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WITWATERSRAND,
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**UNDERSTANDING THE DYNAMICS OF HERDING AND CATTLE POSTS IN
PRE-COLONIAL TSWANA OF THE LAST 500 YEARS.**

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**A Thesis submitted to the Faculty of Science, University of the Witwatersrand,
Johannesburg, in fulfilment of the requirements for the degree of Doctor of
Philosophy (Archaeology)**

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DECLARATION

I declare that this thesis is my own unaided work. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. The degree is by thesis and the text provides details of my publication and work that is ready for submission. The thesis has not been submitted before for any degree or examination at any other University.



(Signature of candidate)

9th day of February 2022

ABSTRACT

Several archaeological studies have shown that keeping cattle outside the main settlement, commonly known as the cattle post system, is not a new phenomenon. This research reviews the evidence, both archaeological and historical, for herd management strategies. It studies the settlement patterning at a modern cattle post (Tswana *moraka*) and shows that several factors lead to its establishment. Two main types of cattle posts are evident, some are designed for risk management and others for ecological management. As an archaeological focal point, a pre-colonial Batswana capital, Kweneng (Suikerbosrand), in South Africa is studied. I hypothesized that as this capital increased in size and wealth from the seventeenth to the early nineteenth century, cattle wealth would have increased. At later stages, as the cattle wealth increased, a reliance on the cattle post system would manifest itself in a proportional reduction in the area devoted for livestock in the capital. I studied variation in the sizes and positioning of kraals at selected Tswana main centres. My research highlights several key issues. The sizes of areas devoted to livestock management (central enclosures) and the areas devoted to residential activities (compound or ward space) varied over time and space. There is a positive relationship between the sizes of central enclosures and compound or ward space. While this may be taken to reflect that there is no reduction as per the hypothesis, the data shows that issues of ‘change’ are complex. Change must be measured at various levels, by firstly, measuring variation across the transition from N Type N-Klipriviersberg-Molokwane compounds, and in the positioning of central or shared kraals. The positioning (and variation thereof) of central enclosures is an indicator for change in herd management strategies. The proportional decline or increase in the space/area devoted to livestock management is key in the identification of evolution in livestock management practices. Other key indicators are the settlement layout, buffering patterns between wards or compounds, and between main centres. Extended buffering for yards and kraals observable at cattle posts and satellite settlements are indicative of livestock shedding and decentralization to outposts. Interestingly, this livestock shedding is consistent with shedding the human population at ward level, from bigger wards or compounds to sub-wards or sub-compounds. As a result, the newer establishments show a percentage decline in central enclosures. Generally, the Type M compounds at Kweneng (South Africa) are allocating less than 30% of their total space to livestock management areas or central enclosures. For Molepolole (Botswana) the sampled wards are largely allocating less than 10% of their total space to livestock management (central kraals).

DEDICATION

To Mathibidi and Ndobochani families

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1 INTRODUCTION

In southern Africa, a lot of research on cattle pastoralism has gone onto the investigation of the antiquity, distribution and number of cattle. Who owned cattle, what was their value, and how was this value integrated in the social, political and economic structure of past societies? Another aspect that characterized research on livestock ownership and management, even up to present, is the seasonal cattle mobility patterns. For example, Jeanette Smith (2005) and J. Smith *et al.* (2010) demonstrate that the Shashe-Limpopo River Basin provided a niche for periodic movement of livestock (in accordance with seasonal variation) typical in the period AD 900 to 1700. Furthermore, about 255 Khami sites in the Mapungubwe area show evidence for palaces and commoner residences, field camps and what are believed to be cattle posts (Huffman 2012a; see also Denbow *et al.* 2008). This shows a strategic exploitation of resources that these studies on seasonal mobility have demonstrated.

Ecological indicators for herder-farmer sites have been identified, variations in the sizes and location of herder-farmer sites understood through ethnohistoric sources, and archaeological settlement hierarchies such as the Toutswe tradition developed. Denbow (1979) noted that abandoned archaeological cattle-enclosures (*kraals*) tended to be recolonised almost exclusively by buffalo grass (*Cenchrus ciliaris*), making them highly visible on aerial photographs. His ground-truthing exercise included archaeological excavations that showed the presence of substantial deposits of vitrified dung.

Previous archaeological work has provided some insights on herd management strategies. The concept of keeping cattle away from the main settlement is termed differently in the literature. Terms used include cattle-place and out-post (Campbell 1822 I, Campbell 1822 II), cattle post and grazing-post (Schapera 1943, 1994; Konczacki 1978; van Waarden 1987), pastoral landscape, cattle camp, grazing management area, temporary camp and cattle encampment (J. Smith 2005; Denbow *et al.* 2008; Smith *et al.* 2010; J. Kinahan 2014).

In South Africa, during the 1970s and 1980s research expeditions in the northern and southern highveld of Johannesburg were led by archaeologists at the University of the Witwatersrand (Taylor 1984; Mason 1986; Huffman 1986a and 1986b). Stone-walled

structures were studied and classified into Type N, the earliest period, Klipriviersberg (K) and Molokwane (M).

A second wave of research which began less than a decade ago has utilized Google Earth satellite imagery, LiDAR imagery and Geographical Information System (GIS) software, combined with foot surveys and soil phosphate analysis to study the changing settlement patterns in the Suikerbosrand area over the last 500 years (Sadr & Rodier 2012; Ensor-Smith, J. 2013; O'malley 2013; Hunt & Sadr 2014; Banhegyi 2015; Sadr 2016a, 2016b, 2019a, 2019b).

In the latest wave of research, the earliest period of stone-walled architecture at Suikerbosrand dates to the 15th and 16th centuries AD (Sadr & Rodier 2012). It is characterized by widely dispersed compounds throughout the massif and at all elevations. A subsequent detailed study of this period by Sadr (2019b) focused on type N compounds, and it indicates that although they are widely spread across the Suikerbosrand landscape, there is an inclination of bigger sized ones to the north, while the smaller isolated ones are predominantly in the south. Sadr (2012) is of the view that the changing nature of herder-farmer sites suggests change in or adoption of herd management strategies such as the cattle post system. It is not yet clear at this stage if this system may have been innovated or adopted in the sequence of the first three phases of stone-walled settlements across Kweneng or the Suikerbosrand landscape.

This clearly indicates the need for more studies to investigate settlement patterning of herder-farmer sites from an integrated and multidisciplinary approach. Herd management strategies should be integral in the interpretation of evolving ideologies on the use of central spaces at intra and inter-site levels. There is need for multi-step research processes.

First, there is a need to understand contemporary cattle posts. What processes and motivations lead to their creation and retention, their locational characteristics and material signatures? Second, we must investigate ways of detecting cattle posts in the archaeological record in order to trace the origin, evolution and spread of this innovation. Thirdly, several methodologies must be employed to facilitate corroboration of results, and enable generation of confident conclusions. As an example, are cattle posts a

periodic phenomenon that came into use in response to specific factors only to disappear when conditions change? If they emerge, disappear and re-emerge, how is this manifested across the landscape and can we discern this process of evolution both temporally and spatially?

As part of the on-going research into the origin and evolution of the cattle post institution among the Tswana of southern Africa, this research uses the Kwena polity in southeastern Botswana to begin to address some of the concerns raised above. First, the historical, socio-economic and anthropological literature on the Kwena is reviewed and shows that among the Tswana cattle posts are a social, political, economic, environmental and ecological response institution that remains relevant today.

Secondly, an ethnoarchaeological study of contemporary Kwena cattle posts (Tswana *moraka*, plural *meraka*) is carried out in order to define cattle posts and their function. This includes an extended discussion of the factors influencing the establishment and location of cattle posts, their settlement patterning as well as those contributing to their continued use among farming societies such as the Tswana. Indicators to discern cattle posts spatially and temporally are developed.

Thirdly, my research studied selected N, K and M compounds at Kweneng in southern Gauteng, South Africa. The specific interest was on investigating the sizes (area) of central enclosures and how this varied over time, and the ratios of these central enclosures to the overall compound sizes. Notwithstanding controversies over the many ethnicities that may have occupied Kweneng, and that the Kwena may have not specifically occupied Kweneng on their own (see Breutz 1958:141-143; Landau 2010), I selected it because it is a landscape that was occupied since the late 17th century by non-Tswana groups (Sadr 2019b; 2019a), and has Molokwane stone-walled structures that were most likely built by the Kwena branch of the Tswana “at the turn of the nineteenth century AD” (Sadr 2019a:3).

1.1 Rationale and hypothesis

Archaeologically, central enclosures at main settlements of herder-farmers are believed to have kept livestock. Understanding of the settlement patterning and distribution patterns of the varying sizes (area) of central enclosures at archaeological sites is important. What

would happen to the sizes of central enclosures if livestock is managed outside of the main settlements?

Can variances in the settlement patterning, size of central enclosures or inner spaces, and overall compound sizes or total area of inner and outer spaces, contribute to our understanding of past herding practices? The inner space in this this research refers to the proportion of area that is or would have been used for livestock management, otherwise also referred to as central enclosures. In the ethnoarchaeological study, this space is referred to as the kraal area or livestock management area. The term livestock management, as opposed to strictly cattle management is adopted here as even small stock would have been kept in the inner space. Furthermore, the literature on Tswana settlement patterning has shown that the central spaces of wards had a multifaceted purpose (Campbell 1822 I, 1822 II; Schapera 1970; Pistorius 1994, 1996; Boeyens 2011).

For the discussions on the archaeological results, I use central enclosures to define the space constituting all the enclosures that make up the central spaces of compounds. The outer space constitutes all the areas containing houses and related domestic activity areas, and I define these individual areas/units containing houses as yards. Where these yards form a circular or semi-circular pattern around a livestock management area, I refer to this as a ward in the discussion of my ethnoarchaeological findings, and as a compound in the discussion of the archaeological results. A comparative of a yard can be made with Schapera's (1970:12) description of a household – "group of people living in the same collection of huts", and several of these making up a ward. My definition of yard broadens the concept of household as it includes consideration of related domestic activity areas. Furthermore, the layout or positioning of these yards is critical in this research as it helps in understanding variations in the positioning and sizes of livestock management areas or kraal areas.

The main aim of this research was to establish, ethnoarchaeologically and archaeologically, the extent to which the proportion of areas of central enclosures to the overall compound size varied across space and time. Can we effectively attribute this, and other factors, to the appearance, disappearance and reappearance of cattle posts in the archaeological record?

Cattle posts remain an important institution among contemporary Tswana societies. An investigation of the antiquity and value of this institution sheds light on why it continues even where it seems not to make any economic sense, as in the case of the Tswana. Existing literature on herd management strategies and ethnoarchaeological studies are crucial in beginning to piece together evidence on the nature, origin and evolution of this tradition of managing livestock out of the main settlement.

This research was premised on two hypotheses. Firstly, keeping cattle away from main settlements served as an ecological strategy, a tool for social wealth and political expansion, a tool for economic growth and as a response to seasonal variation and climate change. Secondly, keeping cattle away from main settlements can be pigeonholed by a reduction in the proportion of the compound allocated to livestock management (proportion of areas of central enclosures to the overall compound size). The more societies accumulated cattle wealth from the Later Iron Age to more recent periods, the less area is devoted to keeping livestock in the central enclosures of main settlements. Through time, the management of livestock is decentralized by firstly creating multiple kraals for additional families, as typified by Molokwane multiple central enclosures (Pistorius 1994). As the stock numbers increased and needed to be managed outside of the main settlement (at cattle posts), a shift was made towards a more decentralized ideology where the management of livestock is family-based (see Pistorius 1996 on definitions and discussions about the family concept), as opposed to ward-based.

In answering to these, my research also shows that understanding of the origin, nature and evolution of short-term and long-term herd management strategies such as cattle posts require more multidisciplinary and multi-stepped research processes.

1.2 Aims and Objectives

This research was aimed at investigating the material proxies that characterize ethnographic cattle posts and applying these to explore cattle posts in the archaeology of Kweneng. The research investigated the nature and form cattle posts take, the settlement patterning at cattle post level, and the effect of the cattle post system on the sizes and positioning of kraals at main centres and cattle posts. Factors that led to the adoption of

the cattle post system by the Kweneng were also investigated. The following guided the research conduct.

1. To document the current status of Tswana cattle posts by conducting a comprehensive survey of the relevant sociological, economic, political and anthropological literature, as well as conducting a number of interviews to establish possible social and economic contexts of cattle raising.
2. To review published information concerning the history and archaeology of cattle posts by examining the relevant historical and archaeological literature from southern Africa and farther afield.
3. As a focal archaeological case study, to carry out a spatial analysis of change and continuity in livestock enclosures in a four century sequence of pre-colonial Tswana occupation of the Suikerbosrand area, between Johannesburg and the River Vaal.

1.3 Theoretical setting

Cattle posts among the present-day Tswana are embedded in a complex social and economic tradition. Tswana cattle posts can be seen as an institution which was innovated or adopted at some point in time and then spread and evolved through time and space. My study uses the theoretical framework of the diffusion of innovation studies, especially the writings of theorists E.M. Rogers & T. Hagerstrand. They argue that new ideas lead to shared behavior, new worldviews and new cultures for both the innovator and the recipient (Hagerstrand 1966; Rogers & Shoemaker 1971). The literature on herd management strategies has shown that keeping and managing cattle out of main settlement is not a preserve for the Tswana. Did the Tswana adopt the practice at the time of acquiring cattle, or at the time when they experienced increased stocks? It is beginning to show at their Iron Age site of Kweneng in South Africa for instance that the sizes of central enclosures were increased at some point in time to as big as 4866m², and then decreased to as low as 90m². This, together with consideration of other factors such as external risk requires more work. Several case studies are necessary to pin point, with confidence, when the Tswana started using cattle posts, and where they got the idea.

Originators of ideas are innovators and their ideas are transferred within and across societies. However, this should not be considered a linear and simple process (Hagerstrand 1968; Rogers & Shoemaker 1971; Kim 2001; Eerkens & Lipo 2005, 2007; Rogers 2010). Innovation is received and processed in the context of the recipient's worldview, and as the new ideas are thought through and implemented, they are socially constructed and sometimes lead to variation from the original idea. As such adoption of change is not easy and may take longer to effect, and often difficult to date (Hagerstrand 1968) because internalization and decision making occurs at both individual and societal level (Rogers & Shoemaker 1971).

With evidence from the literature that the cattle post concept is not a new phenomenon, and with results of the study on the Kwena cattle posts system, it is clear that the idea of keeping cattle away from the main centres such as Molepolole was acquired elsewhere and adapted. The ethnographic study has shown that the Kwena made decisions at societal level to mitigate risk - address push factors, and to responsibly exploit extensive pastures beyond their main settlement - pull factors necessitating establishment of cattle posts. The literature shows that southern Africa was troubled for a good three centuries from AD 1600 to AD 1900 by colonial expansion and Mfecane wars (Ngcongco 1979; Gulbrandsen 1993; Hall 1993; Perry 1996; Etherington 2004; Richner 2004). While this would have led to adoption of concepts such as the cattle post system to take cattle away from the risk, this should also be seen as a politically, economically and social construct that got integrated into the daily lives of the Tswana.

The ethnoarchaeological study in Botswana has shown that the cattle post concept was adapted and evidently resulting into two main types – ERCPs and RMCPs. These two types often result in three distinct entities in the cattle post process – moraka (a place where only livestock is kept); moraka-masimo (cattle post that has attracted arable activities) and masimo-moraka (arable landscapes that later attract pastoral activities). The idea of keeping cattle away (to hide them or to address environmental degradation) is now becoming a viable wealth generation strategy that continues to be used by the Tswana.

As a result, the complexity of issues regarding diffusion of innovation requires understanding of the distribution and evolution of ideas/cultures through time and across

vast landscapes (Hagerstrand 1968; Boles & Lane 2016). This process is often affected by factors beyond cultural behavior (e.g. Gifford-Gonzalez 1998, 2000 notes the impact of animal diseases on the spread of pastoralism and herding practices). The diffusion of innovation theory thus provides a framework for studying evolution in behaviour, practice, socio-cultural systems and material culture, and is an appropriate lens through which to observe the evolution of Tswana cattle posts.

1.4 Methodological approaches

It is clear from the literature that cattle posts are not a new phenomenon and understanding their origin and evolution still requires more research. Although the identification of cattle posts at archaeological sites such as Kweneng requires multi-stepped research processes, this research only exploited four steps. Firstly, archaeological and historical literature on herd management strategies was reviewed to gain insights on issues relating to the occurrence, nature, distribution and sustenance of cattle posts.

Secondly, an ethnoarchaeological study of cattle posts among the Kweneng of Botswana was carried out to document factors prompting establishment of cattle posts, settlement patterning (placement, sizes and orientation of kraals), and types of cattle posts.

Thirdly, an archaeological study of the stone-walled compounds at the Kweneng (Suikerbosrand) landscape in southern Gauteng, South Africa, was carried out. The areas of central enclosures at Kweneng were used to determine any traits/indicators of structures that could have served as cattle posts. The areas of central enclosures were established, their proportion to overall compound sizes calculated, and the distribution patterns of these across Kweneng north, central and south studied. Lastly, existing phosphate analysis results are discussed to show why I did not do phosphate tests, even though they formed part of my research objectives.

1.5 Synthesis

Notwithstanding the wealth of information already available on herd management strategies, several questions still needed to be answered. The origin, evolution, variation in settlement patterning and use of space, material composition and chemical analysis are critical variables in the study of cattle posts. How do we begin to trace the origin of the cattle post concept? When, for example, did the cattle post system first appear, and if it was adopted during the Toutswe tradition (AD 800-1200), can we trace its origin in the

Early Farming Communities (AD 200-900), and its evolution and spread from the Later Iron Age to the present (from AD 1300-1840-present)?

Recent research in the Suikerbosrand area (Sadr 2019b) shows that the earlier stone-walled settlements of type N compounds were largely herder sites, and these are predominantly in the north and south, with the south distribution showing a more dispersed pattern of N compounds. He further demonstrates that there is clear cultural continuity between Type N and Type M compounds. If the cattle posting process (keeping cattle outside of the main settlement) started during the Type N culture, what will we see on the M compounds to showcase that the cattle post system was already adopted at this stage, or had not begun? My research shows that central enclosures for Type N compound are relatively smaller, growing bigger during Klipriviersberg when agglomeration begins, and finally becoming even much bigger during Type M compounds.

Studies of use of space at herder-farmer sites have shown that central enclosures at main settlements kept livestock. My research shows that the distribution pattern and the varying sizes (area) of these central enclosures is an indicator that herd management strategies changed over time. When livestock increases, the size of central enclosures would become bigger, and reducing when stock numbers decline either due to loss or as a result of them being kept outside the main settlement.

Large stock numbers would have necessitated their management out of these main centers. When a decline in sizes of central enclosures is coupled with a reduction in the sizes and positioning of wards/compounds, this is an indication that decentralization of livestock management has occurred. Livestock is now managed at family level, as the new families (or new population additions to the society) are assigned wards that get appended to the older ones. The management is not only decentralized to family or sub-ward level, it is at this stage also decentralized to areas outside the main center – resulting in smaller wards and kraals that characterize the peripheral areas of Molepolole and Kweneng.

In terms of settlement patterning, can we differentiate cattle posts from isolated homesteads, and do we see a distinction between main settlements and those initiated

through cultivation and the cattle posting process? The ethnoarchaeological study of the Kweneng cattle posts shows that they can be pigeonholed by distance from the main settlement – a buffer of at least 2.5km from the main settlement and 2.5-5km in between cattle posts.

The Kweneng data shows that there is peculiarity in the sizes of central enclosures, and their relationship to overall compound sizes and types. A total of 69% of Type N compounds have central enclosures that are less than the mean of 909m². The same compounds have areas of outer spaces (66%) that are less than the mean of the total sample of 3878m². For Type K compounds, 68% have areas of central enclosures that are less than the mean area (909m²) for the total sample. For the areas of outer spaces, a total of 71% are less than the mean area of 3878m² for the total sample, compared to the 66% for Type N. This means that although the central enclosures for Type N compounds are relatively smaller, the outer spaces or rest of the compounds are bigger. A total of 54% of Type M compounds have central enclosures that are less than the mean area of 909m². This shows that M compounds have relatively larger central enclosures than N and K compounds.

In terms of spatial variation, the north, central and south parts of Kweneng display variation in the distribution pattern of sizes of central enclosures. Although the three sectors of Kweneng have representation of the later period Molokwane compounds, they are predominant in central Kweneng and are largely characterized by larger central enclosures.

What can ethnoarchaeology tell us about some of the underlying issues in the establishment of cattle posts? I used the Kweneng capital of Molepolole in Botswana, while for the archaeology I used Kweneng in South Africa. My study indicates that the number of cattle, both at family and community level, the depletion of grazing and water resources immediately around the main settlement, political instability, risk from diseases, theft and wildlife, environmental pressure and ecological concerns collectively lead to the establishment of two types of cattle posts. The Ecological Response Cattle Posts (ERCP) and Risk Management Cattle Posts (RMCP) have a bearing on the positioning of kraals and yards. ERCP cattle posts can take three forms. Some cattle posts were solely for keeping cattle (*moraka*), and such places are usually furthest from the

capital and the cultivation areas, and are mostly preferred by families with large numbers of cattle. At this type of cattle posts, only herdboys or cattle owners resided, and they are kept in one place for longer periods unless water, grazing pastures and diseases become a problem. Another form is the one that later attracts arable farming activities (*moraka-masimo*), and these are usually in reasonable distance from the main settlement as their establishment would have resulted from an incremental exploitation of pastures around the main settlement. There may be need to keep cattle at cultivation areas, resulting in the third form of cattle posts (*masimo-moraka*). These types of cattle posts have different distributions and growth patterns and are geographically distinct.

Furthermore, environmental issues (topography, climatic conditions and vegetation), types of cattle posts and settlement patterning facilitate socially constructed and shared landscapes among Tswana herder-farmers. Landscapes, especially grasslands, devoid of structural remains are not necessarily a reflection of lack of utilization of such landscapes. They have socio-economic value in that they are daily grazing zones, the extent of which are often marked by establishing royal cattle posts if the distance reaches up to 5km from main settlement. The continued need for suitable pastures for livestock and cultivable soils has led to long-term mobility by Kwena herder-farmers and the growth of satellite settlements that still characterise present-day Botswana.

Notwithstanding knowledge gained through my research there is still room for more focused research. There is need for detailed micro research processes that can begin to determine differences between pastoralists and nomadic mixed farmers, and how their settlement patterning and use of space was adapted or transformed over time. Examples of these are the multidisciplinary studies of the type and distribution of stone-walled structures by Sadr (2012), Sadr & Rodier (2012) and Sadr (2019). Sadr's study of Type N compounds across the Suikerbosrand landscape should be repeated for other compound types to allow for an effective investigation of innovations and how they were adapted and shared temporally and spatially.

1.6 Thesis structure

This thesis is submitted in accordance with the format for the Faculty of Science at the University of the Witwatersrand for the submission of a PhD by thesis in the School of

Geography, Archaeology and Environmental Studies. It presents the results of my PhD research conducted from 08/02/2017 to 28/02/2021.

In this thesis, I present results of my two-stepped research approach. The results of an Ethnoarchaeological study on the Kwena cattle posts has resulted in one (1) paper publication, presented in Chapter 4, section 4.2. An archaeological study at Kweneng in southern Gauteng, South Africa has resulted in a draft paper ready for submission, presented here in Chapter 5. Details of the thesis structure are presented below.

Chapter 1: Introduction

I introduce the reader to the issues in the thesis. The justification for studying cattle posts is provided by first contextualizing the knowledge of their existence ethno-historically and archaeologically. The objectives of the study are outlined, and a rationale for the research intent and a theoretical context provided. I outline the key issues emerging from my research.

Chapter 2: Literature Survey.

The first two objectives of my research required that I did extensive literature search for the archaeological, anthropological and historical knowledge on Tswana herding practices. In this chapter, I demonstrate some of the extensive work done to date on the topical issue of herding and herd management strategies in general. The chapter gives a synopsis of arguments around herding (origin and distribution) and its spread from the Kalahari to the interior of southern Africa and the Cape. The herding practices in southern Africa are reviewed, and how linguistic studies have been used to address the issue of contact in herder-farmer societies. Factors leading to the adoption of herd management strategies are reviewed, and the settlement systems of herder-farmers and the Tswana discussed.

Chapter 3. Methodology

Using the Botswana case studies, the setting of cattle posts areas are discussed to show the relevance of environmental consideration by herder-farmers and those who study them. This is contextualized in existing researches on vegetation, digestible grasses for cattle and rainfall patterns. A detailed background on the existence of cattle posts amongst the Tswana, and the Kwena in particular, is augmented with results of the

ethnoarchaeological study to produce maps of known Kwena cattle posts from the late AD 1700 to 1950s. The ethnoarchaeological component of the methodology employed interviews and onsite discussions at kraals and grazing zones with informants. Other methodological approaches are also discussed, and these include the use of Google Earth imagery, QGIS and SPSS for quantitative data collection and analysis. For the Kweneng (Suikerbosrand) case study,

The central enclosures of 306 stone-walled structures at Kweneng were digitized and analyzed. The sizes (area) of central enclosures and the rest of compounds were calculated. Their distribution in relation to the compound types of N, K, and M was studied. It was also necessary to establish how the sizes of central enclosures were distributed across the three sectors of Kweneng – the north, central and south. Once this was done, the proportions of areas (central enclosures to the overall compound sizes) allocated to management of livestock was studied.

Chapter 4. Ethnoarchaeological approaches to the study of cattle management strategies: a case study of the Kwena cattle post institution.

This chapter presents the results of an ethnoarchaeological study of the Kwena cattle posts in Botswana. The last sections of the chapter present the results, noting key contributions of the research in regards to factors leading to establishment of cattle posts and the associated settlement patterning. This chapter has been published in AZANIA. Nonofho Mathibidi Ndobochani (2020) The Kwena of Botswana and the cattle post institution, *Azania: Archaeological Research in Africa*, 55:2, 258-289, DOI: [10.1080/0067270X.2020.1761687](https://doi.org/10.1080/0067270X.2020.1761687).

Chapter 5. Cattle posts in archaeology: a case study of Kweneng, southern Gauteng.

This chapter begins by introducing the purpose of the second lap of my research – a focal archaeological study of central enclosures of stone-walled structures at Kweneng. It presents the results of the analysis of sizes of central kraals or enclosures at main settlements. Not only did I study the sizes, I evaluated their variation over time, for the N, Klipriviersberg (K) and Molokwane (M) compounds. The variation was also observed across Kweneng north, central and south. It was also necessary to establish the positioning of these central enclosures, and if it changed across the Kweneng landscape – if Tswana kraals are placed within wards at main settlements, where are they positioned in a cattle post setup. For the latter, two cattle posts were studied in Botswana. The

proportion of ward/compound space allocated to central enclosures, and how this varied over time and space, was also studied.

Chapter 6. Discussion and Conclusion

This final chapter presents key findings of my research, noting that there are several indicators that can be used to identify cattle posts in the archaeological record.

Consideration of the environmental setting is key in the establishment of cattle posts. A few comparative studies in southern Africa and elsewhere are discussed to contextualize my results. The need for more work is highlighted, especially the need for systematic and multi-stepped research approaches.

The last section of the thesis provides the references.

2 BACKGROUND

2.1 Pastoralism and evidence for herding in Africa

Pastoralism has long been a focus of research in Africa. Bollig and Schnegg (2013) put together an edited volume that synthesized the past, present and future perspectives on pastoralism in Africa. Introducing the volume, Bollig & Schnegg (2013) offer various definitions to the concept of pastoralism, and note that pastoral activities occupy most of pastoralists' time and mind because they are underpinned on the societal socio-economic and ideological dogma. In the same volume, Sadr (2013: 172) defines herding as “a way of life that was economically, socially and symbolically focused on livestock management”. Where did it all start, and how did it spread across Africa and to southern Africa.

Much of the literature on pastoralism concerns the antiquity of herding in Africa. The southern Libyan desert has conclusive evidence that the Nile valley witnessed cattle herding as early as 5th millennium BC, with linguistic evidence suggesting milking activities dating to 12 000 BP (Grigson 1991; Jesse *et al.* 2007). East and West Africa also have evidence for early herding (Grigson 1991; A. Smith 1992; Jousse 2004; Lesur *et al.* 2014). Di Lernia *et al.* (2013) are of the view that since Africa has good historical depth of cattle herding and management, this provides good opportunity for diversified and broad-minded research agendas.

Southern Africa, like other parts of Africa, also paid attention to the presence, distribution and increasing numbers of cattle in the Later Stone Age, Early Iron Age and Later Iron Age periods (e.g. Deacon *et al.* 1978; Denbow 1979; J. Kinahan 1986; Voigt 1986; A. Smith 1992; Plug 1996; Sadr 1998, 2013; Robbins *et al.* 2005; Badenhorst 2008, 2010, 2011; Huffman 2012b, 2012c; Orton *et al.* 2013). In a review of the long-standing arguments on relations between southern African herders and farming societies, Sadr (1997, 1998, 2013) alluded to the complexity of origins of herding. He notes that irrespective of the relationship between herder-hunters, farmers and hunter-gatherers it is still critical to investigate the dynamics of cattle herding and herd management strategies, and indeed socio-political relations between different ethnic groups. As an example, Sadr (2012:262) demonstrates that changes in settlement patterning at Klip River Kraals can be equally interpreted as representing three cultural groups, or as denoting a pastoral

settlement that is gradually changing from a dispersed setup to an agricultural settlement characterized by nucleated patterns.

Evidence for herding in southern Africa can be traced ethnographically (Barnard 1992), linguistically and from missionary records (Boonzaier 1997; Ehret 2008). Linguistically, the origin of words associated with domesticates (and these would become loan-words to the recipients of the innovation) can be used to trace the spread of herding (Ehret 2008). Herders were present in southern Africa; they moved from one place to another and shared ideas on herding practices as they interacted with non-herders.

Archaeologically, evidence for early cattle herding has been observed at the Cape, at open-air and cave sites (Deacon *et al.* 1978; Klein 1986; Bousman 1998; Mitchell 2002; Sadr 2003; Pleurdeau *et al.* 2012; Orton *et al.* 2013). Deacon *et al.* (1978) note that although the Boomplaas Cave shows evidence for episodal occupations, it is clear that the population was nonetheless established herders, who kept goats, sheep and cattle. Sadr (2003) and Orton *et al.* (2013) also emphasize the presence of livestock that predates the Bantu and the European occupation of the Cape area in AD 1488. Besides the presence of fauna, Benjamin Smith & Ouzman (2004) have noted the contribution of rock art to the understanding of herding in southern Africa.

Vitrified dung has been widely used in southern Africa to detect the presence of livestock. Livestock penning activities resulted in dung middens forming at kraals. Depending on the rate of accumulation, number of animals, longevity of the activity and post-depositional processes, this may result in vitrified dung deposits (Denbow 1979; Thy *et al.* 1995; Denbow *et al.* 2008). The study at Bosutswe in Botswana concluded that where vitrified dung is present, cattle would have been kept at such centres for longer periods. The absence of vitrified dung at centres occupied for longer periods (e.g. Bosutswe from AD 700–1700), would mean that cattle must have been kept at cattle posts. Bosutswe shows that from AD 800–1200 cattle outnumbered small stock, but that from 1200–1650 cattle numbers continued to rise even though there was no evidence for vitrified dung.

One must however note that studies on vitrified dung attracted debates concerning its origin (Denbow 1979) and whether all of it was anthropogenic (Peter 2001). Other

concerns were on the depositional processes such as the rate of accumulation, depth and composition of the dung (Badenhorst 2009; Peter 2001). Post-depositional processes such as prolonged burning with very high temperatures are attributed to the formation of biomass slag (Thy *et al.* 1995; Peter 2001; Huffman *et al.* 2013). Bearing these issues in mind, subsequent studies focused on the occurrence and distribution of sites with vitrified dung (Denbow 1986; Jacobson *et al.* 2003; Huffman *et al.* 2013).

Soil phosphate analysis has also been used to distinguish structures where livestock were believed to have been kept. These studies (e.g., Ensor-Smith 2013; Banhegyi 2015; SGSWS project field school reports of 2012-2015) used soil phosphate analysis to distinguish structures where livestock was possibly kept. Furthermore, other activity areas including homesteads (equivalent to yards or households), courtyards (activity areas usually in front of houses), and control areas as well as the inside and outside of stone-walled structures were tested.

Their researches highlight a few key points. Old cattle kraals and recent ones too show a medium intensity of phosphate reading (2-4). In terms of activity areas, ash middens composed of burnt dung and organic rubbish show very high intensities of phosphate readings of 4-6. Banhegyi (2015) notes that sediments elsewhere, that is in and outside the homesteads, showed low intensities of soil phosphate. For example, for stone walled structures, smaller enclosures or what he terms Type A structures, are ranging from 6-456m² and yielded low phosphate readings. What he defined as Type B (medium sized-structures) structures have courtyards and a minimum area of 47m² and maximum of 1059m², and they yielded higher readings in the courtyards. Type C structures are larger than Types A and B, have a minimum area of 561m² and maximum of 9065m², and scored higher readings in their central enclosures. These studies indicate that although there is still room for more studies (increased and more targeted phosphate samples and application of other chemical analysis) soil phosphate analysis can be one of the instruments used to delineate herder-farmer activity areas in southern African archaeology.

2.2 Increased stocks and herder-farmer mobility

What factors facilitated the accumulation of wealth? The accumulation of cattle was facilitated by several factors. In southern Africa, Konczacki (1978) and Kinahan (2014) identify trade as one of the tools used to study herding, and maybe as one of the factors which motivated increases in stocks. Favorable environmental and climatic conditions, coupled with availability of suitable grazing pastures and water, led to the expansion of territories so as to increase stocks.

The quest for political expansion, together with the socio-cultural value of cattle amongst herder-farmer societies such as the Tswana, also facilitated increased stocks and mobility. Increased human populations and cultivation resulted in the development of highly nucleated settlements that necessitated the keeping of cattle outside these centres (Smith 2005; Denbow *et al.* 2008; Sadr 2012). We also note that increased stocks and the idea of keeping cattle away from main settlements resulted in the interaction of herders with non-herders, leading to symbiotic relations amongst groups of different cultural backgrounds (Schapera 1994; Hitchcock 1978, 1987, 2004; Campbell *et al.* 2006).

However, the mobility of herder-farmers was not only triggered by increased stocks and availability of resource-rich landscapes. Keeping cattle outside of main settlements was an environmental and ecological management strategy (Stenning 1957; Rennie *et al.* 1977; Hitchcock 1978, 1988; Majekodunmi 2018) geared towards addressing seasonal and climatic variations (Campbell 1999; Smith 2005; Denbow *et al.* 2008). The literature shows that the Kwenya population was expanding (Schapera 1970; Okihiro 1976; Ramsay 1991), and it is assumed here that this would have put pressure on the immediate environment and requiring relocation (Ramsay 1991). Environmental degradation would have required a refocus on herd management strategies - cattle would have been taken elsewhere (Okihiro 1973; Silitsheya 1979), whether on a permanent or temporary basis, to mitigate the risk of loss (Braat & Opschoor 1990; Denbow *et al.* 2008; Mlay 1986).

2.3 Herder-farmer settlement system

2.3.1 Major centres and satellite settlements

Denbow interpreted sites located near the edges of Toutswe as possible cattle posts (and perhaps occupied by former hunter-gatherers) and those located closer to the centre of Toutswe polities considered as potential agricultural homesteads. The next tier in the

hierarchy comprised large sites on hilltops with extensive middens and deep dung deposits, thought to be mid-ranking agro-pastoral centres. At the apex of this hierarchy Denbow identified three very prominent sites (Toutswe-mogala, Bosutswe and Shoshong) that were occupied for longer periods with evidence for higher political order and which he considered served as the capitals for three sub-regional Toutswe chiefdoms (Denbow 1986, 1999; see also Plug 1996).

Alternative models of the regional Toutswe settlement structure have been proposed, however, especially with reference to the evidence from Lose in Botswana, where a more diffuse pattern of residential clusters may have prevailed (Kiyaga-Mulindwa 1993; Kiyaga-Mulindwa and Widgren 1993; see also Segobye 1994; Reid and Segobye 2000; Mookodi 2001 for additional critiques of elements of Denbow's tripartite model). Despite such reservations, more recent research provides a detailed assessment of the evolution of herd management strategies from localised grazing pastures, as witnessed by vitrified dung at some Toutswe-type sites, to keeping cattle further away from the settlements (Denbow *et al.* 2008).

Drawing extensively on ethnohistoric sources (especially that of Schapera 1930, 1943) to interpret variations in the size and location of sites, Denbow (1982, 1984) then identified a tripartite settlement hierarchy associated with the Toutswe Tradition (AD 800–1500). In this model, numerous small settlements comprise the base of the settlement hierarchy, typically occupied for shorter periods.

Denbow *et al.* (2008) contextualized the concept of cattle posts in the broader framework of the Zimbabwe Cattle Pattern. They note that the value of cattle to past and present societies facilitated their accrual in large numbers. Where the carrying capacity of the main settlement was exceeded, its political sphere would be expanded to conquer good pastures beyond its initial boundaries. This way, instead of completely abandoning the main settlement, cattle posts would be established as an ecological response to degraded pastures. With a larger number of cattle, Chiefs and Headmen had to change herd management strategies, an aspect that Denbow *et al.* (2008:472) equate to a change in the agro-pastoral ideology and how this would have impacted on politics of a wider region.

2.3.2 Central Cattle Pattern

The value of cattle among the Tswana and the rest of Bantu groups has been extensively addressed through the works of travelers and missionaries, archaeologists and historians. Huffman (1986b) talks to the political value of cattle as witnessed by the Central Cattle Pattern model. This model can be identified by the positioning of cattle kraals in the centers of settlements, and in association with men's meeting places (Huffman 1986b). Although this model has been widely accepted and equally criticized in the southern African archaeology, it has explained the ideology behind having cattle kraals in the middle of main settlements. Several reasons have been given for the positioning of cattle kraals, and these ranged from arguments for cattle as symbolic assets and therefore central to the society and placed in the center. Some views are that the positioning of kraals in the center of wards is a purely functional move to protect cattle against enemies and thieves. Despite the different views on their representation, the Central Cattle Pattern Huffman (2007), or the Central Cattle Kraals by Sadr (2012), sheds light on the interaction between groups of different cultures and how their socio-economic ideologies were integrated into their political system. This interaction resulted in increased populations, expanding and shifting stratified settlements, some of which have left behind stone walled structures.

Schapera (1930; 1943; 1994), who carried out research in the Bechuanaland Protectorate (present Botswana) in the 1930s and 1940s, noted that the Tswana had a settlement system characterized by the smallest social unit called ward, and that each ward had a kraal and a men's meeting place (*Kgotla*) in the center. Households, mainly of family group and therefore related, formed a semi-circular pattern around the kraal and the *Kgotla* and were managed or headed by a Headman. Schapera (1994) notes that except for the Ngwato, the Tswana place the Chief's ward in the middle of the settlement, surrounded by wards of the royal family then the rest of the society. The tribal *Kgotla* and the cattle kraal for the whole society were therefore at the Chief's ward and very central to the socio-politics of the society denoting that the Chief was the pillar.

2.3.3 Tswana settlement system

The Tswana had cattle and the numbers alluded to in the literature would have necessitated keeping the surplus outside the main settlements. In Southern Africa, Boeyens (2000), Boeyens and Plug (2011) and Pistorius (1992, 1994) have surveyed and

mapped Later Iron Age sites associated with the Tswana (see also Schapera 1970; Maggs 1976; Taylor 1979; Morton 2013 for more discussions on the Tswana). They discussed the socio-political organization and settlement patterning characterizing these Tswana societies during this period, and most importantly noted the occurrence of cattle kraals, which were located in the centres of settlement units or wards. They argue that cattle were central to the socio-political setup amongst the Tswana, leading to the observed settlement patterning. Their arguments for the presence or absence of cattle kraals was augmented with documentary sources of missionaries and travelers who either resided with these societies or had contact with them through other means. As an example, Campbell (1822, II: 152-154) notes the arrangement of Tswana settlements into wards that had big kraals in their centres where some of the cattle were kept, while the rest were at cattle posts (II: 60), possibly hiding them from cattle raids theft that characterized this period (Campbell 1822, I: 174-182, 1822, II: 178).

In Botswana, Schapera (1994) notes that the settlement system of the Tswana was traditionally characterized by main settlements called villages or towns, cultivation areas at a reasonable distance from the village and places where livestock was kept (cattle posts) – much further from the cultivation areas or ploughing fields. Although the location of these could be anywhere within the tribal land, Schapera (*ibid*), based on his observation of the Tswana in the early 1900, noted a careful consideration of the hydrology, geology and suitable grazing pastures (see also Arntzen and Opschoor 1986; Campbell *et al.* 2006 on strategic positioning of cattle posts). Cattle were kept at cattle posts and in the main settlement, and if the latter occurred, they would influence the settlement patterning. The kraals were surrounded by a ring of houses or households, forming a single settlement unit known as a ward which constituted people of the same social group and mostly relatives. These smallest social units among the Tswana had their own central kraal and a meeting place for men (*kgotla*) in the center of the ward. According to Schapera, this kraal was used periodically to house cattle or small stock if they were brought to the main settlement for draught power and for cultural ceremonies (Schapera 1994).

2.4 Herd management strategies in southern Africa and beyond

The pioneering archaeological research of James Denbow in Botswana in the 1970s and 1980s used ecological indicators to identify sites and further discern herd management

strategies among Toutswe type sites (Denbow 1979, 1982). Denbow (1979) noted that abandoned archaeological cattle-enclosures (*kraals*) tended to be recolonized almost exclusively by buffalo grass (*Cenchrus ciliaris*), making them highly visible on aerial photographs. His ground-truthing exercise included archaeological excavations that showed the presence of substantial deposits of vitrified dung.

Stable nitrogen and carbon isotope analysis was used to assess changes in herd management strategies, showing that after AD 1200 cattle were kept at outer posts that may ultimately have evolved into settlements. With evidence of an 800-year-long period of herding, Bosutswe society must have sustained a cattle economy through seasonal mobility and the establishment of permanent cattle posts at in and on the edges of the Kalahari

Seasonal cattle mobility patterns in some parts of southern Africa have been discussed by Jeanette Smith (2005) and J. Smith *et al.* (2010). These are thought to have characterised the Shashe-Limpopo River Basin, a landscape that connects present day Botswana, South Africa and Zimbabwe, from AD 900 to 1700. They highlight factors that contributed to seasonal mobility, and these include disease outbreaks and environmental degradation, aspects that are noted by Gifford-Gonzalez (2000) in the discussion of how cattle-based economies in southern Africa were compromised by animal diseases.

There are several other archaeological and anthropological studies that at least tangentially have dealt with questions of identifying cattle management strategies in ancient landscapes (e.g., Hall 2000; Huffman 2012b; Hitchcock 1978; Kinahan 2014; Sadr 2012; Voigt 1986; Fredriksen and Chirikure 2015; Hitchcock 2004). Elsewhere, John Kinahan (2014) investigated cattle camps and how their presence could be used to study trade and settlement patterning in pre-colonial occupations of the Namib Desert coast. Pretty much around the time when the Tswana were already found in some parts of southern Africa from AD 1800 (Ngcongco 1979; Scotch 2008; Sadr 2019a), Kinahan discusses points where cattle would be assembled in preparation for trade activities. There were key areas across the landscape that enabled the exercise - watering points and grazing areas inland, and the point of contact at the shorelines. He notes the positioning of grazing camps or cattle posts inland as a herd management strategy that protected the much valuable resource from traders, intruders and diseases. The dune valley

environment emanating from sea fog and periodic light rain showers resulted in good grazing pastures that created a niche for establishing a cattle post at Khaeros.

Tanzania traditionally exhibited shifting herding and cultivation practices that allowed for environmental recovery (Mlay 1986). This process would have facilitated maximum and systematic exploitation of arable and pastoral pastures without putting untimed pressure on such resources. There was therefore nomadic pastoralism as a land management strategy, and if this issue is also understood in the context of Thomas and Sporton (1997: 12), it is indeed a complex enviro-socio issue, and also a socio-enviro issue or both, as would be argued by Braat & Opschoor 1990).

The Dinka and the Nuer are also known to have had a seasonal settlement system around the Nile area, largely influenced by the need for water and suitable pastures for cattle (Newcomer 1972; Glickman 1972). The Sahelian region was not an exception as it experienced the nomadism, transhumance and semi-transhumance settlement system dictated by the need to have cattle camps outside of main settlements (Niamir-Fuller 1998: 255). This process would have facilitated maximum and systematic exploitation of pastures without putting undue pressure on such resources.

In the Neolithic of the South Deccan and North Dharwar region of South India cosmology was intertwined with arable and pastoral management strategies (Fuller 2001; Murphy & Fuller 2016; Paddayya 1998; Boivin 2004; Johansen 2004). It is evident from the literature that mobility of herder-farmers was not only triggered by increased stocks and availability of resource-rich landscapes. Keeping cattle outside of main settlements was an environmental and ecological management strategy (Arntzen & Opschoor 1986; Hitchcock 1978, 1988; Majekodunmi 2018; Rennie *et al.* 1977; Stenning 1957) geared towards addressing seasonal and climatic variations (Campbell 1999; Denbow *et al.* 2008; Smith 2005).

With populations expanding in main settlements and the surrounding landscape experiencing environmental degradation, cattle would have been taken elsewhere, whether on a permanent or temporary basis, to mitigate the risk of loss (Braat & Opschoor 1990; Denbow *et al.* 2008; Mlay 1986; Thomas & Sporton 1997).

2.5 Tswana herd management strategies

2.5.1 The Tswana – brief historical background

From the early and late 16th century, the Western-Sotho largely occupied the former Transvaal area, present-day Botswana and the Lichtenburg area. The other Tswana groups were concentrated north of Rustenburg, present-day Mpumalanga and present-day Botswana. The group included the Mogopa Kwena, Fokeng, Tlhalerwa, Phiring, Kgatla of Mosetlha, Kgafela and Mmanaana (Schapera 1943, 1994; Huffman 2002; Matemba 2003; Morton 2013; Morton & Hitchcock 2014; Schapera & Comaroff 2015). Sadr (2019a) offers a succinct history of the Tswana in pre-colonial and colonial period, showing that the society was arranged categorized into wards, each having cattle kraals in the middle of these wards, and that the central spaces also served as meeting places/administrative spaces.

These groups manifested themselves across southern Africa (South Africa, Botswana, Zimbabwe and Namibia) to the extent that their population was notable as early as the 1780s into the 1930s. Schapera and Comaroff (2015) indicate that the census of the 1930s placed the Tswana in South Africa at 365 000, about 43% of the Total Tswana in the four countries. Botswana followed with an almost 32% of total Tswana in the region at 270 500. According to them, the Cape Province (which was western South Africa and including the present-day North West Province), had a sizeable number of 168 400 Tswana and constituting 20%. A lesser number of 5% was found at the Orange Free State, specifically in Thaba Nchu with 43 800 Tswana.

By 1946 Tswana Tribal Land in South Africa and Botswana included about 105 000sq miles for the Bechuanaland Protectorate, 3 600sq miles for the Cape Province and another 3 600sq miles for the Transvaal area. Land continued to be an important aspect in the traditional way of life of the Tswana. Each Ethnic group had land under its administration and therefore ownership, and this was known as tribal land. Ownership of land was key to the Tswana as it was a multi-faceted resource. It was much needed for settlement, cultivation, keeping livestock (especially extended grazing zones) and for political expansion.

In comparison, Potts (2000) notes that in Zimbabwe, land and livestock ownership as well as cultivation are entrenched values among Zimbabweans. Even if men secured jobs in cities they still held onto the traditional values of having access to land, cattle, small stock and cultivation. As such, even in instances where land was not utilized it would still be kept, and workers often end up becoming part-time farmers.

2.5.2 The value of cattle amongst the Tswana

There is literature on Tswana herd management strategies and these are known to have socio-economic and political values. The earliest writings of missionaries (e.g. Campbell 1822) and ethnographers (e.g. Schapera 1930, 1943) both speak to the tradition of cattle-keeping among the Tswana. Schapera (1930) specifically noting herd management strategies and how they can be seen through the Tswana land tenure system.

The growing value and numbers of cattle among the Tswana facilitated further investigation into the socio-political and socio-economic values of cattle (Schapera 1930, 1943; Kooijman 1978; Parson 1981; Hitchcock 1987; Comaroff & Comaroff 1991), as well as herd management strategies (Grivetti 1979; Arntzen & Opschoor 1986; Braat & Opschoor 1990; Livingstone 1991; J.H.A. Kinahan 2000; Campbell *et al.* 2006). The Kwena settlement patterns is discussed at length by Silitshena (1976, 1978, 1979, 1982), Caister (1982), Schapera (1980, 1994) and Sekgarametso (1995). Information from these studies, together with the results of my fieldwork, was used in mapping the cattle posts of the Kwena (Figure 3.1).

Cattle are central to the economy of the Tswana. Traditionally, cattle did not contribute directly to the daily diet, except through milk and milk products. In Tswana society cattle are wealth and traditionally they were the basis of political power (Parson 1981; Comaroff & Comaroff 1991; Gulbrandsen 1993; Denbow & Thebe 2006).

Of particularly importance in Botswana and elsewhere in the region (e.g. Eldredge 1987; King 2017) is the *mafisa* system. This is an economic structure that allows for the circulation of cattle. It enabled those who have cattle to loan to those without, thereby empowering them. However, this process was at the same time indebting the recipients via the expectation to demonstrate political loyalty and take responsibility for managing

the stock on the owners' behalf (Schapera 1994). Among other purposes, the *mafisa* system of cattle loans functions as means of mitigating ecological risk (Cashdan 1985) and allows the extension of cattle loans to both Tswana and non-Tswana herder-farmers. Furthermore, this process mitigated against wealth polarization, as families without cattle could now have access to draught power and milk products.

While this may have facilitated and perhaps even stimulated regional exchange (Cashdan 1987), the system has often been attributed to creating conditions of clientism, inequality, serfdom and even conditions of slavery among various San/Basarwa and Bakgalakgadi groups living on the margins of different Tswana polities (Vierich 1982; Gadibolae 1985; B. Morton 1994; Solway 1998), ultimately creating in the twentieth century an economic and political underclass (Parson 1981; Wilmsen 1989; Good 1992). It is evident, however, that the system could also have more beneficial consequences, even for non-Tswana groups such as Herero refugees from Namibia (Gewald 2002).

Socially, cattle ownership connotes status (Schapera 1943; Roberts & Schapera 1980; Comaroff & Comaroff 1990; Matjila & Haire 2008). It elevates individuals and families and those with cattle have more power as can be seen through the value accorded cattle in ceremonies such as rites, weddings, infant socialisation, burial practices and funerals, as well as inheritance. Providing cattle for slaughter at traditional ceremonies enhanced one's social status (Comaroff & Comaroff 1990; Schapera 1994; Matjila & Haire 2008; Morton & Hitchcock 2014; Schapera & Comaroff 2015).

2.5.3 Tswana cattle posts

What are cattle posts?

In Botswana, cattle posts are open unenclosed communal grazing areas that are usually located away from main settlements or villages with watering of animals done at communal water points and natural sources such as rivers (Schapera 1943, 1994; Rennie *et al.* 1977; Grivetti 1979; Denbow *et al.* 2008; Holm 2016). In a cattle post scenario, cattle are allowed to roam vast landscapes during the day, leading to deserted homesteads during the day, but were secured in kraals at night. Cattle posts were managed by men and boys and were an extension of the socio-economic activities of the main settlement.

Schapera (1994) notes that in some instances cattle posts resulted from ward formation outside of the main settlement. This occurred if the Chief desired to have a special cattle post, and tended to be an extension of the Chief's ward. In such a scenario, a carefully selected group of men (with their families) would be assigned to take care of the cattle at the newly established ward, and a headman is selected from them. Although these men could be of the different ethnic group from that of the Chief, they would ultimately become accepted members of the settlement resulting from the cattle post process. Another way in which cattle posts emerged was through the Chief's establishment of a special cattle post for one of the wives. The selected caretakers' main responsibility would be taking care of cattle, and would become members of this ward (see Roberts and Schapera 1980). In instances where the sons of a Chief (usually from the same mother) were allowed to establish their own ward, it would have its own fields, a cattle post and a sizeable number of caretakers. The location and distribution of cattle posts was according to social units such that ward X would have cattle posts at place Y. As such one could have cattle posts of a single ethnic group spread across much wider landscapes within its tribal territory.

2.5.4 The value of Tswana cattle posts

Tswana cattle posts have an economic value. The rural economy of Botswana was by the late twentieth century characterised by arable and pastoral farming, with cattle production constituting about 80% of the rural economy (Grivetti 1979; Parson 1981; Comaroff and Comaroff 1990; Wikan 2004). Cattle posts were an essential ingredient for the expansion of cattle herding. Rennie *et al.* (1977) note that in the 1970s, about 92% of the total number of cattle in Botswana was kept at cattle posts. There were active beef export initiatives and cattle posts supplied 85% of this, with commercial ranches catering for the remaining 15%.

Livingstone (1991), observed that in Botswana commercial ranches benefit from purchases of juveniles from cattle posts as these had access to unlimited grazing. Noteworthy in his study is that herd management at cattle posts puts more emphasis on output per hectare (the concern is on the number of cattle – see also Holm 2016), while commercial ranches focus on maximizing the weight of animals. Livingstone demonstrates that cattle posts have access to a wider landscape and so can practice seasonal herd management strategies thereby allowing for environmental regeneration.

The traditional management style of cattle posts makes them the property of the family and therefore a hereditary institution (Matjila & Haire 2008). The cattle post system made people reliant on the rest of society and even on members of other ethnic groups for labour issues and for policing. This meant that cattle posts became an instrument for co-opting and controlling members of other ethnic groups, resulting in socio-politically symbiotic relations among herder-farmer societies in southern Africa (e.g. Hitchcock 1987, 2004; Schapera 1994; Hall 2000; Campbell *et al.* 2006; Ehret 2008; Tselaesele *et al.* 2016).

A cattle post is often used by its male owners as a place of relaxation to check on livestock, reminisce and affirm their manliness and status (Holm 2016). Because of the value attributed to cattle by Batswana historically and today, irrespective of qualification and position many people still have the urge to own cattle (Matjila & Haire 2008; Holm 2016). Even if men secure jobs in cities they still hold onto the traditional values of having access to land, cattle, small stock and cultivation areas, something that is a common phenomenon in much of contemporary Africa.

Besides their socio-political value, cattle posts among the Tswana were also an environmental and ecological management strategy (Rennie *et al.* 1977; Arntzen & Opschoor 1986; Braat & Opschoor 1990). With populations expanding at the main settlements, cattle posts relieved pressure on nearby pastures. Thomas and Sporton (1997: 11) are of the view that causation of change in spatially variable environments must be understood in the context of social and ecological dimensions. They emphasize that where societies own resources, and are aware of the dynamics underlying the availability or lack of such resources, they feel entitled to them and obliged to manage the same effectively.

Braat and Opschoor (1990) used a computer simulation model to investigate risks associated with traditional cattle farming in Botswana. They note that since keeping cattle in a fixed central location results in environmental stress, and grazing would need to be extended, and this would be especially necessary for areas where rainfall variability is high and below average. Effective land tenure systems among the Tswana (Schapera 1930, 1943) were especially necessary for management of sensitive landscapes and

grazing terrains such as high plains and grasslands and in areas where settlements were aggregated (see Denbow *et al.* 2008).

Keeping cattle away from the main settlement can be a risk management strategy. There is evidence that as early as the 1820s, the Tswana and other groups had cattle, a much needed resource for trade, ploughing and pulling ox-wagons. John Campbell highlights that the weight of ox-wagons, coupled with the rough terrains they traversed in the early 19th century could require up to 22 oxen per wagon (1822, II: 26). The Tswana mainly kept their cattle at the main settlements, although some were kept at cattle posts, and the size of cattle kraals could be up to approximately 286m² (938 feet) or larger.

Morton (2013) discusses the western Transvaal and eastern Kalahari Tswana settlements and the preferred landscapes, showing that they were largely characterised by large towns, and cattle keeping predominantly at towns and cattle posts (see also Campbell, II: 63 on the history of cattle ownership by the Tswana). Specifically, Morton notes the Kwena cattle posts at Morwa, Lentsweletau and Letlhakeng (2013:22). A potential possession of large number of cattle by the Kwena is also highlighted in the work of Okihiro (1976) and Schapera (1980). They note the establishment of several cattle posts in the process of managing the much needed resource, cattle, in the 19th century. In the 20th century, the main contributor to the economy of Botswana economy has been cattle. Konczacki (1978, 128-132) shows that by 1911, Botswana had about 324 000 cattle, and reaching 1.3 million in 1958. Though the numbers fluctuated after 1965 due to periodic droughts, they rose again to about 2 million by 1972, and contributed significantly to the country's gross economy (see also Hitchcock 1978, 274; Kooijman 1978).

Cattle posts took cattle away from the main settlement where they could be easily accessed by raiders, and also minimised the risk of losing all one's stock in the case of disease outbreaks. In the latter situation, they could also become a rescue place for unaffected stock, while during extended droughts their establishment in unaffected areas helped to mitigate the impact of climatic variation.

2.5.5 Factors influencing the establishment and distribution of Tswana cattle posts

Schapera (1930) notes that the traditional land management system, especially for herding and grazing activities, ensured responsible use of land resources. The tripartite settlement system (of having the main settlement, cultivation area and cattle post) that

characterize present day Tswana in Botswana must be understood as land tenure intended to accommodate the socio-economic and political organization of the society. The growing population of most Tswana groups resulted in the need for cultivation and keeping of cattle away from the main settlements (Schapera 1994: 11). The need for closer monitoring or policing for cattle and small stock as well as cultivated fields, led to small settlements mushrooming at these places. He noted that the settlement patterning at these places was irregular and family based, with households located closest to the fields. Positioning of the cattle posts was dictated by availability of water and good grazing pastures, with the settlement patterning at these places also irregular.

Borrowing a lot on previous researches amongst the Tswana in Botswana, such as that of Opschoor's 1981 work, Arntzen and Opschoor (1986) demonstrate intricacies underlying herd management in mixed farming societies. Using the Tswana in the Kgatleng District of Botswana, they illustrate how availability of suitable grazing areas, watering points and suitable soils for cultivation can facilitate nomadism even amongst highly structured and settled societies. The detailed analysis of their data suggests a direct relationship between availability of resources, the amount of livestock kept, and the extent, and or ratio, to which the society practices arable farming.

Noteworthy here is that rainfall patterns and soil suitability may positively or negatively impact the location of cattle posts, arable areas and mixed farming areas. Arntzen and Opschoor (1986) illustrate that the hardveld and below average rainfall patterns characterizing certain parts of eastern Botswana have contributed to aggregation and dispersal of settlements and cattle posts. It is evident from these studies (and of course the earliest work of Schapera in the 1930s and 1940s), that cattle posting was not just an issue of utilizing available grazing space, but a strategy to ensure livestock is separated from cultivation and residential areas, and that resources were exploited in a responsible manner. Would this be easily identifiable in the archaeological record?

In sum, a survey of archaeological, historical, socio-economic and anthropological literature shows that keeping cattle in posts away from the main settlements served different purposes in pre-colonial and contemporary Botswana. The adoption of the cattle post system can be an ecological strategy, a tool for social wealth and political

expansion, a platform for economic growth, a response to seasonal variation and climate change, and an effective strategy for managing and minimizing risk.

Despite this wealth of information, there is need for multi-step research processes towards investigation of the origin and evolution of the concept of keeping cattle away from main settlements.

