Exploring the Stone-Walled Structures of the Suikerbosrand: a Study on Location, Visibility and Political Rankings

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Date of Submission: 28 October 2013

Honours project submitted in partial fulfillment of the requirements of the Degree of Honours in Archaeology of University of the Witwatersrand in 2013

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Abstract

The Suikerbosrand Nature Reserve has a number of Iron Age stone-walled structures situated in the landscape. The most recent stone-walled structures – the Group II stone-walled structures – date between the 17^{th} and 19^{th} Centuries, and have the highest potential for political stratification. This study aimed to identify political and social structures in the Suikerbosrand Group II sites, using Geographic Information Systems (GIS) and visibility analyses to establish an index for social and political rank. Links were identified between socially constructed landscapes, political hierarchies, economic control of resources and trade, and the interactions between site formation and visibility. A complex construction of social and political indices was identified, and a number of observations on social and political interactions were concluded.

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Chapter 1: Introduction

1.1. General Introduction

The Iron Age in southern Africa is a diverse field of study, ranging from ethnographic based research to quantitative studies. Understanding how and why people interacted with each other, their environment and their society has been key in Iron Age archaeological studies in recent years (Sadr 2012; Badenhorst 2009). Tracing the intricacies of early southern African politics can provide insights into past societies and their social structures. There are many Iron Age complexes in southern Africa to study, and the stone-walled structures in the Suikerbosrand area have been the subject of many studies over the past few decades (Huffman 2002; 2007).

Karim Sadr and Xavier Rodier (2012) conducted the most recent survey on the Suikerbosrand stone-walled structures using new technologies such as remote sensing and Geographic Information Systems (GIS). They identified 4 phases of stone-walled structures, Groups I, II, III and IV, and used a number of spatial analyses to identify trends in the settlement patterns. These spatial analyses included altitude, size/area, inner enclosure areas, clusters of stone-walled structures, the ranking of site/cluster importance with regards to social stratification, arable land proximity and chronology. They identified Group II stone-walled structures as showing the highest levels of social hierarchy. Group II was also the most recent group, dating between the 17th and 19th Centuries. A more detailed spatial analysis of this phase can offer a better understanding of these social and political structures. The Group II sites have a high potential for social stratification, especially if Clusters and Sub-Clusters are defined and used in a ranking system. The use of GIS analyses, such as a viewshed analysis, as well as statistical analyses, is one way to ascertain the potential for political indices.

This study aims to ascertain whether visibility can provide an index of social and political rank, and if a social and political structure can be ranked in the Group II Suikerbosrand sites. These rankings may indicate how the socio-political structure was formed. I hypothesise that the more important sites will be larger in size and number of stone-walled structures, have more associated middens and will be more visible, with more sites in their viewsheds. The rationale behind this hypothesis is outlined in the literature review.

1.2. Geographical Background

This study focuses on a 400km^2 area in the Suikerbosrand Nature Reserve, approximately 10km South of Katlehong and 13km West of Heidelberg.

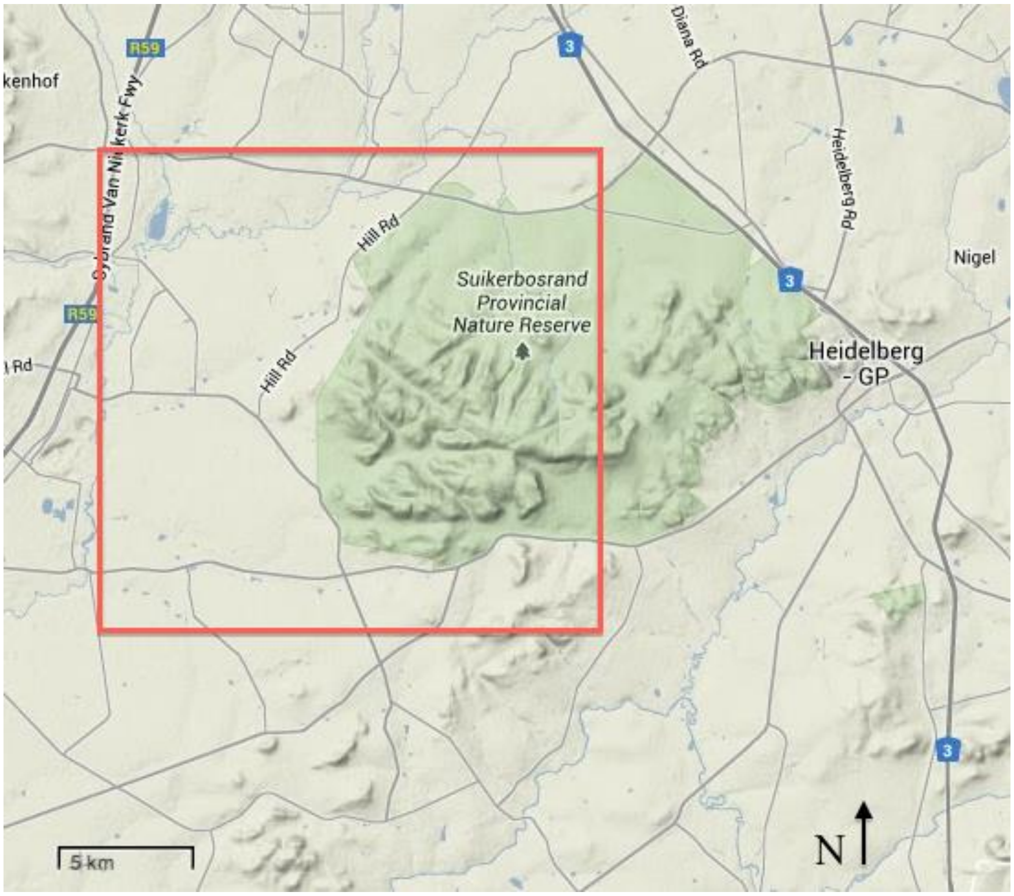

Figure 1: The study area (highlighted in red) and the surrounding features

The dominant vegetation type in the area is open grassland, and most of the surrounding areas are used for intensive agriculture. The nature reserve supports a large range of game and birds, and is a zone with diverse flora and fauna. The study area contains western and northern floodplain areas, and a southern plateau area. At the centre of the study area, more than 160 stone-walled structures are located just above these floodplains and plateau. The altitude of the area ranges from 1520m to just over 1840m. The area receives its highest rainfall in the summer months of January, February and December, which can be up to 150mm. During the winter months of June and July, there is also no rain in the area. The average temperature throughout the year is moderate, remaining above 0°C and below 30°C throughout the year. Due to its climate and agricultural potential, this area has been ideal for habitation by groups such as the Group II inhabitants at the centre of this study.

1.3. Theoretical Background

The research project focuses on merging archaeology with GIS studies, particularly visibility studies. I will be using landscape theory as a base for this project, as it aims to understand how an individual may have understood and experienced their social and political structures through their visual landscape. Landscape theory has been criticised in the past for its ambiguity and lack of clear methodology, and so its application in archaeological studies has been minimal (Llobera 1996:614). Research using GIS in an archaeological study, however, apllies both a clear methodology and clear aims as to what aspects of their society they want to investigate. The combination of GIS and archaeology is best defined by landscape theory, as it aims to identify how communities understand their landscape, and in turn how the landscape influences the communities (Llobera 1996:613).

Llobera's (1996) paper on using GIS in archaeology is useful for understanding how landscape theory can be applied in a number of different ways. His paper, however, does not adequately address the political influences within societies, and how societies interact with the landscape. There is too much standardisation of human behaviour, and he does not account for how politics may have influenced individual choices. Kosiba and Bauer (2013) suggest using a 'political landscapes approach' when applying landscape theory to studies on past societies. They attempt to bring the focus of the study back on the society, as often GIS studies become mostly about the landscape, and the behaviour is lost in the interpretation. Their approach focuses on how people use the landscape for economic and political gain, and how places are formed by interacting with the cultural constructs attributed to landscape (Kosiba and Bauer 2013:66). By studying the social and political boundaries within a landscape, the 'political landscapes approach' aims to move beyond the homogenous understanding of human actions. This can be done by combining GIS and environmental analyses with historical and ethnographic records; in other words, by mapping a political landscape (Kosiba and Bauer 2013:67). This project aims to use the ‘political landscapes approach’ as outlined by Kosiba and Bauer (2013) in order to ascertain whether visibility can provide an index of social and political rank, and if a social and political structure can be ranked in the Group II Suikerbosrand sites.

Chapter 2: Literature Review

The stone-walled structures in southern Africa have been a popular topic of study for a number of years in archaeology. The focus of study has shifted from identifying who made the structures, to how the structures may depict class distinctions or economic divisions within different societies (Sadr 2012:257). The most common categories used to identify different patterns in southern African stone-walled structures were outlined by Huffman (2007) as the Zimbabwe pattern and Central Cattle pattern. The patterns describe a structure organisation that is a spatial reflection of how a society may have functioned. The majority of southern African stone-walled structures have been studied using Huffman's patterns, leading to a larger focus on social structures and their physical manifestations in the archaeological record. Some archaeologists disagree with Huffman's definition of Central Cattle Patterns due to the diagnostic traits specified by Huffman (Badenhorst 2009:152), but their alternative methods used to understand past societies through stone-walled structures still place great emphasis on spatial characteristics and the site's associated ethnographies.

Many spatial studies of stone-walled structures in southern Africa use ethnographic evidence, as looking at spatial characteristics alone cannot provide a context in which varied patterns may fit. Huffman's (2007) categories were informed by his work on the Iron Age Venda and Sotho-Tswana sites (Huffman 2002; 2007); without the ethnographies, the variable social importance placed on different stone-walled structures would not be identifiable. The study conducted by Sadr and Rodier (2012) investigated the stone-walled structures in the Suikerbosrand area by using spatial analyses to survey the sites, and ethnographies to interpret them. They also used ethnographic evidence from a number of sources to suggest possible occupants of the area. They proposed that the occupants of the later, Group II Suikerbosrand stone-walled sites may have been pre-Sotho, Sotho-Twana or, more likely, a proto-Sotho culture of both Khoekhoen pastoralists and Bantu cultures (Sadr and Rodier 2012:1039; Sadr 2012:263). The survey included the classification and analysis of Group I, II, III and IV sites and middens in the area. For each category of sites, a number of spatial analyses were conducted, including: altitude, size, inner enclosure, dispersal vs aggregation, social ranking of the sites, arable land proximity and group chronology. They used Sotho, Sotho-Tswana ethnographic evidence to identify patterns in their spatial analyses, indicating possible trends of population drift and growing economic complexity for the stone-walled structures.

The information relating to site location, middens and political structures are particularly relevant to this study. Sadr and Rodier (2012:1041) noted how the analysis of site size and distribution can be used towards identifying political power and social stratification. The concept of political structures being important to the formation of settlement patterns in Southern Africa is present in much ethnographic research. Huffman (1986: 280) notes that political structures within a community are found in all Bantu-speaking groups, and while they are a social construct, they are also evident spatially in settlement patterns. There are specific places designated as places of importance, where, for example, issues may be discussed or people of a higher social rank may reside. These places are the spatial representations of political and social structures.

There was also a shift towards more complex Sotho-Tswana sites established from the late 17^{th} Century that represent an increasing population and growing political organisation (Boeyens 2003:69). A shift in climate around this time may explain why the large populations began to migrate, requiring an increased level of political leadership, structure and stability (Boeyens 2003:71), in order to survive in a harsher climate. The Group II sites in the Suikerbosrand area show the most developed social stratification, and date from this period (Sadr and Rodier 2012). This shift may have also led to different choices in site location as well as settlement size. Defensive settlement locations, with lower visibility, were common before the late 17^{th} Century, but after this time many settlements were positioned closer to resources such as water or wood (Boeyens 2003:71). Huffman (1996:58) ascribes the large population increases and site location in this period to the maize production in the area. Maize grindstones and maize found in the large Suikerbosrand sites show evidence of the production of maize in the area, and Huffman notes how the sites increase in both size and visibility as maize production increased in the area. He also believes that the effects of the climate shift around this time may have been worsened by a dependence on maize, creating more political tensions and an increasing need for larger settlements due to defence and safety (Huffman 1996:59). Increased political tensions and competition for resources may have been expressed through kinship claims on land, where stone-walled structure formation and placement was influenced by political manoeuvring (Mitchell and Whitelaw 2005:229). The landscape and site formation are therefore important factors when assessing political structures.

