A STUDY OF VEGETATION CHANGE ALONG THE NORTH COAST OF KWAZULU-NATAL FROM THE UMGENI RIVER TO THE TUGELA RIVER

by

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ABSTRACT

The vegetation along the north coast of KwaZulu-Natal has long been considered to have originally consisted of forest, scrub forest and savanna. The classical view is that in the last 600 years the early Africans and European farmers were responsible for the removal of forest and scrub forest along the coast. This view was not based on direct evidence but on the theory that the eastern part of the country has a climate "suitable" for forest and scrub forest. The present 'false' grasslands were thus thought to have developed through anthropogenic influences. All of this has its basis in the paradigm of ecological succession and the presence of a "climatic climax". This traditional view has been contested recently, based on archaeological, historical, biogeographical and ecological evidence that has become available since the 1950's. It is suggested that South Africa's grasslands have been in existence for the last two thousand years but probably for more than ten thousand years. This study aims to investigate this controversy in greater detail, using evidence from archaeological records, travellers records, transcripts, historical reviews, and diarised records.

The locations of archaeological sites within the study area were determined and mapped out, followed by an analysis and interpretation of the data with reference to vegetation change. Archaeological evidence included shell middens, evidence of iron working and pottery remains. The activities of the early humans included iron smelting, agriculture and stock farming. Their activities required the selective use of vegetation for specific purposes, and vegetation was cleared for homesteads and villages. However, the density of people within the study area was low, and there was limited technological development, such that extensive clearing by relatively few people is unlikely. Furthermore, sites are concentrated along the coastline, with fewer sites away from the coast, suggesting that impacts would have been greatest along the coastline. However, this is where forests presently occur. Overall, the evidence suggests that the natural vegetation on the north coast was not modified drastically by precolonial settlers.

Historical accounts of early travellers and settlers indicate a strip of forest along the coastline and a grassland/woodland mosaic away from the coast. Records of mammals suggest a fauna typical of savannas and not forest. With settlement over time, the major activity that impacted on the north coast vegetation, was agriculture. Sugar cane plantations contributed considerably to the clearing of vegetation that seems to have consisted primarily of open grasslands with patches of trees. Colonial settlement of this area resulted in various activities that required the large-scale removal of natural vegetation.

It is important to know the human disturbance history of an area as this helps to assess the extent of change and to design appropriate management strategies for conservation of plant resources. The belief that the early vegetation of the north coast was forest has placed great emphasis on the conservation of forests along this coastal area. Based on this study, it seems that this vegetation type should not be the focus of conservation efforts, but that coastal grasslands with scattered bush clumps should be given much greater emphasis. Grasslands were more widespread in the region prior to European settlement, and based on this, conservationists should place greater emphasis on preserving this habitat.

PREFACE

The work described in this thesis was carried out in the School of Life and Environmental Sciences, University of Natal, Durban, from March 1997 to February 2000, under the supervision of Prof. W.N. Ellery.

This study represents original work by the author and has not been submitted in any other form to another tertiary institution. Where use has been made of the work of others it is duly acknowledged in the text.

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CHAPTER 1

INTRODUCTION

1.1 The North Coast Under Threat

The natural vegetation of the north coast of KwaZulu-Natal is under threat. Agriculture and development have disturbed and destroyed much of the pre-existing vegetation. The result of this is the confinement of remaining coastal forest to coastal foredunes and to isolated forest patches on steep ground unsuitable for agriculture. This stretch of coastal vegetation has been under threat for many centuries, especially as the land was recognised to be fertile and as having great potential for crop cultivation by the colonial settlers. The vegetation of this coastal margin has been highly modified due to agricultural activity and the development of urban nodes. Prior to European settlement Iron Age people also impacted on the vegetation through their use of natural vegetation for the building of homesteads and the use of wood for fires. The people of this time also cleared vegetation for cultivation and they reared stock. The extent of their impact on the natural vegetation during their period of occupation has been a subject of debate (Ellery & Mentis, 1992).

Even early accounts of the vegetation of South Africa indicate the destructive nature of humans on natural vegetation. Pole Evans, in a 1917 account of the vegetation of South Africa, stressed that it was necessary to have a picture of the present vegetation of South Africa since many parts of the country were undergoing "rapid development under the influence of man", and it would follow that there would be considerable changes in the character and distribution of the existing vegetation (Pole Evans, 1918). He described the loss of important timber and forest trees, and considered overstocking and grass fires as being responsible for this. He listed settlement, cultivation, drainage and irrigation as some of the main activities that altered the original landscape.

The coastal margin continues to experience the growth of urban and peri-urban development and the coastline is seen as an opportunity for economic development, with the Port of Durban at the southern end and the Port of Richards Bay further north. This area has vast stretches of magnificent beaches and it has tremendous potential for tourism. This may result in the development of more beach resorts and/or the expansion of existing resorts. Nodal development is most likely along the north coast resulting from the recently upgraded transport route, which makes coastal towns more accessible. The greater capacity of the N2 national road provides opportunities for various activities to occur along this coastline.

1.2 Conservation Through Open Space Systems

There is interest in the development of this area occurring in a manner that does not compromise the natural environment to a great extent. It is hoped that sustainable development will thus be achieved by maintaining a network of conservation areas in keeping with open space systems elsewhere in the region and in the world. This may be possible through a more holistic and integrated approach to urban planning. In the past urbanisation in South Africa has disregarded ecological value and has resulted in certain species being threatened. As a result of this it has become important for open space systems to be an integral part of the design and planning of urban developments (Roberts, 1994).

There are many areas along this coastline that have tremendous conservation value and many pristine areas which have the potential for ecotourism. Apart from the many values that urban open space systems have (Parks Department, Durban, 1994), such as aesthetic, recreational and temperature regulation, of particular importance in this context is the value of open space as a means to conserve indigenous vegetation (Roberts, 1994).

1.3 Vegetation Change

According to Acocks (1953) natural vegetation change is a consequence of vegetation succession. This was the foundation for Acocks's classification of the vegetation types of Southern Africa. Ellery & Mentis (1992) however, have contested his explanation of how the vegetation of South Africa has changed, with specific reference to the age of South Africa's grasslands.

In his famous "Veld Types of South Africa", Acocks (1953), described the east coast of South Africa as being extensively covered by forest and scrub-forest in the past. He proposed that in the past six hundred years this vegetation was replaced by grasslands, which he termed "false grasslands". He attributed these changes to the activities of the Bantu-speaking and European settlers. Bews (1920) described the chief climax vegetation along the Natal coastal belt as forest. He also indicated that the grasslands in this area were very unstable and that fire played an important role in preventing succession from going any further. Bews (1920) stated that "pure grassveld areas" along the coastal belt were not extensive. White (1983), in his description of the vegetation of the Tongaland-Pondoland region, describes secondary grasslands which replaced coastal forests as the latter were destroyed.

Acocks's (1953) work on the vegetation of South Africa became the foundation for many courses taught at tertiary educational institutions (Feely, 1987). Since Acocks's (1953) first edition of the "Veld Types of South Africa", an ecological paradigm emerged which persists up to the present. Many authors, including Feely (1987) have recently challenged this paradigm and in particular, Ellery & Mentis (1992) have contested Acocks's (1953) theory. They based their argument on evidence from various fields of study including archaeology, palaeobotany, biogeography and ecology. While there may have been alteration of the boundaries of biomes in the past few hundred years these authors suggest that it seems unlikely that there was a biome-wide alteration such that one biome was completely replaced by another biome. In particular it is unlikely that the early Iron Age and/or European settlers cleared vegetation to the extent that there was a biome-wide change (Hoffman, 1997).

The role of fire in the modification of vegetation is also of importance, since humans have been using fire for thousands of years (Ellery & Mentis, 1992). According to Acocks (1953) the climatic climax vegetation of the east coast should be forest and scrub-forest, however natural fires, edaphic factors and fauna indicate that the distribution of grasslands in this area may have been as they are today, for a long time, possibly several thousand years (Mentis & Huntley, 1982). Ellery, Scholes and Mentis (1991) suggested that distribution of the grassland biome is determined by climate. Despite many grassland and savanna areas having the ability to support forest vegetation, disturbance regimes (e.g. fire) prevent this from happening. The fire disturbance regime is natural and is viewed as being under climatic control (Ellery, Scholes & Mentis, 1991). Natural fires are considered inevitable in areas with strongly seasonal rainfall where there is a prolonged dry season.

1.4 Implications for Conservation

Work of this kind is important from a conservation perspective. At present there is the general view amongst natural scientists and the public at large that the north coast vegetation was forest and scrub forest, and that this should remain a priority for conservation. It is believed that this forest was subsequently removed due to settlement (Wager, 1976), development and agriculture. It is for this reason that conservationists working along the north coast have focussed primarily on forest conservation. However, if grasslands were widespread in the area, then we should probably place more emphasis on preserving this habitat.

It is important that we ascertain whether grasslands encroached into the coastal forest biome or whether the present vegetation along the north coast of KwaZulu-Natal has been unchanged for the past few thousand years. Knowledge of the most accurate representation of the earliest vegetation of this area will assist us in developing proper management systems in order to conserve the vegetation in a sustainable manner.

1.5 Aim and Objectives

The earliest vegetation of the north coast is unknown. Although most of the removal of natural vegetation has occurred during the modern era due to technology and industry, the extent of early human impact is uncertain. The **aim** of this study is to determine the patterns of vegetation distribution of this area prior to human settlement. This study investigates the impact of Stone Age and Iron Age humans as well as European settlers on the vegetation of this area.

The following **objectives** were identified in order to achieve the aim:

- To determine the patterns of settlement of the Iron Age Bantu speaking people in the region.
- To determine the possible impacts on vegetation by these Iron Age settlers, by investigation of relevant information from archaeological records.
- To determine the nature of the vegetation prior to settlement of the region by European settlers, by studying the earliest European travellers' records.

1.6 Structure of the Thesis

Chapter Two reviews the theoretical debate that forms the background to this study. The role of humans in vegetation change in the area over time is reviewed. In this regard Acocks's views are compared to that of more "modern ecologists". There is an examination of the work of Acocks with reference to the vegetation of the study area and consideration of contemporary views of the vegetation of this area. The prevailing ecological paradigm of ecological succession at the time that Acocks published his work, is discussed. Classical views of succession and the concept of the climatic climax are examined, followed by a review of succession theory after Clements. Finally there is a discussion of the current views on the climax vegetation of the north coast.

Chapter Three, entitled "The Study Area", describes the area in question, its boundaries and its characteristic features. This chapter gives an account of the climate, geology, soils, physiography, coastal morphology, vegetation and conservation status, land use, socioeconomic conditions and settlement patterns of the north coast.

Chapter Four investigates the impact of precolonial settlement on the vegetation of the north coast. The methods used are described and the results are presented primarily in tabular form. Accounts of archaeological finds in the area and elsewhere in the province are used to establish what activities brought these early settlers to this area. An attempt is made to recreate the lifestyle of these people in order to understand their impact on the vegetation. The archaeological records are mapped to establish patterns of settlement.

Chapter Five gives an account of the impact of colonial settlement on the area. The major activities that took place here are examined. Historical records and historical texts form the bulk of the sources of information used in this chapter. The strong influence of agriculture in this area is discussed in detail in order to establish the major impacts on the vegetation during this period.

Chapter Six attempts to consolidate the findings and conclusions reached in chapters four and five in order to provide a holistic picture of the impacts of settlement on the vegetation of this area. The role played by seasonal rainfall and natural fires in vegetation change is examined. It is here that an attempt is made to fulfil the aim of presenting a description of the vegetation of the north coast prior to settlement.

CHAPTER 2

THEORETICAL BACKGROUND

2.1 Introduction

Conservation along the north coast emphasises the conservation of the "natural environment". It is however, uncertain what exactly is meant by "natural". This is of concern if one considers that humans have inhabited this area for thousands of years. Wherever humans have settled or passed, their activities have had an effect on the original state of the environment. This raises fundamental philosophical questions about what nature conservation organisations should attempt to achieve in their conservation efforts. On the north coast of KwaZulu-Natal it is difficult to know exactly what is natural because the landscape has been dramatically altered over the last 200 years and there is little record of what the landscape was like prior to settlement by Iron Age or European settlers. These are important issues that need to be considered by conservation organisations such as the KwaZulu-Natal Nature Conservation Services and the Wildlife and Environment Society of South Africa.

Traditionally it has been considered that the "natural environment" that needs to be conserved along the KwaZulu-Natal north coast is coastal forest (Wager, 1976). This seems to be justified by the reigning view that prior to human settlement much of the province was covered in forest, scrub forest and savanna. This view had a strong foundation in early views of vegetation succession and the existence of a "climatic climax" (Clements, 1916). Acocks (1953) based his views very much on the paradigm of plant succession. In his "Veld Types of South Africa", Acocks proposed the view that much of KwaZulu-Natal was covered in forest, scrub forest and savanna.

The vegetation of South Africa, according to Acocks (1953), is a result of millions of years of natural vegetation migration. A secondary influence on the vegetation has been the activities of Iron Age Bantu-speaking people and European settlers during the last

300 years and particularly the last 100 years. Acocks (1953), in his classical view of the origin of grasslands, identified the grasslands of the eastern part of South Africa to be 'false' grasslands. He claimed that these grasslands replaced the original forest and scrub-forest vegetation of this area as a result of human disturbance in the last 600 years. His assumption that the original vegetation of this area was forest or scrub-forest was rooted in the theory of succession, which proposed that the climax vegetation of an area was influenced primarily by climate. Acocks (1953) viewed the climate of the eastern part of the country as "suitable" for forest development. This view was supported by the fact that this area received high rainfall (greater than 800 mm per annum), which was favourable for forest or scrub-forest growth.

This chapter will elaborate on the classical views of succession and the concept of climatic climax. Vegetation succession after Clements looks at the individualistic hypothesis, the continuum concept and allogenic succession amongst others. This is followed by the current views held with regards to the role of humans in vegetation change along the north coast, and the importance of studying the disturbance history of an area. The strong influence of Acocks's work is discussed, with particular reference to the paradigm of ecological succession. Finally current views on the climax vegetation of the north coast are discussed, with reference to work done by Ellery and Mentis (1992) on the age of the grasslands of South Africa.

2.2 Succession Theory

2.2.1 Classical views of Succession and the climatic climax

Vegetation is dynamic and various processes influence the changes that occur. One significant process of natural vegetation change is succession. This process was first reviewed by Clements in 1916 (Luken, 1990). Ecological succession was first described by a French biologist, Dureau de la Malle in 1825 (Golley, 1977). Plant communities all over the world change as they age. These changes include replacement of species and shifts in population structure, as well as changes in availability of resources such as light and nutrients. Since Clements's work was published in 1916 the concept of regular patterns of vegetation change has become an important subject in vegetation ecology (Burrows, 1990). Succession is basically explained as follows: "One group of plants establishes and is then replaced by another group until a stable state is reached" (Luken, 1990). Succession can be described as an orderly sequence of development over many years until a stable or "climax" community is reached (Mitsch & Gosselink, 1993). The limiting factor with regard to succession is traditionally viewed as the climate of a region.

Early views of succession viewed plant cover as a complex community from which animals and humans sought shelter, food and resources. This community, was viewed as "essentially an organism" which possessed structure and underwent development. There was coordination of functions and the whole "organism" was viewed as a unified mechanism which was more effective than the individual constituents acting on their own. This "organism" had properties of its own. This concept was first introduced by Clements in 1916. He claimed that the climax community as an organism, arose, grew, matured and died.

The theory of vegetation succession as described by Clements (1916) was associated with an elaborate terminology. It started with **nudation** (provision of new sites). This was followed by **ecesis** (plants establish, grow and reproduce). Also included in this view of succession are **action** (effects of the environment on the plants), **reaction** (effects of the plants on the environment and their response to the environmental effects), **competition** and **stabilization**. The term **sere** was also introduced at this time to define a stage of succession from the pioneer to the climax. The term **seral** derives from the term sere, and is used to describe developmental phases. **Cliseres** are initiated by major climatic shifts (Burrows, 1990).

Successions that occur on recently exposed land and occur in the absence of external changes in abiotic factors are termed **autogenic** succession (Begon, *et al.*, 1996). In the instance where the landform was bare and was being settled for the first time, this was termed **primary succession**. This type of succession takes hundreds of years to reach the climax stage. **Secondary succession** follows fire or cultivation, when existing disturbed land is left bare, and this type of succession may be complete in less than half a century. The initial processes of aggregation and migration contribute to formation of the community. Growth of the community is influenced by soil and climate (Allred & Clements, 1949).

According to succession theory, the communities go through various changes until the final community, termed the climax community, is attained. Every climate has a specific climax community (Allred & Clements, 1949). The climax constitutes the major unit of vegetation and forms the foundation for the classification of plant communities. This view that a single climax exists in any given climatic region, i.e. the **monoclimax** view, was contested by many ecologists. The **polyclimax** view holds that a local climax may be influenced by one factor or a combination of factors, such as climate, soil conditions, fire and topography. Hence a single climatic area may contain a number of specific climax types (Begon, *et al.*, 1996)

Any community that is more or less permanent and resembles the climax to a certain degree is termed the **proclimax**. This may be replaced by the climax in the absence of disturbance and under the influence of the climate. The **subclimax** is the general term used to describe the stage preceding the climax in all complete seres (Allred & Clements, 1949). **Disclimax** is frequently represented by climax communities that are modified through disturbance by humans and domestic animals. This type of community also results where the true climax vegetation is replaced, for example, by alien species. **Serule** is the diminutive of the term sere, a term used to describe miniature successions that run a short course within a larger community.

2.2.2 Views on Vegetation Succession after Clements

Many plant ecologists found the monoclimax concept to be unrealistic at regional or local scales as the habitat conditions are not homogeneous. This results in local vegetation patterns being diverse. This led to the development of the polyclimax concept by some ecologists, most notably Whittaker, during the period up to the 1930s (Burrows, 1990). Whittaker further proposed the **prevailing climax concept** which states that climax communities are relatively stable and self-maintaining within the vegetation continuum (Burrows, 1990).

As early as 1917, Gleason proposed an **individualistic hypothesis** to describe the distribution of plant species (Mitsch & Gosselink, 1993). Gleason's view proposed that recognised vegetation units are temporary and fluctuating (Burrows, 1990). Species come together due to their overlapping environmental requirements, but essentially species behave as individuals and adapt their own responses to environmental variations. Vegetation therefore varies in space and time. Hence, succession according to Gleason, is not an orderly process and does not lead to a definite climax, but rather tends to be stochastic with much more noise than pattern in the process of vegetation development.

These ideas have developed into the **continuum concept** which states that individual species responses to the environment determine vegetation composition and distribution (**allogenic succession**). Each species responds individually and therefore different species occupy different zones. There is a continuum of overlapping sets of species, as each species responds to slight differences in the environment. In this view no "communities" or clearly defined associations of species exist as proposed in Clementsian succession. Although changes occur in the ecosystem, there is little evidence to indicate that this change is directed and that a particular climax is attained. In the classical view of succession there is zonation of vegetation that simply reflects different associations of species, but in the continuum concept the zonation is an indication of an underlying environmental gradient (Mitsch & Gosselink, 1993).

Some ecologists have considered eliminating the use of the term 'climax'. Proposed alternatives to terms such as 'seral' and 'climax' were 'intermediate' and 'most advanced phases' of vegetation development. Since it is unlikely that absolute stability is possible, it was recommended that the term 'climax' be replaced with 'steady state', while some ecologists preferred the term 'mature'.

Succession was the reigning ecological paradigm at the time that Acocks (1953) was studying vegetation in South Africa, and the notion of a "climatic climax" strongly influenced his ideas on the nature of vegetation prior to human disturbance. The high rainfall and generally mild temperatures characteristic of the coast of KwaZulu-Natal and the Eastern Cape, led him to conclude that prior to human disturbance, much of the land to the east of the Drakensberg escarpment was covered in scrub forest and/or forest (Fig. 1).

2.3 Current Views on the Role of Humans in Vegetation change

It is important to know the human disturbance history of an area. Knowing the extent of transformation enables one to partition climatic and anthropogenic effects to seek important interactions where they might exist (Hoffman, 1997). Knowledge of the disturbance history of an area assists in the construction of baseline vegetation patterns that may have existed prior to human settlement. A comparison of the present vegetation of an area with "hypothesised pre-human constructs" provides a clue to the extent of change in an area (Hoffman, 1997).