First, there is a need to understand contemporary cattle posts. What factors influence the establishment and location of cattle posts? What are some of the key issues that facilitate continued use of the cattle post system among farming societies such as the Tswana? What factors influence the settlement patterning, material signatures, sizes and positioning of kraals and yards at cattle posts?

Second, we must investigate ways of detecting cattle posts in the archaeological record in order to trace the origin, evolution and spread of this innovation. Understanding of the settlement patterning and distribution patterns of the varying sizes (area) of these central enclosures is important.

Thirdly, several methodologies must be employed to facilitate corroboration of results, and enable generation of confident conclusions. The employment of digital survey methodologies such as Google Earth and QGIS in the spatial analysis of cattle posts allows for contextualizing the indicators of the concept at localised and landscape levels. The growth direction of settlements, the issues of buffering and peculiarity in positioning of big and small kraal enclosures are assessed easily with such tools.

In terms of settlement patterning, can we differentiate cattle posts from isolated homesteads, and do we see a distinction between main settlements and those initiated through cultivation and the cattle posting process? What theoretical underpinnings are necessary considerations in studying herd management systems?

3 METHODOLOGY

3.1 Kwena cattle posts: Kweneng District, Botswana

3.1.1 Geology

The geology of eastern Botswana has been extensively described by various scholars. Crockett (1972) and Crockett and Jones (1975) attribute it to the Waterberg and Transvaal Systems, with the latter subdivided into the Lobatse, Molepolole, Dikgomo di Kae, Moshaneng and Molopo Zones. These studies laid the foundation for hydrological studies, with Buckley and Zeil (1984), Thomas *et al.* (1991) and Gustafsson (1994) arguing that the character of groundwater in the eastern Botswana region is influenced by the structural features associated with its geology. The hilly areas around Molepolole (Figure 2) have many natural springs and this has led to continuous use of some of them, for example Dithejwane, since the 1790s. It is worth noting that most of the earliest Kwena occupations, some of which were cattle posts, were on hilly areas. Thomas *et al.* (1991) provide a detailed account of the pedology of Botswana, indicating that the Kweneng District is largely covered by Kalahari Sands and the hardveld.

3.1.2 Vegetation and grasses

Several studies describe the vegetation of eastern Botswana. Weare and Yalala (1971) ascribe eastern Botswana's vegetation to savanna (Sub-Tropical Evergreen and Deciduous Trees and Shrubs) and Desert Shrub. The Kweneng District, and the environs of Molepolole in particular, is characterised by Tree Savanna (Semi-Sweet Mixed Bushveld and Arid Sweet Bushveld), Close Tree Savanna on Rocky Hills (*Croton/Combretum* spp.) (Figure 3.1) and Semi-Arid Shrub Savanna (*Acacia* Shrub Savanna). Setshogo and Venter (2003) also indicate that the Molepolole region is characterised by *Bridelia mollis*, *Acacia permixta*, *Mundulea* sp., *Securidaca* sp. and *Ziziphus mucronata*.



Figure 3.1: Vegetation type at the historical site of Dithejwane, which is now re-used for grazing by the Kwena.

According to Field (1976), the grasses found in Kweneng District are of low quality and undesirable to livestock. They include *Aristida stipitata*, *A. congesta*, *Cymbopogon plurinodis*, *Eragrostis denudata*, *E. lehmanniana*, *E. pallens*, *E. rigidior*, *Schizachyrium jeffreysii* and *Stipagrostis uniplumis*. Additionally, the area has one of the most poisonous plants to cattle (known as *mogau* in Setswana language), *Dichapetalum cymosum* (Aganga *et al.* 2011: 57–58), which can cause death within 4 to 48 hours unless watering is withheld within 24 hours. My informants indicated that other plants dangerous to their cattle in the study area include Legonnyana (*Clerodendrum tertanum*), which, according to Modisa and Majinda (1998), may have medicinal value to humans when rubbed on wounds but is otherwise poisonous. Some of the grasses noted by Field (1976) to be good for grazing, and highly digestible when wet, include *Antheophora pubescens*, *Cenchrus ciliaris*, *Brachiaria nigropedata*, *Digitaria milaniana*, *D. pentzii* and *Schmidtia pappophoroides*.

The low quality grasses in the Kweneng district explain the seasonal movements of cattle in search of good pastures as the area is largely characterised by grasses that are less digestible in winter periods necessitating frequent movement during this season (Field

1976: 153). Interviews at Mosokotswe revealed that the only reason there has been continuous occupation of the area is its proximity to the old settlement of Dithejwane, which is now used as a grazing area due to the availability of good grasses on hilltops and foothills (Figure 4) and of perennial water from the natural springs. These seemingly unoccupied spaces are significant as they facilitated the growth of the cattle industry in the past and continue to do so currently through the cattle post system.



Figure 3.2: Dithejwane hills area (hilltops and foothills) has good grazing pastures facilitating its continuous use.

Skarpe (1990) observes that overgrazing has resulted in woody vegetation, while less disturbed areas tend to have varying heights of woody species. Sebegu's (2008) study in Kweneng District shows that cultivation consumes the pastures needed by herders, pushing them further into areas that can only be sustained through borehole drilling (see also Livingstone 1991). Sebegu shows that the original diverse vegetation, which would have otherwise been suitable for grazing, is not recoverable. Silitshe and McLeod (1992) have also studied vegetation behaviour in relation to grazing activities, using cattle posts and ranches as a case study. Ringrose and Chanda (2000) and Ringrose *et al.* (2000) also argue that cattle and small stock, as well as soils and rainfall patterns, contribute to range deterioration and fluctuations in vegetation regeneration. Field (1976),

however, shows that some of the grasses that grow in highly disturbed areas can be good forage, citing *Cenchrus ciliaris* as an example.

3.1.3 Hydrology

Eastern Botswana has a mean annual rainfall of 450–500 mm. Byakatonda *et al.* (2018: 494) have shown that a period from 2000 to 2016 was characterised by three episodes of long-term droughts. They demonstrate that most parts of Botswana, in fact, were characterised by prolonged droughts in 1961–1965, 1979/80, 1981–1987, 1991–1999, 2001–2005, 2009–2013 and 2014–2016. Obviously, these episodes did not only affect output in terms of cultivation, but also hit cattle rearing hard, especially given that most cattle posts in Botswana rely on water bodies that are recharged by annual rainfall (see also Peters 1984 on how shortage of water affects herder-farmers).

Reaching further back in time, Nash (1996) and Nash and Endfield (2002), provide an in-depth understanding of the history of climatic variation in southern Africa during the nineteenth century using historical accounts, often from European missionaries. Nash (1996) specifically makes reference to areas such as Boatlaname and Lephephe (which are known to have been cattle posts and residence of the Kwenas around 1831) having experienced episodes of wet and dry periods. The Lephephe and Boatlaname areas are reported to have had been affected by drought episodes of 1820-1827 and 1857-1865.

A closer look at Nash (1996) and Nash and Endfield (2002) account of the history of climatic variation characterising southern Africa suggests that the period 1810 to 1900 would have been generally dry with wet periods only recorded in 1816-17, 1829-30, 1851-52, 1863-64, 1874-75, 1889-91 and 1899-91. Byakatonda *et al.* (2018) observation of the period 1961 to 2016 in Botswana further shows that this period was characterised by seven occurrences of drought episodes, some of which were prolonged.

Notwithstanding gaps in travellers and missionaries records, as well as challenges regarding availability of rainfall data, it seems that southern Africa has a regular cycle and its temporal span of wet and dry periods can be used as a medium term climatic ‘constant’ to which practices such as herding would have needed to be adapted.

3.1.4 Materials and methods

Documentary survey

The first objective set out to review existing knowledge on Tswana herd management strategies in southern Africa through a survey of the relevant sociological, economic, political and anthropological literature. This was augmented with an ethnoarchaeological study of the cattle post system among the Kwena of Botswana.

The area around Molepolole was chosen for study as it has a history of occupations by herder-farmers as early as AD 600 to AD 1000 (Campbell *et al.* 1991), to mid AD 1700 to present (Schapera 1980). Although the areas of study are not necessarily occupied by descendants of the Early Iron Age farming societies, they shed light on factors critical in situating herder-farmer sites.

For field observation and interviews, the sample used consisted of four cattle posts of the Kwena, and all these fall within 50km radius of Molepolole. The study thus focused on Dithejwane (which according to informants, was used as a cattle post following relocation to Molepolole), Mosokotswe (informants alluding to long standing occupation, especially the part they refer to as 'old Mosokotswe'), Morabane and Mmamoagi (also used following relocation to Molepolole, see Figures 3.3 and 3.4 for the location of these places). Other Kwena cattle posts such as Phiring, Mhage and Kotolaname were briefly visited as they were important for understanding the general landuse and ethnic interactions underlying sustenance of the cattle post system. Mantsho, Lephephe, Letlhakeng and Kgompata were not visited but are included in the map as they are specifically singled out in the historical literature as having been cattle posts of the Kwena in the past (Okihiro 1973; Schapera 1980; Ramsay 1991).

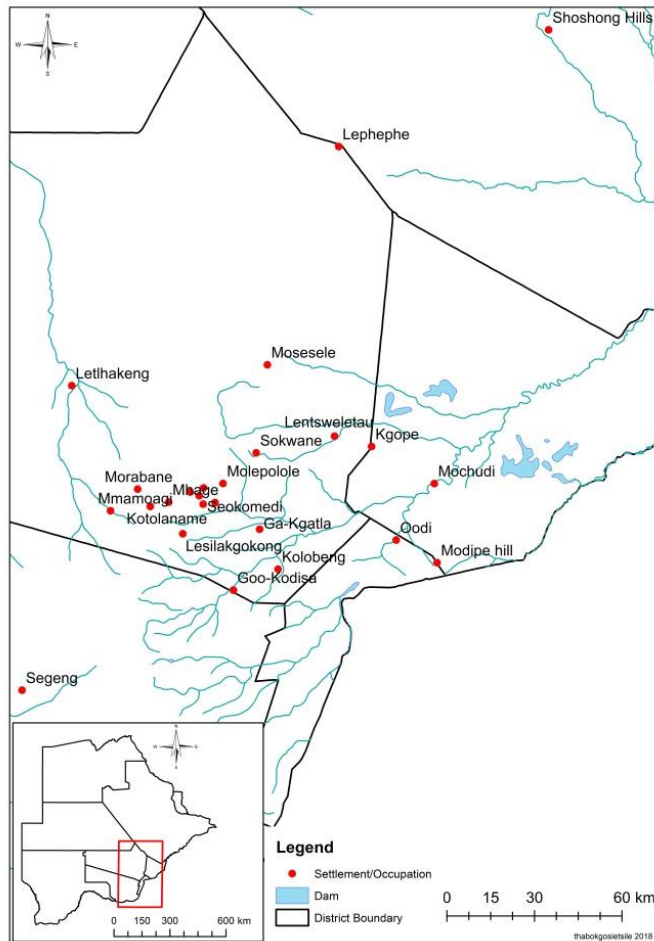


Figure 3.3: Study areas and other places mentioned in the text.

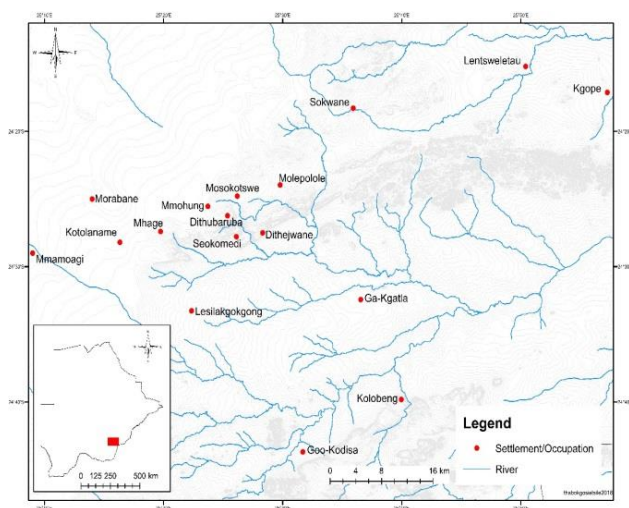


Figure 3.4: Geology (shown by a concentration of contours in grey colour) in and around Molepolole

The research methodology adopted included a review of the literature and ethnoarchaeological field observations with interviews. Historical maps, environmental data and Google Earth images were important additional sources for teasing out some of the key issues influencing the location of cattle posts in the past and now. Once identified on Google Earth, parts of some selected cattle posts were sampled for digitisation and spatial analysis through QGIS 3.4.8 to plan the layout of yards and kraals. Field observations mainly investigated the location of cattle posts across the landscape, the exploitation of grazing and water resources and possible factors influencing the location of cattle posts. Observations were also made regarding what constitutes a cattle post, types of cattle post, the positioning of kraals and households at such places and factors that may lead to the abandonment of cattle posts.

To understand the transition from centralized management of cattle (ward-level based), to a more family-based approach, the sizes and positioning of ward-based or communal kraals at the Kweneng capital of Molepolole were studied. For this exercise, the names of wards were not considered the main focus. Instead, much attention was given to the spatial arrangement of these wards (using satellite imagery and QGIS) and their associated kraals. As a result, no interviews were conducted at Molepolole, but only at the selected cattle posts. The interest in Molepolole was to establish if there was any percentage reduction in the proportion of space allocated to livestock - compared to earlier occupations by other Tswana groups found at Kweneng in South Africa.

Ethnographic surveys

For interviews, this research adopted purposive sampling strategy since the study population and the sample frame were influenced by the researcher's prior knowledge of the areas around Molepolole. Regarding sample selection, the research adopted a case study approach and utilized four cattle posts.

A snowball approach was employed in the selection of respondents in that the first randomly selected informant suggested names of people who could be interviewed or households that could be visited for observations. Otherwise, besides the referrals the author selected households randomly, especially those with kraals. This was done because the primary purpose of the study was to look at the physical evidence for kraals.

Semi-structured interviews were administered through open-ended questionnaires, and this approach was necessary as it facilitate a more relaxed sharing of information by informants and accord them an opportunity to share their own construction of meanings and interpretations of the issue under investigation (Babbie 1992; Wisker 2001).

Although the questions were written in English they were read out to informants in Setswana, and their responses captured in English. Consent forms were designed and the ethical issues (informed prior consent) were explained to informants, although they declined to sign the forms, opting to consenting verbally.

A total of ten (10) informants were selected for interviews (see Table 3.1), and three of them were selected for in-depth on-site discussions to appreciate positioning of cattle posts at landscape level. Although all the informants were asked the same questions, some of them were very extensive in their answers, and in some cases indicating their knowledge of Kwena history post 1900 (based on their ability to answer questions and relating the movement of the Kwena in and around present day Molepolole). The choice of the three informants for follow up was based on the extent to which they became elaborate in their answers to the questions.

Table 3.1: List of informants

Informant No.	Age (years)	Gender	Totem	Original ward
1	66	Female	Kwena	Goo-Thato
2	48	Female	Kwena	Mokgalo
3	76	Female	Kwena	Mokgalo
4	62	Female	Kwena	Mokgalo and Lekgwapheng
5	30	Male	Nare	Gaobotse (Ramotswa)
6	67	Male	Phare	Seletlo
7	66	Female	Kwena	Borakalalo
8	31	Male	Kwena	Borakalalo
9	64	Male	Baboon	Mokgalo
10	49	Male	Kwena	Goo-Mosarwa

Variables included the place/location (cattle post), age, gender, totem (to discern self-ascribed ethnicity) and wards of informants. It is worth noting that the interview sample was kept minimal as the process was lengthy involving administration of the questionnaire, deliberations held at kraals and in the yard to appreciate the general use of

space, sizes of kraals as well as discussing their orientations in relation to other yards and fields.

Interviews were necessary to assist in defining the cattle post concept, settlement patterning at cattle posts, social relations and challenges in herd management. Seven key questions were posed to all informants, as follows:

- What defines a cattle post?
- What factors lead to their establishment?
- How far are cattle posts from the main settlement?
- Do cattle posts always accord with ward affiliation?
- What determines the sizes of cattle/goat/sheep kraals?
- What determines the positioning of cattle/goat/sheep kraals?

Additionally, follow-up questions explored whether cattle posts are a Tswana concept, whether they are individually owned, the ideal number of herders or caretakers per herd, the distance between cattle posts, whether the ward structure at main settlements affects the management of cattle whether cattle posts are more dispersed than they used to be in the past, and who makes decisions at them.

Spatial analysis of cattle posts

For this research, I categorized my variables into qualitative and quantitative aspects. For the qualitative I looked at the aspect of ‘presence’ – do we have evidence of a cattle kraal or kraal space, and if yes these points were plotted. I then looked at the ‘positioning’ of these kraals in the context of a settlement unit. Consideration of the ‘size’ aspect was necessary - how big are these kraals and kraal spaces, and does this reflect differently over time and space?

I was also looking for evidence of a decline in the proportion of area dedicated to livestock management in relation to a settlement unit, in this case a ward or compound. I had hypothesized that adoption of the cattle post system by the Tswana would result in a reduction in the proportion of space allocated to livestock management at the main settlement. As livestock is managed away from the main settlement, the kraal spaces or livestock management areas at the main settlement should reduce. To address these

issues, I discuss in section 4.3.3 the results of these aspects observed through the Molepolole case study.

3.2 Kweneng: Southern Gauteng (Suikerbosrand area), Johannesburg

3.2.1 Materials and Methods

Sadr (2012) is of the view that the changing nature of herder-farmer sites suggests change in or adoption of herd management strategies such as the cattle post system. This system may have been innovated or adopted in the sequence of the first three phases of stone-walled settlements across Kweneng or the Suikerbosrand landscape. My research followed up on this and studied selected N, K and M compounds across Kweneng north, central and south. The specific interest was on investigating the sizes (area) of central enclosures (livestock management areas/enclosures) and how this varied over time, and the ratios of these central enclosures to the overall compound (ward) sizes.

For data collection, Google Earth was employed to study the general Kweneng landscape for familiarity with the distribution of stone walled structures. This exercise was also useful for appreciating the terrain that constitutes the different sectors of the Kweneng landscape.

QGIS 3.4.8 was then used to create a database for the selected compounds. Firstly, the Raster files containing LiDAR imagery for Kweneng north, central and south were added to a new QGIS project. With the advantage that LiDAR imagery offers more visual clarity, I randomly selected two hundred and ninety (290) compounds, basing on visibility of the boundaries of central enclosures and those of the outer extent of compounds. In this research, a compound refers to a ward structure. It comprises the ring or semi-circular yards that make up the compound, and the central enclosures, which were presumably used for keeping livestock.

In some cases, a single compound would have more than one set (multiple enclosures) of central enclosures, and where these sets were apparent; they were counted (for the sample size) and measured individually, before lumped into a single number (area of the central enclosures for that particular compound). This approach was necessary to establish any evidence for the evolutionary patterns in livestock management areas or central

enclosures. This resulted in a total sample of three hundred and six (306) central enclosures for the 290 compounds. I then assigned the selected structures IDs and compound types of N, K and M, before the digitization exercise. A lot of work has already gone into the study and classification of stone-walled structures in South Africa. Maggs (1976), Taylor (1979), Mason (1986), Sadr (2012, 2019) and Banhegyi (2015) have gone into great detail to describe the key architectural features of stone-walled structures in South Africa. The identification of compound types for my sample are therefore based on these existing classifications, and my N is the earlier period, K is Klipriviersberg (transitional phase between N and M) and M is the later period of Molokwane.

Once the compound types were assigned, the geographic spread of these compound types were assessed against Kweneng north, central and south. Once digitization was done and the polygons for central enclosures and overall compounds sizes were created, a QGIS Plug-in for calculating areas – FieldCal was used to calculate the areas of central polygons (central enclosures) and outer polygons (the total area constituting the rest of the compound – usually made up of yards). The minimum, maximum and average areas (m²) of both central enclosures and the rest of the compound were noted for the three compound types, and how this varied across Kweneng north, central and south (Table 3.2). The standard deviation for the sizes of type M compounds is higher than that of N and K, showing that the size distribution for the type M compounds is widely spread, and that some of them have areas (m²) that are way above the average size. This means that some M compounds are increasing the rest of the compound without necessarily reducing the size of central enclosures – evidenced by the lack of disparity in the standard deviations of central enclosures.

Table 3.2: Descriptives for sizes of central enclosures and the rest of compounds assessed against variables N, K, and M compound types and the location of Kweneng north, central and south

Area (m ²)	N	K	M	North	Central	South
Minimum	105	117	99	195	99	105
Max	3086	2105	4869	4869	4170	4869
Average	710.77	776.41	1062.23	946.6296	882.913	838.6396
STDEV.S	522.46	489.1	787.04	778.6672	693.4498	698.1335
Area (m ²) – compound size						
Minimum	1088	1043	868	1103	868	1043
Maximum	11371	11701	24737	14330	24737	16067

Average	3392.5	3245.95	4401.2	3890.84	3951.804	3625.631
STDEV.S	1861.43	1870.39	3098.67	2387.703	3256.255	2410.269
Ratio – proportion of central enclosures to compound area						
Ratio minimum	0.04	0.1	0.04	0.04	0.04	0.1
Average ratio	0.20	0.23	0.24	0.23	0.22	0.22

To allow for comparing the distribution patterns of areas of central enclosures temporally and spatially, a QGIS Plug-in for Attribute-Based Clustering was used. Through this process, the areas of central enclosures for the 306 compounds were auto-grouped into classes or bins of 1-10. The distribution pattern for these classes were assessed for the N, K, and M compounds across Kweneng north, central and south.

For the first stages of analysis, the Kolmogorov Smirnov (K-S) Test of Significance was run for the areas of central enclosures against the N, K and M compounds and the north, central and south sectors of Kweneng. Once this was done, SPSS and Microsoft Excel were used to study the temporal (Type N, K, and M) and spatial (Kweneng north, central and south) distribution of areas of central enclosures.

In terms of change and continuity in sizes of central enclosures, this research had an assumption that an adoption of the cattle post concept would result in reduced proportions (ratios) of areas of central enclosures to the overall compound size through time.

The ratio patterns for the 306 compounds were determined and assessed against N, K, and M, and across Kweneng north, central and south. For comparatives, the ratios were manually grouped into 5 classes of 0.00-0.10; 0.11-0.20; 0.21-0.30; 0.31-0.40 and 0.41-0.50 as the data range for the 306 sample was not exceeding 0.50. The ratio readings are representative of the percentage of areas that could be allocated to livestock enclosures over time.

To determine how many of the enclosures were used to keep livestock, I was supposed to analyze soil samples using a Merckoquant field kit. Before this process, I was to utilize results of a large number of phosphate samples that have already been collected and analysed as part of the SGSWS project. Each enclosure and open space within each of the compounds was to be sampled multiple times to produce a distribution map of phosphate readings. Control samples were to be collected from areas away from activity areas. The

whole idea would be to establish if high phosphate concentrations are directly associated with keeping livestock.

The first lap of this exercise, reviewing existing phosphate results (e.g., Ensor Smith 2012; Banhegyi 2015; field school reports of 2012-2015), showed that there is no peculiarity of phosphate results in relation to livestock areas. This insight was used to refine the objectives by focusing more on establishing variation in sizes of central enclosures and outer enclosures, and determining the proportional variation for the two temporally and spatially. I therefore increased the sample size of Kweneng from 124 compounds to 290 compounds. I also increased the size for the sample on contemporary kraals in Botswana.

4 ETHNOARCHAEOLOGICAL APPROACHES TO THE STUDY OF CATTLE MANAGEMENT STRATEGIES: A CASE STUDY OF THE KWENA CATTLE POST INSTITUTION IN BOTSWANA.

4.1 Sampling and data presentation

As part of the ongoing research into the origin and evolution of the cattle post institution among the Tswana of southern Africa, this chapter presents results of a case study among the Kwena polity in south-eastern Botswana to address some aspects of the two-step research process. Firstly, following the review of the literature on the historical, socio-economic and anthropological literature on the Kwena is reviewed. It showed that among the Tswana cattle posts are a social, political, economic, environmental and ecological response institution that remains relevant today. It should be noted here that while the Kwena have several cattle posts, this research only sampled those that were established during Dithejwane occupancy and the early stages of Molepolole occupation. Cattle posts referenced and discussed in section 4.2 are shown on Fig. 3.3 in chapter 3 – map showing known Kwena occupations and cattle posts. I highlight the sampling and presentation approach relating to other sections of this chapter in their specific opening paragraphs.

4.1.1 Definition of concepts

In this chapter, I refer to the space allocated to management of livestock as the kraal area or livestock management area in the discussion of my ethnoarchaeological study among the Kwena of Botswana. The term livestock management area is preferred here, as opposed to strictly cattle management, since small stock would have also been kept at these areas. At main settlements, these livestock management areas were usually located in the centres of wards. For the discussions on the archaeological results, I use central enclosures to define these livestock management areas. The surrounds of these livestock management areas or central enclosures are made up of yards (the spaces containing houses and related domestic activity areas). Amongst the Tswana, a number of these yards were traditionally arranged in a circular to semi-circular pattern (to enclose the livestock management area), constitutes a ward. Notwithstanding the detailed definition of family, household, ward etc. already given by Schapera (1970), I broaden the concept of a household to include consideration of related domestic activity areas that are not necessarily aligned to married family lifestyle. This approach helps in understanding

variations in the positioning and sizes of livestock management areas or kraal areas (and other domestic activity areas) at main settlements and cattle posts.

4.2 Ethnoarchaeological approach

An ethnoarchaeological study of contemporary Kwenā cattle posts (Tswana *moraka*, plural *meraka*) was carried out in order to define cattle posts and their function. This included an extended discussion of the cultural factors influencing the establishment and location of cattle posts, as well as those contributing to their continued use among farming societies such as the Tswana. Sections 4.2.1 and 4.2.2 present the results of the exercise.

4.2.1 Field observations — cattle post level

In the Tswana language a cattle post is a *moraka* (pl. *meraka*). According to informants, a *moraka* is a place where cattle, goats and sheep are kept, while *morakeng* (pl. *merakeng*) is a locative - the place where the cattle post is. Places that are initially earmarked for cattle posts, may later on attract cultivation and occupation by other members of the society other than herdboys – in this research I refer to this as *moraka-masimo* (Table 4.1), denoting that the initial occupation was intended for herd management.

Table 4.1: Characteristics of a permanent ecological and environmental management response cattle post (*moraka-masimo*).

Characteristics	Type of cattle post
	<i>Moraka-Masimo</i>
Burials	Yes, but for herdboys, especially if their ethnicity is different from cattle owners, have no ancestral connection to any ward in the main settlement, had stayed at that particular cattle post for a longer period of time, and if they had brought their immediate family with them.
Material culture & structures	Would accumulate more depending on population size, and may vary from main settlement if caretakers are of different ethnicity. Mud structures with poles and thatch grass.
Presence and position of cattle kraals	More cattle kraals than those for small stock. There are fewer yards and cattle kraals are located away yards to manage flies, and away from fields to minimize the risk of cattle destroying fields.
Presence and position of goats and sheep kraals	Yes and largely attached to yards or cattle kraals. Small stock present and kraals either located inside or attached to yards or cattle kraals. Yards at these cattle posts are often smaller than at <i>masimo-moraka</i> so kraals would be predominantly outside yards.
Kraals, materials and orientation.	Thorn bush kraals and their sizes would vary depending on the number and type of livestock. Kraals may be made bigger at the onset if more permanent material such as poles is used, and if the owner anticipates growing the stocks. Mindful of drainage. Entrances would have initially faced anyhow, but would later (with introduction of cultivation at these cattle posts) face away from the direction of fields.
Yards, materials and orientation.	Small to medium sized yards (often with a specific objective to contain the herdboys' houses and domestic activity areas) of thorn bush or poles, face anyhow though often consider position of kraals.

Characteristics	Type of cattle post
	<i>Moraka-Masimo</i>
Security measures for livestock	Cattle only manned during ploughing season, otherwise they are allowed to roam alone during the day and are penned at night.
Topography and availability of pastoral and arable resources	Areas with digestible vegetation and grasses as well as water. Informants indicated that since cattle can go a day or two without water, the determinant factor for these types of cattle posts is often good grasses. Cattle can be watered at distant areas. The area may not have the best soils for cultivation.
Settlement patterning	These types of cattle posts later attract cultivation if they are on good soils and have readily available water supply. Yards are dispersed to create enough buffers between them and kraals so as to minimize environmental degradation. Animals graze near kraals and yards in the mornings and afternoons before penning. For this type of cattle post, there would be more kraals for cattle and small stock than yards and fields.
Presence of children	Boys and girls
Presence of women	Yes
Cultivation	Yes, fields widely spread and located near yards that are spaced apart to minimize environmental degradation. Topography may however disrupt this setup as in the case of Morabane where fields are confined to one area due to the pedology of the area. Fields may be relatively smaller, if only meant to support caretakers.

In the same token, cultivation areas (*masimo*) may have the cattle post aspect to them if livestock used for draught power and milk supply are kept there, and if the *masimo* area is well pastured I refer to as *masimo-moraka* (Table 4. 2) as the initial object would have been to look for cultivable land. Cattle posts can be temporary to address risk (Table 4.3), or gradually established and permanent (irrespective of whether they are associated with cultivation or not).

Table 4.2: Characteristics of a permanent ecological and environmental management response cattle post (*masimo-moraka*).

Characteristics	Permanent (ecological and environmental management)
	<i>Masimo-Moraka</i>
Burials	Minimal and for herdboys and fieldworkers, especially if their ethnicity is different from employers and they had brought their families with them.
Material culture & structures	Material culture includes farming equipment, and may be highly representative of that at main settlement.
Presence and position of cattle kraals	Fewer cattle kraals and located away from fields and yards (to manage flies).
Presence and position of goats and sheep kraals	Yes and would be more prevalent as goats and sheep are often the responsibility of women. Kraals are either inside yards or attached to yards.
Kraals, materials and orientation.	Thorn bush kraals and their sizes would vary depending on the number and type of livestock. Kraals may be made bigger at the onset if more permanent material such as poles is used, and if the owner anticipates growing the stocks. Mindful of drainage. Entrances face away from the direction of fields.
Yards, materials and orientation.	Medium to large sized yards of thorn bush or poles. Face anyhow though often mindful of terrain and position of kraals.

Characteristics	Permanent (ecological and environmental management)
	<i>Masimo-Moraka</i>
Security measures for livestock	Cattle only manned during ploughing season, otherwise they are allowed to roam alone during the day and are penned at night.
Topography and availability of pastoral and arable resources	Areas with good cultivable soils and water, and may be poorly resources in terms of digestible (by cattle) grasses and vegetation. Continuous use and occupation of these places, if well resourced, mushrooms into main settlement.
Settlement patterning	The place would have started as cultivation and later attracting keeping of some cattle for draught power and milk. Yards may be dispersed as they are built next to fields. Fields may be nucleated, as in the case of Morabane, depending on the topography. There would be more goats/sheep kraals than cattle.
Presence of children	Boys and girls
Presence of women	Yes
Cultivation	Yes, fields are bigger, may be widely spread or aggregated in one section of the landscape for better control of livestock. In this case, there would be designated grazing zones and cultivation zones (as in the case of Mmamoagi). Yards would be sparsely distributed as they are positioned near fields.

Table 4.3: Characteristics of a temporary and risk management cattle post

Characteristics	Type of cattle post
	Temporary and for managing risk
Burials	Absent, unless if the cattle post is very far and carrying the corpse to the settlement would be cumbersome.
Material culture & structures	Minimal, small temporary pole/thorn and grass huts.
Presence and position of cattle kraals	Present and would be located closer to yards if risk is theft and raids.
Presence and position of goats and sheep kraals	Goats and sheep may be absent unless if they were also affected by the risk.
Kraals, materials and orientation.	Thorn bush kraals and their sizes would just be enough for the available livestock. If risk is theft and raids, the thorn/bush fence would be stronger. Kraal entrances would face the yard.
Yards, materials and orientation.	Small yards with thorn bush, would face anyhow, but preference may be towards kraal entrances.
Security measures for livestock	Cattle always manned and tightly secured at night, also dependent on the risk.
Topography and availability of pastoral and arable resources	Highly secure terrain such as hilly areas and areas very distant from threat. Good resources to pasture livestock without extended travels.
Settlement patterning	May be nucleated for security reasons, or dispersed depending on risk at the original place
Presence of children	Only boys
Presence of women	Absent
Cultivation	Absent

Cattle posts generally have minimal occupation – only herdboys, semi-permanent house structures with smaller yards, and more kraals than the residential footprint. At cattle posts that are combined with cultivation such as Mosokotswe, Morabane and Mmamoagi, the number of yards increases, even though this is still outnumbered by kraals. Although

burials usually take place at the main settlement they can also occur at cattle posts, especially permanent ones. As an example, at Mosokotswe and Mmamoagi burials are unmarked and occur at residences of the deceased. There are instances where herdboys would bring their entire family to where they are employed, especially people of Sarwa origin. In this instance, they would bury at that cattle post. Mmamoagi (personal observation) has several burials in compounds. At Mosokotswe, some informants indicated that they buried in yards at old Mosokotswe and where they are presently located.

However, recently the Botswana government now encourages occupants of cattle posts and cultivation areas to bury at main settlements irrespective of whether the deceased are herd owners or caretakers. One must also mention that cattle owners were not buried at cattle posts, but at their respective main settlements, unless if the particular cattle post had graduated into a settlement, as witnessed by Lephephe and Boatlaname.

Tables 4.1- 4.3 show some of the physical characteristics of a cattle post discerned from interviews and field observations. Generally, cattle posts can be pigeonholed by 'location', denoting a sense of place or area where livestock is kept, and 'distance' - from the main settlement and cultivation areas. As grazing pastures around the main settlement get depleted, herders undertake daily trips to exploit resources further thereby extending grazing zones (*mahudiso* in Tswana language). A cattle post is established if the distance is too much for daily trips and if environmental regeneration around the settlement is slow. A cattle post also denotes a 'process' of having livestock and taking them to different places, and 'resources' - digestible grasses, vegetation and water resources.

Cattle posts are sometimes mixed with cultivation areas or *masimo*. In this case, the small stock would also be kept there, with cattle largely grazing far from cultivation areas during the ploughing season and later grazing in the fields after harvesting. Note that unlike ranches, which are demarcated areas with exclusive rights that are intended to produce surplus stock for sales through supplementary feeding, cattle posts facilitate the free movement of livestock and their associated grazing pastures are communally owned.

Some of the factors that influence the establishment and location/position of cattle posts include the need to minimize destruction at the main settlements as the stock numbers

increase, and a response to environmental degradation around main settlements. The expansion and encroachment of the main settlement into grazing zones and the need to extend these zones to minimize degradation are also considered. According to informant no.5, issues include “the village expanding to grazing area, the need for better pastures, and an increase in the number of livestock. The area selected must be good in pastures, far from other cattle posts to minimize environmental degradation. One can relocate *moraka* as and when people and cultivation encroaches”. Generally, the distance of cattle posts from the main settlement varies as it is influenced by availability of resources, consideration of the buffer between cattle posts and the main settlement, and between cattle posts themselves. Issues of security and accessibility to main settlements are also considered.

Once a cattle post is established, several factors are considered in positioning of kraals. In this thesis, a kraal refers to a cattle pen, usually constructed of bushes or wooden poles. It is a specific area where livestock is milked, dipped for parasites and secured to regulate unnecessary movement during the day and at night. The topography of an area becomes crucial as the vegetation, mainly trees for shade, drainage system, the type of livestock, size of kraal, the preferred position for yards, risk management issues and the location of fields if cultivation also occurs there (Table 4.4). Tables 4.1 to 4.4 have implications for the identification and classification, with possibilities for reconsiderations in some instances, of cattle posts in the archaeological record.

Table 4.4: Relationship between animal type, kraal size and positioning of kraals at ERCs and RMCPs.

Kraal no.	Area of kraal (m²)	Animal type: cattle, calves, goats, sheep	Kraal Position: isolated, attached to yard, inside yard, attached to another kraal, inside field
1	25	goats/sheep	inside yard
2	20	goats/sheep	inside yard
3	60	goats/sheep	inside yard
4	70	cattle/calves	attached to yard
5	143	cattle	attached to another kraal
6	196	cattle	attached to another kraal
7	94	cattle/calves	attached to yard
8	242	cattle	isolated
9	124	cattle	inside field
10	87	goats/sheep	isolated
11	103	goats/sheep	attached to yard
12	64	goats/sheep	isolated

Kraal no.	Area of kraal (m ²)	Animal type: cattle, calves, goats, sheep	Kraal Position: isolated, attached to yard, inside yard, attached to another kraal, inside field
13	108	cattle	isolated
14	21	goats/sheep	isolated
15	57	goats/sheep	inside yard
16	11	goats/sheep	inside yard
17	68	goats/sheep	attached to yard
18	194	cattle	isolated
19	51	goats/sheep	inside yard
20	56	goats/sheep	isolated
21	38	goats/sheep	isolated
22	84	cattle/calves	isolated
23	108	goats/sheep	inside yard
24	21	goats/sheep	isolated
25	51	goats/sheep	isolated
26	40	goats/sheep	inside yard
27	39	goats/sheep	isolated
28	276	cattle/calves	attached to another kraal
29	531	cattle	attached to another kraal
30	365	cattle	isolated
31	78	goats/sheep	isolated
32	485	cattle	isolated
33	118	goats/sheep	isolated
34	82	goats/sheep	inside yard
35	82	goats/sheep	inside yard
36	122	goats/sheep	inside yard
37	57	goats/sheep	inside yard
38	339	cattle	isolated
39	95	goats/sheep	attached to yard

Another key issue from this research is that the positioning of kraals varies between families. Kraals are generally located behind or on the sides of yards, next to fields, often attached to yards (Figure 4.1 to 4.3), and are in some cases several metres from the latter's boundaries (Figures 4.4, and 4.6). However, they may also occur within yards, especially for small stock, or be positioned away from them, but attached to cattle kraals (Figure 4.4). An increase in stock numbers often leads to the extension of the kraals rather than their complete relocation, provided that dung accumulation is not a problem. This data provide useful information not only for future studies, but also for possible reconsideration of the way small scale settlements and cattle posts have been classified archaeologically. The data specifically has implications for the interpretation of the 19th

and 20th century Tswana herder-farmer settlement patterning – the dynamics of small stock ownership and management.

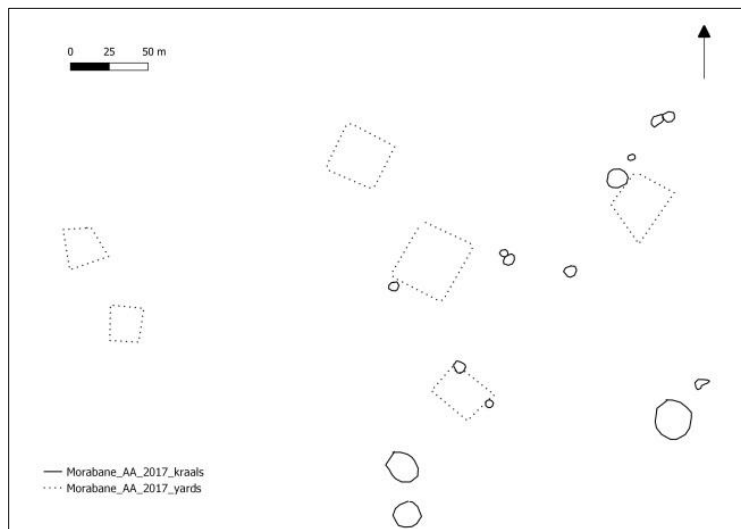


Figure 4.1: Morabane -small stock kraals attached to yards.



Figure 4.2: Mosokotswe settlement layout showing kraals, yards and fields

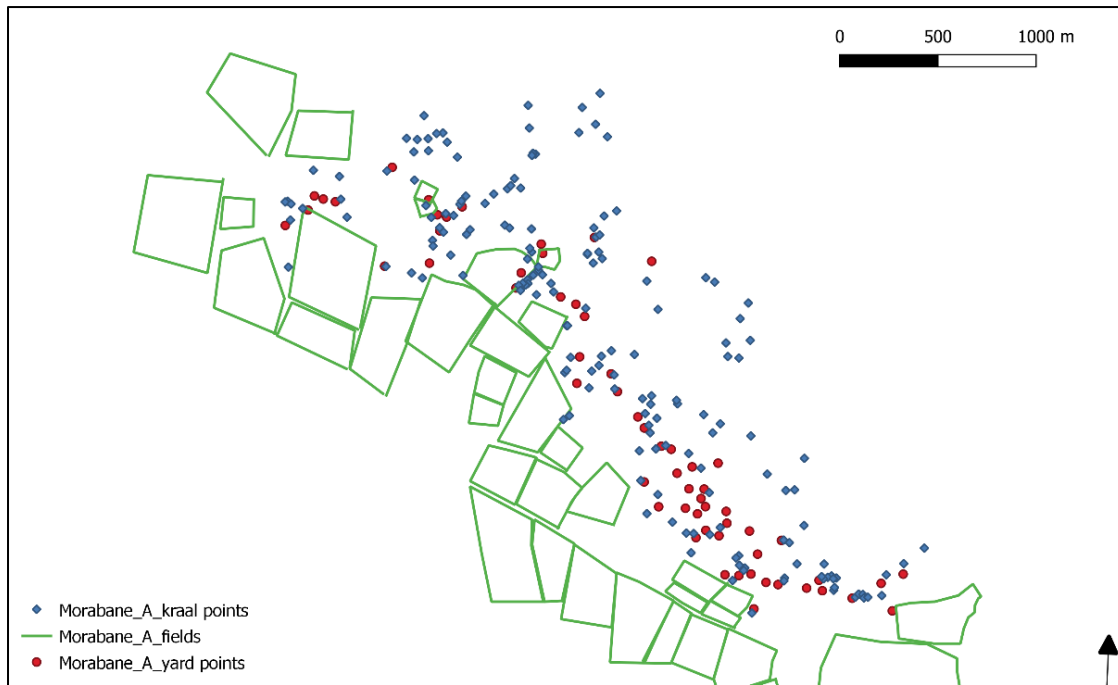


Figure 4.3: Settlement layout of Morabane showing distribution of kraals, yards and fields.

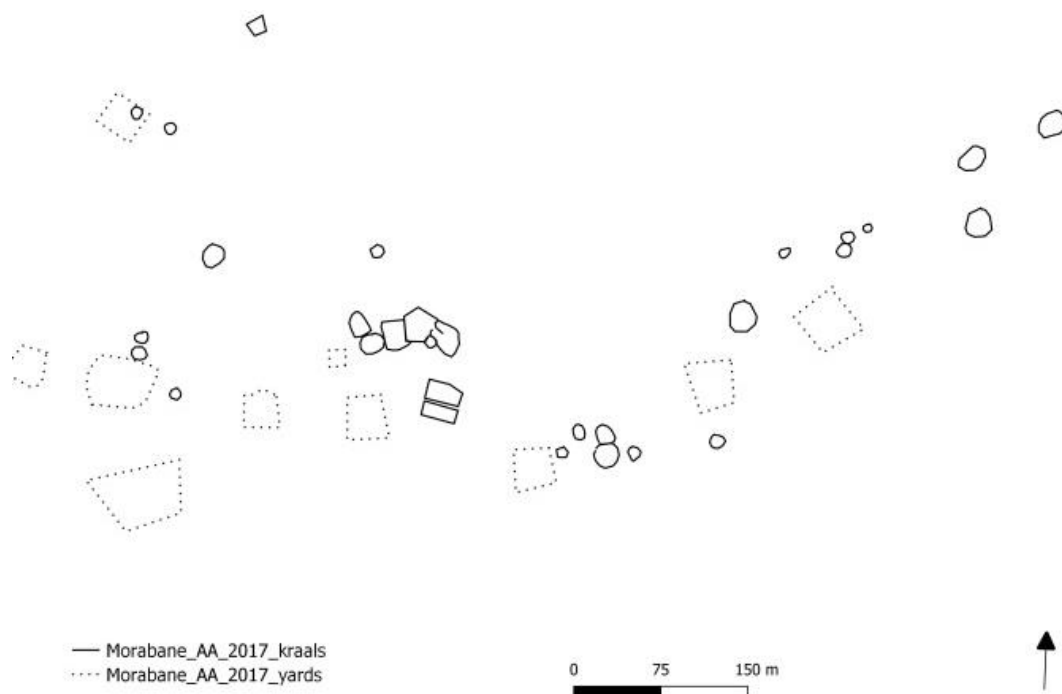


Figure 4.4: Morabane layout showing that kraals are largely positioned away from yards.

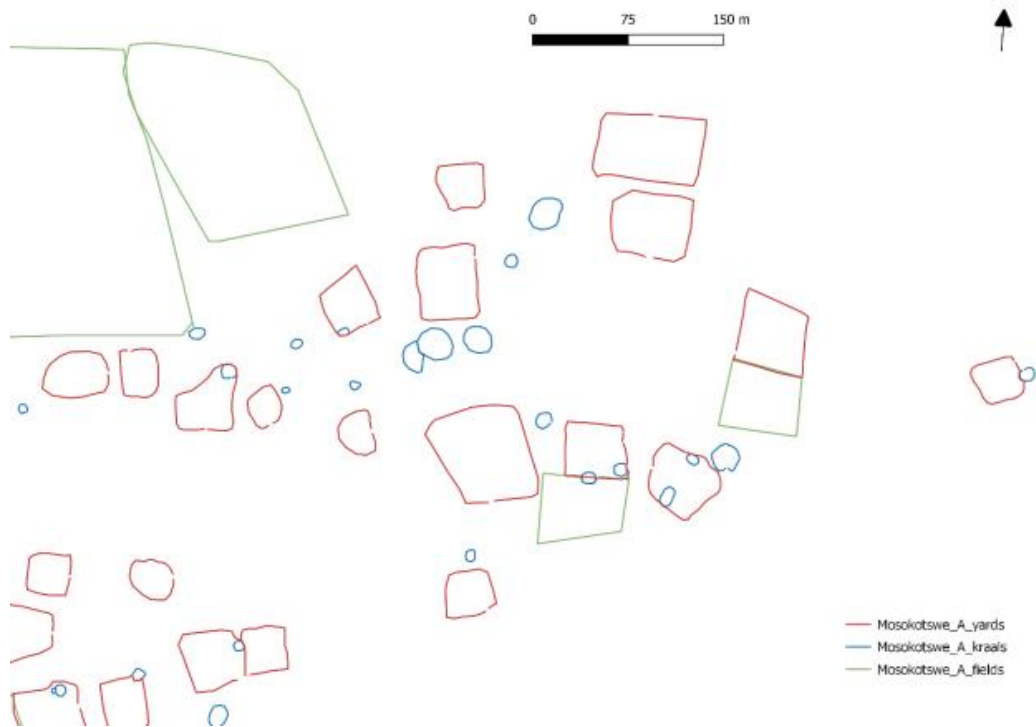


Figure 4.5: Mosokotswe settlement layout showing the positioning of kraals, fields and yards



Figure 4.6: Settlement layout of section B of Mosokotswe showing a limited number of kraals that characterize this part of the settlement.

One of the salient issues emerging in the study is the frequency of kraal movement at cattle posts. Kraals may be moved around as and when necessary, with some farmers

using one kraal for as long as ten years, while others may shift kraals several times within the same period. Informants indicated that kraals are often relocated due to the build-up of dung, poor drainage – water stagnation, dung washed into yards, overgrazing and erosion caused by the repeated movement of animals near yards and kraals.

Figures 4.1-4.5 show that there is generally no politically inclined locational rule for positioning yards and kraals at a cattle post. However, several issues are considered, including the presence of big trees for shade at kraals, topography for drainage issues and the direction along which stock must move upon leaving the kraal. There is no consistency in the orientation of yards, and yard entrances face any direction. This is a critical indicator for discerning cattle posts in the archaeological record. It is evident that at main settlements, the Tswana traditionally (Schapera 1970) arranged their yards and their openings inwardly facing kraal areas. This scenario is apparent in archaeological stone-walled sites known to have been occupied by the Tswana, where there is spatial formality, with identifiable inward orientations of yards.

My research shows that at cattle posts, there is spatial informality regarding the positioning and orientation of yards and kraals. The yards are not necessarily always facing inwards to kraals. Their positioning is rather unpredictable, and heavily dependent on whether the cattle post is an Ecological Response Cattle Post (ERCP) or Risk Management Cattle Post (RMCP). Furthermore, there are instances where smaller fields are attached to individual yards (e.g. at Mosokotswe and Morabane). In much older cattle posts and cultivation areas, these would look like empty spaces with no evidence of material culture. The only evidence of human impact would be in the form of secondary vegetation, and therefore perhaps only detectable archaeologically through soil micromorphology and other geoarchaeological studies such as electromagnetic conduction surveys (Klehm and Ernenwein 2016; Thabeng *et al.* 2019).

Generally, the materials traditionally used for constructing houses and kraals in grassland environments would have been mud, grass thatch and wooden poles, with kraals largely constructed from thorn bushes. This means that where only bushes and mud were used for construction, it will be difficult to discern abandoned cattle posts and cultivation areas, save for identifiable cattle kraal signatures such as dung middens and *Cenchrus ciliaris*. Also, recent researches with adoption of more scientific methodologies have

shown that cattle post areas can be discerned from the archaeological record using electromagnetic conduction surveys (Klehm and Ernenwein 2016; Thabeng *et al.* 2019). However, once occupation is more permanent and cultivation is consistent, evidence of fields and the patterning of yards and houses can be used to discern occupations that are *moraka-masimo*, meaning a cattle post that has turned into a cultivation area, or *masimo-moraka*, i.e. cultivation areas that are combined with cattle posting.

In some cases, the bipartite settlement system, wherein cattle posts are combined with cultivation, saw a member of the royal family appointed to reside with the community at that particular *moraka-masimo*. In such an instance, yards form a semi-circular pattern around the royal family yard, with an open space in the middle (Figure 4.8). However, this open space would not have kraals in it as in the main settlement (Figure 4.9), but would instead have been used for communal activities. Yards and houses within such ward-like structure would be sparsely distributed owing to the lack of restriction on yard-size as at the main centres. The rest of Mosokotswe is organized by family relationships, but the yards do not necessarily form a circular pattern and do not have a communal space or an actively utilised one (Figure 4.10).



Figure 4.7: Mosokotswe settlement layout showing an open space for communal activities.



Figure 4.8: Molepolole settlement layout showing a communal kraal in the middle of a ward.



Figure 4.9: Mosokotswe settlement layout with no communal space.

The physical environment and climatic conditions sometimes allow cultivation to occur at areas near cattle posts if they have cultivable soils. As an example, areas like Mmamoagi, which is still largely considered a cattle post, has not disappointed in crop yields even during years with below average rainfall. As such, it would have been a cattle post that later attracted cultivation. Generally, environmental and ecological response cattle posts would have started with grazing zones and watering points closer to the settlement, with grazing extending further away as resources were depleted. Informants indicated that since cattle can go for two days without water, in the dry season they can still be kept at settlements or in cultivation areas that are far from water, with stock undertaking trips to peripheral grazing resources as the need arises. For families or individuals with larger herds, and therefore wealthy enough to dig dams or boreholes,

cattle posts can be established farther away at the outset. Informants emphasised the need for having enough space between cattle posts as a way of ensuring environmental sustainability.

4.2.2 Field observations — landscape level

The broader Dithejwane landscape, which includes the grazing zones on hilltops and at the foot of hills, was ideal for cattle herding. Additionally, Dithejwane had, and continues to have, perennial water sources (Figure 4.10) from the aquifers, natural springs and rivers that characterise the area.



Figure 4.10: Water sources at Dithejwane River showing in-use well (left) and dis-used well (right).

According to informants 3 (76 years), 4 (62 years) and 7 (66 years), while the main settlement of the Kwena was at Dithejwane (which was occupied in episodes from the 1750s into the 1950s), the cultivation areas and cattle posts were combined in the Mosokotswe landscape, spreading later to other areas (see also historical accounts by Okihiro 1973; Ramsay 1991). This means that as more cattle were accumulated there was a need to keep them outside the main settlement and away from cultivation areas. While this is consistent with Schapera (1943), who observed a tripartite settlement system among the Tswana, it should be noted here that the system evolved over time and that its precise form depended on prevailing circumstances.

Observation of the Dithejwane and Mosokotswe landscapes also shows that shared resources and population management were crucial. Basing on information from the informants, we should think of a tradition that firstly cultivated at a relatively small scale within Dithejwane. This is in comparison to the post-independence setup where a more

than 9 hectare production can be the responsibility at family level. Therefore, although the Kwena would have initially had fewer cattle, the numbers would have increased, as alluded to by Okihiro (1973) that by 1820s the Kwena had a lot of cattle. Even after the raid by Sebetwane around 1825, the Kwena are believed to have been left with a reasonable number of cattle (Okihiro 1973:104).

This, together with other socio-political factors, would have put pressure on the Kwena Single/Centralised settlement system, and thereby triggering relocation from places such as Dithubaruba (Ramsay 1991). As an example, judging from the occupation area at Dithejwane, especially the land available in the foothills, the population would have been nucleated at some point in time. With population growth, cattle posts and cultivation areas would have been necessary for accommodating the demographic ‘spill over’ as the main centre expanded. For cattle herding, expansion outward of the main settlement would have been gradual, with exploitation of the immediate resources such as grazing zones, and water, until ultimately extending further out and establishing more distant cattle posts and cultivation areas. Also, the availability of transportation from main centres to cultivable landscapes, and the usage of ploughs would have facilitated increased production with less labour.

For cultivation, several issues must be considered. The need for more production would also have led to the exploitation of cultivable landscapes farther away from the main settlement. Also, the availability of draught power would then have increased production, leading to the need for cultivation outside the main settlement rather than in gardens close to/within it. Furthermore, the availability of suitable soils, the growth/expansion rate of the main settlement and the cost-effectiveness (labour and transport) of managing fields would all have influenced the location of cultivation areas outside — and often very far from the main settlement. The availability of cattle, plows and wagons would have facilitated cultivation at more distant places, and an increased production that could be easily transported to the main settlement.

Additionally, the availability of pasture at areas selected for cultivation, the numbers of cattle and risks posed by predators, poisonous plants or the possibility of raiding would all have facilitated a combination of cultivation with cattle posting. In instances such as this, we would therefore expect to find a Bipartite settlement system that is either a

representation of a *moraka-masimo* or *masimo-moraka* setup discussed in Tables 4.1 and 4.2. Contemporary Mosokotswe and Morabane are good examples of cultivation areas/*masimo* that are combined with cattle posts/*meraka* (Figures 4.11 and 4.12), and the main settlement being Molepolole.

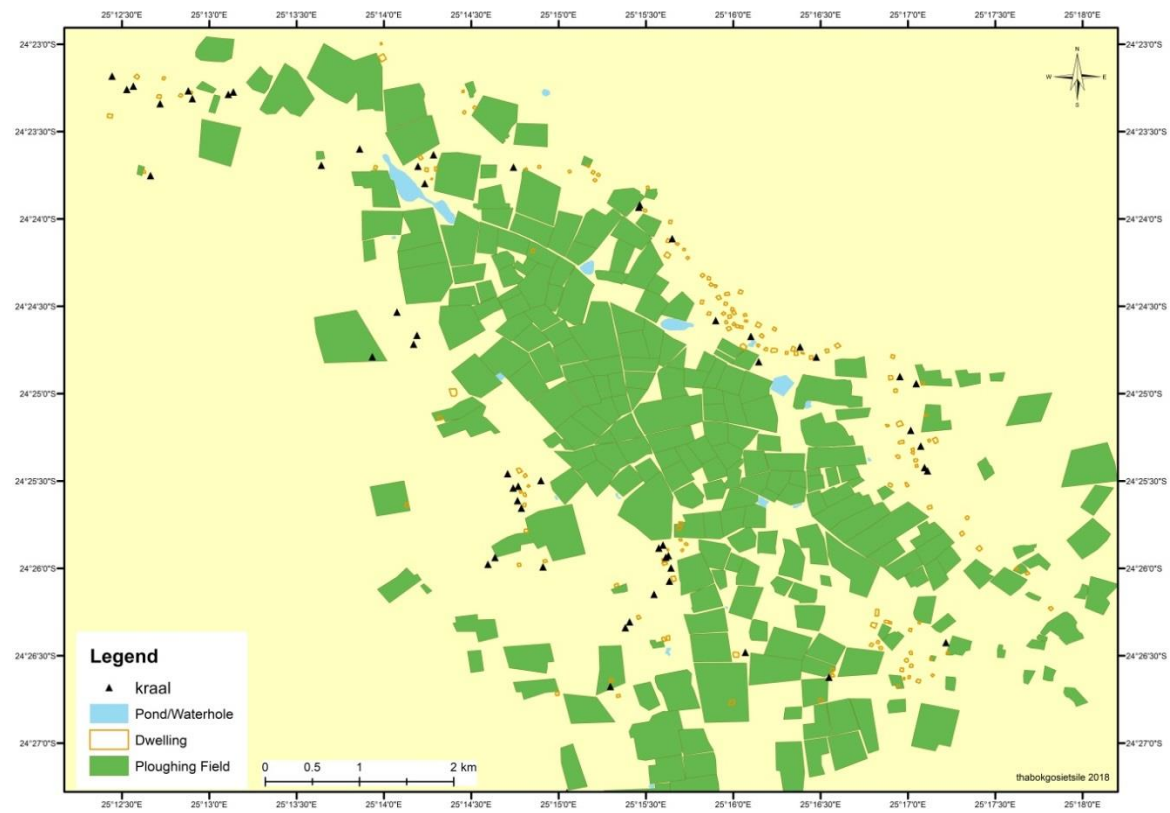


Figure 4.11: Morabane - arrangement of yards, kraals and fields in a bipartite settlement system. Kraals are per household and not in the centre and shared as in Molepolole which is their main settlement.

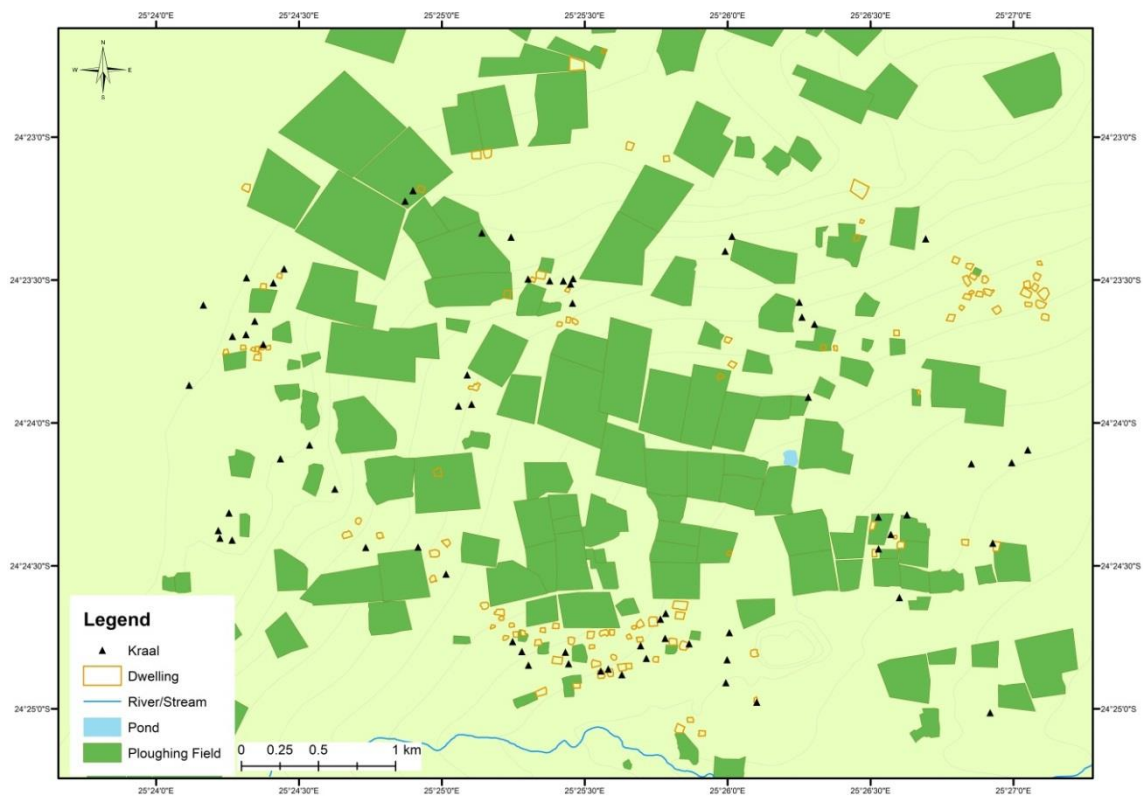


Figure 4.12: Mosokotswe - arrangement of residential/yards, kraals and fields in a bipartite settlement system. Kraals are per household and not in the centre and shared as in Molepolole which is their main settlement.

