper slopes which are also rugged.

The slope measurement of the raised structures to the east of the drainage area was correlated with the viewshed area of the eastern structures and this produced a correlation of 0.553 ($p < 0.01$, $n = 22$). From this, it can be inferred that the raised structures which were built on a steeper slope, have a larger viewshed area. The slope measurement of the eastern structures was also correlated with the intervisibility of the eastern raised structures, the correlation produced was 0.439 ($p < 0.05$, $n = 22$). A one-tailed correlational analysis between the slope of the eastern structures and their elevation also revealed a moderate, positive relationship ($\rho = 0.365$, $p < 0.05$, $n = 22$). From these three correlations, it can be concluded that the raised structures

which were built to the east of the drainage area on steeper slopes were also built on higher elevations and have a high degree of intervisibility and a large viewshed area.

A one-tailed correlation analysis between the width of the structures built to the west of the drainage area and their degree of intervisibility yielded a moderate, positive relationship between the two variables ($\rho = 0.470$, $p < 0.01$, $n = 30$). A one-tailed correlation analysis was also performed between the viewshed area of the structures built to the west of the drainage area and their degree of intervisibility which yielded a stronger moderate, positive relationship between the two variables ($\rho = 0.529$, $p < 0.01$, $n= 30$).

Mann-Whitney U tests were conducted to determine whether or not there are any differences in the medians of the east and west raised structures. The Mann-Whitney U test was run to determine if there were differences between the height measurements of the east and west raised structures. The distributions of the height measurements between the east and west structures were dissimilar, as assessed visually. Median height measurements were statistically different between the east and west structures ($U = 617$, $z = 5.32$, $p < 0.05$). Likewise, the distribution of the slope measurements of the east and west structures were also dissimilar. The median slope measurements were statistically different between the east and west structures ($U = 462$, $z = 2.446$, $p < 0.05$). The distribution of the aspect measurements of the east and west structures were also dissimilar, as visually assessed. The median aspect measurements were statistically different between the east and west structures ($U = 533$, $z = 3.76$, $p < 0.05$).

Additionally, the distribution of the elevation measurements of the east and west structures was also significantly different from each other, as visually assessed. The median elevation measurements were statistically different between the east and west structures ($U = 660$, $z = 6.112$, $p < 0.05$). The distribution of the viewshed area measurements of the east and west structures were also different from each other, as visually assessed. The median viewshed area measurements were statistically different between the east and west structures ($U = 479$, $z = 2.76$, $p < 0.05$). Lastly, the distribution of the intervisibility scores were also different, also as visually

assessed. The median intervisibility scores between the east and west structures were statistically different ($U = 447$, $z = 2.176$, $p < 0.05$).

Interestingly, the distribution of the width measurements of the raised structures in the east and west were similar and the median width measurements were not statistically different, however the result was not statistically significant ($U = 355$, $z = 0.472$, $p > 0.05$). As well as this, the distribution of the ruggedness measurements from the east and west structures was also similar and the median ruggedness measurements were not statistically different, however the result was not statistically significant ($U = 347$, $z = 0.317$, $p > 0.05$).

Coupled with the correlations, the Mann-Whitney U tests are interesting because both types of tests showed that, by and large, the raised structures found to the east of the drainage area are different enough from the raised structures found to the west of the drainage area for the two groups to be definitively separated. On average, the raised structures to the east are placed on steeper slopes, are facing north-west to north-west-north, are on greater elevations with larger viewsheds and have greater intervisibility. Interestingly, the two groups of raised structures do not show significantly different measures of ruggedness which could be attributed to the ruggedness of the surrounding area or the state of preservation of the surrounding walling or the raised structures themselves and the width of the raised structures of both groups also do not differ much between the two groups.

4.6 Viewshed analysis

The viewshed analysis conducted on each of the 52 identified raised structures resulted in several maps which can be viewed in Appendix A. The viewshed analysis was conducted to see whether the raised structures on higher elevations also had larger viewshed areas. An intervisibility analysis was also carried out on the 52 identified raised structures. The total area of each viewshed was calculated as well and is displayed in Table 4.13. Table 4.14 shows which Raised Structures can see which other structures.

Table 4.13: Table displaying the viewshed area of each raised structure

RS #	Viewshed area (km^2)	RS #	Viewshed Area (km^2)
1	9356	27	3623
2	8844	28	1835
3	8922	29	1835
4	8141.4	30	2055
5	8844	31	11856
6	27940	32	12609
7	26149	33	19813
8	26149	34	21505
9	19552	35	15377
10	18227	36	14366
11	20591	37	16869
12	13496	38	17177
13	14419	39	29138
14	14011	40	32447
15	20891	41	19103
16	20891	42	28127
17	14042	43	24713
18	15189	44	24713
19	15189	45	20021
20	15871	46	42514
21	22639	47	37128
22	15965	48	21385
23	6455	49	2300
24	6455	50	2300
25	5602	51	20869
26	4264	52	18822

Table 4.14: Table showing which Raised structures are visible from other Raised structures.

Intervisibility				Intervisibility		
RS #	RS # (seen)	total		RS #	RS # (seen)	total
1	2, 3, 4, 5, 43, 44, 45	7		27	23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 49	24
2	1, 3, 4, 5, 43, 44, 45, 37, 38, 41	10		28	25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	22
3	1, 2, 4, 5, 23, 24, 37, 38, 41, 43, 44, 45	12		29	25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48	22
4	1, 2, 3, 5, 24, 37, 38, 41, 43, 44, 45	11		30	14, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	23
5	1, 2, 3, 4, 25, 37, 38, 41, 43, 44, 45	11		31	12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47	33
6	7, 8, 9, 15, 16, 20, 21, 37, 38, 39,40, 41, 42, 44, 46, 47, 48, 49, 50, 51	20		32	12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 37, 38, 40, 41, 42, 43, 44, 45, 46, 48	33
7	6, 8, 9, 10, 11, 12, 15, 16, 19, 20, 21, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	31		33	7, 8 ,9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 37, 38, 41, 42, 43, 44, 45	34
8	6, 9, 10, 11, 12, 15, 16, 19, 20, 21, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	31		34	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 38, 41, 42, 43, 44, 46	36
9	7, 8, 10, 11, 15, 16, 19, 20, 21, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	28		35	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 37, 38, 41, 42, 43, 44, 45	35
10	7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	32		36	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 37, 38, 41, 42, 43, 44, 46	32

RS #	RS # (seen)	Total		RS #	RS # (seen)	Total
11	7, 8, 9, 10, 12, 15, 16, 19, 20, 21, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	30		37	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 38, 41, 42, 43, 44, 45	34
12	8, 9, 10, 11, 15, 16, 19, 20, 21, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	34		38	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 41, 42, 43, 44, 46	34
13	12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51	32		39	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 40, 46, 47, 48, 52	31
14	13, 25, 26, 27, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48, 49, 50	26		40	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 39, 46, 47, 48, 49, 50, 51, 52	35
15	7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	37		41	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 42, 43, 44, 45	35
16	7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	37		42	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 41, 43, 44, 45	36
17	7, 8, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 31, 32, 33, 34, 35, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	33		43	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 41, 42, 44	38
18	7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 21, 22, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	35		44	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 41, 42, 43	38
19	7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	35		45	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 34, 35, 36, 37, 38, 41, 42	36

RS #	RS # (seen)	Total	RS #	RS # (seen)	Total
20	7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 21, 22, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	34	46	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 39, 47, 48, 49, 50, 51, 52	35
21	7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	34	47	6, 7, 8 ,9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 39, 40, 46, 48, 49, 50, 51, 52	35
22	7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52	34	48	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 40, 46, 47, 49, 50, 51, 52	22
23	24, 25, 26, 27, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	21	49	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 40, 46, 47, 48, 50, 51, 52	24
24	23, 25, 26, 27, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48	21	50	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 40, 46, 47, 48, 49, 51, 52	24
25	23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	24	51	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 40, 46, 47, 48, 49, 50, 52	22
26	23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48	24	52	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 40, 46, 47, 48, 49, 50, 51	22

Spearman’s rho correlations were performed to determine whether there is a relationship between the number of raised structures visible from each structure and each structures’ height and viewshed area. These correlations are displayed in tables 4.15 and 4.16.

Table 4.15: Table of Spearman's correlation between the number of other raised structures visible from each structure and each structures viewshed area

Correlations

			Amount of other RS visible	Viewshed area (m)
Spearman's rho	Number of other RS visible	Correlation Coefficient	1.000	.575**
		Sig. (2-tailed)	.	.000
		N	52	52
	Viewshed area (m)	Correlation Coefficient	.575**	1.000
		Sig. (2-tailed)	.000	.
		N	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.16: Table of Spearman's correlation between the amount of raised structures visible from each structure and each structure's height

Correlations

			Amount of other RS visible	Height (m)
Spearman's rho	Number of other RS visible	Correlation Coefficient	1.000	.494**
		Sig. (2-tailed)	.	.000
		N	52	52
	Actual Height (m)	Correlation Coefficient	.494**	1.000
		Sig. (2-tailed)	.000	.
		N	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.15 shows that there is a medium strength positive relationship between a structure's viewshed area and the number of raised structures which can be seen from the structure ($\rho = 0.575$, $p < 0.01$, $n = 52$). The Spearman's rho correlation between the number of structures visible from a particular structure and the structure's height resulted in a medium strength positive relationship ($\rho = 0.494$, $p < 0.01$, $n = 52$). Both of the correlations show that there is a medium strength relationship between the amount of intervisibilty between the 52 raised structures and their height and viewshed area – i.e. the more raised structures visible from a particular structure, the larger the structure's viewshed area and the taller it generally is.

4.7 Buffer Zones

Buffer Zones were calculated for each of the 52 raised structures. The buffer zones were set up at 15m, 20m, 40m and 50m in order to determine the extent of possible clustering regarding the raised structures. Maps detailing these buffer zones are found in Figures 4.13 and 4.14. These maps show that already at 15m, some clustering is evident, however, at 50m, all the raised structures fall into at least one cluster. The buffer zone analysis was conducted to establish whether there were clusters of raised structures which could be defined clearly. Three main clusters of raised structures are evident at a 15m buffer zone level, however this increases when the buffer zones are set at 50m. The raised structures are spatially more distributed than one would expect if they were used as, for example, grain bins or as a way of marking a ritual space.