Middens too may be an indicator of political importance manifested in the physical landscape. Sadr and Rodier (2012) note that large middens indicate court areas, therefore associating large middens with political importance. The Suikerbosrand middens are usually within 5km of arable land, and are most closely associated with the later Group II sites. This suggests that the link between political power and agriculture may be a factor in site and midden location. Middens have been used to indicate the political power in other Iron Age sites (Huffman 1986). A large midden in proximity to a stone-walled structure indicated the wealth and social status of that household. Boyens & Plug (2011:7) found that around the late 17th Century within the Sotho-Tswana groups, middens began to replace cattle kraals as areas where important political discussions would take place. The shift of kraals to middens also indicated increasing political complexities within a group, and a larger scale of social organisation. Middens have also been viewed as an indicator of the fertility and productivity of a household. Middens specifically associated with households and kinship are common, as they are composed of the disposals from a kin unit (Hall 2012:312). Middens are therefore important as both political meeting areas, and household identities used to establish kin authority. Nicholas David (2013) links the location of a midden to the richness of the household, where importance was associated with the size and proximity of the midden. Middens, when linked to location and density, can indicate the level of political complexity within a site.

The Suikerbosrand pottery has been subject to analysis (Huffman 2002; Huffman 2007) in order to identify the possible occupants of the area, however Sadr and Rodier (2012) were the first to subject all stone-walled structures in the area in terms of spatial analyses. Group II sites in particular were noted as being the group with the highest potential social stratification, as they had the largest clusters and were in proximity to the largest middens. Looking at how size, visibility, distribution, site location, middens and political complexity are all related in the ethnographies (Boeyens 2003; Hall 2012; Huffman 1996; Mitchell and Whitelaw 2005), it is clear that in order to gain a better understanding of the occupants in the area, more complex spatial analyses on each specific group of sites is required. This was suggested by Sadr and Rodier (2012), and the potential to take the study of cluster analysis further in order to gain a fuller understanding of the occupants is highest in the Group II sites. The idea that places of power are often large, have a higher visibility, are close to arable lands, have many middens associated with them, and their locations are often chosen with care and intent, indicates a need for a visibility study to be conducted on the Group II Clusters in the Suikerbosrand area.

Visibility studies cover a wide range of applications, not only in archaeology, but also most prominently in geography. Using Google Earth and GIS has led to the increasing popularity of spatial analyses. There are a number of useful applications for a wide range of fields, but the use of visibility studies in archaeology has been applied prior to the application of GIS (Lake and Woodman 2003). The practical methodologies of visual analysis, such as GIS, have developed alongside theoretical methodologies, namely the phenomenological and embodiment theories. These theories emphasize that viewing space in the way that it may have been viewed in the past offers archaeologists a chance to interpret how space may have been interacted with and shaped in the past, the perception of power and space being key in this study (Frieman and Gillings 2007). By using GIS, landscapes may be studied as active entities that are a mixture of physical features, social constructions and spatial practices. The archaeological landscape, being a product of the social and political realms, can be analysed to gain a better understanding of these social and political structures (Kosiba and Bauer 2013:62).

There are problems associated with using visibility studies to analyse the political structures of past societies. Archaeologists use what is available to them, in both the archaeological record and landscape, and sometimes the physical landscape is studied without attempting to investigate how the landscape may have been viewed in the past. This lack of ethnographic focus, and the reliance on sight analysis alone, can lead to a mono-dimensional interpretation of past social structures (Frieman and Gillings 2007:5; Llobera 2007). This criticism has been levelled against many archaeological studies that use visibility and GIS. Recent studies accept that there is a gap in ‘perception’ that archaeologists are unable to fill with GIS analyses alone (Llobera 1996:613). By attempting to incorporate ethnographies into visibility analyses and the interpretation of these analyses, archaeologists can attempt to move beyond visibility alone when interpreting past social structures (Kosiba and Bauer 2013:67). This offers a more thorough approach as to how a landscape may have been perceived by those who inhabited it (Lake and Woodman 2003; Frieman and Gillings 2007).

Intervisibility studies conducted on ancient landscapes have become more popular in the past few decades. Viewshed analyses are used in a wide range of archaeological applications, especially the studies focused on a number of sites in proximity to each other (Frieman and Gillings 2007:6). Wheatly (1995) used intervisibility and statistics to study Neolithic Long Barrows in Southern England. He attempted to understand how existing monuments in the landscape affected where new Barrows were built and placed, showing how a social structure may have been influenced by intervisibility. There were two different areas that placed different importance on intervisibility between monument sites: in one area, sites seemed to have a high intervisibility rate, and in another area, sites seemed to be unrelated. This spoke to the nature of the culture and practices surrounding funerary rituals for the different inhabitants. Intervisibility has been used in a wide variety of archaeological studies, and recently the focus has shifted from what is merely visible to how the social context relates to feature formation (McCoy and Ladefoged 2009:272). In order for a visibility study to be successful, the landscape is only one factor in understanding the past; social and political complexities, as well as agency in site formation, must be integrated into the study (McCoy and Ladefoged 2009:273). The Suikerbosrand inhabitants may have viewed political structures as inherently linked to the landscape and intervisibility, and so these factors should not be mutually exclusive during this study.

There have not been many visibility studies conducted on southern African stone-walled structures, but if ethnographical evidence indicates that the size of a structure and size of a midden is seen as more politically important (Huffman 1986; Hall 2012:312), it is possible that those with larger structures and more power may have wanted to be more visible. Site visibility was also noted as being higher from the 17th Century (Boeyens 2003:71), indicating a change in the way landscape was interacted with, and the meaning placed behind the importance of being visible. The Suikerbosrand Group II SWS are therefore interesting to study with regards to shifting perceptions in visibility and political structures. Understanding how the occupants interacted with, formed and viewed the landscape will give a greater understanding to how the political complexities were shifting around this time. With so much debate around whom the inhabitants were (Sadr 2012:263), understanding their political practices and how they relate to visibility may help our understanding of their social practices.

Chapter 3: Methodology

3.1. The Samples

In the Suikerbosrand, the Group II SWS appear to be clustered in a number of dense groups. In order to establish whether there is a complex political structure within the Group II stone-walled structures, this study focused on running a number of spatial analyses on these sites. The scale of the project limits the number of analyses that can be run on individual stone-walled structures, and so creating clusters of stone-walled structures will reduce the number essential of analyses, while still maintaining a framework from which a political structure can be identified. For the purposes of this study, sites within the Clusters and Sub-Clusters are established as follows:

- Sites that are within 1000 m of each other will be considered to be in the same Cluster.
- Sites that are within 275 m of each other will be considered to be in the same Sub-Cluster.
- Sites that are within 500 m of a Sub-Cluster will be classified as outliers that are related to that Sub-Cluster.
- Middens that are located within 150 m of a Sub-Cluster will be classified as middens related to that Sub-Cluster.

The distances above were determined by using mapping software to assess the arrangement of the SWS and middens. The SWS and middens in proximity to one another were measured, however the values determining the related sites were assigned by myself according to what I believed to be most suitable. Due to this, it must be noted that it is possible that the following analyses results are biased.

These proximity measurements were used to collect the visibility data and run the analyses. The SWS points were from Sadr and Rodier's (2012) survey, collected from Google Earth imagery and converted to shape files for use in GIS programs. Their classification of Group II structures was also employed.

3.2. Viewshed Analysis Specifications

Using the ArcGIS software, namely the ArcScene program, viewshed analyses were conducted on a number of sites. The viewshed analysis tool can be found in the ArcScene "Toolbox", under the menus:

- 3D Analyst → Raster Surface → Viewshed

Before running the viewshed application, the extent of the viewshed was specified as 20 km by 20 km (400 km^2). To run the viewshed analysis, the DEM file (.tiff) and point files of the SWS (.shp) were used. The viewshed analyses are conducted on a raster file, and the results are in the form of binary data: The value 0 is given to the number of pixels not visible, and the value 1 is given to the number of pixels that are visible. These values appear as two different colours on the DEM file on a separate layer.

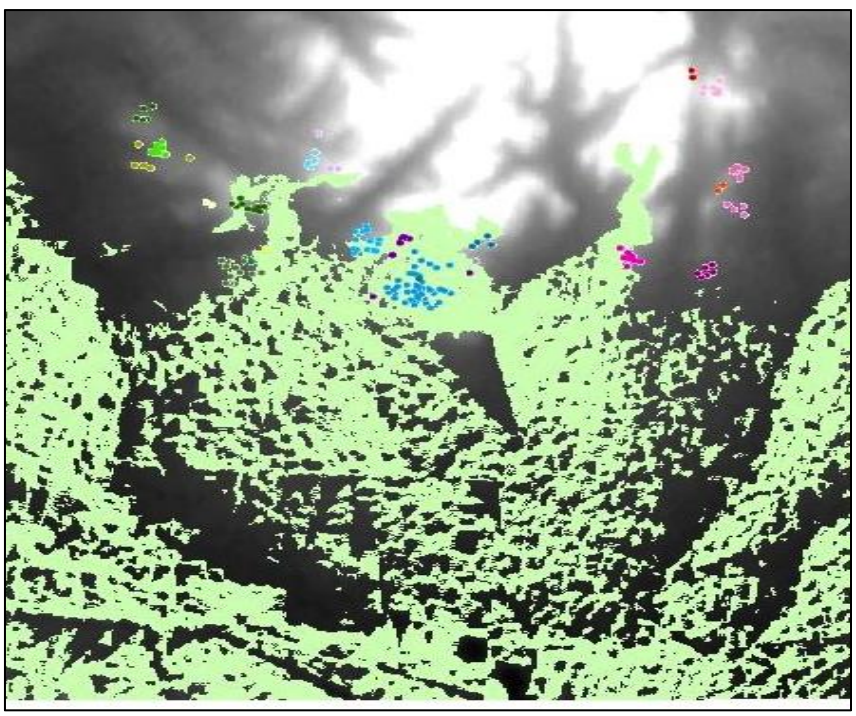

Figure 2: A viewshed analysis run from a set of SWS. The green area is the visible area from the entire Sub-Cluster.

3.3. The Viewshed Analysis

The analyses were run for each Sub-Cluster from four points. The sample selection for the first three viewpoints in a Sub-Cluster analysis was based on altitude. These three viewpoints were specified as:

- The SWS at the highest altitude within the Sub-Cluster
- The SWS at the lowest altitude within the Sub-Cluster, and
- The SWS within the Sub-Cluster that is closest to the altitudinal mean of all of the SWS within the Sub-Cluster.

A viewshed analysis was conducted from these three viewpoints. The final viewshed analysis was a multiple viewshed analysis, run simultaneously on every SWS in the Sub-Cluster. A separate .shp file was created to include all points (SWS) within the Sub-Cluster. This was run through the viewshed analysis function, using the DEM file and the new .shp file. The results show the total area that is visible from all the SWS in the Sub-Cluster. This process was repeated for each of the 13 Sub-Clusters within all 3 Clusters. Each Sub-Cluster had four viewshed analyses in total. These results were tallied and averaged for the final viewshed value for use in the analyses.

Viewsheds were also run for 5 points (1.5 km apart) along both the northern and western floodplains, and the southern plateau. The points were taken along lines that ran parallel to the rivers of the floodplains, and the line that ran along the flattest topographical area of the plateau. The motivation behind running these viewsheds will be addressed in the discussion. These viewsheds were used for the Agricultural Visibility analysis.

3.4. Data Collection

3.4.1. VISIBLE AREA ANALYSIS

After the viewsheds were run, the visible vs. non-visible areas within the 400 km^2 area were calculated as a percentage, and tabulated for each sample. The values were compared to evaluate which Sub-Clusters have the highest visibility, and following this, are the most visible. The 13 Sub-Clusters were ranked within the sample area, and the 3 Clusters were ranked.