As more cattle were accumulated to facilitate increased arable farming and for the other reasons already discussed, it would have become necessary to keep the surplus cattle outside the main settlement and away from cultivation areas, leading to a Tripartite settlement system. It should be noted that the Single, Bipartite and Tripartite settlement systems would together likely form a gradual process in situations where keeping cattle outside the main settlement is an ecological response, leading to Ecological Response Cattle Posts. These are characterised by a movement and exploitation of resources away from the main settlement that is gradual and incremental.

However, it should be mentioned that establishment of cattle posts was not always a gradual process. In times of war, raiding for cattle by other ethnic groups, colonial expansion, prolonged drought spells and outbreaks of epidemic disease, the establishment of cattle posts would have involved taking cattle to the most suitable place to reduce the risks such events posed, leading to the creation of Risk Management Cattle Posts. At these places there would usually be no cultivation unless the whole population had relocated in response to the risk, or the place was later reoccupied as a main settlement.

The examples of these occupations include Mosokotswe which was contemporaneous with Dithejwane, Shoshong Hills cattle posts where the Kwena would have probably co-existed with the Ngwato briefly from 1800 to early 1830s. According to Schapera (1980:84), there was also a brief stay at Shokwane in the 1790s and again in 1805, before a re-occupation of Dithejwane landscape - see also Okihiro (1973:104) on occupation of Sokwane village by the Kwena. This is possibly the same Shokwane settlement (if the Chief Motswasele was buried there, then it must have been a settlement at that stage – in Tswana tradition royals are not buried at cattle posts) that is alluded to by Schapera (1980).

Gapiana, occupied around 1808, is another place of interest in the Kwena history as it is a place where they experienced loss of their cattle. According to Schapera (1980: 85), “Motswasele's reign was far from peaceful. Soon after his accession, the tribe was disastrously defeated by the Ngwaketse in a battle fought at Gapiana. Many royals were killed, and all the Kwena cattle were captured”. Lephephe was occupied from 1831-1832 and re-occupied in 1837, while Letlhakeng may have been periodically occupied from mid 1830s, as the literature suggest several movements that were triggered by the need to protect cattle (Okihiro 1973; Schapera 1980). Although establishment of these was a temporary measure to address the risk, it nonetheless took cattle away from the main settlement or cultivation areas, and that some of these cattle posts are now Kwena settlements.

It is apparent from this analysis that places that were either occupied or abandoned in response to risk, but otherwise had abundant grazing resources, were usually reoccupied or reused at later stages, as witnessed by the Dithejwane and Mosokotswe landscapes. On the other hand, where emergency cattle posts were set up at very resourceful landscapes far from main settlements, this often led to the mushrooming of satellite settlements at such places, as shown by Kotolaname, Lephephe (occupied from 1831-1832 and again in 1837 (Schapera 1980: 85, 87) and Letlhakeng (occupied from 1832. As a final point, the distance from the main settlement to the cattle posts and cultivation areas is influenced by the availability of pastures and water and indeed the whole range of issues discussed in this chapter. Most importantly, cattle posts needed a greater buffer to prevent overgrazing. In the same manner, where cattle posts are mixed with cultivation areas, a

reasonable buffer is maintained between households to allow cattle to forage in the late afternoons before they are secured in their kraals.

4.3 Spatial and statistical analysis

It is necessary to do spatial analysis of the cultural and natural factors that may have acted as push and pull factors influencing the establishment of Kwena cattle posts. For this exercise, I selected a few cattle posts from the recorded ones, and I present the results in sections 4.3.1 and 4.3.2.

The application of technology, particularly the survey and geographic analysis tools like Google Earth, Earth Explorer and QGIS in studies such as mine is critical. They not only corroborate ethnographic data, but also gather additional data at both localized and landscape level.

I also demonstrate that cattle posts must be studied at intra-site (issues at cattle post level) and at inter-site (landscape) levels. The use of technology for both data collection and analysis has proven useful in understanding the synergy between push and pull factors underlying the cattle posting process. I therefore employed these to study the cultural and natural factors that may have acted as push (necessitating establishment) and pull (attracting occupancy/establishment) factors for Kwena cattle posts.

4.3.1 Spatial analysis of cattle posts - landscape approach

Push factors

Cultural and natural aspects

There are cultural and natural factors that act as push factors thereby triggering the cattle posting process. An evaluation of push factors shows that cultural considerations played a role in mushrooming of Kwena cattle posts. There was a socio-economic requisite of reaching out to extended areas in search of suitable soils and precipitation patterns that meet a secure farming output. Figure 4.13 is a satellite imagery showing the varying cultivation intensity at Mosokotswe, Morabane and Kotolaname. In this case, the location of *masimo-moraka* is dependent on the extent to which a given location can support adequate cultivation and grazing.

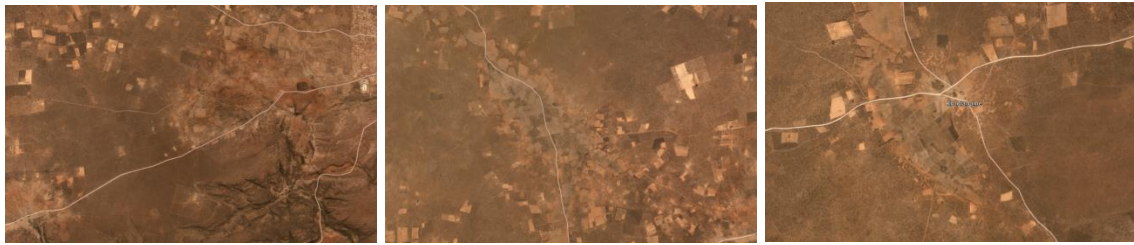


Figure 4.13: Extent of cultivation at Mosokotswe (left), Morabane (center) and Kotolaname (right). Kotolaname has even graduated to a formal settlement that Botswana government has provided with a primary school and a health post).

Politically, cattle posts were used to delineate tribal territorial spheres. This way, grazing areas were extended to zones beyond the society's immediate forage reserves. There was need to have an adequate distance matrix to mitigate risk such as raids, theft, disease outbreaks and prolonged droughts. Depletion of pastoral resources and the general environmental degradation (carrying capacity issues) around main centers resulted in exploitation of resources beyond such centers.

In Fig. 4.14, the 2,5km buffer rings shows the incremental exploitation of pastoral resources around Molepolole and Dithejwane. Cattle posts further away from main centers, such as Morabane tend to attract a larger population to these areas due to cultivation. As the size of these cattle posts increases, the buffer between them and the next candidate location would increase.

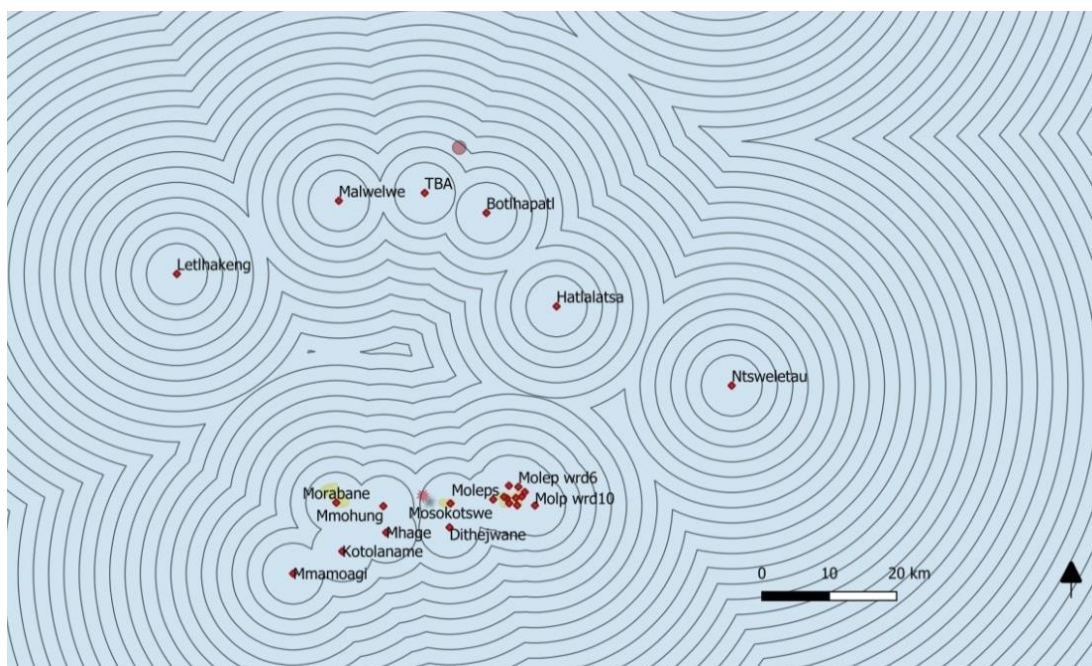


Figure 4.14: Distribution of cattle posts within and beyond 20km radius of Dithejwane and Molepolole. Each ring represents 2.5km, and the red diamonds represent some of the recorded cattle posts and the sampled wards at Molepolole.

Risk from prolonged droughts, theft, raids, wars, disease outbreaks etc. results in the establishment of main centers and cattle posts on hilly areas and places distant from the risk. Depending on the reasons for which cattle posts were established, the result would be the two main types - Ecological Response Cattle Posts (ERCP) or Risk Management Cattle Posts (RMCP).

Climatic variation and rainfall patterns have varying impact levels to arable and pastoral farmers. As an example, a pastoral farmer requires that the two rainy seasons that characterize Botswana are consistent and adequate to facilitate good forage and surface water for the livestock. This is obviously more relevant to traditional and small scale cattle posts – ranches and wealthier cattle owners drill boreholes and buy feeds. In a situation illustrated by Fig 4.15, a pastoral farmer without a borehole would have probably had increased mobility in search of water and good pasture during the period from January 1982 to January 1984, with a little relief in 1985 before becoming bad again from January 1986. There is a drastic improvement for all the five cattle posts in the period January 1988 to January 1989. Sojwe is standing out as a place that would have not attracted much occupancy in this ten-year period, except for being a rescue option in 1984 when other areas received less rain.

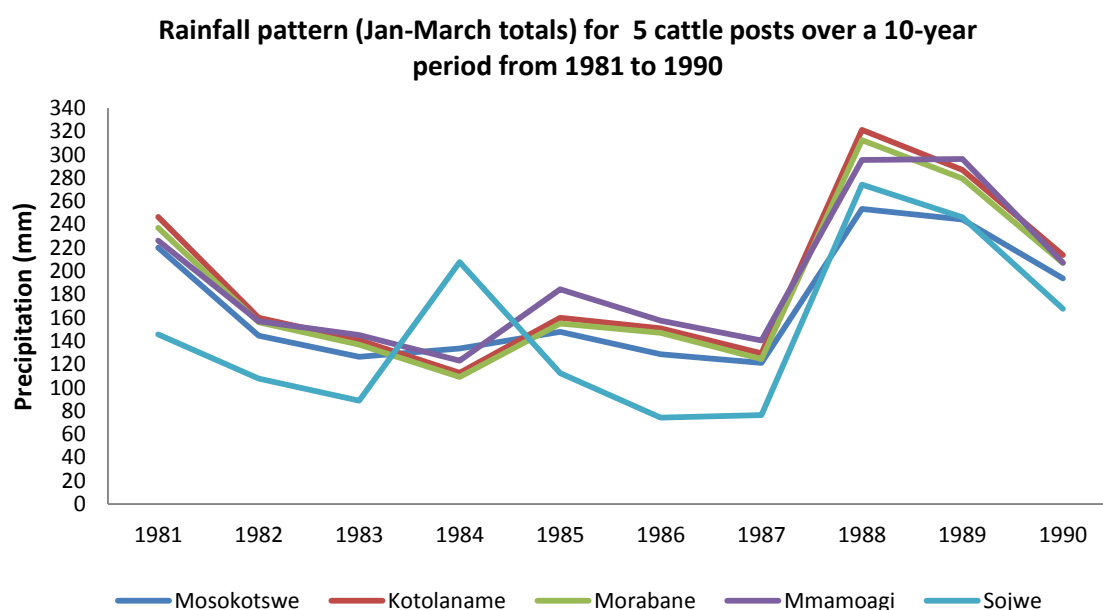


Figure 4.15: Rainfall patterns (January-March totals) for the five cattle posts of Mosokotswe, Morabane, Kotolaname, Mmamoagi and Sojwe observed over a 10-year period from 1981-1990.

Pull factors

The pull factors attracting occupancy or establishment of cattle posts must be studied. An assessment of the pull factors indicates that the Kwena cattle posts locale decisions were not random. There was careful consideration of the cultural and environmental processes, and that the application of terrain analysis is key to identify these. The geology of Molepolole area is fascinating and has had a bearing on the location of cattle posts at highlands, lowlands and flood plains (Fig. 4.16).

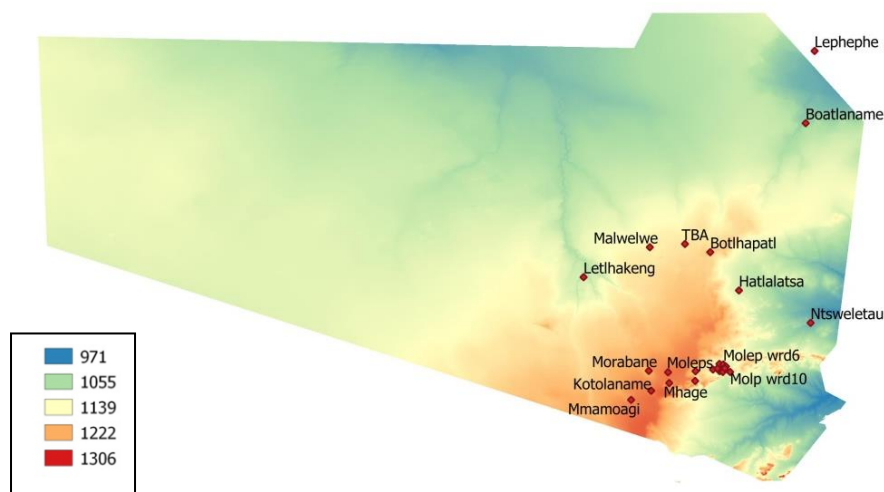


Figure 4.16: The Digital Elevation Model (DEM) for the Kwena territory showing that the altitude and the general topography acted as a pull factor in the location of the main settlements and cattle posts.

The hydrology of the Kwena territory is key in studying the distribution of Kwena cattle posts. The river channel network analysis shows that specific locales were targeted for the positioning of cattle posts. The bulk of herder farmers in Botswana are still using cattle posts and they rely on rain water for the forage, watering their animals and cultivation. The river channel analysis allows for appreciation of how these issues ultimately affect firstly the distribution of cattle posts across the landscape, and secondly the resultant settlement patterning.

In Fig. 4.17, the location of cattle posts that the informants indicated were occupied for longer times during occupation of Dithejwane and Molepolole, an example being Lephephe having been periodically occupied since 1831 (Okihiro 1973; Schapera 1980). It is worth noting here that there are obviously other cattle posts for other wards, but for

detailed analysis of some issues my research used the ones mentioned in the interviews at Mosokotswe.

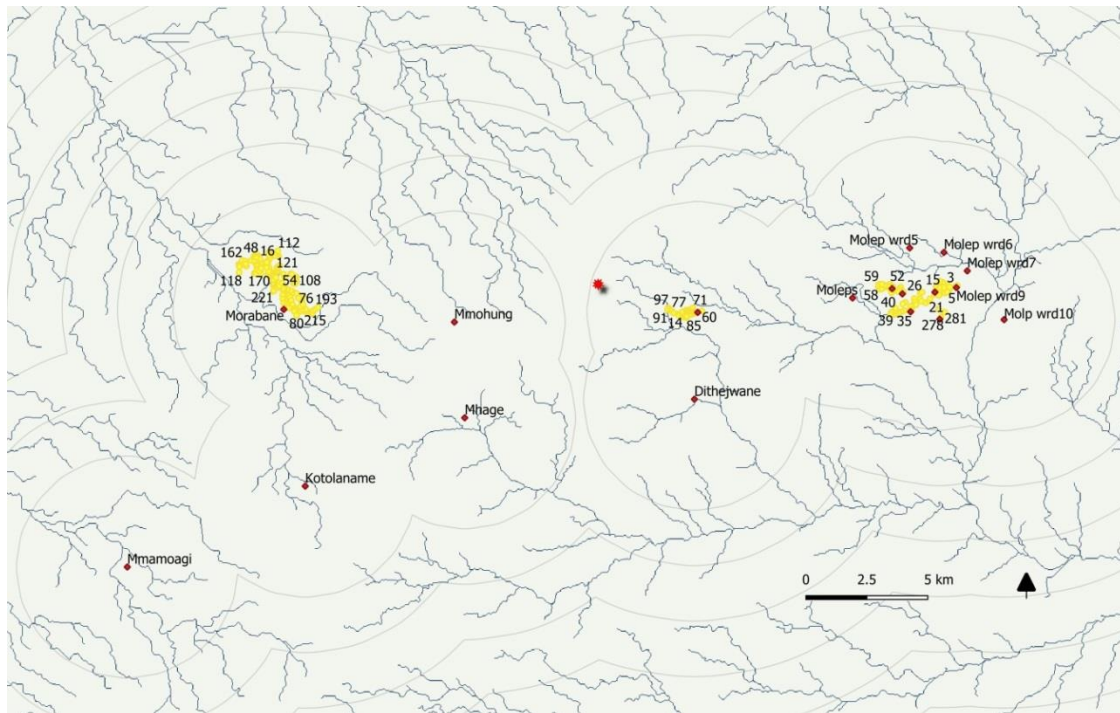


Figure 4.17: River channel network of the Molepolole environs(in the context of 2.5km buffer rings) showing the distribution of some of the cattle posts and the case study wards at Molepolole. The yellow represents all kraal areas mapped.

All these issues have impact on the establishment process and distribution of cattle posts across the Kwenā landscape. For the ecological response cattle posts, the establishment of which is incremental in approach, a buffer of at least 2.5 – 5 km between cattle posts is maintained. These indicators must be studied and applied to the identification and interpretation of livestock management strategies at archaeological herder-farmer sites.

Pull factors and settlement patterning

As shown above, consideration of the environmental aspects such as topography and hydrology are important in the understanding of factors influencing the location and positioning of cattle posts. In this section, I demonstrate how these issues often affect the settlement patterning both at a broader and at a localized (cattle post) level.

Figure 4.18 illustrates the settlement patterning of the sample wards at Molepolole in the context of the river channels and elevation. The selected ward sample at Molepolole (Fig.

4.18) is spread between contours 1130-1160m, while Mosokotswe (Fig. 4.19) is between 1190-1210m and Morabane (Fig. 4.20) is at 1220-1240m. This map shows that in some parts of Molepolole, the settlement was expanding in an east-west and northerly direction probably to avoid the 1170-1210m elevation characteristic of the area south of Molepolole.

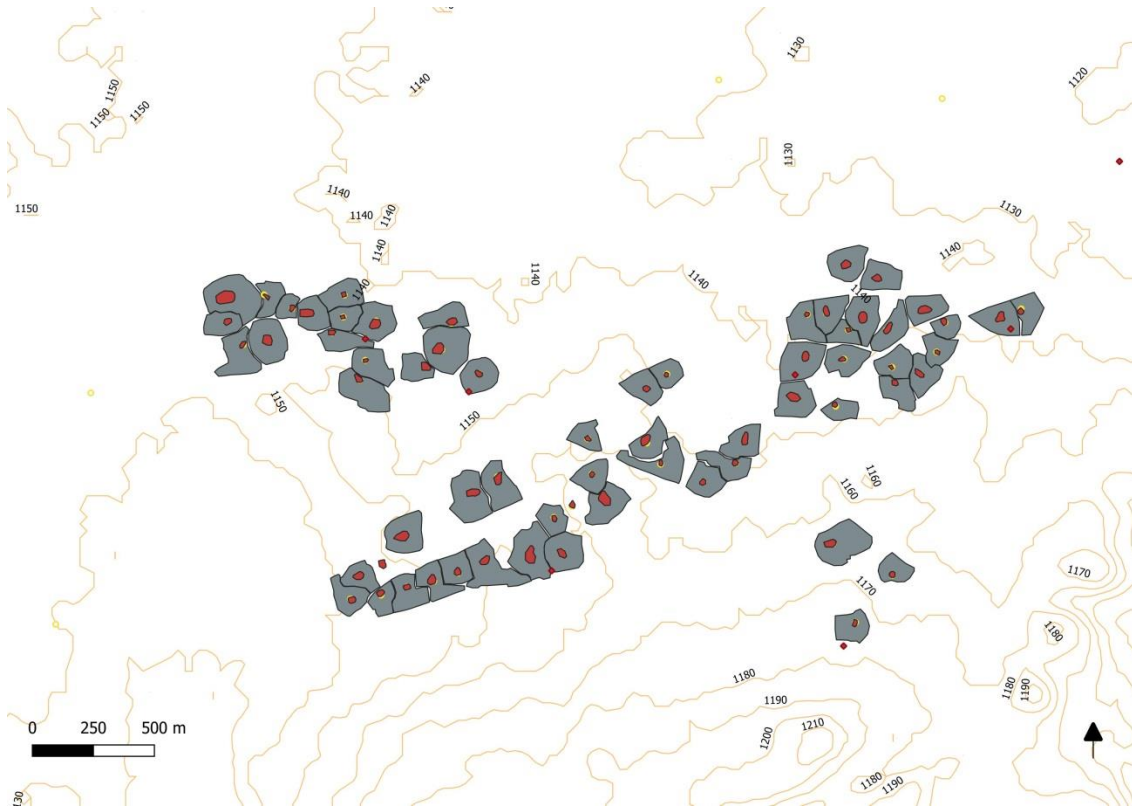


Figure 4.18: Distribution of sample wards (grey polygons) and their associated kraals (red polygons inside wards) at Molepolole.

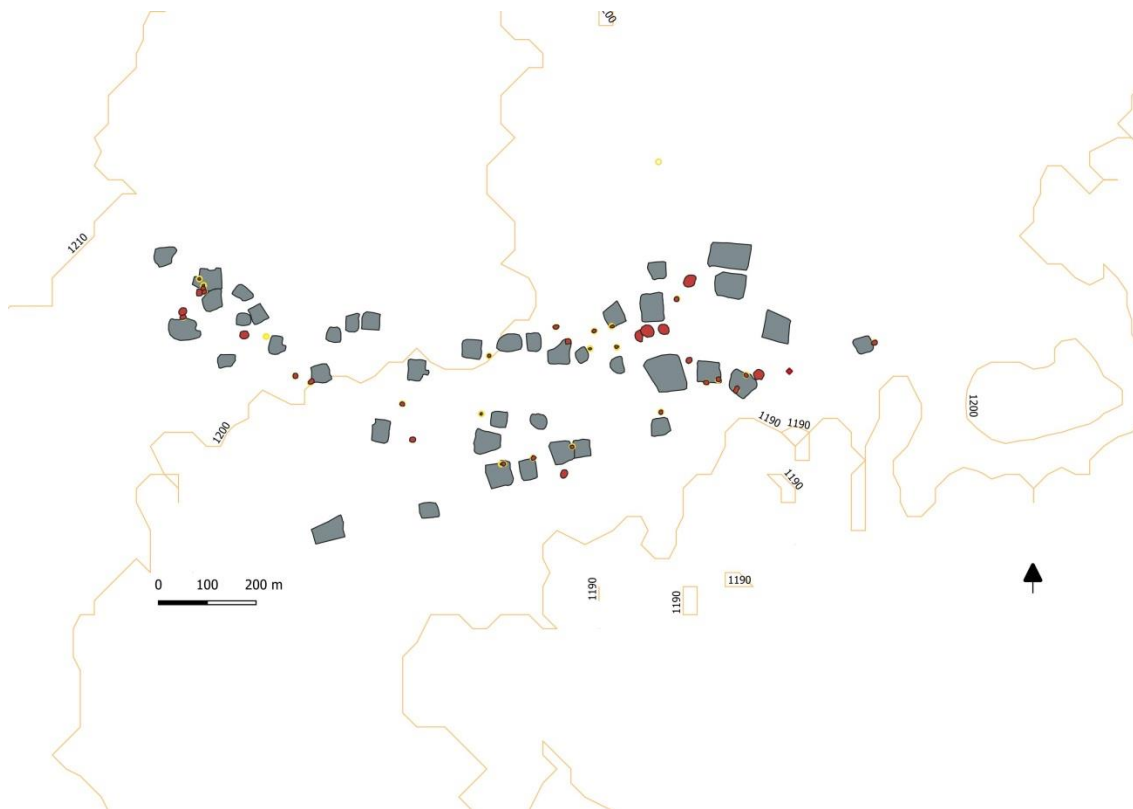


Figure 4.19: Distribution of sample yards (grey polygons) and their associated kraals (red polygons attached to or inside yards) at Mosokotswe.

In Figure 4.19, Mosokotswe's southerly expansion is restricted by its proximity to the Dithejwane hills. For Morabane (Fig. 4.20), the elevation and pedology of the area play a major role in the settlement patterning as it grows north-westerly, with yards and kraals restricted to 1220-1240m and in line with the river channel network.

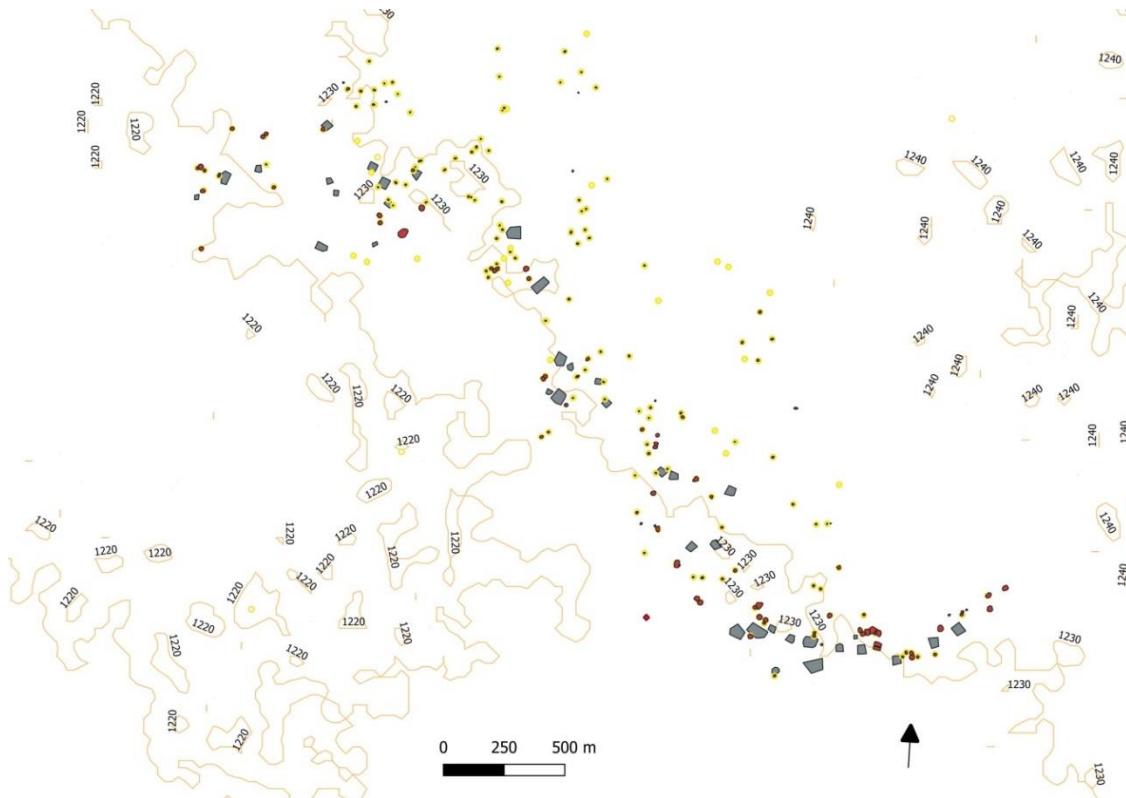


Figure 4.20: Morabane layout and the distribution of sample yards (grey polygons) and their associated kraals (red polygons attached to or inside yards). The yellow represents all the digitized kraals (including the ones mapped and studied shown in red colour).

Cultivation is one of the main activities at Mosokotswe (Fig. 4.21) and Morabane (Fig. 4.22). The fertile soils along the river channel are reserved for cultivation and as such the expansion of the settlement is north-westerly. For Mosokotswe, the cultivation fields are largely on the north and west (note that fields on the west are not shown on this particular map) of the settlement.



Figure 4.21: Mosokotswe settlement layout showing the arrangement of yards (grey), kraals (shades of red indicating the bigger sizes in dark red) are positioned in close proximity to the cultivation fields (green).

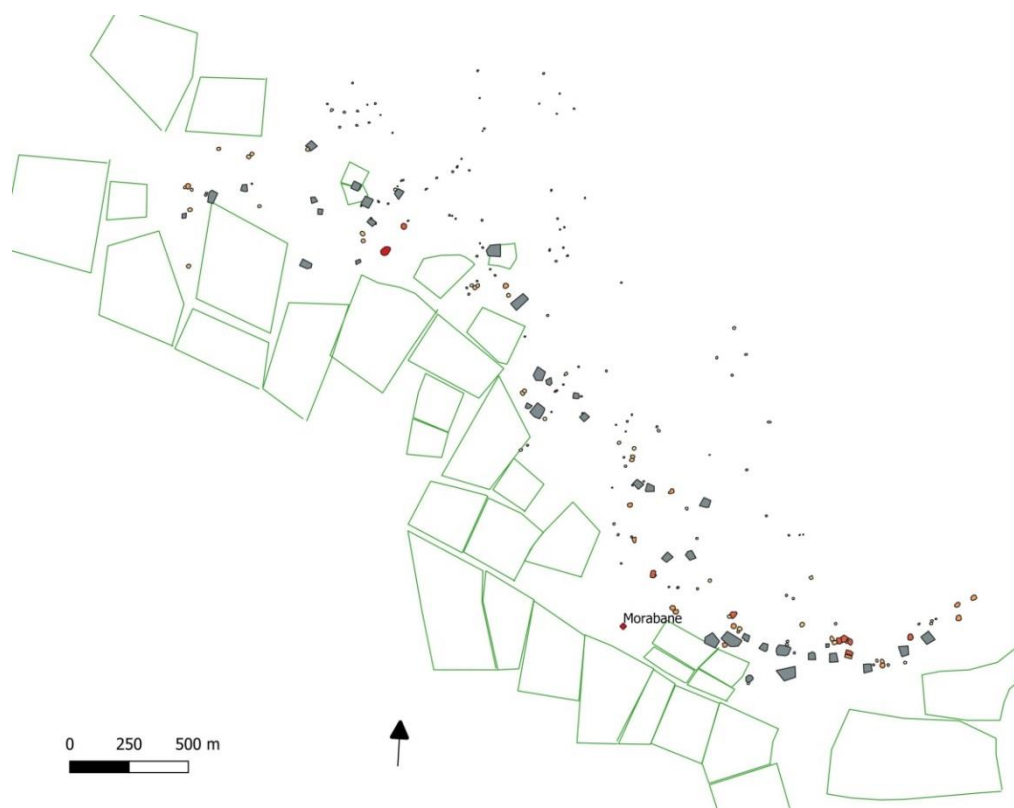


Figure 4.22: Morabane settlement layout showing the distribution of yards (grey). Cultivation fields (green). At Morabane the fields are restricted to the flood plain while yards and kraals extend outwards from the fields.

Ecological Response Cattle Posts (ERCP) that are established incrementally from the main center often mushroomed into settlements, especially during the post-independence period. The data shows that the settlement patterning at these areas is highly shaped by not only the environmental setting but also by the aspects which necessitated establishment. This means that assessing the settlement patterning of herder-farmer sites in the context of natural pull factors can assist in studying the evolution of livestock management strategies and their synergy with the societal socio-economic and political system. This means that certain landscapes such as Dithejwane and Molepolole were preferred for establishment of main settlements, while the grasslands of Mmamoagi and Morabane became better options for ERCPs.

4.3.2 Spatial analysis - Cattle post level

I conducted a detailed assessment of the sizes of yards and kraals at Molepolole, Mosokotswe and Morabane. I wanted to establish if there is a distinctive spatial variation in the sizes and positioning of kraals at Mosokotswe and Morabane. For this exercise, I categorized my variables into qualitative and quantitative aspects. For the qualitative I looked at the aspect of 'presence' – do we have evidence of a cattle kraal or kraal space, and if yes these points were plotted. I then looked at the 'positioning' of these kraals in the context of a settlement unit (wards in the case of Molepolole), and in relation to individual yards (applicable to Mosokotswe and Morabane).

For the quantitative variables, consideration of the 'size' aspect was necessary - how big are these kraals and or kraal spaces? Does this reflect differently for the sample settlements (Molepolole, Mosokotswe and Morabane)? Is there evidence for variation over time (between settlements and within a settlement - the earliest sections of a settlement to the later sections)? Before assessing all these, I studied the sizes of yards and wards at the three areas.

For better processing of the collected data, I created 1km x 1km and 200m x 200m grids for the three case study areas. This was used in the spatial analysis of the yards and wards. For the Molepolole case study, I detail later in the chapter how I increased the sample and repeated the process of recording the presence, sizes of both yards and kraals, their positioning and the ratio.

Spatial analysis of yards: presence, positioning and sizes at Mosokotswe and Morabane

The hypothesis of my research is that the proportion of space allocated to livestock management would decline at main centres such as Molepolole if the cattle post concept is adopted. Determining a ratio requires two variables, so studying the presence and sizes of yards was necessary. Mentioning the issue of presence is important because I was largely relying on Google Earth to select the samples, so I was mainly interested in cases that were either clearly a yard, kraal or evidence that there used to be an occurrence of such. It is worth noting also that for the Morabane sample, very few yards were digitized since it was challenging to effectively associate kraals to yards through the main method I used - Google Earth. I therefore did not include Morabane and Mosokotswe in the calculations of ratios - the proportion of kraal area to the size (area m²) of a yard area, and the proportion of kraal area to the size (area m²) of ward.

The sizes (area in m²) of yards were calculated by firstly identifying possible yards and their boundaries in Google Earth. Using QGIS, the boundaries of these were then digitized (Fig. 4.23 top) and polygons (Fig. 4.23 bottom) developed to calculate the areas of each polygon.

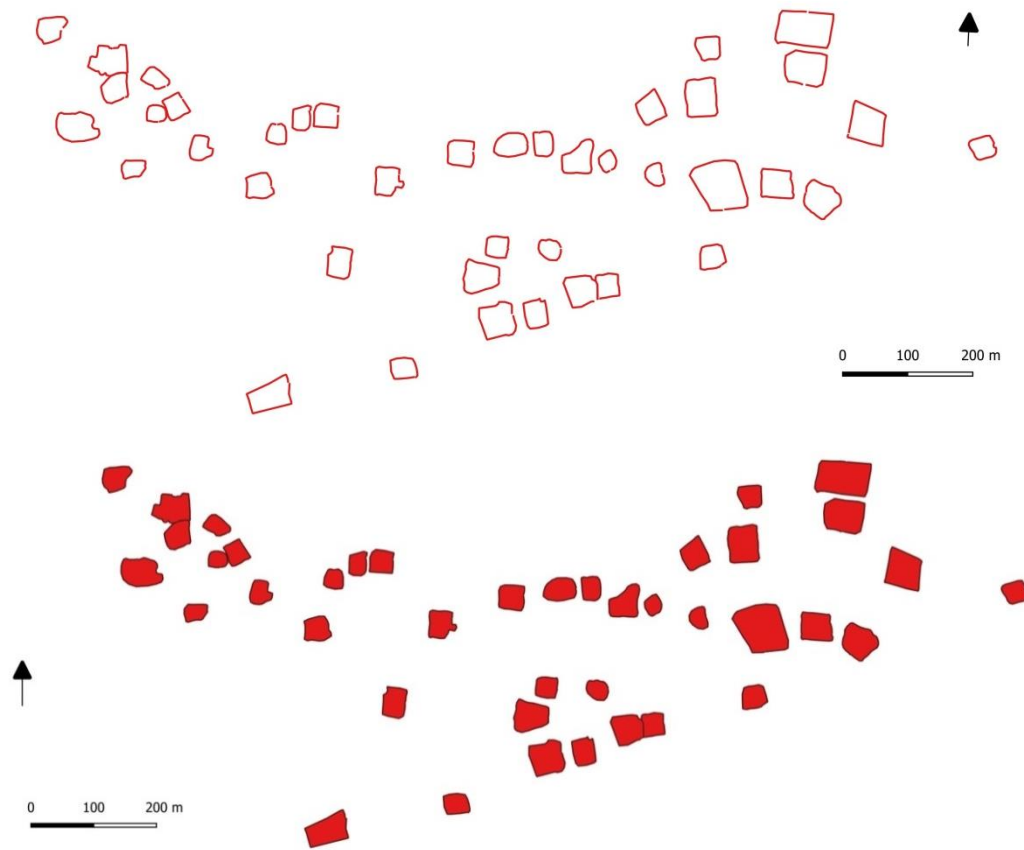


Figure 4.23: A map of Mosokotswe illustrating the digitization and creation of polygons used in the calculation of sizes of yards.

There is variation in the sizes of yards at Mosokotswe and Morabane (Fig. 4.24). Mosokotswe is largely characterized by yard sizes ranging from 497-2272m², while Morabane has more of the 201-1385m².

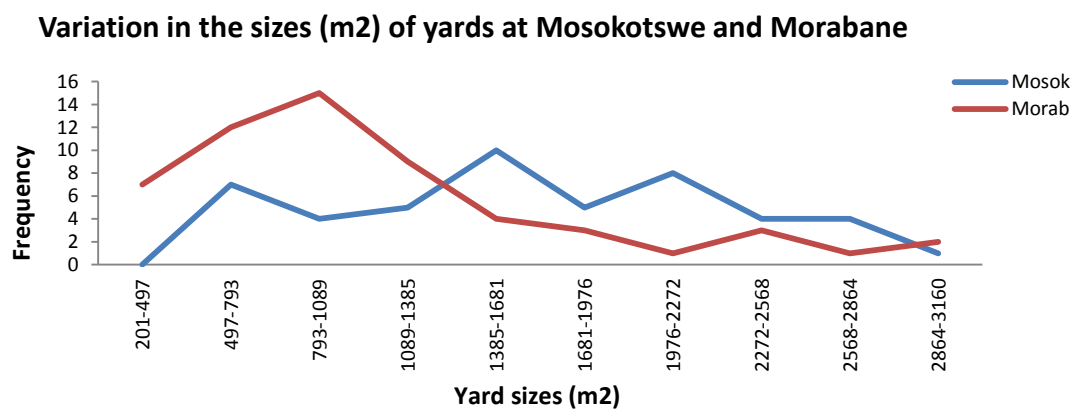


Figure 4.24: Yard size variation at Mosokotswe and Morabane showing that for my sample, most of the yards are less than 1385m² are found at Morabane.

This demonstrates that the sizes of yards would have declined away from the main settlement of Molepolole as the setup changed to suite the cattle posts layout. Yards outside of main settlements would have only been intended to accommodate herdboys, temporary stay by those managing the fields, and allowing enough space for crop processing activities at *masimo-moraka* setups.

Notwithstanding the challenge of easily associating kraals to specific yards using Google Earth, the positioning and sizes of yards at Mosokotswe and Morabane was necessary to determine other indicators, besides the ratio, that could be used in discerning cattle posts in the archaeological record. As an example, this research has shown that cattle posts would have more kraals than yards as the different types of animals owned by a single family would have their own kraals. Figure 4.25 (example from Mosokotswe) and Fig. 4.26 (example from Morabane) show that in some instances, a family would construct more than one kraal as stocks diversified, and these may be shifted around as need arises to address dung accumulation and drainage issues. Another noteworthy issue is that for setups at ERCPs, not all yards would have kraals as some families did not own livestock and would therefore only have fields and yards. The fact that not everybody in the society would have owned livestock can be easily detected and studied through the cattle post system.

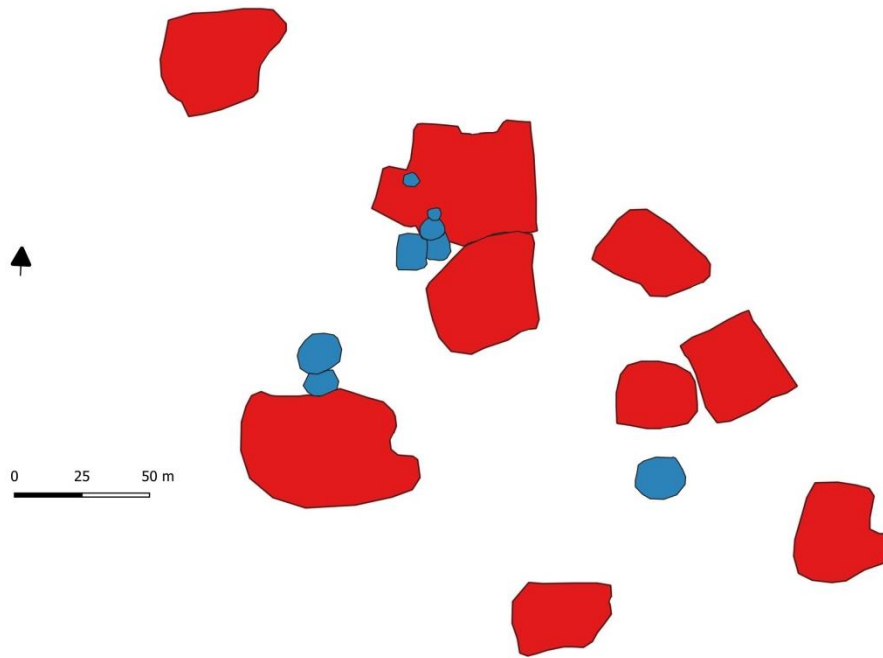


Figure 4.25: An example from Mosokotswe illustrating that yards (red) may have more than one kraal (blue) associated to them.

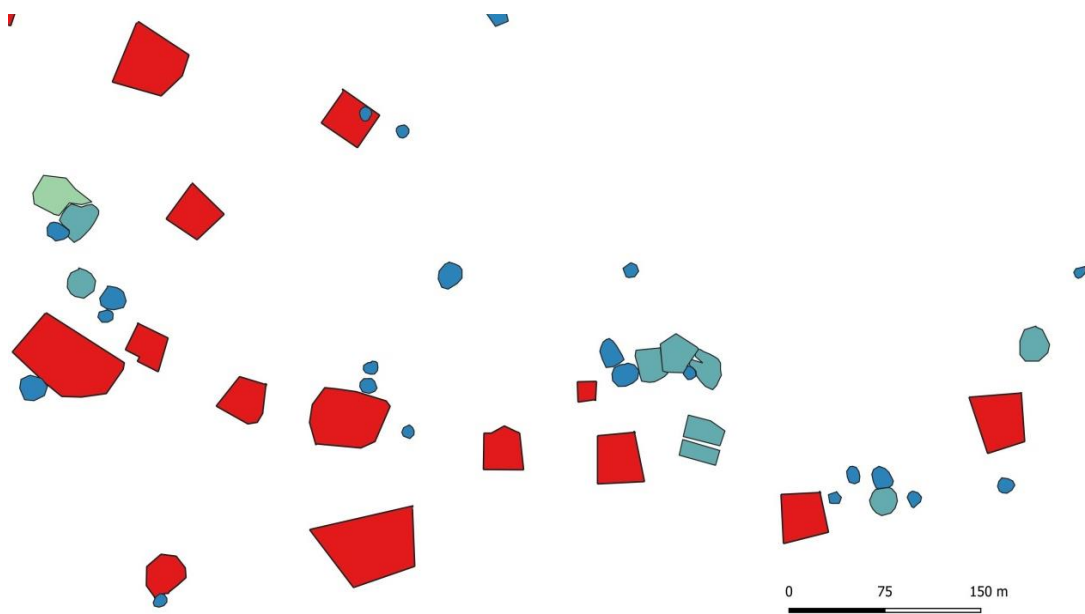


Figure 4.26: An example from Morabane illustrating that yards (red) may have more than one kraal (varying shades of blue) associated to them.

The need to compare the allocation of spaces reserved for livestock management at main settlements and cattle posts required a two-way approach. Firstly, there was need to observe variation in the sizes of spaces allocated to livestock management at main

settlements, and how this would have varied over time – from earlier occupations such as Kweneng, to later ones such as Molepolole. Secondly, it was necessary to observe how management of livestock outside of the main settlements would have affected the positioning of yards and livestock management areas such as kraals. The comparison of sizes of yards was therefore only applied to cattle posts where livestock ownership is at family level, whereas ward sizes were used for the Molepolole sample.

To further understand the geographic spread of yards at Mosokotswe and Morabane, the selected areas of focus were divided into 1km x 1km grids for an assessment of the distribution pattern. The Mosokotswe sample covers an area of about 2km², and has 41 yards spread in an east-westerly expansion (Fig. 4.27). For Morabane, the 58 yards are spread over more than 10.5km² in an east-westerly and northerly expansion (Fig. 4.28). The two areas show no record of bigger yards, with the biggest recorded size category being 3380-6560m² and Mosokotswe only has two of these while Morabane has none. Another issue to note in both illustrations is the dispersal of yards and kraals to minimize degradation – livestock grazes near yards in the mornings and afternoons.

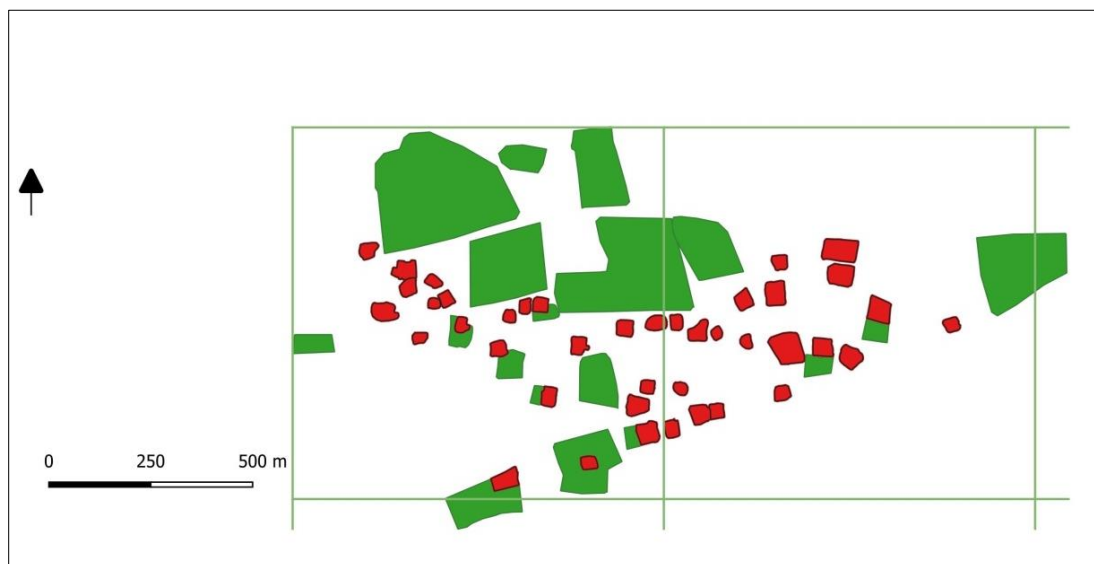


Figure 4.27: Mosokotswe layout showing the distribution of yards (red) and fields (green) in a 1km x1km grid

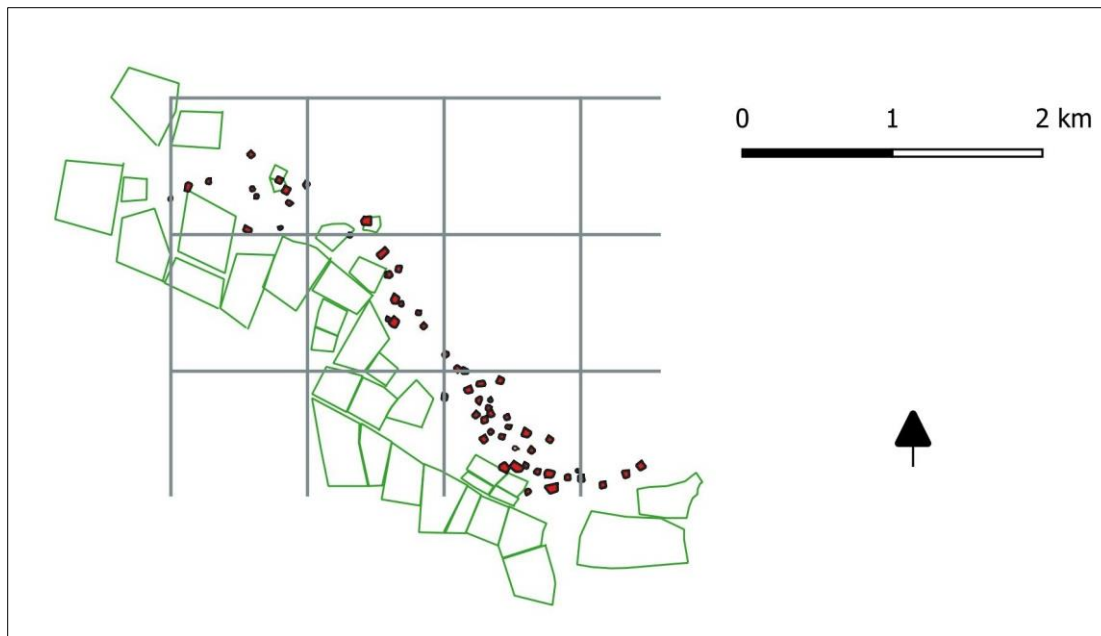


Figure 4.28 : Morabane layout showing the distribution of yards (red) and fields (green) in a 1km x1km grid

Spatial analysis of wards: presence, positioning and sizes – Molepolole

The calculation of ward sizes was applied to samples from main settlements (Molepolole in Botswana for the ethnoarchaeological study, and Kweneng in South Africa for the archaeological comparison). Generally, the data from Molepolole shows that there are fewer bigger wards (Fig. 4.29) and a larger number of relatively smaller wards. A total of 79 of the sampled 99 wards (79.8 %) at Molepolole fall at size category 7329m²-26185m², showing that the bulk of the sample wards are quite smaller. In my sample, I define bigger wards as any size range above 26185m², and as such all the ward size categories ranging from 26185-54469m² constitute bigger wards for the sample.

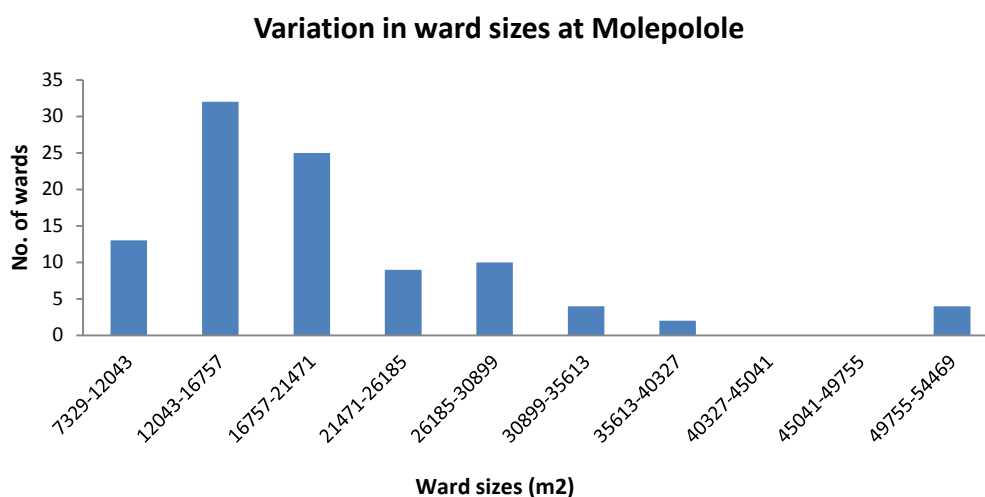


Figure 4.29: An illustration of variation in the sizes (area in m²) of wards at Molepolole.

At these main settlements, the smallest settlement unit is largely the ward and ownership of livestock at wards is communal as evidenced by centralized livestock management areas of varying sizes located within these wards.

In Figure 4.30, I use the digitized example of a cluster of wards from Molepolole to illustrate the positioning of the various sizes of communal livestock management areas or kraals. The legend shows the size categories which were generated through the Attribute-Based Clustering Plugin in QGIS. This cluster of wards shows that in this part of Molepolole, these shared livestock management areas or kraal areas are largely less than 990m², making up (73%) of the total kraals illustrated in figure 4.30.



Figure 4.30: An example of digitized wards from Molepolole showing the positioning of the various sizes of communal livestock management areas or kraals. In this cluster of wards, the smallest kraal is 227m² (in category 118-554) and the biggest is 1487m² (in category 1426-1862m²).

To further assess the spatial organization of wards at Molepolole, the area of focus was also divided into a 1km x 1km grid like at Mosokotswe and Morabane. The sample size for Molepolole is spread over more than 10km² (Fig. 4.31), and it shows that there are only 10 wards of size category 30899-54469m² (Fig. 4.32). It is evident from the results that the bigger wards are sparsely distributed, with smaller wards abutting to them to create agglomeration. With the assumption that the bigger wards are an indication of the first occupations, wards categories 30899-54469m² were probably sub-centres that agglomerated as smaller wards were abutted to them. The relatively smaller wards are in category size of 7329-26185m², constituting 79.8% of the sample.

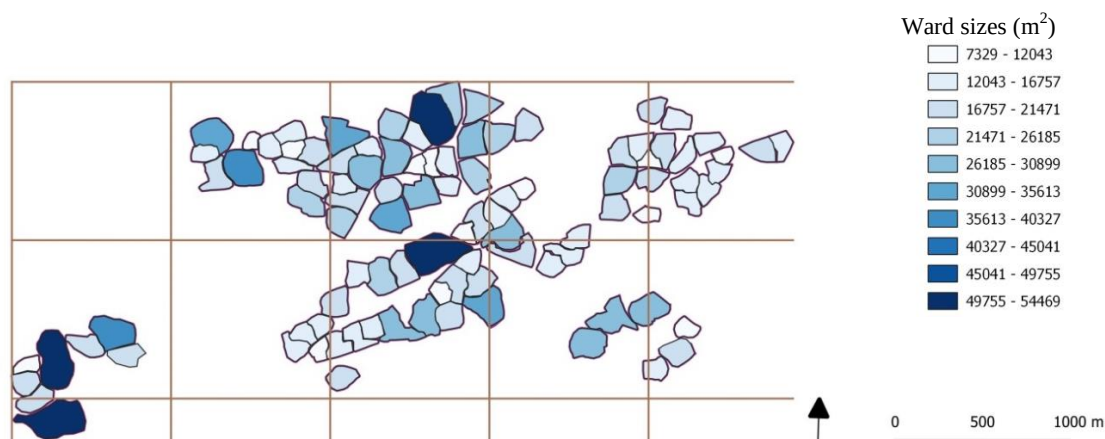


Figure 4.31: Spatial distribution of the varying sizes of wards at Molepolole assessed through a 1km² grid

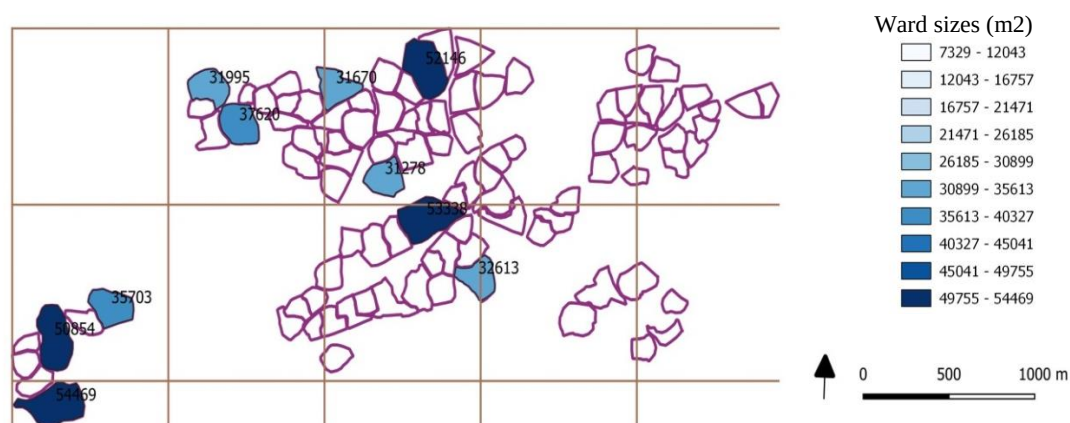


Figure 4.32: Spatial distribution of ward sizes 30899-54469m² at Molepolole assessed through a 1km² grid.

The presence and positioning of kraals

To assess the presence and sizes of kraals at Molepolole, Mosokotswe and Morabane, I followed the same approach for assessing wards and yards. However, it was not necessary to design separate size categories for kraal management areas or kraals at the cattle posts and for those at Molepolole. Although the kraals at Molepolole are shared by the whole ward (ward-based), and those at the cattle posts are for each family (family-based), it was still necessary to investigate if there was any size variation. As an example, does the introduction of family-based kraals at cattle posts necessarily result in a reduction in the size of kraals? So the first step was to look for evidence of kraals on

Google Earth, and if found these were mapped using QGIS. Polygons were created for the mapped kraals, and their areas (m²) calculated through QGIS, which was also used to classify the individual kraal areas into ten size categories. The lowest size category for kraals at Molepolole, Mosokotswe and Morabane is 6-335m², and the largest is 2969-3298m², with Morabane recording the largest number of kraals for this category. The occurrence of kraals per these categories was recorded (Table 4.5 and Fig. 4.33 illustrate the point).