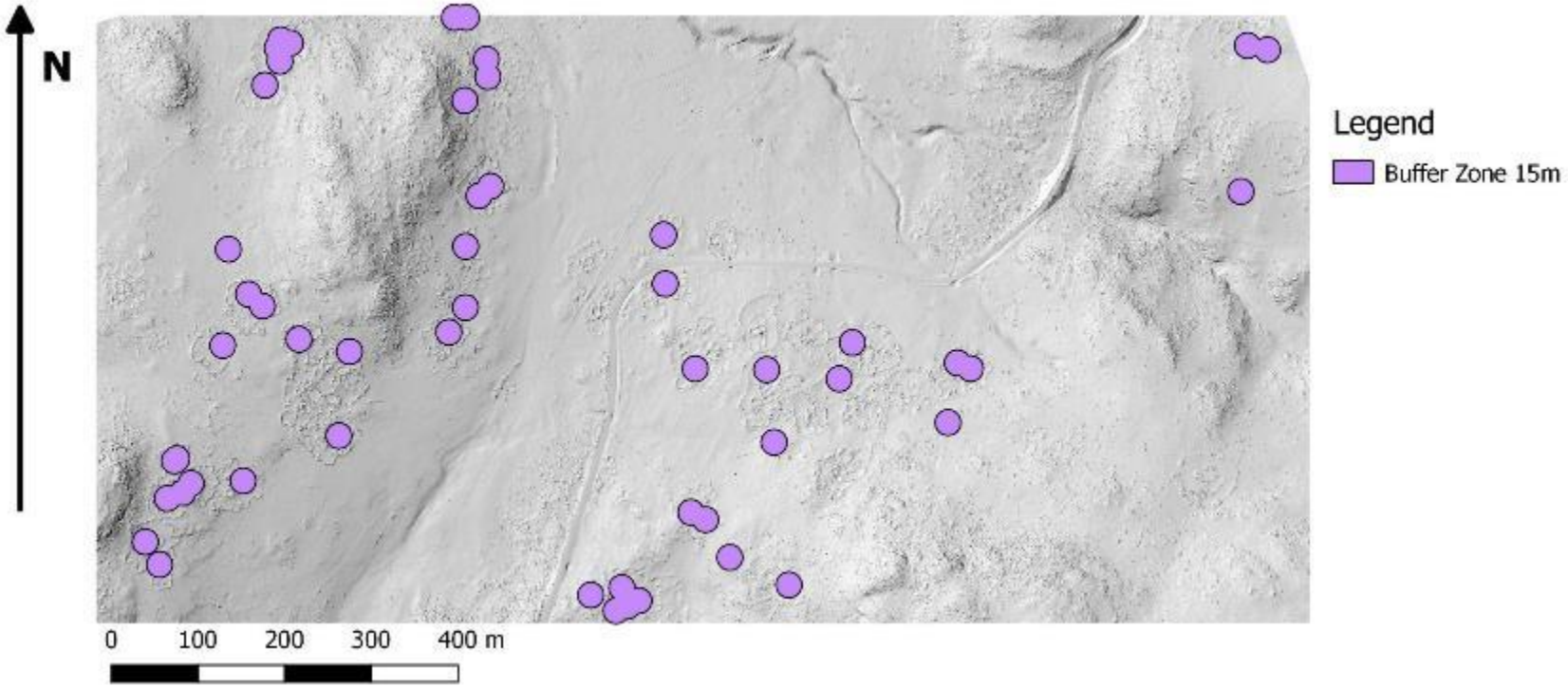


Figure 4.13: Buffer Zones around raised structures at 15m

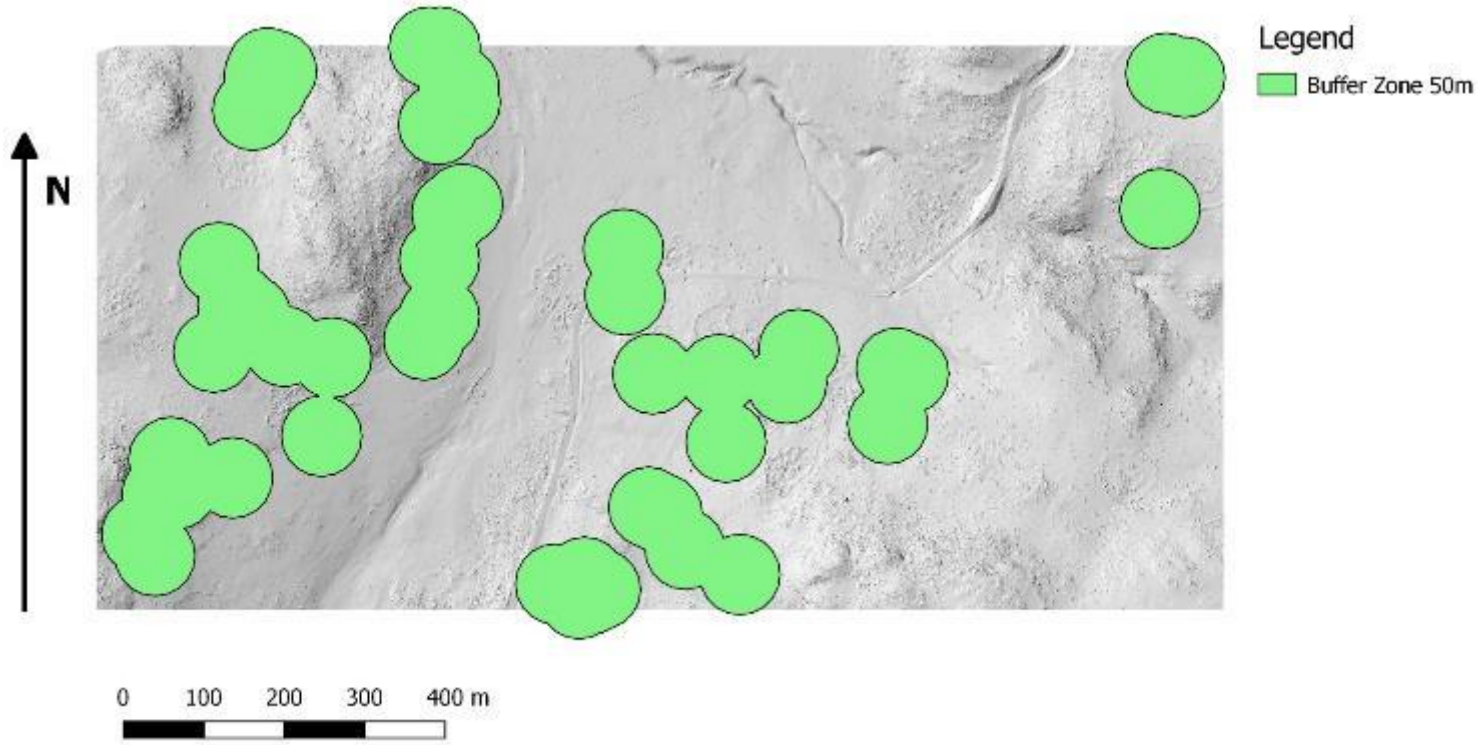


Figure 4.14: Buffer Zones around raised structures at 50m

Buffer zones were also set at 40m, following the Nearest Neighbour analysis, the results of which are presented below:

Table 4.17: Nearest Neighbour analysis

Nearest Neighbour	
Observed mean distance	37m
Expected mean distance	65m
Nearest neighbour index	0.57
Number of points	52
Z-Score	-5.93

The negative z-score of -5.93 means that the null hypothesis that the raised structures are completely spatially random is rejected – in other words that some clustering is occurring, in this case, as shown in Figure 4.13 and 4.14, these clusters become evident when 40m and 50m diameter buffer zones are used. From these maps, seven main clusters were identified, which are marked, using numbers, on Figure 4.15. The term ‘main clusters’ describes three or more buffer zones which cluster together and merge.

Cluster number 3 contains the most raised structures (8) and cluster number 6 contains the least number of raised structures (4). All seven clusters identified are not on the highest elevations in the study area, however, 43% of the “height group 3” structures fall within these seven clusters. Importantly, 75% of the raised structures fall within these seven main clusters, which means that the majority of the raised structures are close enough to each other to fall within a cluster created at 40m. However, when the buffer zones are made much smaller (15m), only three clear clusters emerge, which encompass only 27% of the sample of raised structures. Overall, less than half of the tallest raised structures fall within the seven identified clusters and these clustered raised structures are also not on the highest elevations. There are also more clusters to the West of the drainage area.

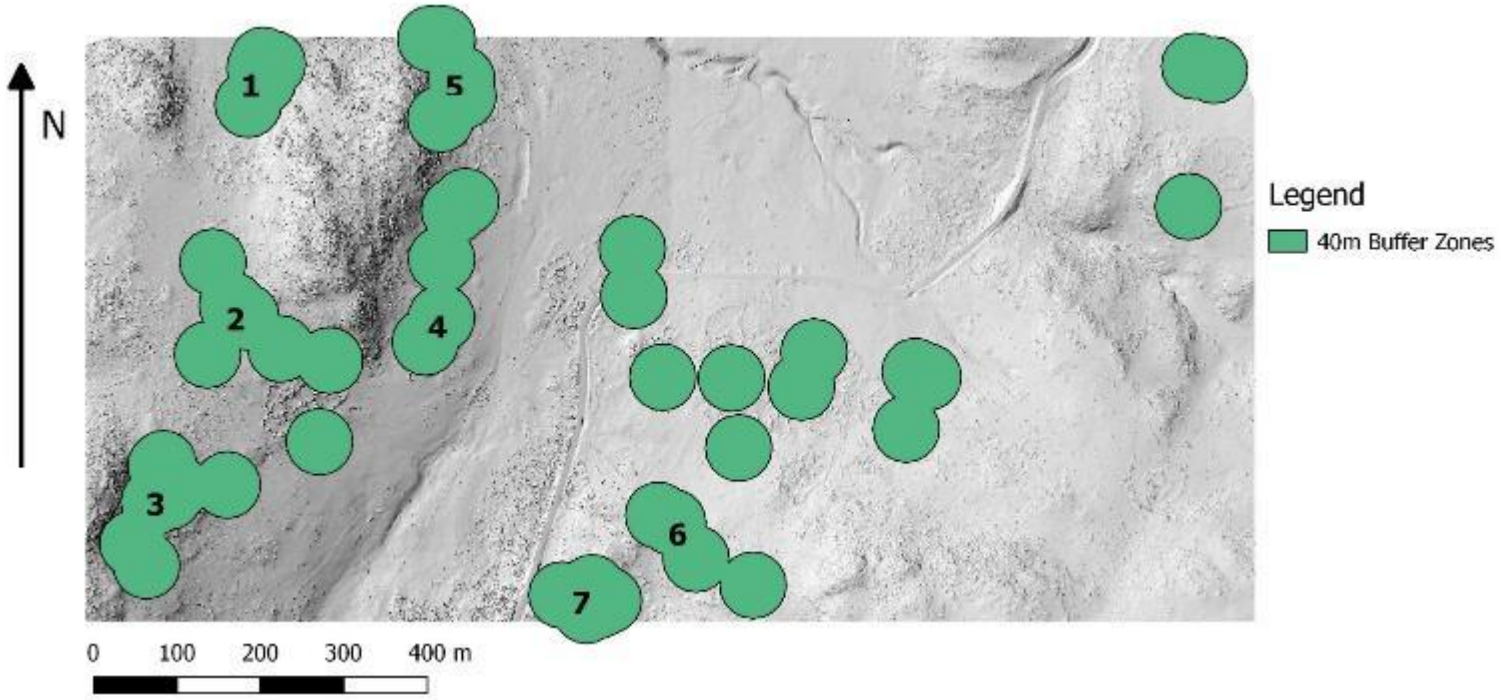


Figure 4.15: Map of the 40m buffer zones around the raised structures, numbers designate main clusters

4.8 Summary of the results

This study sampled 52 raised structures within the Suikerbosrand Nature Reserve and the neighbouring farm. 46 of these structures were ground truthed during different seasons over a period of two years. Only 30 of the structures were measured on the ground by undergraduate assistants. The 46 structures which were ground truthed were also photographed. This Chapter displayed the results and analysis pertaining to all 52 raised structures.

Overall, the geographical distribution of the raised structures lies over two areas which the researcher separated – this area is the main drainage area between the Suikerbosrand Nature Reserve and the neighbouring farm. This drainage area provides a convenient spatial gap with which the raised structures were divided into two groups – East and West.

The height and width of the raised structures were the first measurements taken of these structures – however, the state of preservation of each structure was also taken into account due to the span of time since the construction of the raised structures and the present day. By taking the state of preservation into account, the researcher has tried to acknowledge that taphonomy has played a part in how the raised structures are presented today. A correlational analysis performed between the state of preservation of the structures and their height found that there was only a slight relationship, implying that the height of the raised structures is probably close to what it would have been at the time of their construction. No relationship between the state of preservation and the width of the raised structures was found, which was surprising because a number of the raised structures show signs of collapse, which one expects would adjust the width of the structures significantly.

The strongest correlation found was between the raised structures' height and their elevation. This means that the tallest raised structures were also found on the highest elevations. Interestingly, even though several statistically significant correlations were found between the raised structures' height and several other measures, none of these

were strong correlations, meaning that the other measures cannot really be used as predictors for finding raised structures.

The division of the raised structures into East and West also produced some interesting results. By using Mann Whitney U tests, the researcher found that on average, there are differences between the east and west groups of raised structures in terms of slope, aspect, elevation, viewshed area and amount of intervisibility between the structures. However, on average, no differences in ruggedness between the two groups were found. These results reveal that, by and large, the raised structures found to the east of the drainage area (those within the Suikerbosrand Nature Reserve) are measurably different to these found to the west of the drainage area.

That said, when the raised structures are clustered together using a buffer zone of 40m diameter, seven clusters emerge – five of which are to the west of the drainage area. It would seem that although the raised structures to the east of the drainage area are generally taller, on higher elevation, have larger viewshed areas and more intervisibility, the structures to the west of the drainage area tend to cluster more than the structures to the east. In the next chapter, these results are discussed in further detail and combined with the literature presented in chapter 2.

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

This chapter details the results of this study with regard to the literature discussed in Chapter 2. This chapter considers the possibility of whether the raised structures are grain bins, cairns, or grave markers or whether they could be considered part of a monumental package by comparing what past researchers have defined for each category detailed above.

5.2 Are the raised structures grain bin supports?

According to Taylor (1984), Pistorius (2001) and Huffman (2009), most of the grain bins have stone bases as a support system or a way to raise them off the ground in order to prevent the grain being consumed by the domestic animals and they usually had one or two rows of stones on which they were raised. Given that this study found that the average height of the raised structures is 2.18m and the average width of the raised structures is 5.8m, it seems, at face value, unlikely that the raised structures were used as grain bin support structures since they are quite tall and wide. What might lend more credibility to this theory is that the raised structures are, on average, built on steeper slopes and on greater elevations – which could speak to the possibility that they might be part of a ritual landscape. This is following Huffman's (2009) assertion that the first temporary grain bin built by the rainmakers was placed on a row of stones on the slopes of nearby hills or mountains. However, those grain bins were burnt after the ceremony of rain making and were built away from the settlements.

Within the stone walled settlements, three of the settlements contain five raised structures within their walls. This could potentially be an indication of wealth or power which was demonstrated by the raised structures which meets what O'Malley (2013) concluded about the Group II structures within her study area – that the Group II stone wall builders were the wealthiest or most powerful of the three building traditions present in the environment. In order to properly ascertain whether these raised structures could have been used as grain bin supports, excavations would need to be

carried out on the surrounding areas to examine for potsherds, and grains. This also corresponds with Taylor's (1984) statement that the raised grain bin bases which he found were centrally located within the settlements, in high status areas near the centre of the settlement area, as shown in Figure 4.5.

5.3 Are the raised structures cairns?

The possibility that the raised structures are a type of cairn is quite strong, particularly when the state of preservation is considered. Using Davies' (2013) definitions of cairns, the range of the widths of the raised structures (1.9m – 9.9m) means that the raised structures fall within the ranges of the width of the simple cairns (2 – 20m). However, the height range (1.9m – 2.6m) excludes the cairns from falling within the class of simple cairn. However, those raised structures which were classed as state of preservation Classes 1-2 could potentially be simple cairns, due to taphonomic influences. Similarly, the raised structures which were classed as Classes 2-3 could be kerbed cairns. However, two aspects of the raised structures pose questions over whether the raised structures could be cairns. First, their height (2.18m) is quite tall compared to average cairns which are created due to ritual or due to habituated re-visits to a site. Second, following from Huffman's (1985, 2014) studies on circumcision lodges and initiation schools, in southern Africa, the cairns created during or after the aforementioned ceremonies are created at some distance away from residential areas or settlement units, which these raised structures are not, as shown by Figure 4.5. This distance away from the settlements definitely excludes the idea that the raised structures studied here are cairns created during those types of ceremonies because they are situated within the settlement units.

5.4 Are the raised structures grave markers?

Based on Walton's (1958) study which stated that when important people within certain southern African groups are buried, their graves are marked by thickened walling at the entrance to the kraals. This thickened walling may be accompanied by an orthostat or a monolith. Within the study area, the raised structures are sometimes built at the conjunction of two walls which makes the walling there thicker, however,

due to the state of collapse of some of the walling, it is hard to determine where the entrances to the kraals would have been. Even so, the average width of the raised structures (5.8m) is much wider than the example given by Walton (1958), which he measured as 2.7m, however, the range of the widths of the raised structures means that some of them do fit that measurement. In order to ascertain whether or not the raised structures are grave markers, they would need to be excavated. Both Davies (2013) and Posansky (1968) detail that cairns can also be used to mark graves or previous graves and this links back to the previous section.