The vegetation of an area constantly changes through natural processes. Throughout the history of humankind however, there has been interaction between natural processes and human interference, which varies temporally and spatially. During the period of occupation by early humans, people impacted on vegetation by burning and cutting vegetation or by tilling the land and keeping livestock. As human activity increased, the natural character of landscapes changed. This pattern of disturbance by humans has

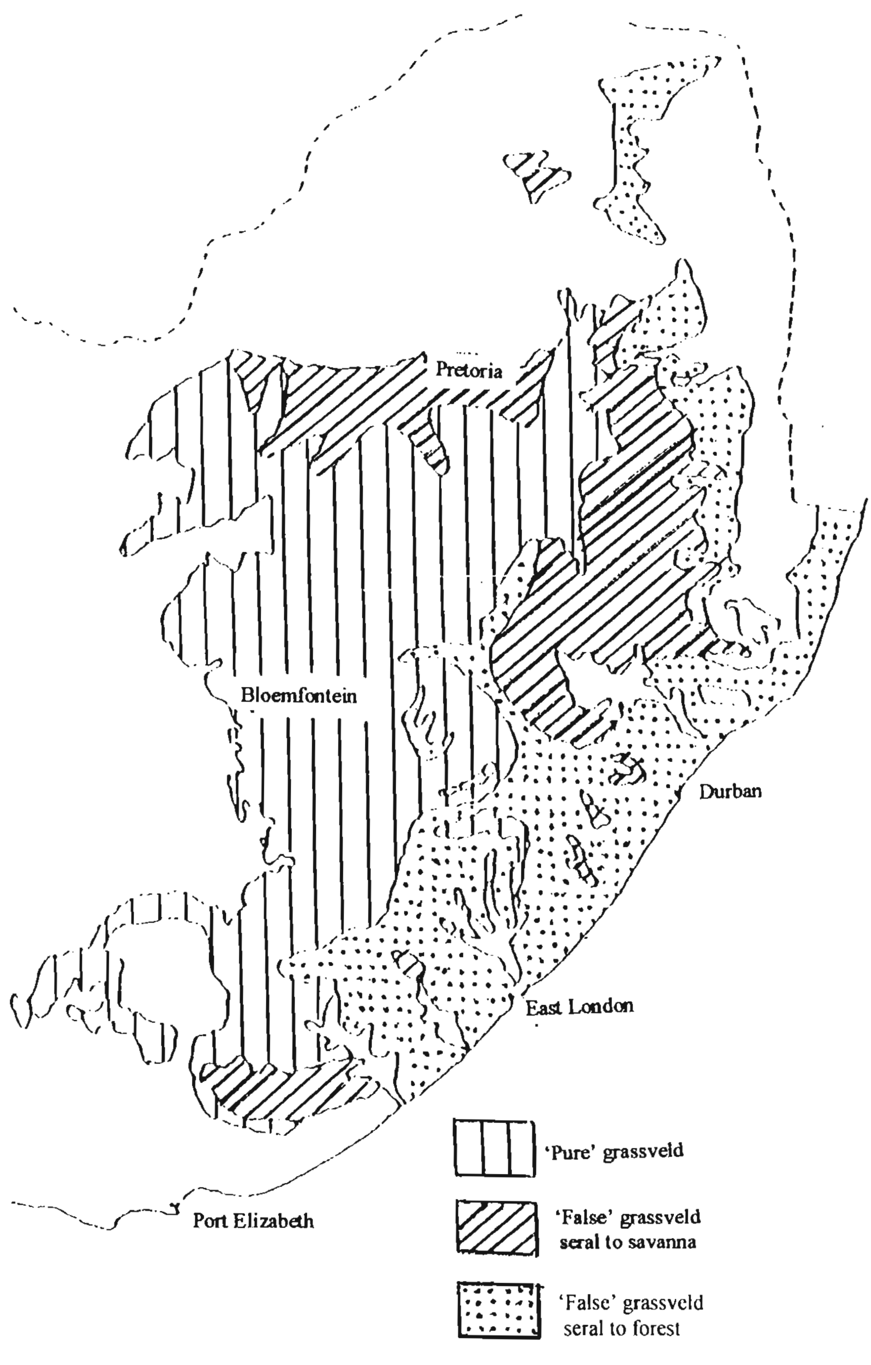

Fig. 1. The major vegetational divisions of the grassland biome (after Mentis and Huntley, 1982).

escalated in recent times and there are few areas in South Africa that have been spared human influence (Luken, 1990).

The north coast of KwaZulu-Natal is no exception to human disturbance. The influence of humans is quite evident by the vast areas that are now cultivated. Durban is now a major city in South Africa, but about 500 years ago it had just been reached by travellers from the western world and it was not until late in the 15th century that European settlers had sighted the land and realised what potential the land had for settlement (Mackeurtan, 1930). By the 18th century cultivation was well established as a major activity of the European settlers (Hattersley, 1950).

Hoffman (1997) discusses the importance of knowledge pertaining to southern Africa's disturbance history and relates the 'slash-and-burn' agriculture of the early Iron Age farmers to the change in vegetation along the coastal forested areas. He postulates that the activities of these farmers resulted in the clearing of coastal forest margins, which, in a few hundred years, led to an increase in the extent of scrub and grassland biomes. This has been contested by McKenzie (1989), as he is of the view that the activities of the Iron Age people were insufficient to cause such significant changes. McKenzie (1989) rather proposes that there has been an increase in the woody vegetation of some areas. Commercial crop cultivation is listed as having the greatest impact on terrestrial biota, especially by replacing natural vegetation. The coastal lowlands of KwaZulu-Natal have received the greatest impact from the cultivation of sugar cane. This started in the 1840s and by 1866 over 5000 hectares of land was under cultivation (Hoffman, 1997). Today, much of the coastal lowlands are cultivated under sugar cane.

2.4 Early Settlement Patterns

Hominids have existed in southern Africa for at least the last 3 million years (Hoffman, 1997). There is general agreement amongst authors that the coastal lowlands of the northeastern seaboard were initially occupied by Iron Age agropastoralists. Areas north of Durban were settled about 1800 B.P. The exact details of the movement of early human settlers in this area has been debated. It is suggested that the Stone Age settlers have been on the subcontinent for the last one to one-and-a-half million years. Their use of fire since approximately 150 000 years ago would have influenced the natural fire regimes. It is difficult to ascertain the impacts of early humans as a result of incomplete archeaological and palaeoecological records (MacDonald, 1989). It has often been assumed, on the basis of very little evidence, that the vegetation of certain areas of the subcontinent have been human-induced. This has led to controversy based on studies of archaeological material and evidence. An example is the grassland vegetation of the Transkei, which was suggested to be man-induced by Acocks (1953), but archaeological evidence suggests that this area has been dominated by grasslands for more than 10 000 years (Feely, 1987).

The impacts of human settlement and human activities on vegetation change are subject to debate. The 'classical' view of land degradation in southern Africa holds that during the modern industrial period in the last few decades, southern Africa has experienced the most vegetation degradation (MacDonald, 1989; Hoffman, 1997). This view is based on the fact that modern technology and an ever-increasing human population have placed great pressures on the land resource. However, many authors also consider the impacts of early humans to have contributed significantly towards vegetation change. The activities of early humans (including agriculture, livestock grazing, and settlement) would have impacted on the vegetation, but there is still uncertainty as to the extent of their impact (MacDonald, 1989).

The older views with regard to the migration of Bantu-speaking farmers into southern Africa from the north, at the time that Acocks (1953) was formulating ideas about historical change in vegetation distribution, indicate the belief that the movement of these people occurred in successive waves. It was believed that this occurred at about 400-300 B.P. across much of the subcontinent. The routes used by these early farmers were proposed around 1905 by Stow (Feely, 1987). However these views were not supported by historiographic or archaeological evidence, but were rooted in speculation and on the pattern of settlement of the subcontinent at the time of European settlement. This view of the history of these early farmers had been accepted and was even taught at tertiary level at the time that Acocks's work was published initially in 1953. This view, as well as Acocks's view of the grasslands of the eastern region of South Africa, were based on indirect evidence, and based on more recent evidence it is possible to shed more light on this matter.

By 1979, archaeological evidence gave new insight into the views related to the settlement of early Iron Age farmers in South Africa. With the aid of radiocarbon dating, the settlement of these farmers dated back to about 1500 B.P. By 1982 the availability of more information resulted in the dates being amended to 1750 B.P. (Feely, 1987). This more current view proposes that early Iron Age farmers settled along the coast of Natal as well as in the lowveld of the Transvaal and Mozambique, about 1750 B.P. or earlier. These settlements expanded inland, along valleys below 1000m above sea level in KwaZulu-Natal.

Modern ecologists have been strongly influenced by Acocks in their views of the state of vegetation prior to the arrival of Iron Age and European settlers. Acocks's work had become the most influential ecological text in this country for many decades. His work has only recently been contested by ecologists.

2.5 Vegetation Distribution, Succession and Human Disturbance

Acocks (1953) refers to South Africa as a "recently settled country", which is a subjective, if not disputable, statement. He also bluntly suggests that there is little or no vegetation in the country left in the original state. In contradiction to these statements, he further states that the records of vegetation at the time of European settlement was very scarce, and that changes in the vegetation since then are difficult to describe. Amidst all the uncertainty and the lack of adequate records, Acocks (1953) was able to provide a classification of the vegetation of South Africa which has reigned as the most often cited reference for ecological studies in South Africa for many decades. Acocks's (1953) work has also provided the basis for ecological and vegetation analysis in teaching at tertiary level, and is still used at present.

Acocks's (1953) classification of vegetation types or "Veld Types of South Africa" was based on the ecological paradigm of succession. He postulated that the vegetation on the north coast of KwaZulu-Natal in about A.D. 1400 consisted of forest, scrub forest and savanna. By the 1950's this area was predominantly bushveld and sour grassveld. The classical view is that in the last 600 years Bantu-speaking African people as well as European farmers were instrumental in the removal of forest, scrub forest and savanna. He explained that although the eastern part of the country has a climate suitable for forest and scrub forest, it consists of grasslands, which have developed through anthropogenic factors. He therefore called these 'false' grasslands. The anthropogenic factors he referred to included keeping livestock, practising agriculture and the frequent use of fire.

The Iron Age Bantu-speaking people were considered to be primarily responsible for destruction of the forest vegetation, and conversion of this vegetation to grassland (Acocks, 1953). There is much evidence to suggest that the vegetation of the eastern part of the country has been in its present form for a longer period than it has been inhabited by Iron Age people (Ellery & Mentis, 1992). Adaptations in lifestyle of these people to an environment lacking trees became evident as Iron Age people moved, after A.D. 1000-1200, into areas currently classified as grassland in KwaZulu-Natal. These adaptations included the use of stone walls for construction, bone tools rather than iron tools, and the use of dung as a major source of fuel. Hence these people may have replaced their requirement for wood resources with alternatives. Fossil evidence containing ungulate mammal remains, which were more than 5000 years old, from the 'false' grasslands, similarly indicated association with grasslands a long time ago. This raises questions about the age of these so-called 'false' grasslands.

2.6 Climax Vegetation of the Natal North Coast

Acocks's theory has been contested by Ellery and Mentis (1992), suggesting that the grasslands of South Africa as they are at present, have been so for the last 2000 years, but probably for more than 10 000 years. This has also been supported by evidence from a variety of disciplines such as palaeobotany, biogeography, archaeology and ecology. This pattern has revealed that many of the areas in Africa believed to have been forest initially, were in fact grassland for many thousands of years.

Since Acocks's initial work in 1953, many studies have produced views that are contrary to that of Acocks's. This is based on evidence from a variety of factors that have influenced the vegetation of the north coast. Fire, initiated by lightning or other natural agents, which favours grasslands over woody biomes, may have played a role in maintaining the grasslands (Mentis & Huntley, 1982). There is also evidence of soils in the areas covered by 'false' grasslands in the Natal coastal hinterland, which are typical of grasslands at higher altitudes. Research in palaeobotany by means of pollen analysis has revealed that areas that Acocks predicted as being forested contain pollen principally from the Poaceae, Compositae and Cyperaceae (Meadows & Meadows, 1988), suggesting grassland. There is also the doubt raised by the widespread occurrence of *Themeda triandra*, which is a grass characterised by poor powers of dispersal but which dominates most of the 'false' grasslands of KwaZulu-Natal (Mentis & Huntley, 1982). This evidence suggests that the influence of early humans on the grassland biome was not as considerable as believed by Acocks (1953). Ellery & Mentis (1992) are of the view that the boundaries of savannas, forests and grasslands may have been modified from the original situation prior to settlement, but the proposal that forests and savannas were replaced by grasslands in the last five to six centuries, is unwarranted. Similarly, studies done on the vegetation of Transkei suggest that the grasslands thought to be seral to forest may have been as they are at present, for the past 1750 years, long before the first farmers settled there (Feely, 1987).

2.7 Conclusion

Two decades after Pole Evans (1936) produced the first colour map depicting the vegetation of South Africa, Acocks (1953) published his classification of the vegetation of South Africa, where he also looked at vegetation change over time and he predicted future changes in vegetation under different scenarios. Acocks's work had a significant effect on the field of ecology in the region. Acocks's map was produced with the objective of agricultural planning as its basis and it was based on a supposed relationship between vegetation development and climate. With the availability of new information and new approaches it is possible to reexamine Acocks's vegetation maps and the concepts and paradigms that underpinned them.

CHAPTER 3

THE STUDY AREA

3.1 Introduction

The area selected for this study was the coastal belt of the north coast of KwaZulu-Natal from the Umgeni River to the Tugela River (Fig. 2). The western boundary was the N2 national road and the eastern boundary was the sea. This represents a coastal strip approximately 6 km wide (varied from 2km to 8 km in places), over a distance of approximately 80 km (Fig. 3).

The natural resources of this coastal belt are important for the economy and the development of this area. The distinguishing characteristic of the north coast of KwaZulu-Natal that is familiar to most people, is the rolling hills of sugar cane grown throughout this area. The climate and soils that make this area suitable for the growth of sugar cane were discovered during the last century and these have resulted in sugar cane cultivation becoming an important economic activity. Land owners have been occupied with sugar cultivation, resulting in much available and suitable land being used for this purpose (Pistorius, 1962).

The other important resource of this area is the coastline. This resource holds great potential for development of this area. However, due to large-scale sugar cane farming, development has been discouraged by denying access to the beaches, possibly due to the increased likelihood of accidental cane fires (Pistorius, 1962).

Development of the transport route along the north coast of KwaZulu-Natal was done for two main reasons: to serve the needs of the sugar industry and to make Zululand accessible. This communication axis was positioned some distance from the coast, which further discouraged development of the coast. A national road has recently been built in the area, which connects Durban to Richards Bay, the latter being an important centre

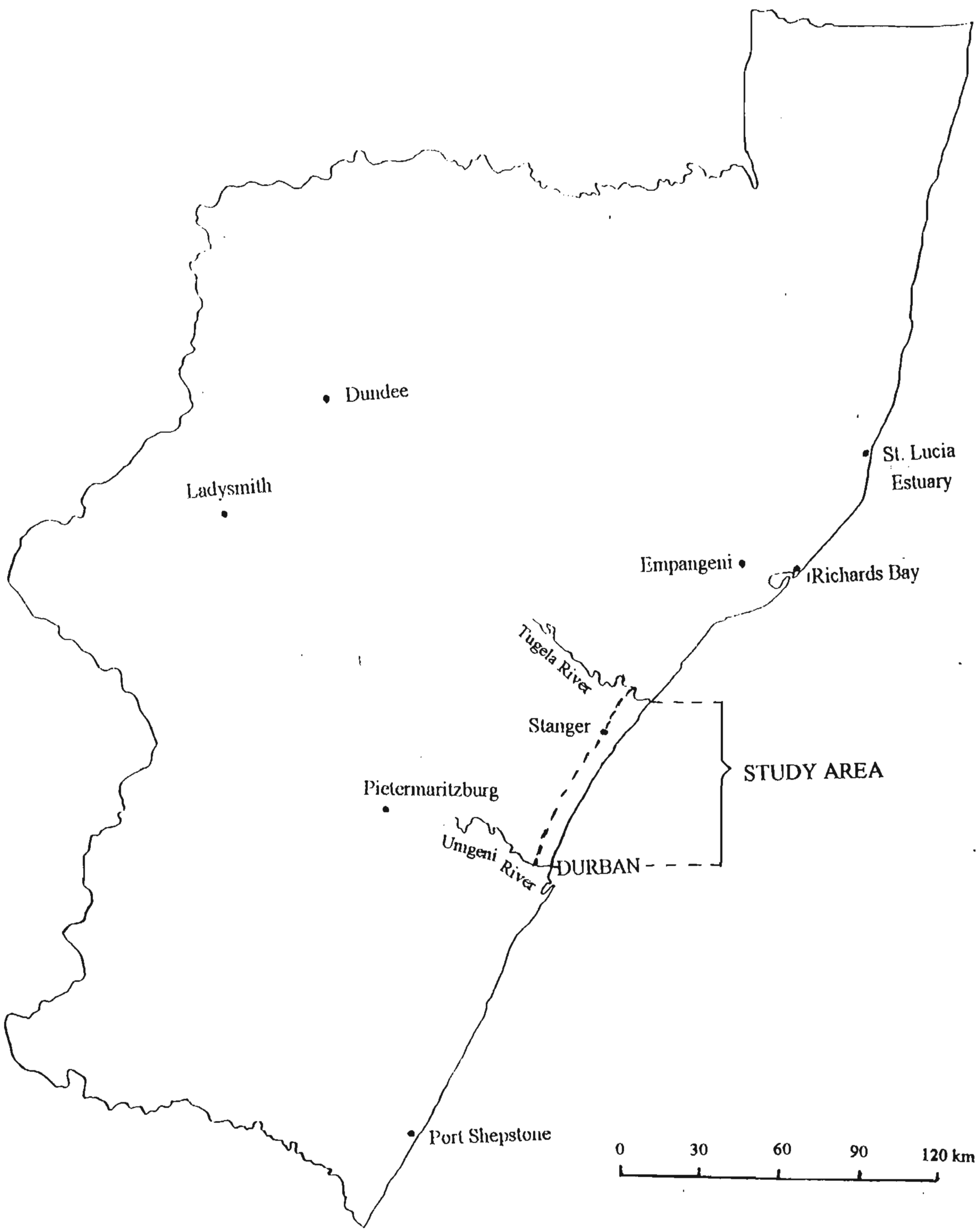

Fig. 2. The Study Area shown in a broader context. A map of KwaZulu-Natal indicating the location of the study area.

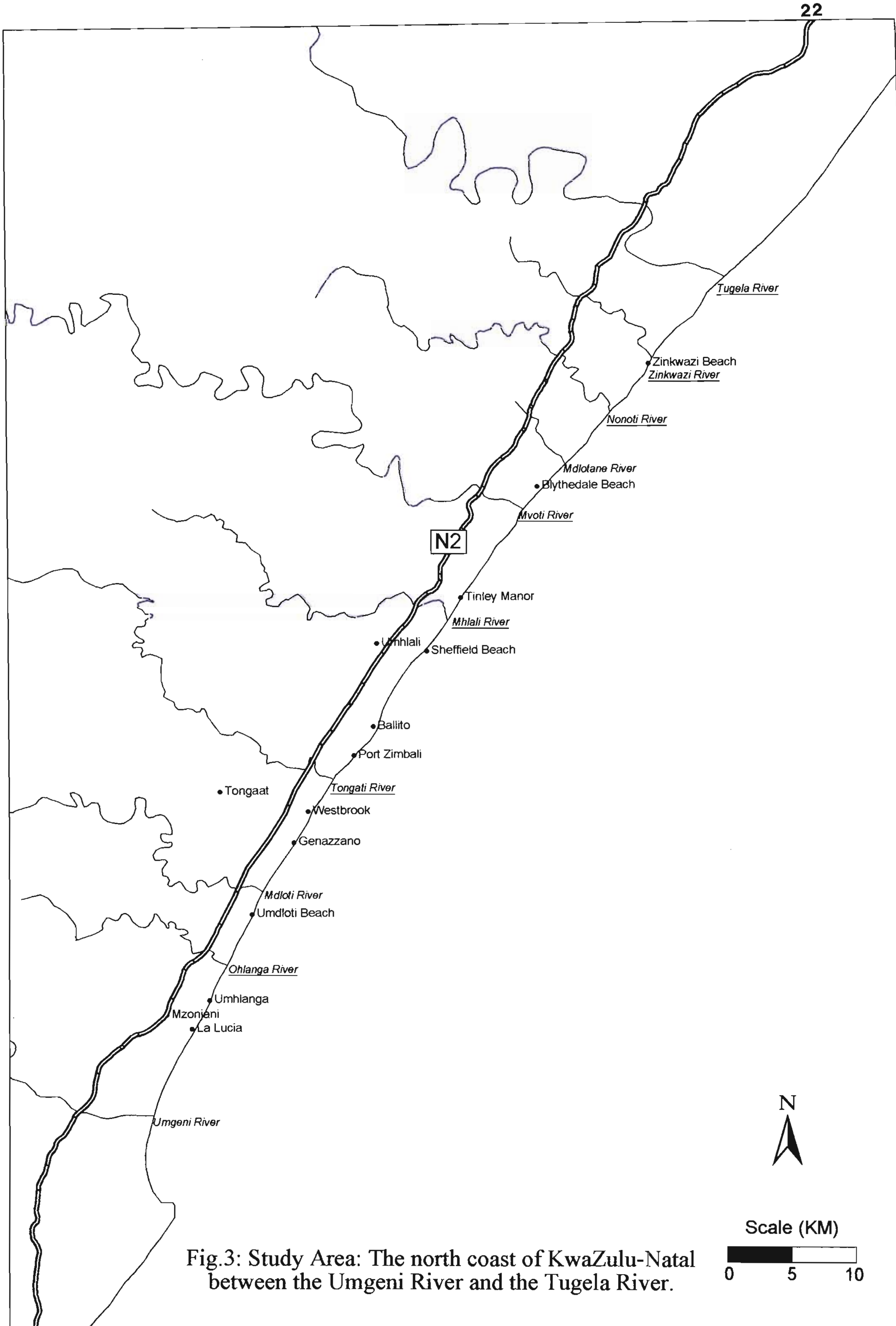

Fig.3: Study Area: The north coast of KwaZulu-Natal between the Umgeni River and the Tugela River.

That is developing rapidly. This new road has made the towns in this area more accessible and will probably increase the tourism potential of this area, an activity which is already showing tremendous growth. These developments will however have a considerable effect on the natural environment.

3.2 Climate

The coastlands of Natal are warm or hot for most of the year and in summer this area becomes exceptionally hot. Most of this area has an average maximum summer temperature (October to March) of approximately 27° C (Fig. 4). In winter the coast is warm, with long periods of fine weather with light winds. The average minimum winter temperature (April to September) varies between 10.9° C and 16.7° C (Mount Edgecombe; Fig. 4). Frost is seldom experienced along the coast.