Table 4.5: Distribution of kraal sizes at Molepolole, Mosokotswe and Morabane across the ten size categories.

kraal area (m ²)	Molepolole	Mosokotswe	Morabane
6-335	30	33	153
335-664	30	4	18
664-994	12	0	1
994-1323	12	0	1
1323-1652	8	0	0
1652-1981	3	0	0
1981-2310	2	0	0
2310-2640	0	0	0
2640-2969	0	0	0
2969-3298	1	0	0
Total	98	37	173

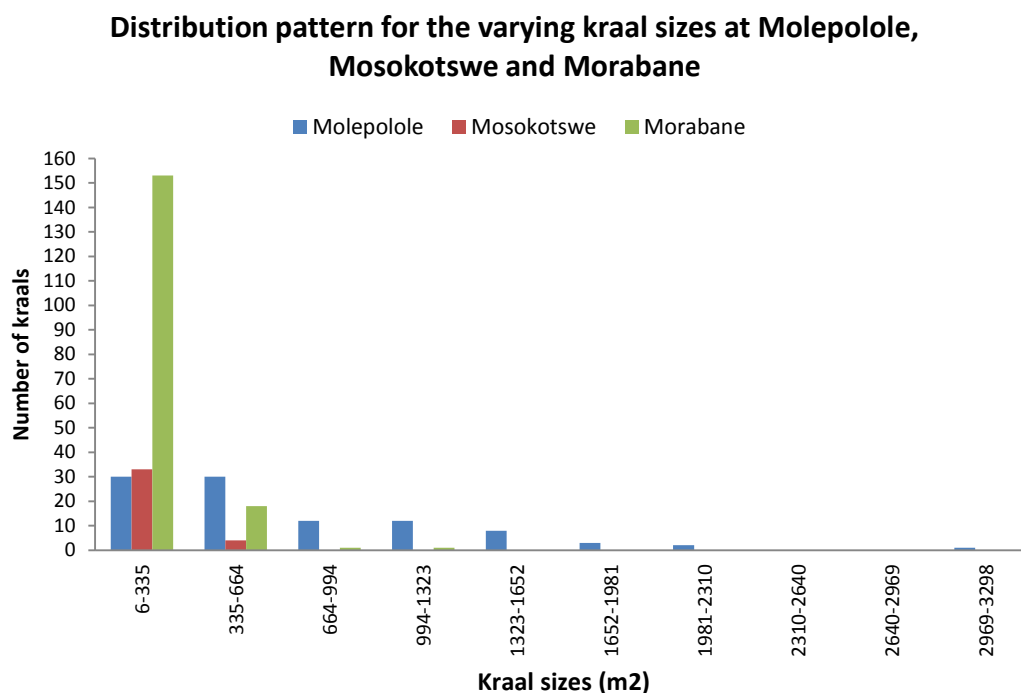


Figure 4.33: Distribution pattern for the varying kraal sizes at Molepolole, Mosokotswe and Morabane.

I also assessed if the sizes and positioning of kraals varied spatially. The variables were analyzed qualitatively (presence and positioning of kraals) and quantitatively (sizes of kraals). The distribution pattern and size variation were assessed through the 1km x 1km grids created for the sample areas at Mosokotswe (Fig. 4.34), Morabane (Fig. 4.35) and Molepolole (Fig. 4.36).

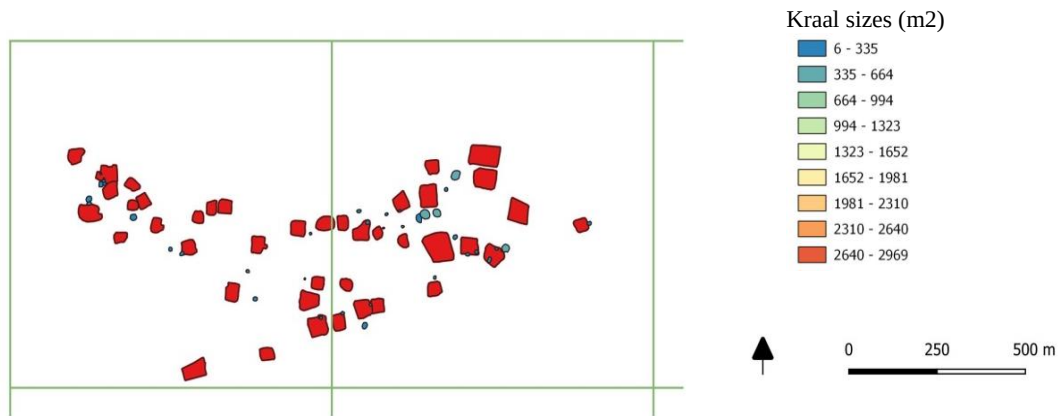


Figure 4.34: Distribution of the varying sizes of livestock management areas or kraals at Mosokotswe cattle post

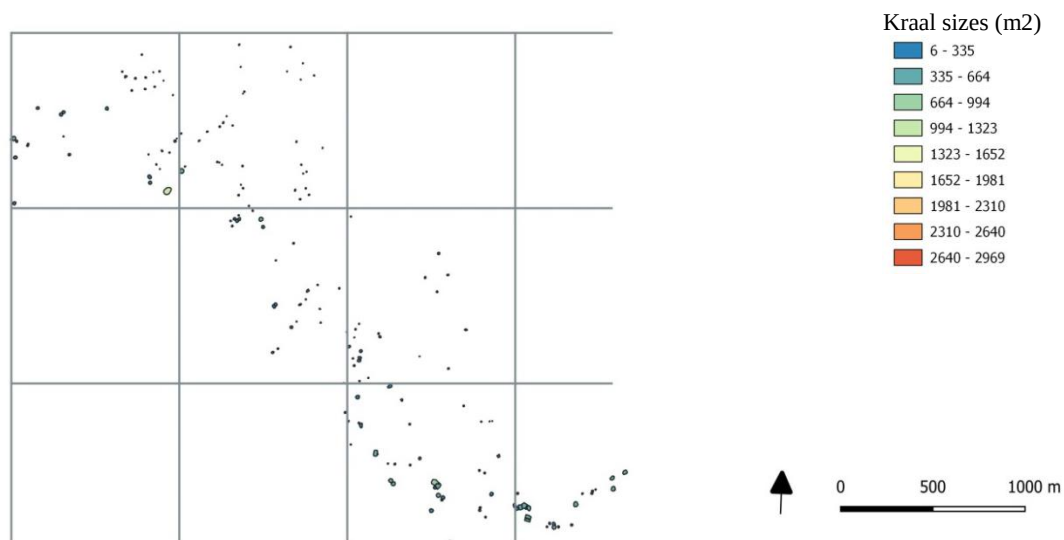


Figure 4.35: Distribution of the varying sizes of livestock management areas or kraals at Morabane cattle post

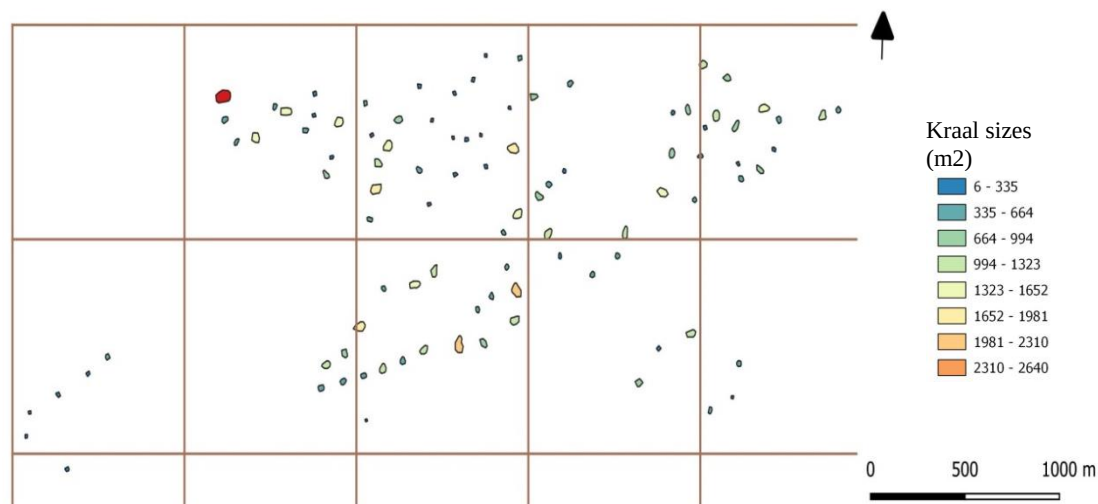


Figure 4.36: Distribution of the varying sizes of livestock management areas or kraals at Molepolole

The maps show that there are more kraals per km² at Mosokotswe (Fig. 4.35) and Morabane (Fig. 4.36) than at Molepolole (Fig. 4.37). The kraals at main centres such as Molepolole are communally owned as opposed to the ones at cattle posts - which are individually (family level) owned, and therefore many.

The wealth of information available on the socio-economic and political value of cattle amongst the Bantu and the Tswana was good enough to presume that cattle kraals will always be a key feature in herder-farmer sites. The data from this research confirms that kraals are present and identifiable at Molepolole, Mosokotswe and Morabane.

Not only does the number of kraals vary their positioning across the 3 areas also varies. At Molepolole, it is evident that the oldest parts of the settlement have kraals in the inner spaces of yards. Oldest here is used to reference all occupations that occurred since 1865 when Molepolole was first occupied, until the time when the yards (residential plots) were allocated in linear form for easier provision of amenities (installation of power and water lines). As a result the number of kraals is dependent on the number of wards, and the distribution of kraals takes shape of that of wards. At cattle posts, kraal positioning is dependent on the location of cultivation fields and yards as well as the availability of shade for kraals and risk management issues. Worth noting is that the application of digital survey tools such as QGIS and databanks like Google Earth allows for effective

assessment and a comparative approach to broader issues such as the cattle posting process.

Variation in kraal sizes and positioning

Datasets of kraal sizes for Molepolole, Mosokotswe and Morabane were analyzed together, and an attribute-based clustering was created for them. The size categories for this exercise (smallest being 6-335m² and highest 2969-3298m²) are therefore different from those created when analyzing Molepolole data on its own (smallest 118-554m² and highest being 4042-4478m²). The size categories for analyzing Molepolole data separately go beyond 3298m² because the sample was later increased. The comparison process was not disregarding the fact that the Molepolole kraals are shared by all the yards that make up a ward, whereas at Mosokotswe and Morabane the kraals are for each yard. Figure 4.37 shows that the sizes and positioning of kraals varied at Molepolole, Mosokotswe and Morabane.

Distribution of the varying kraal sizes at Molepolole, Mosokotswe and Morabane

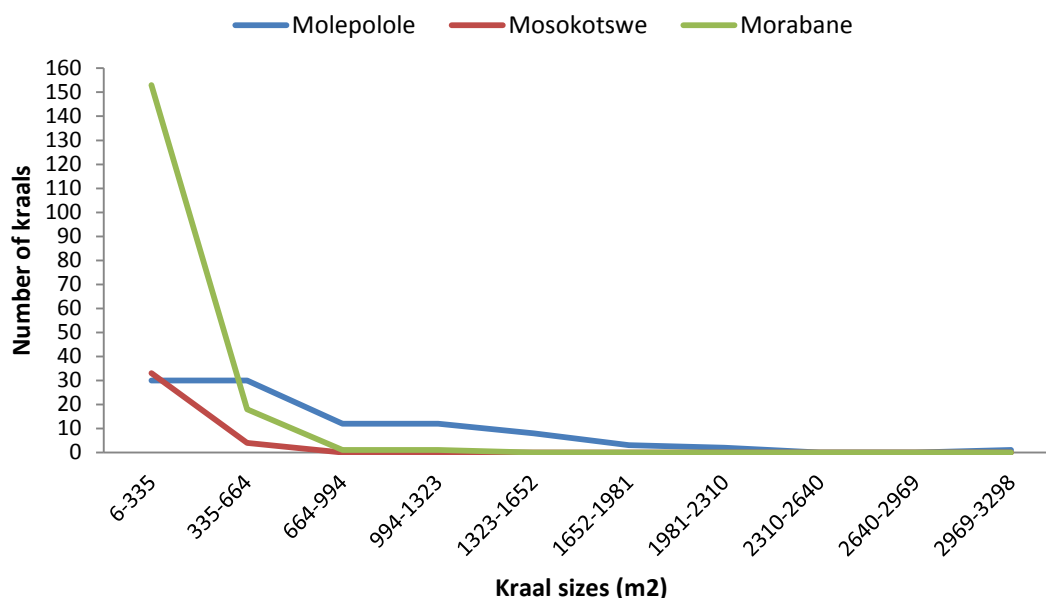


Figure 4.37: Variation in kraal sizes at Molepolole, Mosokotswe and Morabane.

The data shows that the sizes of kraals are generally smaller, and their sizes decrease outwards from the main settlement of Molepolole, with Morabane having smaller kraals, 153 (70.8%) of them at category 6-335m². Mosokotswe and Morabane are less

represented from categories 664-994m² onwards. However, there would be exceptions at cattle posts of individuals with large numbers of cattle as these would show an increase in the sizes of kraals away from the main settlement. The sample I selected for Mosokotswe and Morabane turned out not to have a representation of bigger kraals. The key issue highlighted here is that as management strategies of cattle evolve, there are indicators that we can use to identify such strategies at ancient herder-farmer sites.

Spatial variation in sizes and positioning of kraals

For the spatial analysis of kraals, I utilized the 200m x 200m grids I created for the three case study areas. I was not only looking for variation in the positioning of kraals, but also variation in the sizes of kraals temporally and spatially. Firstly, the hypothesis is that the introduction of cattle posts results in reduced proportions of space allocated to livestock management at main centres. Secondly, as the practice of communally managing cattle is abandoned and decentralization occurs as cattle are managed out of main centres, the sizes of kraals become smaller as each owner/family have their own (the above section illustrates the point).

Several issues must obviously be considered regarding methodological approaches to realizing the hypothesis. The results of this research demonstrate that there is need to firstly establish evidence for herd management strategies, e.g. that the Tswana have ERMCS and RMCPs. Once this is done, the occurrence, nature (sizes and types) and positioning of these must be studied. Their evolution in terms of variation in sizes and positioning must be studied spatially and temporally. It is evident from this research that variation in the sizes and positioning of kraals is not only triggered by the relocation of main centres. It is also influenced by possible increase in stock and requiring management outside of main centres. Most importantly, this research highlights a key socio-economic and political transition among the Tswana - the decentralization of livestock management from ward-based (communal) to family-based (individual) level.

It is also evident from this research that while it is demonstrable that the adoption of the cattle post system triggered variation in the sizes and positioning of kraals, subsequent studies need to now establish the extent of this impact. There will be need to now increase the sample for main centres, and then calculate the possible kraal area per yard by dividing the communal (ward-based) kraal size by the number of yards that make up a

ward. This would give a clear indication that indeed the kraal size per yard changed over time. This would not only validate that there is indeed variation in the sizes of kraals at main centres. It will also facilitate an effective comparison of the variation in the sizes and positioning of family-based livestock management areas or kraals.

In Figure 4.38 to Fig. 4.40 I illustrate that not only do kraal sizes vary temporally, their positioning is also indicating peculiarity. The Molepolole sample shows that the kraal size category of 6-335m² (Fig. 4.38) is largely distributed to the northeast of the settlement. Category 335-664m² (Fig. 4.40) - is skewed in a south-easterly direction in a rather dispersed manner. There is at least one kraal in each 200x200m² (Fig. 4.39 and 4.40). This would largely be typical for setups in main centres where kraals are in the inner spaces of wards. Therefore the buffer between kraals is dependent on the buffer between wards. Figure 4.40 illustrates how the distribution of bigger kraal sizes was dispersed across the 200m² grids.

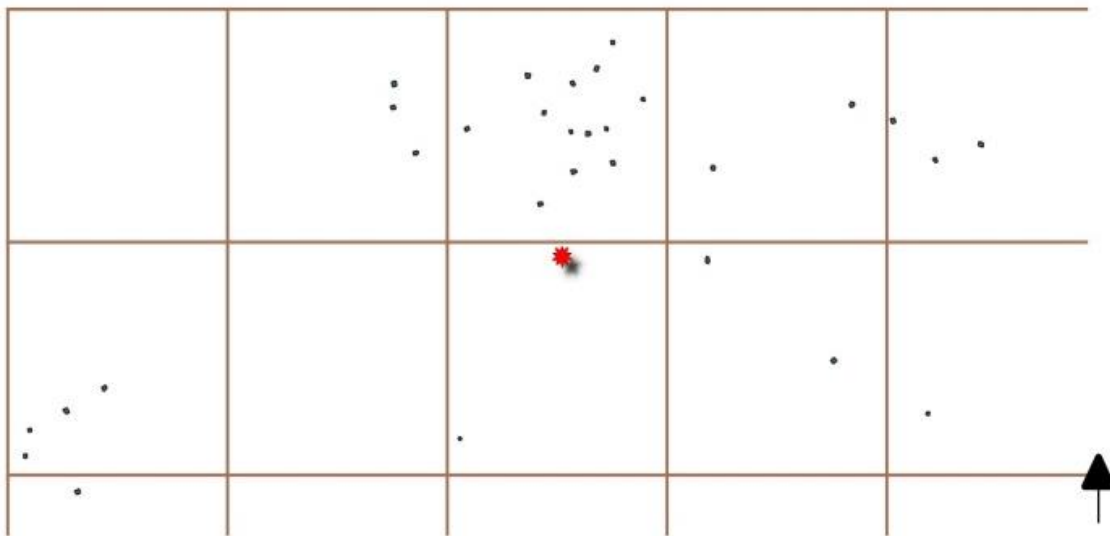


Figure 4.38: The spatial distribution of kraal size category 6-335m² for the Molepolole sample assessed in the context of 1km x 1km grid and showing that these kraal sizes skewed in a north easterly direction. The red star is the centroid (generated through QGIS), and overlaps with the location of Kwena main Kgotla.

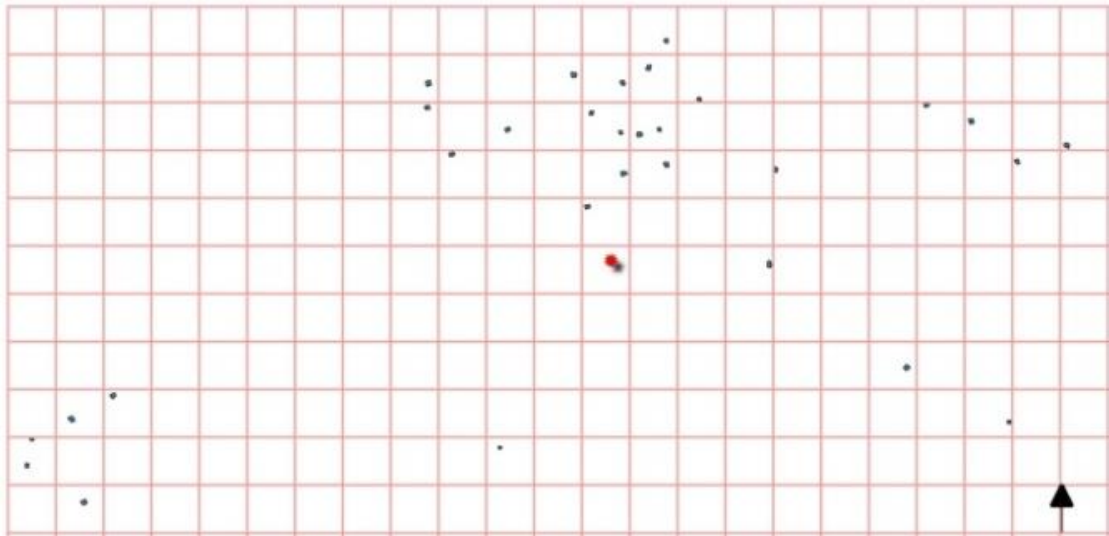


Figure 4.39: The spatial distribution of kraal size category 6-335m² for the Molepolole sample and showing that there is at least one kraal in each 200m x 200m grid. The red star is the centroid (generated through QGIS), and overlaps with the location of the Kwena main ward. This spatial distribution shows that there is not much of kraal sizes 6-335m² near the Kwena main ward.

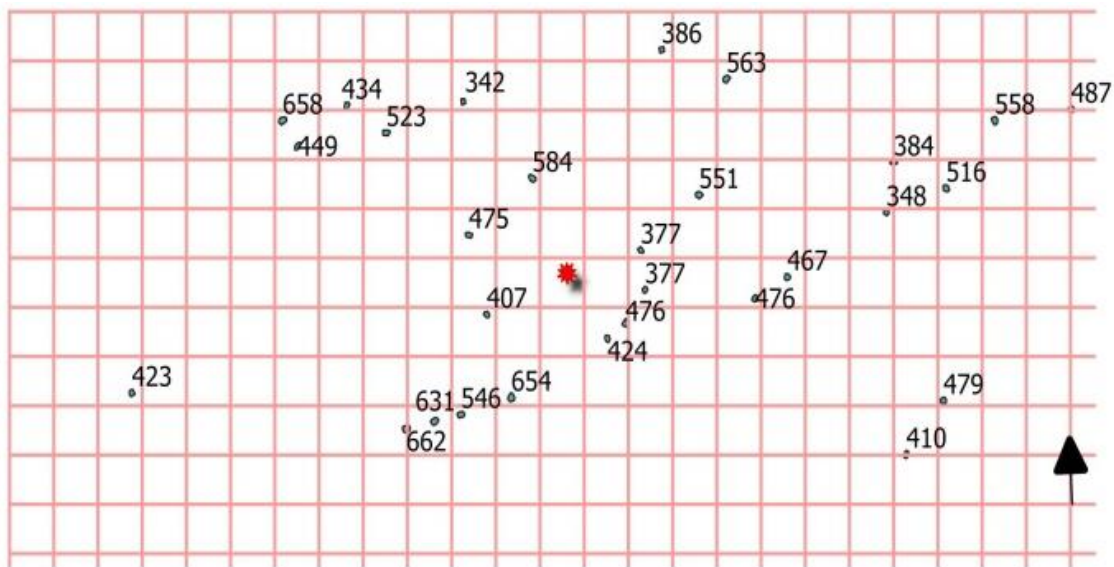


Figure 4.40: The spatial distribution of kraal size category 335-664m² for the Molepolole sample, assessed in the context of 200m x 200m grid.

Figure 4.40 illustrates that the kraal size category 335-664m² is widely spread although restricted to the north and south-easterly parts of the settlement. The red star is the centroid (generated through QGIS), and overlaps with the Kwena main ward. Also, the spatial distribution shows that the Kwena main ward is mainly surrounded by kraal sizes of 335-664m², unlike the setup in Fig.4.40.

For the kraal distribution at Mosokotswe, most of them are for small stock (goats and sheep, although sheep are very few). The mapping of Mosokotswe (Fig. 4.41) showed

that the kraals become smaller in an east-westerly direction, and then become bigger again. The reason for this increase in size is because most of the yards located west of Mosokotswe have cattle kraals – evidence based on field observations and information from interviews. Being a typical masimo-moraka setup, Mosokotswe map shows that the positioning of kraals follows the location of yards and fields (Fig. 4.41).

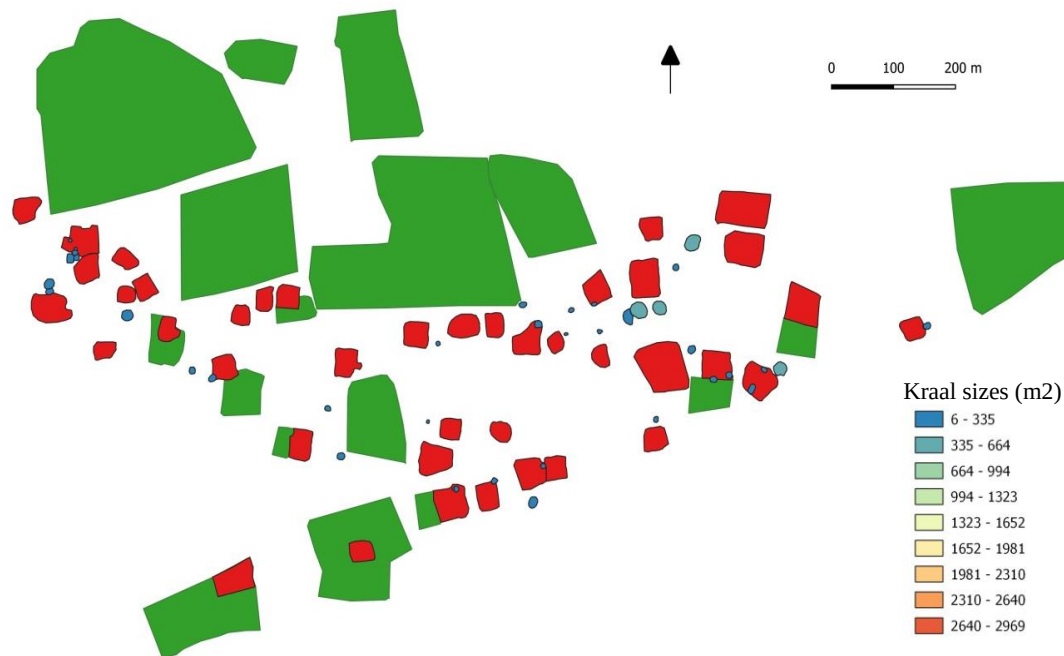


Figure 4.41: Illustration of kraal distribution pattern that is influenced by the positioning of yards and fields.

Another key aspect of this study is that also it makes it evident that the lack of a ward structure, coupled with variation in the type of animals kept, has a bearing on the size and number of kraals per 1km² and per 200m² (Fig. 4.42 top, and Fig. 4.42 middle). The Mosokotswe illustration shows that there are more goat kraals than those for cattle in a 200mx200m area. This is because cattle owners have to worry more about buffer zones around yards (for grazing in mornings and afternoons) than small stock owners. However, another aspect that may lead to dispersal of small stock kraals is positioning of yards next to fields – small stock are always positioned next to yards for risk management purposes. As at 2017, very few kraals at Mosokotswe are for cattle. In Figure 4.42 (bottom), the few kraals in the size category 335-664m² are for cattle and are restricted to the north of the settlement.

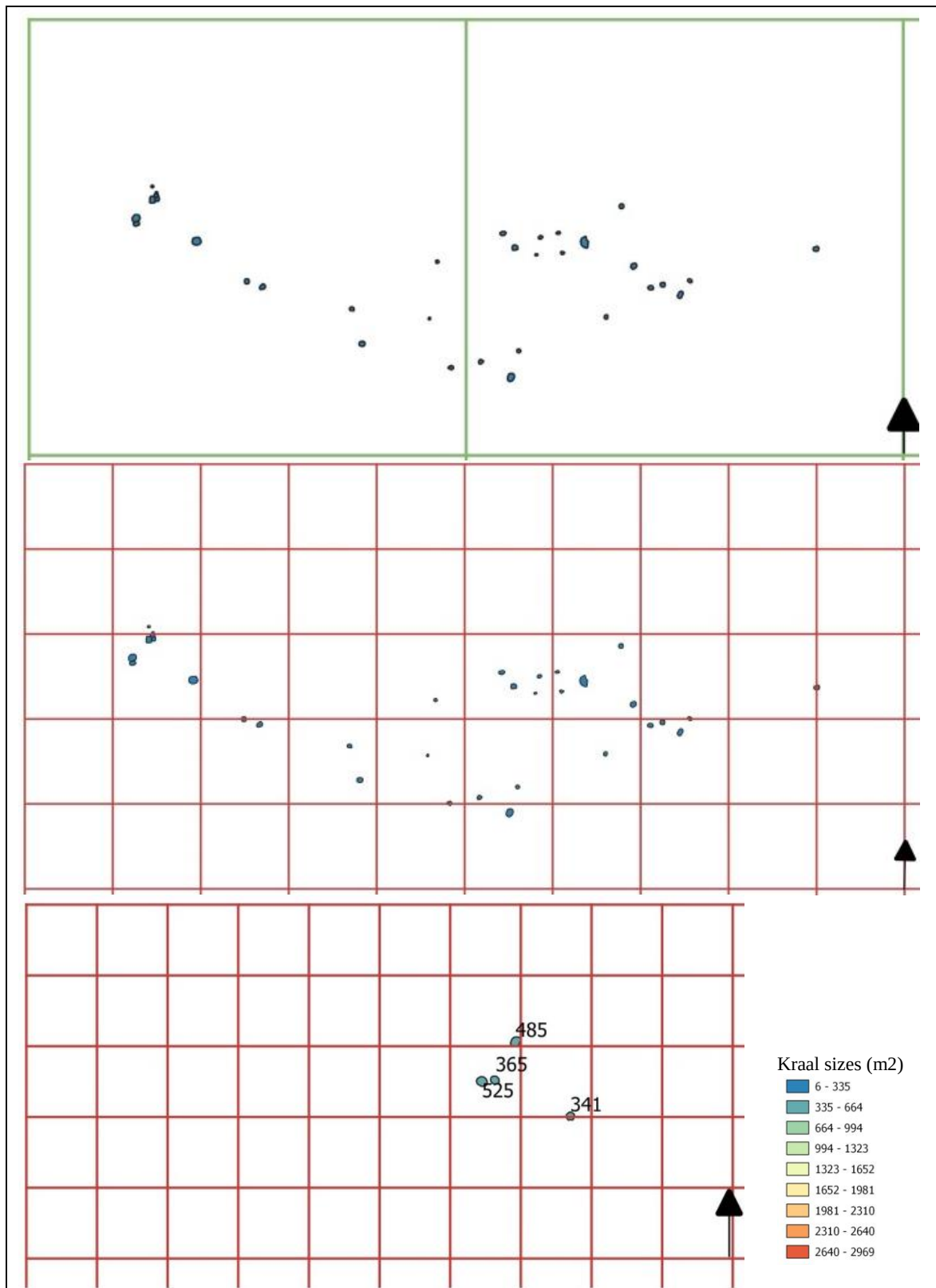


Figure 4.42: Distribution of kraal size category 6-335m2 at Mosokotswe in the context of 1km x 1km (top) and 200m x 200m (middle) grids. The kraal size category of 335-664m2 is very limited in this illustration (bottom).

At Morabane kraal sizes decrease in a northerly direction away from cultivation areas (Fig. 4.43). The maps show that in some sections of the settlement there are several kraals

within 1km² and 200m² (Fig. 4.43 top and middle). I think this is because the number of cattle per yard is also low, and so there is still no need for extended buffers between yards and kraals. Another reason for clustering is that some yards have more than one kraal, and in some cases members of a single family have either combined their stocks or positioned their kraals in close proximity to each other. Figure 4.43 (bottom) also illustrates that kraal size category of 335-664m² is dominant in the eastern and western parts of the settlement, and these are some of the older occupations.

Another key issue here is that kraals extend to beyond the settlement boundary. This is possibly indicating the occurrence of temporary kraals or individual cattle posts at extended grazing zones. These isolated occurrences of kraals and kraal-like features can be indicators for modeling day-trip grazing zones and big trees across the landscape where cattle would gather in summer periods.

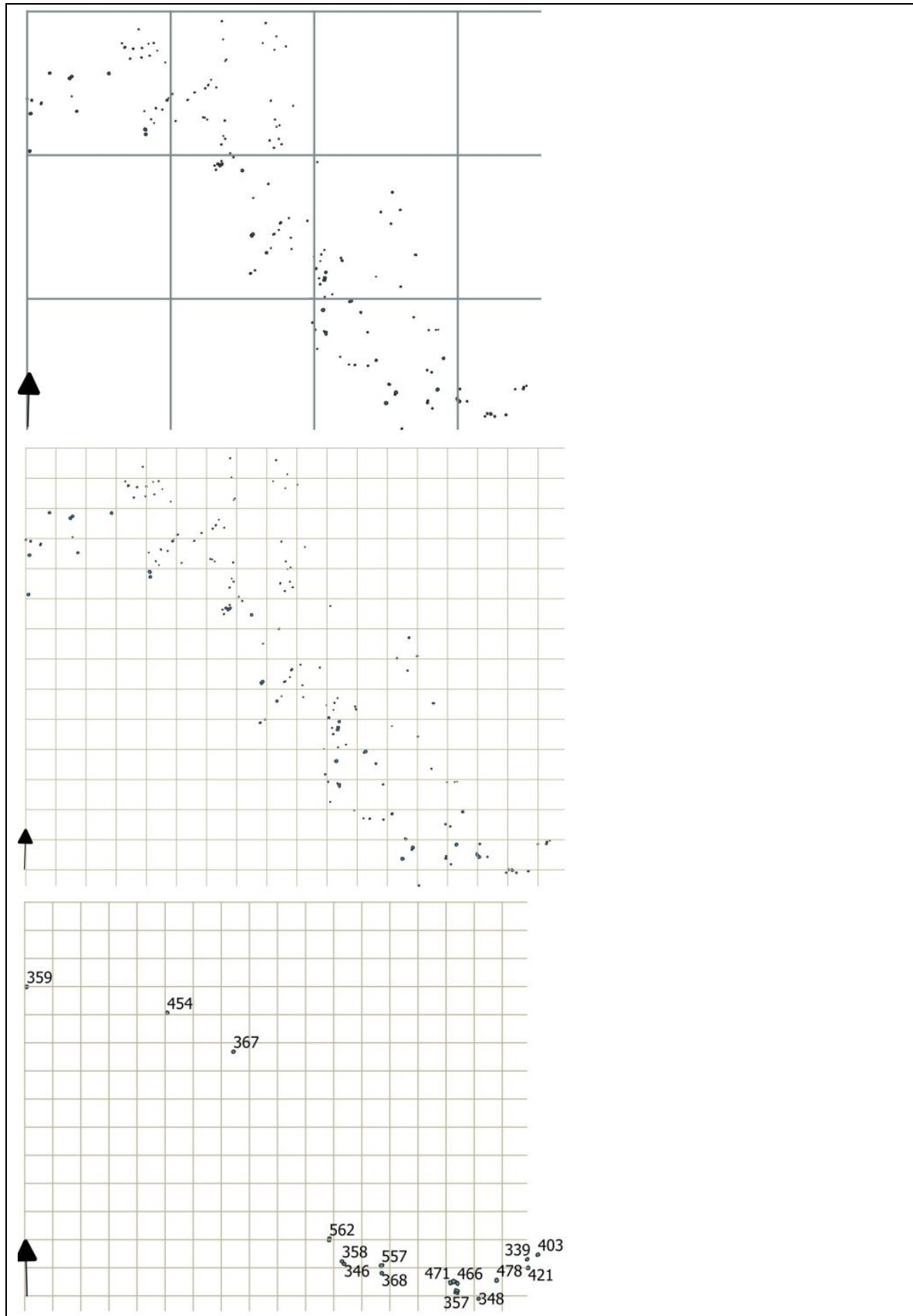


Figure 4.43: Distribution of kraal size category 6-335m2 in the context of 1 km x 1km (top) and 200m x 200m (middle). Kraal size category 335-664m2 is assessed in a 200m x200m grid and the distribution shows that this category is dominant in the eastern and western parts of the settlement, and according to the informants, these are some of the older sections.

Sections 4.3.1 and 4.3.2 presented the results and analysis of the statistical and spatial data relating to the presence of kraals and yards at the three case studies of Molepolole, Mosokotswe and Morabane. The main focus was on the identification and recording of the presence of kraals and the associated yards and fields. The sizes of wards and yards were necessary for establishing if the proportion of space allocated to the management of livestock was declining or increasing over time with the introduction of cattle posts (only used results from Molepolole in section 4.3.3).

The temporal aspect here is inferred from documentary sources (Okihiro 1973, 1976; Schapera 1980) that Mosokotswe, Morabane and other cattle posts associated with the Kwena would have been occupied later than AD 1800. According to these sources, the royal main wards and sub-wards are established first, then the associated wards are appended, and in most cases expanding outward. This creates a situation where the settlement layout would have a few bigger wards and kraals, and these would be in close proximity to smaller wards that are managed by the ward of the sub-chief. These smaller wards appear as infill to spaces in between wards or as annexures to bigger wards. According to Okihiro (1976: 16), the Kwena senior sons establish their own wards, and as also noted by Schapera (1970: 20) population increase triggers a split of wards into sub-wards and even new settlements.

The positioning of kraals was assessed in relation to the positioning of wards and yards. The positioning of kraals in the inner spaces of wards had impact on their number and distribution pattern. At cattle posts, the kraals are isolated and located in close proximity to yards for risk management purposes.

Can we effectively attribute the shifting ideologies in the use of space (loss of centrally owned and utilized spaces), and a reduction in kraal sizes at the main canters to the cattle post phenomenon? Historically, the Tswana settlements are known to have been organized into wards, with a centralized livestock management system evidenced by the placement of shared kraals in the centres of wards (Schapera 1970; Silitshena 1979; Kuper 1982; Huffman 1986b, 1986c; Sadr 2019a). The literature therefore shows that at this stage, the responsibility to manage and protect livestock is shared at ward level, but ownership is most probably family-based. Is the adoption of the cattle post system one of

the major contributors to a shifting ideology towards family-based ownership, management and protection of livestock?

The data from the three case studies demonstrate that while other factors may have been responsible for the absence of communally owned kraals (in the centers of wards) at Molepolole, the cattle post system evidently led to a decline in the sizes of kraals over time. The increasing numbers of livestock and other push and pull factors necessitates the continual use of the cattle post phenomenon. There is an evolution in the Tswana livestock management strategy. The practice of managing livestock at main centers degenerates over time and this is evidenced by a reduction in the sizes and positioning of central kraals.

In the Molepolole sample, kraal sizes show a reduction from the bigger category of 2969-3298m² (sizes common in the older sections of the settlement) to the smallest one of 6-335m². The intensity of managing livestock at Molepolole is reduced leading to usage of neighboring existing kraals by families that do not have. Also, the more the livestock management strategy becomes family-based, the lesser the need to use communal kraals (pigeonholed by the absence of kraals in newer sections of Molepolole). A Google earth survey of the newer and peripheral sections of Molepolole shows an absence of the ward structure and centrally located kraals, or any sign of big kraals irrespective of the location. At cattle posts, whose primary function is to absorb excess livestock wealth from the main settlements, there are more kraals than yards. There is evidence for variation in the sizes of livestock management spaces or kraals, as well as their positioning. Both of these are impacted by the location (whether they are at main settlements or cattle posts) and the decentralization or evolution of livestock management from ward-based (communal) to family-based (individual).

4.4 Spatial analysis of the sizes and positioning of kraals at main centres: Molepolole case study

4.4.1 Sampling and data presentation

One of the key initiatives of my research objective is to demonstrate if there are any indicators we can use to detect the adoption and continued or discontinued use of the cattle post system by the contemporary Tswana. Once these are known, how effective are

they in tracing the adoption of the cattle post concept by the Tswana of the last 500 years. The approach is therefore to develop indicators that can be rolled-back to archaeological sites and assess the adoption of the cattle post concept. For assessments done at archaeological sites, especially at main centers, a few key questions are critical. What would happen to occurrence of central kraals, would they disappear with the adoption of the cattle post system? Is their positioning changing over time and space? If kraals are still maintained at main centers during the period when cattle posts are in use, would a reduction in the size of kraals be the best indicator? Where variation and decline are apparent on the sizes of kraals, would consideration of other issues such as the direction of change and the specific locations at which change takes place add any value? To facilitate an effective application of these indicators to older settlements, there is need to answer these questions through the study of a contemporary one. With prior knowledge that my case study in South Africa is a Kwena pre-colonial center, I selected Molepolole in Botswana to answer these questions.

Following the assessment presented in sections 4.3.1 and 4.3.2, I revisited my Molepolole sample to increase it and carry out more analysis on the spatial variation in the sizes of kraals. Figure 4.44 (top) shows the ward selection process (yellow points), digitization and creation of polygons to measure the sizes (aream2) of such wards (purple polygons), and the additional wards to the sample (no points). The additional wards were targeted at extending the sample footprint to the west, south and northeast, while the ones in the central part of the sample area were needed to close the gaps and have a more agglomerated distribution, as well as to include the wards near the Kgosing wards. A closer assessment of Molepolole satellite image showed that some sections beyond the sample areas have no central kraals - either non-existent or demolished.

The 200m x 200m grid illustrates the distribution pattern of the size categories of wards (Fig. 4.44 middle). It shows that the smaller wards (size category 7329-16757m²) are either on the periphery or located in the central part as infill. To further assess the distribution of kraals across these wards, a concave hull (bottom left) was created and used to create a center point (red dot) for assessing the distribution pattern of kraals in relation to this point. Because most of my sample is from the older part of Molepolole, my kraal center point overlapped with the main Kwena Kgotla ward (Fig 4.44 bottom right).

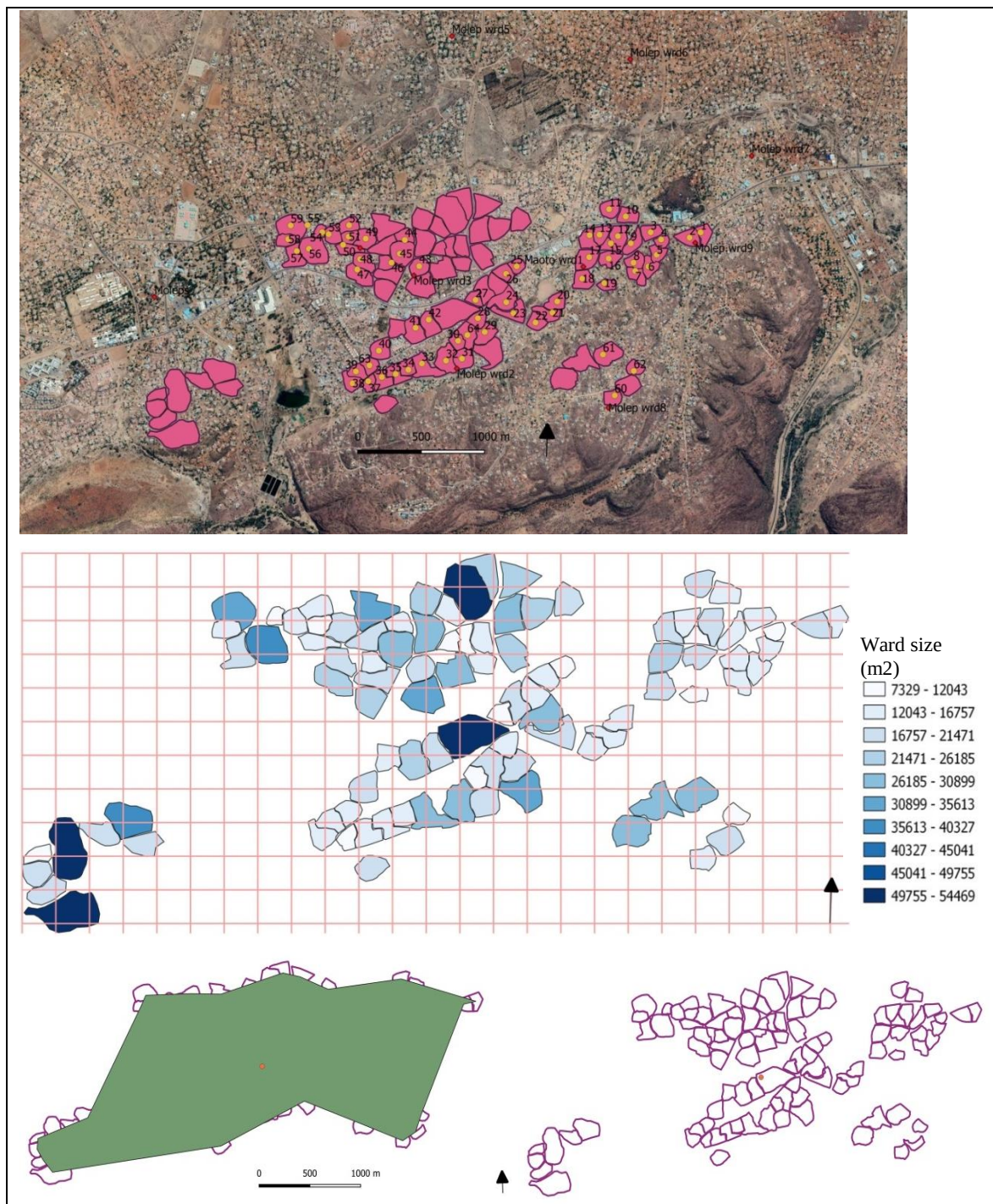


Figure 4.44: Selection, digitization and creation of polygons for calculation of the sizes of wards (top). The sizes of wards varied, with the smallest at size categories 7329-12043m2 and 12043-16757m2.

4.4.2 Assessment of kraals at Molepolole

Once the sizes and positioning of wards was mapped and the variation of these across the different sections of Molepolole assessed, the kraals were identified and mapped. With a specific focus on the Molepolole kraal sample, the sizes of kraals previously discussed under section 4.3.2, were now reclassified into ten categories using the

Attribute Based Clustering Plugin in QGIS. While the minimum kraal size category for the three study areas (Molepolole, Mosokotswe and Morabane) was 6-335m², the new classification for the Molepolole sample is 118-554m², and more than 50% of the kraals sizes fall in this category (Fig. 4.45).

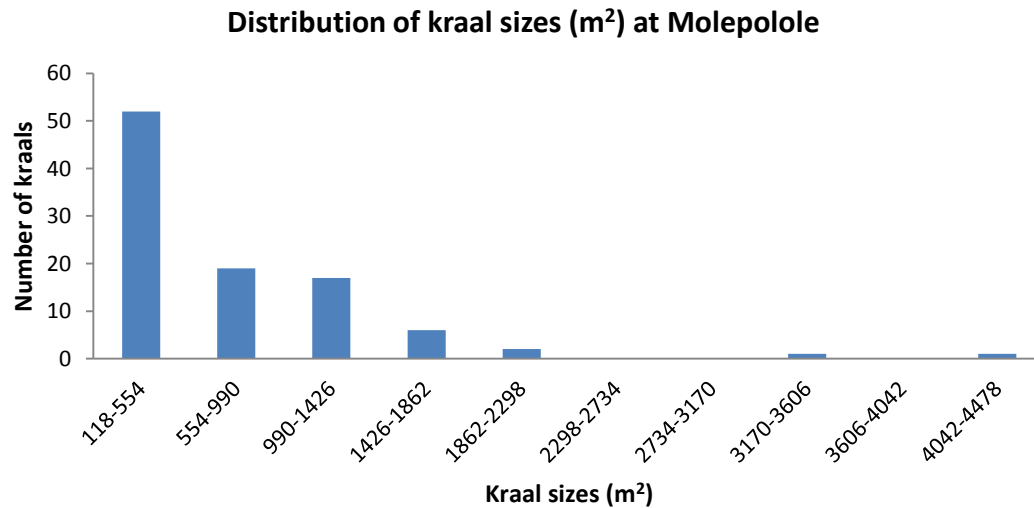


Figure 4.45: Distribution of varying kraal sizes for selected wards at Molepolole.

Figure 4.46 (top) shows points Molep wrd 5, 6 and 7, which represent the newer part of Molepolole that I have confirmed (by assessment through satellite imagery) not to have ward structures and central kraals. The kraal polygons (for calculating sizes of kraals) were created through QGIS and the kraal sizes assessed through a 100m x 100m grid. The data shows that there is at least one kraal per 100m² (Fig. 4.46 bottom).

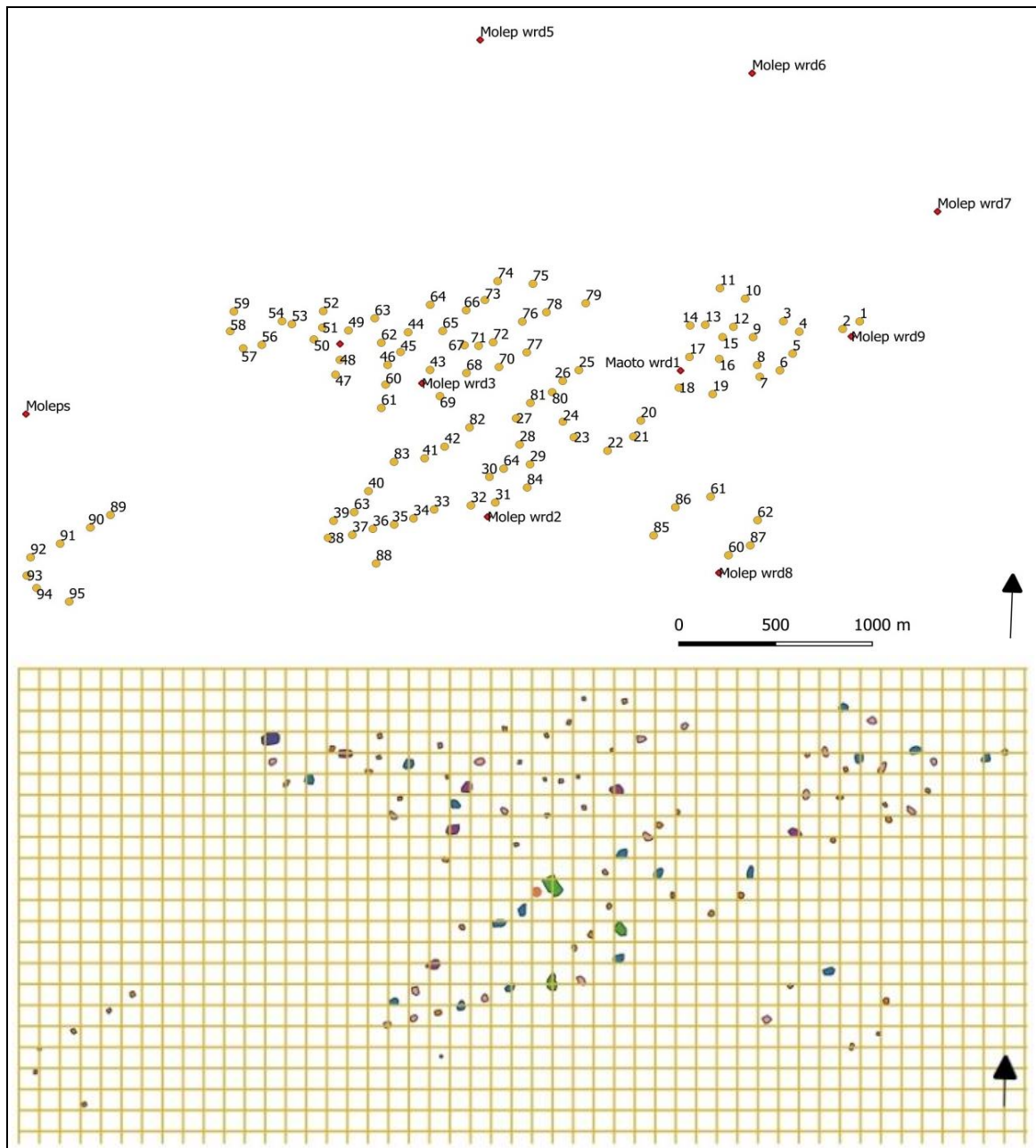


Figure 4.46: The presence of kraals at selected wards (top) and their spatial distribution on a 100 x 100m grid (bottom left). The sizes of kraals varied, with the smallest category of 118-554m² mainly on peripheral areas. Overall, the Molepolole kraal sample is dominated (52%) by kraals that are less than 1500m² (bottom right).

The distribution of kraals takes the pattern of wards, indicating a systematic positioning as opposed to scenarios at cattle posts where the positioning of kraals is dependent on the individual yards. It is therefore evident that at main centers the positioning of wards was centralized and socio-economically (based on management of resources such as cattle) and socio-politically orientated (with the (spatial organization of wards and kraals based on the authority of the sub-chiefs and headmen). At cattle posts there is a shift towards a more decentralized approach towards management of excess wealth, exploitation of the extended resource base offered by new areas, and risk management.

Once I established the positioning and variation in sizes of kraals, I assessed if their sizes were increasing or decreasing away from the center point (red point) and the main Kgosing ward by creating a 200m constant distance multi-ring.

Figure 4.47 shows that for the Molepolole sample, the relatively bigger kraal sizes 1862-4478m² are about 400m, and beyond, from the center point (red star). This gap would be closed as agglomeration of kraals occurs at size ranges below 1862m².

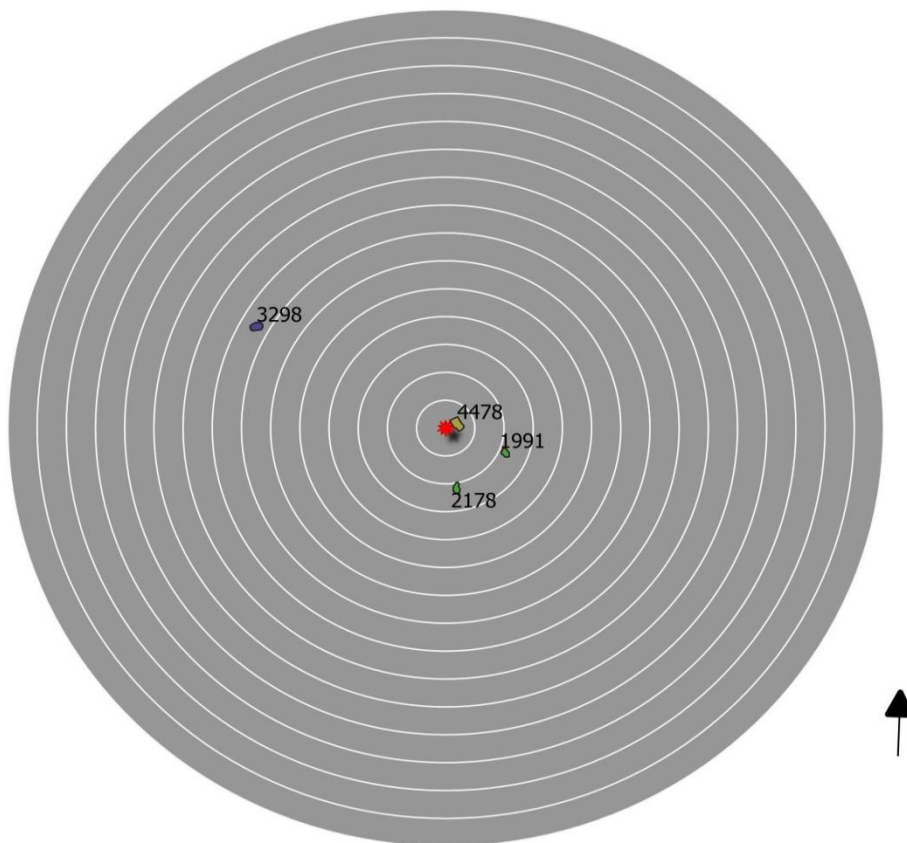


Figure 4.47: Distribution of kraal sizes 1862-4478m² across the 200m constant distance multi-ring measured from the center point (red) of the Molepolole kraal sample.

In Fig 4.48, there are also no kraal sizes of category 1426-1862m² within a 400m radius of the center point (which overlaps with the main Kgosing ward). These kraal sizes are also restricted to the north of the center point (red star) of the kraal sample.

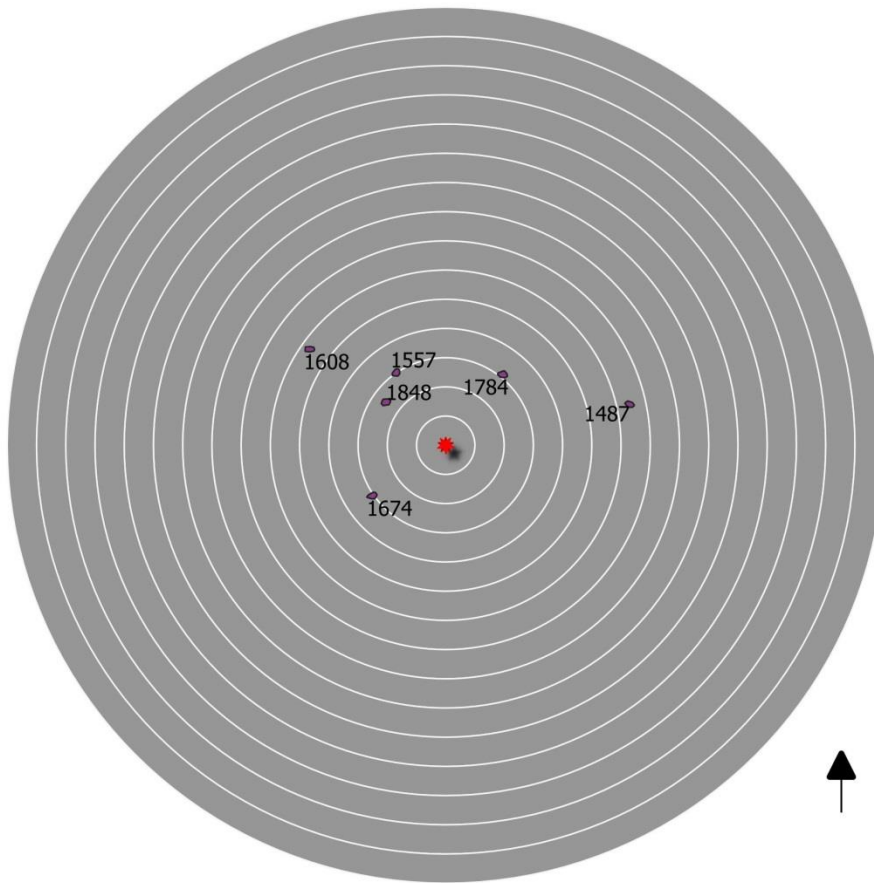


Figure 4.48: Distribution of kraal sizes 1426-1862m² across the 200m constant distance multi-rings measured from the center point (red) of the Molepolole kraal sample.

The distribution of kraal size category 990-1426m² is skewed to the west and south of the center point of the Molepolole sample is represented by red star). Unlike other size categories, kraals 990-1426m² occur from less than 200m of the Kgosing ward. Figure 4.49 illustrates the point.

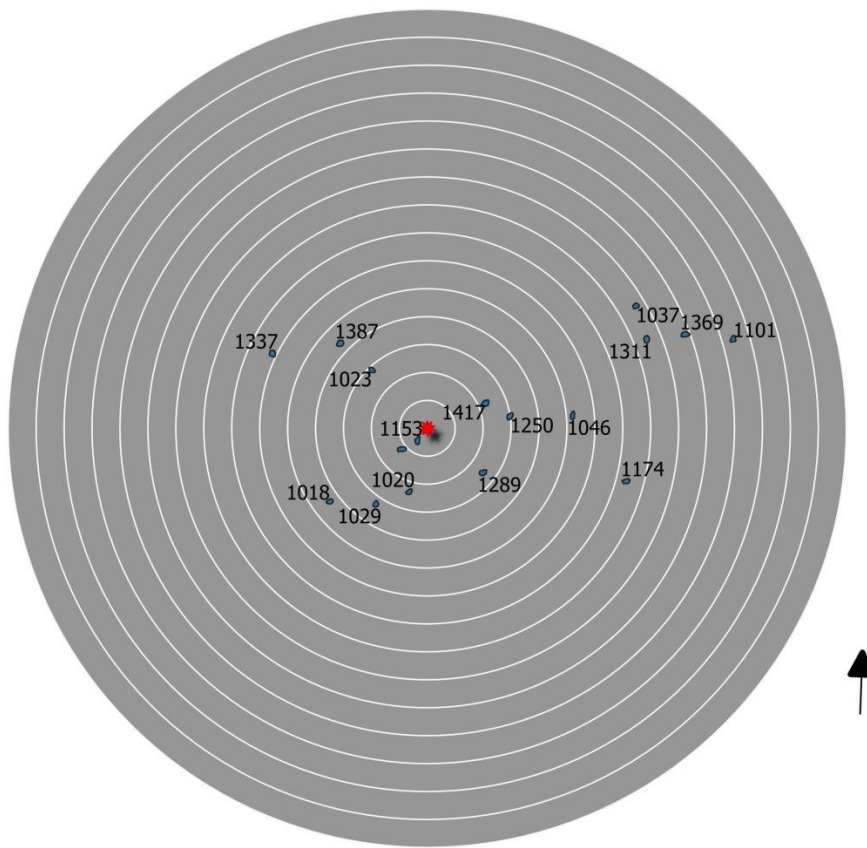


Figure 4.49: Distribution of kraal sizes 990-1426m² across the 200m constant distance multi-rings measured from the center point (red) of the Molepolole kraal sample.