5.5 Are the raised structures monuments?

In order to evaluate whether the raised structures could be termed as “monumental”, this study used a combination of the variables used by Furholt (2011), Furholt and Müller (2011), Higuchi (1983) and Johansen (2004) to define monuments. This study combined the variables Colossality (after Furholt 2011 and Furholt and Müller 2011) and Scale (after Johansen 2004); Durability (after Furholt 2011 and Furholt and Muller 2011) and Permanence (after Johanesen 2004); Prominence, Contrast with Background (after Higuchi 1983) and Visibility (after Johansen 2004), and lastly, Ubiquity, on its own. Thus, the researcher decided on the following names for these combined variables: Immutability (for the combination of Durability and Permanence), Scope (for the combination of Scale and Colossality), Markedness (for the combination of Prominence, Contrast with Background and Visibility) and lastly, Ubiquity was exchanged for Pervasiveness.

Immutability was chosen because it represents how immovable these raised structures are, in terms of their size, the size of the rocks with which they were built, and the structures’ overall durability. Scope was chosen to encompass the middle ground which Davies (2013) spoke about – the intermediate, grey area into which many African monuments potentially fall. Markedness was chosen to demonstrate the raised structures’ difference from their surroundings and lastly, Ubiquity was renamed Pervasiveness because the word implies how often the structures occur within the landscape under study.

5.5.1 Immutability

From the photographs below, and those found in Appendix A, the raised structures studied here were built from stone, which was likely quarried or collected nearby. Stone is not generally that vulnerable to weathering and so, in choosing stone as a construction material, it is not unreasonable to assume that the constructors of the raised structures expected them to last at least as long as their occupation of the site, if not longer.

The state of preservation of the raised structures, as evaluated by the researcher was, by and large, not too bad. Most of the raised structures were classed as Class 2 and 3, which means that at least part of the retaining wall of the structure was still standing. From this, it can be gathered that, for the most part, the raised structures have survived the passage of time and the natural effects of taphonomy.

5.5.2 Scope

Although these raised structures are relatively small, when compared to the tower at Great Zimbabwe, for example, they stand out enough from their surroundings to be noticeable. The average height of the raised structures is 2.18m and the average width is 5.8m, which means that they stand taller than most of the stone walling surrounding them and they are significantly wider than the average stone wall section. The raised structures have a range of sizes, however, and most of them fit within the medium to large groups, for both the width and height of the structures. For the height of the raised structures, 55.8% of the structures fall with the medium group (1.5 – 2.15m) and 53.8% of raised structures fall within the medium (3 – 6m) width category. This fits in with what Davies (2013) states about the intermediate ranges of sizes and scales of monuments – that researchers should not solely focus on the larger monuments on the scale, but rather analyse the smaller ranges as well and include them in the discussion on monumentality within Africa.

5.5.3 Markedness

In terms of markedness, the structures stand out from their surroundings in several ways. The strongest significant correlations identified were between the height of all the raised structures and their elevations (ρ = 0.640); between the height measurements of the eastern structures and their elevations (ρ = 0.860) and between the height of the eastern structures and their intervisibility (ρ = 0.797), from which it can be implied that the raised structures are different enough from their surroundings, in terms of elevation, and that the eastern structures are particularly different from their surroundings in terms of their elevations and amount of intervisibility.

Stated in general terms, what can be determined from the correlations is that the taller structures can be found in areas with steeper slopes, they have a north-west or north-north-west aspect, higher elevations and have larger viewshed areas. All the raised structures have fairly large viewshed areas, in terms of square meterage ($\bar{x}$ = 16357.5 km^2). However, the structures to the east of the natural drainage area between the raised structures on the Nolte farm and the structures within the Suikerbosrand Nature Reserve have larger viewshed areas than those structures to the west, which was demonstrated by the differences in the average viewshed areas between the eastern and western structures (for the west, $\bar{x}$ = 13248 km^2 and in the east $\bar{x}$ = 20597.7 km^2). There is a general trend in the western raised structures that the raised structures are, on average, smaller, less elevated and have lower degrees of intervisibility than the eastern structures. The general trend among the eastern structures is that they are, on average, taller, on higher elevations, have more intervisibility, and larger viewsheds. The Mann-Whitney U tests between the two groups, east and west, showed that there is enough statistical difference between them for the eastern raised structures to be considered different from the western structures.

These structures are also taller, on average, than those in the west. Thus, in terms of Johansen's (2004) variable of visibility, the structures in the east certainly meet his requirement of prominence on the landscape.

In order to meet Higuchi's (1983) two variables, Prominence and Contrast, with Background, the raised structures needed to stand out from their surroundings and be

different enough to be noticed easily. They do this by being higher and wider than the surrounding stone walling and by being different from stone cairns, grave markers and stone walling. Even though today the raised structures and their surrounding stone walls are overgrown by trees and shrubs, presumably, when the site was occupied, the raised structures would have been far more prominent and visible on the landscape due to the lack of vegetation

5.5.4 Pervasiveness

Within the study area, the raised structures occur frequently within the stone walling of the area. There are 52 raised structures within the area, with 23 of the 34 settlement units containing at least one raised structure (68% of settlement units). In order to meet Johansen's (2004) variable of Ubiquity, the raised structures needed to be everywhere and within the 98ha study area, the raised structures are spread across the entire area. The clustering of the raised structures, especially using buffer zones set at 50m, shows that the raised structures are pervasive within the landscape under study. The raised structures are also spatially distributed throughout the landscape under study, as can be seen in Figures 1.2, 4.1, 4.2 and 4.5.

The nearest neighbour analysis also showed that the raised structures are positioned nearer to each other than was statistically expected (observed mean distance = 37m, expected mean distance = 65m). The nearest neighbour analysis also showed that the raised structures are not randomly spatially distributed across the landscape, but rather fall into clusters which the buffer zones also showed. The study also found that 75% of the raised structures fall within seven main clusters which form when the buffer zones are set at 40m. However, less than half of the tallest raised structures lie within the seven identified clusters. Alongside this, more clusters exist on the western side of the drainage area which also lies on lower elevation. This means that the raised structures to the west of the drainage area were constructed closer together.

5.6 Summary of Discussion

This study found that some of the raised structures potentially fit into the labels of "grain bin support structures or bases" or "grave markers". The descriptive statistics

show that some of the raised structures fall into these categories due to the comparative examples discussed in the literature review. However, overall, using the categories laid out in the beginning of this chapter, the raised structures could be monuments.

The raised structures match the first variable (immutability) because they were constructed from stone which is known to be one of the more permanent building materials. This is not to say that the raised structures are all in a perfect state of preservation, on the contrary, a number of them show evidence of collapse. In terms of the second proposed variable, scope, the raised structures have a wide range of widths and a narrower range of heights and they are not the same width or height as the surrounding stone walling, thus, even if some of the width and height measurements are skewed due to collapse, the structures are still, scale wise, larger than the surrounding stone walling. As well as this, more than 50% of the raised structures fall within the “medium” category which means that they are reasonably different from their surrounding landscape.

In terms of the variable of markedness, the raised structures all have large viewsheds, but the structures to the east of the drainage area are markedly different from the structures to the west of the drainage area, in terms of slope, aspect, ruggedness, elevation and level of intervisibility. Lastly, in terms of pervasiveness, the raised structures are spatially clustered within the study area while also being spatially distributed – 75% of the raised structures fall within the seven main clusters created using buffer zones. Thus, the raised structures meet all four variables proposed in this study for them to be considered as representations of monumental architecture present in the archaeological record in southern Gauteng.

The original hypotheses – that the raised structures are either grain bin bases, grave markers or the result of rituals (or cairns) – were all nulled, since, without excavations, being able to prove these three hypotheses definitively is very difficult, for example, the clay structure of the grain bin probably would not be found near the raised structures; and the grave would possibly be underneath the raised structure which would need to be dismantled in order to determine whether there was a grave there.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This study examined the 52 raised structures found within the Nolte farm and the neighbouring Suikerbosrand Nature Reserve. These structures were identified using LiDAR data gathered during research by Sadr (2015) and Sadr and Rodier (2012) which was then processed using a program called QGIS. During several field visits, the identified raised structures were photographed and measured, as best as possible. The raised structures were also measured for height, width, slope, ruggedness, elevation, viewshed area and the number of other structures visible from each structure (intervisibility). This data was then analysed further using SPSS to determine whether there are any relationships between the aforementioned variables.

6.2 Conclusions of the study

This study was mostly a descriptive study of the raised variables but even so, presents several possible reasons for their construction. First, the raised structures could potentially have been grain bin supports or bases. The basis for this theory is their location within the walls of the settlement units. However, their height and width mean that this is unlikely because most of the raised structures' sizes lie outside of the sizes suggested by other studies (e.g. Taylor 1984 and Pistorius 2001).

Second, those raised structures which show a large amount of collapse could potentially be the simple or kerbed cairns described by Davies (2013), however, the location of the raised structures within the settlement units' walling suggests that these are not cairns. This statement is based on Huffman's (1985, 2014) studies which found that cairns created through rituals, such as initiation or circumcision, are often found in areas which would be considered impossible to farm or live on.

Third, the raised structures which are built into the walls of the surrounding stone walling might be grave markers. This follows from Walton (1958) who found that when an important person is buried at the entrance of a kraal, the wall is often thickened and this thickening is supported by orthostats or monoliths. However, from the LiDAR

images, it is difficult to decide where the entrances may have been and the same is true on the ground due to the collapse of both the raised structures and the stone walling.

Lastly, this study proposes that the raised structures could be considered as representations of monumental architecture present in the archaeological record. This is a strong possibility as the variables studied and analysed regarding the raised structures meet the four variables combined from other studies presented here. The raised structures are immutable, they have a scope larger than their surroundings, they are markedly different from their surroundings and they are pervasive throughout the settlement units found within the study area. Thus, by meeting these four variables, the raised structures can be considered as representations of monumental architecture. However, this study cannot state what kind of meanings or messages these raised structures would have communicated to the society who constructed them. This is due to the study's lack of access to the full social context within which these structures were built (Johansen 2004). This potential for monumentality is important because Renfrew (1973, as cited by Hildebrand 2013) noted that monumental architecture is related to chiefdom-level societies due to the level of influence required to order their construction and coordinate the work force. This ties in with O'Malley's (2013) conclusion that the builders of Group II stone walling were probably the most politically stratified group occupying the area. Taking O'Malley's (2013) research into account, this research suggests that the people who lived to the east of the drainage area may have held higher social status or were possibly richer than those to the west of the drainage area insofar as the eastern sites have larger raised structures.

6.3 Suggestions for further research

This study could be improved first and foremost by excavations. These excavations should examine whether there is any evidence of a different arrangement of stones and possible daga on the surface of the raised structure in order to determine whether the raised structures could be grain bin bases. The excavations should also attempt to determine whether the raised structures are cairns or grave markers even though

the excavations would have to destroy a select few of the raised structures. An ethnographic survey of the elders of the surrounding area would be useful to determine what the local people may think the raised structures represent. An examination of the written historical records regarding the area may also shed some light on the purpose behind the construction of the raised structures. Further research could also study the type of stone which the raised structures with and research potential original locations for these stones. Other studies could utilise the new technology which is coming through to produce accurate 3D models and representations of the raised structures which could be used to calculate measures such as volume, man-power hours used to construct the raised structures. Lastly, future studies should integrate inter-analyst discussions in order to improve the accuracy of measurements of validity and reliability.

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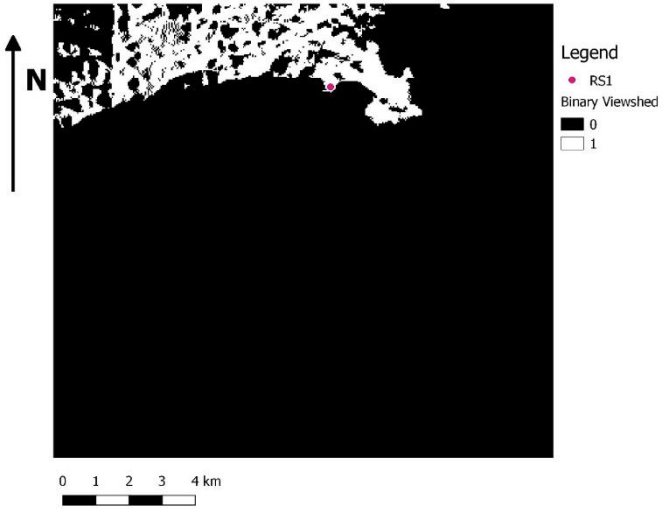
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APPENDIX A

Raised Structure 1



Photograph of Raised Structure 1 (meter stick for scale)



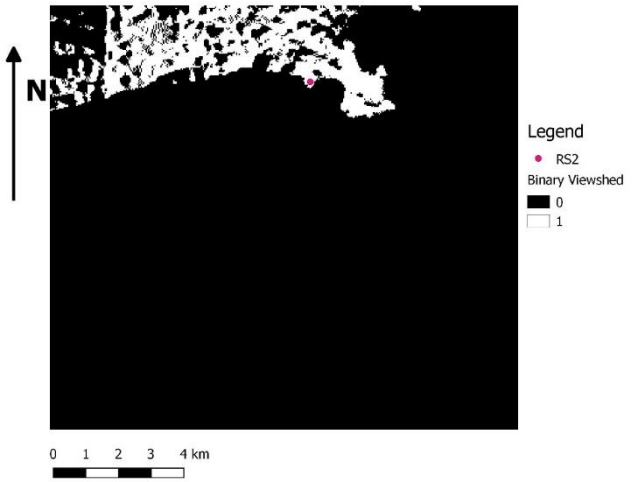
Binary Viewshed Map from Raised Structure 1