Coastal areas experience exceptionally high maximum temperatures under Berg wind conditions, which occur mainly in the winter months (Preston-Whyte, 1980). As such the highest maximum temperatures are experienced in winter. The presence of these hot, dry winds desiccate vegetation, rendering it susceptible to fire (Ellery *et al.*, 1991).

The humidity is relatively high, particularly in summer (Pistorius, 1962). The average relative humidity for Durban for the month of January is approximately 85-90 % at night and approximately 65-70 % during the day. In winter the air is drier, with July having an average relative humdity of 70-80 % at night and the figure for the day being approximately 55 % (Pistorius, 1962). Relative humidity has a greater range in the winter months, when the land breeze circulation is strongest, while the sea breeze plays a major role in circulation during the summer months (Preston-Whyte, 1980).

This area receives mainly summer rainfall, from October to March (Fig. 5). During this time this area receives about 70 % of its rainfall, although there is some rainfall every month of the year. In spring much of the rain is in the form of drizzle which may last

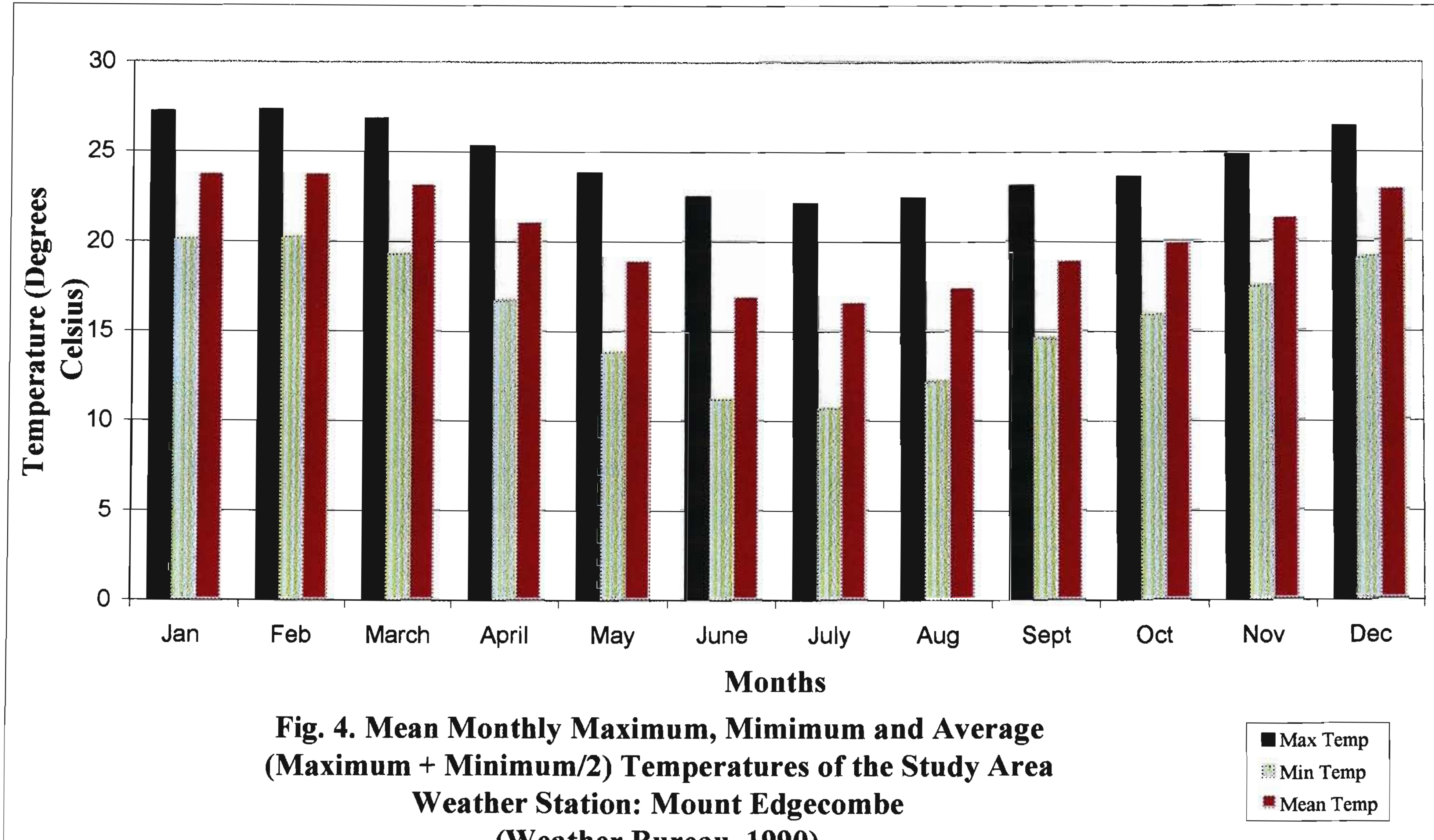

Fig. 4. Mean Monthly Maximum, Mimimum and Average (Maximum + Minimum/2) Temperatures of the Study Area Weather Station: Mount Edgecombe (Weather Bureau, 1990)

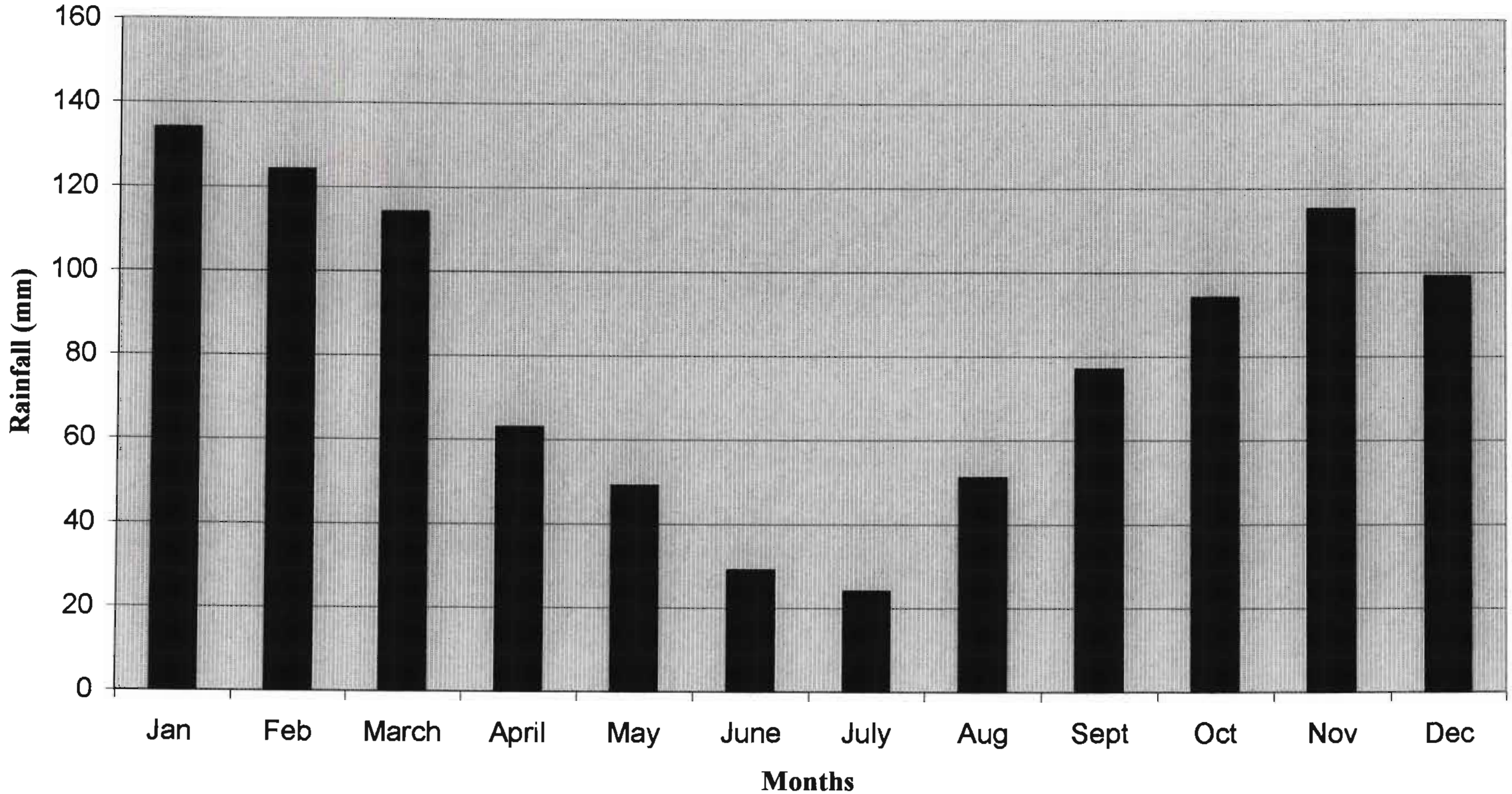

Fig. 5. Mean Monthly Rainfall of the Study Area for the period 1961-1990
Weather Station: Mount Edgecombe
(Weather Bureau, 1990)

several days. Annual rainfall is approximately 1000-1200 mm (Pistorius, 1962). This coastline is characterised by coastal lows and berg winds. Coastal lows produce warm offshore airflow ahead of them and cool onshore airflow behind. Berg winds are associated with dry, hot conditions (Preston-Whyte & Tyson, 1988). There are regular sea breezes during the day and the nights are generally cool (Pistorius, 1962). The prevailing winds also influence precipitation along the north coast. May, June and July are the "windless" months and August is the beginning of the windy season. Mean wind speeds are the lowest in May and June, with the strongest winds experienced in September and October. The prevailing wind directions are north-northeast, northeast, south-southwest and southwest (Preston-Whyte, 1980).

3.3 Geology

The north coast lies on the seaward slope of the Natal monocline, which resulted from folding movement at the time that Gondwanaland broke up about 150 million years B.P. (Archaeology and Natural Resources of Natal, 1951). The axis of the monocline, approximately 32-40 km inland, runs almost parallel with the coast. East of the axis are the originally horizontal beds of Karoo rocks and Natal Group Sandstones, which tilt down towards the east. The basement rock beneath these have also been tilted down towards the sea. Subsequent to the break-up of Gondwanaland, movement and erosion has occurred which has resulted in the surface of Natal sloping down towards the sea, and this has caused the rivers to erode deeply into the steepening land surface, which has resulted in the broken topography of the area with its numerous deeply incised rivers. The north coast is on a granite basement and on the seaward side, Natal Group Sandstone, Dwyka Tillite, Lower and Middle Ecca shales and sandstones, as well as sand that has been recently deposited, occur.

Many fault lines occur as a result of the formation of the Natal monocline and this is further complicated by many dolerite intrusions (Pistorius, 1962). Beach sand is confined to long narrow beaches, with large concentrations of sand usually close to river estuaries where they may form substantial dunes (Linström, 1987). Alluvium occurs along rivers, streams and many valley drains, as this is deposited by flowing water. This does not always contribute to good soil, as much of this forms river sands (Beater, 1957).

The beaches on the north coast are often characterised by rock outcrops, which breaks from the general straight, featureless, unsheltered beaches. These rock outcrops along the shore are often dolerite sills or belong to the Natal Group Sandstone, Dwyka and Middle Ecca or coal-bearing series (Pistorius, 1962). Some places such as Umhlali have thin seams of coal (Fig. 6). This coal had been removed in some places by Bantu-speaking Iron Age settlers and early European settlers, to fire smelting furnaces or sugar mills.

3.4 Soils

The soils of this area reflect the rocks from which they are formed. They vary in structure, depth and fertility, depending on the slope, parent material and the climatic conditions prevalent at the time of their formation. Alluvial deposits and alluvial soils are a common occurrence along the large rivers. The soils may vary in fertility but they are generally suitable for cultivation of sugar cane, the only limitations being steepness of slope and waterlogging (Pistorius, 1962).

Red and grey coastal sands are found along the ridges and valleys of the coast and generally do not occur more than 6.5 kilometers from the coast (Beater, 1957). The grey sands occur on flat terrain while the red sands occur on the steeper areas.

There are a great variety of soils in the sugar belt. Some are poor for cultivation while others are naturally fertile. The latter type was described by Van der Merwe as "gley-like podsolic soils" (Archaeology and Natural Resources of Natal, 1951). He stated that these soils were in their initial stages of development and that the topography inhibited the production of stable profiles. Soil analyses have shown that a large amount of gravel had accumulated in the B1 horizon, which consisted predominantly of 'pea ore' iron oxide

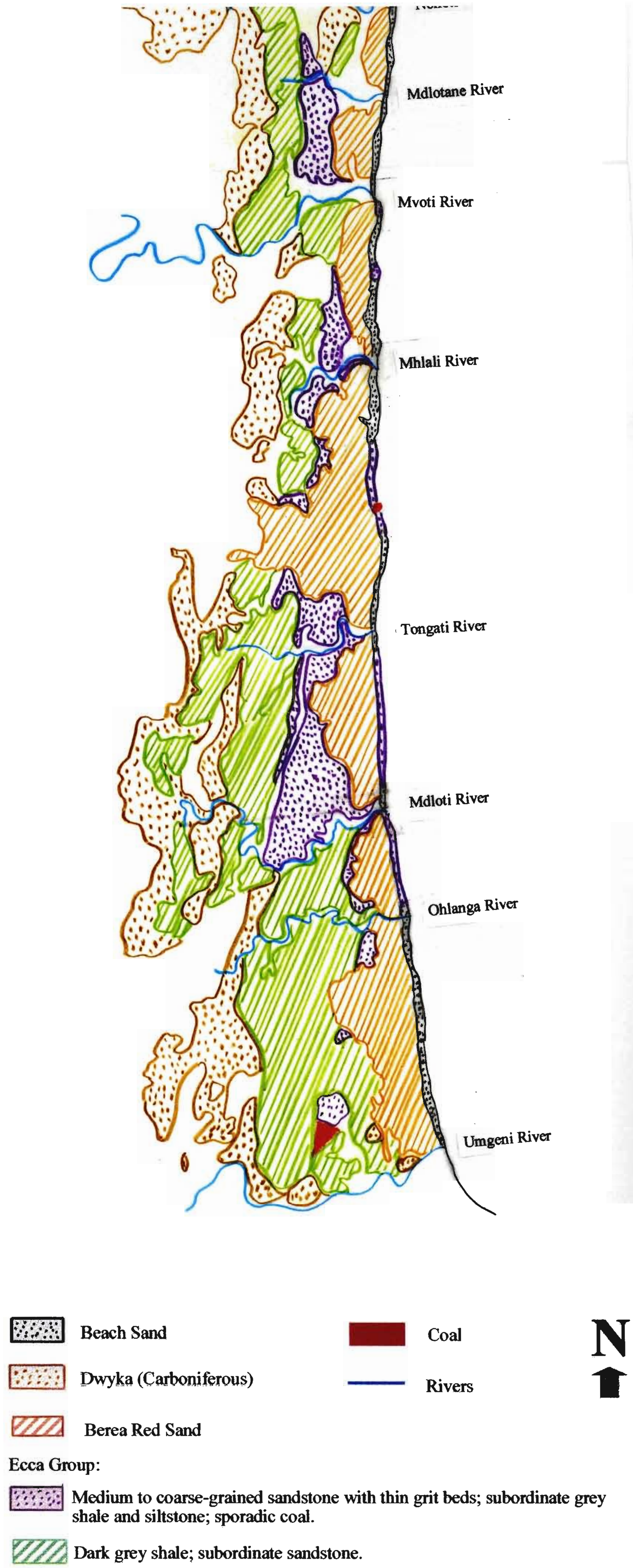

Fig. 6. Geology of the Study Area. Scale 1 : 250 000

deposits. Some soils did not develop the podsolic profile completely due to unfavourable topography.

3.5 Physiography

The characteristic land forms in this area are rolling hills. The north coast can be described as coastal lowland (Fig. 7). In the inland areas the rivers cut deeply into the Natal Group Sandstone, while at the coast the valleys tend to be shallower. During geologically recent times the sea level has risen and fallen many times. Consequently, when the sea was low, the rivers cut very deeply into the valleys and these became choked with silt when the sea level rose. As a result of this, the mouths of the large rivers have solid rock far below the lagoon surface.

As the sea level dropped in earlier periods, raised beaches were left behind. The high red dune which lies parallel to the coast covers some of these raised beaches. These may have been formed due to wind or may have been a submarine sand-bar during a period when the sea level had risen. These dunes are characteristic of the Natal coast and form prominent hills behind the beach, as at Umdloti (Pistorius, 1962).

The process of silt deposition is common on the north coast. This results in the formation of a submarine offshore sand-bar which closes off the mouth of a river, forming a lagoon in the dry season. This is a characteristic feature of the north coast.

3.6 Coastal Morphology

The north coast of KwaZulu-Natal is characterised by magnificent beaches with numerous rock outcrops. The mouth of the Tugela River is bordered by an extensive beach on the south side that forms part of the river mouth barrier. South of this, densely vegetated coastal dunes form the backdrop to a narrow beach which is underlain by rock

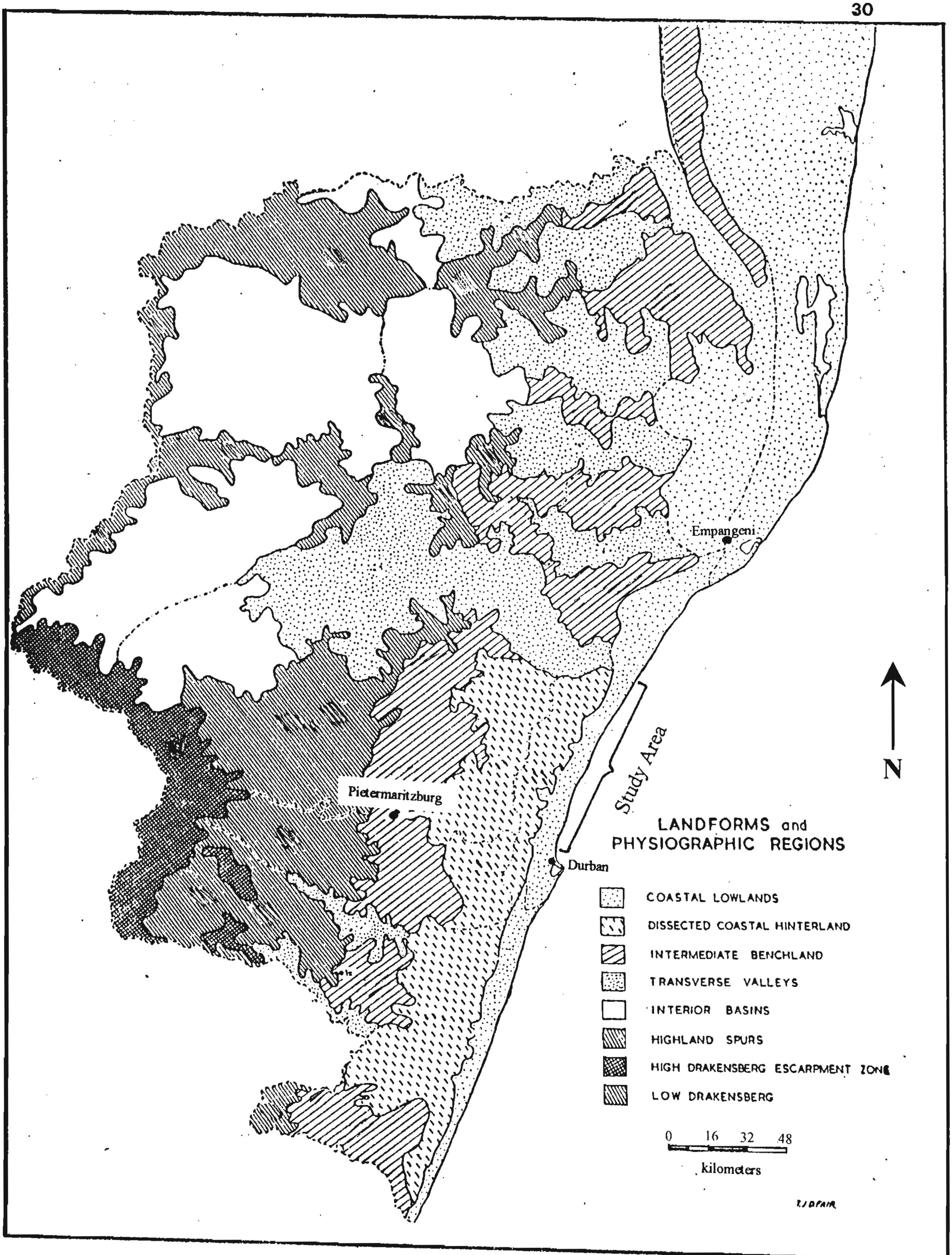

Fig. 7. Landforms and Physiographic Regions of KwaZulu-Natal (Fair, 1955).

outcrops (Dwyka Tillite). South of the Zinkwazi River mouth is a narrow beach with rocky outcrops. The Nonoti River is flanked by a large donga on the north side and two large dongas on the south side. As far south as Blythedale Beach, the beach is underlain by rock resulting in several embayments between prominent rocky outcrops.

On the south side of the Mvoti River is a dolerite outcrop and a wide vegetated dune. South of this river is an irregular coastline resulting from continuous bedrock outcrop. This part of the coastline has a narrow beach and scattered coastal dune development. The coast between Umhlali and Port Zimbali is very irregular and rocky where dolerite outcrops occur. In contrast there is a wide sandy beach with little rocky outcrop between Port Zimbali and the Tongati River. South of this, up to the Mdloti River, the coast is rocky, while between Umdloti and Umhlanga Rocks the beach is mainly sandy with scattered rock outcrops. A wide sandy beach is found between Umhlanga and the Umgeni River. This section of coast has experienced much destruction by humans and most of the coastal dunes have been modified or removed due to development (Cooper, 1991).