3.4.2. SITE VISIBILITY ANALYSIS

For each viewshed analysis, the number of Group II sites seen from the averaged viewshed results was counted, and the values tabulated. These values were compared, to evaluate which Sub-Clusters and Clusters are able to see the most SWS, and following this, are visible from most other SWS. The Sub-Clusters were ranked within each Cluster from most to least number of seen SWS, and each Cluster was ranked from most to least number of seen SWS.

3.4.3. AREA AND SITE VISIBILITY ANALYSIS

The values of area and site visibility were analysed together for each sample. This was to assess whether there were any trends between the area of visibility of a sample and number of sites seen from that sample. The ratio of SWS seen to the sample's visible area was calculated, and the percentage calculated from this. These percentages were compared to evaluate which samples had the highest number of visible sites per km^2 of viewshed.

3.4.4. OUTLIER ANALYSES

The number of SWS within a Sub-Cluster was compared to the number of outliers of that Sub-Cluster, and a ratio of SWS to outliers was calculated. The total area of the Sub-Cluster was compared to the number of related outliers, and a ratio of Sub-Cluster area to outliers was calculated. These ratios were compared between Sub-Clusters to assess whether there were any coherent spatial relationships between Sub-Clusters and their outliers.

3.4.5. MIDDEN ANALYSES

The number of SWS within a Sub-Cluster was compared to the number of related middens, and a ratio of SWS to middens was calculated. The number of middens was compared to the total area of that Sub-Cluster, and a ratio of Sub-Cluster area to middens was calculated. These ratios were compared to assess which Sub-Clusters had a higher number of middens associated with them.

3.4.6. AGRICULTURAL VISIBILITY ANALYSIS

The 15 viewsheds were analysed in sets of 5 according to which floodplain or plateau they were on. Each set of 5 viewsheds was displayed simultaneously, and the number of entire Sub-Clusters was counted. This assessed which Sub-Clusters were visible from which areas, and the total number of Sub-Clusters visible from the surrounding landscape was tallied.

3.5. Summary of Methodology

Analysing whether the Sub-Clusters and Clusters can be clearly ranked can reveal whether the social structures of the Group II sites were complex. By running analyses on the area of visibility, number of sites visible and number of associated outliers and middens, the analyses aimed to identify which Sub-Clusters and Clusters may have been of a higher rank in the political index of the Group II society.

Chapter 4: Results

4.1. The Sample

The Group II sample consisted of 163 stone-walled structures (SWS) and 148 middens. The 163 SWS included 134 SWS within Sub-clusters, and 29 SWS that were outliers. The SWS and middens discussed in the results were ascribed to a Sub-Cluster (Sub) and Cluster (C). There were 3 Clusters and 13 Sub-Clusters in total.

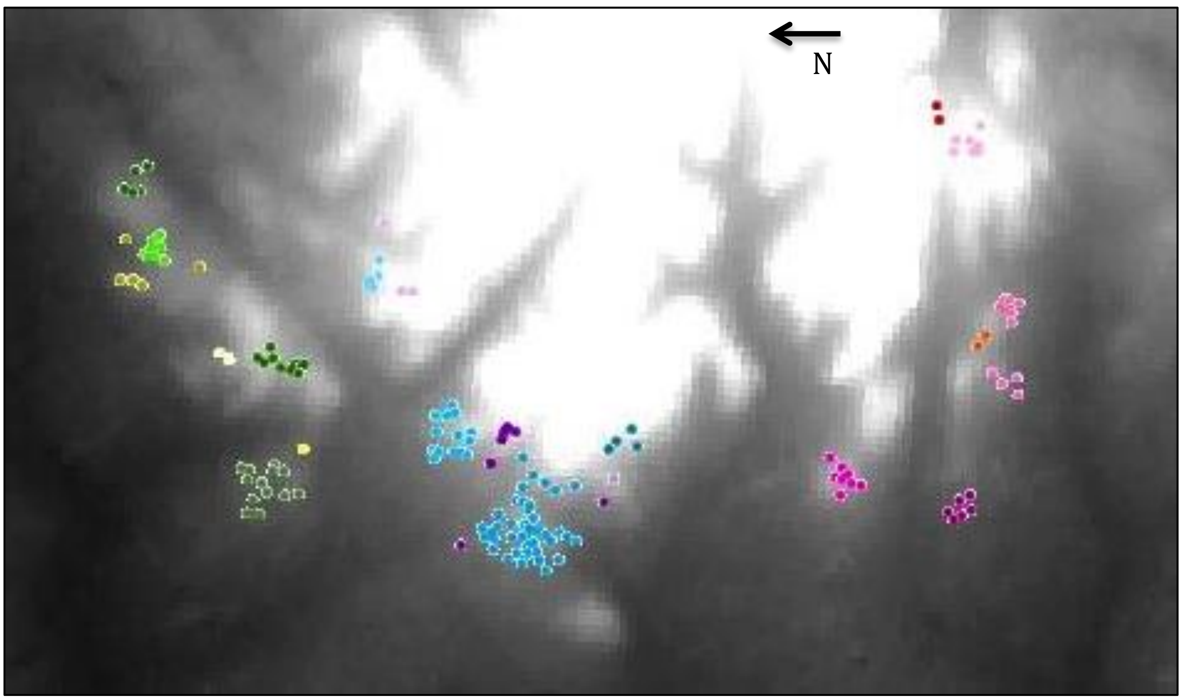

Figure 3: The 3 Clusters. Cluster 1 is green and yellow, Cluster 2 is blue and purple, and Cluster 3 is pink and orange.

The number of SWS, middens and outliers for each Cluster and Sub-Cluster was tallied. The table below outlines the figures for each Sub-Cluster:

Table 1: The number of SWS, middens and outliers for each Sub-Cluster.

Sub-Cluster	Sites	Middens	Outliers
C1 Sub1	14	20	1
C1 Sub2	10	9	2
C1 Sub3	8	13	5
C1 Sub4	5	8	0
C2 Sub1	5	16	3
C2 Sub2	14	9	4
C2 Sub3	42	33	7
C2 Sub4	4	5	1
C3 Sub1	8	10	0
C3 Sub2	6	6	0
C3 Sub3	4	5	2
C3 Sub4	7	4	2
C3 Sub5	7	10	2

The Sub-Clusters without associated outliers (C1 Sub4, C3 Sub1 and C3 Sub2) were ranked last in the outlier analyses, as this project worked on the premise that more outliers will be associated with the more important cluster of SWS. They are represented on graphs and tables as value of 0.

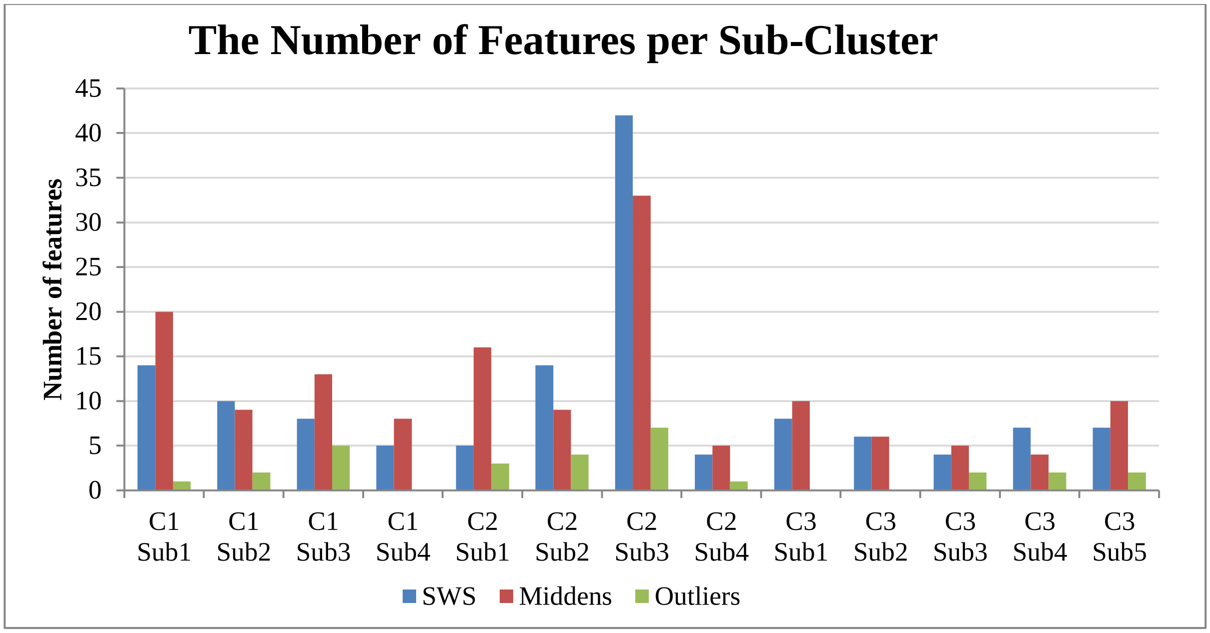

Figure 4: Number of SWS, Middens and Outliers in Each Sub-Cluster

The largest Sub-Cluster is Sub-Cluster 3 in Cluster 2 (henceforth referred to as C2 Sub3). It has the largest number of SWS, outliers and middens of all the Sub-Clusters. Cluster 2 also has the overall largest number of SWS, outliers and middens. The Cluster with the overall lowest number of SWS, outlier and middens is Cluster 3. While Cluster 3 (32 SWS) only has 5 fewer SWS than Cluster 1 (37 SWS), it has far fewer middens than Cluster 1, only having 35 middens while Cluster 1 has 50 middens in total. By order from largest number of features to smallest, the Clusters are ranked as Cluster 2, Cluster 1 and Cluster 3. Cluster 2 is also centrally located, between Cluster 1 and Cluster 3.

4.2. The Analyses

4.2.1. VISIBLE AREA ANALYSIS

The visible area analysis used the averaged viewshed analysis results in order to minimise the potential for anomalies in the data. The five Sub-Clusters that were most visible were C2 Sub4, C2 Sub2, C3 Sub1, C2 Sub3, and C1 Sub2, all of which had a total visible area over 10%. It is important to note that Cluster 2 has three of the most visible Sub-Clusters in the study area. The other Sub-Clusters had less than 10% visibility, and C2 Sub4 had double or higher visibility than over half of the other Sub-Clusters. The remaining four Sub-Clusters from Cluster 3 fell into the five least visible Sub-Clusters, C1 Sub4 being the other Sub-Cluster in the bottom five.