The smaller categories of 554-990m² (Fig. 4.50) and 118-554m² (Fig. 4.51) are more on the east and west of the sample center point and the main Kgosing ward. These wards are found in newer sections of Molepolole, and sections of the settlement beyond these wards do not have central kraals.

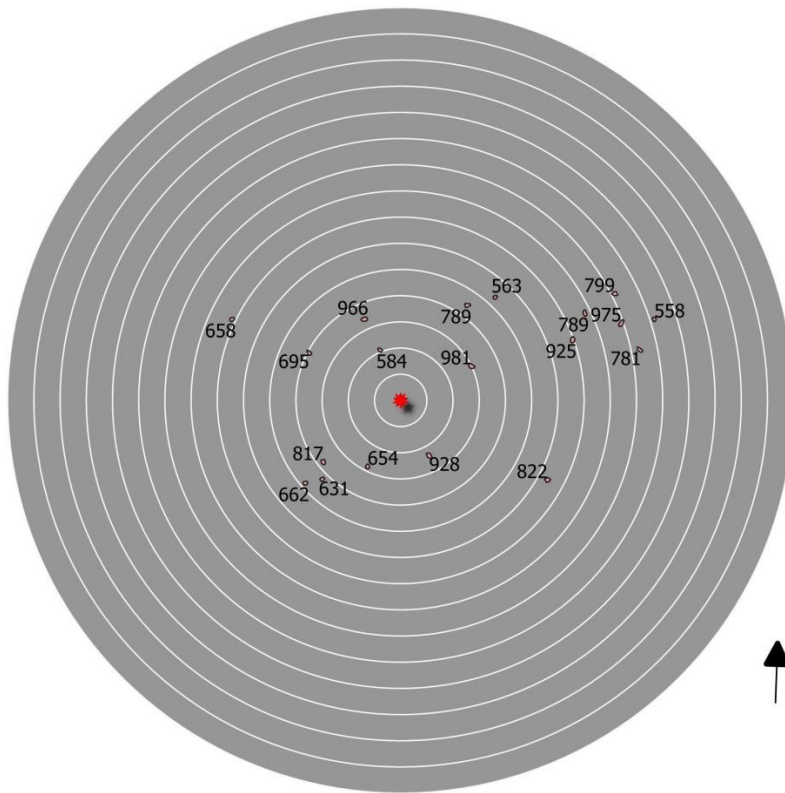


Figure 4.50: Distribution of kraal sizes 554-990m² across the 200m constant distance multi-rings measured from the center point (red) of the Molepolole kraal sample.

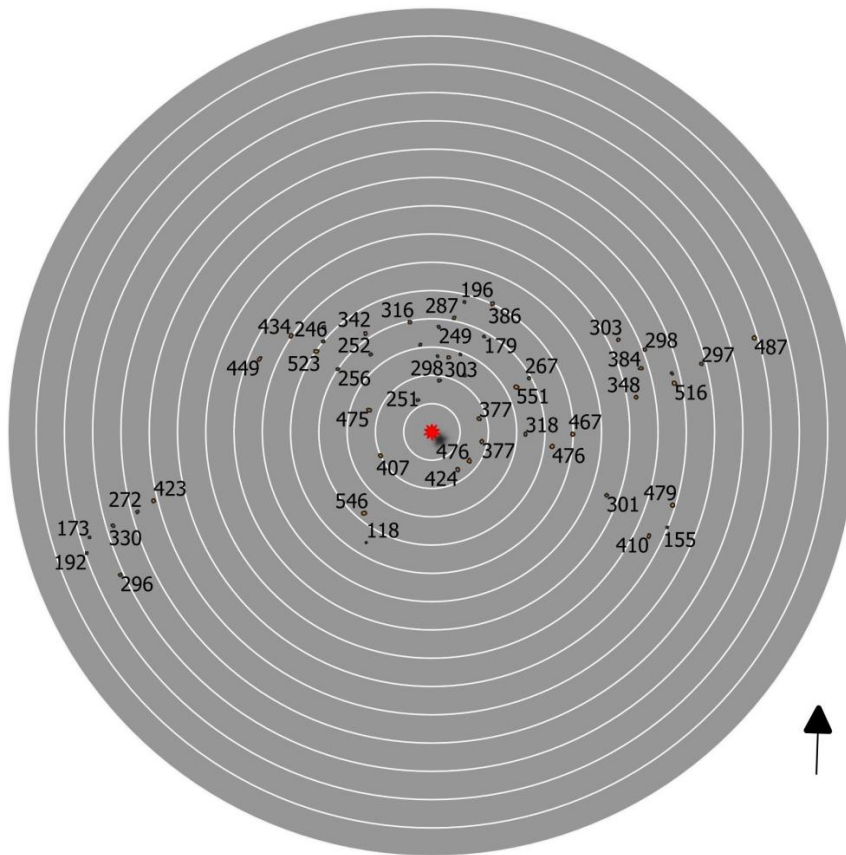


Figure 4.51: Distribution of kraal sizes 118-554m² across the 200m constant distance multi-rings measured from the center point (red) of the Molepolole kraal sample.

It is evident that although the bigger kraals are about 400m and above from the sample center point and the main Kgosing ward (Fig. 4.48), this gap is closed as agglomeration of kraals begins during establishment of kraal size ranges below 1426m² (Fig. 4.49 to 4.51). In terms of the variables of ‘presence’ and ‘positioning’ of kraals, there is evidence for a continued practice of having kraals and kraal spaces in the inner spaces of wards. However, this is only up to a period when the ward structure disappears from the 1970s and 1980s with allocation of residential plots becoming more and more linear to allow provision of basic amenities such as water and electricity. Also, with population increase in most villages, the allocation of land to build individual yards was no longer kinship based, and as such resources such as livestock would no longer be communally managed.

Is the positioning of wards a good enough indicator for adoption of the cattle post system? I used QGIS to create 100m buffers and assessed if any trend emerges. Figure 4.52 shows that for the Molepolole sample, as the positioning of kraals varies and decrease from the center point, a buffer of at least 100m is maintained between kraals.

Generally, there is at least one shared kraal in every 100m. It is worth noting that the spaces which buffer these shared kraals are taken up by the yards that make up these wards. For main centres such as Molepolole, the yards are clustered, and this is caused by abutting of yards and wards characteristic of traditional Tswana settlement patterning. Because the kraals are shared amongst the many yards that make up a ward, this gives the kraals a buffer. The only irony is that at main centres this buffer does not necessarily translate to enough grazing zones for livestock. This scenario would only be applicable at cattle posts – where buffering of kraal allows for grazing spaces in close proximity to yards as illustrated in Figures 4.54 and Fig. 4.55.

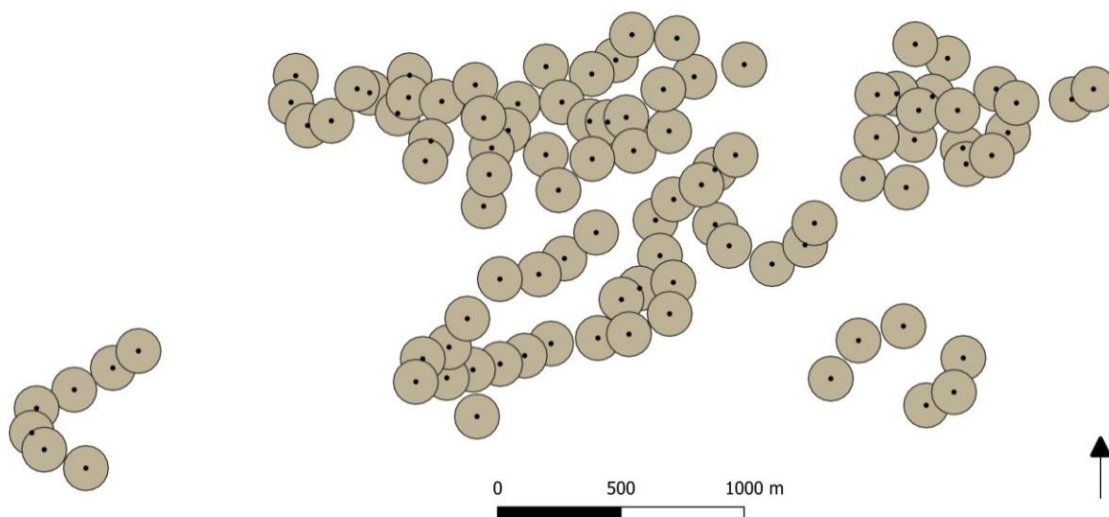


Figure 4.52: Distribution of kraal sizes at Molepolole across the 100m buffer shows that there is generally one kraal per 100m.

As a comparison, at Morabane (Fig. 4.53 left) and Mosokotswe (Fig. 4.53 right), the 100m buffer is disrupted by the clustering of kraals in some sections of the settlement where some individual families have more than one kraal. Figures 4.54 (Mosokotswe) and Fig. 4.55 (Morabane) illustrate that unlike the setup at Molepolole, having 100m buffer around kraals at cattle posts creates grazing space for livestock.

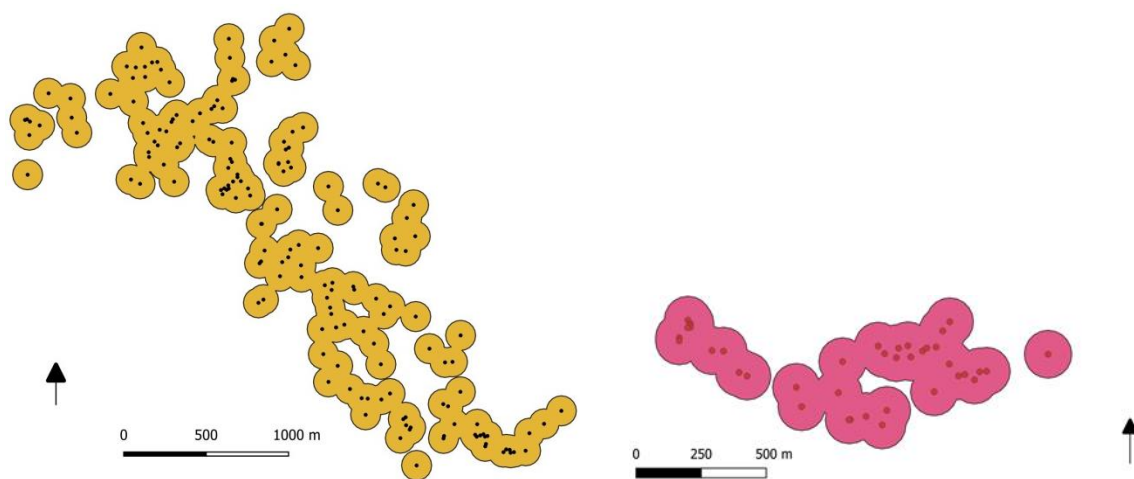


Figure 4.53: Distribution of kraal sizes at Morabane (left) and Mosokotswe (right) across the 100m buffer showing that although there is generally one kraal per 100m, except for instances where each family have more than one kraal

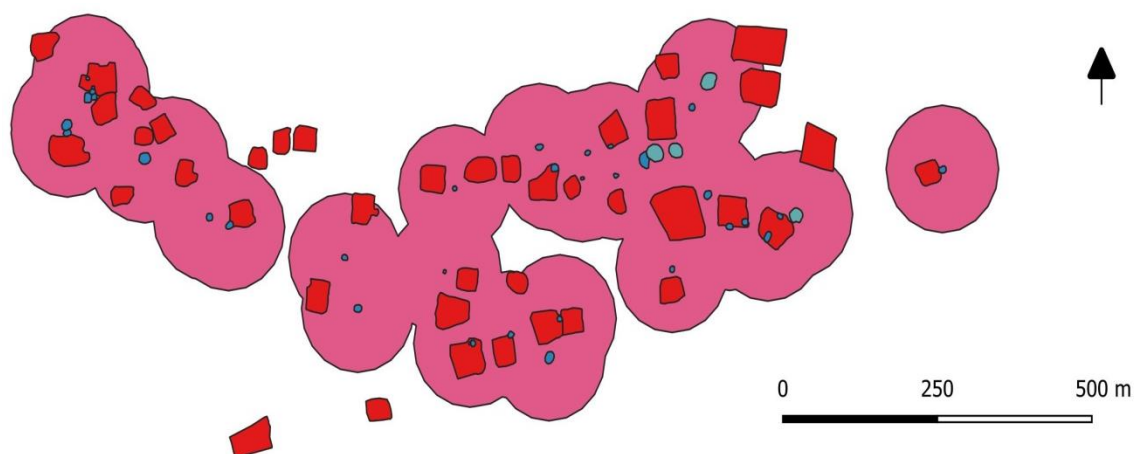


Figure 4.54: Mosokotswe settlement patterning illustrating how the 100m buffer around kraals at cattle posts would create grazing space for livestock.

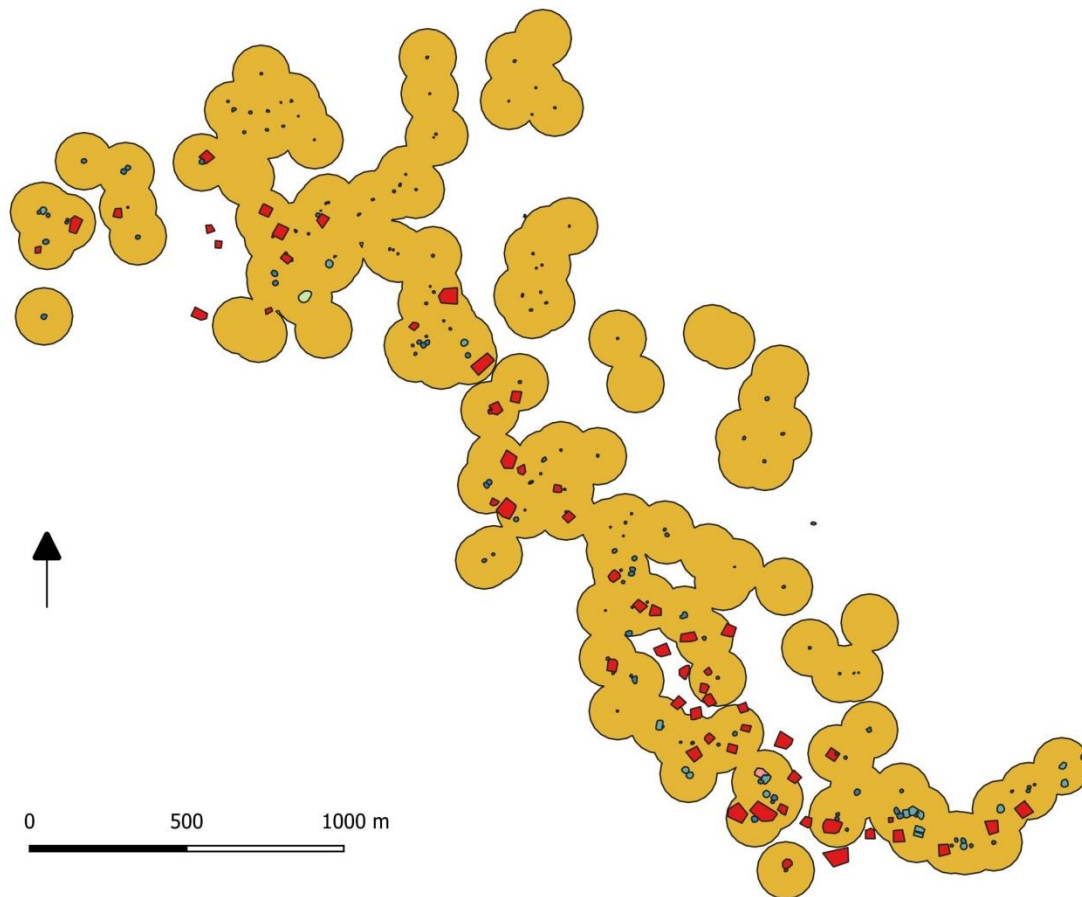


Figure 4.55: Morabane settlement patterning illustrating how the 100m buffer around kraals at cattle posts would create grazing space for livestock.

This research shows that the sizes of wards varied over time, but one thing seems to have remained relevant and possibly constant, and that is the buffering in between wards. This seems to have been critical in the location of wards and their associated livestock enclosures – at least 100-200 m was maintained between wards. This ecologically conscious decision would have been paramount to herder-farmers. Large numbers of livestock, if kept at main centers, would have required adequate buffer between wards, probably explaining the isolated nature of bigger kraals at Molepolole.

It is necessary to understand the dynamics of livestock management strategies as may be reflected by the presence or absence of kraal spaces and kraal enclosures. The positioning and sizes of kraals and how these varied over time and space was studied through the Botswana case studies. What does the temporal and spatial variation in sizes of kraals mean? Is it an effective indicator of the adoption of herd management strategies, or that the adopted ones are evolving to address some of the push and pull factors discussed in section 4.3.1. Should we also expect fluctuations in sizes of yards and kraals,

as opposed to a straight forward decline and increase – what would happen if cattle posts are used and disused as and when need arises. My research in Botswana has shown that there is variation in the sizes and positioning of livestock enclosures through time – as indicated in the literature, earliest occupations would have bigger wards and kraals before they are split into sub-wards (Schapera 1970; Okihiro 1976).

4.4.3 Looking for relationships - wards and kraal sizes

Not only does the location of wards affect the positioning of kraals, it also affects their size. A reduction in the size of wards triggers a reduction in the sizes of kraals. Is there any evidence that specific kraal sizes are particular to certain ward sizes? Are the varying sizes of kraals randomly occurring at wards? In Table 4.6, it is evident that firstly, of the 20 bigger wards (size category 26185-54469m²) in the sample, ten of them have small kraals of size 118-554m².

Table 4.6: Ward size and kraal size matrix showing that a larger percentage of the smaller kraals (size category 118-554m²) are found in smaller wards.

	Kraal area (m ²)									
Ward area (m ²)	118-554	554-990	990-1426	1426-1862	1862-2298	2298-2734	2734-3170	3170-3606	3606-4042	4042-4478
7329-12043	11	2	0	0	0	0	0	0	0	0
12043-16757	16	10	5	1	0	0	0	0	0	0
16757-21471	11	3	6	3	1	0	0	0	0	0
21471-26185	4	3	1	1	0	0	0	0	0	0
26185-30899	4	1	3	1	1	0	0	0	0	0
30899-35613	2	0	1	0	0	0	0	1	0	0
35613-40327	1	0	1	0	0	0	0	0	0	0
40327-45041	0	0	0	0	0	0	0	0	0	0
45041-49755	0	0	0	0	0	0	0	0	0	0
49755-54469	3	0	0	0	0	0	0	0	0	1
Totals	52	19	17	6	2	0	0	1	0	1

The distribution pattern in Figure 4.56a shows that 52 (53%) of 98 kraals in the Molepolole sample fall in size category 118-554m². It also suggests that there is peculiarity in the way kraals sizes ranging from 118m² to 554m² are associated with wards. They are mostly found at ward category sizes 7320-21471m².

In Figure 4.56b, the sizes of kraals are assessed against the compound sizes, and it is apparent that although kraal size category 554-990m² is found across ward sizes 7329-

26185m², they are (together with size category 118-554m²) a key feature of ward sizes 12043-16757m². Most of the kraal sizes in this sample are associated with ward sizes 7329-26185 (Fig. 4.56a-d).

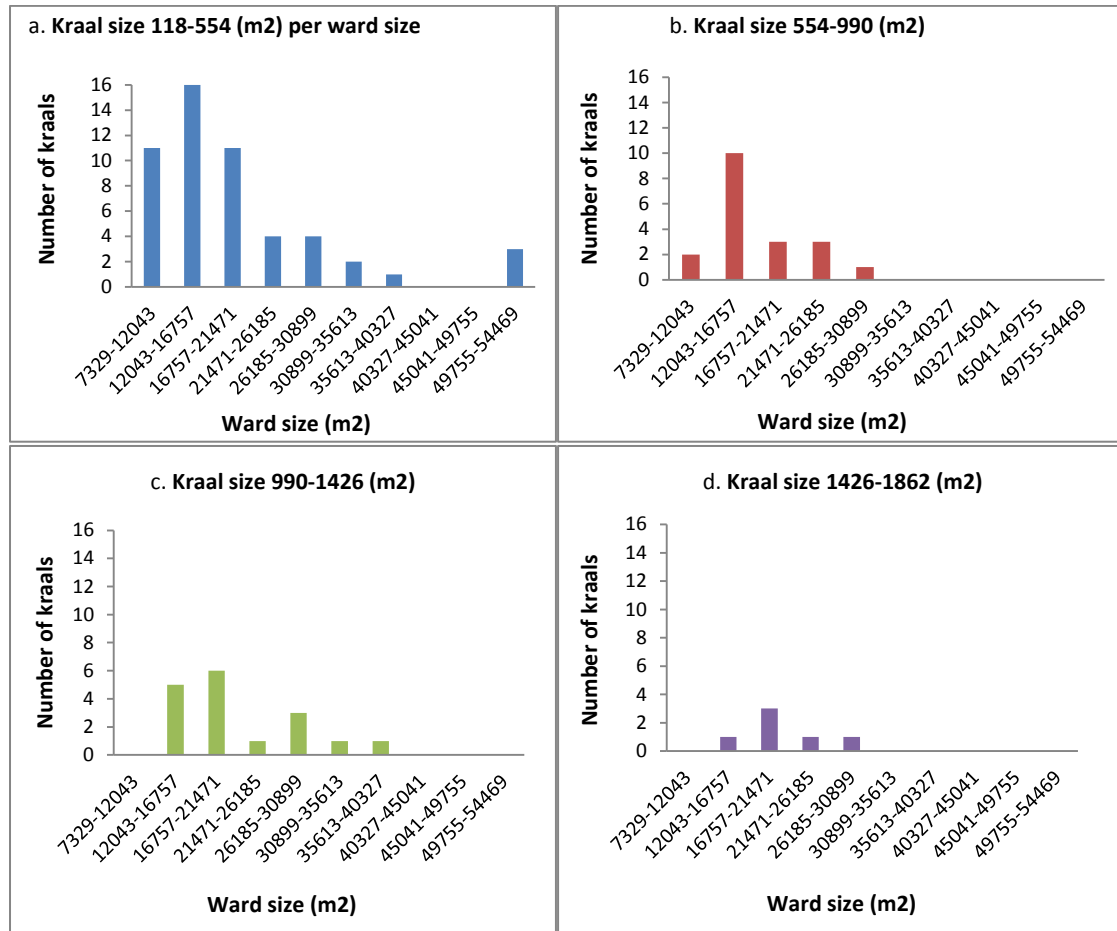


Figure 4.56: Illustration of the relationship between ward sizes and kraal sizes showing that the Molepolole sample is largely characterised by kraals ranging from 118m² to 1862m².

Figure 4.57 shows that in terms of the geographical spread, kraal size 118-554m² is widely distributed across the sample area. There is also evidence that although this size category is indiscriminately spread, kraal sizes beyond 350m² are sparsely distributed. Furthermore, of the total number of these kraals (52) at category 118-554m², 20 (38%) of them have areas beyond 350m², and are concentrated at wards 12043-16757m².

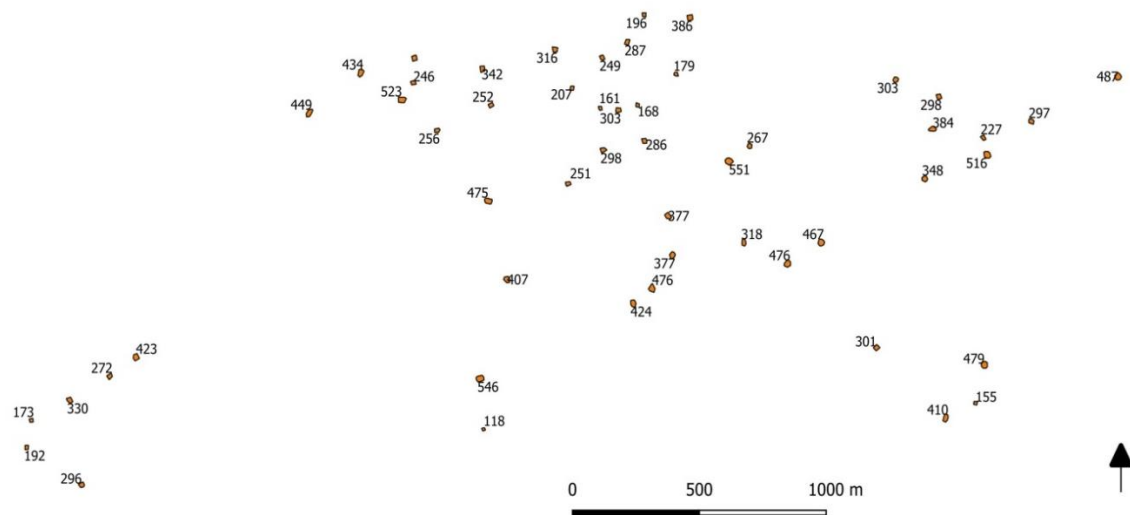


Figure 4.57: Illustration of the geographical spread for kraal size 118-554m² across the Molepolole sample area.

It can be argued at this stage that the reduction in the sizes of wards happens as the population of older wards expands and new members of the ward append to the older ones with smaller wards. If they take along their wealth with them, it makes sense that the sizes of kraals would also reduce as decentralization of livestock resources occurs.

Notwithstanding that more work is still necessary to complete the puzzle regarding the study of the Tswana cattle posts system, it can be argued here that variation in the sizes and positioning of kraal enclosures is an indication of evolving livestock management strategies. The relationship between ward/yard sizes and kraal sizes is also critical for noting subtleties such as ‘where to look for variation’ and ‘how to identify indicators’ for this variation. Since smaller kraals are appearing as infill and on the periphery of bigger wards, is there a way of determining how agglomeration would have taken place?

One of Maoto wards (Fig 4.58), which are some of the older ones, is used here to assess how an increase in human and livestock population would have led to agglomeration of wards and kraals. In this research, Maoto wards are a sample of group of wards that make up the main Mato section, which is found in close proximity to the new main present day Bakwena ward. In my analysis of the data, I wanted to exemplify the distribution of ward-sizes and how this related to the sizes of kraal areas. I therefore picked a sample of wards from Maoto area to illustrate the point. In terms of specific classification of Bakwena into wards, Schapera (1952: 52-63) has addressed that. Also, Okihiro (1976)

has gone on detail on the classification of the Kwena population into wards and sub-wards.

The assumption here is that bigger wards and kraals are characteristic of earlier Kwena occupation of Molepolole from 1865 onwards. One therefore expects that they are established first and strategically positioned from each other since they operate more or less like satellite centers (Fig. 4.58b-c). Schapera (1970:20) alludes to setting up of new wards whenever the original ones became unmanageably bigger. The setting up of new wards needed a headman or leader, who was usually given livestock to take care of his group. The spatial manifestation of this socio-economic and socio-political decision results in an occurrence of dispersed bigger wards and their associated kraals. The rest of the sizes are built around and away from them, creating a network of wards and kraals (Fig. 4.58d and Fig. 4.58e) that result in a kraal patterning at Figure. 4.58f.

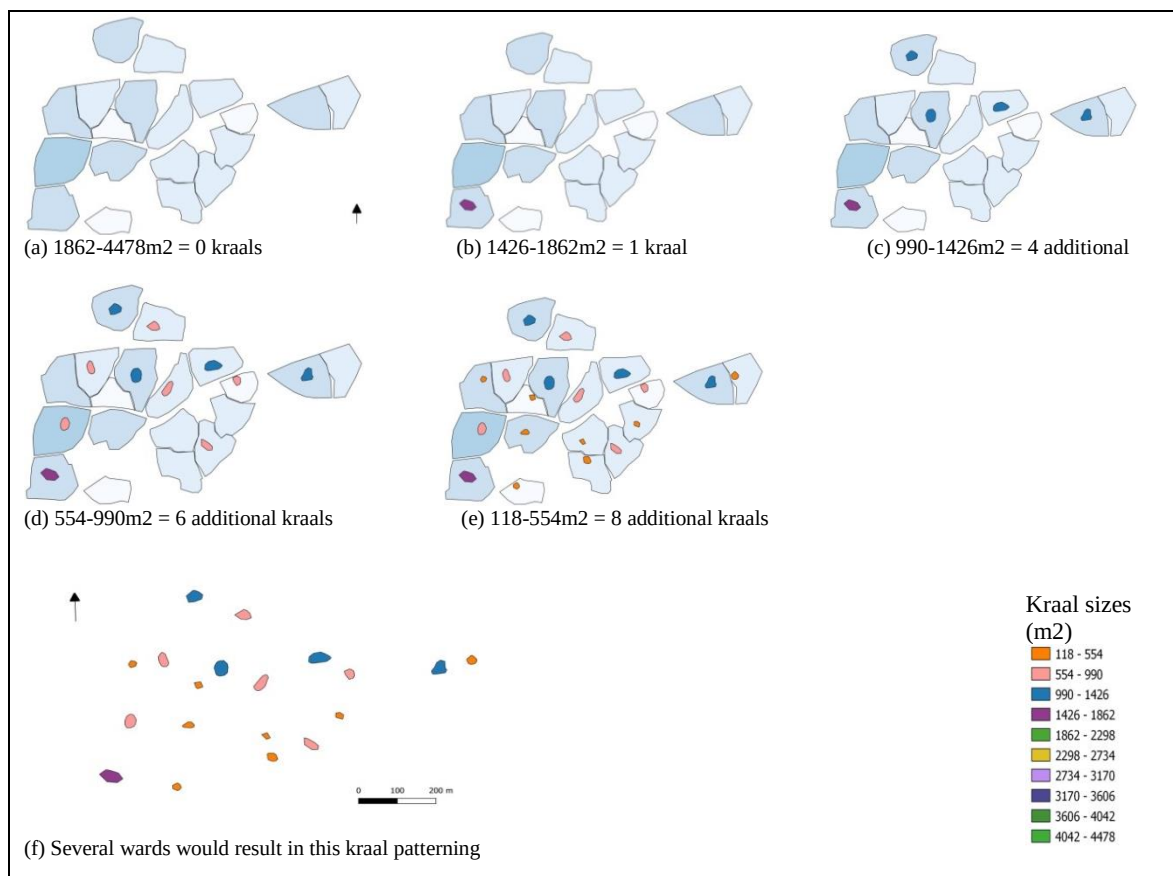


Figure 4.58: Maoto ward cluster used to illustrate how the agglomeration process of varying ward sizes results in the distribution pattern of kraals at (4.57f).

Cattle posts facilitated a sustainable management of livestock outside of the main centers and this process left a trace of indicators. These must be systematically studied to

understand the evolution of herd-management strategies in southern African archaeology. This is especially important considering that southern Africa was largely characterized by civil unrests, colonial expansion and climatic variations that would have necessitated stringent measures for management of resources which were central to societies, especially cattle.

The Tswana socio-political structure of dividing the settlements into wards that were tasked with managing their socio-economic affairs (Okihiro 1976) ensured a shared responsibility towards management of cattle and the system spread the risk of loss. As noted by Schapera (1970), an increase in population per ward triggered establishment of new wards, and this could even occur at completely new settlements if there is overcrowding near the original ward. A classic example is the Kwena in Botswana who occupied Dithubaruba and Dithejwane hills area from 1750s till 1865 (although there were intermittent reoccupations) when the main settlement was finally relocated to Ntsweng and Molepolole areas (Okihiro 1973; Ramsay 1991).

The Kwena ethnic group, being a larger population than for example the Kgatla, had up to 20 000 people by 1857, due to other ethnic groups that sought refuge with them (Okihiro 1973). The Kwena managed to occupy vast landscapes almost simultaneously because the brothers to Sechele I, were given the responsibility to fully establish and manage their wards (see Okihiro 1973 for details). With the main base at Dithejwane hills area, Ntsweng and Molepolole, the Kwena briefly occupied several places in an attempt to block colonial expansion and protect their land and livestock. As an example, the Kolobeng and Dimawe areas were occupied from 1848-1852, control of Dithubaruba landscapes reclaimed from 1852 till abandonment in 1865. While still having their main settlement at Ntsweng, the Kwena briefly occupied Mochudi area from 1870-1876 (Ramsay 1991).

The Kwena are believed to have had a lot of cattle (Schapera 1970; Okihiro 1973) which was time and again raided (Ramsay 1991), and this may have facilitated the popularity of the cattle post system, especially the risk management cattle posts. Beside the risk, Schapera (1970) notes that in some instances, cattle were moved out to posts once it became difficult to manage them from within the main settlement.

The data from my research shows that the foregoing issues had impact on the varying sizes and positioning of Kwena wards and their associated central kraals over time. At present day Molepolole, which became the official administrative center for the Kwena in 1937 when the current Kwena main ward was relocated from Ntsweng, there is a marked decline in the total space allocated to livestock management at the various wards that make up the Kwena capital. It is evident that if more studies such as mine are carried out at contemporary, historical and archaeological sites, we can have a mosaic of indicators to use in tracing the origin and evolution of the cattle post institution.

Proportion of ward and yard space allocated to livestock management. The proportion of kraal space to yard space would be expected to decline with the adoption of the cattle post system – as is anticipated by the hypothesis of this research. For the Molepolole sample, ward space is the total area (m^2) for all the yards, and their associated domestic activities, that make up a particular ward. In the ward setup a kraal is shared by all yards. For Morabane and Mosokotswe the yard space referred to the actual individual yards.

Proportion of total space allocated to livestock management per total area accessible to a cluster of wards.

Before presenting the analysis of ward/kraal ratio, I discuss here other aspects that I think are worth consideration in the process of developing indicators for discerning cattle posts in the archaeological record. There is need to, in addition to the ward/kraal issues, evaluate the total proportion of space allocated to livestock management per cluster of wards or section. The Tswana are known to have had main wards, besides the Kgosing ward, which usually constituted a cluster of wards based on kinship (Schapera 1972). These main wards were managed by Headmen, and must have had extensive wards and a reasonable amount of space allocated to management of livestock. This would result in an occurrence of bigger wards and kraals that we see in some parts of the Molepolole sample area. With this in mind, how much of the total area designated for a cluster of wards is reserved for kraal management?

Using the Maoto sample wards again (which constitutes 19 wards), I demonstrate that the total area allocated to all kraals across the Maoto ward sample (13 992m²) is way less than the total ward space (29 5005m²), leading to a ratio of 0.04. This means that of the

29 5005m² available for wards, only 4% of that was allocated to management of livestock at this section of Molepolole.

I re-assessed the 19 Maoto wards in the context of a 300m x 300m grid (Fig. 4.59). Firstly, I created a polygon for this grid and calculated its total area (999 203m²). With knowledge of the total area (size) for the 19 wards (295 005m²) and the 19 kraals (13 992m²), I established the proportion of the grid area utilized by the wards and kraals. The overall size (m²) for the selected wards was obtained by adding the sizes of all the wards that make up this sample cluster, while the overall size of kraals was obtained by adding the areas (m²) of kraals that make up my Maoto ward sample. I wanted to know how much of my set grid was taken up by wards and kraals. Only 30% ($308\,997\text{m}^2:999\,203\text{m}^2 = 0.30$) of the grid was utilized by 19 wards and their kraal spaces.

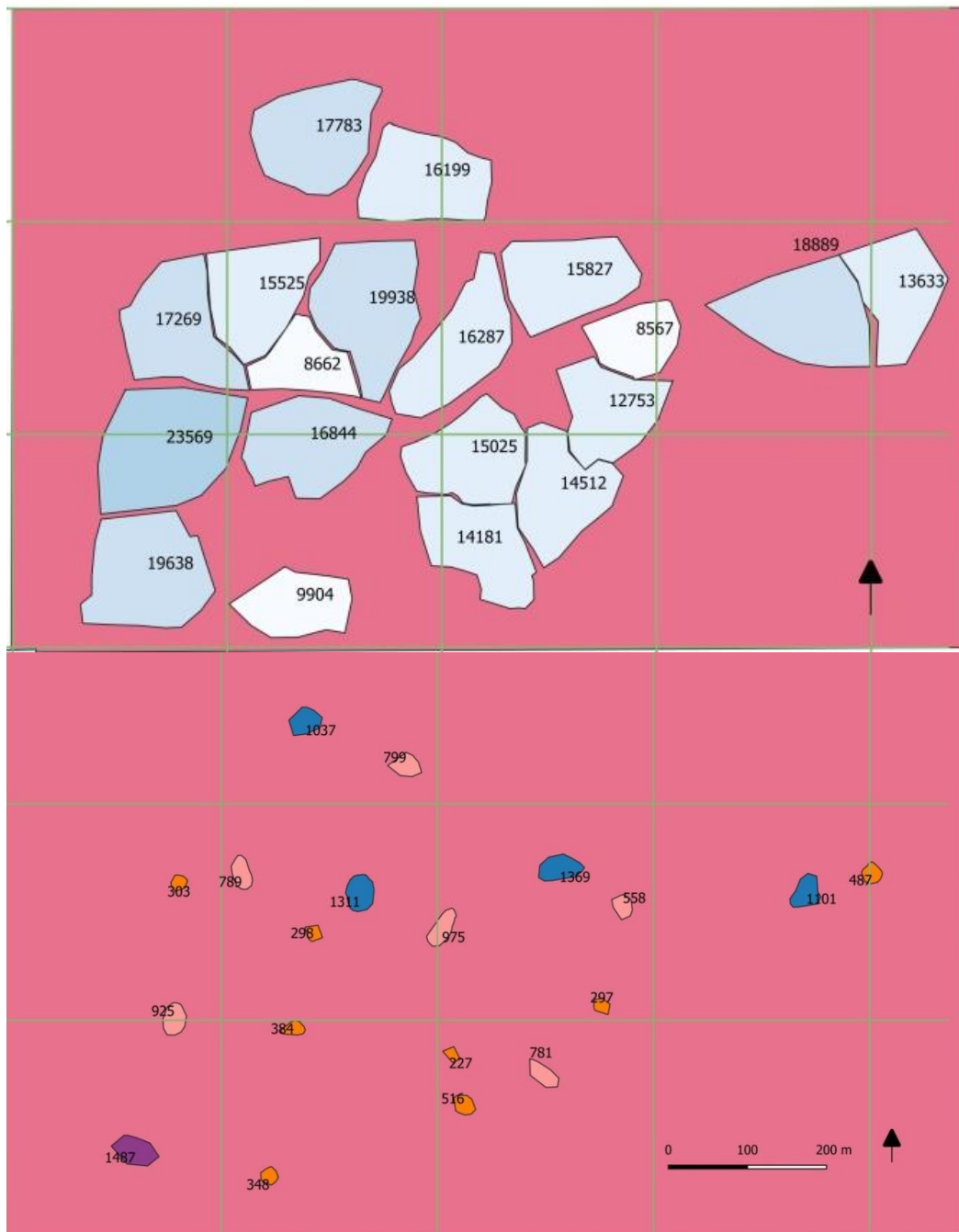


Figure 4.59: Distribution of the 19 Maoto wards across about 1.5km² (top) and the patterning of associated kraal sizes (bottom) showing that 8 of the kraals that make up the 19 wards of Maoto cluster are less than 554m².

Were the bigger kraals at some point in time used to keep large numbers of cattle and therefore needed more buffer from others at the initial stages – before agglomeration? Is the dispersal of the bigger wards and kraals just a socio-political indicator (location of headmen at strategic areas of the settlement), or is it also a socio-economic one (creating enough buffers between main wards to allow for livestock management)?

The data shows that while each Maoto section ward may allocate only up to 4% of its total occupation space (or settlement unit) to livestock management, in general the ward and kraals may take up to 30% of any given 1.5km² available for occupation by those wards. This is a critical factor in the study of herd management strategies at macro level (cattle posts – livestock managed away from main settlements) and at micro-level (livestock management areas or kraal areas – reduction in the proportion of space allocated to livestock).

It is evident from this research that the use of space must be understood at communal level (proportion of shared kraal space to total ward area – characteristic of main centres) and at family level (proportion of individual kraal space to total yard area – observable at cattle posts). Variation over time must be established, and factors that facilitated it must also be investigated.

There is an explicit lack of or minimal representation of bigger kraals at bigger wards (Fig. 4.60). This suggests that at the time of Molepolole occupation the proportion of space allocated to management of livestock was already declining. Several issues could have led to this scenario, and these include reduced stocks due to risk (raids, theft, disease outbreaks etc.) and ecological response strategies. The establishment of cattle posts to absorb the excess wealth – either to exploit the abundant resources beyond Molepolole, or to manage the increasing stocks outside of the center).

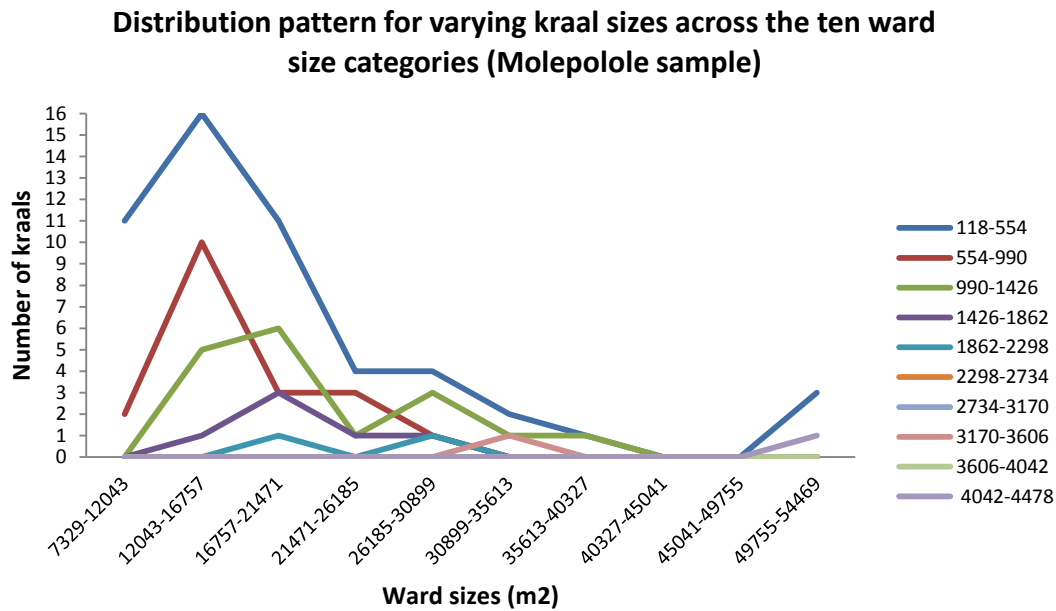


Figure 4.60: Distribution of varying kraal sizes per wards at Molepolole showing that 89.8% of the sample wards, which are largely less than 30899m², have relatively smaller kraals.

This research demonstrates that an increase in the number of smaller wards and their associated smaller kraals is an indication of the decentralization of livestock management from ward-level to family-level. Also, there is evidence for intensification of the cattle posting process – actively keeping cattle away and only retaining smaller kraals for occasional use. Figure 4.61 illustrates that the north of Molepolole, which is a later occupation than other sections, has mostly kraal size category 118-554m² (61% of the cluster sample – purple polygon).

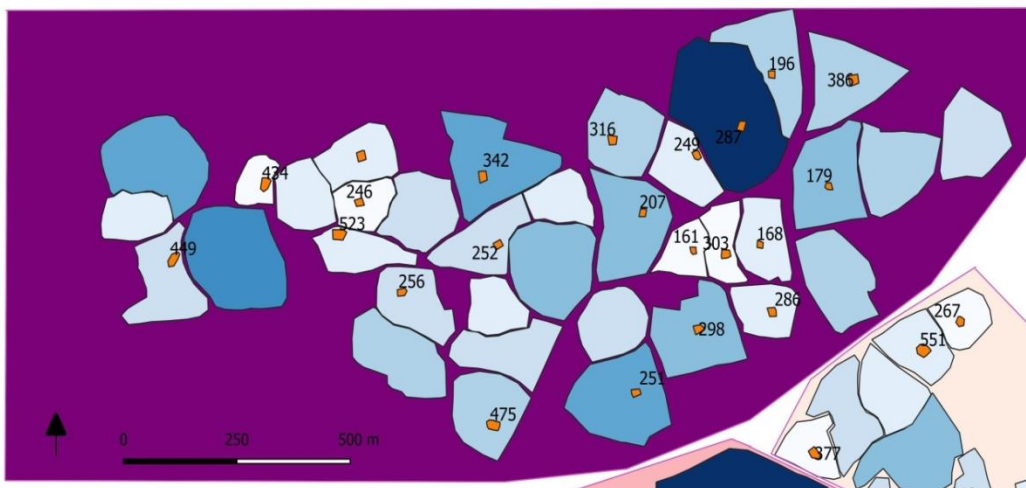


Figure 4.61: Distribution of kraal sizes 118-554m² at the Molepolole north ward cluster (on the purple polygon) showing that the majority of wards (61%) have kraals less than 554m². The rest of the wards have kraals more than 554m².

Proportion of ward and yard space allocated to livestock management

In terms of ratio of shared kraal spaces to ward spaces for the Molepolole sample, I went back to my categories of ward sizes and kraal sizes. I recorded the individual ward sizes and their associated kraals, and then calculated the proportion of space allocated to kraals (see illustration of the process on Fig. 5.9). Table 4.7 illustrates the resultant ratios, which have been calculated to two-decimal places to accommodate wards with smallest kraal sizes. I then plotted the ward sizes per category, against their associated ratios to establish if the proportion of kraal space was increasing or decreasing as wards became bigger and or smaller. A synthesis of information from the literature (Schapera 1952; Okihiro 1976; Schapera 1980) suggests that the smaller-sized wards would be the sub-wards. For my research, the wards were not identified by their historical names, but were given IDs on QGIS. What is apparent is that some of the bigger wards have relatively smaller kraal areas – possibly suggesting that cattle were kept elsewhere, or that the families comprising a ward did not have a lot of cattle.

Table 4.7: Illustration of ratio calculation (Molepolole sample) for the ward size category 7329-12043m2.

Ward sizes (m2)	Kraal sizes (m2)	Ratio (kraal/ward)
7329	434	0.06
8567	558	0.07
8662	298	0.03
9465	161	0.02
9904	348	0.04
10183	631	0.06
10640	173	0.02
10812	303	0.03
10943	267	0.02
10976	246	0.02
11142	377	0.03
11631	424	0.04
11862	479	0.04

For the graphical representation, the first five ward size categories (7329-12043m2; 12043-16757m2; 16757-21471m2; 21471-26185m2; 26185-30899m2) are illustrated individually (Figures 4.62-4.66) while the last five categories (30899-35613m2; 35613-40327m2; 40327-45041m2; 45041-49755m2; 49755-54469m2) are grouped together (Fig. 4.67).

Figure 4.62 shows that the majority of wards are allocating less than 4%, (0.04) of their total space to livestock management areas or kraal spaces. With an average ward size of 10162m², average kraal size of 361m² and average ratio of 0.04, the ward size category 7329-12043m² has relatively smaller wards that are characterized by smaller kraals. The average ratio for the entire Molepolole sample is 4%, suggesting that for category 7329-12043m², only 23% of the wards are allocating 4% and less, of their area to livestock management. In this category, there is no record of wards that are allocating 1% of their area to kraal spaces.

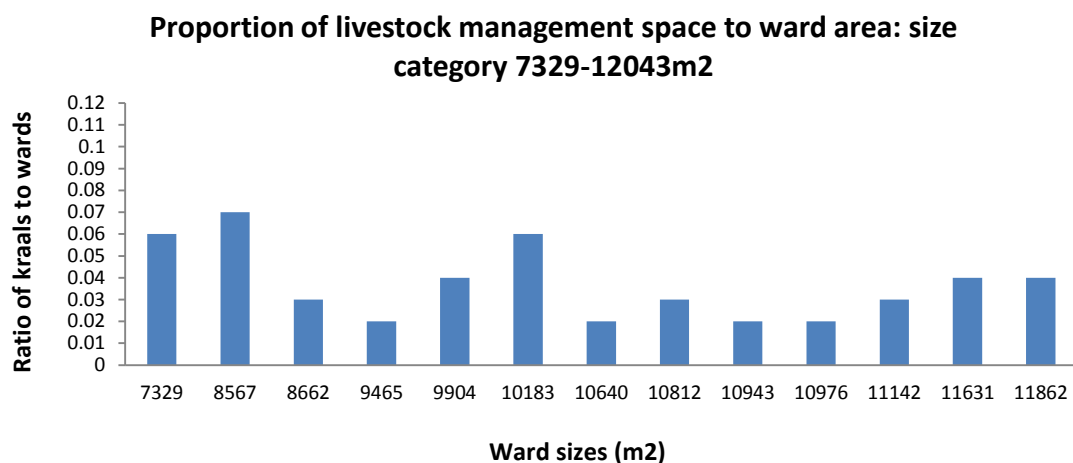


Figure 4.62: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (7329-12043m²) allocated to livestock management area or kraal space.

In Figure 4.63, there is evidence that 68.7% of the wards are generally allocating less than 5% (0.05 – which is also an average ratio for category 12043-16757m²) of their total area to livestock management. However, almost half of the wards (53%) that make up this category are allocating 4% (0.04 and less) of their area to livestock management. This means that the majority of the wards are allocating less than 4% of their total space to livestock management. A few bigger kraals are notable in this ward size category, and only 6 wards have kraals that are less than 2% (0.02) of the ward area. Only one ward has allocated 1% (0.01) of its area to livestock management.

It would be interesting for future work to conduct more ethnographic studies to establish the history behind these big wards and the composition of their associated wards. Using Okihiro (1976) more work can be geared towards identifying wards that were established at the initial occupation of Molepolole, and study their ethnicities and cattle acquisition

activities. Their central kraals can be studied to discern additional reasons for variation in the sizes of central kraals, and also talk to issues relating to wealth marginalization. For additional information on cattle posts, ethnographic studies can be conducted at Gookodisa and other Kwena cattle posts distant from Molepolole. Another interesting area to look into would be to trace the connection of selected wards in Molepolole to those in Dithejwane (once surveyed and mapped), and trace the affinity of those at Gookodisa and other cattle posts.

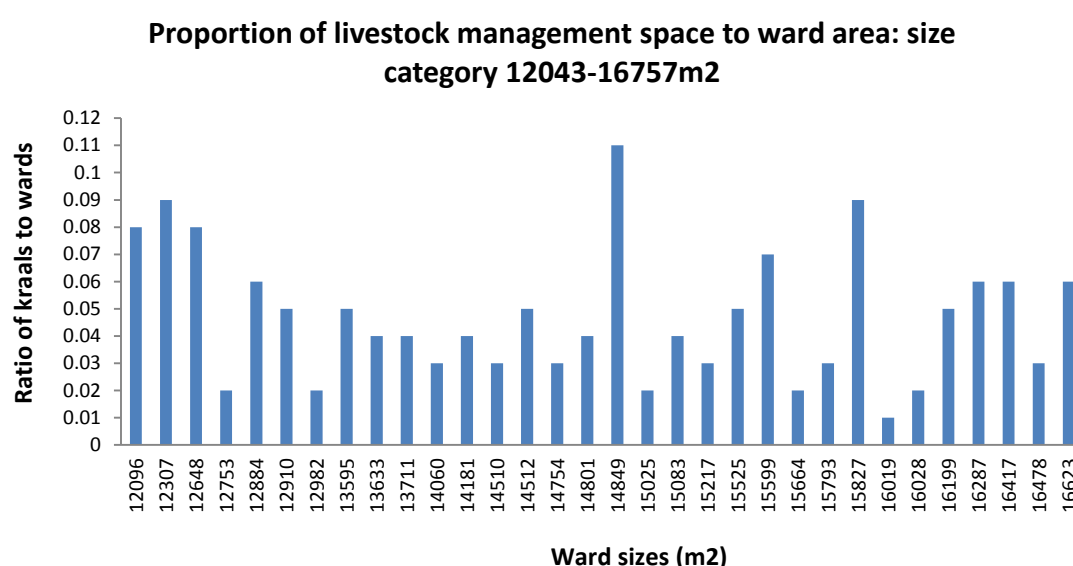


Figure 4.63: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (12043-16757m²) allocated to livestock management area or kraal space

Figure 4.64 shows that with a ratio average of 0.04, ward sizes 16757-21471m² have both relatively smaller (56% of the kraals are below ratio 0.04) and bigger kraals. A total of 44% of the wards in this category are allocating more than 4% (average for entire sample) to kraal spaces. Another noteworthy issue is that unlike ward size category 7329-12043m² (Fig. 4.62), this group of wards has several wards (44%) that are allocating less than 2% of their total area to livestock management (Fig. 4.64). Specifically, 6 wards (24% of wards in category 16757-21471m²) have at least 1% of their area reserved for livestock management.

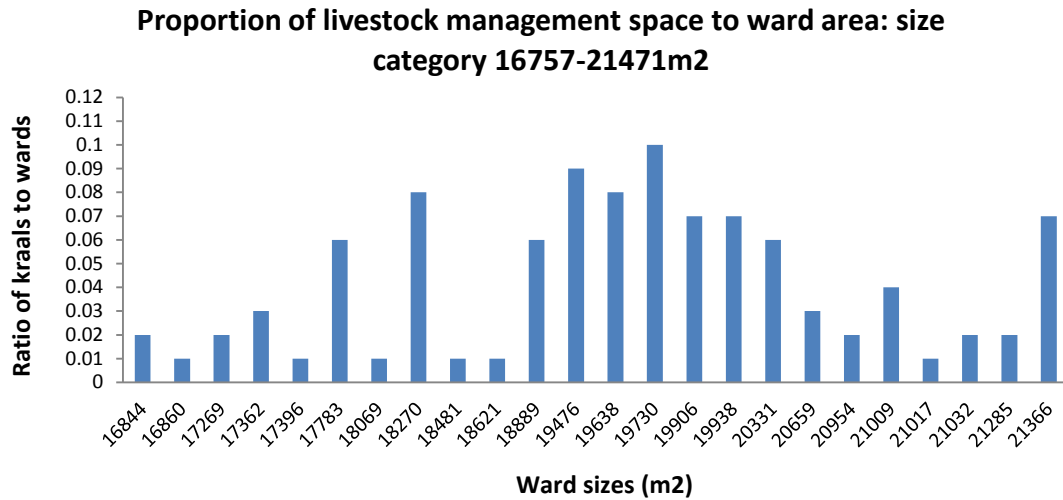


Figure 4.64: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (16757-21471m²) allocated to livestock management area or kraal space

Ward size category 21471-26185m² has an average ratio of 0.03 3% (0.03), which is less than the average ratio of 0.4 for the entire Molepolole sample. It is evident (Fig. 4.65) that 66% of these wards are allocating less than 3% of their total area to livestock management.

Only two wards have at least 1% of their area reserved for livestock management.

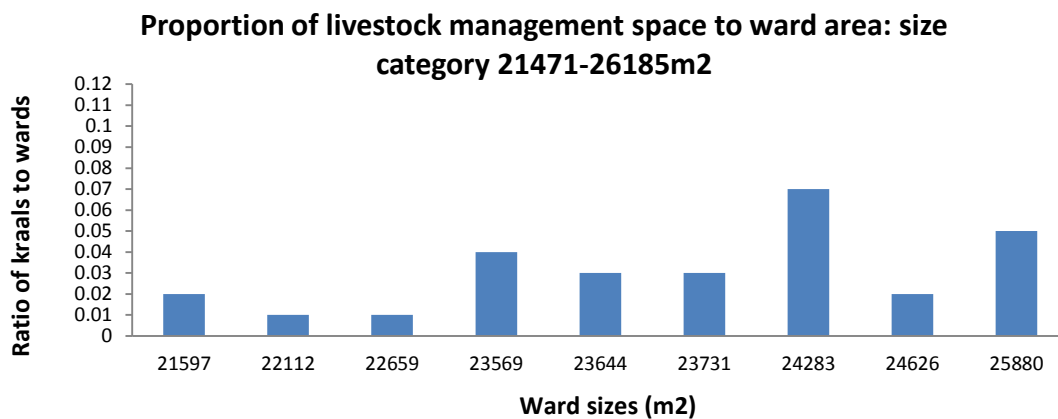


Figure 4.65: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (21471-26185m²) allocated to livestock management area or kraal space

Figure 4.66 illustrates that 70% of the wards in category 26185-30899m² are allocating 4%, and less, of their areas to livestock management. This means that the proportion of kraal space for these wards is less than the average ratio (4%) for the entire Molepolole sample. Fewer wards (40%) have at least 1% of their area reserved for livestock management.

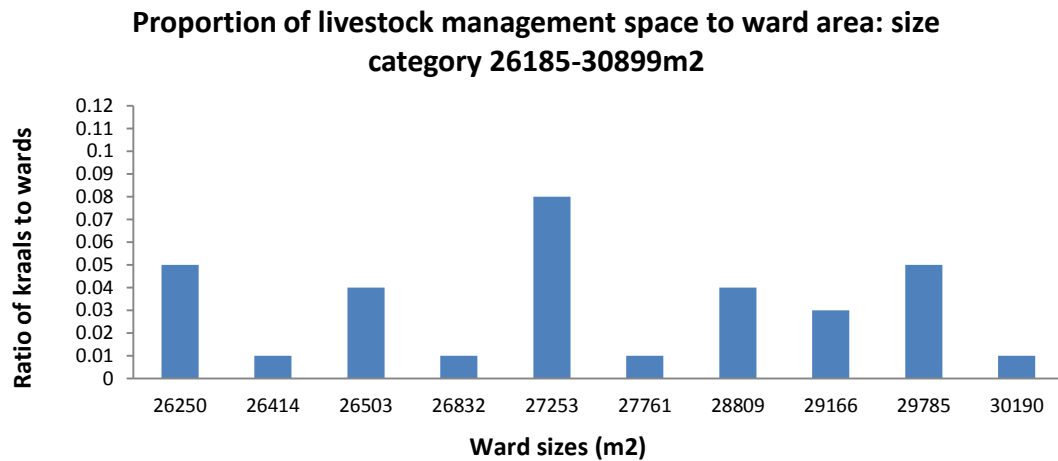


Figure 4.66: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (26185-30899m²) allocated to livestock management area or kraal space.

In Figure 4.67, I illustrate that although the remaining five ward size categories (30899-54469m²) comprise fewer wards (10), about 80% of them are characterized by kraals that are less than 4% of their total areas. Also, 60% of the wards in these categories have smaller kraals – constituting only 1% of the total ward area.

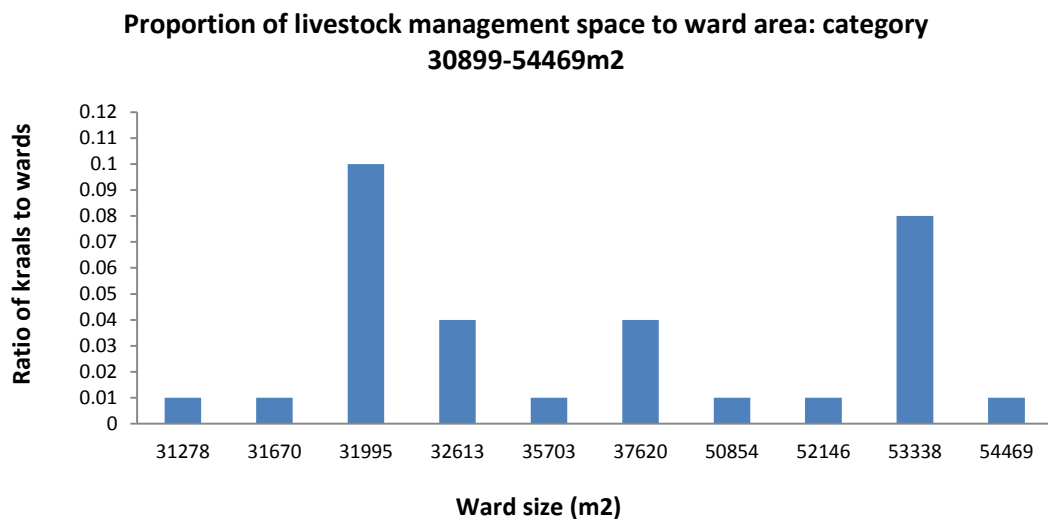


Figure 4.67: Ratio patterns for the Molepolole sample illustrating variation in the proportion of ward area (30899-54469m²) allocated to livestock management area or kraal space

4.5 Concluding remarks

Understanding subtleties in the appearance, disappearance and reappearance of the cattle post concept requires studying the spatial layout of ancient and contemporary settlements. The Tswana cattle post institution has fundamental socio-economic and environmental

pointers critical for studying the origin and evolution of this concept in the archaeological record.