3.7 Vegetation and Conservation Status

In his description of the coastal vegetation of KwaZulu-Natal, Acocks (1953) refers to the forest and scrub forest which have largely disappeared (Fig. 8). This area is covered by thornveld and bushveld at lower altitudes and by mixed grassveld at intermediate altitudes. Patches of forest have survived in the area.

Coastal forest typically exists in areas of high rainfall. In some areas these forests are restricted to the dunes. In certain areas where the vegetation is exposed to salt spray, tall trees are prevented from reaching their full potential as this damages the trees and results in dune thicket (Low & Rebelo, 1996). Dune thicket develops into forest in more sheltered areas. Forest patches constitute part of the coastal bushveld-grassland vegetation type, which is part of the savanna biome (Low & Rebelo, 1996).

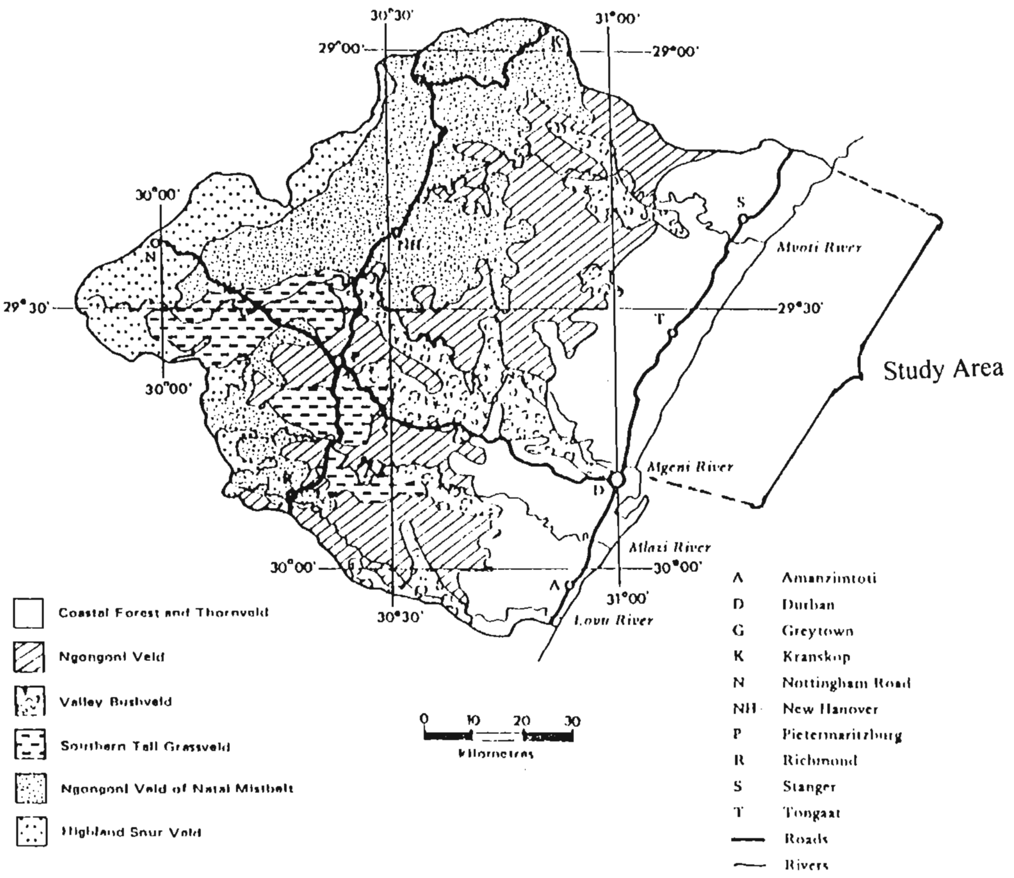

Fig. 8. The vegetation of the study area as described by Acocks (Moll, 1976).

Coastal Forest is well conserved in some reserves in KwaZulu-Natal, although this vegetation type is threatened by holiday resort developments, and the use of firewood, building materials and muti plants in rural areas (Low & Rebelo, 1996). Coastal bushveld-grassland exists in the form of remnants and is poorly conserved. This vegetation type shows signs of disturbance and invasion by alien plants. Urbanisation, industrial development and especially sugar and timber plantations have aided in the eradication of this vegetation type. The use of wild timber has ceased but there is still illegal exploitation of some poor specimens.

Tinley (1985) described the dunes of the study area as being small and supporting thicket or forest. According to Tinley the following were unique coastal dune areas that require protection (Fig. 3):

- Hawaan Forest at Umhlanga lagoon
- Seteni: a strip of dune forest south of Casuarina (At Westbrook)
- Deep forested ravines, south of the Mvoti River
- Dune forest between Blythedale and Mdlotane River
- Deep forested ravine, south of Nonoti River
- Hlogwane forest, south of the Tugela River.

3.8 Land use

The dominant activities along the north coast are the cultivation and processing of sugar cane. Approximately 70 percent of the area was covered by this crop by 1960 (Pistorius, 1962). As one travels along the north coast the importance of sugar cane in this area is evident by the endless fields of this crop in various stages of cultivation. The north coast is the most intensively cultivated region in KwaZulu-Natal.

The following table extracted from a study done by McCarthy (1987) demonstrates the intensive cultivation of sugar cane along the north coast when compared to the south coast. McCarthy (1987) divided the coastal margin into regions and for each region the land use of the coastal belt was determined (Table 1). The percentage of land used for sugar cane cultivation is highest in the regions that fall within the study area. It is also evident that with the exception of the area from Illovo Beach to Umhlanga, the study area contains high proportions of natural vegetation. The areas further south are more built up than those on the north coast in spite of the relatively high land usage for sugar cane cultivation.

Table 1. Land Use along the Natal Coast in 1981 (McCarthy, 1987).

Region	Natural Vegetation (%)	Forest Plantation (%)	Built Up Area (%)	Sugar Cane (%)
Port Edward to Southbroom	16	7	43	34
Ramsgate to Melville	6	1	48	45
Mtwalume to Ocean View	7	4	14	75
Park Rynie to Umkomaas	9	3	20	68
Illovo Beach to Umhlanga *	2	0	5	82
Umdloti to Ballito *	13	0	5	82
Umhlali to Tugela *	18	3	2	76

* Regions that fall within the study area.

Immediately north of the Umgeni River there is an industrial area, but as one moves eastwards and north away from here, residential areas are predominant. Further north, towards Umhlanga Rocks, the residential and commercial area is close to the coast (about 1 km from the coast) and west of this is cultivated land. Between Umhlanga Rocks and Newsel Beach-Umdloti there is little or no formal urban development. In this area there is natural vegetation along the coast and cultivated land west of this. Between the Mdloti and Tongati rivers there are small residential areas (La Mercy, Desainagar and Westbrook). Apart from these, the rest is cultivated land. North of this are extensively cultivated areas, with few patches of natural vegetation. The developed areas here include Ballito, Umhlali, Salt Rock, Sheffield Beach, Blythedale Beach and Zinkwazi.

Land use along this area is changing as development spreads up the coast. This is due to the expansion of the Durban metropolitan area in keeping with decentralisation. More and more people tend to live a considerable distance from the city centre and commute daily to work. In addition, the development of this coast as a tourist attraction is likely to influence land use change in the near future.

3.9 Settlement Patterns

Many of the areas along the north coast were settled as sugar mills sprung up, and these have become prominent towns in the area. A few decades ago these towns were controlled and serviced by sugar companies. Apart from the settlements that grew around sugar mills there are three other centres that became important areas for trading and commerce. These are Stanger, Tongaat and Verulam (Fig. 3).

The residential areas north of the Umgeni River were laid out in 1926 (Durban North) and thereafter these areas grew considerably. Umhlanga Rocks is expanding rapidly to accommodate the large number of people that choose to live in this area, due to its sea views, exclusive character and close proximity to the city centre. The growth of office parks and commercial nodes in Umhlanga have also drawn people to this area, as services and employment seem promising.

McCarthy (1987) studied urbanisation along the Natal coastal margin with a view to developing planning policy for this area. In his study he grouped the various towns according to their settlements. Tongaat Beach and Tinley Manor were grouped as settlements characterised by high levels of undeveloped land and low levels of space used for flats and houses. Umhlanga, Umdloti, Umhlali, Blyhtedale and Tugela were characterised by high levels of space used for housing and much land used for public recreational space. These settlements were also found to have rapid population growth rates. Glen Anil was characterised by a large percentage of land used for industrial purposes and rapid non-residential growth. Ballito and Zinkwazi were found to have high levels of population growth and a 'good supply' of public recreational space. Most of the towns in the study area were classified as medium or small size coastal towns by McCarthy (1987), with reference to future planning and policy formulation.

3.10 Socioeconomic characteristics

In the 1960s there were eight sugar mills (Mount Edgecombe, Maidstone, Shakaskraal, Groutville, Gledhow, Glendale, Darnall and Doornkop) along the north coast. At present this number has decreased to three (Maidstone, Gledhow and Darnall). This decrease in the number of the sugar mills initially was due to two large sugar companies monopolising the sugar industry, which resulted in the smaller mills shutting down. Subsequently there was a focus on efficiency of the existing mills, which became larger in order to process more sugar cane. More recently however, there has been pressure for urban development, which has resulted in the closing down of one large sugar mill. In the southern part of the study area, the growth of the metropolitan area of Durban has resulted in development encroaching on cultivated areas (Pistorius, 1962).

Although the coastal resorts within the study area did not play a significant role in the economy of this area, this is changing, especially in the cases of Umhlanga, Umdloti, Ballito, Shaka's Rock and Salt Rock. These areas have long stretches of beaches with rocks and varied coastline. Other resort areas include Tongaat Beach, Compensation Beach, Willard Beach, Sheffield Beach, Blythedale Beach and Zinkwazi Beach (Fig. 3).

The north coast has pristine beaches and large tracts of undeveloped land, but developers and investors realise the potential of this area for development. Umhlanga, which is situated about 20 km north of Durban, is growing rapidly. There are plans to develop this into a major regional node (Verbaan, 1998). There has also been a major development of a prestigious lodge at Zimbali, north of Tongaat. There are additional plans to develop Umdloti and expand the residential area at Ballito by rezoning a large sugar estate. The development along this coastline is largely due to the potential of this area as a holiday destination and the plans to relocate the existing airport south of Durban, to La Mercy west of Umhlanga.

The need for development along the north coast is a very controversial issue. There are those that support this as it will create jobs and economic growth for the area while there are those that oppose this as it will disturb the natural areas that have been protected from human impact for decades. McCarthy (1987) indicates the importance of a comprehensive coastal planning policy, especially in terms of ensuring that coastal conservation is an integral part of development along the coast.

CHAPTER 4

PRECOLONIAL IMPACT ON VEGETATION

4.1 Introduction

Southern Africa has been inhabited by hominids for at least three million years (Volman, 1984). The settlement pattern of the subcontinent of southern Africa by Bantu-speaking people has only recently been established. It was believed that as Bantu-speaking people were still moving southwards and westwards, they first encountered white colonists on the Eastern Cape border. However evidence indicates that Bantu-speaking people settled south of the Limpopo River in the first few centuries A.D. and that Iron Age communities were well established in Natal and Transvaal before A.D. 300 (Maggs, 1986). It is important to examine the settlement pattern of the study area in order to ascertain what impact early settlers had on the land, including both the Stone Age and Iron Age people.

In order to survive, the Stone Age and Iron Age people relied extensively on natural resources. One important resource was, most certainly, vegetation. The natural vegetation at the time would have been used for consumption (food), to build dwellings, for fuel and later vegetation would have been cleared to create bare land that could be cultivated or settled and used to rear livestock. Agriculture played a major role in changing the lifestyle of these people from a nomadic to a settled one (Maggs, 1986).

The physical environment played a significant role in the existence of early humans. The availability of material for tools, the climate and the surrounding terrain were of importance. The climate determined the type of shelter that was required and this in turn determined the type of tools required. For example, where caves were available, there was no need to construct a shelter, and fewer tools were required for construction. In this instance, ordinary stone and bone implements were required for hunting. Stones were required for softening small skins and reeds were used for making arrows (Cooke, 1968). In contrast, where there was a lack of cave shelters, there was a need to construct a shelter. It then became necessary to use chopping tools. The type of food eaten also determined the type of tools required.

The geology was important for both Stone Age and Iron Age people, as the former relied on rocks for manufacture of stone tools and the latter relied on rocks and soil to shape their social structure. The available rocks were also a determining factor in the manufacture of tools for various activities. Iron Age people relied on the rocks and soil as a source of iron ore as this was a prerequisite for the process of iron smelting. This process also required a source of energy in the form of charcoal (Haaland, 1985). These two requirements determined where these people settled. Iron smelting became important as a specialised occupation and villages formed around this activity.

4.2 Precolonial History

4.2.1 Stone Age People

Based on the technological innovation and lifestyle of humans, it is possible to distinguish different periods in the history of human development (Table 2). The use of tools in hominid development was gradual as was the domestication of crops and livestock. The excavation and collection of Stone Age materials in southern Africa have assisted in an understanding of the cultural development of humans over time. The Stone Age is divided into the Early Stone Age (ESA), the Middle Stone Age (MSA) and the Late Stone Age (LSA). These three phases can be distinguished by the tools used, the aggregations and industrial complexes prevalent during the various phases (Volman, 1984).

The Early Stone Age involved the production of rough choppers from flakes of pebbles. This period was also characterised by the production of large hand-axes, picks, cleavers and choppers. Hand-axes and picks were used, amongst other things, to kill animals, dig

Table 2. Guidelines for the dating of the various periods in precolonial South Africa.
(Anderson & Whitelaw, 1996b)

Period	Abbreviation	Approximate Age
Early Stone Age	ESA	2 million years ago to 200 000 years ago
Middle Stone Age	MSA	200 000 years ago to 30 000 years ago
Late Stone Age	LSA	30 000 years ago to the last century
Early Iron Age	EIA	1 700 years ago to 1 000 years ago
Late Iron Age	LIA	1 000 years ago to A.D. 1829
Historical period		Post-1829

up roots and dig game traps. Cleavers had a wide blade and were used to chop wood or to skin animals. The ESA covers about 400 000 years. Early hominids had a predominantly vegetarian diet but as the diet changed, the manufacture and use of tools became very important. Wild fruit and other vegetable foods were the food source during the wet season but during the dry season it was necessary to seek meat as a food resource, which required the use of tools (Clark, 1959). There has been evidence of hunting and killing of animals at ESA sites (Volman, 1984). Tools such as cleavers, handaxes and bifacial knives were found at these sites. Some ESA assemblages have been assigned to the Sangoan Industrial Complex, which were represented by small scraping forms and crude pick-like forms (Volman, 1984).

ESA site location generally varied but the extremes of dry desert and dense forest were avoided (Volman, 1984). These sites were often located close to water sources, as there was a lack of utensils to carry water. The majority of ESA sites were disturbed, open areas but some evidence suggests that the Sangoan Complex had adapted to more wooded areas. Sangoan assemblages occur predominantly north of the Limpopo River. Palaeoenvironmental information at ESA sites is lacking, making it difficult to make general statements regarding the duration and intensity of occupation (Volman, 1984).

The main tools of the Middle Stone Age were thin flakes and blades, including points, scrapers and denticulates. The main weapon during this phase was the spear. MSA sites have similar locations to ESA sites. These include river banks, floodplains, lake or pan edges and springs. Information on the subsistence of the MSA people comes from faunal remains. Evidence suggests that MSA people hunted more intensively than their predecessors and they sometimes managed to drive entire herds over cliffs (Volman, 1984). It is generally believed that MSA people were hunter-gatherers and that they had little impact on the vegetation.

The Late Stone Age was characterised by use of the barbed arrow. In Natal, this was known as the Smithfield culture, where people used tools made from thin flakes which were more carefully trimmed. Also characteristic of this phase were ground bone and stone objects, various types of scrapers and microbladelets (Kaplan, 1990). Unlike MSA people who lived in open areas, most Smithfield people lived in rock shelters (Archaeology and Natural Resources of Natal, 1951).

4.2.2 Iron Age People

Evidence indicates that iron technology diffused from North Africa southwards. Iron-using traditions may have spread through contact, although this is not well documented. Metallurgical technology necessitated changes in the socio-economic structure of communities (Kense, 1985). Iron working may have had a great role to play in a given society, economically, socially and politically. Factors of importance in this regard include: the purposes of iron production, the availability of raw materials, the time invested in iron working, the labour cost involved, the risk involved in construction of a furnace, the intensity of iron working required, and control of the process of manufacturing and distribution of iron products. These factors resulted in fundamental differences between Iron Age society and Stone Age society. Unlike their Stone Age predecessors, Iron Age people could make metal objects.

The Iron Age is divided into two phases, namely, Early Iron Age and Late Iron Age. This is based on chronology and ceramic typology. Much controversy surrounds this dichotomy. Distinctions between EIA and LIA sites are based on location (EIA sites were generally close to a water source and LIA on hill tops), huts, the use of stone walls, smelting furnaces, grindstones, ceramic sculpture and ornaments (Maggs, 1984). There was also considerable variation geographically.

The process of iron smelting required a specialised knowledge involved in the selection and preparation of the fuel (wood), furnace construction, maintaining a constant temperature and creating the finished product. In Africa there were (and still are) three main types of furnaces: bowl furnaces, low shaft furnaces and high shaft furnaces. Bellows were classified as either drum bellows or skin bellows (Kense, 1985). Skin bellows were made of sheep skin or goat skin (Haaland, 1985). Tuyeres were made by shaping clay around a stick. These were used to direct air from the bellows deep within the furnace.

Iron smelting commenced with the construction of the furnace and the bellows, as well as tuyeres, where the latter were used. The ore was added to the furnace. Slag was separated from the iron either during the process of smelting or when the process was over. Shaft furnaces were tied with plant fibres in order to prevent the shaft from cracking during the firing (Haaland, 1985).

The Iron Age people settled in an area to form a village of several to many homesteads, as they kept livestock and they grew crops. In addition they produced pottery and other crafts. The Iron Age people in southern Africa were Bantu-speaking. It is thus generally agreed that the spread of the Iron Age was associated with the spread of this language and its derivatives within Southern Africa (Maggs, 1986).

Pottery manufacture was a significant activity in the lives of Iron Age people. Pottery may be differentiated by the materials they were made from and the technology that they were associated with. Different types of pottery also give us clues to different technologies associated with them. Reference may be made to NC2 and NC3 pottery in the course of this account. NC2 pottery was either found on its own or together with NC3 pottery. NC2 pottery was made of soft material and tended to be grey to black in colour (Inskeep, 1971). This type of pottery included platters, pots and bowls. These were characterised by notching of the rim, surface pitting and surface relief by pinching, grooving, incisions and comb-stamping. NC3 pottery was made of generally course material and 'self-coloured'. Decorations included deep grooving in parallel lines, cross-hatching and herring-bone. NC3 pottery was commonly found in association with iron smelting (Inskeep, 1971).

4.2.3 Migration of Iron Age People

Iron smelting was first discovered in the Middle East. It spread to West Africa by about 500 B.C. and a few centuries later this technology had reached Central Africa (Maggs, 1986). Early Iron Age sites dating back to around 2000 years ago were discovered in parts of Central and East Africa, with some sites in these areas dating to around 400 B.C. It has been accepted that the first route used by Iron Age people to reach South Africa was down the eastern seaboard. The Natal coast had been reached before A.D. 300. Early Iron Age people moved into areas that were already inhabited by Stone Age hunter-gatherers, spreading through the savanna areas of southern Africa. They settled primarily in the summer rainfall area of more than 600 mm mean annual rainfall (Maggs, 1986). This rainfall was adequate to meet the requirements for cultivation, for grazing, and for timber, which was used for building materials and fuel.

The Early Iron Age (EIA) sites represented four phases (Anderson & Whitelaw, 1996b):

(a) the Matola phase – 4^{th} to 6^{th} centuries A.D.

(b) the Msuluzi phase – 6^{th} and 7^{th} centuries A.D.

(c) the Ndondonwane phase – 9^{th} century A.D.

(d) the Ntshekane phase – 9^{th} and 10^{th} centuries A.D.

During the Late Iron Age (1000 years B.P. to A.D. 1829) there was expansion from the savanna areas into areas currently mapped as open grassland areas of South Africa.

Settlement was influenced to a large degree by agriculture, as this activity tied people down to a specific area. People had to remain in the area to tend to crops in the growing season, and to process and store produce during and after the harvest. Iron Age crops included grain (sorghum, bulrush millet, finger millet), legumes (groundnuts and cowpeas), cucurbits (Cucurbitaceae), pumpkins, melons, squashes and gourds. These crops were originally domesticated in Africa, although the time and location of this domestication is unknown (Maggs, 1986). The pioneer villages in Natal practised agriculture but depended on wild animals for their meat requirements, since it was not until about A.D. 500 that domestic animals were kept.

4.3 Methodology

It was necessary to examine archaeological sites within the study area in order to discover more about the patterns of settlement and the livelihoods of the Stone Age and Iron Age people. It was hoped that the information contained in archaeological records would provide clues or direct evidence as to the type of vegetation present during the precolonial settlement of the study area. This would enable one to compare the vegetation during this early period to the vegetation present during later periods, and thus establish possible patterns of vegetation change.

There was a need to establish where archaeological sites existed within the study area. The Natal Museum in Pietermaritzburg was visited and archaeological records for Natal were examined in detail, covering the area from the Umgeni River to the Tugela River. Information captured for this purpose included the following:

- Site number (For the purposes of this study site numbers were used when the sites were plotted on a map.)
- Locality

- Local name
- Grid reference
- Date of occupation (Early, middle, late – Stone or Iron age)
- Site category (midden, dune, riverine site, surface pottery, pottery scatter)
- Evidence of pottery
- Evidence of iron implements or smelting activity (slag or tuyeres)
- Evidence of shells
- Evidence of stone implements
- Other evidence

These criteria were used to draw up a table of all sites within the study area. Using the grid reference, these sites were plotted on 1: 50 000 maps which covered the entire study area. The result was a single map which included the archaeological sites, together with major rivers and towns. The map was then reduced to a more manageable scale. From this map, patterns of the location of archaeological sites were identified.