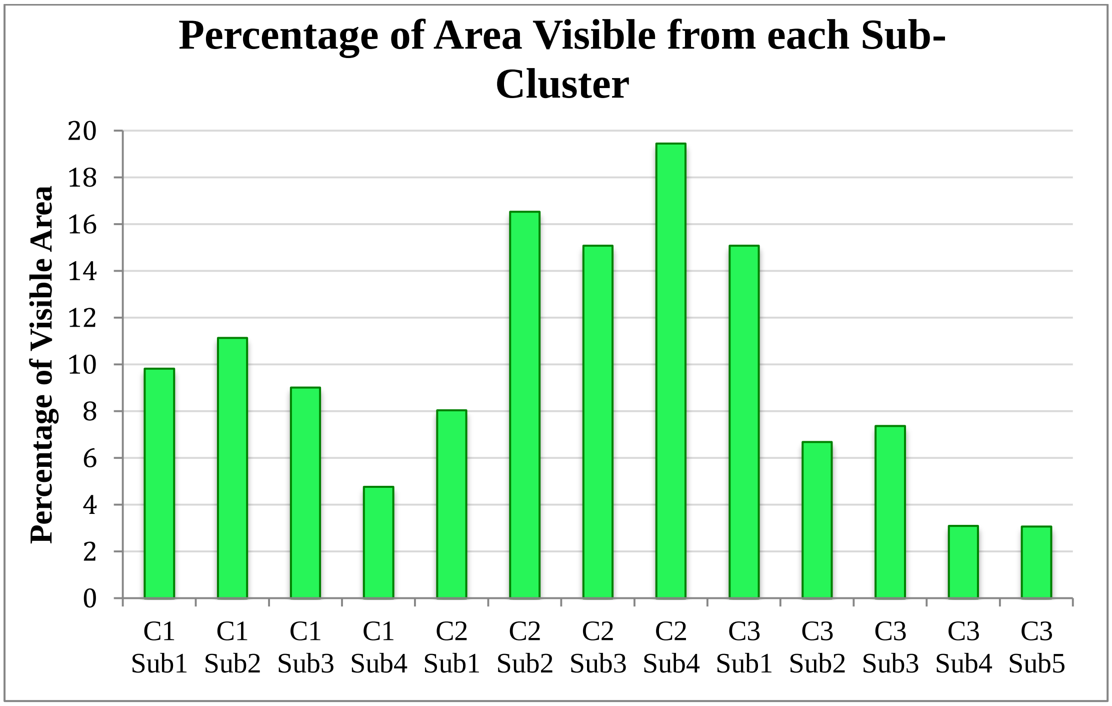

Figure 5: The percentage of the visible area from each Sub-Cluster, according to the averaged viewshed values

The elevation of a site is a factor to consider when measuring visibility. As one would expect higher sites to have a larger viewshed, it is important to make sure the viewshed is not attributed to cultural factors when natural factors are the cause. In the instance where elevation is the main factor influencing viewshed results, one would expect to find a positive association between elevation and visibility. When comparing these variables in the Group II data, there was not a clear positive or negative correlation between elevation and visibility (see figure below). There was a weak positive association, but not enough to attribute the higher visibility to the level of elevation alone. The results for visibility must therefore be influenced by variables other than elevation. This means that there is a possibility that cultural factors, such as politics, may have influenced site location.

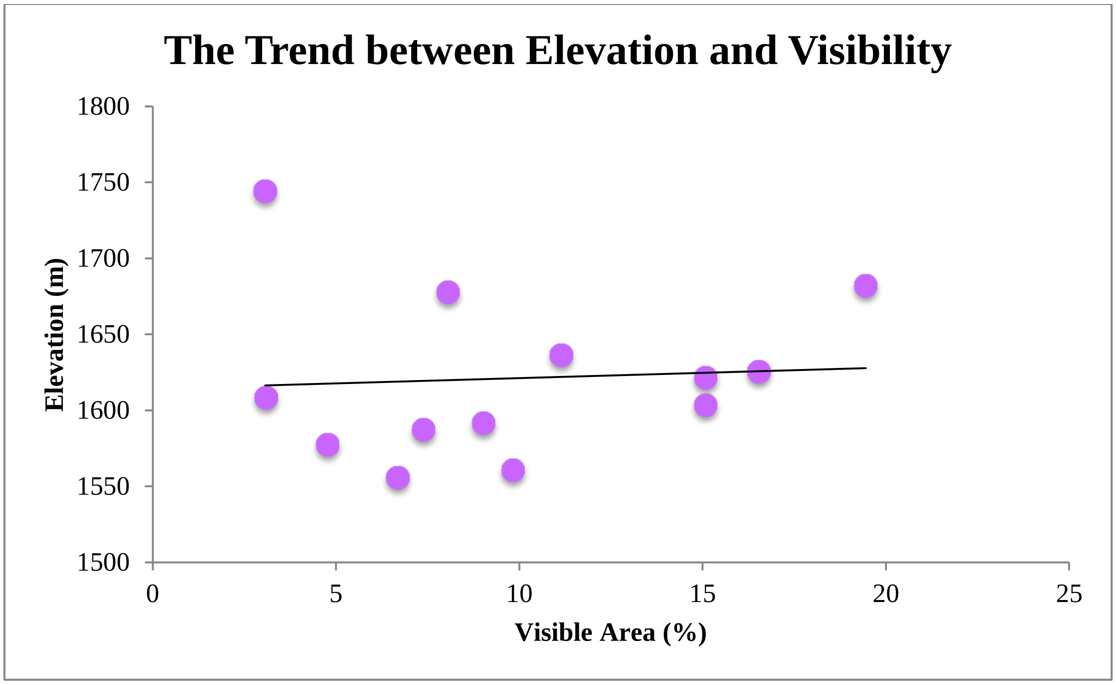

Figure 6: A table comparing the percentage of visibility (x-axis) to the elevation (y-axis) of the Sub-Clusters to establish a correlation pattern. The trendline is linear.

The results for the Sub-Clusters were ranked with a value from 1 to 13, 1 being the highest visibility percentage, and 13 being the lowest visibility percentage (see table below). These values of 1 to 13 were used in the final tally, discussed later in the results. The percentages of visibility were also averaged for each Cluster, to provide Cluster rankings. Clusters were ranked from 1 to 3.

Table 2: The Sub-Cluster rankings of the Visible Area Analysis. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Percentage of Visible Area
1	C2 Sub4	19.5
2	C2 Sub2	16.5
3	C3 Sub1	15.1
4	C2 Sub3	15.1
5	C1 Sub2	11.1
6	C1 Sub1	9.8
7	C1 Sub3	9.0
8	C2 Sub1	8.0
9	C3 Sub3	7.4
10	C3 Sub2	6.7
11	C1 Sub4	4.8
12	C3 Sub4	3.1
13	C3 Sub5	3.1

Table 3: The Cluster rankings of the Visible Area Analysis.

Rank	Cluster	Average Percentage of Visible Area
1	Cluster 2	14.8
2	Cluster 1	8.7
3	Cluster 3	7.1

Separating the rankings into thirds (positions 1-4, 5-8 and 9-13), one can see the that four most visible rankings are dominated by Cluster 2, the middle four are dominated by Cluster 2, and the lower five are dominated by Cluster 3. This dominant Cluster hierarchy is important to note, as this project is focused on visibility being a major indicator of political indices. If this Cluster ranking were similar to the overall Cluster ranking, it would be a significant indication of site location actively interacting with social structures. This is also true for the Site Visibility Analysis and the Area and Site Visibility Analysis.

4.2.2. SITE VISIBILITY ANALYSIS

The Site Visibility Analysis tallied the total number of SWS seen from an entire Sub-Cluster, excluding all the SWS within that Sub-Cluster. This analysis was used to assess which Sub-Clusters were more visible to other SWS in the area, an analysis that is focused on SWS intervisiblity rather than overall SWS visibility. The five Sub-Clusters that had the highest number of SWS within their viewsheds are C2 Sub2 with 23 SWS, C2 Sub3 with 18.75 SWS, C1 Sub2 with 18 SWS, C1 Sub1 with 16 SWS and C2 Sub1 with 15.5 SWS. Four of the five Sub-Clusters with the fewest SWS in their viewsheds were from Cluster 3.

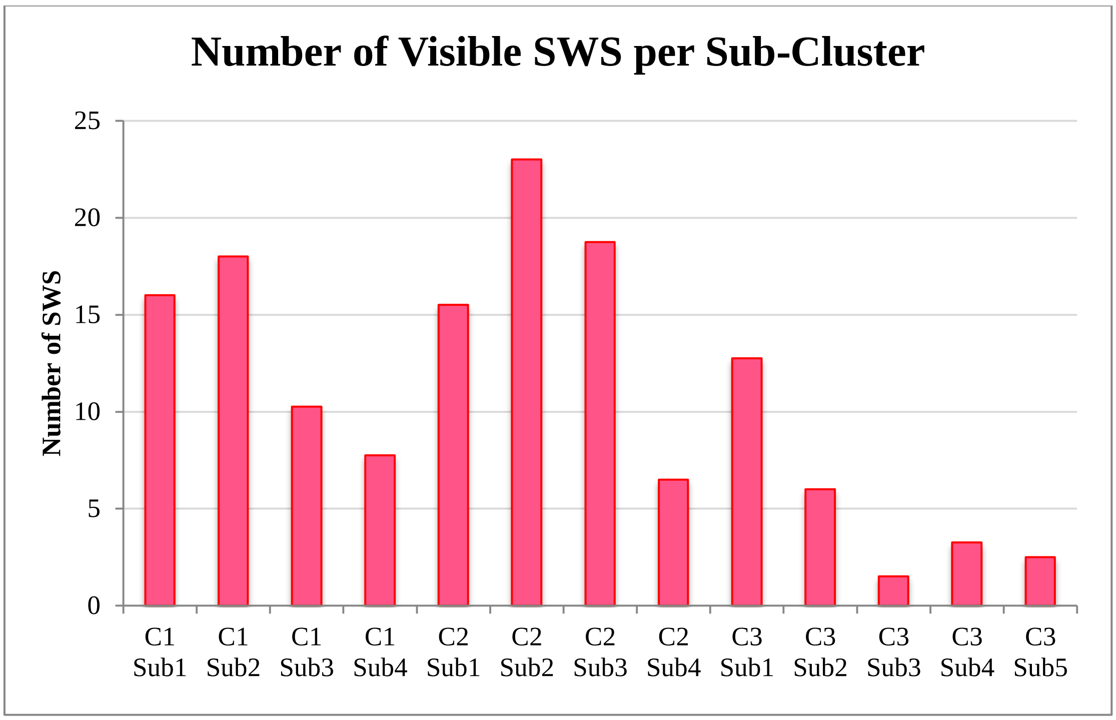

Figure 7: A graph depicting the number of other SWS seen from an entire Sub-Cluster, excluding the SWS from within the Sub-Cluster.

The measure of Sub-Cluster intervisibility differs from Sub-Cluster visibility, as it analyses the relationships between Sub-Clusters within a landscape, rather than the relationship between a Sub-Cluster and the surrounding landscape. The Visible Area Analysis and the Site Visibility Analysis are not mutually exclusive; rather, they are complimentary analyses that attempt to place a political index within the context of both social networks and the surrounding landscape. Sites that are extremely visible may not be socially important, and in turn, sites that are socially important may be relatively hidden from the surrounding landscape. The relationship between the Sub-Cluster visibility and intervisiblity in this study area will be explored in the Area and Site Visibility Analysis. For now, it is important to note that three of the same Sub-Clusters are in the top five rankings for both the Visible Area Analysis and the Site Visibility Analysis: C1 Sub2, C2 Sub2 and C2 Sub3. The Cluster with the highest average number of visible SWS is Cluster 2, closely followed by Cluster 1. Cluster 3 has the lowest number of visible SWS, and has a much lower average than the other two Clusters.

Table 4: The Sub-Cluster rankings for the Site Visibility Analysis. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink

Rank	Sub-Cluster	Number of Visible Sites
1	C2 Sub2	23
2	C2 Sub3	18.75
3	C1 Sub2	18
4	C1 Sub1	16
5	C2 Sub1	15.5
6	C3 Sub1	12.75
7	C1 Sub3	10.25
8	C1 Sub4	7.75
9	C2 Sub4	6.5
10	C3 Sub2	6
11	C3 Sub4	3.25
12	C3 Sub5	2.5
13	C3 Sub3	1.5

Table 5: The Cluster rankings for the Site Visibility Analysis

Rank	Cluster	Average SWS Visible
1	Cluster 2	15.9
2	Cluster 1	13
3	Cluster 3	5.2

4.2.3. AREA AND SITE VISIBILITY ANALYSIS

The Area and Site Visibility Analysis studied both the visible SWS and the area of the viewshed to determine whether there is a relationship between the two. By plotting the relationship between the SWS within a viewshed and the area of the viewshed on a scatter graph, one can assess whether there is a strong or weak correlation between the two, and whether it is positive or negative. A strong correlation would suggest that the Sub-Cluster visibility and area of the viewshed are related, and therefore need to be assessed together. A weak correlation would be indicative of either visibility or intervisibility as being unrelated to the other. This would mean that either visibility or intervisibility is unimportant to site location choice, as both are variables that influence site location. This is therefore not only an assessment of the relationship between the two factors, but also a assessment of whether the Visible Area Analysis and Site Visibility Analysis are as indicative of political structures as was proposed.