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.19m	1.91m	4	92	2	1611	9356km^2	7

Raised Structure 2



Photograph of Raised Structure 2 (meter stick for scale)



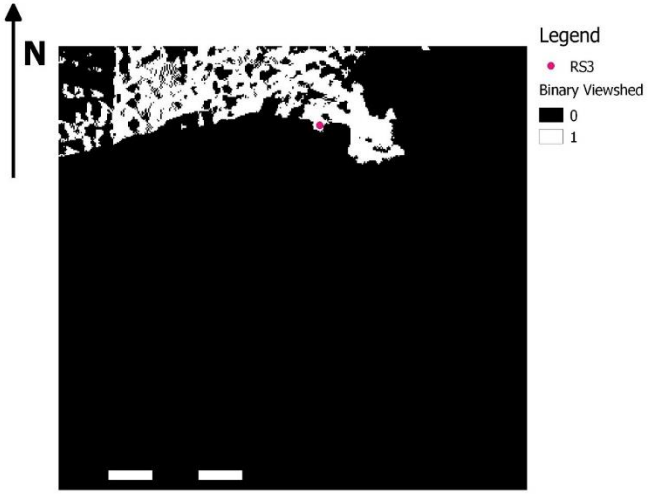
Binary Viewshed Map from Raised Structure 2

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.14m	3.99m	3	7	2	1609	8844km^2	10

Raised Structure 3



Photograph of Raised Structure 3 (meter stick for scale)



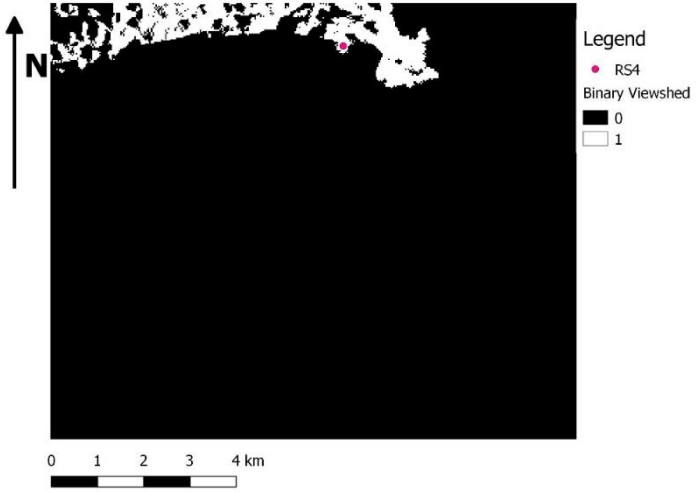
Binary Viewshed Map from Raised Structure 3

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.24m	5.37m	8	310	2	1607	8922km^2	12

Raised Structure 4



Photograph of Raised Structure 4 (meter stick for scale)



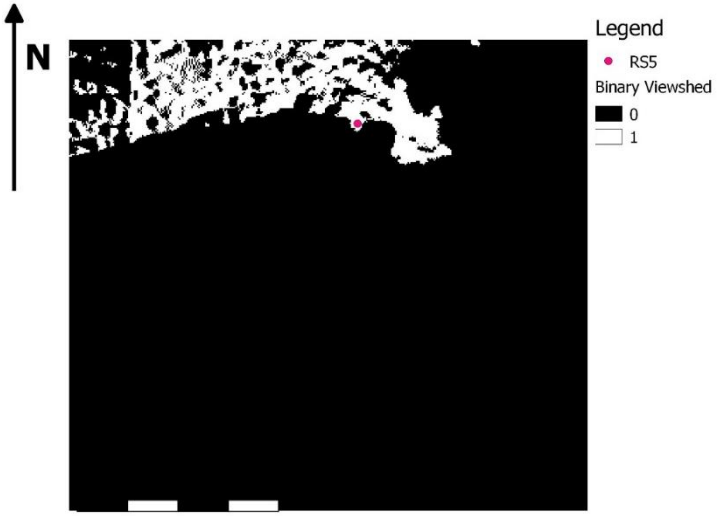
Binary Viewshed Map from Raised Structure 4

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.08m	4.63m	8	7	3	1607	8141km^2	12

Raised Structure 5



Photograph of Raised Structure 5 (meter stick for scale)



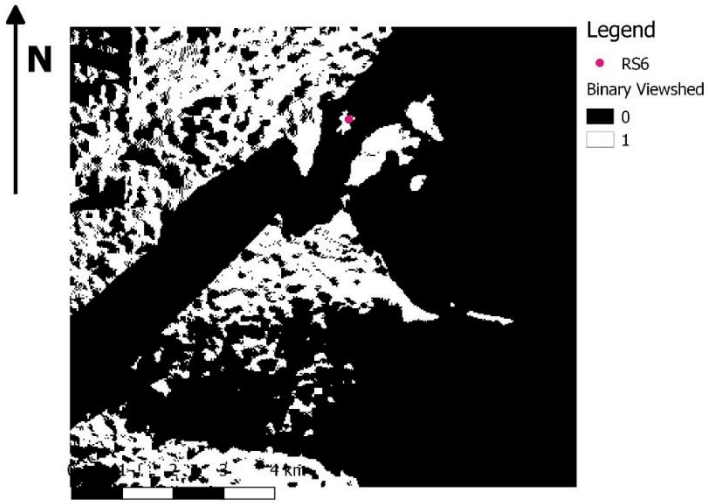
Binary Viewshed Map from Raised Structure 5

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.08m	4.33m	7	306	2	1607	8844km^2	12

Raised Structure 6



Photograph of Raised Structure 6 (meter stick for scale)



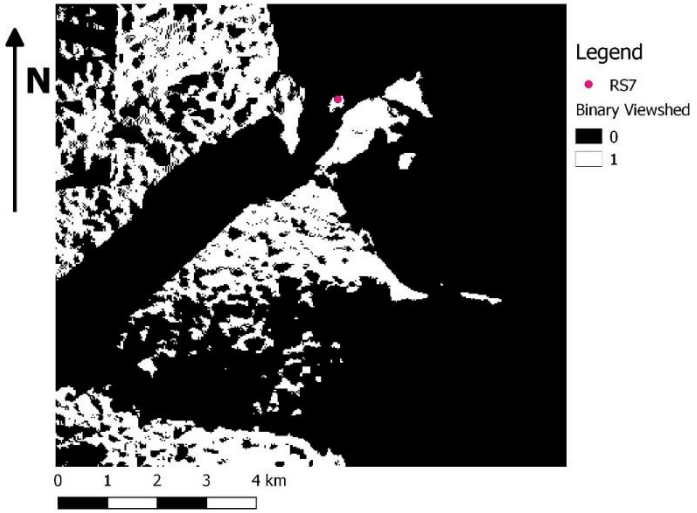
Binary Viewshed Map from Raised Structure 6

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.08m	4.16m	3	284	1	1619	27940km^2	20

Raised Structure 7



Photograph of Raised Structure 7 (meter stick for scale)



Binary Viewshed Map from Raised Structure 7

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.97m	5.87m	1	157	0	1620	26149km^2	31

Raised Structure 8



Photograph of Raised Structure 8 (meter stick for scale)



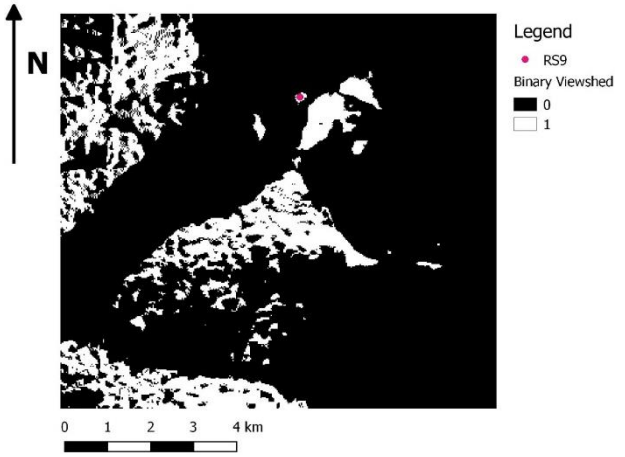
Binary Viewshed Map from Raised Structure 8

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.17m	6.31	16	262	2	1622	26149km^2	31

Raised Structure 9



Photograph of Raised Structure 9 (meter stick for scale)



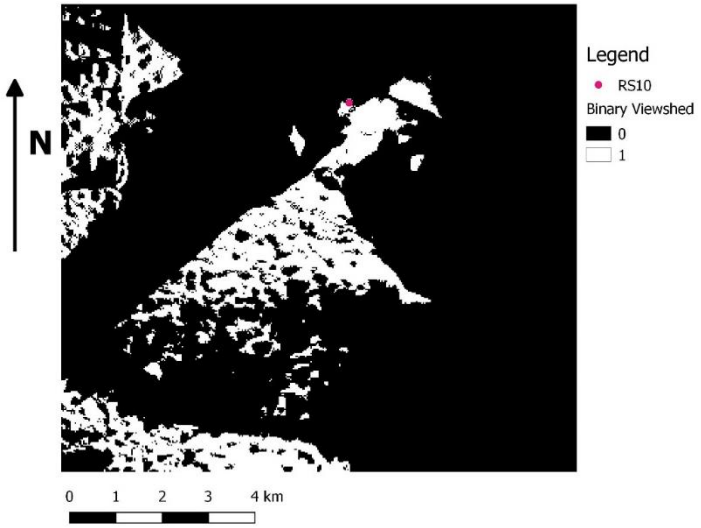
Binary Viewshed Map from Raised Structure 9

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.1m	7.95m	4	340	2	1618	19552km^2	26

Raised Structure 10



Photograph of Raised Structure 10 (meter stick for scale)



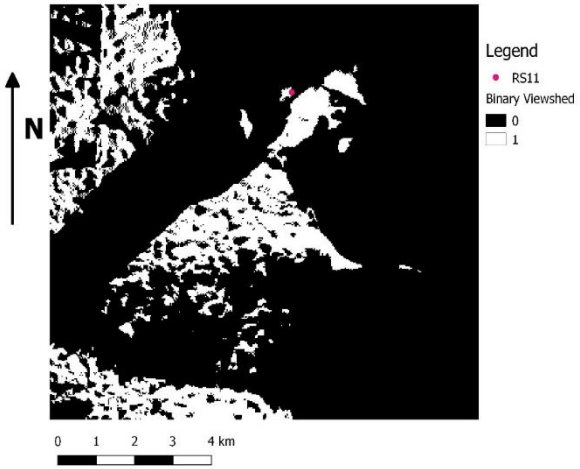
Binary Viewshed Map from Raised Structure 10

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.05	3.95	4	24	1	1623	18227km^2	30

Raised Structure 11



Photograph of Raised Structure 11 (meter stick for scale)



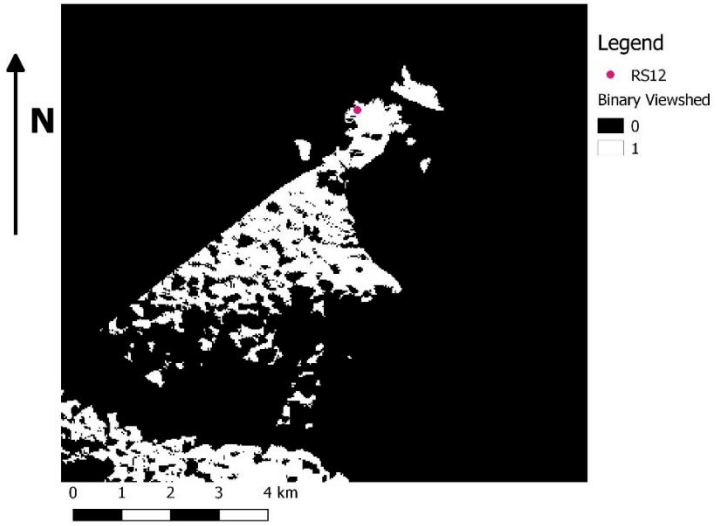
Binary Viewshed Map from Raised Structure 11

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.89m	4.15m	5	158	1	1623	20591km^2	28

Raised Structure 12



Photograph of Raised Structure 12 (meter stick for scale)



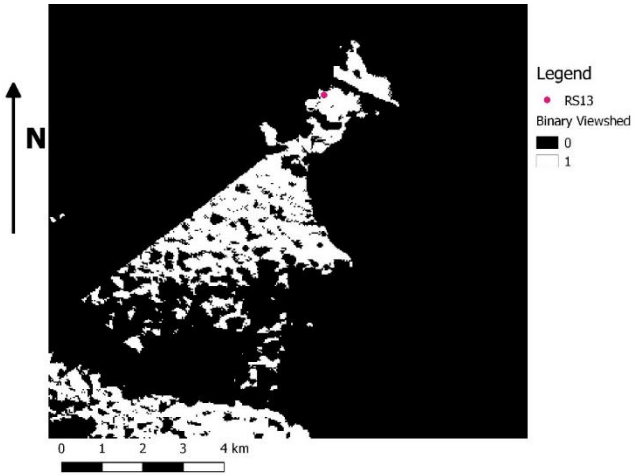
Binary Viewshed Map from Raised Structure 12

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.09m	5.74m	4	249	3	1613	13496km^2	31

Raised Structure 13



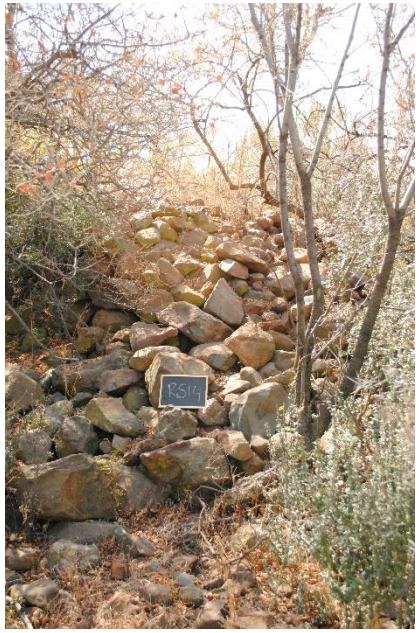
Photograph of Raised Structure 13 (meter stick for scale)