My research highlights a few key issues about the push and pull factors that underlay the cattle post establishment process. It shows the need to study the socio-economic and environmental processes that facilitate the establishment of cattle posts. The occurrence and absence of cattle posts across landscapes must be studied in the context of the resourcefulness (or lack of it) of such landscapes.

Besides the push and pull factors, the data shows that the adoption of the cattle post concept by the Tswana can be pigeonholed by a temporal and spatial variation in the sizes and positioning of wards and kraals. As an example, the data from Botswana case studies shows that Molepolole ward sizes show a decline from 54 469m² to 7329m².

This suggests that an assessment of variation in the sizes of wards and kraals must not only be measured at sites of occupation by different cultures, but should also be assessed within time periods/occupations. In the case of Molepolole, the wards established during earlier occupations have bigger wards while the later ones have smaller, with the recent expansion of Molepolole showing no ward patterns.

Not only were ward sizes varied, their associated kraals also had varying sizes. Kraal sizes at Molepolole recorded a decline from 4 478m² to 118m², and latest occupations suggest that kraals are no longer a necessary resource within the main settlement. The significance of shared livestock management spaces or kraal spaces at the main centres such as Molepolole diminishes as cattle are managed at cattle posts.

A different setup is evident at cattle posts. Besides that the individual yards and kraals are isolated, the kraals for small stock are at close proximity to yards. They are many at the cattle posts than at the main center – an indication that whereas not everybody in the society owned cattle, they at least own small stock, mostly goats.

These indicators should be tested further at other herder-farmer sites to develop a modeling of ERCPs and RMCPs. Would RMCPs have significant impact on the variation in the sizes of kraal spaces at the main center? There are two possibilities, that yes it can if the risk is prolonged and the rescue area/place proves more pastoral than the main

settlement. The idea with RMCPs is that once the risk is mitigated or overcome, the livestock would be returned to the original place. Alternatively, it would mean that we measure the failure of a society to mitigate or overcome the risk by the variation in the sizes of kraals over time. As an example, if cattle are wiped out by foot-and-mouth disease and farmers are not able to restock to their initial capacity, the subsequent kraal spaces should record a declining size.

For ERCPs, an accumulation of surplus stocks would lead to increased kraal sizes, which may decline later as stocks are managed out of the main settlement. The Molepolole sample (covering 15km²) shows that the earliest occupations, represented by bigger ward sizes 26185-54469m², were allocating less than 4% (average for the sample) of their ward area to livestock management. At least 50% of wards in category 26185-54469m² are allocating only 1% of their area to kraal space. In the later periods as the human and livestock population grows, new wards are appended to older ones, and these wards would have increased kraal sizes as evidenced by ward category 12043-21471m². Decentralization of cattle management from ward-based (shared kraals at main centres) to family-based (individual kraals largely found at cattle posts) would contribute to a decline in the sizes and positioning of kraal spaces.

Besides the above issues, the literature shows that amongst the Tswana of Botswana, the socio-political and socio-economic value of cattle posts did not end in the pre-colonial, colonial nor the post-colonial periods. Using Botswana as a case study, Kalabamu (2000) discusses the land management reforms of southern Africa, noting that the protocols governing land management in the pre-colonial period was classified as tribal. However, the colonial period saw a shift to statutory laws that largely ensured that the management of land was shared by the colonized and the colonizers. For other Tswana groups in present-day South Africa, Breutz (1958:141) notes that during the colonial period Bechuanaland (later part of Bophuthatswana) had several categories of land administration. There were a) the tribally-owned farms or tribal land, b) the Native Reserves (which would translate to state land during the post-independence periods), c) the Native Trust Farms, being land bought for natives, d) Native privately-owned land, e) the European-owned farms and f) the European urban areas. This shows that colonial expansion disrupted traditional land management strategies within present-day Botswana and outside her borders.

Kalabamu (2019) is of the view that land management in most African countries is seen as a political tool critical in addressing issues of poverty and social inequality. It is not surprising therefore that the post-independence period is a witness to how in Botswana the ruling elites used the cattle post system and land management as a social and economic instrument that needed to be protected and nurtured. Large scale herding and ranching were encouraged and government availed funding for that (e.g., the Tribal Land Act of 1968, the National Policy for Rural Development of 1973, and the National Policy on Tribal Grazing Land of 1975). The cattle post system became an essential ingredient in the establishment and expansion of Botswana's beef industry and a clear assertion of integration of the cattle economy in Botswana's socio-political system (see also Picard 1980).

5 CATTLE POSTS IN ARCHAEOLOGY: A CASE STUDY OF KWENENG, SOUTHERN GAUTENG

5.1 Background – Stone walled structures and their typologies

This section contextualizes the research area into previous archaeological work on the stone-walled Iron Age sites in the Suikerbosrand massif. During the 1970s and 1980s research expeditions in the northern and southern highveld of Johannesburg were led by archaeologists at the University of the Witwatersrand (Taylor 1984; Mason 1986; Huffman 1986a, 1986b and 1986c). Stone-walled structures were studied and classified into Type N, the earliest period, Klipriviersberg (K) and Molokwane (M).

Subsequent researches were large scale and landscape in approach. Since 2010, the Southern Gauteng Stone-walled Structures (SGSWS) project, under the auspices of the Witwatersrand University and coordinated by Prof Karim Sadr, conducted detailed exploration and analysis of stone-walled structures between the Witwatersrand Ridge and the Vaal River. They utilized Google Earth satellite imagery, LiDAR imagery and Geographical Information System (GIS) software, combined with foot surveys and soil phosphate analysis to study the changing settlement patterns in the Suikerbosrand area over the last 500 years. The project studied more than 7 000 stone-walled structures, and these showed evidence for three cultural groups, with pastoral settlement system that gradually changed from a dispersed pattern to an agricultural one characterized by nucleated patterns (Sadr 2012: 262).

Using Maggs (1976) and Taylor's (1979) typologies, the SGSWS project demonstrated that the earliest period of stone-walled architecture at the Suikerbosrand landscape dates to the 15th and 16th centuries AD (Sadr & Rodier 2012). This earliest period is characterized by widely dispersed compounds throughout the massif and at all elevations. A detailed study of these Type N compounds by Sadr (2019b) indicates that although the compounds are widely spread across the Suikerbosrand landscape, there is an inclination of bigger sized ones to the north.

Also, although the Type N structures are the earliest and often considered simplistic architecturally, there is evidence for variation. Sadr (2019:249) puts together the varying Type N patterns as a result of classification by different researchers, and Figure 5.1 is

adapted from Sadr 2019b and it shows categorization of these structures in the late 1970s (top – e, f, g) in 2003 (bottom, c) and 2007 (bottom – a & b). The SGSWS project identified more patterns associated with Type N structures (Fig. 5.2). Variant as they may be, it is evident that the Type N structures are exemplified by a settlement patterning that has isolated compounds and evidence of kraals for cattle and small stock. The extent of these settlement units are delineated by straight walling, as opposed to scallops that are characteristic of Klipriviersberg and Molokwane compound types.

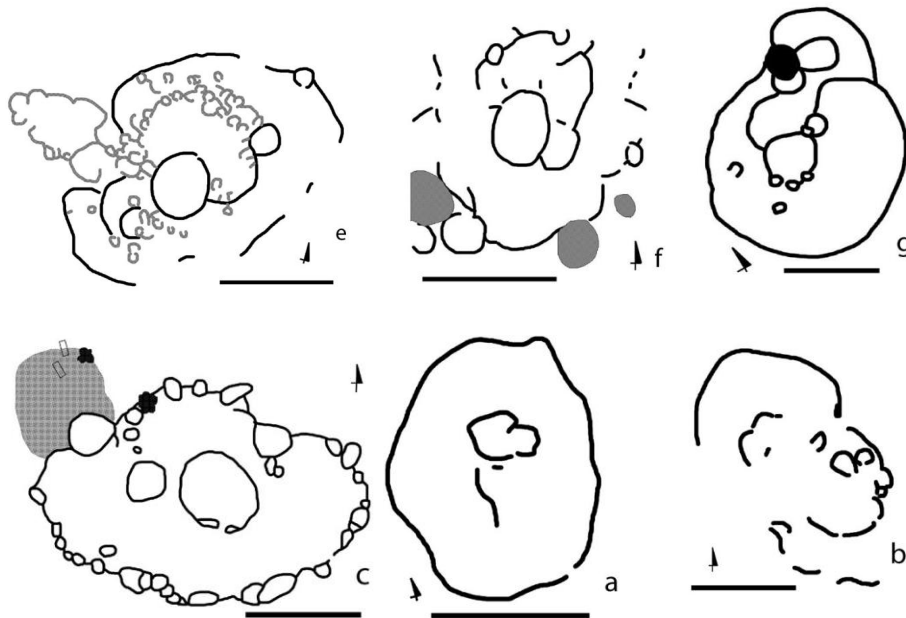


Figure 5.1: Classification of Type N structures by Maggs (1976 - e & f); Taylor (1979 - g); Sadr (2003 - c) and Huffman (2007 - a & b). Derived from Sadr (2019b:249).

Another noteworthy issue from previous research is that while the Type N compounds can be identified by the basic structures, they can also be complex architecturally (Fig, 5.2, bottom).

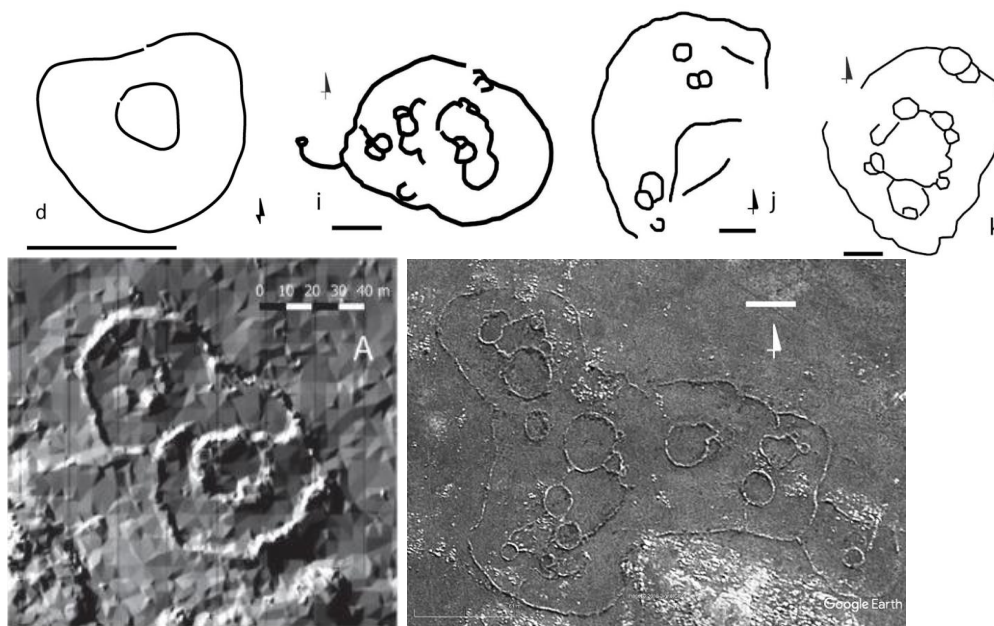


Figure 5.2: Classification of other Type N structures by the SGSWS project (d, i, j, k, derived from Sadr 2019b:249), and illustration of the simple Type N (bottom left – Sadr 2019a:4) and the complex Type N architectural styles (bottom right – Sadr 2019b:262).

The Type N occupations at Suikerbosrand are succeeded by the middle phase which shows a shift towards nucleated clusters of compounds in the north-western foothills of Suikerbosrand (Sadr 2019b). These are more socially and politically structured walling patterns, and they date from the 17th to 19th century (see also Sadr 2012). Huffman (2007) classify these compound types as Klipriviersberg (K). Sadr considers Type K to be a transitional architecture between Type N and Molokwane (M) period.

Figure 5.3 illustrates what Sadr (2019a) considers to be typical K and M architecture at Kweneng. He shows that K may be a simpler manifestation with straight walling that has bits of scallops (5.3B) or a complex one with evidence for a more scalloped perimeter (5.3C). The M architecture, which he identified along the entire western foothills of the Suikerbosrand massif, has more scallops (Fig. 5.3D). It is also evident that at Kweneng, this architecture has preference for the richest arable soils and the alluvial floodplains characteristic of areas between the massif and Klip River.

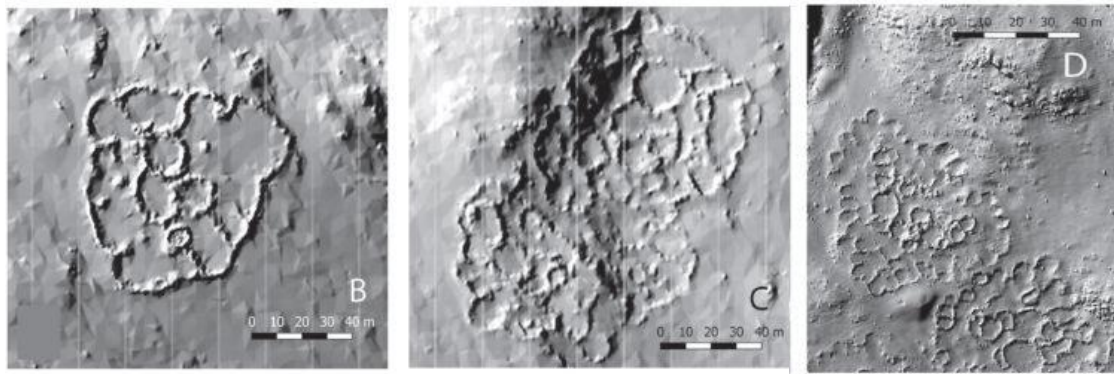


Figure 5.3: Klipriviersberg architecture at Kweneng showing semi-scalloped architecture (B & C), and a more scalloped Molokwane pattern (D) with multiple central enclosures (Source: Sadr 2019a)

The Tswana capitals are known to have been highly populated and nucleated, resulting in agglomerated settlement patterning characteristic of Klipriviersberg and Molokwane settlement types. Pistorius (1994) discusses at length the architectural layout of Kwena wards or compounds, as evidenced at Molokwane, their capital occupied from AD 1600. Figure 5.4 (derived from Pistorius 1994:43), illustrates the patent scalloped perimeter, and multiple central enclosures that seem to characterize the 17th and 18th century Molokwane type architecture.

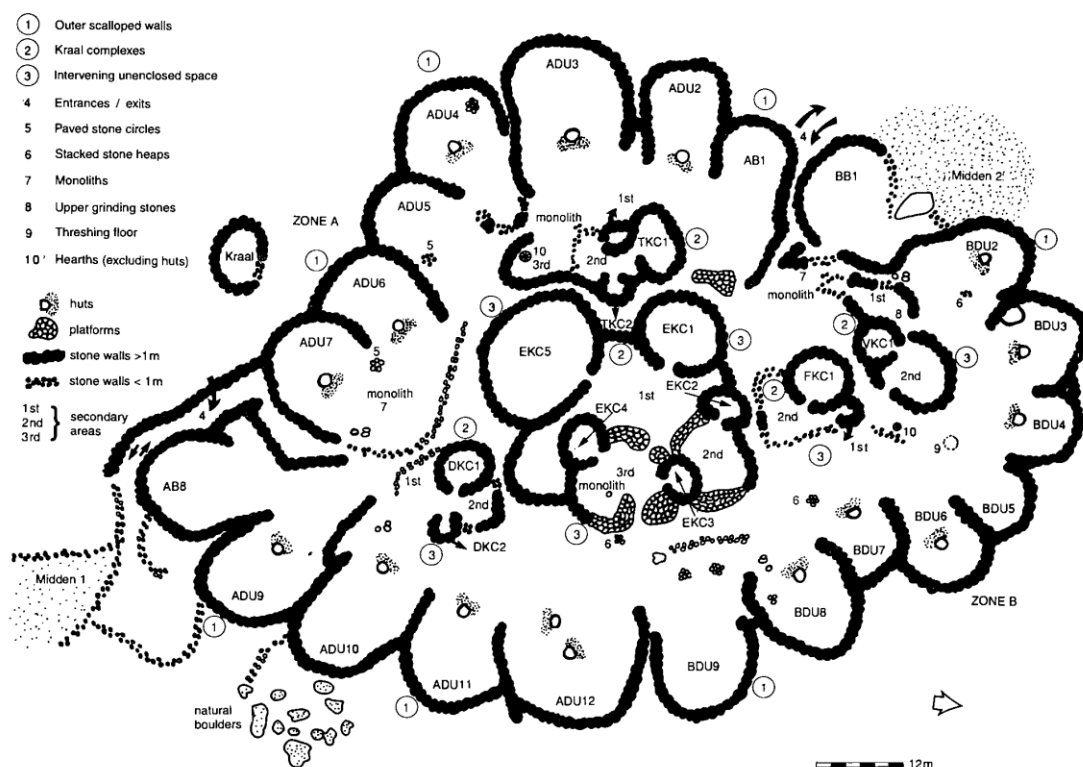


Figure 5.4: Typical Molokwane architectural layout showing the scalloped perimeter and multiple central enclosures (derived from Pistorius 1994:43).

Pistorius (1994:52) proposes three models behind the multiple central enclosures (Fig. 5.5 illustrates his models). My understanding is that irrespective of one's preference to the suggested models, the critical issue is the identification of what constitutes 'central enclosures' and the rest of the ward space reserved for houses and related activities. This is critical for researches such as mine which investigates changes (temporally and spatially) in the proportion of total ward area (m²) that the Kwenas allocated to livestock management or kraal spaces.

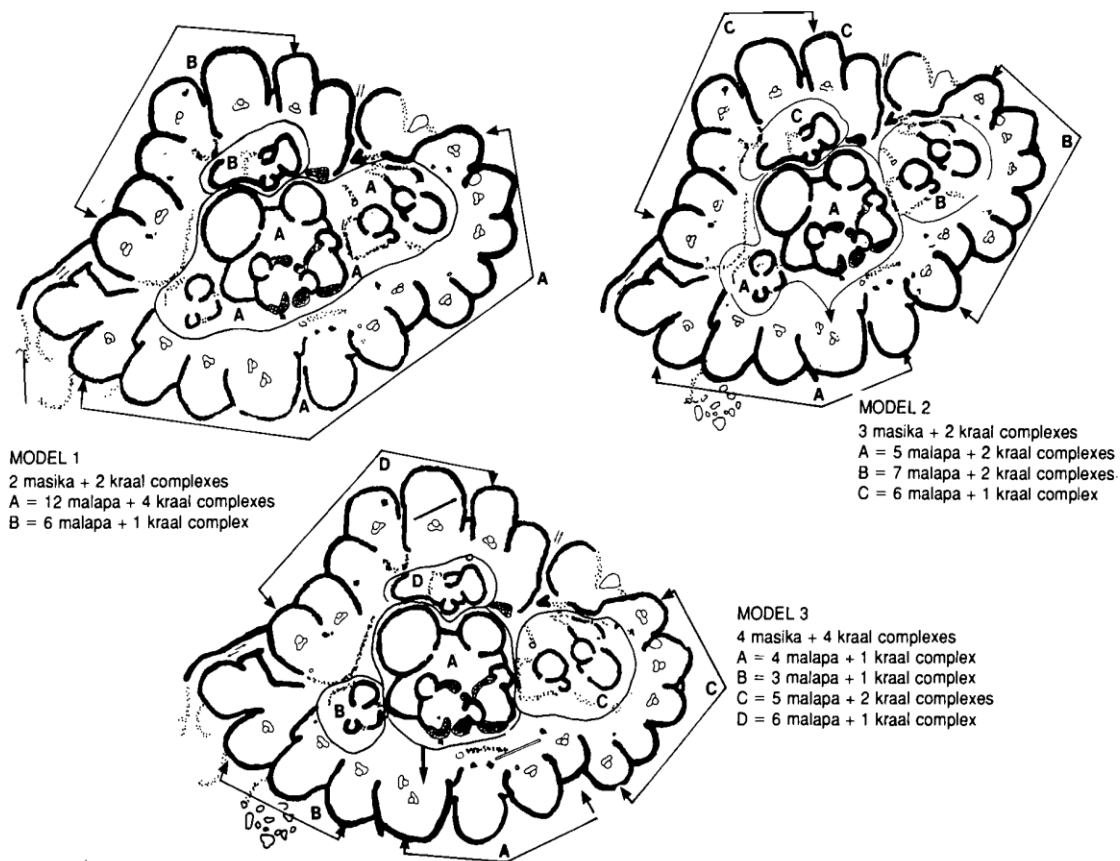


Figure 5.5: Modelling the identification of central enclosures characteristic of 17th and 18th century Kwenas capitals or main centres (Derived from Pistorius 1994:52).

Following the detailed study of the different phases of occupation at the Kwenas capital (Kweneng) in the Suikerbosrand landscape, Sadr and Mshuqwana (2020) provide yet another detailed typical architectural style for a Molokwane compound. It shows the scalloped perimeter, the multiple central enclosures, and the corbelled huts that are closely associated with the central enclosures (Fig. 5.6), suggesting that they are part of the livestock management area, as my research describes the 'central enclosures' concept. In a nutshell, it is evident that the M compounds are extensive, and have multiple central

enclosures. This has implications on the changing dynamics in the socio-economic and socio-political aspects of Tswana societies, and their associated settlement patterning.



Figure 5.6: A typical Molokwane compound at Kweneng reconstructed to show the scalloped perimeter, the multiple central enclosures (prefixed by letter E) and the corbelled huts (prefixed by letter C) that are closely associated with the central enclosures (derived from Sadr and Mshuqwana 2020:77).

5.2 Data sampling and presentation

As part of the Southern Gauteng Stone Walled Structures (SGSWS) project, I carried out the second phase of my research at the old Kweneng capital, Suikerbosrand or Kweneng as it is now known to the SGSWS project. The objective was to establish ways of identifying the adoption of the cattle post concept by the Tswana. Specifically, this involved assessing the changing relationship through time in the sizes of central enclosures at Kweneng.

The hypothesis that I tested is that as the cattle post concept was adopted or became more popular, the proportion of area within compounds that the Tswana devoted to livestock enclosures became smaller. This would be a result of decentralization as kraals became more family-based (livestock managed at family level), or even sub ward-based, rather than ward-based (shared responsibility towards management of livestock). This was

against the assumption that in the earliest phases, the cattle post concept was not yet adopted, or if it was, it would have been minimally or occasionally used, or not at all utilized. This presumption is based on the argument that being a herd management strategy, the cattle post system (which manages livestock away from main settlements) would have effect on the proportion of space allocated to kraal areas at main settlements.

The question was whether we can detect their adoption in the early stages of population agglomeration (clustering of settlements) during the Klipriviersberg period and onwards. If not, did cattle posts emerge during the later phase which is characterized by Molokwane architecture? What happens to the settlement layout as herd management strategies change (from management at main centres to being managed remotely at cattle posts) and a decentralized approach is adopted (from communal ward-based to family-based level).

As part of the broader SGSWS project, I selected a sample of compounds at Kweneng. Figure 5.7 shows that the broader project area has already been surveyed by the SGSWS project (left) and a lot of sites have been recorded (right), and are being studied through ongoing researches. The context of my sample is shown by the black dots on both maps.

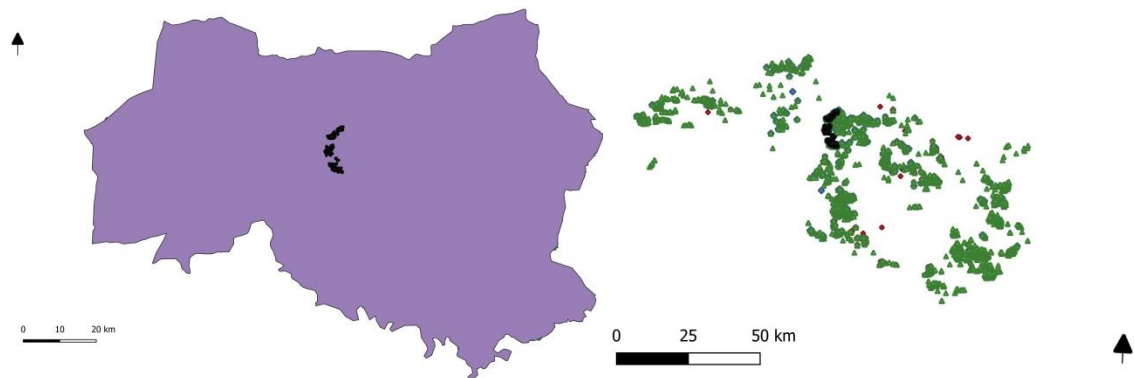


Figure 5.7: Map of Kweneng showing the context of my sample (black dots on both maps) in the SGSWS project survey area (left) and the recorded compounds and structures (right).

The sample area was arbitrarily divided into the three areas of north, central and south, and using QGIS, selected compounds were plotted, central points (centroids) set for these points, and the selected compounds classified into N. K and M types (Fig. 5.8).

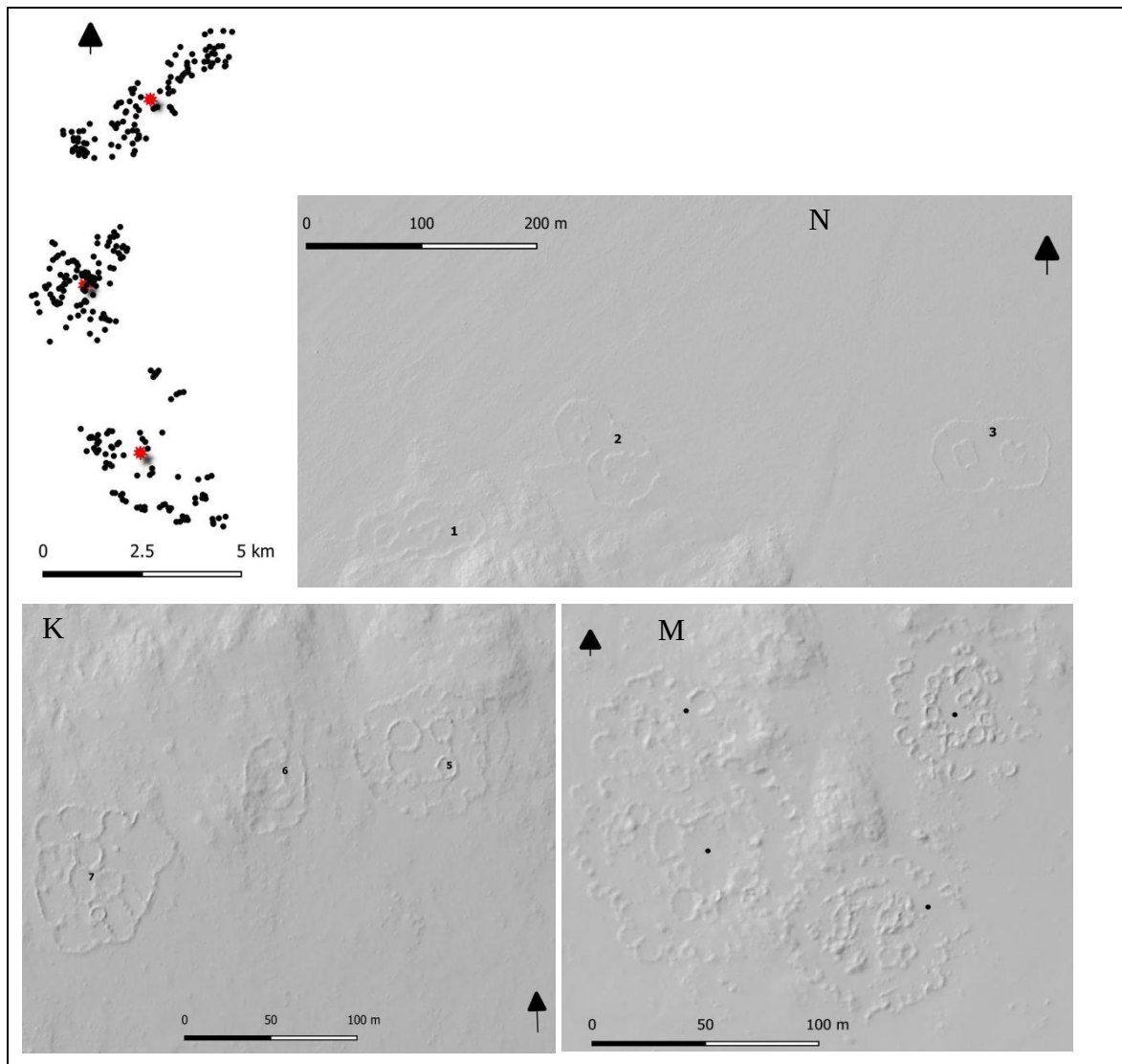


Figure 5.8: Map (top left) showing the distribution of sample compounds in black dots and their centre points in red stars. The selected compounds were classified into Type N (top right), Type K (bottom left) and Type M (bottom right).

Delineation was made for the central enclosures (inner spaces used for livestock management) and for the rest of the compound area (outer space used for households or yards and the related activities (Fig. 9). In the calculation of the sizes of central enclosures and outer spaces, multiple kraals were measured as a combined total square area (Fig. 5.9B). Where the selected compounds had abutting structures or sub-compounds (equivalent to sub-wards), and if the latter had evidence for central enclosures, they were measured individually and considered as separate entities for those abutting compounds (Fig. 5.9C illustrates the point).

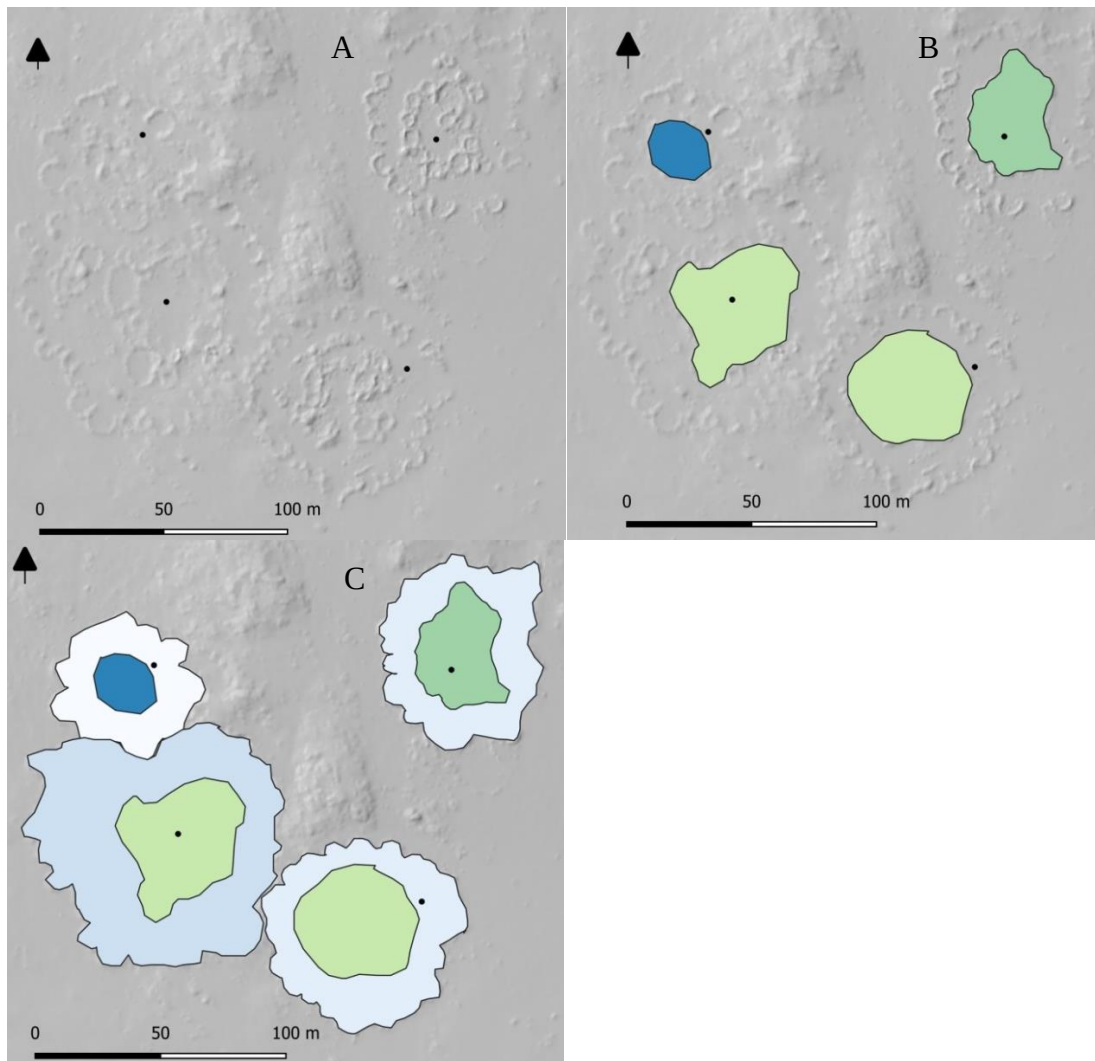


Figure 5.9: Illustration of the classification of compounds (A), delineation of central enclosures (B) and the outer space or rest of the compound reserved for households and related activities (C)

Once the sample was decided on, the areas of central enclosures, areas of outer spaces and ratios for the selected 290 compounds were analyzed. It is worth noting that I selected a total of 290 compounds - 68 N, 72 K and 150 M and these subtotals will be used when discussing the sizes of compounds. To better understand the sizes of central enclosures, where compounds had multiple enclosures that were distinctly separated from each other, they were first recorded individually before adding them together as I calculated the ratios. As such, the detailed discussion of the central enclosures shows a total of 306 sample – 78 N central enclosures, 74 K and 154 M as shown on Figures 5.16 to 5.18.

The mean area of central enclosures for the 290 compounds in the sample was also calculated and noted to be 909m². The mean area of compounds is 3878m², and the

mean ratio is 0.23. These, together with other variables, have been used to study the distribution patterns of areas of central enclosures, areas of compounds and ratios of central enclosures to compounds. These were also examined in relation to the Type N, K M compounds and the geographic sectors of Kweneng north, central and south.

5.3 Areas (m²) of central enclosures (kraal spaces) and outer enclosures (compound area)

The data shows that 61% of my sample compounds at Kweneng have sizes of central enclosures that are less than the sample mean area of 909m². This means that although there is variation in the sizes of central enclosures (including for M compounds whose multiple central enclosures were measured as a total square area), the majority of them have central spaces that are less than 1000m² (Fig. 5.10). My study therefore provides a baseline or yardstick against which future researches can study the impact of herd management on the use of space at herder-farmer sites.

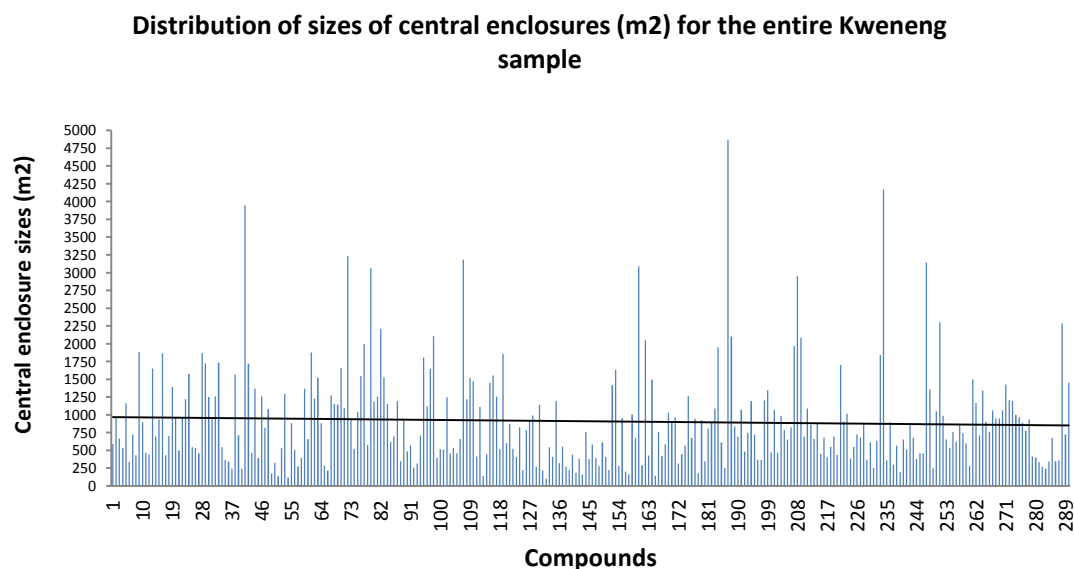


Figure 5.10 : Distribution of varying sizes (m²) of central enclosures for the entire sample of 290 compounds, showing that the majority have central enclosures that are less than 1000m² as shown by the linear trendline.

For the area (m²) of compounds, the data indicates that 62% of them are less than the sample (290 compounds) mean of 3878m (Fig. 5.11). Even though the sizes increased, Fig 5.11 shows that this was generally not exceeding 5000m². Later in this section, I demonstrate how variation in compound sizes relates to their types (N, K and M), their

positioning (variation in the positioning of the bigger and smaller compounds) and location (Kweneng north, central and south).

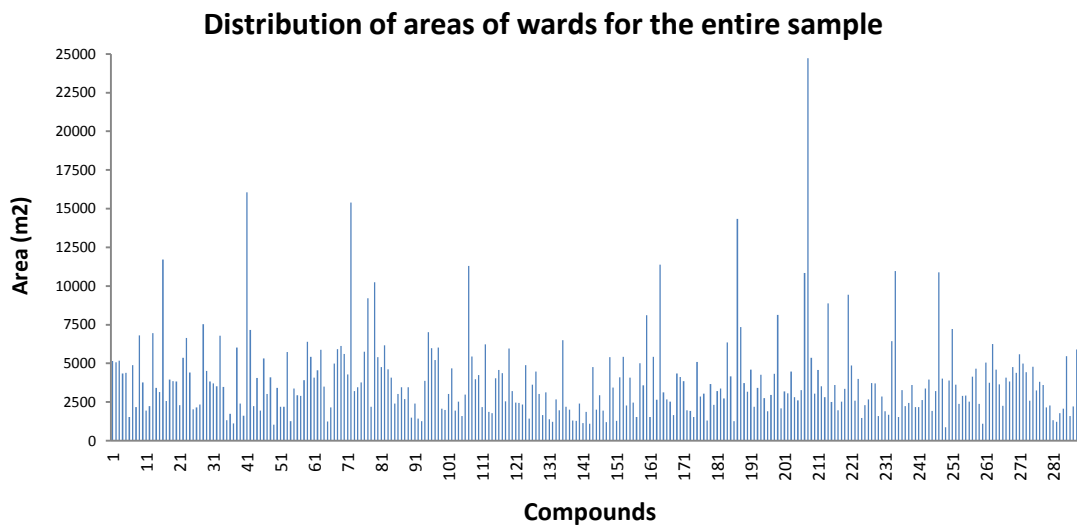


Figure 5.11: Distribution of varying sizes (area – m²) of compound sizes for the entire sample of 290 compounds.

The distribution pattern of the areas of central enclosures and outer spaces is further assessed in relation to the mean 909m² and the Type N, K and M compounds. Figure 5.12 shows that 69% of Type N compounds have central enclosures that are less than the central enclosure sample mean of 909m². The same compounds have areas of outer spaces (66%) that are less than the mean sample size of 3878m².

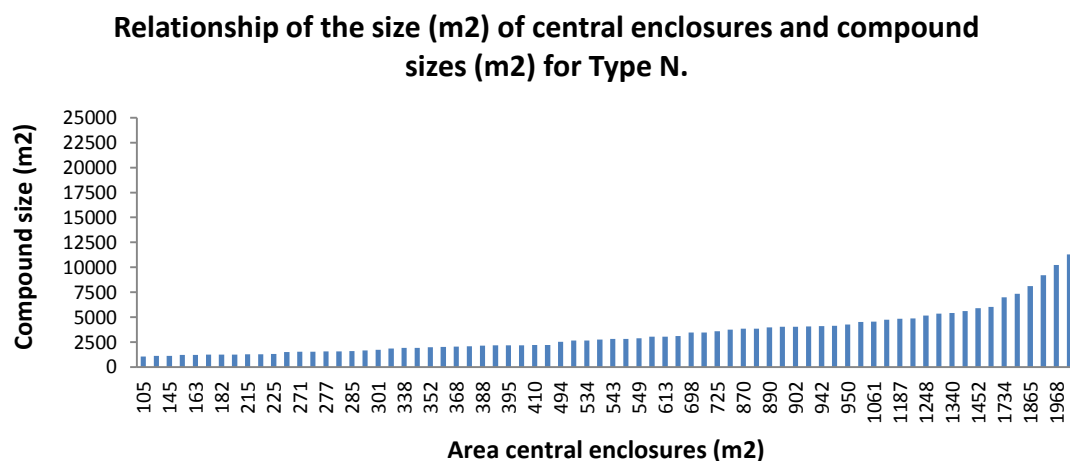


Figure 5.12: Distribution of areas of central enclosures and outer spaces for the 68 Type N compounds.

For Type K compounds, with a minimum central enclosure of 90m², 68% of the compounds have areas of central enclosures that are less than the sample mean area of 909m² (Fig. 5.13). For the areas of compounds, a total of 71% are less than the sample mean area of 3878m² for the total sample, compared to the 66% for Type N.

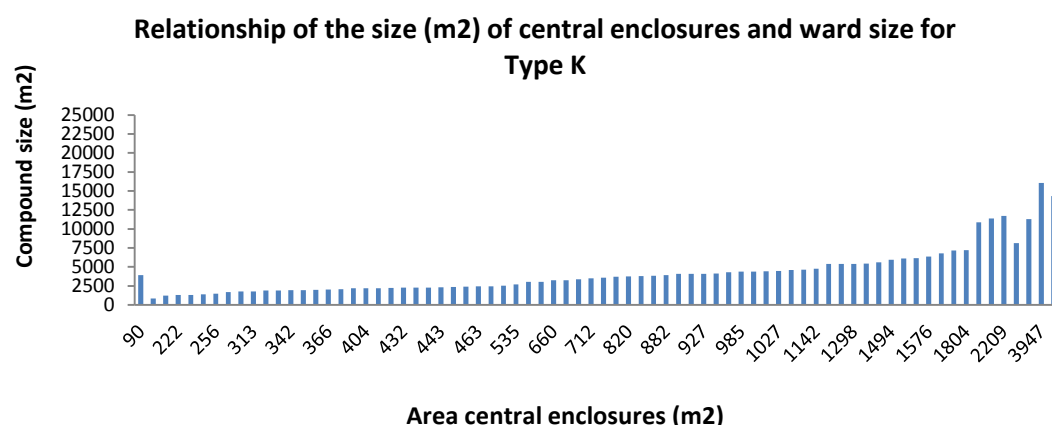


Figure 5.13: Areas of central enclosures and outer spaces for the 72 Type K compounds

A total of 54% of Type M compounds (Fig. 5.14) have central enclosures that are less than the mean area of 909m². This shows that M compounds have relatively larger central enclosures than N and K compounds. Also, the areas of outer spaces for M compounds are relatively larger, resulting in only 57% of them falling under the sample mean of 3878m². Almost half of the M compounds therefore have areas of compounds that are more than 3878m² (Fig. 5.14), rightly so considering that M compounds are highly characterized by agglomeration.

My research therefore highlights two key issues firstly that change over time must not only be measured across N, K, and M, it must secondly be measured within these categories. It is therefore appropriately assumed here (basing on the trend in the data) that transition from N-K-M should increase the sizes of kraals and compounds as wealth is accumulated and populations grow – leading to bigger kraals at M compounds. However, where communal livestock management is refocused to a more decentralized one, there should be an effect on the sizes of central enclosures – from relatively smaller sizes, then bigger ones, before becoming smaller again with decentralization.

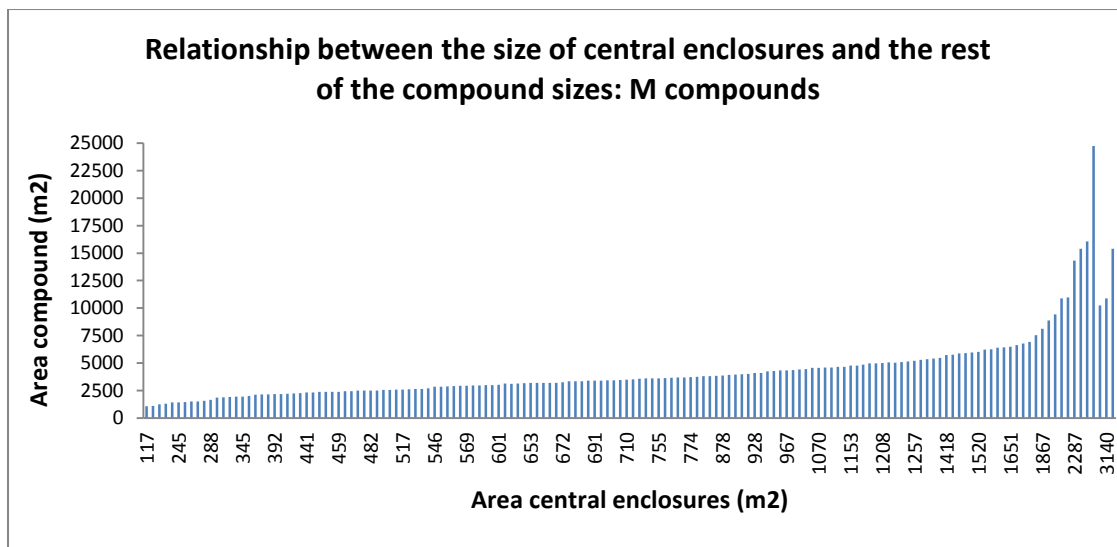


Figure 5.14: Distribution of areas of central enclosures and outer spaces for 150 Type M compounds.

In sum, a positive relationship is evident between the areas of central enclosures and outer enclosures (Figure 5.15). My research hypothesis implied that as the total area (m2) reserved for households and related activities increased during agglomeration that characterised the later Iron Age settlement patterning, central enclosures would have firstly increased as more stocks are accumulated from arrivals. At later stages, a change in herd management strategies, and of course population management, would have been necessary. This would have been a gradual process that started with decentralization of kraals at main centres (as witnessed by multiple central enclosures at some K and M compounds). An assumption here is that as cattle increased, they are managed out of the main settlements.

As newer compounds are established with population growth (assumed basing on agglomeration), and this is done at a time when cattle are managed out, the sizes of central enclosures should decrease irrespective of the size of the compound. One expects to find in some instances, compounds that are bigger, but having smaller sizes of central enclosures. However, this scenario can be triggered by several reasons, the immediate one being that members of that particular compound did not have a lot of cattle. Another would be that compounds have been decentralized into sub-compounds (equivalent to sub-wards) and each is managing their own stocks. My research proposes that the adoption of the cattle posts system can also be a trigger – it should lead to a lesser proportion of the compound being allocated to livestock management or kraals. Figure

5.15 shows that the 290 compounds in the Kweneng sample increase the proportion of space allocated to kraals as compounds expand. Generally, compounds of up to 5000m² are not allocating more than 1500m² to central enclosures, which means that they generally only give the kraal spaces up to 30% of the compound size.

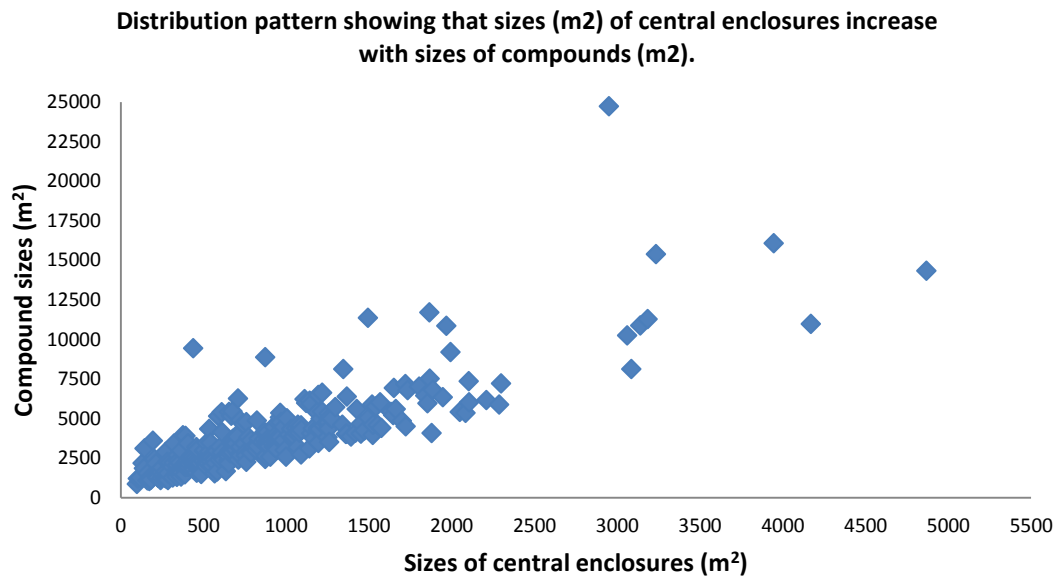


Figure 5.15: Distribution pattern showing the relationship for sizes (area m²) of central enclosures and the compound sizes.

5.3.1 Distribution of central enclosures per Type N, K and M compounds.

Through time the area of central enclosures in the compounds increased. Figure 5.16 shows that central enclosures in Type N compounds are largely smaller, with very little representation beyond 1153m². Type K compounds, which may be transitional between N and M (Sadr and Rodier 2012) show a bimodal distribution with both small and large central enclosures (Fig. 5.17).

Type M compounds, the most recent ones, have relatively large central enclosures (Fig. 5.18). A Kolmogorov-Smirnov Test (K-S Test) was done for the sizes of central enclosures per compound type. Although the Kolmogorov-Smirnov (K-S) Test shows that only the difference between the K and M distributions (K-S Test values of 0.089 and 0.086 respectively) is statistically significant, the overall chronological trend is clearly pointing to more space within compounds being devoted to livestock. A few reasons could account for this.

For starters, from the 17th century, the colonial expansion into southern Africa caused a lot of uncertainty and loss to livestock, especially cattle. An account of the ‘The archaeology of colonial settlement in southern Africa’ by Martin Hall suggests that from the 16th century onwards, the ownership and security of cattle was of paramount concern to Khoikhoi and Bantu herder-farmers (Hall 1993). There was trade and raiding of cattle, acquisition/dispossession of land, and the security of both livestock and the human population must have been a fundamental socio-political and socio-economic agenda. The smaller and less powerful societies would have joined the more powerful ones in pursuit of protection (of their lives and their livestock).

The recipient societies may have experienced a boom in the cattle economy – leading to communal management of the increased stock, and an increase in the proportion of the compound/ward allocated to livestock management. Increased human and livestock numbers would have most likely necessitated reengineering of human and herd management strategies. A shift from the ideology of centrally managing the human and livestock population, towards a more decentralized one would have resulted in the establishment of sub-compounds/wards - smaller and managing their own livestock. Table 5.1 shows that although M compounds are largely allocating more space to livestock management, they also have smaller sizes of central enclosures.

Table 5.1: QGIS Attribute-based-clustering for areas of central enclosures. The area-ranges are assessed against the Type N, K and M compound types.

Central enclosure sizes	Size category	Totals	Total N	Total K	Total M
90-256m2	1	27	12	8	7
269-379m2	2	39	14	11	14
383-486m2	3	40	16	12	12
494-583m2	4	27	8	6	13
600-704m2	5	28	4	4	20
705-859m2	6	24	5	5	14
870-1153m2	7	48	10	12	26
1161-1576m2	8	39	5	9	25
1634-2299m2	9	25	3	7	15
2688-4866m2	10	9	1	0	8
Totals		306	78	74	154

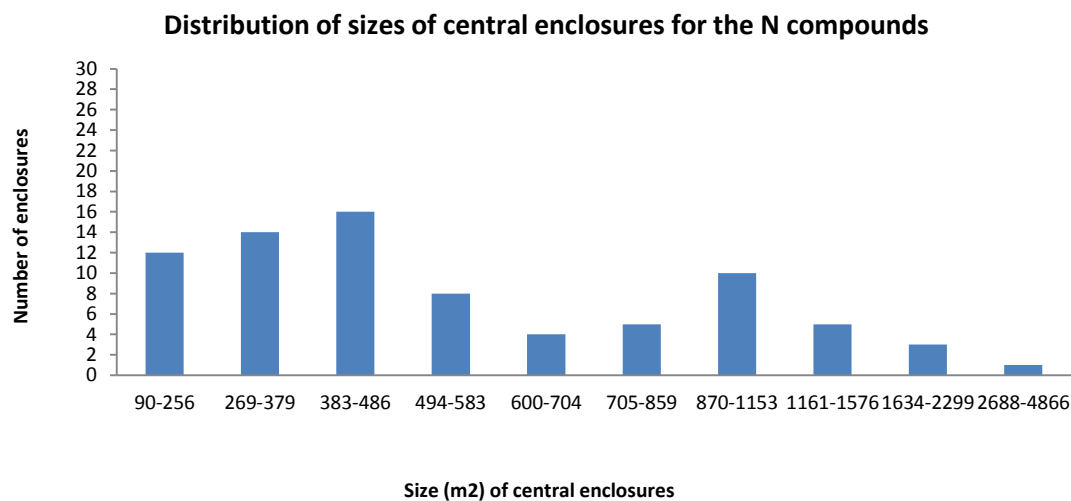


Figure 5.16: Distribution pattern for the 78 Type N central enclosures at Kweneng.

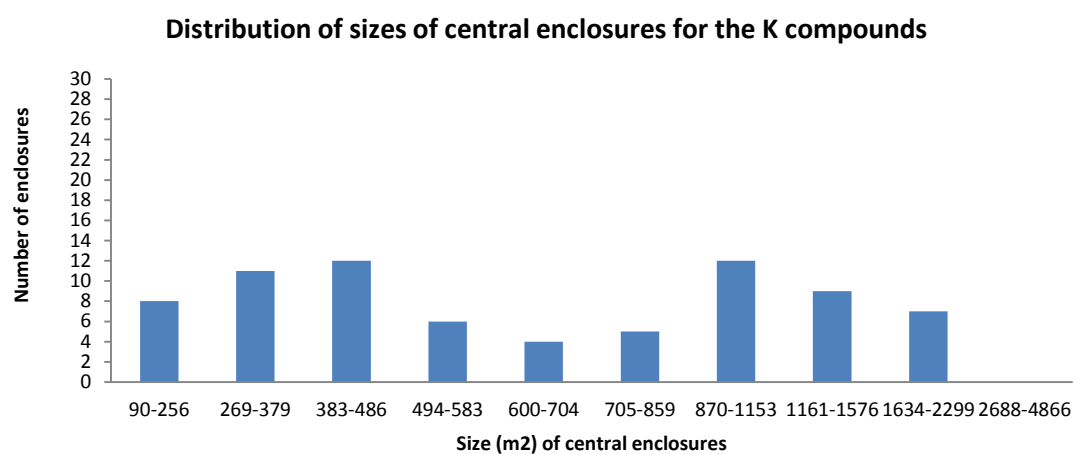


Figure 5.17: Distribution pattern for the sizes of 74 Type K central enclosures at Kweneng.

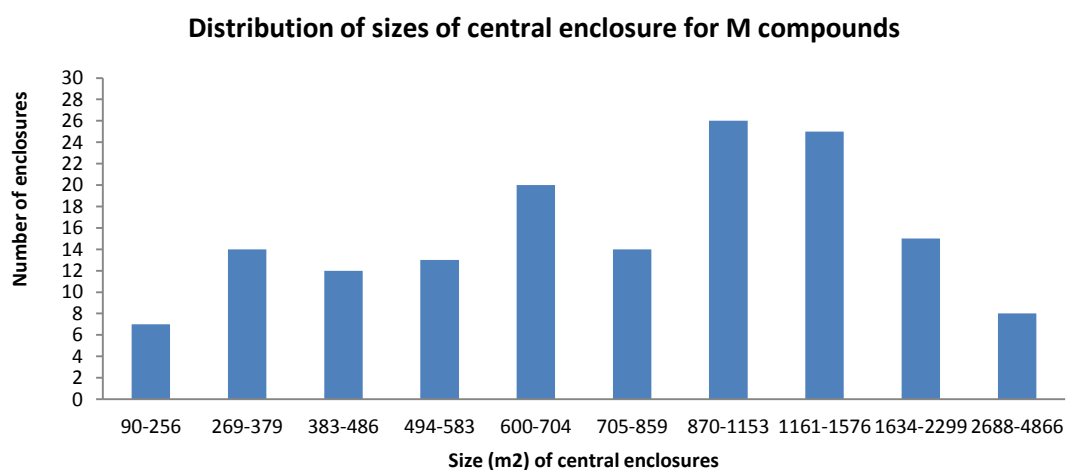


Figure 5.18: Distribution pattern for the sizes of 154 Type M central enclosures at Kweneng.

5.3.2 Areas of central enclosures at Kweneng north, central and south.

Not only did the areas of central enclosures increase over time, they also varied spatially across Kweneng north, central and south. The central part of Kweneng is largely characterized by Type M compounds while there is not much disparity in the distribution of compound types at the north and south. The south is largely characterized by smaller central enclosures, with a total of 42% of the compounds at category 1-5 ($90\text{m}^2 - 704\text{m}^2$) are found in the south, while 28% and 30% of the same cluster category are found in the central and north respectively (Fig. 5.19).

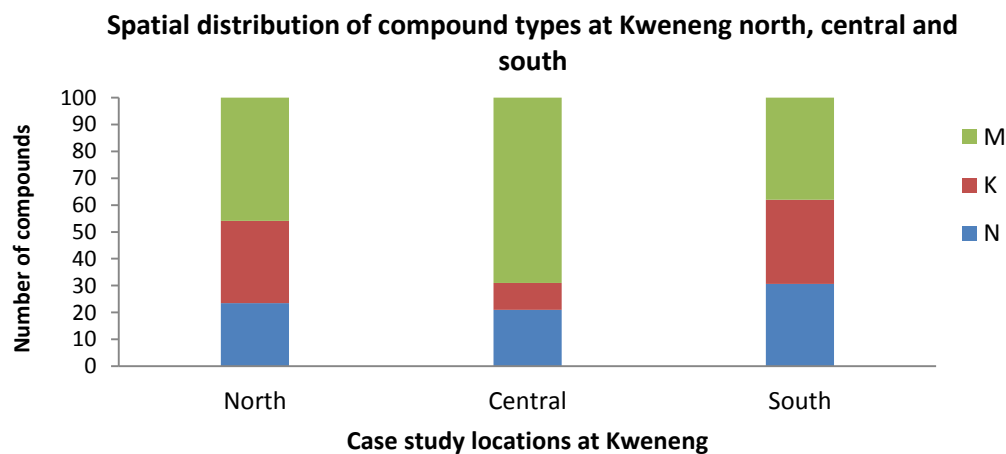


Figure 5.19: Distribution of compound types at Kweneng north, central and south.