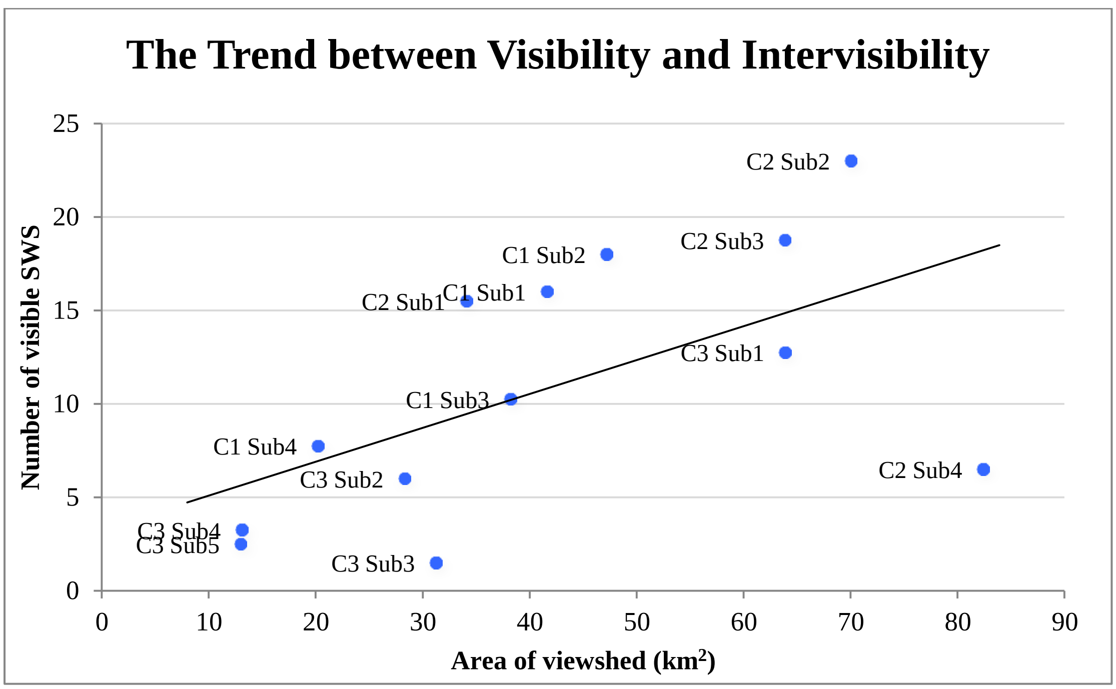

Figure 8: A scatter graph depicting the correlation between the number of visible SWS and the area of the viewshed. The trendline depicted is linear.

There is an overall strong, positive trend between the number of visible SWS and the area of the viewshed. As the visibility of a Sub-Cluster increases, so does the number of SWS within its viewshed. This means that visibility and intervisiblity are linked, and that they both relate to site location. This means that both the Visible Area Analysis and the Site Visibility Analysis rankings are more likely to be good indicators of political structures, as was proposed. There is one particular Sub-Cluster that does not relate closely to the trendline: C2 Sub4. It has the highest area of viewshed, but has fewer visible SWS than most of the other Sub-Clusters. As this is the only real deviation from the positive trend between SWS visibility and area of visibility, the integrity of the trend is good.

Once a relationship between SWS visibility and area of viewshed had been established, I divided the area of the viewshed by the number of visible SWS in order to calculate the density of visible SWS per km^2. The results were tabulated and ranked; this is an important ranking, as it assesses a number of factors within the parameters of visibility around which most of this study is based.

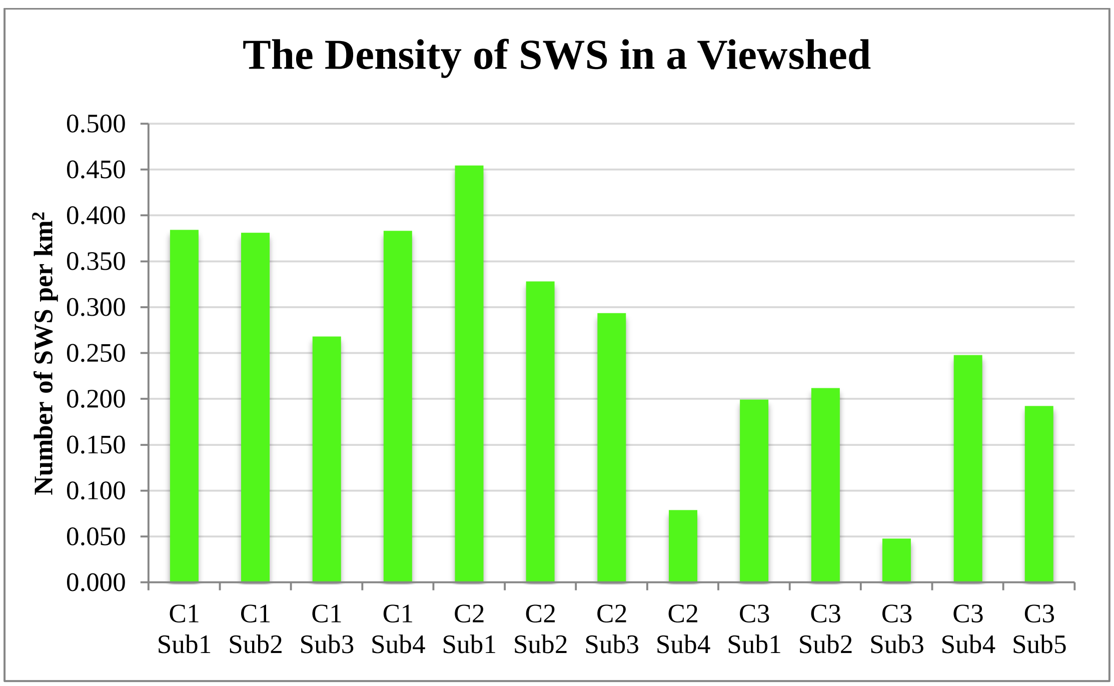

Figure 9: A graph comparing the densities of visible SWS per Sub-Cluster. The higher value means a higher density of SWS per km^2.

The Sub-Cluster with the highest density of visible SWS is C2 Sub1, with 0.45 visible SWS per km^2. C1 Sub1, C1 Sub2 and C1 Sub 4 have the next highest densities of SWS per km^2, which mean Cluster 1 dominates the top third of the SWS densities. This assessment of density ranks the Sub-Clusters with the highest densities of SWS as more important, because the sites that have maximised the number of other SWS they can see with the viewsheds available to them suggest a stronger network than the other Sub-Clusters. It also allows those Sub-Clusters that may have been under-ranked due to a smaller viewshed or a lower number of SWS to be represented in the data. There are Sub-Clusters that have an increased density of visible SWS that is well above average, indicating a purposeful attempt to see other SWS, and therefore increase their social and political networks. It is also important to note that while the figures for the density analysis may seem low, and the difference between them too slight (0.4 SWS per km^2), these figures represent a large area (400 km^2) and the difference is actually quite significant. If one were to compare the densities for C2 Sub1 and C3 Sub3 over 20km^2, C2 Sub1 would be able to see nine SWS, and C3 Sub3 would only be able to see one SWS.

Table 6: The Sub-Cluster rankings for the Area and Site Visibility Analysis. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink

Rank	Sub-Cluster	Density of SWS per km^2
1	C2 Sub1	0.45
2	C1 Sub1	0.384
3	C1 Sub4	0.383
4	C1 Sub2	0.381
5	C2 Sub2	0.33
6	C2 Sub3	0.29
7	C1 Sub3	0.27
8	C3 Sub4	0.25
9	C3 Sub2	0.21
10	C3 Sub1	0.20
11	C3 Sub5	0.19
12	C2 Sub4	0.08
13	C3 Sub3	0.05

There is an interesting trend in these rankings that was not present in the Visible Area Analysis or the Site Visiblity Analysis: Cluster 1 dominates the top third of the rankings, and there are only Cluster 1 and Cluster 2 Sub-Clusters in the top half of the rankings. All of Cluster 1's Sub-Clusters are in the top seven rankings, which makes Cluster 1 the highest ranked Cluster for this analysis. Cluster 2 is ranked second, and Cluster 3 is the lowest ranked Cluster.

Table 7: The Cluster rankings for the Area and Site Visibility Analysis.

Rank	Cluster	Average Density of SWS per km^2
1	Cluster 1	0.35
2	Cluster 2	0.29
3	Cluster 3	0.18

4.2.4. OUTLIER ANALYSES

The Outlier Analyses are comprised of two analyses: A ratio of Sub-Cluster SWS to outliers, and a ratio of Sub-Cluster area to outliers. As the Outlier Analyses are not the main focus of this study, and Outliers are not specified as being important political indicators in the ethnographic record, these two analyses will be combined for one single ranking to be used in the final tally. The importance of separating the analysis into Sub-Cluster SWS and Sub-Cluster area ratios is to standardise the results for the Outlier Analyses in an attempt to reduce any unreliable data. The first analysis, the ratio of Sub-Cluster SWS to outliers, was calculated by dividing the number for SWS within a Sub-Cluster by its related outliers. C1 Sub4, C1 Sub1 and C3 Sub2 did not have any related outliers. As this analysis is functioning on the assumption that the more important Sub-Clusters will have more associated outliers, these three Sub-Clusters were automatically ranked in joint eleventh place. Excluding the Sub-Clusters with no outliers, C1 Sub1 has the highest ratio of SWS to outliers at fourteen SWS per outlier, which is more than double the other Sub-Clusters. All other Sub-Clusters have six SWS or fewer per outlier, and there is no prevailing trend between the Clusters compared to what was seen in the previous analyses.

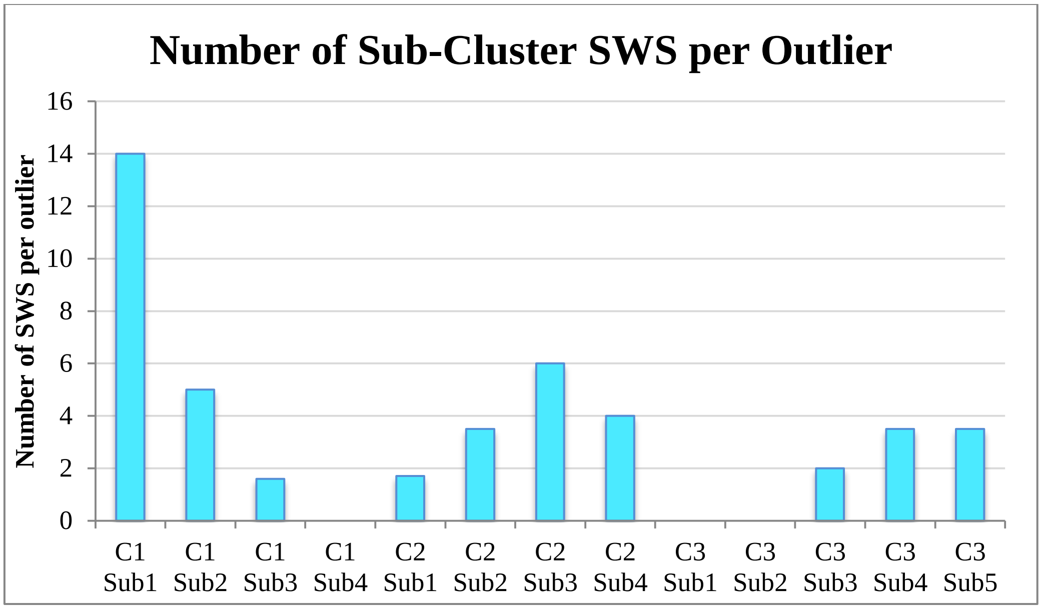

Figure 10: A graph depicting the ratio of Sub-Cluster SWS to every outlier. C1 Sub4, C3 Sub1 and C3 Sub2 did not have any outliers, and so have values of 0.