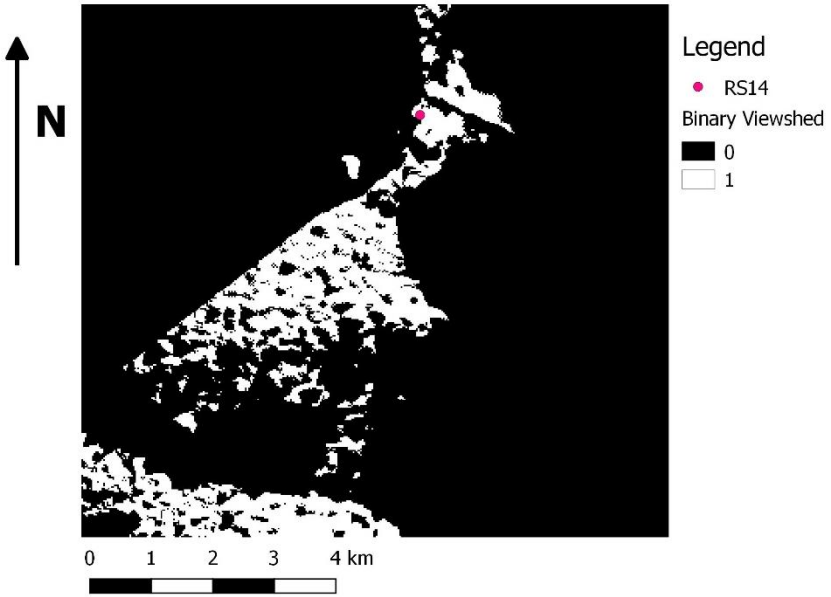
Binary Viewshed Map from Raised Structure 13

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.01m	535m	5	89	3	1622	14419km^2	31

Raised Structure 14



Photograph of Raised Structure 14 (meter stick for scale)



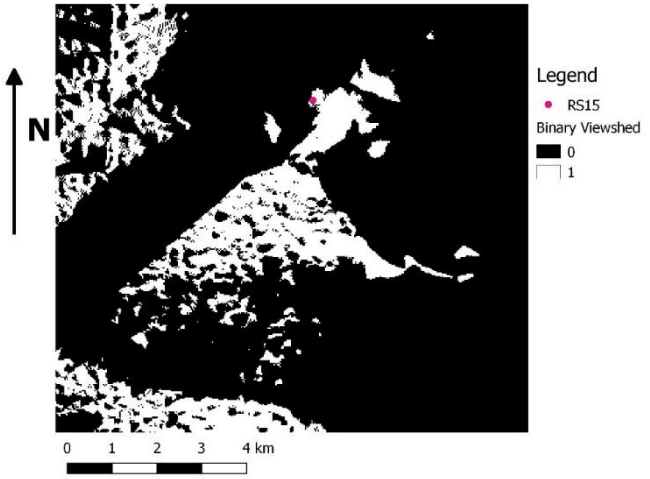
Binary Viewshed Map from Raised Structure 14

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.9m	4.31m	4	171	0	1621	14011km^2	26

Raised Structure 15



Photograph of Raised Structure 15 (meter stick for scale)



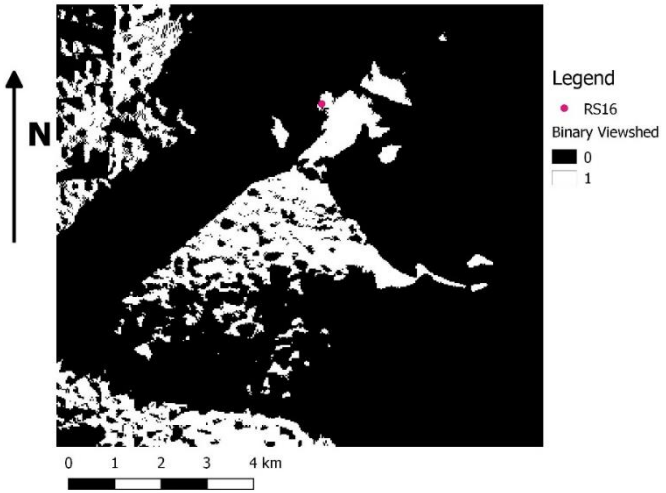
Binary Viewshed Map from Raised Structure 15

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.06m	4.97m	10	19	2	1615	20891km^2	38

Raised Structure 16



Photograph of Raised Structure 16 (meter stick for scale)



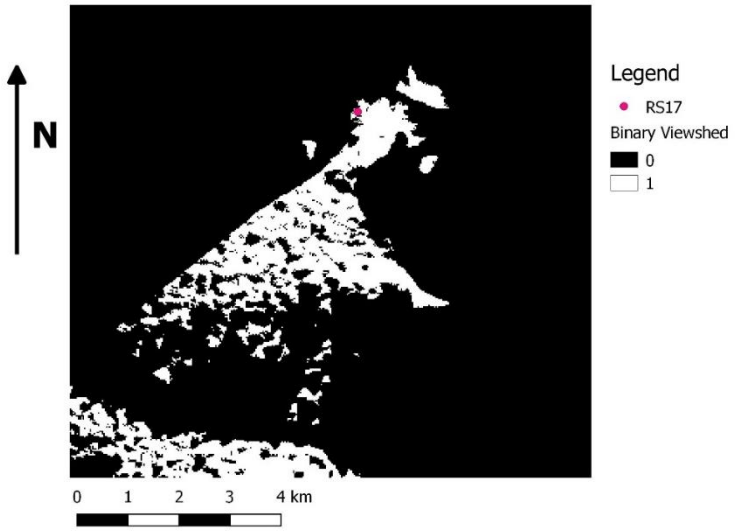
Binary Viewshed Map from Raised Structure 16

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.18m	8.79m	6	112	2	1616	20891km^2	38

Raised Structure 17



Photograph of Raised Structure 17 (meter stick for scale)



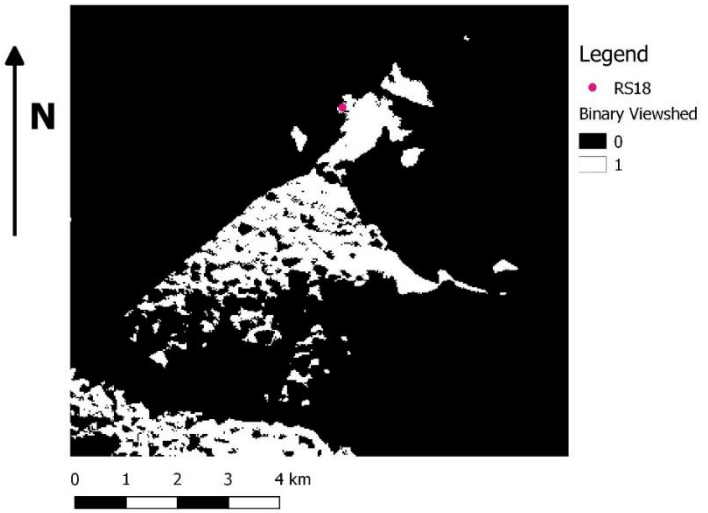
Binary Viewshed Map from Raised Structure 17

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.89m	8.05m	4	94	2	1612	14042km^2	33

Raised Structure 18



Photograph of Raised Structure 18 (meter stick for scale)



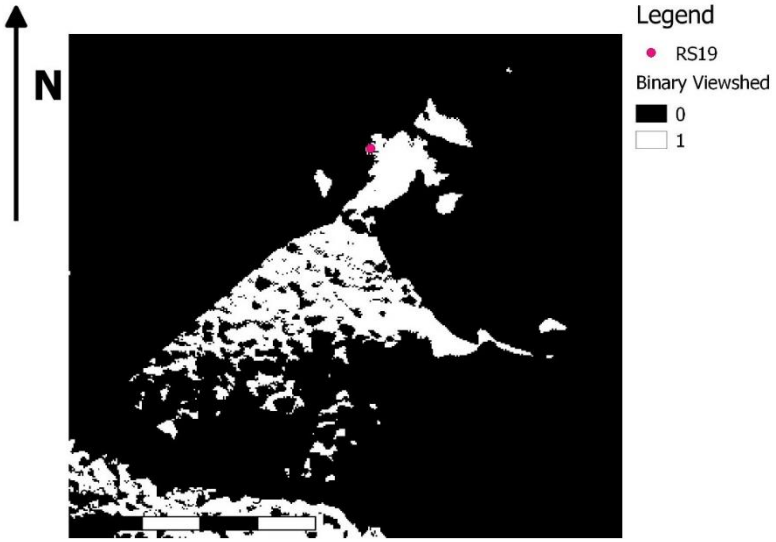
Binary Viewshed Map from Raised Structure 18

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.08m	7.21m	12	202	2	1614	15189km^2	37

Raised Structure 19



Photograph of Raised Structure 19



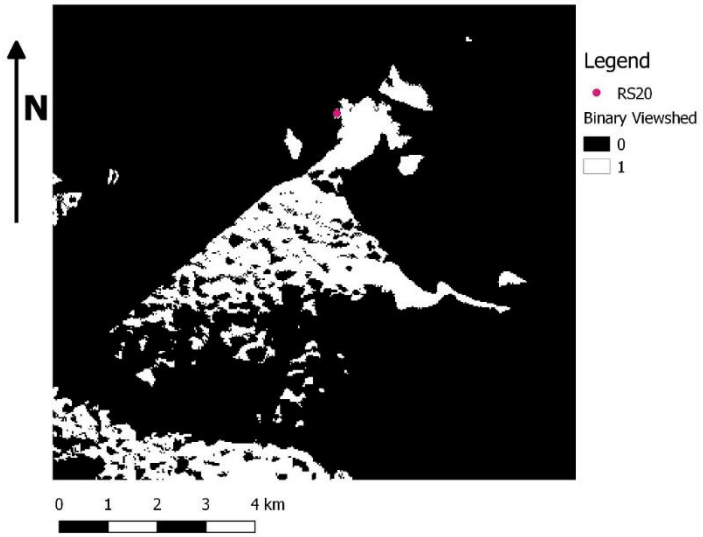
Binary Viewshed Map from Raised Structure 19

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.13m	5.9m	4	45	3	1615	15189km^2	37

Raised Structure 20



Photograph of Raised Structure 20



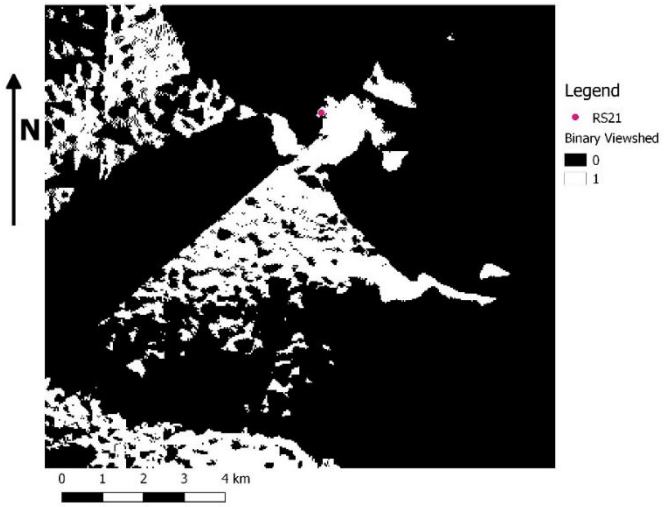
Binary Viewshed Map from Raised Structure 20

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.16m	6.67m	7	238	4	1615	15871km^2	37

Raised Structure 21



Photograph of Raised Structure 21



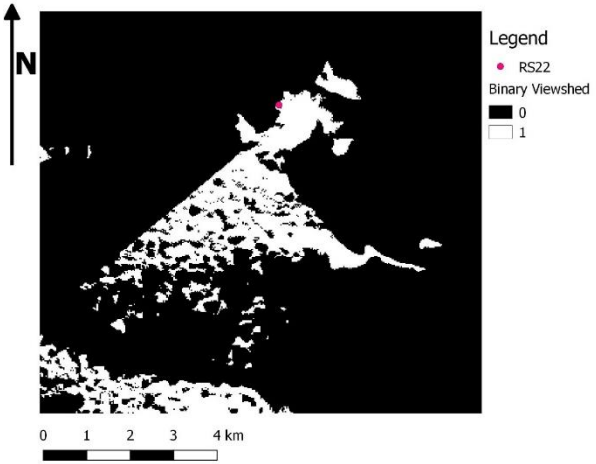
Binary Viewshed Map from Raised Structure 21

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.96m	7.04m	7	105	2	1612	22639km^2	37

Raised Structure 22



Photograph of Raised Structure 22



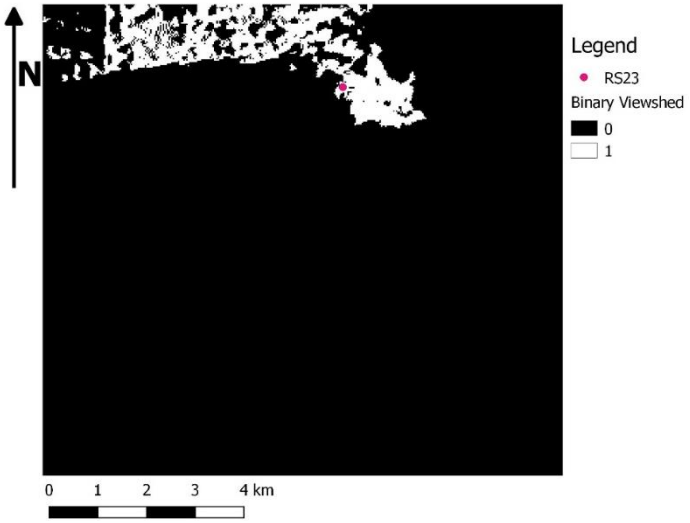
Binary Viewshed Map from Raised Structure 22