The K compounds, indicative of transition between N and M, are predominantly in the north and south (Fig. 5.20 and Fig. 5.22), pointing possibly to these parts of Kweneng realizing increased livestock. Although the three sectors of Kweneng have representation of the later period Molokwane compounds, these M compounds are predominant in central Kweneng, and are largely characterized by larger central enclosures (Fig. 5.21).

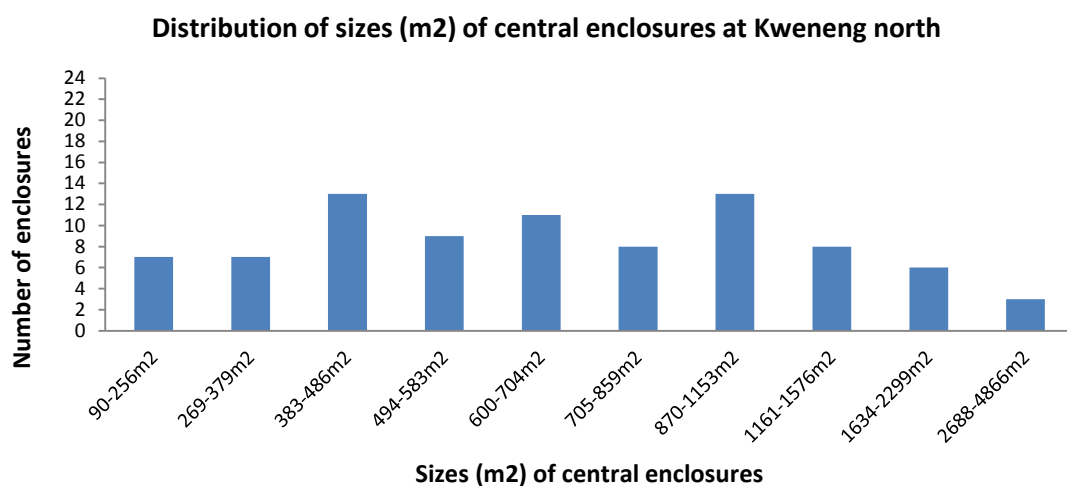


Figure 5.20: Distribution pattern for the sizes of central enclosures at Kweneng north

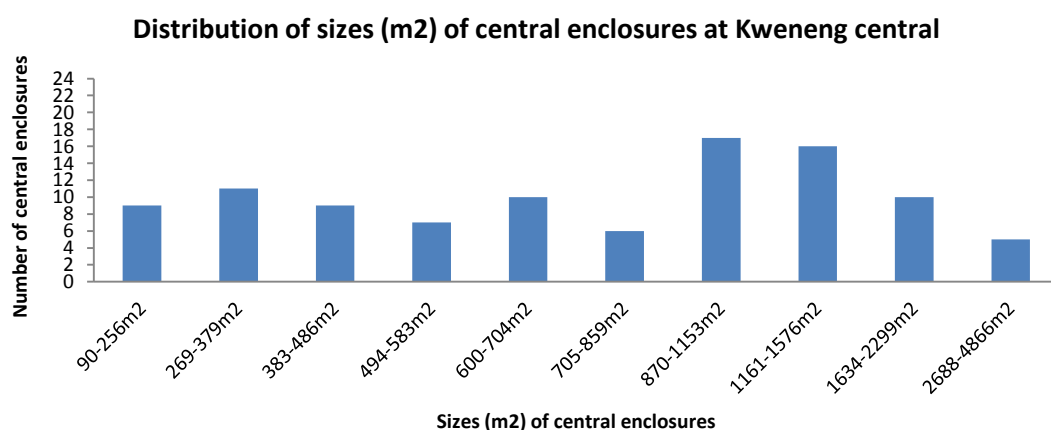


Figure 5.21: Distribution pattern for the sizes of central enclosures at Kweneng central

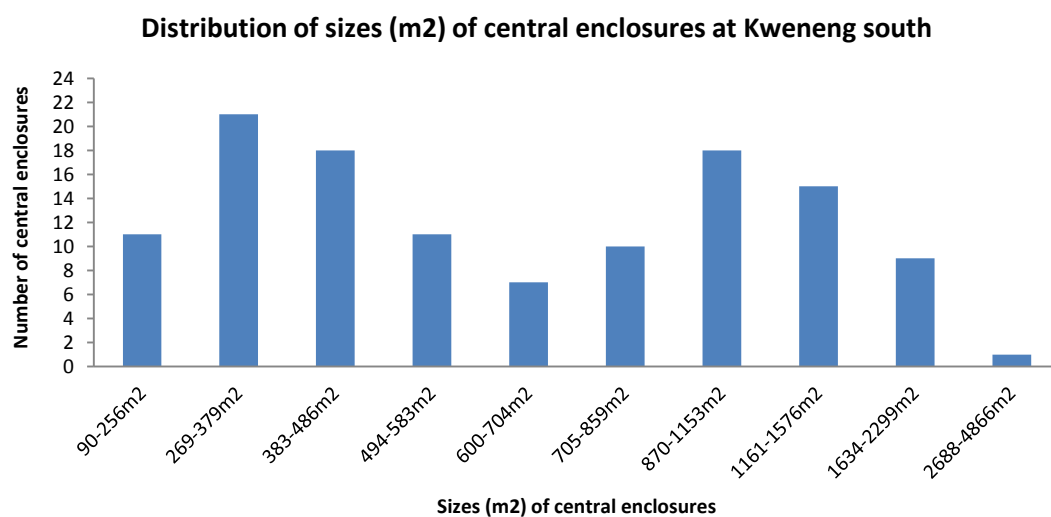


Figure 5.22: Distribution of sizes of central enclosures at Kweneng south

5.3.3 Proportions of areas of central enclosures to the overall compound size per N, K and M

Before a summary of ratio distribution per N, K and M compound types for the north, central and south is provided, I discuss below the details for ratio distributions per compound type. Figure 5.23 (top) shows that for N compounds, the proportion of area allocated to livestock (central enclosures) does not generally exceed the mean ratio of 0.23 (23%) for the total sample of 290 compounds. The ratio for most N compounds fall below 0.30, with only 17 compounds recording a ratio above the sample mean ratio of 0.23.

Type K compounds are also displaying ratios less than the total sample mean of 0.23, and just like N compounds, shows an indication that some compounds have increased central enclosures (Fig. 5.23 middle). This may suggest that change is often gradual as it gets internalized, and it may even be apparent within types. The change within type is inferred from the fact that as population increased and settlement agglomeration (characteristic of type K and M settlements) was realized, some of the resources such as livestock increased.

For the Type M compounds, the ratios are still largely not exceeding the sample mean ratio of 0.23 (Fig. 5.23 bottom). However, there is an indication that in some instances the areas dedicated for livestock (central enclosures) are allocated up to 30% (and to a lesser extent 40%) of the overall compound sizes. The ratio for Molokwane compounds has considered the multiple enclosures that constitute the kraal space or livestock management space. Where there is evidence for abutting compounds (sub-compounds) and their independent central enclosures, these were considered individually.

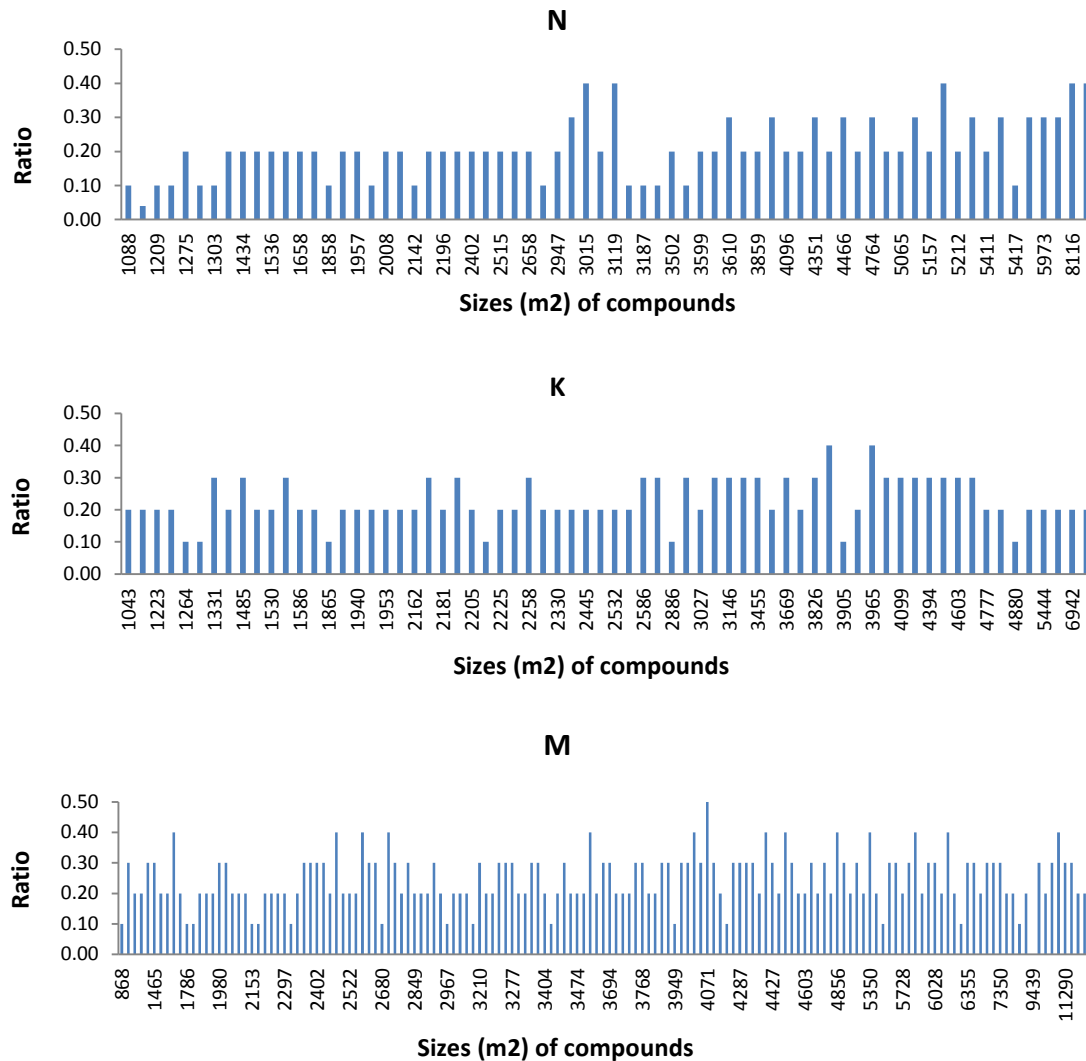


Figure 5.23: Illustration for ratio patterns for the 68 N compounds (top), 72 K compounds (middle) and 150 M compounds (bottom).

As the size of central enclosures increase temporally and spatially, so did their proportion relative to the overall size of the compounds. Ratio range 0.0-0.10 is mostly N compounds with 22% compared to the 10% and 11% of K and M respectively (Fig. 5.24). A significant percentage of compound types with increasing ratios is notable at ratio range 0.11-0.20 (N 53%, K 53% and M 43%).

Despite a notable decline in percentages of compound types at ratio range 0.21-0.30, both K (35%) and M (37%) are still showing relatively larger percentages compared to N (18%), suggesting a probable increase in the accumulation of livestock. Although the proportion of areas of central enclosures relative to the entire size of the compound

increases over time, all compound types are generally not allocating more than 30% of their total size to central enclosures (Fig. 5.24 right, middle and left).

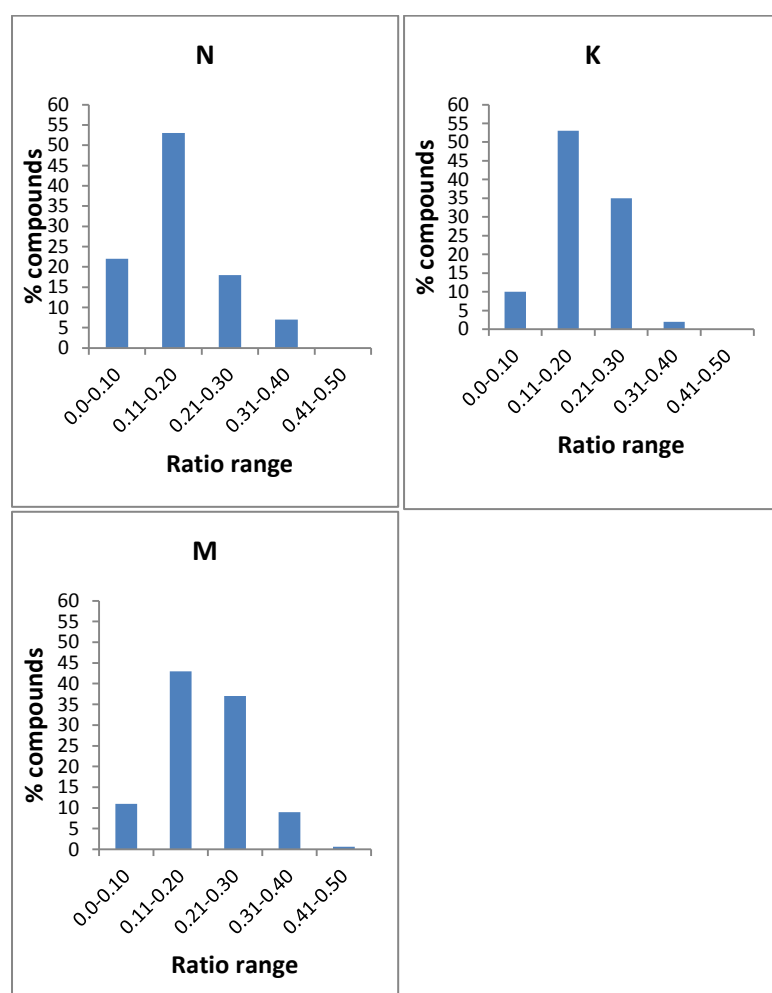


Figure 5.24 : Ratio patterns for N, K and M compounds showing that the space allocated to central enclosures is largely below 30% of the overall compound size.

5.3.4 The proportions of areas of central enclosures to the overall compound size for Kweneng north, central and south.

The proportion of sizes of central enclosures relative to the overall compound size varied across Kweneng north, central and south. The data indicate that Kweneng north, central and south are largely characterized by compound types of ratio range 0.11-0.20, with the south displaying a relatively higher percentage of 52.2% (Fig. 5.25) While the distribution of ratios per compound type (discussed above) has shown that ratio range 0.21-0.30 is predominantly K and M, the same category here shows that most of these compounds would be found at Kweneng north and central (Fig. 5.25 right and middle).

It is evident that although central Kweneng largely has M compounds, not all of them have bigger central enclosures, resulting in not much disparity between the north and central. The variation in the proportion of central enclosures to the overall compound sizes across the Kweneng landscape is a possible indicator for accumulation of livestock (witnessed by increased central enclosures), and this would have necessitated a change in herd management strategies.

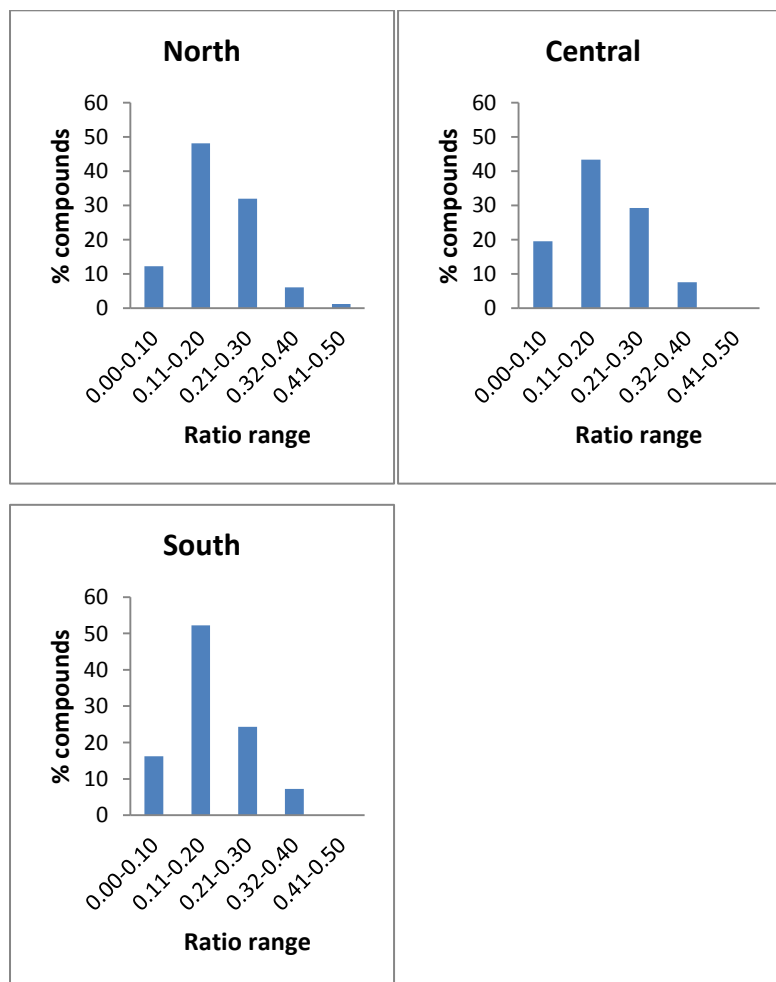


Figure 5.25 : Ratio patterns indicating that compounds in the north, central and south predominantly have ratios ranging from 0.11-0.30.

5.4 Spatial analysis - central enclosures at Kweneng.

5.4.1 Sampling and data presentation

What are cattle posts and how can we identify their existence through studying the main settlements and cattle posts themselves? While the literature has shown that they are not a new phenomenon, this research illustrates that there is need to study both the main and

satellites settlements and develop qualitative and quantitative indicators for cattle posts. I emphasized that these studies must be considerate of the socio-cultural and natural push and pull factors within which we find the indicators. The studies must take the inter-site and intra-site approach in both the collection and analysis of data.

Key issues such as the presence and occurrence of wards/compounds/yards (settlement units) and kraals/central enclosures form part of the first steps. The positioning of these must be studied in the context of the settlement units. The sizes of kraal enclosures and settlement units, and their temporal and spatial variation are key variables. Is managing livestock away from main settlements having direct impact on the proportion of ward/compound space allocated to central enclosures? Is there evidence that kraal spaces are increased or decreased temporally and spatially, and to what extent? For example, the Molepolole case study showed that over time, the Kweneng were reducing the proportion of ward space allocated to livestock management from 8% (4478m² biggest kraal:54469 of biggest ward = 0.08) to 1% (118m² of smallest kraal:7329m² of smallest ward = 0.01).

Would we realize this percentage reduction at older Tswana settlements, or the proportion of compound space allocated to livestock management would be bigger? This is against the backdrop that up until the 19th century, the Tswana societies experienced socio-political and economic circumstances that necessitated aggregation of populations and controlled authority over food and land resources (see Schapera 1970; Ngcongco 1979; Scotch 2008; Anderson 2009; Morton 2013; Schapera & Comaroff 2015 for details on Tswana history and settlement patterning).

Following an ethnoarchaeological study of the Kweneng of Botswana cattle post system, I studied a sample of compounds at the Kweneng capital in South Africa. Notwithstanding that political factors that may have influenced settlement patterning in precolonial and postcolonial Tswana societies varied, the positioning and sizes of livestock enclosures at Kweneng were studied. Firstly, the qualitative approach involved identifying the sample compounds and their central enclosures). I then studied the indicators for spatial change that could be used as an indicator for transition in the livestock management strategies at Kweneng.

For this exercise, I firstly created polygons for my case study areas – Kweneng north, central and south (Fig. 5.26a). I then used these polygons to create centroids for the distribution of the selected compounds at these areas, and overlaid this on the SGSWS 10km grid (b). To have a more focused assessment of the variation in the sizes of central enclosures and the rest of the compounds, I created a 1000mx1000m (1kmx1km) grid for the three polygons (c). The distribution of kraal points, and the associated centroids, at Kweneng north, central and south is shown on the 1km (d) grid.

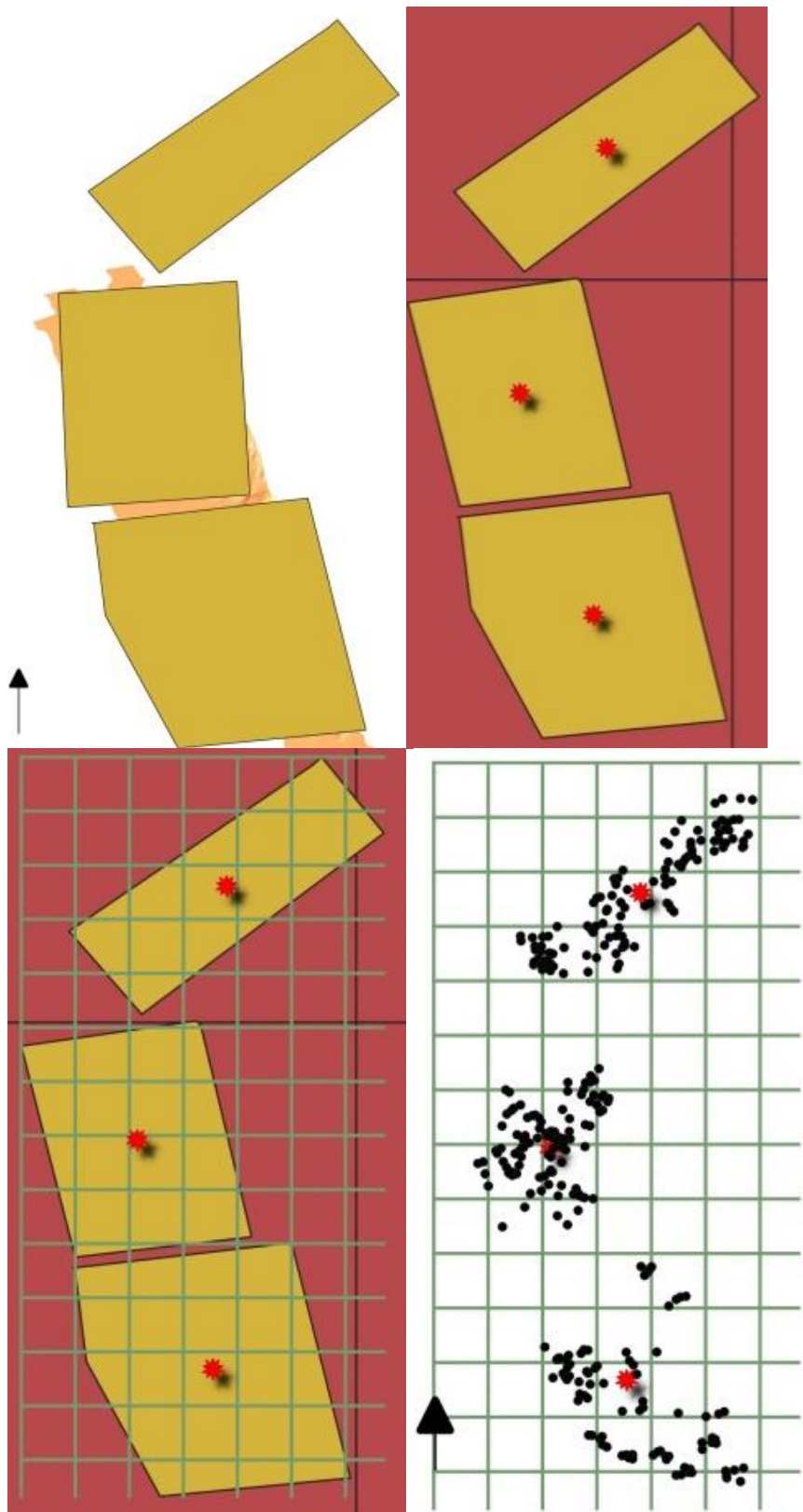


Figure 5.26: Sample selection process showing areas of Kweneng north, central and south (top left), centroids for the kraal distribution (red stars – top right), 1000mx1000m (1km²) grid (bottom left), distribution of all kraal points against the 1km (bottom right) grid.

It is worth noting that my sample does not include all the compounds at Kweneng. Because the main object was to establish variation in the sizes of central enclosures in

relation to the compound areas, I only selected compounds with evidence (owing to post-depositional processes) for a clear distinction between central enclosures and the rest of the compound space. Figure 5.26d shows that my sample is spread over 84km² (84 000m²), with the north sample area accounting for 30km² (30 000m²), while the central is within 24km² (24 000m²), and the sample from the south assessed within 30km² (30 000m²).

5.4.2 Kweneng north, central and south

I used QGIS symbology plugin to classify the areas of central enclosures and compounds. For the qualitative and quantitative analysis in section 5.2, I used the plugin for attribute-based clustering and the categories were not set at equal intervals. For the graduated presentation of the sizes (using the symbology plugin) I set the classification to equal intervals and generated 10 classes for easier analysis. Figure 5.26 shows that Kweneng north (Fig 5.27), central (Fig. 5.28) and south (Fig. 5.29) have smaller central enclosures that are largely below 1523m².

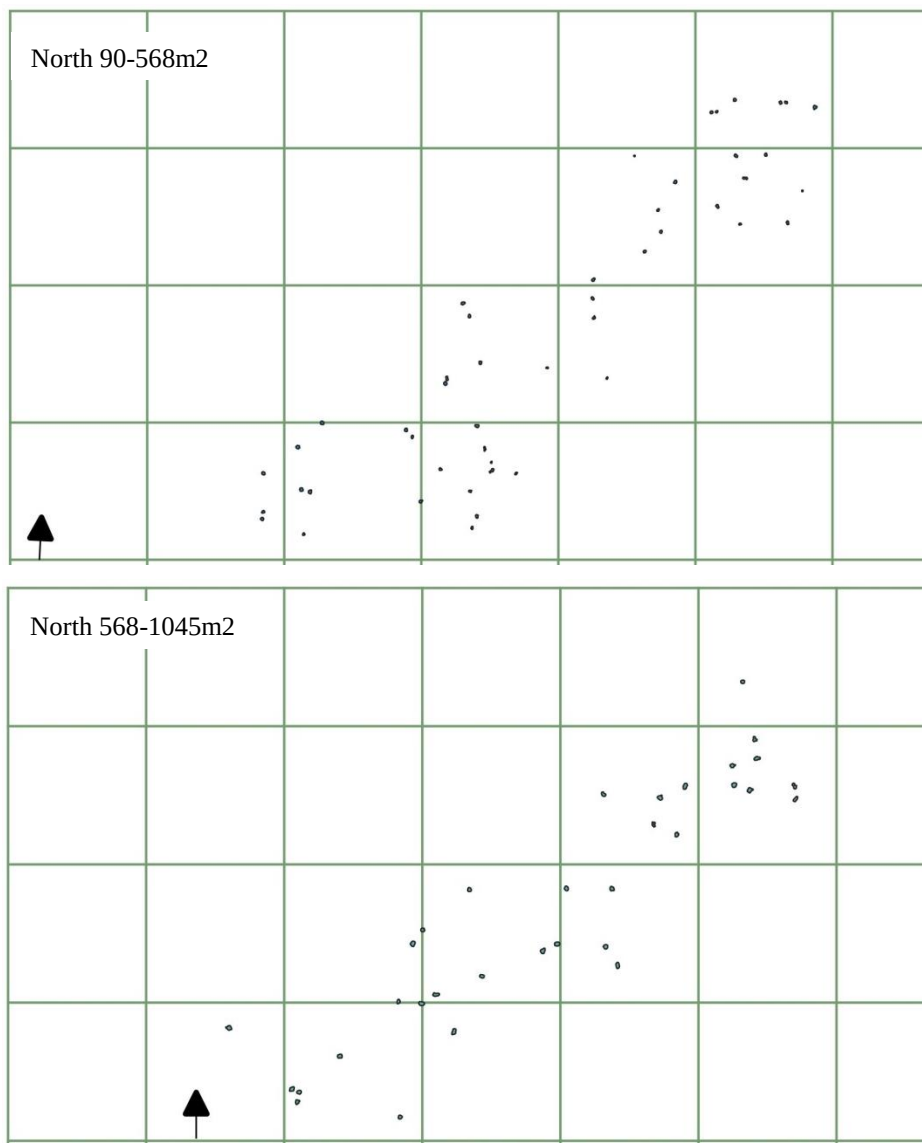


Figure 5.27: Distribution of central enclosures at Kweneng north beginning to show a notable increase in kraals in the smaller size 90-568m2 (top) and 568-1045m2 (bottom).

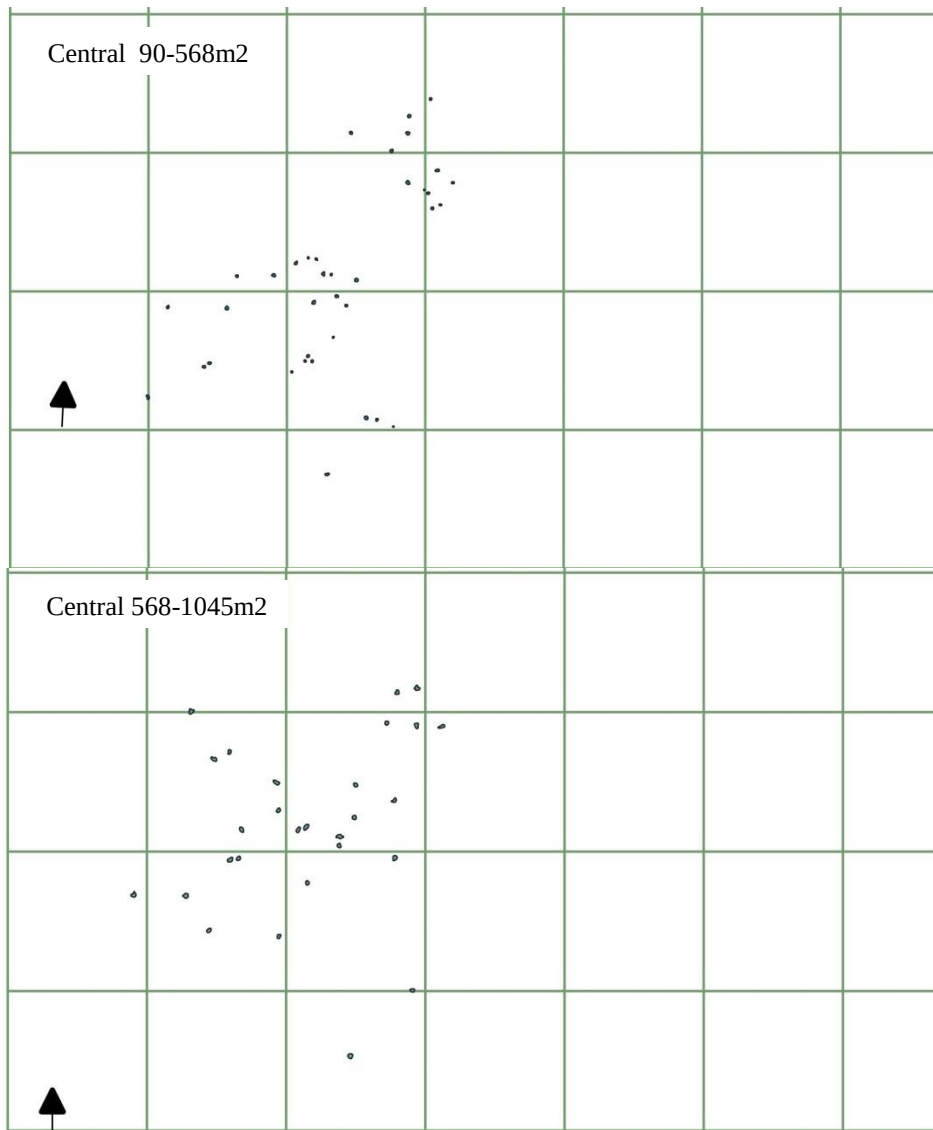


Figure 5.28: Distribution of central enclosures at Kweneng central beginning to show a notable increase in kraals in the smaller size 90-568m² (top) and 568-1045m² (bottom).

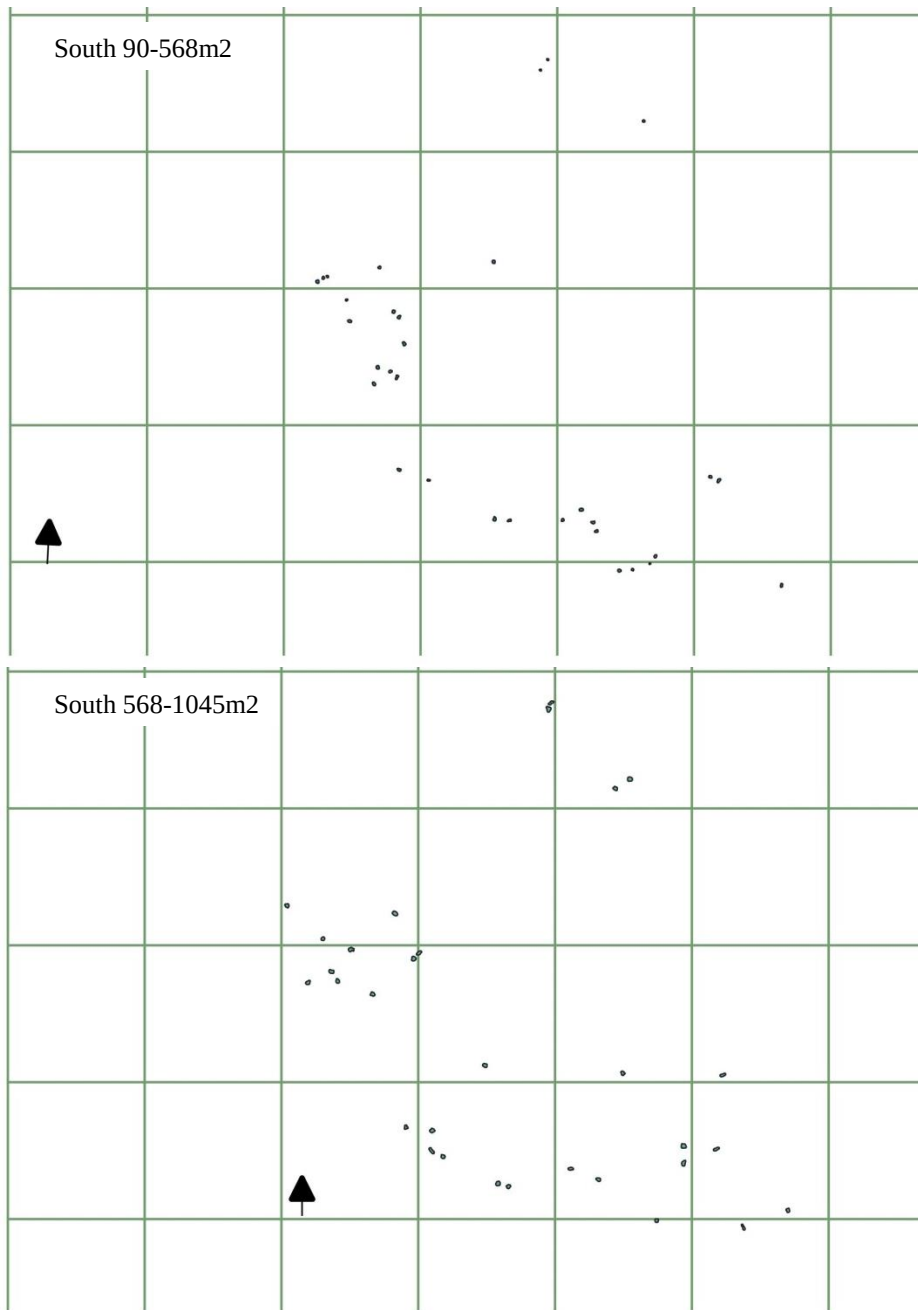


Figure 5.29: Distribution of central enclosures at Kweneng central beginning to show a notable increase in kraals in the smaller size 90-568m² (top) and 568-1045m² (bottom).

The distribution of kraal sizes for the Kweneng sample shows that the majority of the central enclosures in this sample have relatively smaller sizes – below 1523m² (Fig. 5.30). Also, when, assessed in the context of each other, it becomes evident that the distribution pattern of central enclosures at Kweneng north is aligned in a northeasterly and southwesterly direction. Kweneng central has a north-south pattern, while Kweneng south shows a southeasterly distribution.

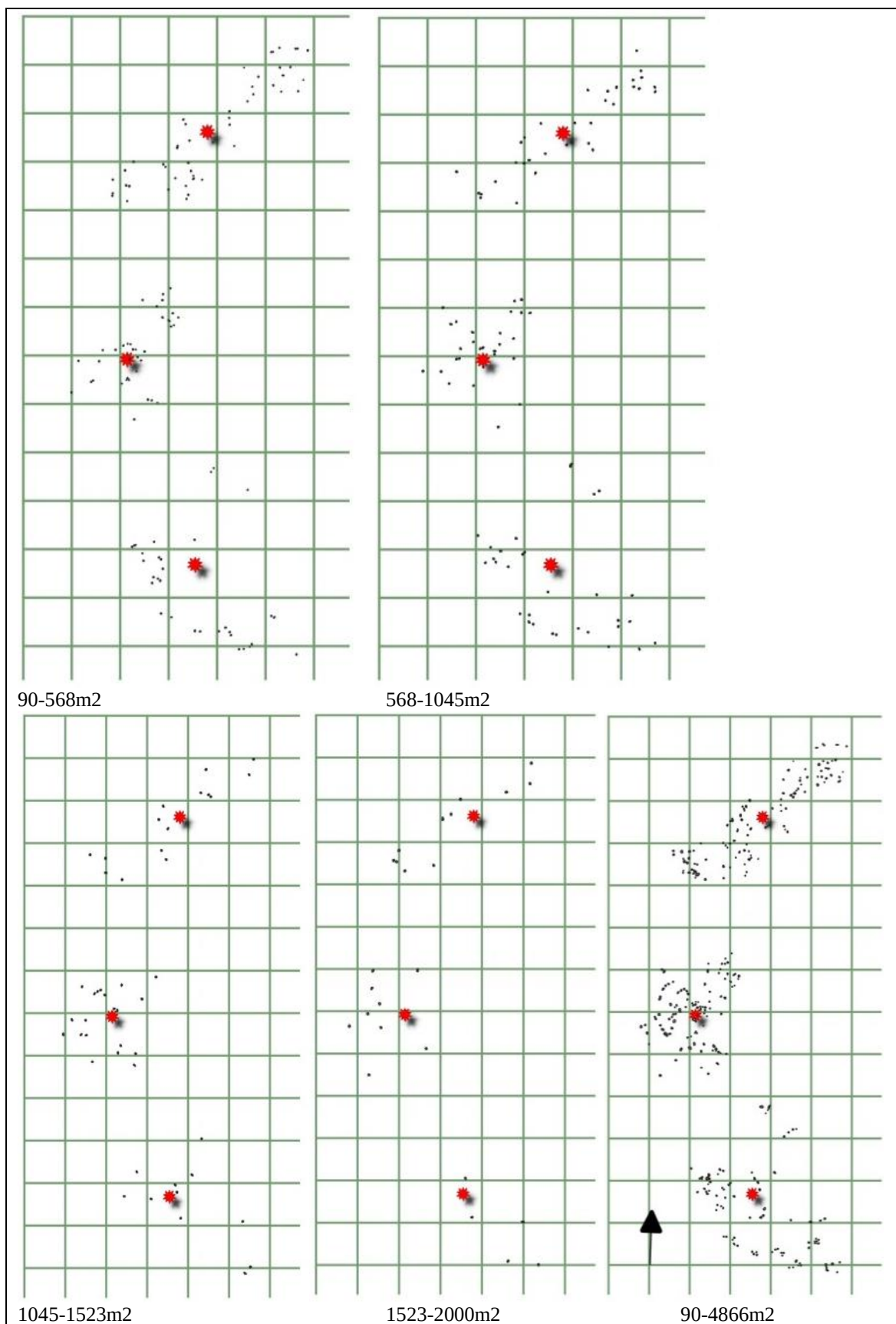


Figure 5.30: Distribution of kraal sizes for the Kweneng sample showing that the majority of the central enclosures in this sample have relatively smaller sizes – below 1523m2.

Which compounds have smaller central enclosures (90-568m²)? All compounds in the sample were categorized by size (smallest is 868m² and the biggest is 24737m²). The spatial distribution for central enclosures 90-568m² was then assessed in the context of the varying sizes of compounds. Figure 5.31 shows that the majority of compounds in Kweneng north have central enclosures below 568m². Where compounds had multiple central enclosures, these were digitized individually but their size calculated as total square area. Figure 5.31 illustrates the setup in Kweneng north. Some compounds have no dark color in them, and this means that they have central enclosures above 568m².

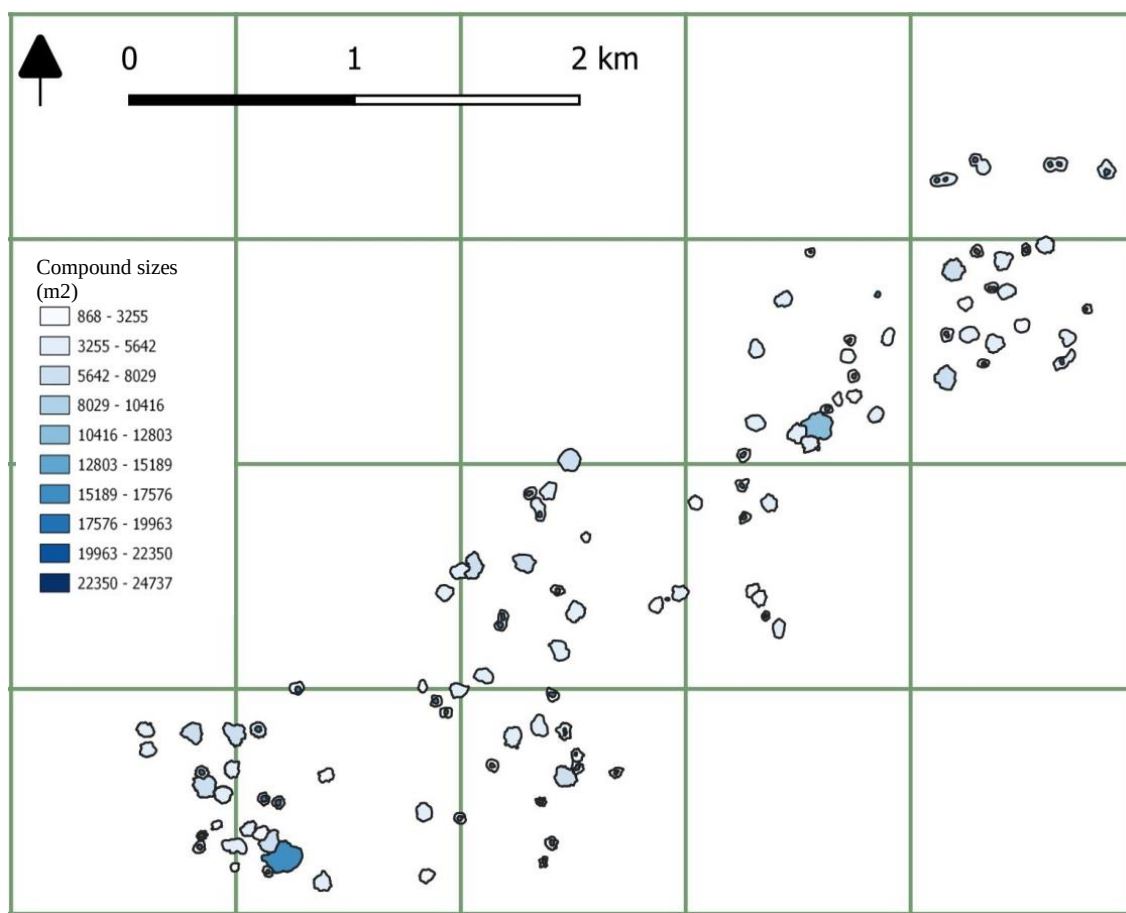


Figure 5.31: Spatial distribution of central enclosures 90-568m² across the varying sizes of compounds at Kweneng north. The central enclosures are dark colour inside compounds, and the compounds with nothing in them have central enclosures above 568m².

Kweneng central (Fig. 5.32) is showing more agglomeration and the compounds with smaller kraals 90-568m² are peripheral and abutted to the bigger ones. The distribution pattern in central Kweneng shows that the smaller compounds and their associated kraals expand in a northeasterly direction.

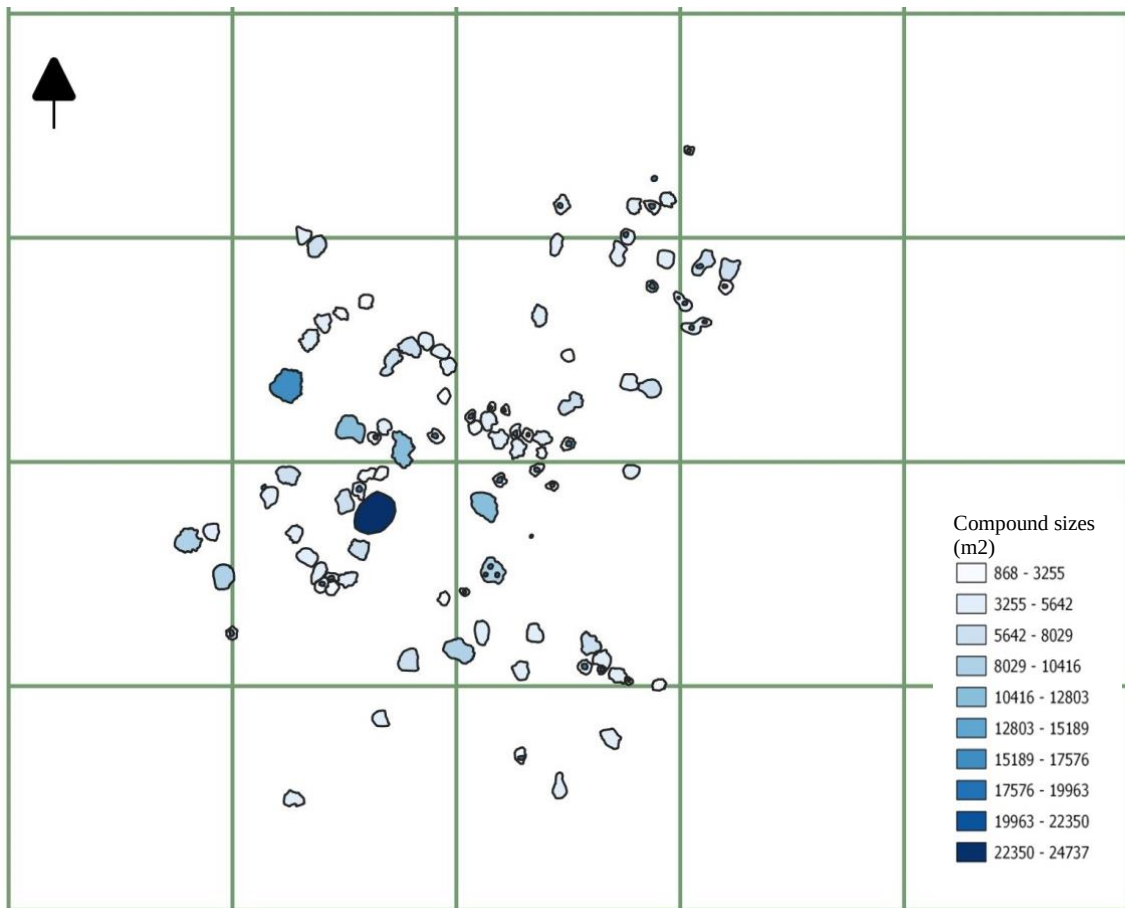


Figure 5.32: Spatial distribution of central enclosures 90-568m² across the varying sizes of compounds at Kweneng central. The central enclosures are shown by dark colour inside compounds, and the compounds with nothing in them have central enclosures above 568m².

The south (5.33) shows a peripheral distribution for central enclosures less than 568m², and these are not isolated.

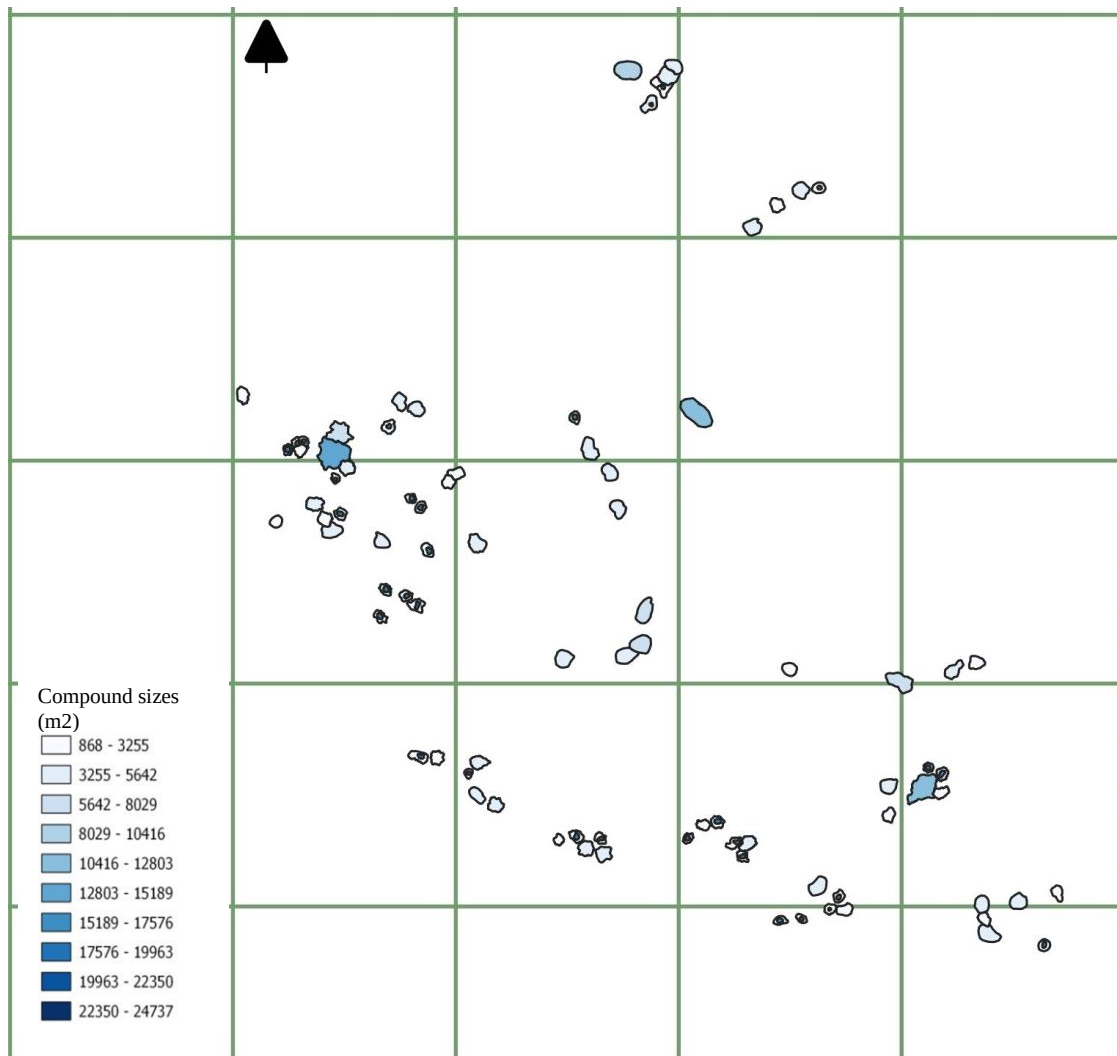


Figure 5.33: Spatial distribution of central enclosures 90-568m2 across the varying sizes of compounds at Kweneng south. The central enclosures are shown by dark colour inside compounds, and the compounds with nothing in them have central enclosures above 568m2.

For the compounds with kraals sizes between 568-1523m2, I illustrate their spatial distribution in figures 5.34 to 5.39. For better presentation, I illustrate the central enclosure size categories (568-1045m2 and 1045-1523m2) separately for Kweneng north, central and south. In Figure 5.34 and 5.35, I demonstrate that for Kweneng north, the pattern of the 48 central enclosures in this size category are spread across almost evenly.

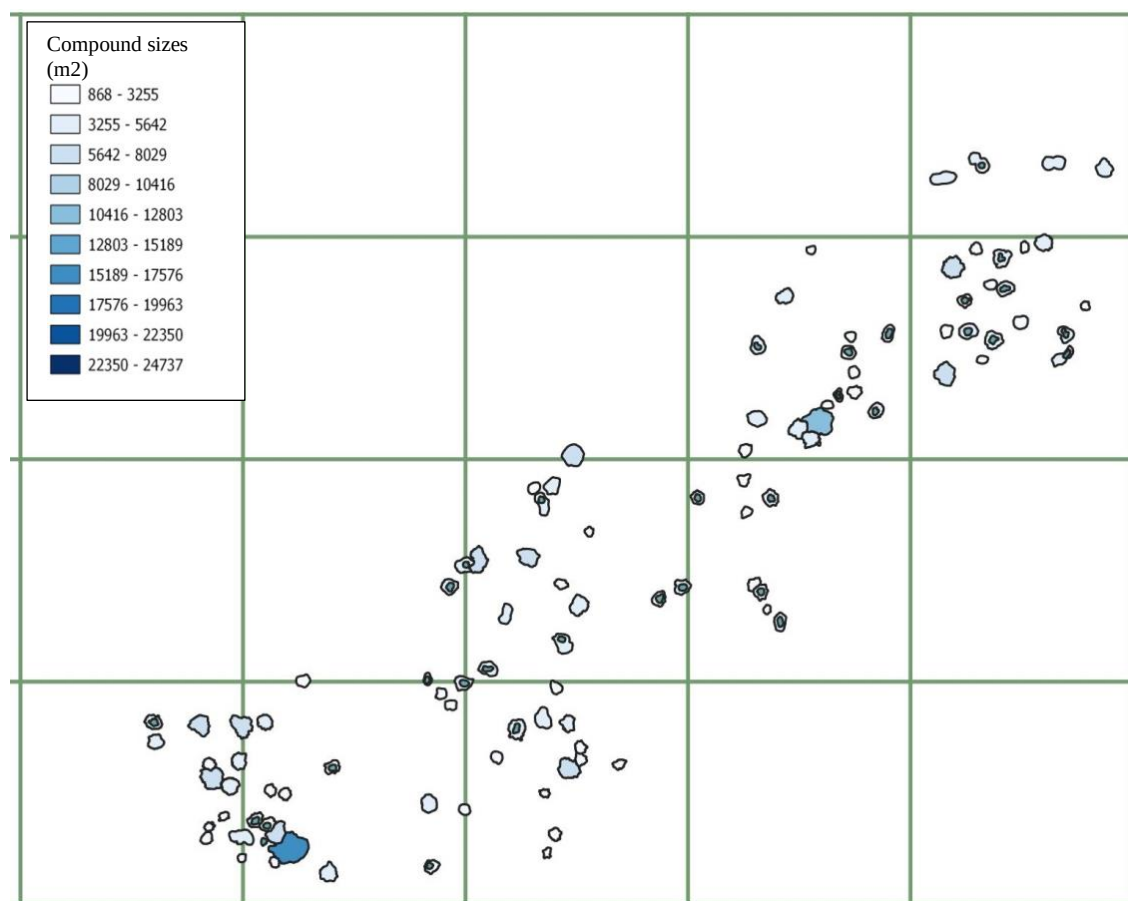


Figure 5.34: Spatial distribution of central enclosures 568-1045m2 across the varying sizes of compounds at Kweneng north. The compounds with nothing in them have central enclosures outside category 568-1045m2.

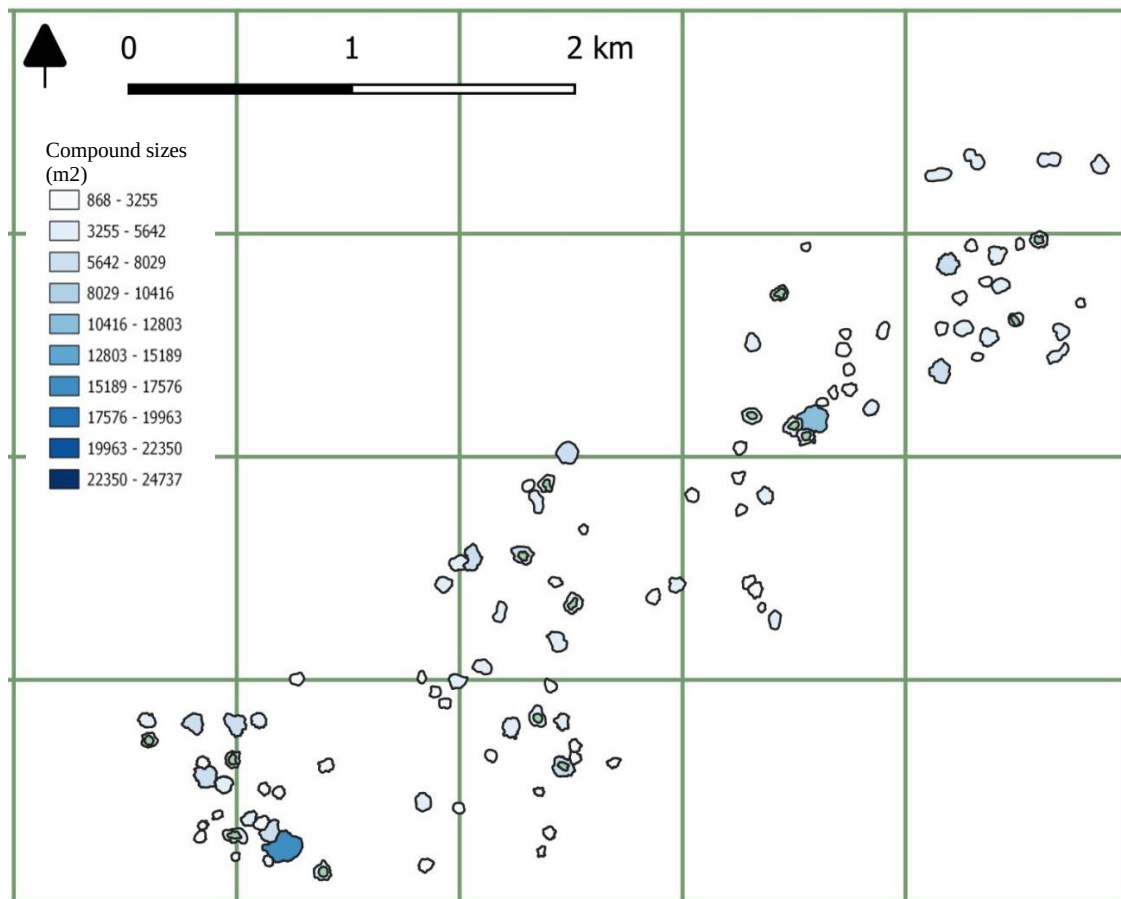


Figure 5.35: Spatial distribution of central enclosures 1045-1523m2 across the varying sizes of compounds at Kweneng north. The compounds with nothing in them have central enclosures outside category 1045-1523m2.

In Kweneng central, Figures 5.36 and 5.37) show that this area has 48 compounds with central enclosures less than 1523m², these are concentrated around the bigger ones and expand northeasterly.