Some information was gathered by speaking to staff of the Natal Museum, Pietermaritzburg. This information included the activities and movement of Iron Age and Stone Age people in the study area. Books, journal articles and magazines were used as sources of additional information.

4.4 Results and Discussion

4.4.1 General Settlement Patterns

A total of 210 archaeological sites were recorded within the study area, details of which are presented as Appendix 1. The period (Early/Middle/Late Stone Age or Early/Late Iron Age) of occupation was not available for all sites. Of the total, 109 sites were recorded as having been of the Iron Age period and 23 sites were of the Stone Age period, with the remaining sites being classified as unknown or Stone Age and Iron Age (Table 3). All the sites were plotted on a map to determine settlement patterns.

Table 3. The number of sites per "cultural period"

Period	Stone Age Only	Iron Age Only	Stone Age & Iron Age	Not Available	Historic	TOTAL
No. of Sites	23	109	20	57	1	**210**
Percentage of Total	11	51.9	9.5	27.1	0.5	**100**

Figure 9 indicates certain areas where there are concentrations of archaeological sites. Sites were generally concentrated along the coast, and where sites were not within close proximity to the coast, they were located within close proximity to rivers. Very few sites occupied the elevated interfluves of the interior of the study area. Areas where concentrations of archaeological sites were high are as follows (numbers in brackets refer to locations shown on Fig. 9):

- Between Durban North and Mdloti River N2 *(1))*
- Between Genazzano and Sheffield Beach *(2)*
- Near the Mhlali River at Headlands and Tinley Manor *(3)*
- At Blythedale Beach near the Mvoti River *(4)*
- At Zinkwazi Beach and at the mouth of the Zinkwazi River *(5)*
- Along the Tugela River, away from the coast *(6 and 7)*.

The majority of the above concentrations of archaeological sites on the beaches coincided with rock outcrops. The rocks would have provided the ideal place for abundant marine food resources in the form of mussels and oysters. The inhabitants of the area would

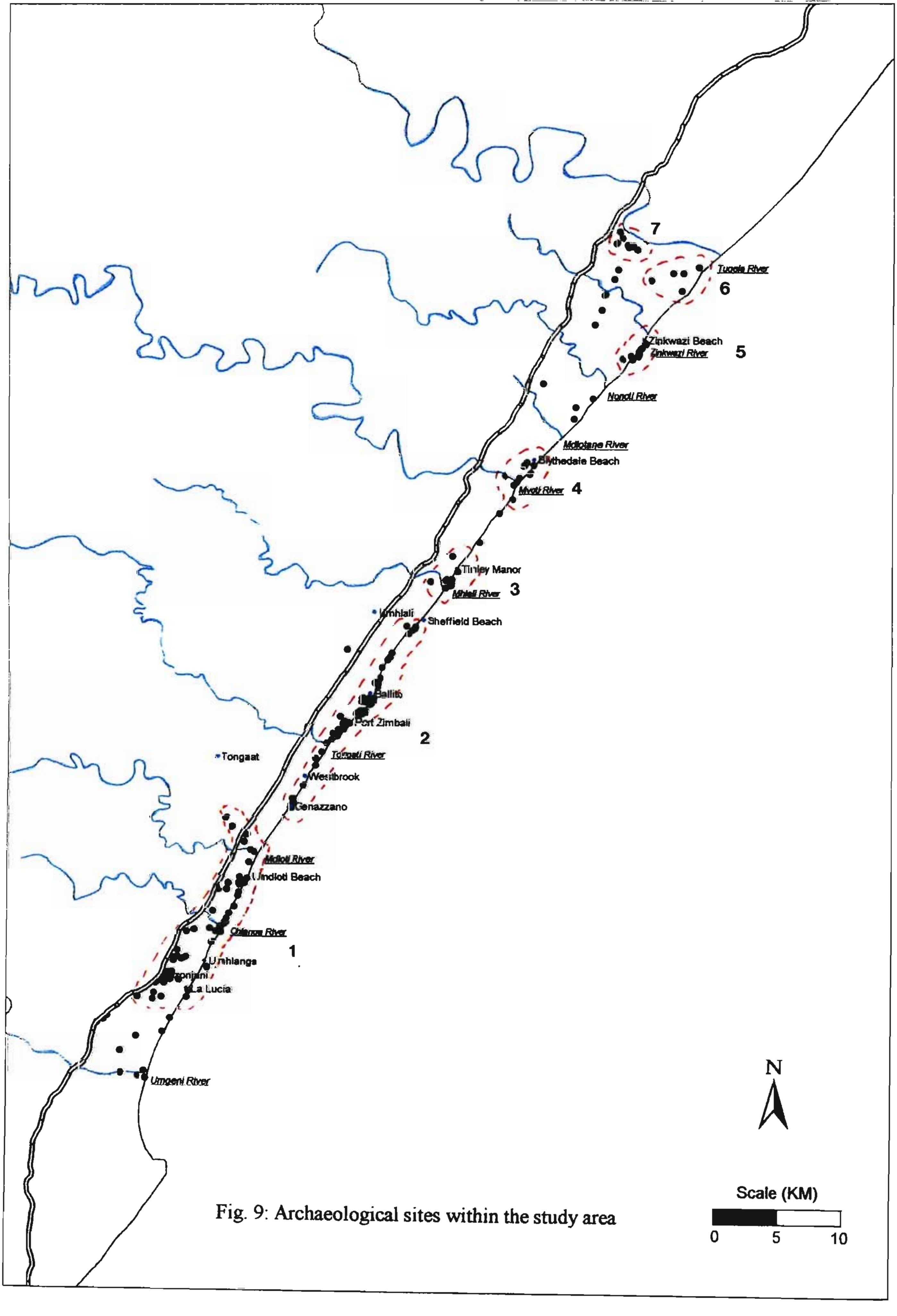

Fig. 9: Archaeological sites within the study area

have come to the beaches to consume this valuable resource. This would also explain the large percentage (53.3%) of sites where middens were found (Table 4).

Table 4. Summary of features of all archaeological sites along the north coast margin between the Umgeni River and the Tugela River .
(Appendix 1: Total Sites 210)

	No. of sites	Percentage of Total	Figure
Middens	112	53.3	12
Evidence of Pottery	97	46.2	13
Charcoal	10	4.8	14
Grindstones	11	5.2	15
Evidence of Iron working	13	6.2	16
Stone Tools	13	6.2	
Bones	26	12.4	

At *1*, Figure 9 there were scattered rocks at the coast, with fairly flat land adjacent to this coastal area. This area consisted predominantly of Iron Age sites, dense concentrations of middens and pottery. This implies that there was a fair amount of activity in this area, although the evidence does not directly imply the extent to which these activities impacted on the vegetation. At concentrations *2* and *3* (Fig. 9), there was a similar pattern. At *4* (Fig. 9) middens and pottery were very sparse. At *5*, *6* and *7* (Fig. 9) middens were less numerous than in the cases of *1* and *2*, but pottery occurred in abundance. It is possible that these three sites coincided with agriculture, as these occurred in the alluvial flats, which would have been suitable for cultivation.

If one considers the Stone Age sites (Fig. 10), these seem to be concentrated in the area between Port Zimbali and the Tongati River mouth along the coast. There is a fairly high density of Stone Age sites south of this, up to Umhlanga. In contrast, the Iron Age sites (Fig. 11) occurred in concentrations along the coast close to the river mouths (Zinkwazi, Mvoti, Mhlali, Tongati) or they occurred in coastal strips (between the Mhlali River and

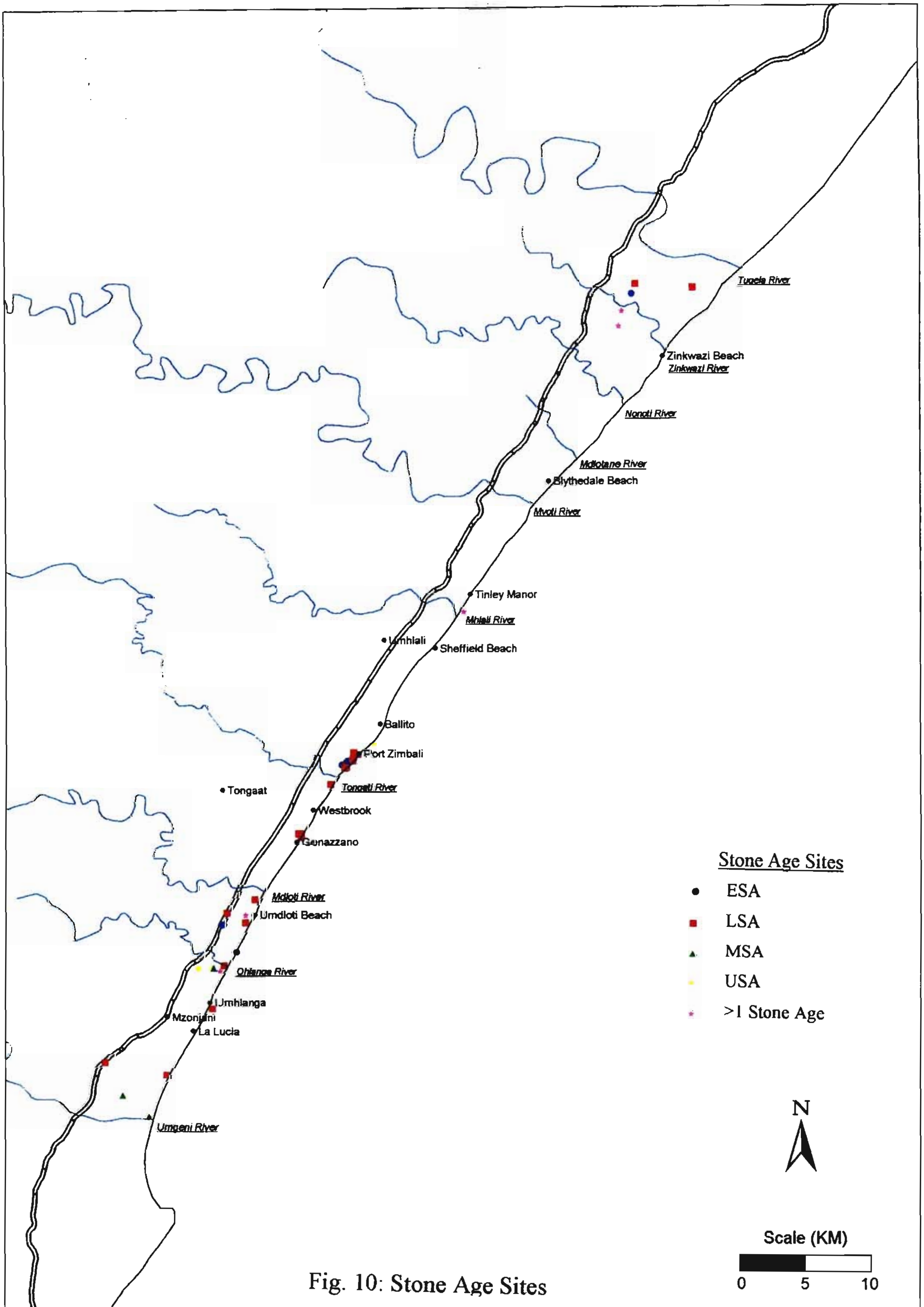

Fig. 10: Stone Age Sites

ESA: Early Stone Age ; LSA: Late Stone Age ; MSA: Middle Stone Age ; USA: Undifferentiated Stone Age

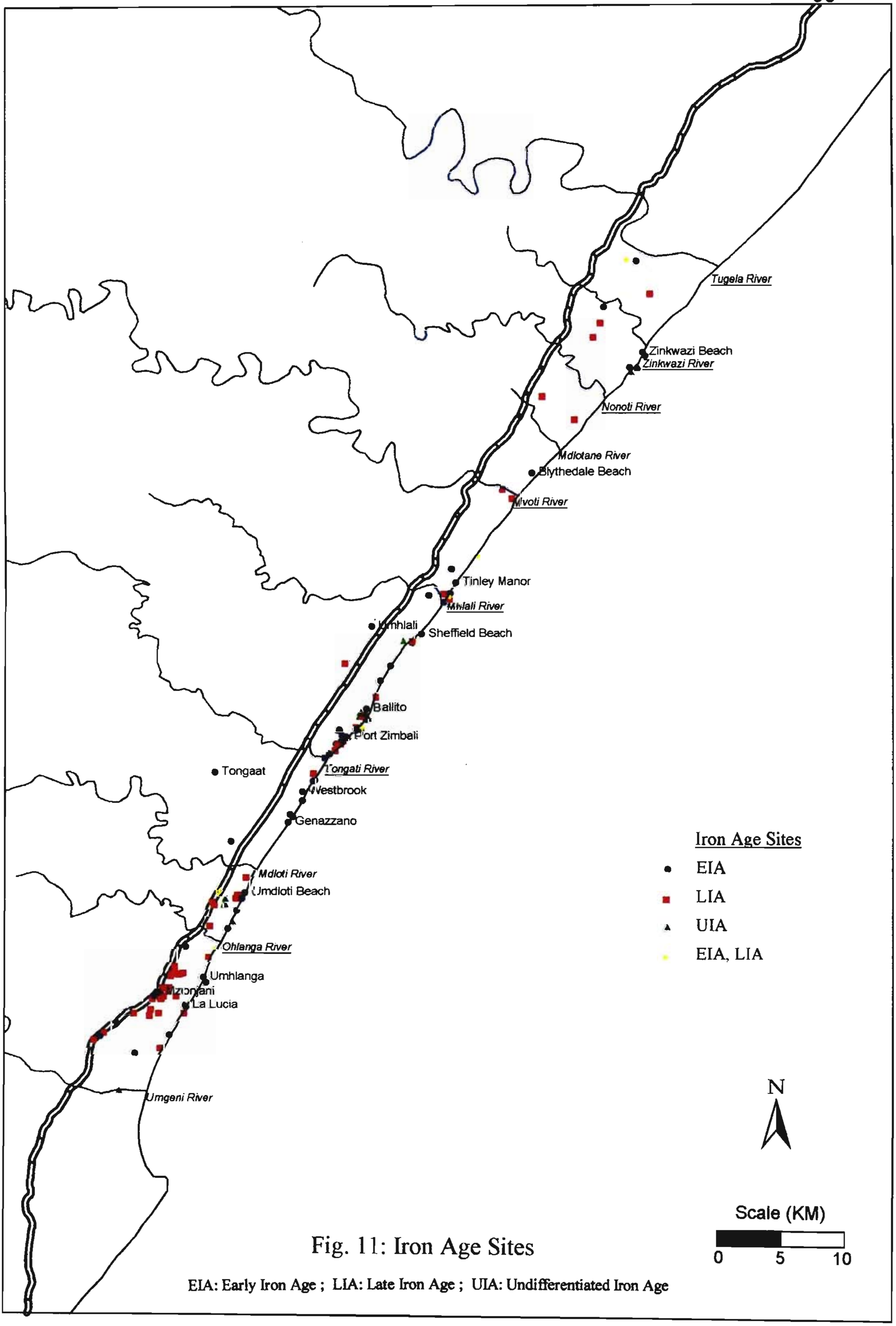

Fig. 11: Iron Age Sites

EIA: Early Iron Age ; LIA: Late Iron Age ; UIA: Undifferentiated Iron Age

Genazzano). South of the Mdloti River, as far as just north of the Umgeni River, sites were widely distributed, and appear to have been concentrated a few kilometres from the coast.

Artefacts recorded at the archaeological sites were predominantly middens (containing discarded shells of shellfish) and sherds (pottery fragments). Stone tools, bone, charcoal and grindstones were other artefacts that were found (Table 4). Direct evidence of iron smelting took the form of tuyeres and iron ore. These records were used to produce maps that would provide a picture of localities where specific artefacts were found. This would enable one to determine whether distribution patterns were present and whether these were related in any way to the vegetation or the physical environment.

4.4.2 Analysis of Stone Age Settlements

At the sites encountered in the study area, 43 showed evidence of Stone Age activities (Table 3). At many of the sites examined, stone tools were found. These included stone knives, "shell-openers", broken stones, flakes and one basalt arrow-head. The presence of flakes at some sites may be indicative of the manufacture of stone tools. Stone tools were found at 6.2 % of the total number of sites (Table 4). Areas with concentrations of stone tools include Port Zimbali, Genazanno, Blythedale Beach, Tinley Manor, Zinkwazi Beach and a few localities close to the Tugela River mouth (Appendix 1). There was a preference for coastal sites (Fig. 10), presumably where there was easy access to the marine food resource.

Tools found in the region of Zinkwazi and the Tugela River included handaxes, cleavers, choppers and stone flakes (Anderson & Whitelaw, 1996b). There was a large scatter of stone tools found here. At another site close by, many stone tools were found, predominantly consisting of flakes and river pebbles. This seems to indicate an ancient quarry of some sort. The Sangoan culture in Natal has been found at the Tugela River mouth (Clark, 1959). Unifaced and bifaced picks, handaxes, flakes, side-scrapers and choppers were found at this site. This culture is associated with the Red Dune (Berea formation). The Smithfield culture is also found in Natal and shows various regional variations. The coastal Smithfield culture sites in Natal indicate that this culture existed at an earlier period than the Bantu occupation, as this underlies the Bantu middens (Clark, 1959).

An excavation at Umhlanga Rocks revealed a very large specimen of the sand-oyster, which became very rare due to over-exploitation (Davies & MacDonald, 1978). There were scanty remains in this midden, which included shell openers. It was suggested that this site was occupied by non-Bantu speakers, as middens of Bantu-speakers normally contained pottery. Although it is a possibility that this midden was occupied by Bantu-speaking people, the evidence suggests that there were people of Stone Age culture that occurred in this area as late as the middle of the present millenium (A.D. 1500).

There is evidence that indicates continuity in the technology between MSA and LSA. The MSA/LSA transition occurred between 35 000 and 20 000 years ago. It has been suggested that this transition was influenced to a greater degree by social responses rather than by adaptations to the environment (Kaplan, 1990). There have been indications that the hunter-gatherers interacted with Iron Age farmers.

During the Stone Age there was reliance on the geology to produce tools to assist these people in their daily lives. Concentrations of stone tools were generally found close to a food source, namely meat. These stone tools were used to dismember animals in order to consume them (Clark, 1959). The Stone Age people's requirements of the natural vegetation were few. They required vegetation as food sources. Wood was used for the production of throwing sticks, digging sticks and wooden spears during the Early Stone Age.

Stone tools were also used along the coast in the processing of shellfish (Anderson, 1997). These stone tools were used to open up the shellfish and extract the meat. Early humans utilised roots and tubers as food sources and these were dug up with the aid of stone tools. Wood required for fire was chopped with specially modelled stone tools. As the diet changed, and meat was consumed to supplement the vegetarian diet, intricately designed tools were used to skin animals (Archaeology and Natural Resources of Natal, 1951) and cut the meat into smaller pieces.

Hence the bulk of the impact of Stone Age people on the vegetation would have been through the use of vegetation for food requirements. This would have been largely non-destructive and therefore sustainable. Plant material would also have been used in the form of wood for fire but presumably dead wood would have been used. Charcoal found at some of the Stone Age sites (Appendix 1) indicates the use of fire. Stone Age people began to use fire about 150 000 years ago, which would have resulted in changes in natural fire regimes (MacDonald, 1989). Fire was used by Stone Age people to keep warm. Furthermore, fire was used extensively to drive game into enclosures where they could be killed during hunting (Woodhouse, 1971).

The impact of Stone Age people on vegetation is considered to be low as they were hunter-gatherers and did not clear large areas of natural vegetation. The role played by Stone Age humans in changing the vegetation of the study area, therefore, was probably small. Stone Age people generally avoided densely vegetated areas for settlement (Volman, 1984). The occurrence of the Stone Age people along the coast may therefore imply that this area was more open, possibly grassland with tree patches.

4.4.3 Analysis of Iron Age Settlements

The social structure of the Iron Age people differed from the Stone Age people in that Iron Age people settled in villages. This was a result of their lifestyle. Iron working was associated with occupational specialization. While the Stone Age people moved in search of food and hence led a nomadic existence, the Iron Age people cultivated crops and kept domestic animals which required them to settle in one area to tend to these activities.

The social structure of Iron Age people was specialised. The EIA villages had populations of several hundred people. These villages consisted of scattered homesteads which housed small families (Maggs, 1986). Each village was self-sufficient with regards to food and the implements that they produced. The men were involved in the production of iron and the women were responsible for making pottery. The area around the village was used to graze their herds, hunt and gather wood, as well as gather wild plants for food. There was also some form of trade between villages.

Figure 11 shows the settlement pattern of the Iron Age people within the study area. The EIA sites are concentrated at the coast to a greater extent than the LIA sites. The latter sites tended to be further inland. The possible reason for this is that EIA people depended more on the marine food resource than the LIA people, who placed more emphasis on agriculture, which implied that the LIA people would need to carry out their activities in areas with suitable soil, for example, river valleys.

The transition from EIA to LIA was characterised by a change in the pottery styles, architecture, settlement patterns, iron smelting furnaces, tools and ornaments. One significant change in the LIA was the expansion of settlements from the exclusively savanna areas during the EIA, to the grassland areas in the LIA. In this open, more treeless environment, building material was predominantly stone. This was done to cope with the scarcity of wood as a building material (Maggs, 1986). These stone-built dwellings are well preserved, but those built of wood have long since perished and leave us little or no evidence of settlement. The occurrence of EIA sites along the coastline suggests that the immediate coastline was more densely vegetated (Fig. 11), while the LIA sites away from the coast suggest a more open vegetation.