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.04m	**7.65m**	**14**	**139**	**2**	**1610**	**15965km^2**	**37**

Raised Structure 23



Photograph of Raised Structure 23



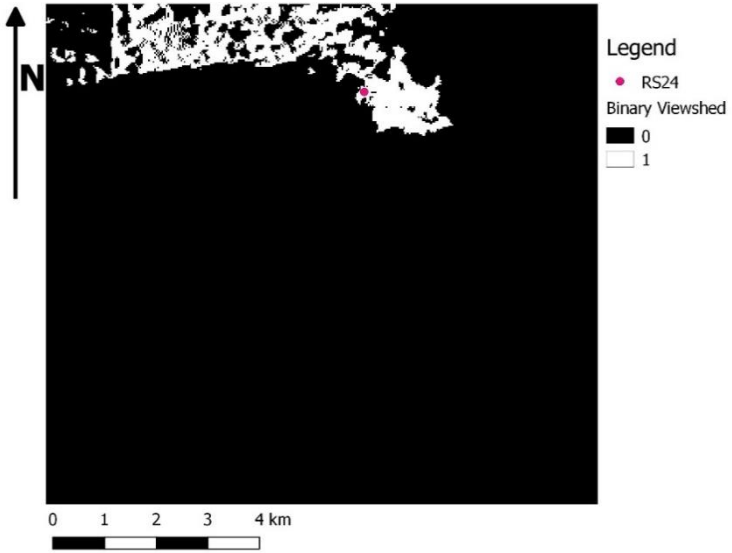
Binary Viewshed Map from Raised Structure 23

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.05m	5.27m	5	244	0	1608	6455km^2	21

Raised Structure 24



Photograph of Raised Structure 23



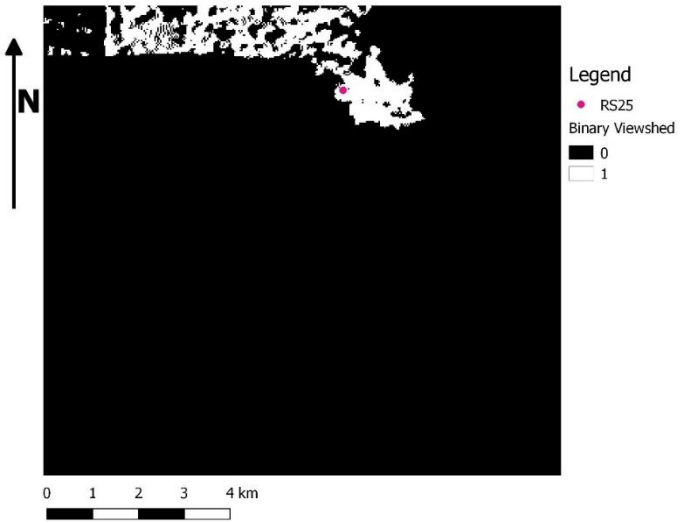
Binary Viewshed Map from Raised Structure 24

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.99m	3.4m	3	37	0	1608	6455km^2	21

Raised Structure 25



Photograph of Raised Structure 25



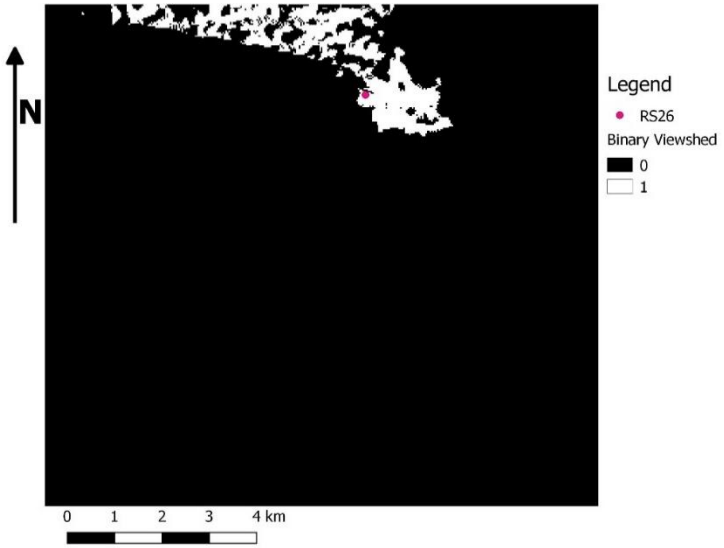
Binary Viewshed Map from Raised Structure 25

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.15m	4.91m	6	340	2	1613	5602km^2	24

Raised Structure 26



Photograph of Raised Structure 26



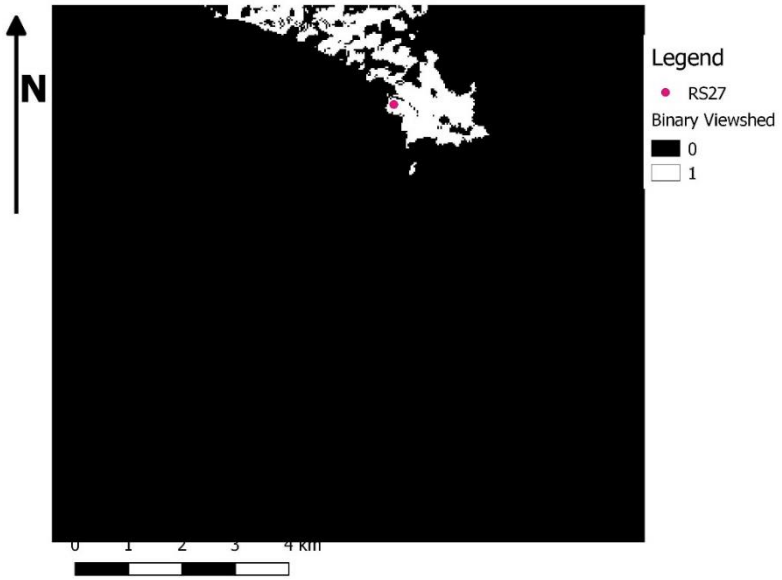
Binary Viewshed Map from Raised Structure 26

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.01m	6.91m	11	72	2	1615	4264km^2	24

Raised Structure 27



Photograph of Raised Structure 27



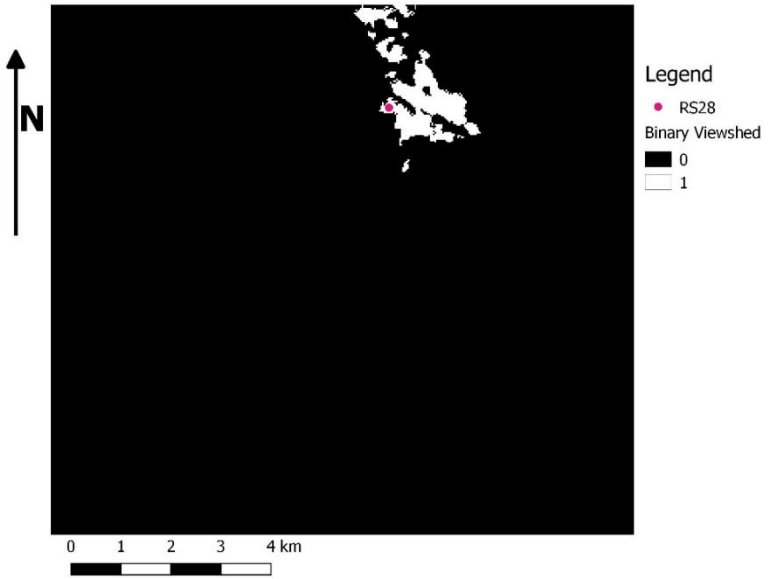
Binary Viewshed Map from Raised Structure 27

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.97m	3.79m	21	58	3	1622	3623km^2	23

Raised Structure 28



Photograph of Raised Structure 28



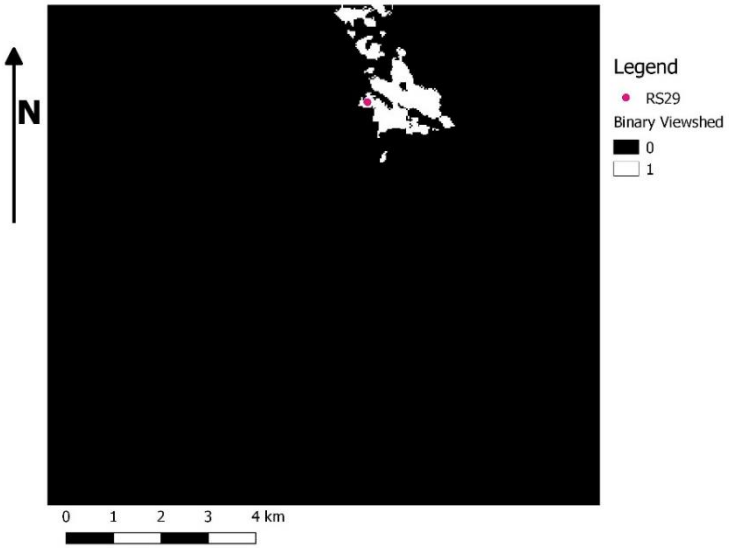
Binary Viewshed Map from Raised Structure 28

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.05m	8.1m	8	235	2	1622	1835km^2	23

Raised Structure 29



Photograph of Raised Structure 29



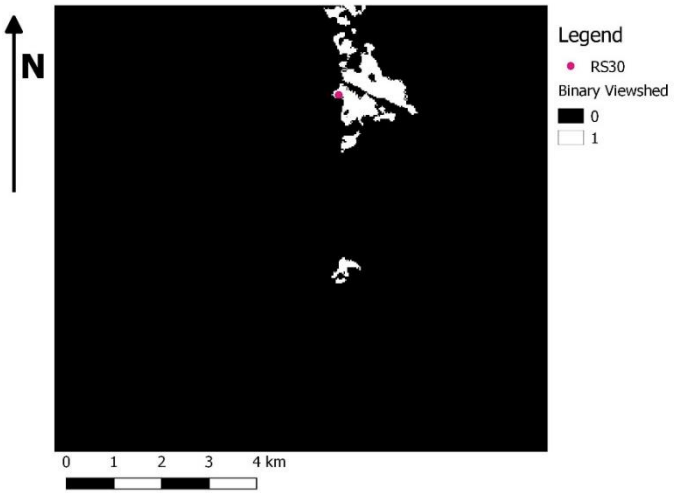
Binary Viewshed Map from Raised Structure 29

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.93m	8.66m	7	61	1	1622	1835km^2	23

Raised Structure 30



Photograph of Raised Structure 30



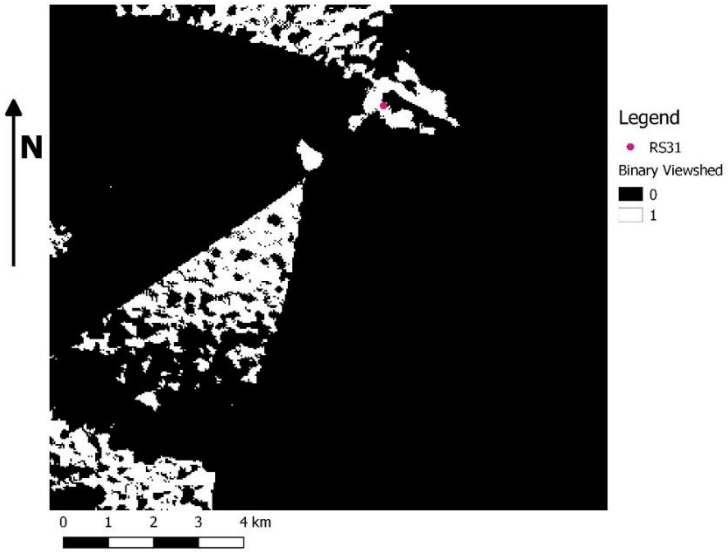
Binary Viewshed Map from Raised Structure 30

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
1.89m	5.21m	9	82	2	1624	2055km^2	24

Raised Structure 31



Photograph of Raised Structure 31



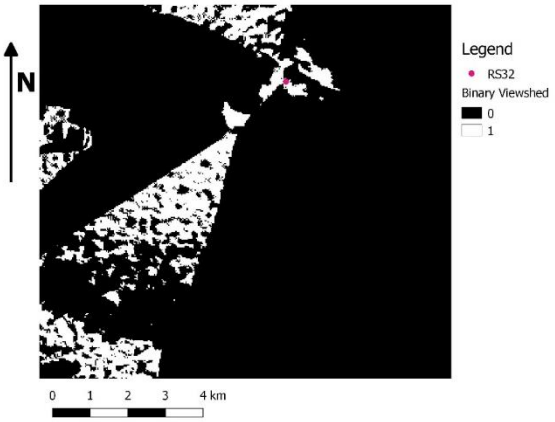
Binary Viewshed Map from Raised Structure 31

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.18m	5.11m	3	332	2	1627	11856km^2	34

Raised Structure 32



Photograph of Raised Structure 32



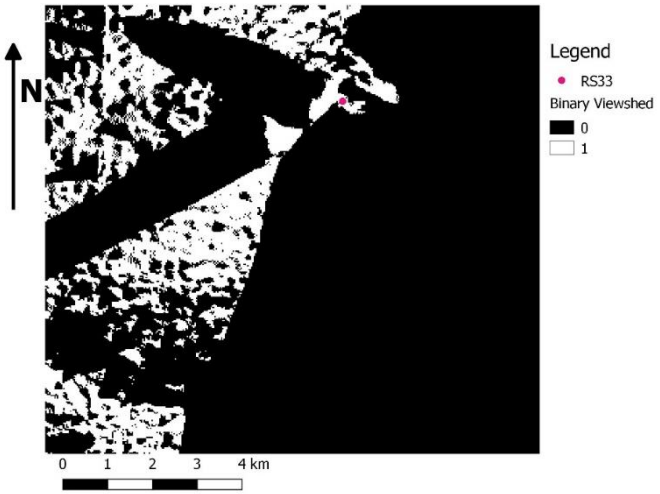
Binary Viewshed Map from Raised Structure 32