Cluster 3 is more highly ranked than in the Visibility Analyses, having 3 Sub-Clusters in the top half of the rankings. Cluster 2 also has 3 Sub-Clusters in the top half of the rankings, while Cluster 1 only has 1 Sub-Cluster, although it is ranked first.

Table 8: The Sub-Cluster rankings for the ratio of the number of SWS to every outlier. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink

Rank	Sub-Cluster	Ratio of SWS per Outlier
1	C1 Sub3	1.6
2	C2 Sub1	1.7
3	C3 Sub3	2
4	C2 Sub2	3.5
4	C3 Sub4	3.5
4	C3 Sub5	3.5
7	C2 Sub4	4
8	C1 Sub2	5
9	C2 Sub3	6
10	C1 Sub1	14
11	C1 Sub4	0
11	C3 Sub1	0
11	C3 Sub2	0

The second Outlier Analysis conducted was the ratio of Sub-Cluster area (m^2) to every outlier. This analysis was designed to standardise the Outlier Analyses, as the number of SWS within a Sub-Cluster is not always an accurate representation of the area of a Sub-Cluster. Combining these two analyses will allow for an analysis that is more representative of the relationship between the Sub-Clusters and their outliers. Again, C1 Sub4, C1 Sub1 and C3 Sub2 did not have any related outliers and so they were ranked in eleventh place. The Sub-Clusters with the least area per outlier were ranked higher than those with a large area, as this suggests a high density of outliers per Sub-Cluster. If a Sub-Cluster has a higher density of outliers, it is possible that the Sub-Cluster may have been more important than another with a large area but only a few related outliers. C2 Sub1 is the Sub-Cluster with the densest incidence of outliers, with 3160 m^2 per outlier. C1 Sub3 and C1 Sub2 are the next densest Sub-Clusters, followed by C3 Sub3 and C3 Sub4. There is a higher representation of Cluster 3 in this analysis compared to the Visibility Analyses, and a more even distribution of Clusters through the Sub-Cluster rankings.

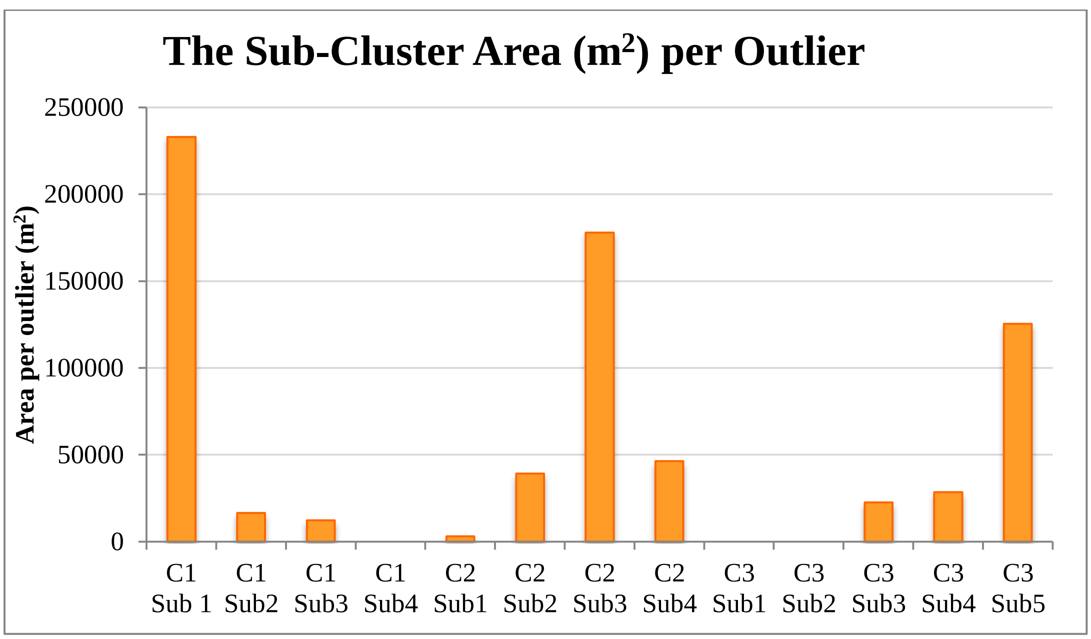

Figure 11: A graph depicting the ratio of Sub-Cluster area (m^2) to every outlier. C1 Sub4, C3 Sub1 and C3 Sub2 did not have any outliers, and so have values of 0.

Table 9: The Sub-Cluster rankings for the ratio of the number of SWS to every outlier. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Ratio of Area (m^2) per Outlier
1	C2 Sub1	3160.7
2	C1 Sub3	12373.8
3	C1 Sub2	16552.5
4	C3 Sub3	22713
5	C3 Sub4	28521.5
6	C2 Sub2	39245
7	C2 Sub4	46391.7
8	C3 Sub5	125495
9	C2 Sub3	177973.7
10	C1 Sub 1	232940
11	C1 Sub4	0
11	C3 Sub1	0
11	C3 Sub2	0

The two analyses, focusing on different aspects of the relationship between Sub-Clusters and their related outliers, are not an integral part of this study. The rankings were combined into one total ranking, so that there is not too much weight placed on the outlier analysis that could potentially skew the finally tally results. The numerical values of the rank were tallied per Sub-Cluster to give each Sub-Cluster a final value. These final values were then ranked from lowest value to highest, as the lowest tallied result would be the most important. The final Sub-Cluster and Cluster rankings for the Outlier Analyses are below.

Table 10: Total tallied Sub-Cluster rankings for the Outlier Analyses. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Tally of Rankings
1	C1 Sub3	3
1	C2 Sub1	3
3	C3 Sub3	7
4	C3 Sub4	8
5	C2 Sub2	9
6	C1 Sub2	11
7	C2 Sub4	14
7	C3 Sub5	14
9	C2 Sub3	18
10	C1 Sub 1	21
11	C1 Sub4	22
11	C3 Sub1	22
11	C3 Sub2	22

Table 11: The total tallied Cluster results

Rank	Cluster	Averaged Sub-Cluster Rankings
1	Cluster 2	11
2	Cluster 1	14.25
3	Cluster 3	14.6

The tallied Cluster rankings for the Outlier analyses are similar to the Viewshed Analyses rankings. Cluster 2 is the highest ranked Cluster, with Cluster 1 and Cluster 3 being ranked second and third respectively. There is less of a difference between the values for the Cluster rankings, indicating a more even spread of outliers across the Clusters. The small difference also means there is less of a strong ranking system, which is contrary to what was observed in the Visibility Analyses. It is possible that this means there isn't a high potential for political stratification, but the Visibility Analyses showed evidence for a high level of political stratification. It is far more likely that the outliers are not as important as visibility, and so they are probably not strong political indicators.

4.2.5. MIDDEN ANALYSES

The Midden Analyses are very similar to the Outlier Analyses, as they assess the ratio of middens to the number of SWS in their related Sub-Cluster, and the ratio of Sub-Cluster area (m^2) to their related middens. There is evidence to suggest that middens are good indicators of political importance and stratification, and so these two analyses will remain separate, and will not be combined into one ranking system for the final tally.

The ratio of middens to SWS in their related Sub-Cluster is used, as there are usually more middens than SWS per cluster. The higher number of middens per SWS indicates an important or wealthy Sub-Cluster, and so the Sub-Clusters with the highest ratios of middens to SWS are ranked highest.

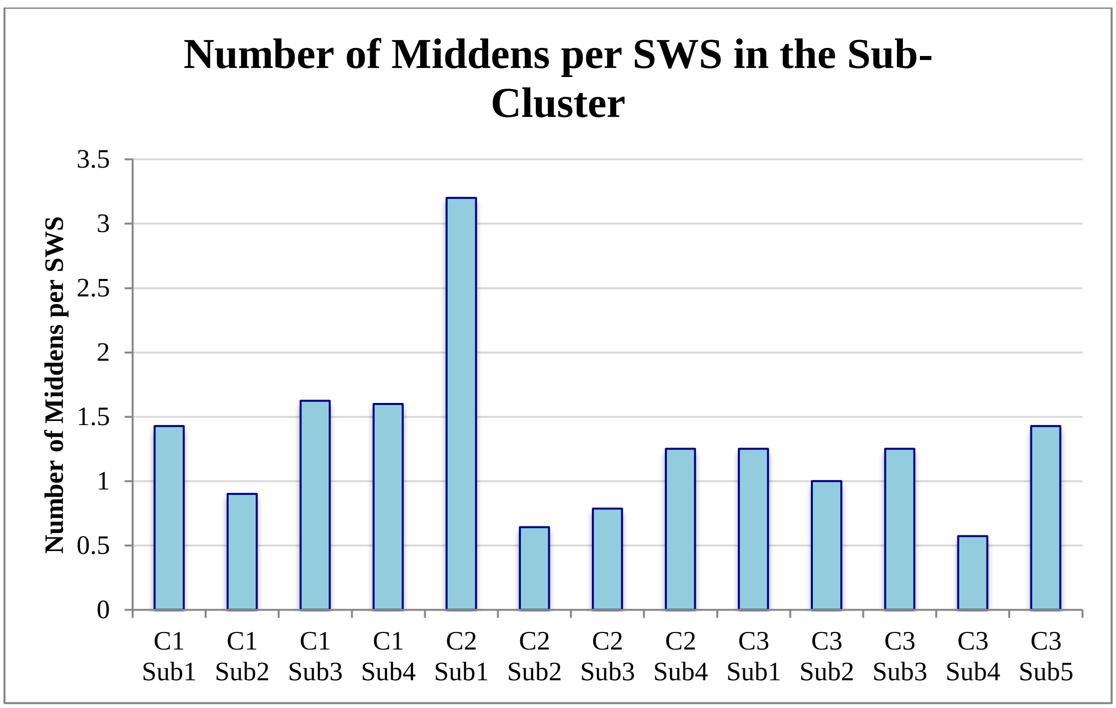

Figure 12: A graph depicting the ratio of middens to their related Sub-Cluster SWS.

The ratio of middens to SWS is highest for C2 Sub1, and this value is much higher than the rest of the midden ratios. The other Sub-Clusters in the top five rankings, with the highest ratio of middens to SWS, have around one and a half middens per every SWS. This is a good indication of political stature or wealth, as statistically, every homestead has at least one midden associated with it. Cluster 1 dominates the top five rankings, with three of its Sub-Clusters in the highest ranked positions.

Table 12: The Sub-Cluster rankings for the ratio of the number of middens to every related Sub-Cluster SWS. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Ratio of Middens to SWS
1	C2 Sub1	3.20
2	C1 Sub3	1.63
3	C1 Sub4	1.60
4	C1 Sub1	1.43
4	C3 Sub5	1.43
6	C2 Sub4	1.25
6	C3 Sub1	1.25
6	C3 Sub3	1.25
9	C3 Sub2	1.00
10	C1 Sub2	0.90
11	C2 Sub3	0.79
12	C2 Sub2	0.64
13	C3 Sub4	0.57

Table 13: The Cluster rankings for midden to Sub-Cluster SWS ratios

Rank	Cluster	Averaged Sub-Cluster Results
1	Cluster 2	1.47
2	Cluster 1	1.39
3	Cluster 3	1.10

The ratio of Sub-Cluster area (m^2) to middens is a measure of how densely situated the middens are within Sub-Clusters. Sub-Clusters with a higher density (lower value) of middens than another may have higher political standing, even if the ratio of SWS to middens is lower than some other Sub-Clusters.