At Zinkwazi River sites (Anderson & Whitelaw, 1996b), there were many pottery sherds, fragmented upper grindstones, upper and lower grindstones, and charcoal. There was also evidence of iron smelting activity in the form of slag, and tuyere fragments. The Zinkwazi River sites conform to the EIA settlement patterns of the Ntshekane phases. These settlements are generally near a river, on flat low-lying ground. The people of this period were agriculturists. They cultivated sorghum and millet and they kept stock animals such as cattle, sheep and goats. They also ate wild animals such as antelope and bushpigs (Anderson & Whitelaw, 1996b).

EIA sites were found at Mount Edgecombe and Sunningdale (Fig. 11). EIA sites throughout southern Africa occur on arable land near lakes or rivers in wooded areas such as savanna and forest (Whitelaw & Moon, 1996). These EIA sites at Mt Edgecombe and Sunningdale were amongst the earliest Iron Age sites in Natal, and Matola-like pottery was found here. Matola is named after a site in southern Mozambique, and Matola pottery has been found in Northern Province, Swaziland, Zimbabwe, Mozambique and East Africa. This indicates the southward movement of Bantu-speaking agriculturists into the savanna and coastal regions of Sub-Saharan Africa. In Natal, the Motala phase dates back to a period between A.D. 400 and A.D. 600 (Anderson & Whitelaw, 1996a). Matola sites were influenced by the availability of iron ore, arable soil and the use of natural vegetation as a resource. Matola site societies were located close to iron ore sources, and they were typically small settlements. The evidence of Matola sites in KwaZulu-Natal indicates the availability of iron ore in the near-coastal or coastal environment. Evidence at Sunningdale indicated iron-working, including the presence of slag at these sites.

There was considerable EIA material found at Mzonjani (Fig. 11), near La Lucia (sites 71, 193 and 194, Appendix 1; Maggs, 1980). This indicates a village of considerable size and an occupation of several decades. A shallow pit with small quantities of domestic debris was found here. It has been concluded that cattle were kept and that hunting and trapping were activities of this settlement. There was also gathering of shellfish and wild plant foods.

At Westbrook Beach a midden site was discovered (Anderson, 1997). This site was repeatedly occupied through a single phase of the EIA. This was the Msuluzi phase which dates between A.D. 615 to A.D. 879. This site consisted of two occupations, one shortly after the other. The predominant food source at this site was shellfish, and to a lesser extent terrestrial food sources (such as small bovids) were consumed. It is most likely that this was an area where shellfish were processed rather than an area where people settled. Evidence found here included fire-cracked stones, hammerstones, grindstones and a hearth-like feature. This could have been used to crack open mussel shells, which could have then been boiled or baked, as this relaxes the mussels in the shell, making it easy to process this food source (Anderson, 1997).

Coastal resources played an important role in the livelihoods of coastal Iron Age agricultural communities. There was an extensive period of coexistence between agriculturists and remnants of the hunter-gatherer communities in Natal. This has led to a debate over which group was responsible for the middens in the area (Horwitz, et. al., 1991). Within the study area, shell middens were found predominantly at the coast (Fig. 12). Shell middens were found at 53.3% of the archaeological sites. This indicates the extensive use of the marine food resources. At most sites there was no indication of settlement, which suggests that the shellfish were processed and consumed at the coast before returning to the settlements further away, or the shellfish were processed and carried away to the settlements.

Two shell middens at Emberton Way (north of the Tongati River) and Umhlanga lagoon on the north coast of Natal yielded a substantial amount of mollusc shells. Terrestrial fauna appeared insignificant in the diet, based on the remains found. The evidence at Emberton Way suggests that there was a long period of use of the shellfish resource over several centuries which spanned the EIA. At this site, as at Westbrook Beach, the presence of hearths and fire-stones, together with a large amount of pottery, is indicative of shellfish processing. Here as well, shells were cracked open either by using a stone tool, or by baking, steaming or boiling (Horwitz, *et al.*, 1991). The pottery at this site consisted of the four EIA phases (Matola, Msuluzi, Ndondondwane, Ntshekane). There

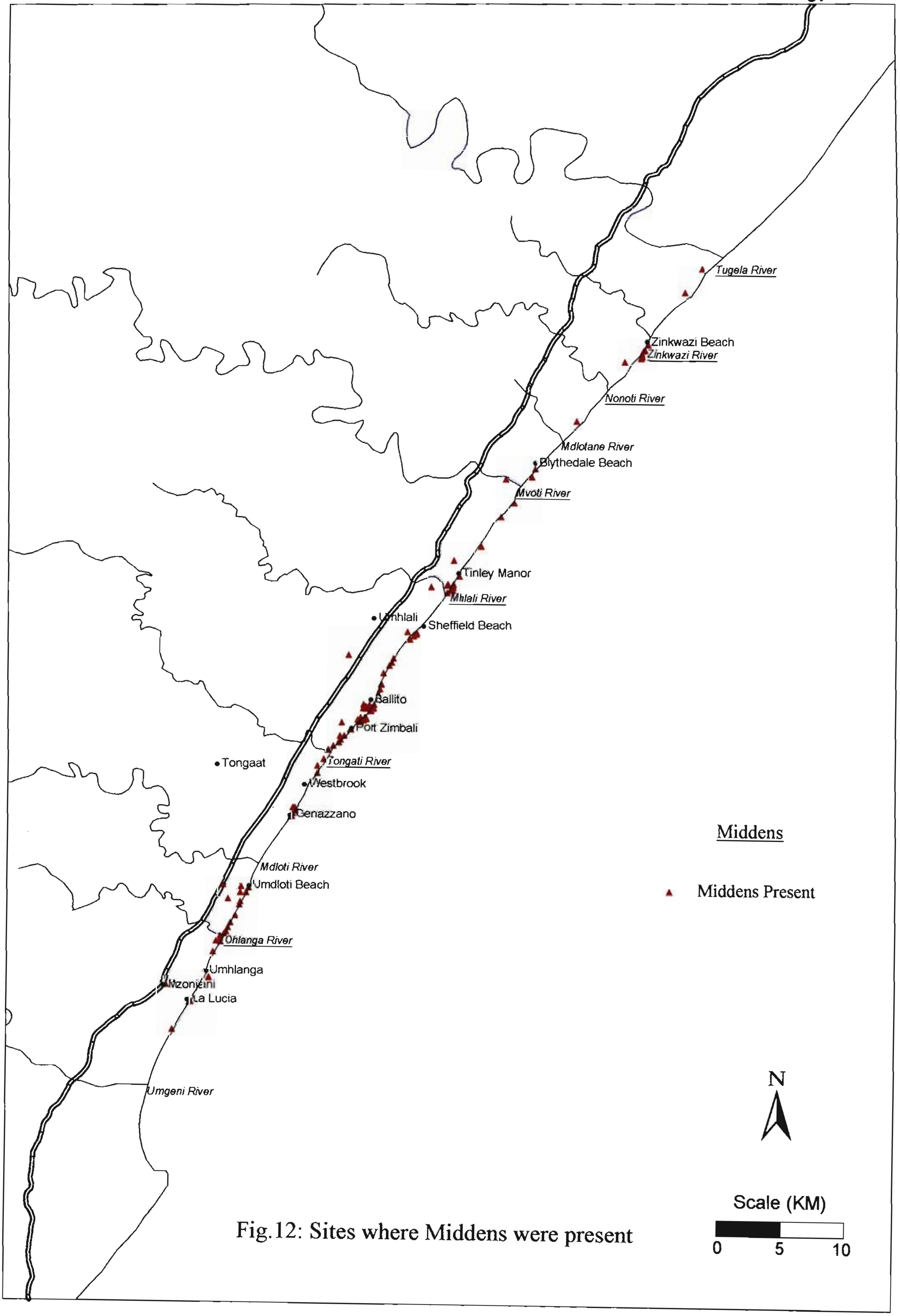

Fig.12: Sites where Middens were present

was a change in shellfish exploitation as settlement and socioeconomic patterns changed during the Iron Age. As time progressed, fewer shells were transported inland. Instead, there was more shellfish processing that occurred at the coast and only the meat of these shellfish was transported inland.

A close examination of the clay used to manufacture the pottery at these sites (Emberton Way and Umhlanga lagoon) indicates that these were of granitic origin rather than from the sedimentary formations of the immediate coastal strip. Granite outcrops occur in a belt 20 to 40 km inland which is parallel to the coast. Should this pottery be confirmed of granitic origin, then either of two explanations are possible:

a) The pottery was produced in the interior of Natal and reached the coast due to trade with the coastal communities,
b) People of the inland communities carried pots to the coast where shellfish processing occurred and they then used the pots to transport the meat back to their settlements (Horwitz, *et al.*, 1991).

A significant activity of the Iron Age people was the making of pottery. Pottery is closely associated with agricultural activity, as these hollow utensils would have been very useful when gathering agricultural produce (Woodhouse, 1971). These vessels were also very useful in the processing of shellfish and in the transportation of processed shellfish (Horwitz, *et al.*, 1991). Sites containing pottery were located all along the study area (Fig. 13). This could be attributed to the fact that pottery was used for a wide range of activities and it could be readily transported. Pottery remains were found scattered in the floodplains within the study area (Tugela River, Zinkwzi River, Mhlali River, Ohlanga River and Umgeni River). These areas would have been suitable for agriculture and settlement, hence the presence of pottery. Pottery manufacture would have also required wood to fire them in order to harden the clay. This fuelwood requirement is likely to have impacted on the vegetation.

The first Iron Age people lived and mixed with the Stone Age people (Clark, 1959). In order to understand more about the early Iron Age in southern Africa, we need to look to

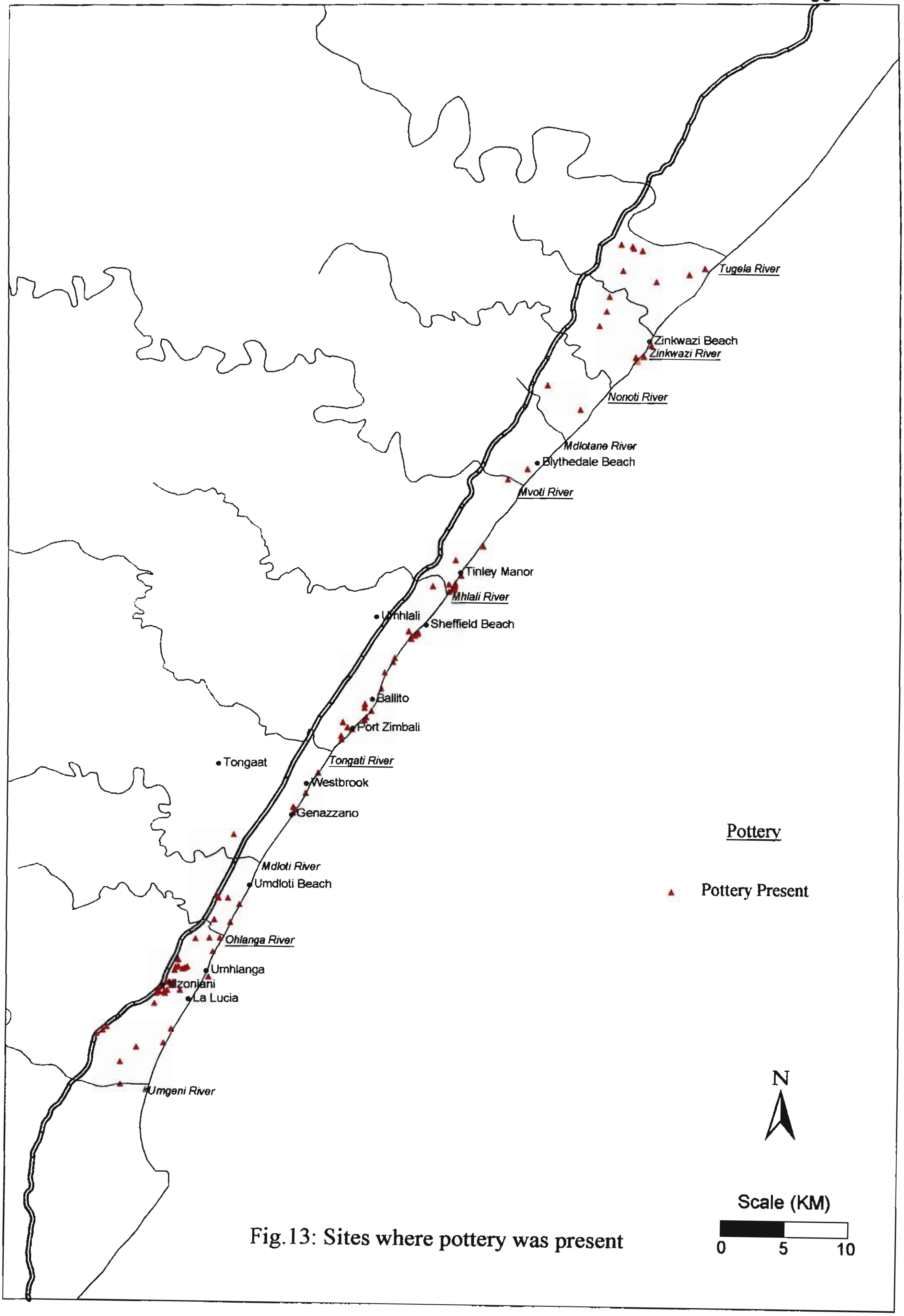

Fig.13: Sites where pottery was present

Central and East Africa where iron working was well established by about 2000 years B.P. (Maggs, 1986). Iron production depended on the natural environment, not only for the availability of iron ore, but also for the wood which would be made into charcoal to fire the furnaces. According to Maggs (1986) EIA people were confined to the savanna areas. An additional factor that influenced their settlement was rainfall, as they settled in the areas that received a mean annual rainfall exceeding 600 mm within the summer rainfall region. These areas received sufficient rainfall to grow crops and graze livestock, and the vegetation supplied sufficient timber for their fuel and building requirements. This included the north coast of KwaZulu-Natal.

The mass of charcoal required to produce iron was approximately twice the amount of iron ore required (Haaland, 1985). Iron Age people were very selective in their requirements for charcoal. The species of trees required were specific as the different woods produced different temperatures. Specific temperatures and conditions were required for iron smelting, which were dictated by the type of wood used. Preferred trees for charcoal in the Natal/Zululand area were found to be *Olea africana*, *Spirostachys africana* and *Acacia caffra* (Whitelaw, 1991). The need to use specific tree species for smelting would have resulted in local deforestation around village settlements over time (Haaland, 1985).

The presence of charcoal at coastal archaeological sites (Fig. 14) suggests that wood was used in this area. However, there has been no identification of tree species used by these early people in the study area, apart from the reference to species used in the region by Whitelaw (1991). All of the sites where charcoal was found occur along the coast. This suggests the availability of this resource along the coast and a lack of suitable timber inland. It is possible that the vegetation along the immediate coastline, that is the coastal dune cordon, was forest.

The volume of charcoal required for smelting exceeded the volume of iron ore (Whitelaw, 1991). As such ore was sometimes carried a great distance to sources of fuelwood. Therefore smelting sites are sometimes found considerable distances from the

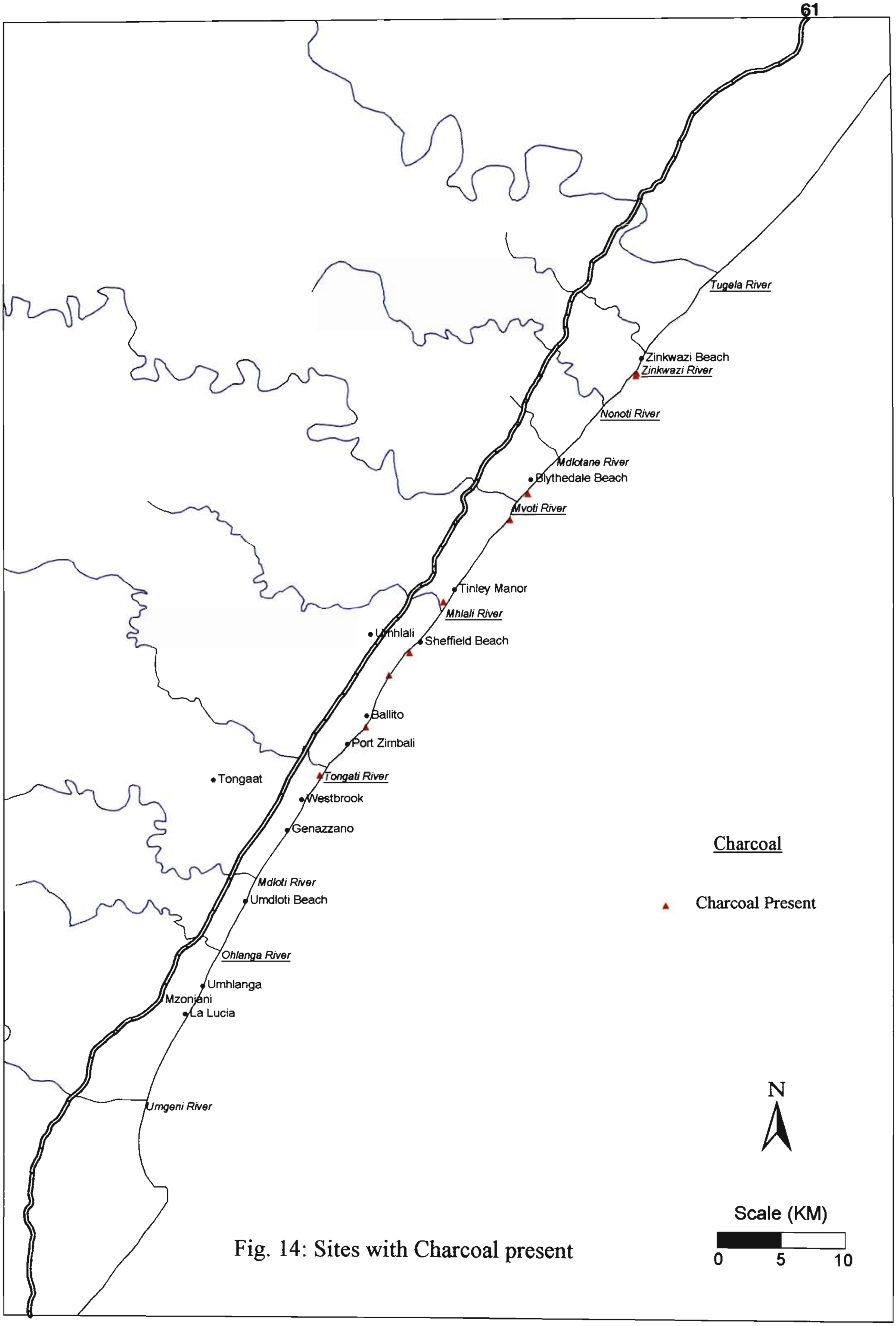

Fig. 14: Sites with Charcoal present

source of the ore. Smelting sites are often found in areas that would have had suitable trees for charcoal production. Most smelting sites have been found in savanna areas where these preferred species occur. Other smelting sites are also located in coastal forests. Although ore was carried vast distances to sources of fuelwood, the usual destination of the ore would have been a river valley where settlements occurred.

The shellfish that were collected were either processed at the coast and consumed there, or they were processed and the meat was then taken back to the settlements (Anderson, 1997). This required pottery in order to transport the shellfish, whether processed or unprocessed (Horwitz, *et al.*, 1991). Many of the recorded sites within the study area contain both mussel shells and pottery sherds. This may imply the use of pottery in processing the shellfish. Although grindstones (Fig. 15) are generally indicative of agricultural activity (used to grind grain), they may be associated with the processing of shellfish as well (Anderson, 1997), since they may have been used to crack open shellfish. This would explain the presence of grindstones both along the coast and away from the coast within the study area (Fig. 15), since agriculture was generally practised in the river valleys where the soil was fertile and suitable. In the region of the Zinkwazi River and the Tugela River there are many grindstones, which imply the presence of agriculture and settlements in these valleys. The presence of agriculture implies the clearing of natural vegetation to cultivate crops and settlement implies the use of trees for fuel and construction.