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.21m	9.85m	3	210	2	1630	12609km^2	34

Raised Structure 33



Photograph of Raised Structure 33



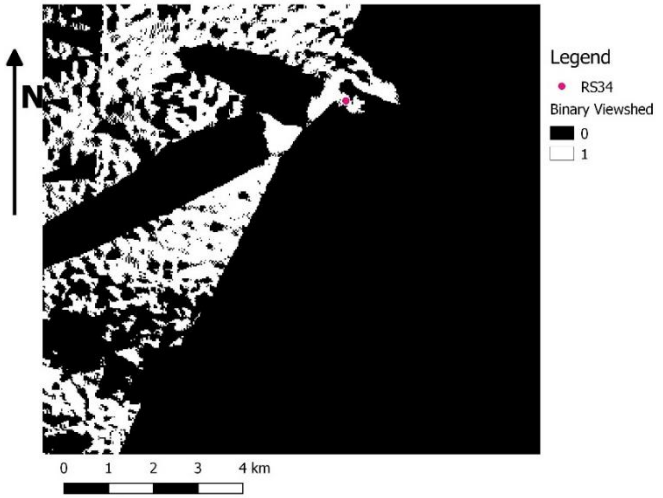
Binary Viewshed Map from Raised Structure 33

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.3m	6.5m	1	219	1	1639	19813km^2	35

Raised Structure 34



Photograph of Raised Structure 34



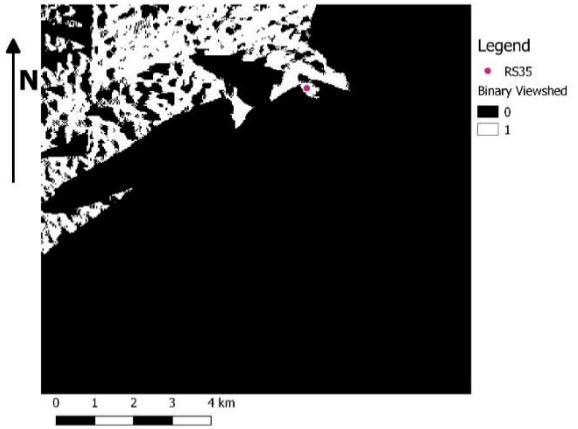
Binary Viewshed Map from Raised Structure 34

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.43m	5m	7	307	1	1650	21505km^2	36

Raised Structure 35



Photograph of Raised Structure 35



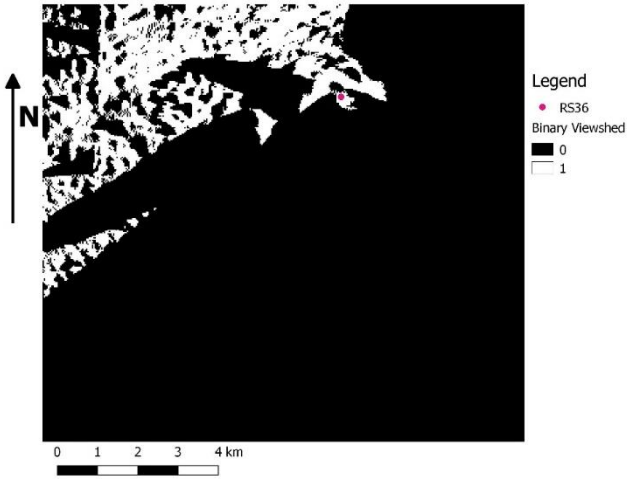
Binary Viewshed Map from Raised Structure 35

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.55m	5.86m	5	343	1	1658	15377km^2	36

Raised Structure 36



Photograph of Raised Structure 36



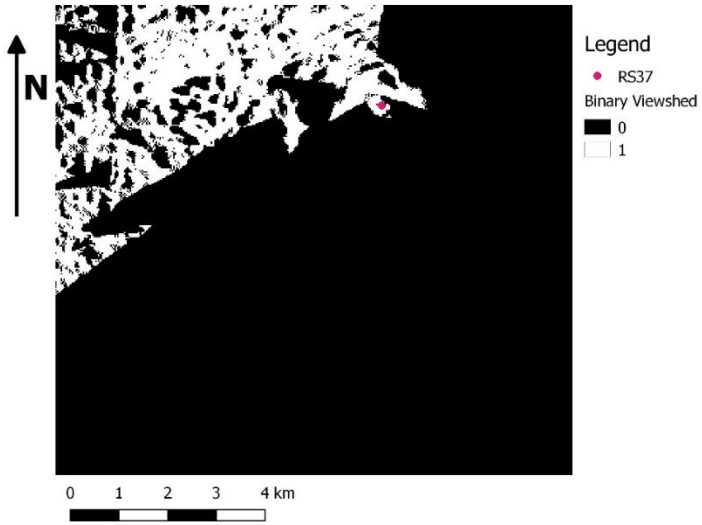
Binary Viewshed Map from Raised Structure 36

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.46m	7.57m	14	325	2	1655	14366	32

Raised Structure 37



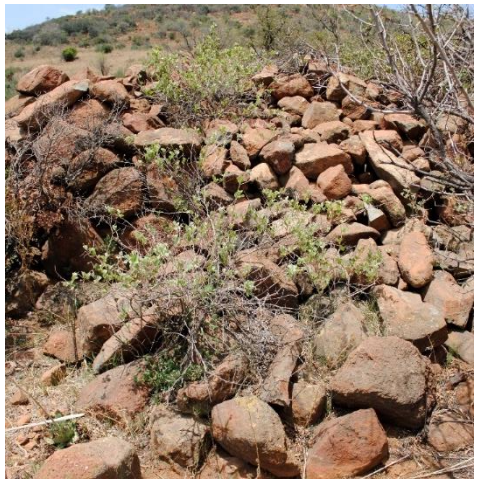
Photograph of Raised Structure 37



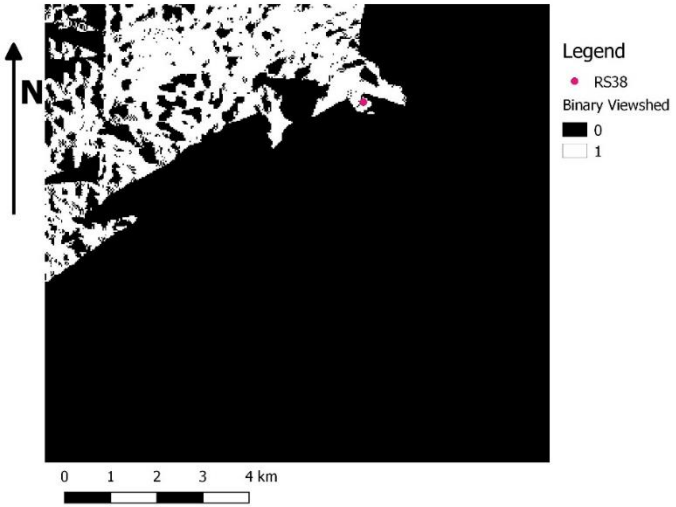
Binary Viewshed Map from Raised Structure 37

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.5m	5.23m	10	312	1	1668	16869km^2	35

Raised Structure 38



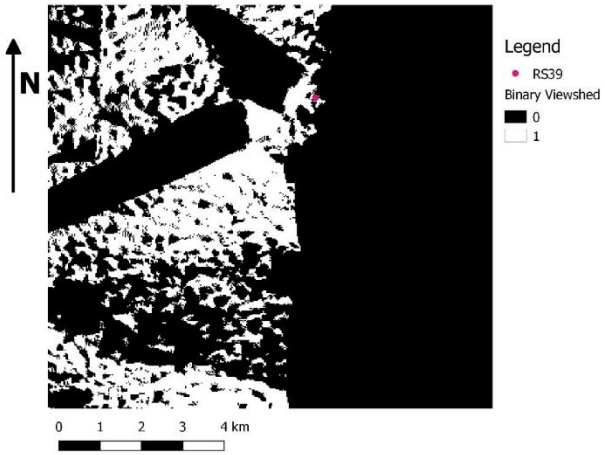
Photograph of Raised Structure 38



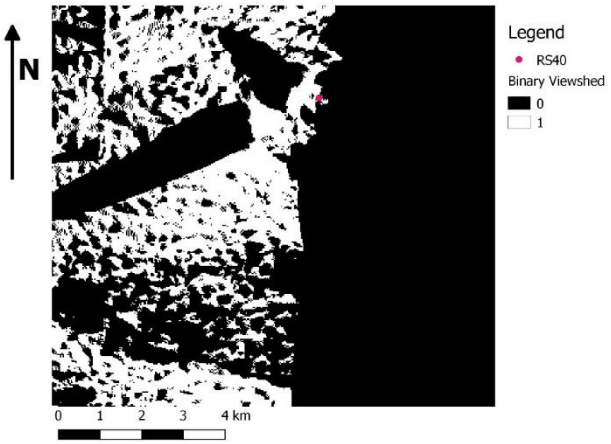
Binary Viewshed Map from Raised Structure 38

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.39m	4.91m	9	41	2	1671	17177km^2	35

Raised Structures 39 and 40



Binary Viewshed Map from Raised Structure 39



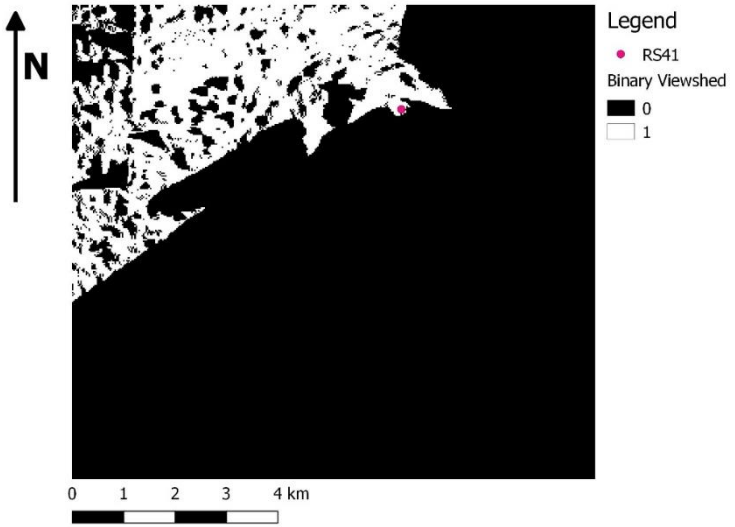
Binary Viewshed Map from Raised Structure 40

RS #	Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
39	2.26m	6.77	18	302	2	1646	29138km^2	31
40	2.33m	5.29	6	194	1	1649	32447km^2	35

Raised Structure 41



Photograph of Raised Structure 41



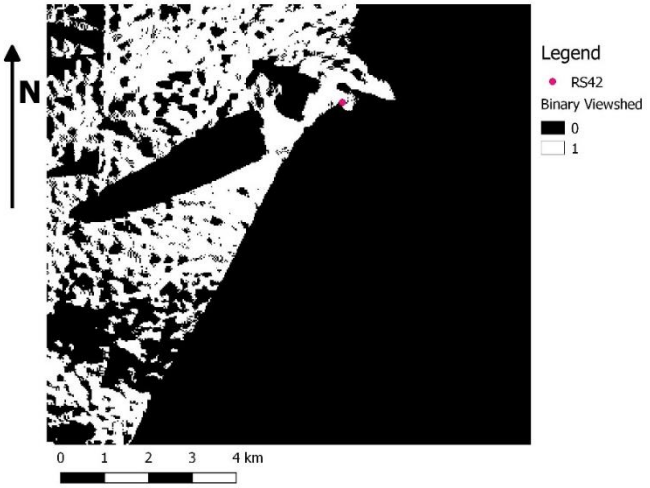
Binary Viewshed Map from Raised Structure 41

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.53m	7.93m	10	313	2	1679	19103km^2	35

Raised Structure 42



Photograph of Raised Structure 41



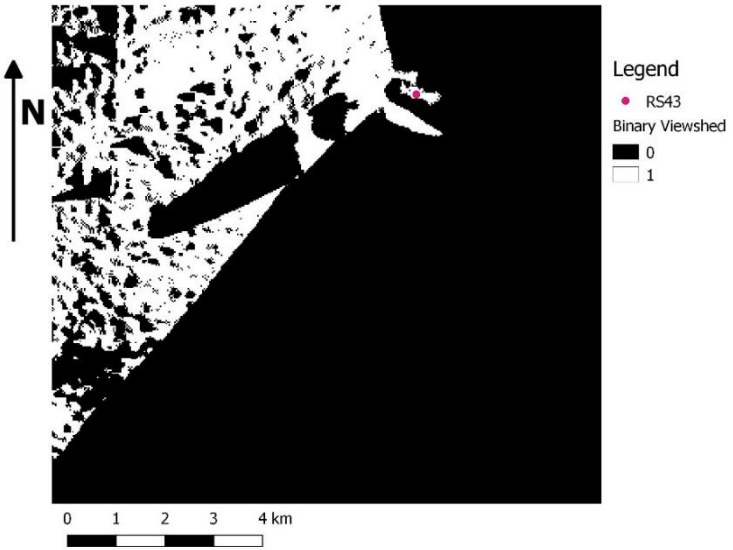
Binary Viewshed Map from Raised Structure 42

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.48m	4.39m	18	297	3	1657	28127km^2	36