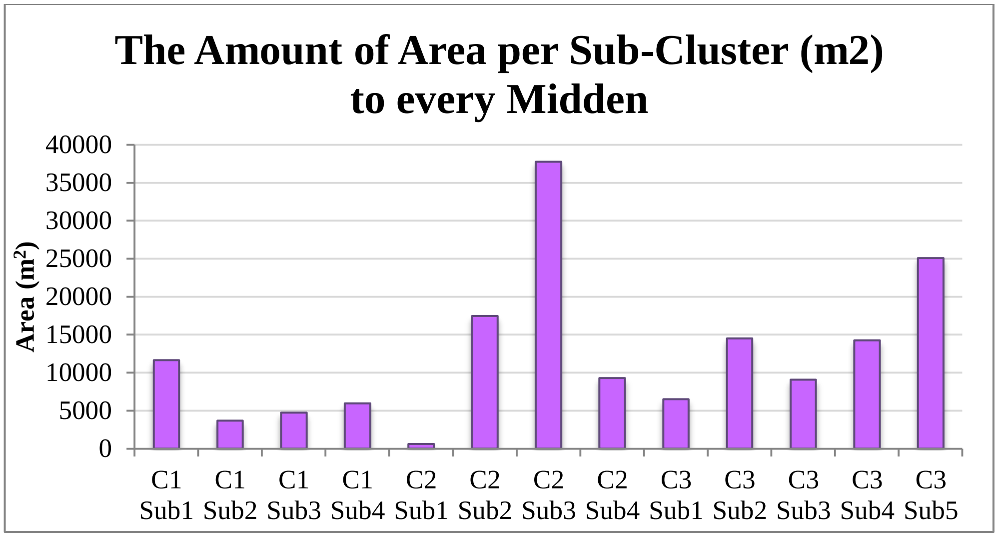

Figure 13: A graph depicting the density of middens per Sub-Cluster area (m^2)

C2 Sub1 has the densest midden value of 593m^2 per midden. The other top four rankings include C1 sub2, C1 Sub3, C1 Sub4 and C3 Sub1. Cluster 1 dominates the top five rankings, with three of its Sub-Clusters represented. The four Sub-Clusters with the lowest density of middens are C3 Sub3, C2 Sub 2, C3 Sub5 and C2 Sub3. There is a more even split between Cluster 2 and Cluster 3 rankings, while Cluster 1 has the highest rankings overall.

Table 14: The Sub-Cluster rankings for the ratio of Sub-Cluster area to every midden. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Sub-Cluster Area (m^2) per Midden
1	C2 Sub1	593
2	C1 Sub2	3678
3	C1 Sub3	4759
4	C1 Sub4	5967
5	C3 Sub1	6525
6	C3 Sub3	9085
7	C2 Sub4	9278
8	C1 Sub1	11647
9	C3 Sub4	14261
10	C3 Sub2	14507
11	C2 Sub2	17442
12	C3 Sub5	25099
13	C2 Sub3	37752

Table 15: The Cluster results for the ratio of Sub-Cluster area (m^2) to middens

Rank	Cluster	Averaged Area to Midden Results
1	Cluster 1	6513
2	Cluster 2	16266
3	Cluster 3	13895

4.2.6. AGRICULTURAL VISIBILITY ANALYSIS

The Agricultural Visibility Analysis was designed after examining the patterns of the viewsheds used in the Visibility Analyses. This analysis cannot be ranked according to Sub-Cluster, as it explores which Sub-Clusters are visible from the surrounding agricultural areas, and in turn, are able to see the agricultural areas. When conducting the viewsheds, I noticed that the majority of the visible area (about 60% or more) did not lie amongst the other SWS, but rather it was focused on the surrounding floodplains. There are floodplains to the north and west of the Clusters, and there is a plateau area to the south of the Clusters (shown in the figure below).

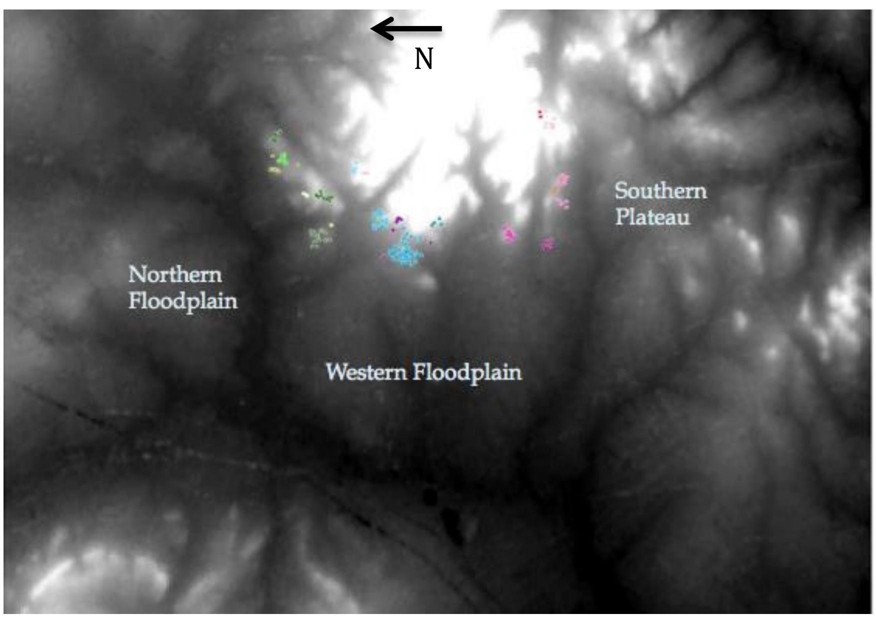

Figure 14: An elevation map depicting the northern and western floodplains, and the southern plateau

The focus of the viewsheds on the floodplains may have important indications for the political structures of the Clusters. These indications will be addressed in the discussion. The Agricultural Visibility Analysis aimed at understanding which Sub-Clusters, if any, were entirely visibly from the floodplains, in order to assess whether this is a topic for further investigation. Five points on each of the floodplains and plateau were created at equal 1.5km intervals, and a viewshed was run from each of these points. The SWS were then tallied from each Sub-Cluster, and if all SWS within a Sub-Cluster were visible from one of the floodplains, the Sub-Cluster was noted and tabulated. The results are not ranked, but are still useful in understanding the political structures in the area and how landscape can influence site location. The northern floodplain has two entire Sub-Clusters from Cluster 1 in its viewshed, and three entire Sub-Clusters from Cluster 2. The western floodplain has two visible Sub-Clusters from Cluster 1, three visible Sub-Clusters from Cluster 2, and one visible Sub-Cluster from Cluster 3 in its viewshed. The southern plateau has three visible Sub-Clusters from Cluster 3 in its viewshed.

Table 16: A table showing the visible Sub-Clusters from the surrounding floodplains and plateau

	Northern Floodplain	**Western Floodplain**	**Southern Plateau**
Entire Sub-Clusters Visible	C1 Sub1 C1 Sub3 C2 Sub1 C2 Sub2 C2 Sub3	C1 Sub1 C1 Sub2 C2 Sub2 C2 Sub3 C2 Sub4 C3 Sub1	C3 Sub3 C3 Sub4 C3 Sub5

What is interesting to note is that three of the four Sub-Clusters from Cluster 1 are visible from both floodplains, and C1 Sub1 can see onto both floodplains. All of the Sub-Clusters from Cluster 2 are visible from the northern and western floodplains, with C2 sub2 and C2 Sub3 able to view both floodplains. There is only one Sub-Cluster from Cluster 3 that is visible from one floodplain, and three other Sub-Clusters from Cluster 3 are the only Sub-clusters visible from the southern plateau. Cluster 1 and Cluster 2 do not have a view onto the

Southern Plateau. The floodplains are very fertile, and are currently used for agricultural purposes. The significance of these findings will be addressed in the discussion.

4.3. The Final Tallied Results

The Visibility Analyses, Outlier Analyses and Midden Analyses all used a ranking system to assess the potential for political stratification of the Group I SWS in the Suikerbosrand. The Sub-Cluster results were ranked from one to thirteen, and each Sub-Cluster was assigned a value according to its rank. These values were tallied to establish the final Sub-Cluster and Cluster rankings. Both an unweighted and a weighted tally were conducted on the ranking results, the rational for which will be explained below.

Table 17: The rankings for each Sub-Cluster, and their final weighted and unweighted tally

Sub-Cluster	Outlier Analyses	Area and Site Visibility analysis	Ratio of middens to SWS	Ratio of Sub-Cluster area to middens	Visible Area Analysis	Site Visibility Analysis	Total Tally	Total weighted tally
C1 Sub1	10	2	4	8	6	4	**34**	**40**
C1 Sub2	6	4	10	2	5	3	**30**	**35**
C1 Sub3	1	7	2	3	7	7	**27**	**34**
C1 Sub4	11	3	3	4	11	8	**40**	**51**
C2 Sub1	1	1	1	1	8	5	**17**	**25**
C2 Sub2	5	5	12	11	2	1	**36**	**38**
C2 Sub3	9	6	11	13	4	2	**45**	**49**
C2 Sub4	7	12	6	7	1	9	**42**	**43**
C3 Sub1	11	10	6	5	3	6	**41**	**44**
C3 Sub2	11	9	9	10	10	10	**59**	**69**
C3 Sub3	3	13	6	6	9	13	**50**	**59**
C3 Sub4	4	8	13	9	12	11	**57**	**69**
C3 Sub5	7	11	4	12	13	12	**59**	**72**

Table 18: The final Sub-Cluster rankings. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Final Tally
1	C2 Sub1	17
2	C1 Sub3	27
3	C1 Sub2	30
4	C1 Sub1	34
5	C2 Sub2	36
6	C1 Sub4	40
7	C3 Sub1	41
8	C2 Sub4	42
9	C2 Sub3	45
10	C3 Sub3	50
11	C3 Sub4	57
12	C3 Sub2	59
12	C3 Sub5	59

The Sub-Cluster with the highest overall ranking was C2 Sub1. It was the highest ranked in both of the Midden Analyses, one Outlier Analysis and one Viewshed Analysis. The Sub-Clusters from Cluster 1 are all in the top half of the ranked Sub-Clusters, and Cluster 1 was the highest ranked Cluster overall, with an average tally of 32.8. Cluster 2, while having the highest ranked Sub-Cluster, was the second ranked Sub-Cluster overall. The average tally for Cluster 2 was very close to Cluster 1 with a score of 35. Cluster 3 was very far below Clusters 1 and 2, with a score of 53.2. This is represented in the Sub-Cluster total rankings, as the four lowest ranked Sub-Clusters are all from Cluster 3.

Table 18: The final Cluster rankings

Rank	Cluster	Average Tally
1	Cluster 1	32.8
2	Cluster 2	35
3	Cluster 3	53.2

The rankings for the first tally were all weighted equally. Unfortunately, an equal weighting of each analysis over-represents less important data, such as the outlier analysis, and under-represents that crucial data to the s study, such as the visible area analysis. The Visible Area Analysis was significant for a number of reasons: it is a physical representation of political landscapes, and it may also be a representation of agricultural control. The Agricultural Visibility Analysis shows that the visible area of a Sub-Cluster has a number of different factors influencing it. While I cannot include the Agricultural Visibility Analysis in the ranking system, I can weight the Visible Area Analysis in the final tally, so that the rankings reflect what the political structure was more likely to be. The Visible Area Analysis was weighted to be twice as much as the other analyses.

Table 20: The final weighted Sub-Cluster rankings. The Clusters are colour coded: Cluster 1 in blue, Cluster 2 in green and Cluster 3 in pink.

Rank	Sub-Cluster	Final Weighted Tally
1	C2 Sub1	25
2	C1 Sub3	34
3	C1 Sub2	35
4	C2 Sub2	38
5	C1 Sub1	40
6	C2 Sub4	43
7	C3 Sub1	44
8	C2 Sub3	49
9	C1 Sub4	51
10	C3 Sub3	59
11	C3 Sub2	69
11	C3 Sub4	69
13	C3 Sub5	72

The final weighted tally still ranks C2 Sub1 as the highest ranked Sub-Cluster, however there is a more even distribution of Cluster 1 and Cluster 2 Sub-Clusters in the top half of the rankings. This is significant, as the overall Cluster rankings have changed from Cluster 1 being the highest ranked Cluster, to Cluster 2 being the highest ranked Cluster. The average tallies are still close for Cluster 1 and Cluster 2, and Cluster 3 has a much lower average tally.