Sixteen sites were discovered in the Durban area which contain debris from iron smelting operations (Whitelaw, 1991). These consisted of one loose cluster in the greater Durban area and another cluster on the northern bank of the Umgeni River. The sources of iron ore used by precolonial smelters in southeast Africa have varied, but the iron-rich sediments of the Ecca Group were exploited to a great extent. A band of the older Pietermaritzburg Formation occurs between Mtunzini in the north and the Umgeni River in the south, near Durban. Many of the iron producing sites close to Durban occur near or on outcrops of this Formation. This Formation contains bands and lenses of siderite ($FeCO_3$) and pyrite (FeS_2), which occurs in the many joints of this Formation. When

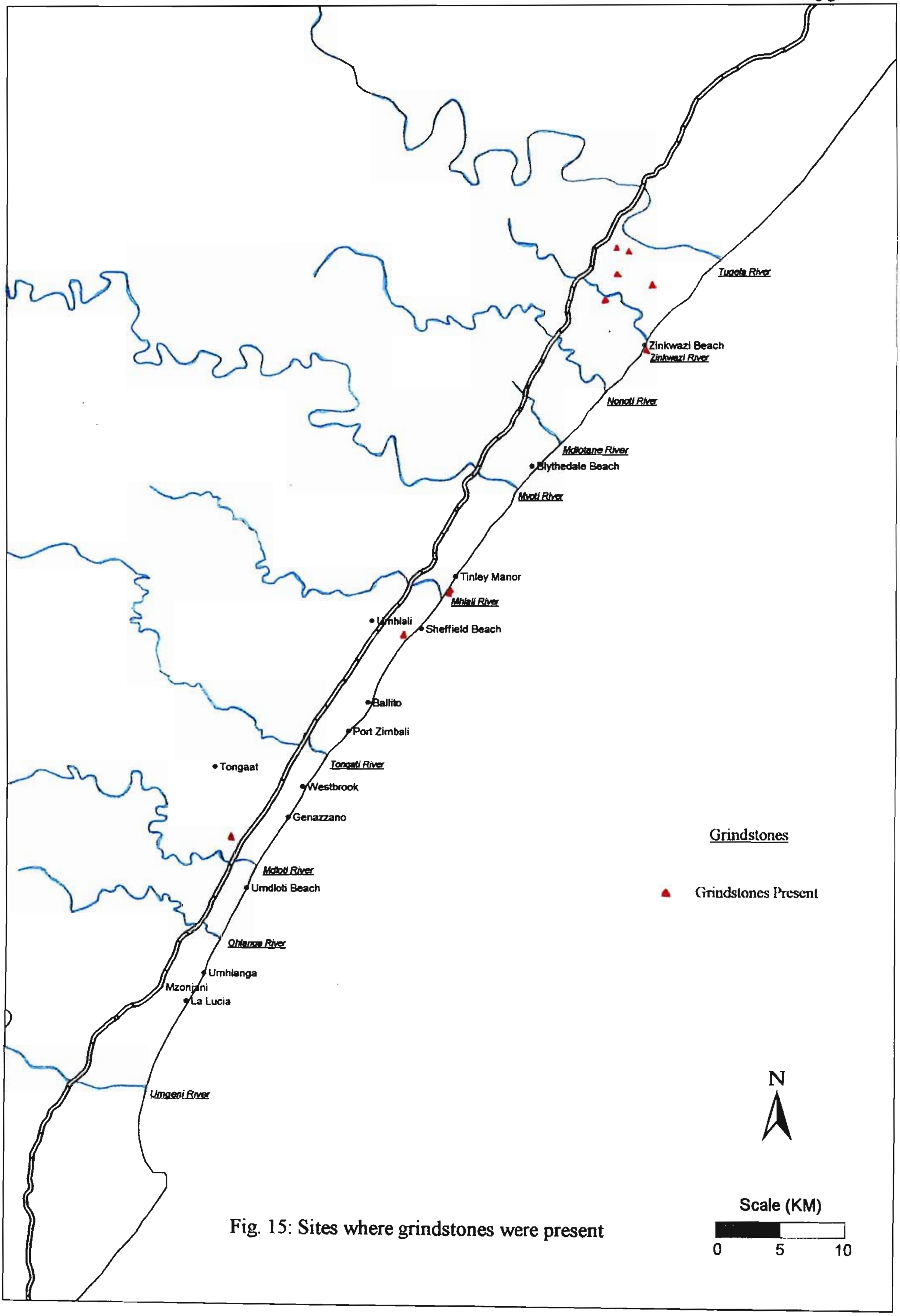

Fig. 15: Sites where grindstones were present

siderite and pyrite are exposed to weathering and oxidation, they result in the formation of haematite (Fe_2O_3). These processes resulted ultimately in the formation of snuff-box shale which provided sources of rich ores for precolonial smelters (Whitelaw, 1991). Hence weathered surface outcrops of the Pietermaritzburg Formation were valuable to the Iron Age people.

The presence of slag and tuyeres are direct indications of iron smelting. Due to rapid oxidation of worked iron there is a lack of evidence of iron implements and worked iron at archaeological sites. Slag is more durable (Clark, 1959) and this explains the presence of slag but not iron at many excavations. The distribution of sites where there is evidence of iron smelting in the form of slag and tuyeres, is shown in Figure 16.

The presence of iron working (Fig. 16) close to the coast may be related to the vegetation and the geology of the area. It is possible that the iron ore or ore-rich rock was collected some distance from the coast and then brought to the coast where the preferred trees for fuelwood were found. It is also possible that there were settlements along the coast due to the proximity to the Ecca Group of iron-rich sediments which was a source of ore for iron smelting (Whitelaw, 1991). In addition to this resource, the coast provided a rich source of protein food in the form of shellfish. This may explain the clusters of archaeological sites close to the river mouths. These relatively flat floodplains associated with some of the rivers may have been suitable for cultivation and grazing, while the abundant protein resources were close by. Hence settlements in the river valleys close to the coast were ideal.

Many possibilities exist as to the activities and settlement of the Iron Age people. It is however necessary to draw conclusions from the evidence and related literature to obtain a picture of the natural vegetation at the time of occupation of these people and assess their impact on the vegetation. It is apparent from the evidence that Iron Age people did impact on the natural vegetation. However the extent of their impact would not have been great enough due to their low densities.

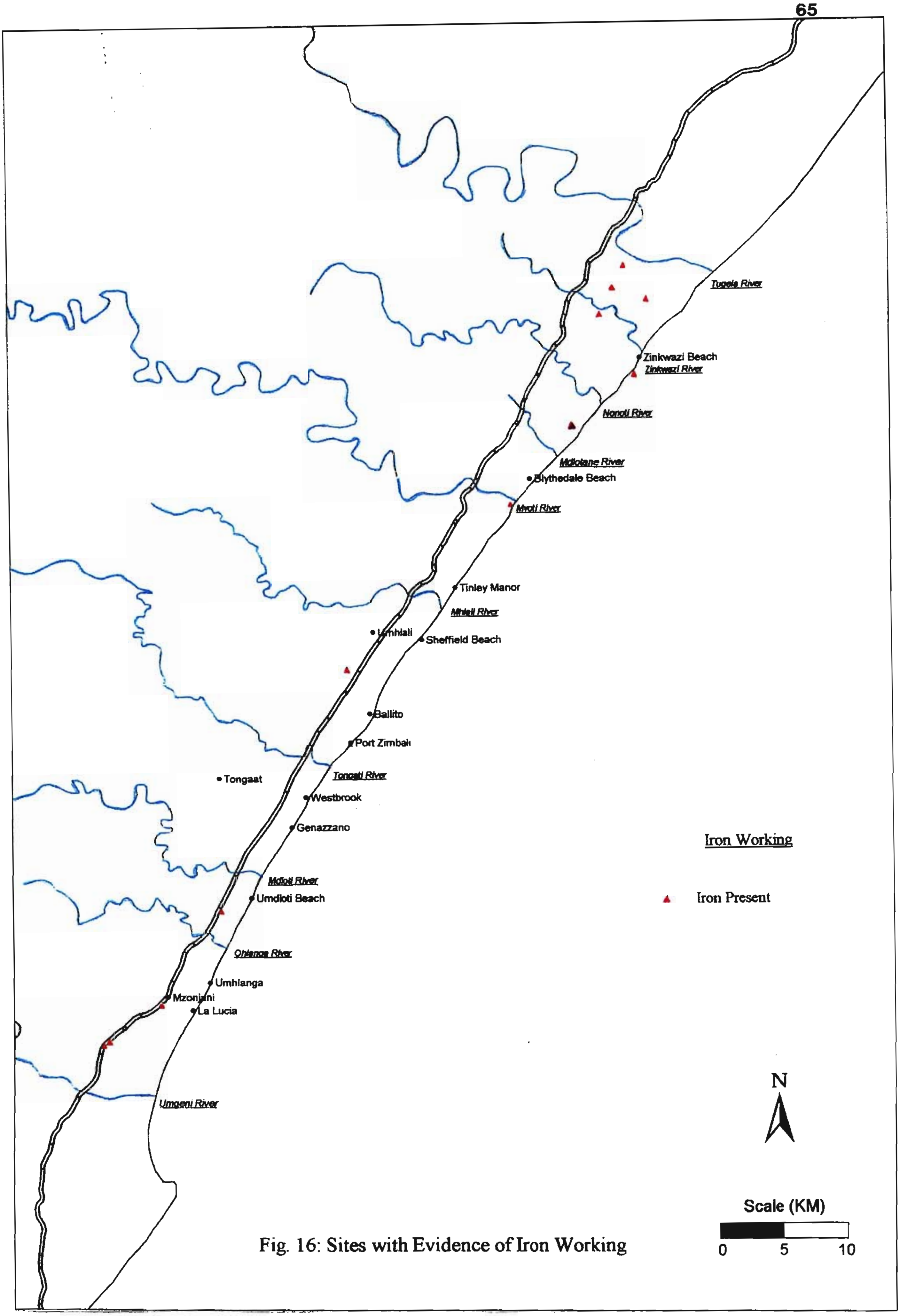

Fig. 16: Sites with Evidence of Iron Working

4.4.4 Reference to Vegetation

Anderson & Whitelaw (1996b) conducted an archaeological survey of the N2 road, part of which was between the Zinkwazi River and the Tugela River. The vegetation of this area is said to have been Coast Forest or Palm Veld (Moll, 1976), although this could have changed to a mosaic of grassveld, forest and thornbush due to the settlement of agriculturists in the area, as they would have cleared vegetation for crop land and village sites. Livestock grazing and fire could also have reduced the amount of forest during the Iron Age period (Maggs, 1980). According to Maggs (1980), the area between the Umgeni River and the Mdloti River was described as having a mosaic of tall grassveld with patches of *Acacia* bush and forest trees. It is possible that the Mzonjani site attracted Iron Age settlers because the vegetation here was more open, e.g. open woodland or grassland (Maggs, 1980). Hence there was no need to clear away trees for settlement and farming.

In their analysis of the material within the midden found at Emberton Way, Horwitz, *et al.* (1991), made reference to numerous female cysts of the genus *Margarodes*, which is a bug that feeds on plant root sap. These cysts were present in the upper three layers but absent in the lower layers of the midden. These cysts are resistant to decay and are indicative of a dense vegetation cover as the midden accumulated. This suggests that the midden had been covered by coastal dune forest. There was one specific identification of faunal remains from a midden at Emberton Way, that of a blue duiker which is endemic to coastal forests (Horwitz, et.al. 1991). The site of Emberton Way is currently located within the built up area at Ballito. It is possible that this area was covered by coastal dune forests initially.

The distribution of the archaeological sites (Fig. 9) on the north coast provides an interesting picture. Middens and other archaeological finds along the north coast indicate a strong tendency towards rivers or river mouths. There are distinct clusters or loose clusters that occur close to the rivers. This may be so due to the settlement patterns of the agriculturists. The preference was to settle in the river valleys where there was fertile soil to grow crops and graze stock animals. The creation of villages and the cultivation of crops would have required the clearing of natural vegetation. In the case of LIA sites, these occurred in more open areas.

Rock outcrops are significant features along the coast. Many of the clusters of archaeological sites are located close to rock outcrops (Fig. 9), such as Sheffield Beach, Headlands, Ballito Bay and Umdloti Beach. Rock outcrops are the ideal habitats for mussels and limpets. The bulk of the middens (Fig. 12) contained considerable volumes of empty mussel shells and to a lesser extent limpet shells. The Iron Age communities came to the coast to exploit the protein resources available in the form of shellfish. Although it is the general view that the Iron Age people lived in the river valleys where the soil was good for cultivation, evidence presented here suggests settlement along the coast as well.

4.5 Conclusion

Early settlement of the north coast of KwaZulu-Natal has impacted on the vegetation of this area through various activities. Many cultures have existed here over thousands of years and as time progressed there were changes in the technologies of the different cultures. The various cultures required different natural resources from the environment. These technologies in turn influenced their social structures, their movement and settlement patterns.

Settlement of the north coast of KwaZulu-Natal by Stone Age and Iron Age people did impact on the vegetation of the area. It is evident that many of the activities of Iron Age people required the selective removal of vegetation for specific uses, as well as the clearing of vegetation, which was replaced by agricultural crops and homesteads or villages. The evidence also suggests that settlement may have been preferred in more open areas, rather than wooded or forest areas (Maggs, 1980), although close proximity to wooded areas would have been preferred as wood was required for various activities. LIA sites would have occurred predominantly in more open areas. The dependence of these people on wood as a resource suggests that there were trees in the area which satisfied their need for this resource in some way.

The number of sites within the study area is relatively low compared to the period that is under consideration. A total of 210 sites have been discovered over a period of considerably more than 2000 years, and over a distance of approximately 100 km of coastline. This suggests a very low density of occupation, which implies low impact on the natural vegetation. In addition, the technology present at this time would have been inadequate to have a great impact on the vegetation.

From the archaeological records it is evident that the greatest activity occurred along the coast. However, this is where the forests or forest patches occur today in relative abundance. One would expect that the areas of greatest activity would have the greatest impact, yet the reverse is true, based on current patterns of vegetation distribution. All of this suggests that the impact of precolonial settlers on the natural was low.

According to Maggs (1980) the vegetation of this area was a mosaic of grassland and trees. It is unlikely that these early settlers would have cleared forest vegetation for cultivation and settlement, as they seem to have preferred more open areas where they could carry out their activities unhampered. If this was the situation, this implies that the vegetation was not modified in a drastic way by these people, but that impacts were local in the case of settlement and agricultural activities, or diffuse in the case of selective tree removal for the production of iron. Evidence presented in this chapter suggests that the impact of precolonial settlers in the area was relatively low and it is therefore unlikely that they were responsible for biome-wide change in vegetation.

CHAPTER 5

COLONIAL IMPACT ON VEGETATION

5.1 Introduction

The eastern seaboard of South Africa was sighted by Vasco da Gama at Christmas in 1497, on his voyage from Europe to Asia. He named this land Natal (Brookes & Webb, 1965). About 150 years later Portuguese sailors who were shipwrecked on the coast of Natal observed the indigenous people growing a sweet cane.

The first permanent colonial settlers in Natal were English. This initial settlement was the result of a storm, as a group of Englishmen had to seek shelter at the Port of Natal in 1822 (Brookes & Webb, 1965). Francis George Farewell and James Saunders King were the founders of the first permanent European settlement of Natal in 1824 (Shuter, 1963).

The study area was historically known as Victoria County by the colonial settlers. This county consisted of two divisions. From the Umgeni River to the Tongaat River was the Inanda Division and from the Tongaat River to the Tugela River was the Lower Tugela Division. The magisterial centre of the Inanda Division was Verulam and that of the Lower Tugela Division was Stanger (Ingram, 1895).

The north coast was described as the chief sugar producing area in KwaZulu-Natal (Russell, 1911). This area was found to be suitable for the cultivation of many sub-tropical crops due to its suitable soil, good climate and the absence of frost (Peers, 1930; Palmer, 1957; Bleek, 1965). These factors attracted settlers in search of prosperity. Hattersley (1950) stated that the area lying parallel to the coast was the most fertile and was 'bush-covered' with deep red soil. Kermode (1882) described Victoria county as one of the most 'thickly populated' counties and as being very prosperous and progressive as early as the 1800s.

Natal was also viewed as being favourable for settlement as this area was generally disease-free and was described as the "healthiest region". Hence, despite the subtropical climate which is often associated with diseases, Natal was viewed as a 'healthy' place to settle, with the exception of some cases of fever and dysentry (Methley, 1850).

The aim of this chapter is to attempt to understand what the vegetation was like at the time of or prior to European settlement along the Natal north coast margin. This is achieved by an analysis of land use change over the last 280 years, and by an analysis of early accounts of vegetation prior to development.

5.2 Methodology

This part of the study included an intensive literature search. As various works were consulted, secondary references from these were also followed up.

Information was gathered from the following sources:

a) Diarized records
b) Travellers records
c) Historical accounts/texts of early colonial settlers in Natal
d) Transcripts of early accounts
e) Photographs and/or drawings and paintings

5.3 Results and Discussion

According to Hattersley (1936) the earliest European settlers were attracted to Natal in the hope of securing ivory and profitable trade with the Zulus. The very fertile coastal area which was suitable for cultivation had to be cleared in order to grow crops. This 'bush-covered' land was difficult to clear but once felled, the timber was burned to produce readily available potash for agriculture (Hattersley, 1950).

5.3.1 Land Use and Land Use Change

Various activities of the colonial settlers, which involved a change in land use, impacted on the vegetation. These activities included settlement, development of infrastructure, agriculture and the planting of exotic species. All of these activities involved the removal of existing vegetation and/or the gradual replacement of indigenous vegetation by other species. Each of these activities is discussed below.

(i) The Impact of Sugar Cane

Experimentation with sugar cane began in the 1840s. There was a temporary collapse of sugar prices in 1847. Due to this, many Mauritian sugar planters immigrated to Natal to experiment with sugar cane (Bulpin, 1958). There was initially much speculation about the prospects of growing cane in Natal. 'Mpha', an indigenous variety of cane flourished in Natal and was eaten by the African people. This cane, however, was not profitable as the sugar content was too low. In 1847 cane seeds and shoots were imported from Mauritius and grown by many farmers as a trial. Edward Morewood successfully grew cane on his estate at Compensation in 1849 and produced the first sugar from a crudely built sugar mill in 1851 (Bulpin, 1958). The first sugar was produced and sold commercially on the Durban market by the Milner brothers in 1855 (Shuter, 1963).

Following Morewood's success with sugar cane, the north coast received much attention as an ideal cane-growing area, and many settlers obtained farms here (Bulpin, 1958). In subsequent years, the cane was grown chiefly on alluvial plains, until the great flood of 1856, when there was extensive damage to Springfield Estate along the Umgeni River. This estate had supplied the first Natal-grown cane for sale to the Durban market (Hattersley, 1936). Morewood also discovered coal on his farm at Compensation, but this was found to be of inferior quality (Bulpin, 1958).

Sir Leige Hulett came to Natal in 1857. Through his dedication and effort, Hulett's Sugar Refinery was established. At this time sugar cane was cultivated at Mount

Edgecombe, Umvoti, Tongaat and Umdloti. The two largest sugar mills were at Mount Edgecombe and Tongaat (Russell, 1911). There was experimentation with various crops along the coast, but it was eventually realised that the area was best suited for sugar cane cultivation (Palmer, 1957). Choonoo (1967) recognised that the presence of the sugar belt represented the extent to which there had been destruction of the natural vegetation along the Natal coastal area. As the sugar industry grew, more of the natural vegetation was removed.

Fuel was also required for manufacturing processes (Ellis, 1998). The early industry in the area that required fuelwood was the sugar processing mills. However, these operations were initially small, which implies that their impact on the vegetation was probably small.

(ii) The Impact of Other Agricultural Products

Initially there was vigorous competition between arrowroot, indigo, cotton, coffee and sugar, in order to determine which would be successful enough for export. The coast was suitable for the cultivation of coffee, indigo and cotton (Hattersley, 1950). The Natal variety of indigo gave a better yield than the Javanese indigo (Hattersley, 1950), hence some indigo was also cultivated for export (Hurwitz, 1957). Indigo was used to dye cotton and woolen materials but the market for this crop decreased with the development of synthetic dyes (Akitt, 1953). Fruits grown in Natal included bananas, pineapples and figs (Bleek, 1965).

Cotton was also experimented with and it grew well in Natal. In the 1840s there was a general rise in the price of cotton in England, and interest grew in planting cotton in Natal. There was a good opportunity to export cotton from Natal, but a lack of expertise and the presence of unskilled labour, led to the failure of the cotton industry (Shuter, 1963). Morewood became manager of a cotton plantation on the Mdloti River. He experimented with cotton in his efforts to find the most suitable crop for the coast (Bulpin, 1958). Morewood later abandoned cotton in favour of sugar cane cultivation

(Hattersley, 1950). England's interest in Natal cotton was the beginning of publicity in England to encourage the English to seek agricultural land in Natal.

Coffee was also grown along the north coast at Umhlali in 1856. Not enough was known about growing coffee, which resulted in its failure as a commercial crop (Brooks, 1876). Tobacco and cayenne pepper were also planted along the coast and maize was grown throughout the province and became the staple grain (Russell, 1911). Tea plants were brought from Kew Gardens in the mid-1800's. In the 1880s James Liege Hulett expanded the tea farming sector (Hattersley, 1950). The main tea plantations were between Umhlali and the Tugela, with the largest at Kearsney tea estate.

Despite much interest in the agricultural development of the north coast of KwaZulu-Natal in the last century, and interest in the area today, sugar cane cultivation is the most important agricultural activity in this area.

(iii) The Impact of Settlements

There was clearing of 'bush' in order to build houses and shops. 'Bush' may indicate dense vegetation, but it is unlikely that large areas of forest were cleared away as this would have been an immense task. Wood of many of the Natal trees was used to build houses and other buildings, and to make wagons, coaches and furniture (Ingram, 1895). Wood was also suitable for building ships (Kermode, 1882).

Durban was formally established in 1835, with 40 European inhabitants (Fair, 1955). Verulam was founded in 1850 and grew from twenty houses in 1850 to forty houses in 1870 (Hattersley, 1936). The land in Verulam was very fertile and the first settlers had much success in growing fruit and vegetables (Bulpin, 1958). Russell's 1911 account of Victoria county made reference to the population of Verulam as being 1325. Verulam became the third important town of the colony of Natal and the capital of Victoria County. Stanger was established in 1873 (Fair, 1955). A number of immigrants from Holland had settled at New Guelderland and Doesberg, a few kilometers north of Stanger

(Russell, 1911). The total white population of the coastal area from the Tugela River in the north to the Mthamvuna River in the south, by 1870, was just over three thousand, which implies that their exploitation of the vegetation for domestic fuel was not extensive (Ellis, 1998).

A government proclamation granted every immigrant a farm of 3000 acres, provided that he settled on it and contributed to defence. This land ('farm' as stated in the proclamation) could only be sold after seven years (Bleek, 1965).

Due to labour shortages, indentured Indian labourers were brought to Natal in 1860 to work on the cane fields. Many of these Indians chose to settle along the north coast and in Durban once their term of employment ended. This led to an increase in the number of settlements and farms along the north coast.