Raised Structure 43



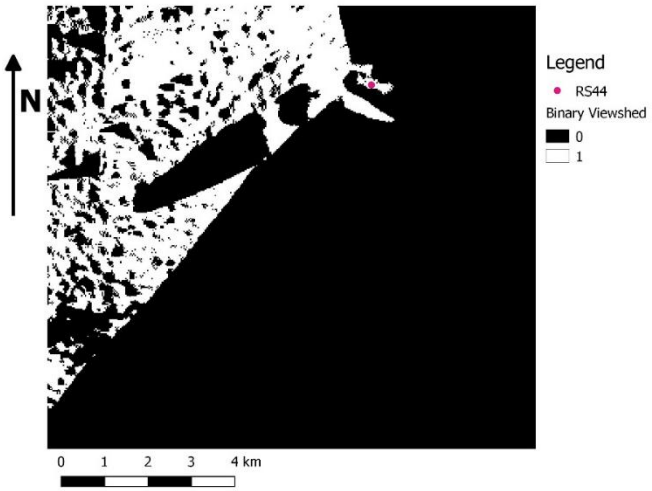
Photograph of Raised Structure 43



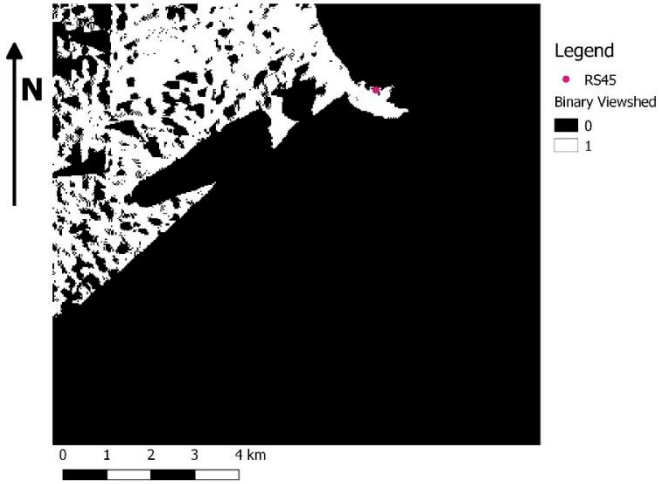
Binary Viewshed Map from Raised Structure 43

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.52m	8.17m	10	284	1	1696	24713km^2	38

Raised Structures 44 and 45



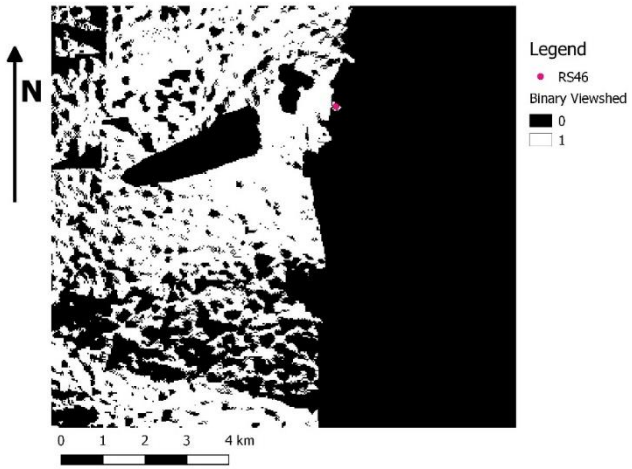
Binary Viewshed Map from Raised Structure 44



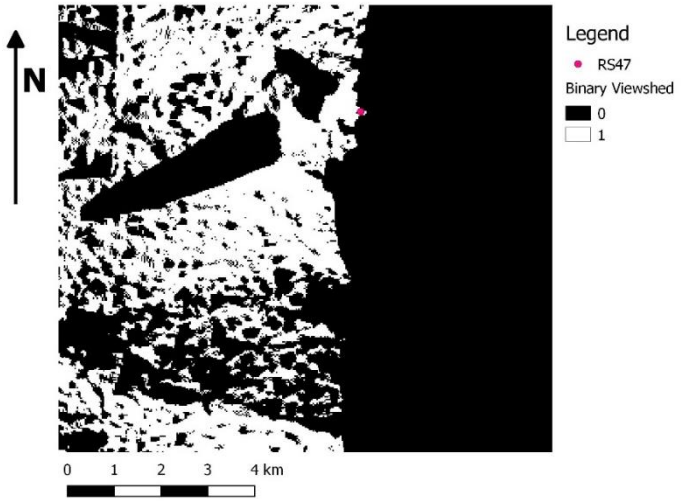
Binary Viewshed Map from Raised Structure 45

RS #	Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
44	2.52m	3.47m	18	276	2	1700	24713km^2	38
45	2.5m	2.96m	11	239	2	1696	20021km^2	37

Raised Structures 46 and 47



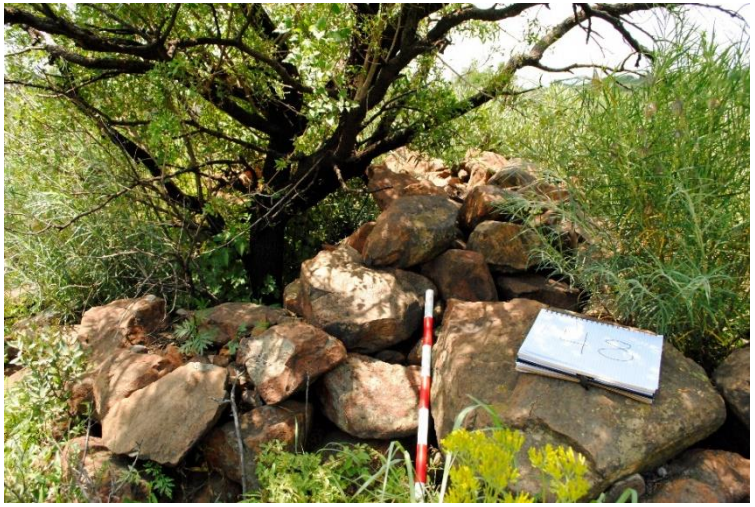
Binary Viewshed Map from Raised Structure 46



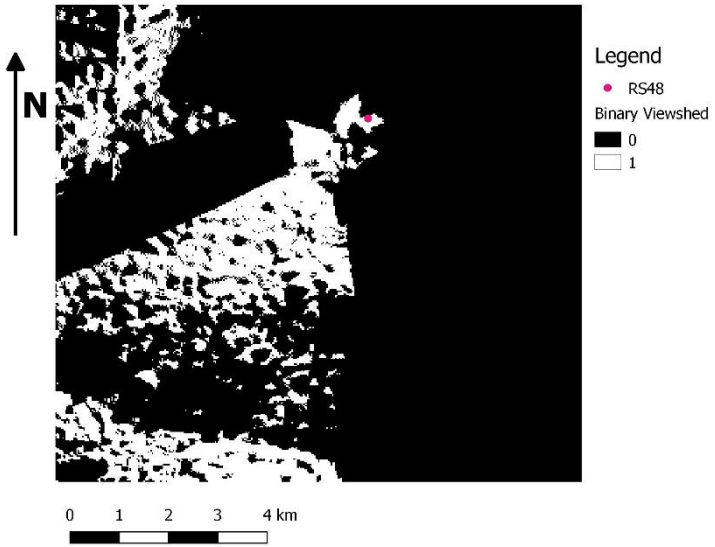
Binary Viewshed Map from Raised Structure 47

RS #	Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
46	2.51m	8.09m	18	281	2	1671	42514km^2	35
47	2.48m	4.54m	14	291	1	1656	37128km^2	36

Raised Structure 48



Photograph of Raised Structure 48



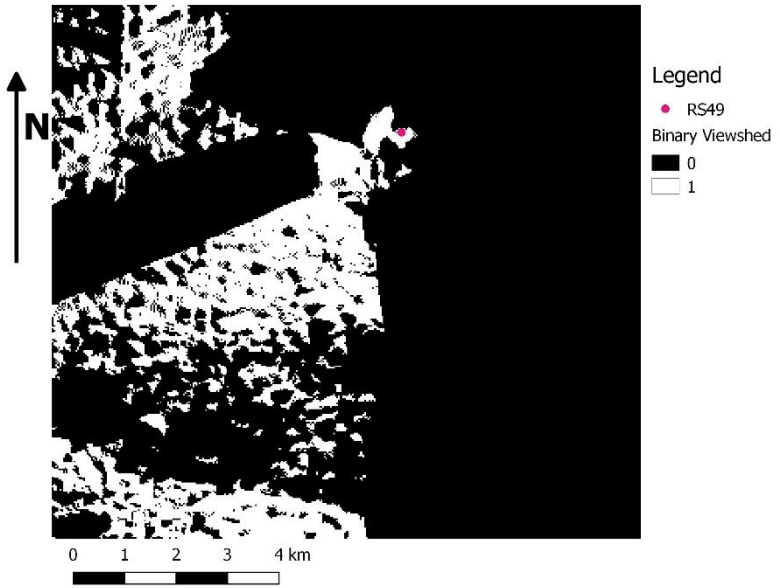
Binary Viewshed Map from Raised Structure 48

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.05m	**7.41m**	**10**	**294**	**2**	**1633**	**21385km^2**	**23**

Raised Structure 49



Photograph of Raised Structure 49



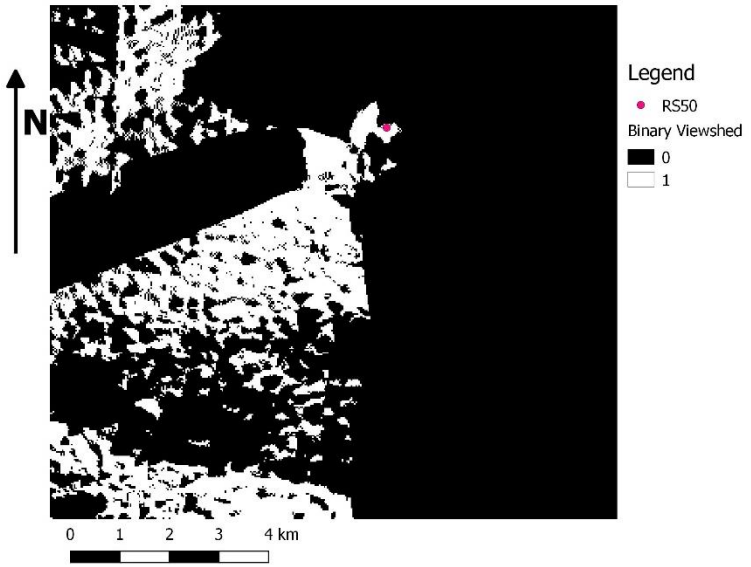
Binary Viewshed Map from Raised Structure 49

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.08m	**6.88m**	**8**	**193**	**3**	**1635**	**2300km^2**	**25**

Raised Structure 50



Photograph of Raised Structure 50



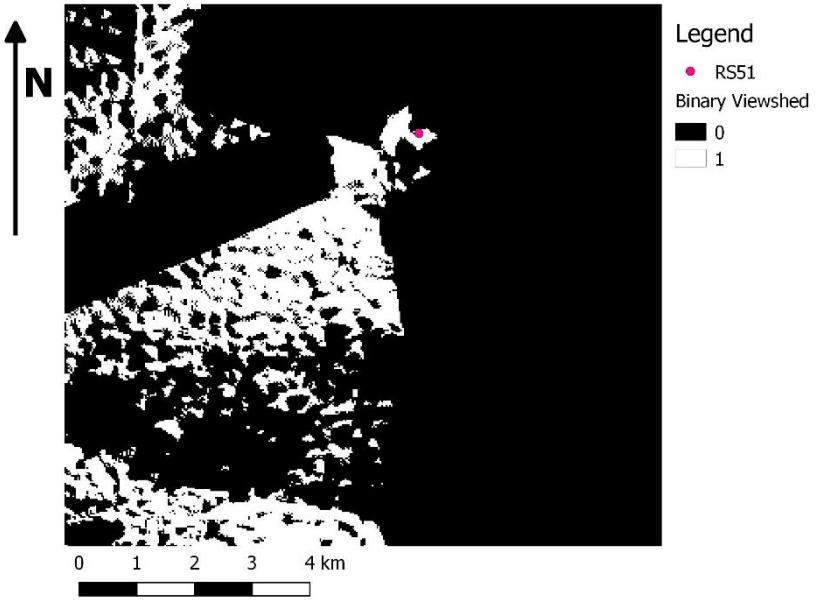
Binary Viewshed Map from Raised Structure 50

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.13m	**4.6m**	**6**	**312**	**2**	**1633**	**2300km^2**	**25**

Raised Structure 51



Photograph of Raised Structure 51



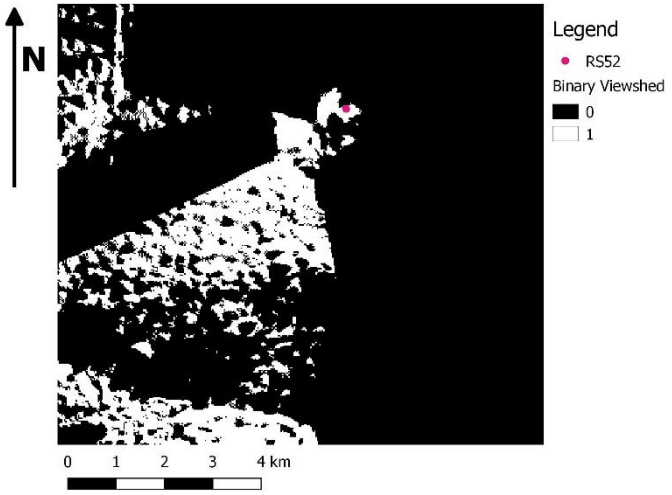
Binary Viewshed Map from Raised Structure 51

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.17m	7.96m	12	266	3	1632	20869km^2	23

Raised Structure 52



Photograph of Raised Structure 52



Binary Viewshed Map from Raised Structure 52

Height	Width	Slope	Aspect	Ruggedness	Elevation	Viewshed Area	Intervisibility
2.31m	2.56m	16	298	4	1631	18822km^2	23