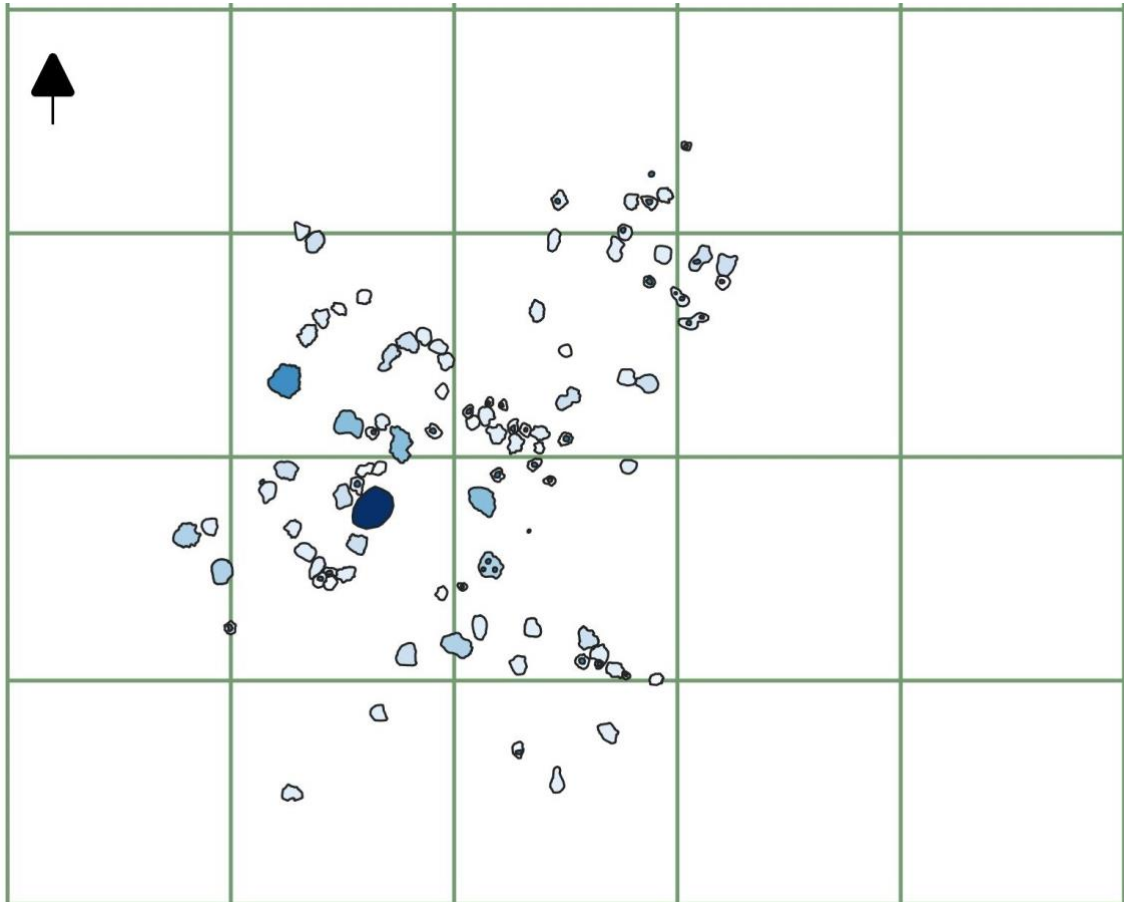


Figure 5.36: Spatial distribution of central enclosures 568-1045m² across the varying sizes of compounds at Kweneng central. The compounds with nothing in them have central enclosures outside category 568-1045m². Legend and scale same as for Fig. 5.35.

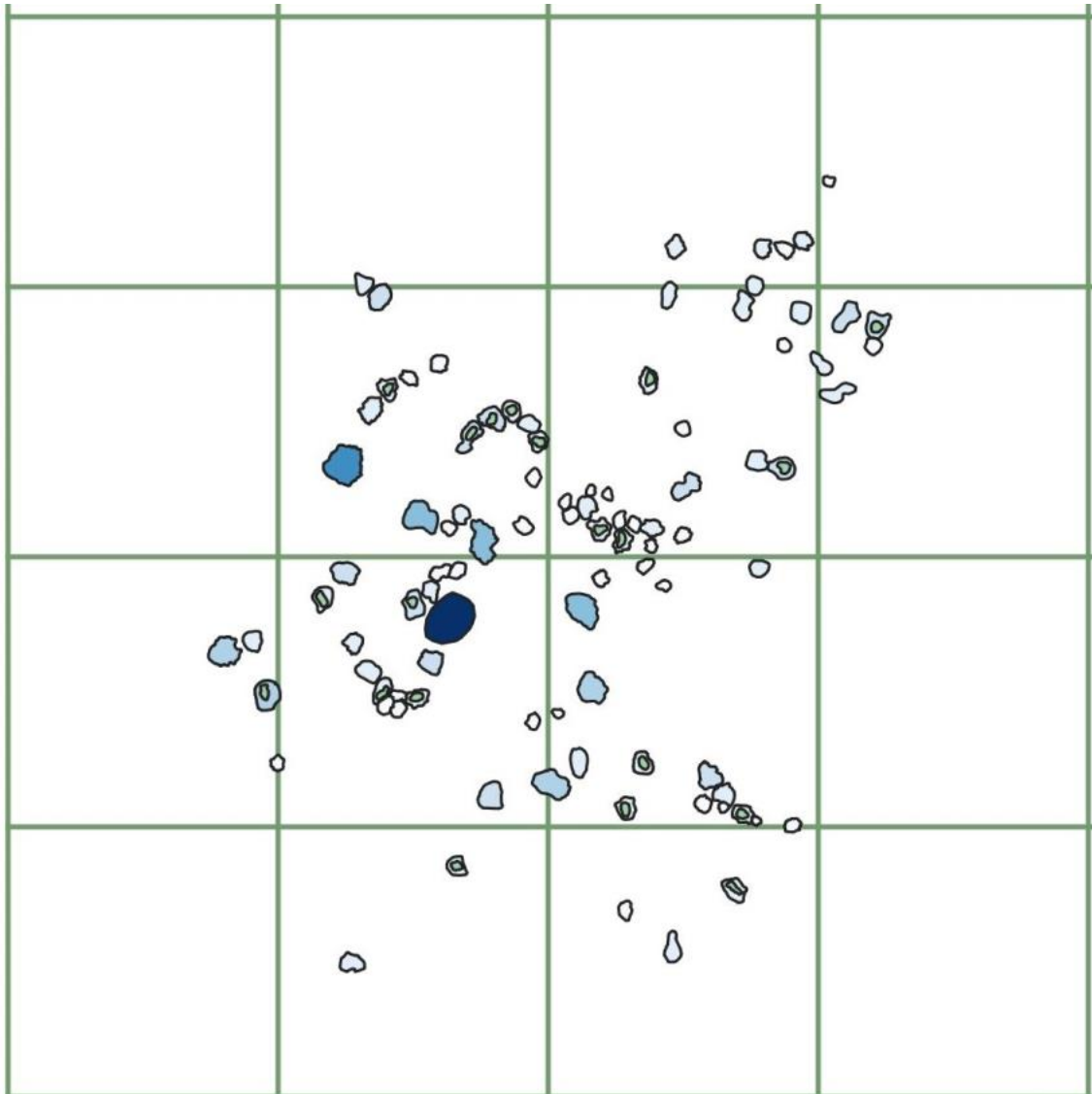


Figure 5.37: Spatial distribution of central enclosures 1045-1523m2 across the varying sizes of compounds at Kweneng central. The compounds with nothing in them have central enclosures outside category 1045-1523m2. Legend and scale is the same as in Fig. 5.35.

In the south (Fig. 5.38 and 5.39), the 42 compounds with kraal sizes 568-1523m² are also surrounding the bigger compounds but they expand southeasterly. Figure 5.36 illustrates the spatial distribution of sizes of central enclosures ranging from 568-1045m², while Fig. 5.37 shows the distribution for size range 1045-1523m².

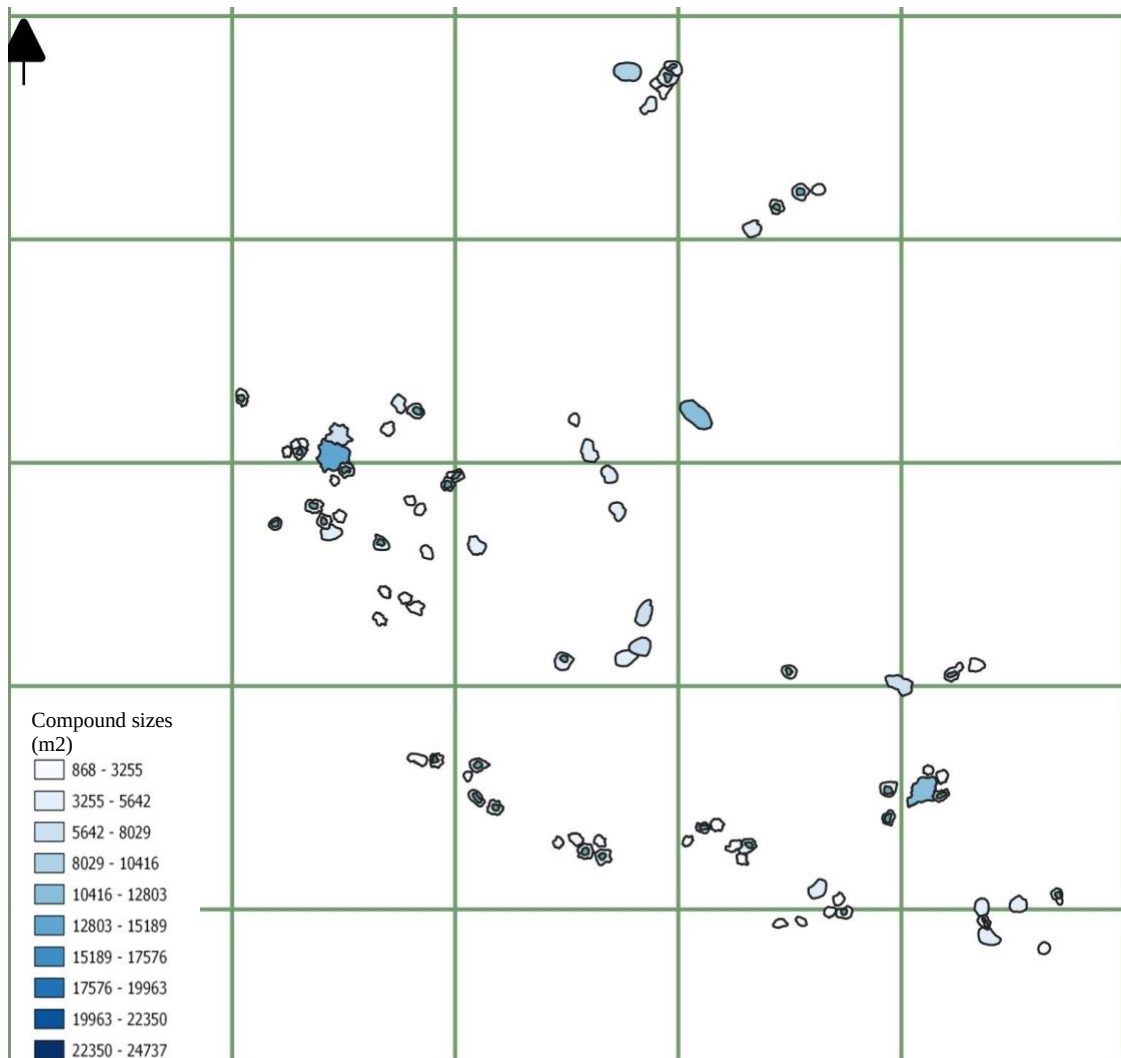


Figure 5.38: Spatial distribution of central enclosures 568-1045m² across the varying sizes of compounds at Kweneng south. The compounds with nothing in them have central enclosures outside category 568-1045m².

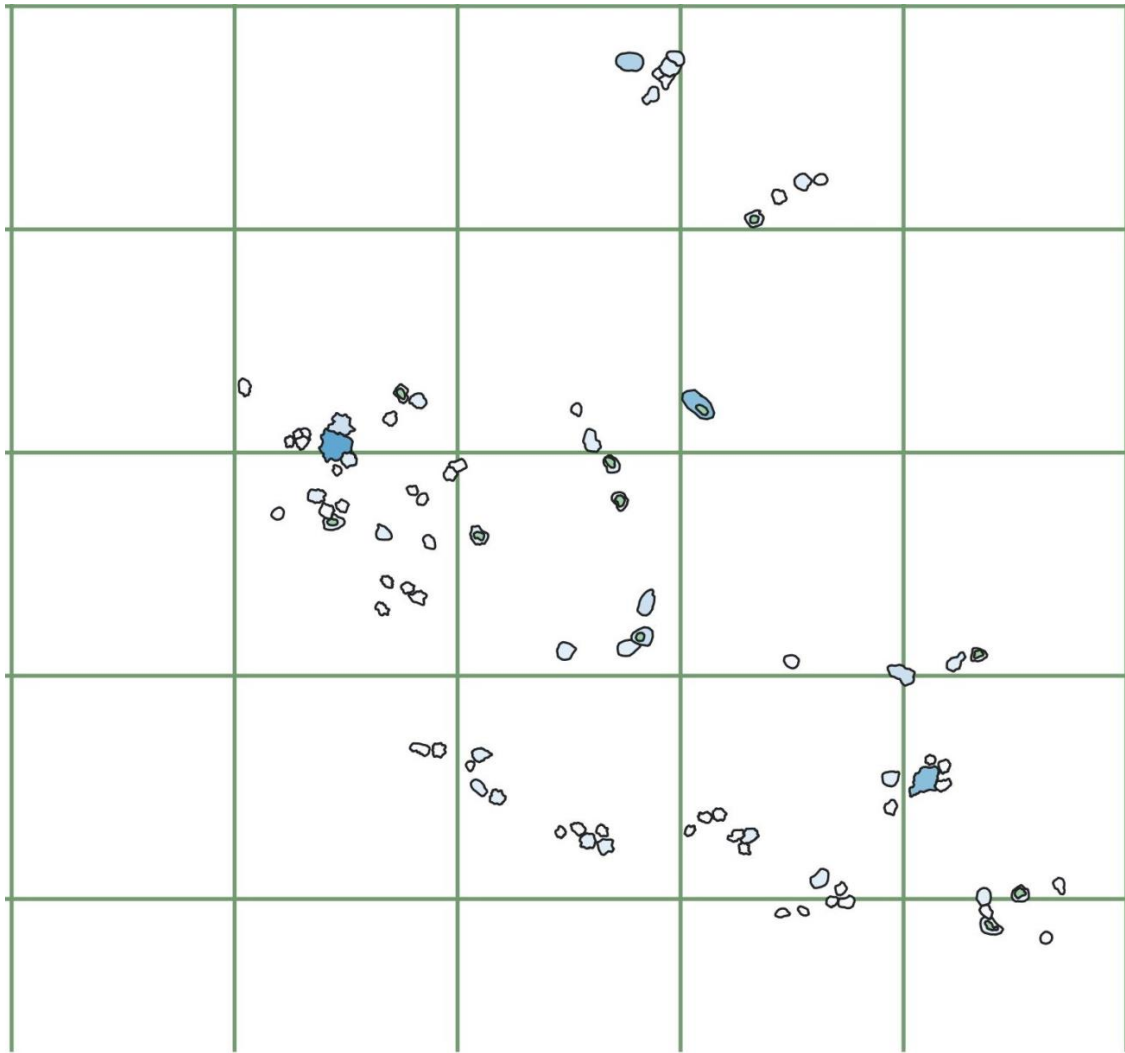


Figure 5.39: Spatial distribution of central enclosures 1045-1523m² across the varying sizes of compounds at Kweneng south. The compounds with nothing in them have central enclosures outside category 1045-1523m². Legend is the same as in Fig. 5.38.

The number of compounds with central enclosures that are larger than 1523m² is reduced, with Kweneng north (Fig. 5.40) only having 12 compounds, central (Fig. 5.41) having 18 compounds and the south (Fig. 5.42) only recording 10.

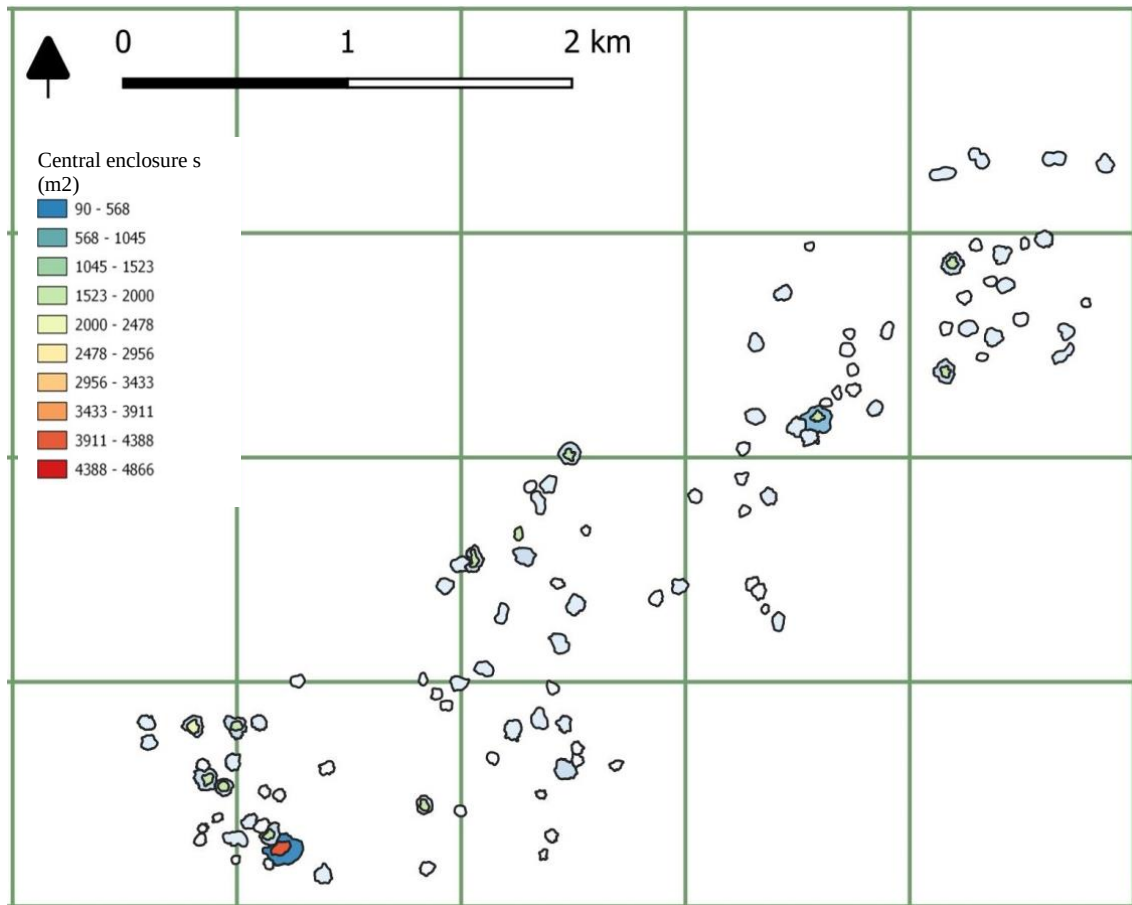


Figure 5.40: Distribution pattern for central enclosures ranging from 1523-4866m2 in Kweneng north

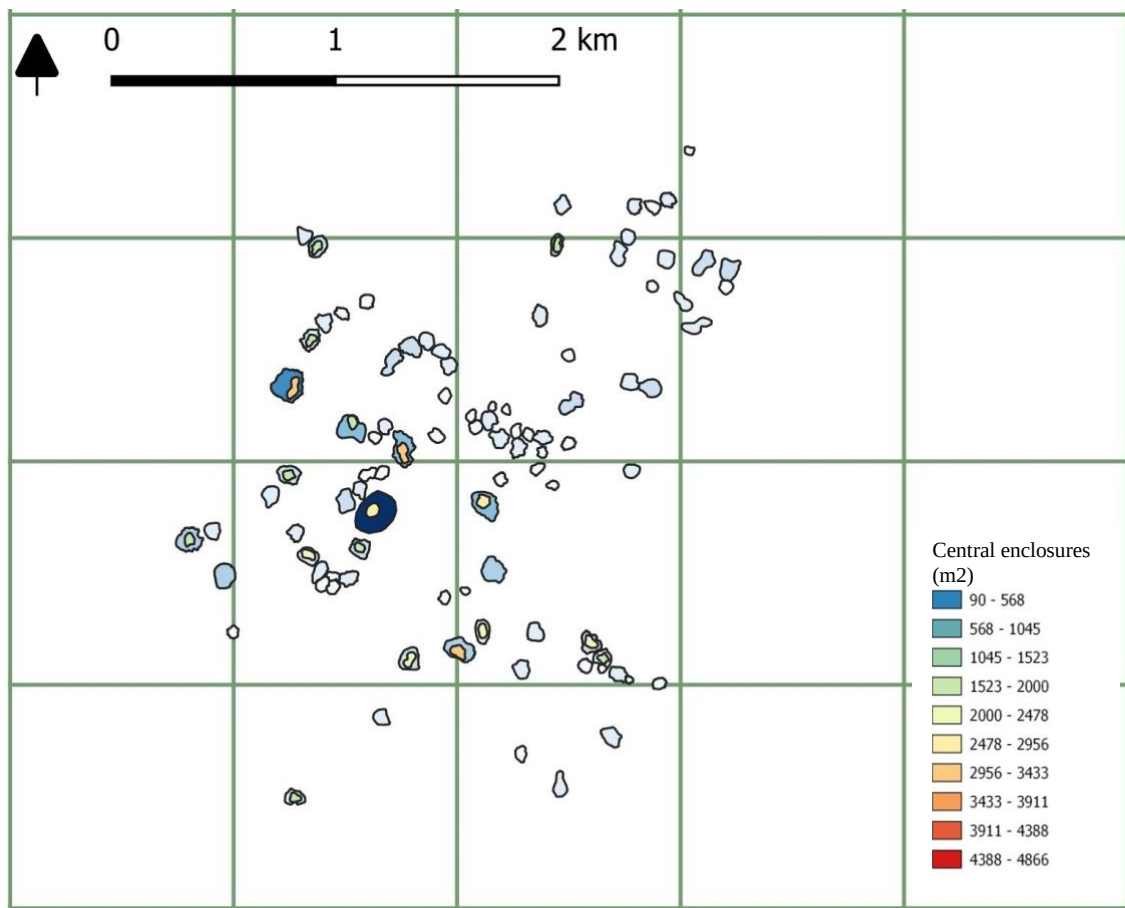


Figure 5.41: Distribution pattern for central enclosures ranging from 1523-4866m2 in Kweneng central.

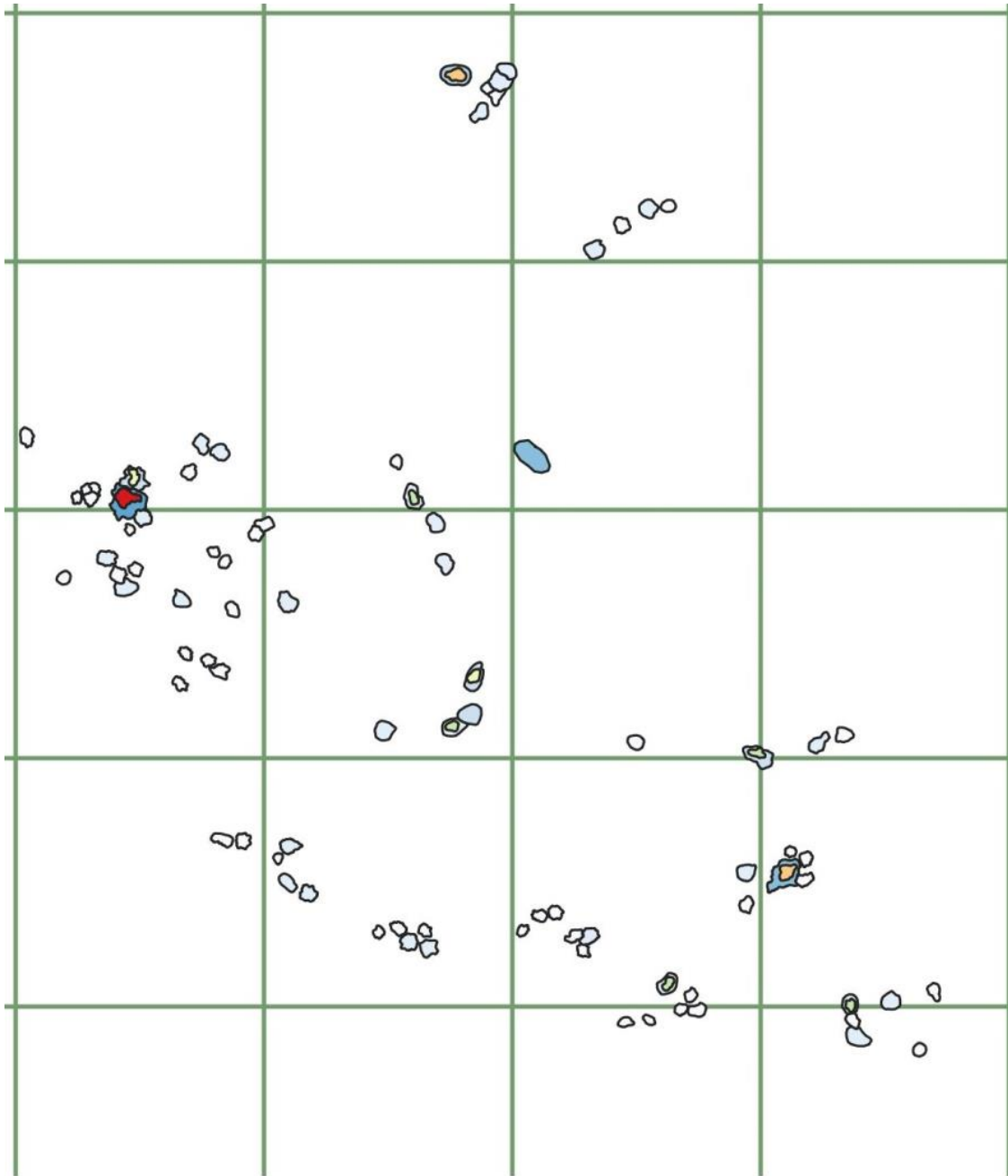


Figure 5.42: Distribution pattern for central enclosures ranging from 1523-4866m² in Kweneng south. The legend and scale are same as in Fig 5.41

5.5 Phosphate analysis

The Southern Gauteng Stone Walled Structures (SGSWS) Project has conducted phosphate tests at several compounds in the Suikerbosrand landscape to establish the presence and peculiarity of livestock enclosures. These previous researches were reviewed to derive general conclusions on whether I needed to carry out phosphate analysis for my sample at Kweneng. These studies used soil phosphate analysis to

distinguish structures where livestock was possibly kept, and other activity areas including households (here meaning houses and their associated courtyards), and control areas as well as the inside and outside of stone-walled structures.

They used the Merckoquant field kit of colour range 1-7 (with 1 being negligible and 7 as the maximum reading). Not all central enclosures yielded high readings and even where they did (mostly 4-6), it was at the edges of some of these structures. The readings were otherwise less than 4. Middens consistently had readings of 4-6, while elevated and low areas fluctuated between high and low readings. Courtyards and some central enclosures yielded high readings while smaller enclosures recorded low levels, and bigger enclosures scored higher levels.

Their results indicate that N, K and M cattle kraals show a low-medium intensity of phosphate reading (2-4). In terms of activity areas, ash middens (composed of burnt dung and organic rubbish) yield generally higher levels ranging from 4-6. Banhegyi (2015) shows that smaller enclosures in his sample yielded low phosphate readings. For example, the structures with a minimum area of 47m² and a maximum of 1059m² yielded low readings, even though their courtyards recorded higher readings. His research further showed that the structures with a minimum area of 561m² and maximum of 9065m² scored higher readings in their central enclosures.

These studies highlight some key issues. High phosphate readings are not peculiar to cattle kraals – other activity areas such as courtyards also yielded higher readings. We cannot at this stage, even after their studies, pigeonhole structures that were used as livestock kraals solely on phosphate readings. A few possible reasons can be put across. It is possible that not all central stone-walled structures were used for keeping livestock. Phosphate readings could be affected by the fact that some structures were probably used for keeping livestock on temporary basis – and resulting in less accumulation of deposits that could yield meaningful results centuries later. Also, Maggs (1976:33) notes that the reuse of dung as fuel can result in less accumulation, and therefore very thinner or lack of dung deposits.

It is also necessary to augment phosphate tests with other forms of chemical analysis so that we can begin to detect the presence of livestock through other elements other than phosphate levels.

In sum, the case studies from Botswana and the results of the Kweneng study in South Africa have shed light on the temporal and spatial indicators that can be used to establish a change in herd management strategies amongst the Tswana. The areas of central enclosures were used to discern patterns that may be indicative of the centralization ideology towards the management of human and livestock population that is characteristic of the 17th and 19th centuries. A decentralized approach in livestock management is evidenced by Ecological Response Cattle Posts (ERCPs), and their establishment is expected to have effect on the space allocated to livestock management at main centres such as Kweneng and Molepolole.

There is peculiarity in the sizes of central enclosures and their relationship to overall compound sizes. The data indicate that, through time, the central enclosures of N, K and M structures became larger. Molokwane structures are showing increased inner spaces as outer spaces increased. A total of 69% of the structures in the central Kweneng are Molokwane style, are mostly characterized by bigger inner spaces ranging from 494m² – 4886m².

The sizes of central enclosures and their proportion to overall compound sizes varied over time and across space. This can be used as an indicator for the presence and periodic movement of livestock in and out of the main settlements.

The results of my research highlight key consideration for studies on herd management strategies. The acquisition of new ideas is a process that gets internalized, and may result in change which is very gradual and customized. As an example, if a reduction in the proportion of space allocated to livestock management (central enclosures) is taken as an indicator for change in herd management strategies, there is need for long-term and multi-pronged research approaches. Change may take longer to reflect, and several indicators or yardsticks are needed to justify it. As an example, with the issue of decentralization of herd management, where do we measure change? Is it only the temporal – transition from N, K and M in the case of Kweneng, and the older sections of

Molepolole occupied since 1865 and new ones established after 1980s? Is it only the spatial – variation across space.

A shortage of pastoral resources immediately near main settlements would result in daily trips to exploit distant pastures – results from Botswana show that this can be 2-3km away. This would result in continued use of central spaces at main settlements, until the carrying capacity is exceeded and temporary or permanent cattle posts are established at 2.5-10km away from the main settlements.

The critical factor in the establishment of cattle posts far from main settlements was the issue of risk from raids, theft, diseases and prolonged droughts – something that would have led to a discontinued use of central enclosures. Also to note is that if the establishment of cattle posts is prompted by risk such as wars or diseases, this may generally result in minimal impact to the sizes of central spaces as the intention would be to bring back the livestock once the risk is mitigated and overcome. There are however instances where these rescue places (risk cattle posts) are better pastured than the original places, leading either to their continuous use or periodic reuse as and when need arise. This would lead to mushrooming of satellite settlements at areas which were initially meant for cattle posts.

The establishment and utilization of cattle posts is a process and not an event. Previous studies noted that decentralization of herd management may firstly start with the central enclosures that are subdivided to manage livestock at family level (Walton 1958; Bonner 2008). One can imagine that as these families gained more wealth, the cattle would have been managed out of main settlements.

The Kweneng data shows that in some cases, a few compounds had more than one central enclosure. They are firstly evidence for increased stock, socio-economic decentralization at compound level, and a transition in the use of space for central enclosures.

6 DISCUSSION AND CONCLUSION

This research set out to review archaeological, anthropological and historical literature on Tswana herding practices. It sought to understand the Tswana of Botswana herd management strategies, with specific interest in the cattle post system and factors that facilitate its establishment. An ethnoarchaeological study of the Kwena in Botswana was carried out to study the evolution of their herd management strategies, both at their main settlement of Molepolole and at a sample of their cattle posts. The nature, types and settlement patterning of selected wards and their kraals at Molepolole, and selected yards and kraals at Mosokotswe and Morabane cattle posts were investigated. The key variables in this process were analysis of the sizes of kraals, their positioning and the proportion of ward space (ratio) that the Kwena allocated to management of livestock at the main settlement and at cattle posts. The central hypothesis of this research is that as the cattle post system is adopted, the proportion of ward space allocated to kraals should decline. Also, through time, there should be variation in the sizes and positioning of kraals at main settlements.

A survey of the literature highlighted several key issues. Investigating livestock (especially cattle) management strategies for herders and herder-farmer societies in southern Africa is a longstanding concern for archaeologists and anthropologists (Schapera 1930, 1943, 1970; Okihiro 1976; Hitchcock 1978; Sadr 1997, 2008, 2012; J. Smith 2005; Denbow *et al.* 2008; Badenhorst 2009, 2011; Huffman 2012b). There were many cattle and they were managed inside or in very close proximity to main settlements.

A few case studies in southern Africa demonstrate an interest in the evolution of herd management strategies. Sites continually occupied from the Early Iron Age to Later Iron age periods by herder-farmers in Botswana have been studied by Denbow *et al.* (2008). Briefly, the research shows that from AD 800–1200 cattle at Bosutswe outnumbered small stock. From AD 1200–1650 cattle numbers continued to rise even though there was no evidence for vitrified dung. Stable nitrogen and carbon isotope analysis was thus used to assess changes in herd management strategies. The results showed that after AD 1200 cattle were kept at outer posts, leading to conclusions that with evidence of an 800-year-long period of herding, Bosutswe society must have sustained a cattle economy through seasonal mobility and the establishment of permanent cattle posts in close proximity to

Bosutswe and at the edges of the Kalahari. In this case, not only was the evidence for continuous occupation at Bosutswe paramount, but where and how the society managed their livestock was also given attention. There was keen interest on how the adopted herd management approaches would have been integrated in the socio-political structure of the society.

Generally, the literature shows that in southern Africa, cattle numbers increased from the Late Iron Age period to present. Their ownership and management was integrated in the socio-economic and socio-political structures of societies. Cattle were initially communally managed and kept in large open central enclosures within settlement units (wards or compound) that made up the main settlements (Maggs 1976; Pistorius 1994; Boeyens 2000; Huffman 2012b; Sadr 2019a; see also the work of Silitsheba 1979 and Morton 2013).

The 17th to 19th century saw human population movement and increase, partly influenced by the socio-political events that characterized this period. Extra families that joined the politically stable societies needed to be managed. This triggered the establishment of extra compounds or wards, commonly known to be appended to the older ones or established as separate entities. The management of additional livestock (where the extra families had them) was also decentralized to the sub-compounds or sub-wards. Decentralization of herd management to sub-compound/sub-ward level resulted in the establishment of their own central enclosures.

It is evident from the literature that through time, an increase in cattle numbers, together with several other factors including climatic variations, necessitated mobility and shifting patterns in herding practices (J. Smith 2005; Denbow *et al.* 2008). Cattle had to be managed inside and outside of settlements through a system that has been termed differently in the literature, owing to its seemingly ubiquitous ideology. The manifestation of this system results in what is commonly known in the literature as cattle posts, cattle camps, cattle encampments and outposts (Campbell 1822, II; Schapera 1930; Hitchcock 1978; van Waarden 1987; Paddayya 1998; Fuller 2001; Butt *et al.* 2009; Smith *et al.* 2010; Huffman 2012a).

Although the origin of this idea is not yet known, the South Deccan and North Dharwar regions of South India offer a comparative beyond Africa. The broad-themed researches range from issues of domestication (Fuller 2001; Murphy and Fuller 2016) to cattle management strategies (Paddayya 1998). Furthermore, the landscape cosmology of the Indian Neolithic and how it was intertwined in arable and pastoral management strategies is given attention (Boivin 2004; Murphy and Fuller 2016). Most importantly, relook at ancient herd management strategies in relation to the physical environment is proposed (Johansen 2004). Cattle ownership and management was critical to the societies in South India, and they were integrated in the socio-political structure of the society (Boivin 2004; Murphy and Fuller 2016). Whether these ideologies, and others from east Africa, got somehow transmitted to herder-farmers in sub-Saharan Africa, or they developed as a parallel, still requires more case studies on herd management strategies within and outside Africa.

Notwithstanding the above, literature specific to Tswana herd management strategies highlights the cattle post system as a long-lived institution. Even though it may have been adopted from elsewhere, it was adapted since the 17th century in response to prevailing circumstances that characterized southern Africa (Campbell 1822, I; Hall 1993; Landau 2010). The Tswana cattle post system is therefore crucial in beginning to piece together evidence on the nature and evolution of the cattle post institution. One thing to note is that despite the literature showing cattle posts are not a new phenomenon, further work is necessary before conclusions can be reached on the origin of the Tswana cattle post ideology. Nevertheless, my research highlights that cattle posts remain an important institution among contemporary Tswana societies such as the Kwena. As such, they offer a platform through which indicators for identifying the occurrence and evolution of the cattle posting process can be investigated.

The study of contemporary Kwena cattle posts shows that at landscape level, cattle posts must be dispersed to minimize environmental degradation. This does not only create enough buffer to allow for environmental regeneration, but also minimizes destruction of property at neighbouring cattle posts. This approach also minimizes cross-breeding and interference with the livestock breeding cycle. In terms of cattle ownership and management, at cattle posts cattle are owned and managed at family or individual level.

At main centres, cattle were communally managed although they were individually owned.

At the cattle post level, kraals and yards must be isolated or dispersed to provide enough buffer for browsing in the mornings and afternoons. Kraals can be owned by a single family or multiple families, leading to bigger sized kraals that take into consideration the current herd size and future growth. The positioning and sizes of kraals is dependent on several issues including the number of livestock and the type of livestock. The ethnoarchaeological interactions revealed that cattle kraals can range from 101-550m², while small stock ranges from 50m² to 200m².

Small stock kraals are often constructed inside yards/homesteads or attached to them, while kraals for calves are inside cattle kraals or attached to them. The availability of shade and drainage issues are also given attention – water from kraals must drain away from houses and yards, and there should be minimal water stagnation during wet periods.

The number of livestock and considerations for environmental degradation near compounds is of paramount importance for cattle posts owned at ward level. The positioning and orientation of kraals considers the direction to which the livestock must go upon leaving the kraals, e.g. away from yards or fields. There is a futuristic approach in planning both the size and construction materials, based on potential expansion of human and livestock population at the cattle post level. Risk from theft, raids and wild animals is also considered in locating cattle posts at landscape and local level.

In a nutshell, my research shows that where the management of cattle was re-engineered from a centralized or communal approach, to a decentralized one at sub-ward level, the sizes of kraals declined. A further decentralization to family-based management typical at cattle posts also affected the positioning, orientation and sizes of kraals at these places.

The main types of the Kwena cattle post system - Ecological Response Cattle Posts (ERCPS) and Risk Management Cattle Posts (RMCPs) is evidence of long-standing ideas which may have been adopted elsewhere and adapted through time. My research has shown that these two types of cattle posts are manifested into three forms. Firstly, there is the concept of *moraka*, being a place where only livestock is kept, and may be very

distant from the main settlement and the other two forms of cattle posts. The second form is the *masimo-moraka* where arable activities attracted permanent keeping of livestock at the place of cultivation. Finally, the *moraka-masimo* is where pastoral activities are located at landscapes which are also most suitable for arable activities.

The Kwena case study shows how the cattle post institution can evolve from being just an occasional phenomenon addressing a particular situation, to an unremitting one that gets integrated in the socio-economic and socio-political structure of a society. Although Tswana farmers are known to build permanent settlements, my research has shown that herder-farmers mobility is inescapable, and is largely a process and not an event, except if it is a short-term mitigatory response to risk such as wars, raids, theft, prolonged droughts and disease epidemics. Furthermore, while being a store for socio-economic wealth, it largely assisted to minimize the occurrence of stray cattle at main settlements (Silitshena 1979). This way, the Tswana cattle post system was a recognizable socio-economic and socio-political tool that was controlled by chiefs and headmen.

However, in the pre-colonial period, the chiefs realized the possibility of cattle posts leading to uncontrollable population movement, and therefore did not allow permanent residence at cattle posts and cultivation areas (Silitshena 1979; Schapera 1980). According to Silitshena (1979) "...as long as the chiefs held sway, buttressed by the colonial regime, dispersion of population to lands and cattlepost areas was impossible or a very remote possibility. The reduction or removal by the post-colonial government of the power of the chiefs to control the movements of their people has created a framework permitting permanent migrations to areas of agricultural activity. The new institution, notably the district councils and land boards, which have inherited the chiefs' powers and functions, are more democratic and sensitive to the wishes of the people..... Although the curbing of the powers of the chiefs by the independent government was not the sole cause of permanent migration to the lands, it created a situation where people could behave in a way they felt was rational. The most important reason for settling there was to be near the lands and livestock. ...In the course of oral interviews especially with the older generations, it became very clear that permanent migrations to the land were not possible until after independence...." (p.55).

It should be noted that here that several reasons could have led to chiefs wanting total control of their societies. The chiefs would have not wanted to lose control of people and their cattle, and at the same time, people needed protection of chiefs because of the raids and wars that characterized the pre-independence period. My research notes here that even though initially permanent residence at cultivation areas and cattle posts was forbidden for the rest of the population besides the herdboys, this does not compromise the idea that cattle posts took away excess livestock from the main settlements. The management of livestock at cattle posts had an impact on the sizes and usage of kraals at main settlement – relatively larger and shared kraals to relatively smaller and shared kraals, and an absence of shared kraals as the cattle post system is fully utilized.

A closer comparative on adoption of the cattle post system can be made with the Kgatla of Kgafela herder-farmers. In a detailed study of land in the Kgatleng District of Botswana, Arntzen and Opschoor (1986) demonstrate intricacies underlying cattle management in mixed farming Tswana societies. They illustrate how availability of suitable grazing areas, watering points and suitable soils for cultivation can facilitate nomadism even amongst highly structured and settled societies such as the Kgatla of Kgafela. The detailed analysis of their data suggests a direct relationship between availability of resources, the amount of livestock kept, and the extent, and or ratio to which a society can practice arable farming. Noteworthy in their study is that rainfall patterns and soil suitability may positively or negatively impact the location of cattle posts, arable and mixed farming areas. As an example, they illustrate that the hardveld and below average rainfall patterns characterizing certain parts of eastern Botswana have contributed to aggregation and dispersal of settlements and cattle posts.

Historically, the central spaces of wards amongst the Tswana had a multifaceted function, and their sizes therefore varied over time. They played a key role as livestock management areas, and as a place where the socio-economic and socio-political decision making processes occur (Schapera 1990; Pistorius 1994; Boeyens 2000; Boeyens and Plug 2011). This means that in the past, central spaces of highly structured societies needed to be bigger to accommodate these activities. The more democratic the socio-political system became, the more space was needed for public meetings. Democratic here means other members of the society being allowed to attend kgotla meetings - still with the chiefs having firm control over the movement of people at cultivation areas and

cattle posts. Silitshena in the quote refers to relaxation of the control of movement of people to cultivation areas and cattle posts.

Also, the more livestock was acquired, the more space was needed to accommodate the stock, which was initially managed communally. Borchers (1861:126) notes there was shared responsibility in the management of cattle amongst the Tswana. On daily basis, herds were divided into groups and placed under management of several men (most probably the less privileged or members of society) who would take them to the grazing areas and return them in the evening. This means that although cattle were individually owned, they were managed at ward-level since a few men would take all cattle in the ward/shared kraal and take care of them on behalf of all the families that make up that particular ward.

Regarding the sizes of kraals, a comparative can be made to Boeyens and Plug (2011: 4-6) work amongst other Tswana groups such as the Hurutshe and the Kwenena. They note that in the past, the Tswana had large kraals and some of them were up to 3375m². It is interesting to note that for the Molepolole sample (98 kraals), the majority of them (94 or 95%) fall at size categories 1862-4478m². This indicates that by the time the Kwenena are at Molepolole and systematically using cattle posts, the proportion of ward space allocated to kraals declines with an active adoption of the cattle posts system.

Subsequent to the documentary survey and a study of variation in the sizes and positioning of kraals, as well as the ratio of kraal space to ward space amongst the Kwenena of Botswana, a similar exercise was carried out at Kweneng in southern Gauteng, South Africa. Kweneng has shown that the landscape is characterized by N compounds (earliest in the sequence), K compounds (transitional between N and M) and the M compounds (most recent). My research at Kweneng highlights variances in settlement patterning, sizes of central enclosures, overall compound sizes, and ratio patterns at Kweneng.

Through time the area of central enclosures in the compounds increased. Type N compounds have relatively small central enclosures. Type M compounds have relatively large central enclosures, while Type K compounds show a bimodal distribution with both small and large central enclosures. The overall chronological trend for the three compound types is clearly pointing to more space being devoted to livestock within

compounds. A comparative of the sizes of Type M central spaces at Kweneng and the sizes of central spaces at Molepolole is illustrated in Figures 6.1 and 6.2. It is evident that a highly stratified Tswana occupation at Kweneng has relatively bigger kraal spaces. With the Molepolole sample, where there is evidence of active utilization of cattle posts, the central kraals are relatively smaller. This is notwithstanding the fact that other socio-political issues could have contributed towards a reduction in the sizes of kraals.

Not only did the sizes of central enclosures vary temporally and spatially, the proportion (ratio) of areas of these central enclosures to the overall sizes of compounds also varied for the N, K and M compounds. This research had assumed that in terms of change and continuity in the sizes of central enclosures, the proportion of area devoted to livestock should become smaller through time as cattle posts are introduced.

The sizes of central enclosures and their proportion to overall compound sizes varied over time and across Kweneng north, central and south. The data indicate that these areas are largely characterized by compound types of ratio range 0.11-0.20, with the south displaying a relatively higher percentage of 52.2%. While the distribution of ratios per compound type shows that ratio range 0.21-0.30 is predominantly K and M, the same category shows that most of these compounds are found at Kweneng north and central. The variation in the proportion of central enclosures to the overall compound sizes across the Kweneng landscape is an indicator for accumulation of livestock (witnessed by increased central enclosures), and this would have necessitated a change in herd management strategies. While Kweneng was allocating up to 30% of the compound area to management of livestock, Molepolole – with evidence that cattle posts were utilized, only allocated up to 10% of the ward area to central kraals.

Although the data indicates that Molokwane compounds were allocating more space to livestock management, not all of them have big ratios – suggesting that a further analysis of these could prove resourceful. Another critical contribution of my research is that although the data clearly shows temporal variation in ratio patterns of the 306 central enclosures, all compound types in my sample at Kweneng are generally not increasing the ratios to more than 30%. As the central space is increased and reworked to create multiple central enclosures in some cases, and also possibly its value reassigned over time, there seems to be a threshold of not allocating more than 30% of compound size to

kraals. This indicator can be used to trace the impact of the cattle post system on central enclosures of Tswana stone-walled settlements. However, multi-disciplinary case studies are necessary to validate and develop a prototype for sizes and ratios of central enclosures that can be used as a check list for identifying cattle posts, or settlements that started as cattle posts in the archaeological record.

The temporal and spatial variation in sizes, positioning and ratio of central enclosures are not the only way to discern cattle posts. Studies in Botswana attest to the number and sizes of kraals (van Waarden 1987) and the extent of kraal middens (Peter 2001; Klehm and Ernenwein 2016) as useful indicators. However, it is proving evident that adoption of more scientific methodologies such as Electromagnetic Conduction Survey allows for a more confident identification of kraals in the archaeological record (Klehm and Ernenwein 2016). The kraals at cattle posts may be bigger and there may be lack of evidence of extensive settlement (see also Cohen 2010).

In terms of technological advancement, Thabeng *et al.* (2019), demonstrate that high-resolution remote sensing is an efficient landscape methodology for identifying pastoral and arable farming activities in the archaeological record. They however note that more and more refined methods are necessary to develop classification patterns for sediments that would otherwise appear similar, e.g. vitrified dung and river sand.

Elsewhere, studies on herding practices of the Maasai in East Africa by Shahack-Gross, Simons and Ambrose (2008) at the Rombo area in southern Kenya used micromorphology, mineralogy, phytolith analysis and studied the isotopic composition of organic nitrogen. They demonstrate that the sequence of abandonment of livestock enclosures resulted in heavy nitrogen isotope increasing at abandoned livestock enclosures. Application of the methodology to archaeological pastoral sites (at the Elmenteitan Neolithic site) showed that these types of sites have a high presence of nitrogen. Studies such as this one are key in the investigation of degraded dung deposits. Critical issues noted by their studies are that there is variance in nitrogen and carbon isotope values for cattle enclosures, small stock enclosures, household areas, midden deposits and local soils within which these activity areas are found. Researches such as these ones would benefit southern Africa where the study on herd management strategies is still at its infancy, especially the application of multipronged research agendas. As an

example, the challenge of isotope analysis to discern cattle enclosures from the rest of other structures could benefit from research in east Africa where soil chemical composition is bearing fruit on the study of subtleties in herd management strategies.

Besides the existing general conclusions in archaeology on the sizes of kraals and material culture, the analysis of human remains at Matanga in Botswana (van Waarden 1987) has shown that a diversity of cultural orientation and representation, as displayed by skeletons or burial practices, may also be indicative of sites that served as cattle posts. Actually, informants in Botswana indicated that burials of cattle post inhabitants are done at main settlements, even though there are instances where burials can take place at cattle posts. For example, cattle posts such as Mosokotswe and Mmamoagi, which were later largely inhabited by people of Kgalagadi and Basarwa origin, had burials at cattle posts.

In conclusion, the ethnoarchaeological study highlights key issues; there are two types of cattle posts, the Ecological Response Cattle Posts (ERCP) and the Risk Management Cattle Posts (RMCP). Cattle posts can be pigeonholed by location, place where cattle are kept, and the settlement patterning. Cattle posts initially have isolated yards, and only retain the pattern of the main settlement (having a communal central space) if that cattle post was assigned to a member of the royal family or representative. Another underlying factor is the distance, referring to the space between yards and kraals at cattle post level, and the required buffer between different cattle posts. The case study in Botswana shows that at least 2.5km buffer would be kept between cattle posts.

At the main centres, there is variation in the sizes of wards or compounds, and the bigger ones are sparsely distributed. Agglomeration occurs as smaller wards or compounds (of the same time period) are appended to the bigger ones. Historically, the Tswana shared the responsibility to manage livestock, and this was done at ward and sub-ward levels. Through time, several factors must have led to a change in ideology from a centrally and communally management approach, to a more decentralized family-level ideology. This research purports that the cattle post system is one of the main contributors. Also, this change in ideology has impact on the sizes of kraals at main centres, with earliest occupations by herder-farmer Tswana societies having bigger kraals (Fig. 6.1), and the later periods having reduced sizes (Fig. 6.2) as cattle posts take away stock from main

centres.

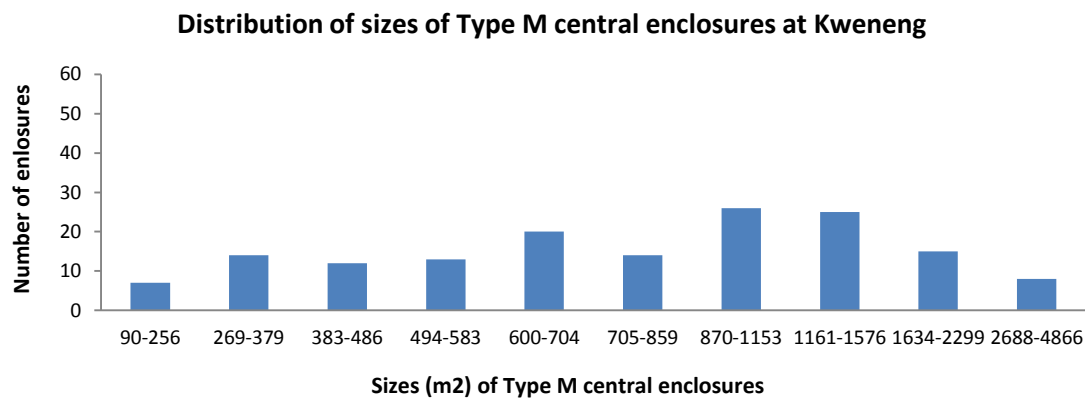


Figure 6.1: Distribution of sizes of Type M central enclosures at Kweneng.

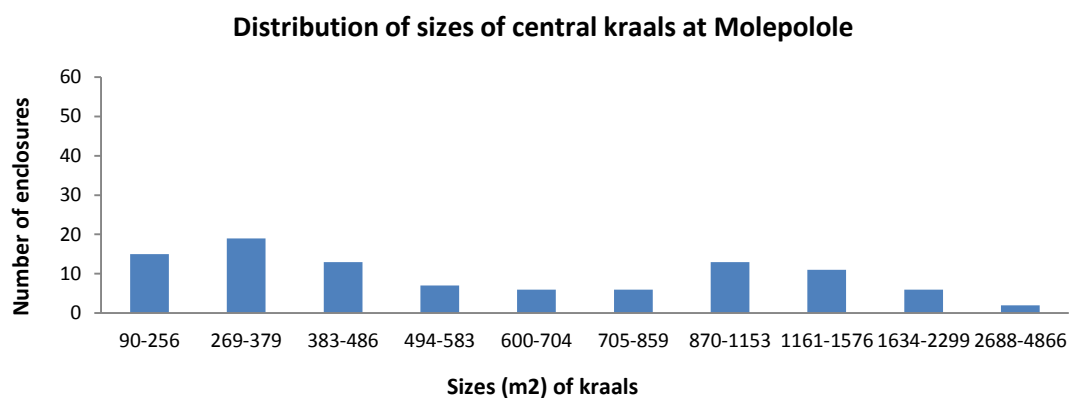


Figure 6.2: Distribution of sizes of central kraals at Molepolole

The kraals in the smaller wards demonstrate that there is a percentage reduction in the proportion of space dedicated to livestock management at main centres. Kweneng shows a percentage reduction from 19% to 10%, while Molepolole reduced from 10% to 1%. Overall, Kweneng was allocating less than 30% (Fig. 6.3) of total compound area to livestock management, while Molepolole allocated only 10% (Fig. 6.4) of the total ward area to kraals.

It is evident from the results of my research that the Tswana cattle post system is a long-lived concept that requires several case studies like mine, and also employing multipronged approaches to be able to pin down its origin. It is recommended that Tswana capitals with LiDAR images e.g. Molokwane and Kaditshwene can be studied to identify stock and central enclosures. The percentage reduction in the sizes of central enclosures at these centres can then be compared with the results of my study at

Kweneng. Further work can also be carried out at Seoke and Makolontwane in Ngwaketse to draw comparisons for Molepolole results.

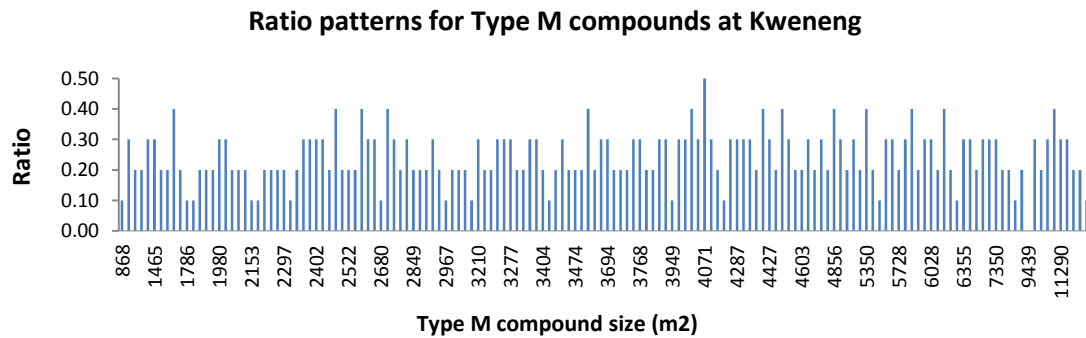


Figure 6.3: Ratio patterns for Type M compounds at Kweneng showing that for my sample almost all compounds allocate less than 30% of their total space to central enclosures.

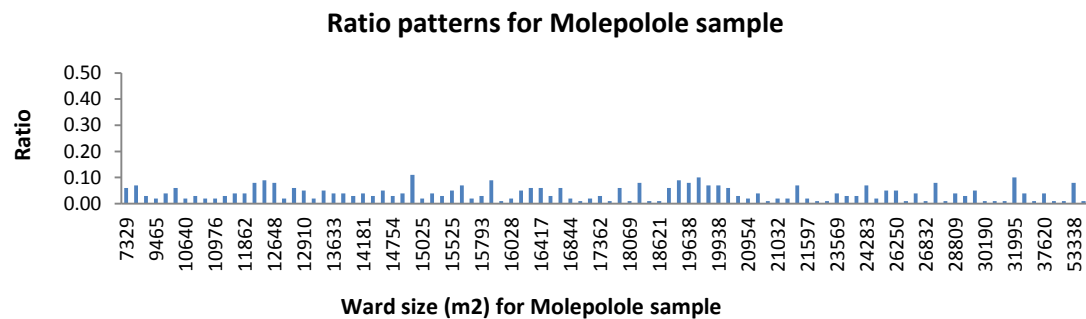


Figure 6.4: Ratio patterns for central kraals at Molepolole showing that for my sample almost all compounds allocate less than 10% of their total space to central kraals.

In terms of methodology, understanding the origin and evolution of cattle posts still require multidisciplinary and multi-stepped research processes. My research offers a platform for a comprehensive research processes that can begin to determine differences between pastoralists and nomadic mixed farmers, and how their settlement patterning and use of space was adapted or transformed over time. Variation in their settlement patterning and use of space, material composition and chemical analysis are necessary.

Also, factors influencing the establishment, management, and the intricacies around the socio-economic and socio-political activities at sites confirmed to be cattle posts still need to be investigated systematically. The availability of grasslands and water are also a crucial consideration, as well as other factors that trigger the need to manage excess

livestock away from main centres. Technological methodologies such as the use of LiDAR imagery and computer-based analysis are necessary for detailed and precise surveys at landscape level (Sadr 2012, 2019b). With this demonstrable precision, LiDAR can be used for detailed and multi-stepped studies at targeted sites and compounds of interest, and generation of diverse testable hypotheses on the dynamics of the cattle posting process derived. Historic Tswana capitals that have already been extensively researched in South Africa such as Molokwane and Kaditshwene, and have LiDAR imagery, can be studied with a focus on varying sizes livestock enclosures. Estimating possible stock populations and grazing zones within their catchment areas can help to develop models for the evolution of the cattle post system. In Botswana, future work may be focused at Kwena sites that have already been documented such as Ntsweng.

Furthermore, regarding phosphate tests, and as a follow up to my research, the compounds with known measurements and ratios of central spaces could be studied in detail to now focus on the individual structures that make up the central space. The sizes of these individual structures must be calculated, the ones that housed cattle and those for small stock, and then soil tests done at targeted structures.

The results of my research indicate that the cattle post institution has a long standing tradition. Among the Tswana, it is a highly institutionalised and two-type periodic phenomenon that comes into use in response to specific factors, and does not disappear when conditions change. This shows that when innovations emerge within cultures, or are adopted from other cultures, change is received and processed in the context of the recipient's worldview. This process may lead to variation from the original idea, e.g. of using cattle posts only when needed then abandoning the idea, to a process where this mitigatory innovation becomes a long-lived culture. In the event that adoption results in a recurrent use of the idea, it is adapted as can be seen by the continued use of the cattle post phenomenon by the Tswana.

The cattle post concept has evolved to become integrated in the socio-economic and political processes of the Tswana. With a checklist of indicators, and further work done, studies such as this one provides a platform for asserting that cattle posts are a very long-lived institution and may be discernible in main centres and satellite settlements.

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