Table 21: The final weighted Cluster rankings

Rank	Cluster	Weighted Average Tally
1	Cluster 2	38.8
2	Cluster 1	40
3	Cluster 3	62.6

This shift from Cluster 1 to Cluster 2 is significant. Cluster 2 is the more centrally situated Cluster, it has the highest number of total SWS, and all of the Sub-Clusters from Cluster 2 are visible from at least one of the two floodplains. This lends the weighted tally more credibility, as the unranked evidence for the Group II SWS supports the final Cluster rankings. I will be using the weighted tallies in my discussion due to their higher credibility. What these results mean for establishing a political index, and how important visibility was to the Group II inhabitants, will be addressed in the discussion section of this study.

Chapter 5: Discussion

The growth of visibility studies in archaeology has been steadily increasing over the past few decades, as GIS technological innovations have become more frequent, sophisticated and accessible. Spatial analyses in archaeology increased as the possibility of workable, accurate visualisation data became available. Visibility has been successfully used in a number of archaeological studies in the past, some of which aimed to identify social, economic or political trends (McCoy and Ladefoged 2009). The focal point of this study is visibility, and how this might influence site location and denote political or social structures. On a larger scale, Sadr and Rodier (2012:1041) used spatial analyses to suggest population drift over a larger time-scale and area than this study, and identified a movement from smaller, more egalitarian settlements to larger, more complex settlements. The scale of this study allows for more detailed, inter-Group analyses, and so visibility and intervisibility studies became ideal tools for identifying relationships between the stone-walled structures of Group II.

5.1. Addressing the Aim of the Study

The aim of this study is to identify whether visibility can provide an index of social and political rank, and if a social and political structure can be ranked in the Group II Suikerbosrand sites. Kosiba and Bauer (2013:66) suggest that people use and interact with the landscape for political advancement, and that the landscape is imbued with social meaning. Wheatly and Gillings (2000:3) term visibility as the "past cognitive/perceptual acts that served to not only inform, structure and organise the location and form of cultural features, but also to choreograph practice within and around them". This understanding of visibility moves beyond mere observation towards understanding perception as an interaction with the landscape through cultural and social understandings. If visibility interacts with social and political practices, then it is a good tool to provide an index of social and political rank. Visibility is a process that formed cultural landscapes and interacted with them. By using cultural landscapes in a visibility study, the underlying social and political structures should be more easily identifiable and understandable.

The Visibility Analyses in this study were structured around understanding the underlying political structures of the landscape. This was done by using viewsheds as a means to identify the organisational patterns in the landscape, and what this may infer about social and political indices. The three Visibility Analyses used a ranking system to organise the results, but this ranking system was not used to impose a hierarchy onto the possible political structure of the area; rather, the rankings were used to compare the variations within the results in order to identify whether the difference was great enough to suggest a complex political structure. In the Visible Area Analysis, C2 Sub4 had more than double the visibility of half the Sub-Clusters, and had more than six times the visibility of the lowest Sub-Cluster (C3 Sub5). This large difference in results suggests that there is a high potential for political stratification within the Sub-Clusters. A similar trend in difference was also seen in the Site Visibility Analysis and the Area and Site Visibility Analysis. The number of visible sites from a viewshed varied between 23 and 1.5 stone-walled structures, and the density of visible sites within a viewshed ranged between nine stone-walled structures per $20km^2$ and one stone-walled structures per $20km^2$. The variations between the highest and lowest ranked Sub-Clusters are all great enough to suggest that visibility can provide an index of political and social rank, complex enough to suggest a hierarchical political structure in the Group II stone-walled structures.

The Outlier Analyses and Midden Analyses were not part of the Visibility Analyses, but were included for a more comprehensive, balanced study of political and social structure. The reasons for outliers and middens being indicators of political importance was outlined in the literature review, and so will not be discussed further here. What should be noted, however, is the continuing variation within the ranking systems that would indicate a high potential for political and social stratification. The ratio of stone-walled structures to outliers ranged between 1.6 stone-walled structures per outlier to 14 stone-walled structures per outlier, and the ratio of Sub-Cluster area to outlier results had an even larger differential gap. The number of middens, a more telling analysis for political importance than the outlier analyses, showed enough variation to suggest a hierarchical political structure. The Sub-Cluster area and midden analysis had a large differential gap of $593m^2$ and $37752m^2$. The continuous trend between all ranked analyses is clear: there is a high potential for social stratifications due to the variation in results. Following this, it is possible that a social and political structure can be ranked in the Group II Suikerbosrand sites.

5.2. Addressing the Hypothesis

I hypothesised that the more important sites would be larger in size and number of stone-walled structures, have more associated middens and would be more visible, with more sites in their viewsheds. When assessing the size of the sites with the overall cluster rankings, the relationship between cluster size and importance was surprising. C2 Sub1, the highest ranked Sub-Cluster overall, only had five stone-walled structures and three outliers. It did, however, have sixteen associated middens, which is a very high proportion for the size of the Sub-Cluster. The largest Sub-Cluster in terms of stone-walled structures number and area was C2 Sub3, and it was only ranked seventh overall. Despite these anomalies, assessing the overall Cluster rankings with the Cluster size shows a trend towards the more important sites having a larger average number of stone-walled structures and a larger average area. The Cluster with the highest average number of stone-walled structures is Cluster 2, and it is the highest ranked Cluster. The lowest ranked Cluster, Cluster 3, also has the lowest average number of stone-walled structures. The same is true for the middens, where Cluster 2 has the highest average number of middens and Cluster 3 has the lowest average number of middens. The Sub-Clusters in all top five rankings for the highest visible area, the highest number and highest density of SWS in their viewsheds were C2 Sub1, C1 Sub2 and C2 Sub2. These three Sub-Clusters were in the top four Sub-Clusters for the overall Sub-Cluster ranking. This would indicate that visibility and intervisibility are both related to social and political rank. The results of the multiple analyses run for this study corroborate the hypothesis that the more important sites are larger in size and number of stone-walled structures, have more associated middens and are more visible, with more sites in their viewsheds.

5.3. Understanding the Political Structure

The political and social structure of the Suikerbosrand Group II sites can be described as a ranked, hierarchical structure. This structure can be divided into a hierarchy of three Clusters, named Cluster 1, Cluster 2 and Cluster 3. Cluster 2 is centrally located between Cluster 1 and Cluster 3, and it overlooks the western floodplain. It is the largest Cluster in area, number of stone-walled structures, number of middens and area of visibility. When assessing the results of the analyses run on these Clusters, and the Sub-Clusters within them, two main implications can be drawn from the results: 1) the Group II inhabitants placed a higher importance on being more visible, rather than on being less visible, and 2) the relationship between site visibility and agricultural control is important to the Group II political structures.

The first implication places visibility as an important factor in site formation. The results from the Visible Area Analysis showed a visibility rate of almost 20%. This level of visibility is very high for a 400km^2 area, and is higher than the statistical average for the area, which was just under 5%. This indicates that the Sub-Clusters were not located for low visibility, as one would expect to find in locations chosen for defensive purposes. The sites were chosen to maximise their visibility, and most of the Sub-Cluster locations have a higher visibility than they would have if the location were to be chosen at random. In the Area and Site Visibility Analysis, the strong positive association between the area of the viewshed and the number of stone-walled structures in the viewshed suggests that there is a connection between political networks and high visibility. The more stone-walled structures in a viewshed indicates a more complex political network, as communication and social interactions would be easier and more diverse with stone-walled structures that were visible, and therefore easily commutable. If the Group II inhabitants were focused on having smaller viewsheds so that they were less visible but still wanted to maintain networks, one would expect to find a negative association between visible area and stone-walled structures intervisibility. This would see the stone-walled structures intervisibility increasing when area of visibility decreased, or remained the same. The overall area of visibility would also be much lower than what was found. This suggests that the Group II inhabitants placed political importance on being visible, and so the sites with the highest visibility may have been considered as the most important sites in the area.

The second implication drawn from the results is that visibility with regards to agricultural control may have been important. The Agricultural Visibility Analysis was designed after the other analyses had been conducted, and I noticed a number of trends emerging in the Viewshed analyses. The majority of the viewsheds conducted for the Sub-Clusters were focused on the floodplains to the north and west. These floodplains are currently used for agriculture, and are very fertile. After discovering that most of the Sub-Clusters had a view onto the floodplains, the analysis focused on identifying which Sub-Clusters were visible from the floodplains, and therefore had the best view onto the floodplains. The highest ranked Cluster, Cluster 2, is also the only Cluster to have all four Sub-Clusters visible from the floodplains. This suggests a connection between the important sites and the view onto the floodplain. There are a number of reasons why a view onto the floodplains may be important. Agricultural control is one motivation for placing a site within full view of the best agricultural lands. Sadr and Rodier (2012:1041) noticed a more northern and western migration towards the fertile floodplains, around the same time that the more complex sites began to emerge. This link between power and agriculture has been a focus of study for many archaeologists. Vogel (1987:160) associates complex political relations with agricultural control and technology, and believes it is inherent in all populations relying on agriculture as a means of economic power. Huffman (2010:6) argues that, without agriculture, there would not be enough resources to support a large enough population where there is social differentiation. Agricultural production is therefore economically and socially vital to sustaining a complex society, such as the Group II society in the Suikerbosrand. The control of the agriculture would therefore control the economic relations and the political power. This may be one reason why the highest ranked Cluster has the best visibility onto the floodplains. Another potential reason is control of trade networks, as trade often travels along rivers. The production of maize and increasing trade networks were prominent in the Suikerbosrand area around the time that the Group II inhabitants were there, and they relied on the floodplains for irrigation and trade (Huffman 2004:104). The control over agriculture also meant control over trade, and so this may be why the viewsheds were focused mainly on the floodplains. These are only speculations, however, and there is opportunity for further investigation into the agricultural control around this time.

5.4. Future Research

There are a number of areas for future research that I have not been able to cover in this study. One area is an investigation into the influence of the agricultural landscape on site formation and political structure, as described above. Another area is the investigation into Cluster 3 as a separate society to the Cluster 1 and Cluster 2 inhabitants. The results for the Cluster 3 sites were consistently lower than both Clusters 1 and 2, and they were placed in a position where only one sub-Cluster could view one floodplain. The other Sub-Clusters were placed so that their viewsheds extended over the southern plateau, and there could be a number of reasons for this. They may have been temporally separated from the Group II sites, as an earlier group of inhabitants. The dates for the Group II sites span between the 17th and 19th Centuries, and so it is possible that they are two separate occupations that are stylistically similar. The plateau has better grazing land than agricultural land, and so pastoralists rather than agro-pastoralists may have inhabited it. This suggests that it may have been an earlier time, where agriculture was not as established yet as it was later in time. The Cluster 3 inhabitants may have also been contemporary, but were placed for security reasons to guard the agricultural area from threats from a southerly direction. These are questions that remain unanswered, and further research is required to fully understand the relationship between Clusters1, 2 and 3.

Chapter 6: Conclusion

GIS and visibility analyses are important tools for analysing cultural landscapes and site formations in archaeology. They can indicate an index for political and social rank, and can aid in understanding the formation of political structures through visibility. This study identified a ranked, hierarchical political structure for the Suikerbosrand Group II sites through a number of visibility, midden, outlier and agricultural analyses. The most politically important sites were centrally located and had a large number of stone-walled sites, middens and outliers. They were highly visible within the context of the surrounding landscape, and placed political significance on being highly visible. The Group II inhabitants had potentially complex trade networks between the other sites in the area, and they possibly controlled the majority of the agriculture in the area. This indicates they also controlled the economic and trade networks. This suggests a highly stratified social hierarchy in this area, with a large population and complex social organisation. The strong associations between political control, social hierarchy and cultural landscape formation are all linked to the importance of visibility and intervisibility for the Suikerbosrand Group II inhabitants.

Acknowledgements

First and foremost, I would like to thank my supervisor, Prof. Karim Sadr, for all of the valuable time, effort, encouragement and advice he gave me throughout this project. I would also like to thank my classmates for their constant support and friendship. Big thanks to my friends and family for their support, and an especially large thank you to my proofreading parents for all of their enthusiasm and love. Last, I would like to thank the University of the Witwatersrand, and the National Research Foundation (NRF) for my funding.

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