(iv) The Impact of Transport Routes

In the 1860s sugar was transported by rail from Umgeni to the Point (Hattersley, 1936). By 1854 there was a need for a railway to serve the sugar industry along the north coast. Verulam became the terminus of the north coast railway line in 1879, which made this settlement accessible. This railway line was extended to Tongaat in 1897. In December 1898 this railway was completed up to the Tugela River (Bulpin, 1958).

The north coast road (Russell, 1911) crossed the Umgeni River over a low bridge and continued into Victoria county, through Tugela Ferry into Eshowe and Melmoth. Along most of this road cultivated land was visible. The only river that was bridged was the Tongaat River.

Indigenous trees were also used in the development of the railway network during the 19th century. Indigenous timber was used for railway sleepers (Lawes & Eeley, 2000). Species used for this purpose included yellowwood (*Podocarpus*), stinkwood (*Ocotea bullata*), sneezewood (*Ptaeroxylon obliquum*) and hard pear (*Olinia radiata*). Most of these species are typical of forest or coastal bush habitats (Pooley, 1993). It was simple to find this timber but regulating the felling of these species was difficult.

(v) The Impact of Exotic Plants

Apart from the indigenous wood being used for building and carpentry, exotic trees and shrubs were planted (Kermode, 1882). The British settlers planted exotic flora for their fruit or for ornamental purposes. Many of these exotic plants grew very well in South Africa (Kermode, 1882). Umzimbeet and flatcrown trees were marketed as wagon wood (Sim, 1905). Mr McEwan, a keen horticulturist, made his home at Greenwood Park. He planted trees from every part of south, east and central Africa in the area, which were thriving well. In this area there were still remnants of a densely wooded vegetation (Ingram, 1895).

In the early 19th century it was perceived that the indigenous forests would not be able to sustain the needs of the Colony of Natal. Due to this, there was an increase in tree-planting. This resulted in the introduction of exotic species (Sim, 1905). Black wattle (*Acacia mearnsii*), blue gum (*Eucalyptus globulus*) and pine (*Pinus* sp.) were grown as they were easily obtainable and grew rapidly. The casuarina (*Casuarina leptoclada*), the silk oak (*Grevillea robusta*) and the teak (*Tectona grandis*) were grown for their useful timber. Various species of bamboo were grown for their use as ornamentals, for shelter and timber (Sim, 1905). Palms were also grown along the coast, for their ornamental value.

Many of the above introduced species replaced the indigenous vegetation as they invaded large areas. These species competed with the indigenous vegetation. Some of these species have become a problem to the extent that they need to be deliberately removed.

5.3.2 Flora and Fauna in Early Accounts

(i) Flora

The coastal areas were viewed with wonder and admiration, and were found to be very valuable fertile land. The area between the Umgeni River mouth and the Umdloti River mouth was described as a belt of 'primeval' forest that was almost uninterrupted. This belt of forest was about two miles (3.2 km) in width (Hattersley, 1936). Hattersley (1936) described the area between Umhlali and Stanger as "park-like", which indicated the natural state of the area as grassland with scattered trees or tree clumps. He also referred to this area as "beautiful sylvan retreats", until they were invaded by sugar cane plantations. The latter description indicated the presence of trees, possibly dense. The phrase "across the grassy glades from bush to bush" implies the presence of grasslands with scattered trees or patches of trees. Hattersley (1950) also referred to the coastal belt as undulating grassland scattered with low trees and brushwood.

The road between Verulam and Zululand was described as having remnants of the original forests along the way in the form of euphorbias and mimosa trees, but the area was predominantly covered by cultivated lands in the late 1800s (Ingram, 1895). This suggests a park-like savanna of grassland with trees.

In contrast, many accounts of the coastlands of Natal describe the vegetation as being lush forest prior to sugar cane cultivation (Ingram, 1895; Peers, 1930). Akitt (1953) described the vegetation of the coast as dense bush and forest, during the 1850's, which would have been a 'formidable task' to clear, in preparation for agriculture. There was little or no conservation of forests when the coastal area was established as sugar cane cultivation land (Phillips, 1973).

The graceful date-palm (*Phoenix reclinata*) and wild banana (*Strelitzia nicolai)* were seen growing wild, in clumps, all along the coast. Other common plants included the leafless, succulent tree-euphorbia and its relatives, *Euphorbia candelabrum* and *Euphorbia caput-*

medusae, as well as the amatungulu (*Carissa*), which is found along the beaches (Russell, 1911). The trees were described as being generally low (9-18m high), consisting of mainly leguminous evergreens. Common trees included the water berry (*Syzygium cordatum*), flat crown (*Albizia adianthifolia*), Cape chestnut (*Calodendrum capense*), knob thorn (*Acacia nigrescens*), red milkwood (*Mimusops caffra*), white milkwood (*Sideroxylon inerme*), red ivorywood (*Berchemia zeyheri*), ironwood (*Olea capensis*), umsimbithi (*Millettia grandis*) and the coast coral tree (*Erythrina caffra*). Many of these trees are typical of coastal forest while others are typical of savanna or woodland. It is possible that these trees occurred in forest patches within more open vegetation.

Kermode in his 1882 account of Natal describes the deficiency of wood fuel. He described the excessive consumption of wood and the great extent of tree-felling. At this time it seemed that there was already a great deal of damage done. The claim was that the normal humidity of the coastal area, in particular, had been affected by the British due to the clearing of coastal bush. Kermode (1882) stated that there was no legislation to protect indigenous trees or forest trees and that there was need to stop tree-felling and to resort to tree-culture. Indigenous trees listed by Kermode (1882), included the following: bitter-almond wood (*Prunus africana*), Cape chestnut (*Calodendrum capense*), essenwood (*Ekebergia capensis*), flat-crown wood (*Albizia adianthifolia*), ironwood (*Olea capensis*), milkwood (various species), saffron wood(*Cassine* sp.), stinkwood (*Ocotea bullata*), tamboti wood (*Spirostachys africana*) and yellowwood (*Podocarpus* sp). These woods were used for cabinet-making and building. Only some of these trees are typical of coastal forest, while the majority are typical of savanna and grassland habitats still found further inland today.

Brooks (1876) described the coastal vegetation as one great mass of trees and flowering shrubs, with evergreen vegetation, and having open 'park-like glades' covered in luxuriant grass and flowers. The wild banana (*Strelitzia nicolai*) and wild date palms (*Phoenix reclinata*) were common along the coast. Other common coastal plants included the 'Natal plum' (*Carissa macrocarpa*) and coast coral tree (*Erythrina caffra*). Many timber trees were to be found in the 'thick bush' along the coast.

Choonoo (1967) stressed the importance of the remnants of the original vegetation which appear in areas that have been difficult to cultivate or unsuitable for the cultivation of sugar cane. These remnants afford some idea of the appearance of the original landscape. The claim by this author was that a narrow strip of the coast consisted of green subtropical forest. This forest was described as short, dense and tangled. There are also areas between forest patches, which were described as open 'parkland', with single trees or groups of trees scattered amongst mixed grassland. Some of these 'parklands' are scattered with wild banana (*Strelitzia nicolai*) and Ilala palms (*Hyphaene natalensis*), hence the label "Palm Belt" in some areas. Ellis (1998) describes the early coastal vegetation behind the dune forest as forested areas interspersed with palm belts, where the Natal fig (*Ficus natalensis*) and the wild banana (*Strelitzia nicolai*) are common. This is still evident in some areas of the north coast.

Many accounts of the coastal area of Natal describe the patches of forest in the area, as remnants of the original vegetation. Most of these authors (Archaeology & Natural Resources of Natal, 1951; Choonoo, 1967; Hurwitz, 1964) made assumptions or based their description of the vegetation on classifications used by the Pentz (1945) or Acocks (1953). The latter two authors based their classifications on the concept of a climatic climax vegetation that they expected to be typical of the area.

From the evidence discussed above, it is apparent that the original vegetation of the north coast, in parts, consisted of dense trees and forest. However, there is also considerable evidence of grassland with scattered bush clumps, and also of savanna typical of the dry river valleys in KwaZulu-Natal ("Valley Bushveld" as described by Acocks, 1953). It seems highly unlikely that large areas were stripped of dense coastal forest, in order to cultivate sugar cane and other crops. Powerful tools, much labour and much time would have had to be invested in the widespread removal of such dense vegetation. One problem that was faced by the settlers, was a shortage of labour, as the African people were unwilling to work for them. Agriculture had to be profitable in order to continue, but it seems that this would not have been the case if vast areas of dense forest were to be cleared. However, densely forested areas may have provided the timber mentioned in some records, which were used for building, carpentry and fuel.

Forest patches that are believed by some authors to be remnants of the original vegetation, may actually be remnants of larger patches. The settlers may have removed trees from these patches for various uses. There is no concrete evidence to suggest that there was continuous forest along the coast, as proposed by Acocks (1953), Adamson (1938) and Moll (1976), Pentz (1945), Pole Evans (1936).

(ii) Fauna

Game was plentiful prior to colonial settlement. "Wild deer" were commonly found amongst the grazing cattle of the indigenous African people, and elephants were viewed in large herds when Natal was visited by Europeans in the late seventeenth century (MacKeurtan, 1930). Kermode (1882) expresses concern over the diminishing number of antelope seen in Natal. These included eland, oribi, kudu, duiker, roan antelope, steen buck and blue buck.

Methley (1850) in his account of Port Natal made reference to lion, elephant, buffalo, leopard, hyaena, eland, hartebees, alligator and wild boar along the coastal areas, and hippopotamus near river mouths. Lion and hyaena were seen in Natal in 1855-1856 (Bleek, 1965). Lions were roaming free at Verulam in the 1850s and they were a menace in cattle kraals (Bulpin, 1958). Hippos were found at Sea-Cow Lake and hyaenas and jackals were plentiful along the old North Coast Road (Bulpin, 1958). Herds of buffalo were sighted at the Umgeni, Mvoti and Tugela Rivers in the early 1850s.

Settlers killed many species of wild animals as they caused much destruction. The dwindling numbers of these animals from the areas with the passage of time meant that their habitats were being destroyed. This occurred as agricultural land became a priority along the north coast.

Most of the animal species that were sighted along the north coast, were species typical of savanna habitats, and would not occur in the area had it been forest or scrub forest.

5.4 Vegetation of Undeveloped Coastal Areas in KwaZulu-Natal

Coastal areas further north of the study area display vegetation that consists of grasslands with scattered bush clumps. Areas south of Mozambique, such as at Sodwana Bay, have vegetation that is open grassland, with scattered patches of trees, together with dune forest along the immediate coastline, predominantly on the foredunes (Plate 1).

It is possible that the original vegetation of the study area was very similar to that in Plate 1. This implies that the original vegetation of this area has changed to a much smaller extent than proposed by Acocks (1953). The areas currently under cultivation, along the north coast, were possibly grasslands with scattered tree clumps. It is likely that these areas were cultivated because the land required less preparation than if it were forested, as the existing vegetation was more open. Much greater effort would have been required to clear forests.

5.5 Conclusion

The coastal belt has become well known for its thriving sugar industry. This began more than a century ago and its impact on the vegetation is apparent by the extensive areas covered by sugar cane. Agriculture was initially the predominant activity along the north coast of KwaZulu-Natal, but this area has since proven to offer much more. The colonial settlers impacted on the vegetation in various ways, which included agriculture, settlements and tree planting. It is evident that agriculture has had the greatest impact on the vegetation of the north coast.

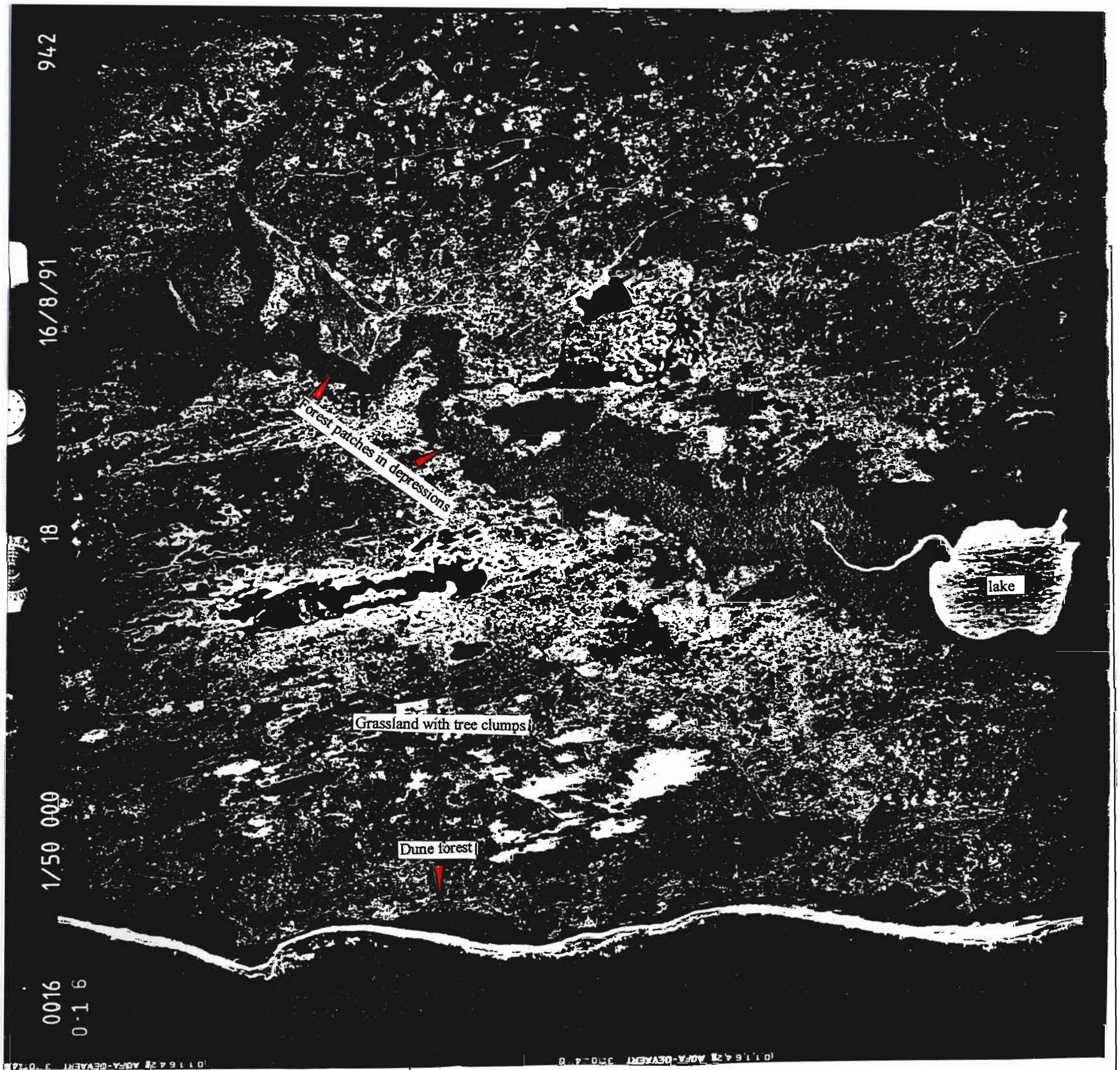

Plate 1. The mosaic of grassland and tree clumps, with forested foredunes, between Sodwana and Kosi Bay.

The coastal dune forests and patches of trees along the north coast are interpreted by many authors as remnants of a continuous belt of forest along the eastern seaboard of South Africa. Evidence suggests that the colonial settlers cleared vegetation that was more open than proposed by authors who described the coastal vegetation as forest. The flora and fauna imply grassy vegetation with patches of trees. This is very much as the natural vegetation is at present, where it has not been removed or replaced. Hence, Acocks's (1953) 'false' grasslands may have been in existence for much longer than the 600 years proposed by Acocks.

CHAPTER 6

CONCLUSION

6.1 The Impact of Settlement

The evidence provided in this thesis suggests that the vegetation of the north coast of KwaZulu-Natal has not been subject to a biome-wide change by the settlement of the area, as proposed by Acocks (1953). Rather, the picture presented, is of an area with natural vegetation that has remained largely unchanged, except for areas where vegetation has been replaced by settlements, developments and agriculture. The vegetation was most likely a mosaic of grassland and forest patches or tree clumps, with coastal forest on the foredunes. Although the settlement of the study area by precolonial and colonial people did impact on the vegetation, this impact was insufficient to result in the extensive conversion of forest to grassland, due to their low densities. Iron Age settlers used woody plants and trees for domestic purposes (fire), iron smelting, homesteads and later, European settlers used it for building purposes and the construction of furniture and wagons. They also cleared vegetation in order to settle in the area or for agricultural reasons.

Various studies have suggested that the grassland biome (including the 'false' grasslands) as it is presently mapped, is considerably older than the 600 years which was suggested by Acocks (1953). It is possible that the boundaries of grasslands, forests and savannas have been altered through time but it is unlikely that there has been a biome-wide change (Ellery & Mentis, 1992).

6.2 The Role played by Climate and Fire

Fire has played an important role in ecosystems (Ellery & Mentis. 1992). In areas where there is seasonal rainfall, fires are a common occurrence during the dry season. These natural fires may occur regularly and must play a role in the maintenance of the different biomes.

Fires generally occur in areas with a mean annual rainfall that exceeds 235 mm (Rutherford & Westfall, 1994). Moderate rainfall is required in order to accumulate sufficient fuel to carry a fire. However, biomes in which fire is an important driving variable, need to burn relatively frequently and generally have a climate with more than 450 mm rainfall per annum, and the presence of a marked and prolonged dry season which desiccates vegetation and makes it flammable. The study area is susceptible to fires, due to its high annual rainfall, and the presence of a season of relatively low rainfall. These conditions would create conditions that make fires a possibility.

The north coast of KwaZulu-Natal has summer rainfall, with dry winters. During winter hot dry 'berg' winds are experienced which result in extremely hot, dry conditions. This desiccates the vegetation and results in their greater susceptibility to burning (Ellery, *et al.*, 1991). Within the 'false' grassland areas, woody vegetation occurs predominantly in sites that are sheltered from fire (Mentis & Huntley, 1982) referred to as "berg wind shadow areas" by Ellery *et al.* (1991). The importance of berg winds as a driving force in the vegetation of the eastern seaboard of KwaZulu-Natal has not really been recognised, but is illustrated by the fact that the highest daily maximum temperatures are recorded here in the winter months (Weather Bureau, 1990). During this time of the year these high temperatures are associated with very low humidities. The climate therefore maintains a disturbance regime that excludes the establishment of woody plants.

Apart from fire that results from hot dry weather, natural fires may result from lightning. Lightning fires have played a significant role in shaping tropical and subtropical savannas (Goldhammer, 1992). Traditional practices of vegetation burning over millenia, have also influenced the distribution of plant communities. Savannas are often of edaphic, climatic or fire (natural) origin. Within the savanna biome, the grass stratum predominantly provides the fuel for fires. The moist savannas that have high loads of flammable grasses per unit area have intense fires and shorter fire-return intervals.

Feely (1987) alternately suggested that the grassland biome may have been maintained by edaphic factors rather than climate. It has also been suggested by Rutherford & Westfall (1994) that distribution of the grassland biome may be influenced by specific edaphic conditions. It is believed that the deep, humic A horizon soils of the interfluves along the coastal hinterland of Natal develop under grasslands (Mentis & Huntley, 1982). This suggests that the 'false' grasslands could be much older than that proposed by Acocks (1953).

There are areas further north of the study area that have not been densely settled on yet (e.g. Sodwana and Kosi Bay). These areas are relatively undisturbed. Here the vegetation is a mosaic of grassland and tree clumps, with forested foredunes (Plate 1). Dense vegetation occurs predominantly in depressions and river valleys that are protected from fire. In contrast, the flatter, more open areas are grasslands, and these appear to have been maintained by the natural fire regime. This area also falls within Acocks's (1953) 'false' grasslands. It is therefore possible that the study area originally had a similar vegetation to this, in which natural fire may have played a major role.

It is indisputable that there has been extensive removal of trees in the past, in KwaZulu-Natal (Lawes & Eeley, 2000). Many early accounts refer to areas of the coast and Durban as "dense jungle" and "primeval bush". The extent of this dense forest however, is questionable. There is little evidence that suggests a continuous strip of coastal forest along the north coast. Many early descriptions of forests along the coast may in fact be reference to what is often termed "relict patches of forest" (Lawes & Eeley). This could possibly be reference to forest patches in "berg wind shadow areas".

Acocks (1953) proposed that the climax vegetation of the eastern seaboard was forest and scrub forest, based on the notion of a "climatic climax" vegetation that was the highest expression of vegetation that a given climate could support. The grassland/forest mosaic discussed above may have been the original vegetation of this area but can this be termed "climatic climax"? Despite the important role of the climate in maintaining the vegetation via the natural fire disturbance regime, it is debatable whether this would concur with Acocks's (1953) concept of a "climatic climax". This study therefore highlights the need to further understand the relationship between fire and vegetation distribution, and the relationship between climate and fire, in order to fully understand natural distribution of vegetation at a biome-wide scale.

6.3 Implications for Conservation

The general view held by scientists, ecologists and the general public is that the vegetation of the north coast of KwaZulu-Natal was forest, and that this has been destroyed by human activities during the precolonial and colonial periods. The focus therefore, has been to conserve forested areas and forest patches. This neglects the opposing view that grasslands in the area may be natural, and that they should be considered as having a high conservation value. It is therefore necessary for the relevant conservation officials to acknowledge that the so-called 'false' grasslands are in fact natural, and that they are important in the future conservation and management plans of the area. This should also be considered in the event of developments in the area, as the north coast is rapidly becoming developed as an important tourist area.

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APPENDIX 1

Data Table of Archaeological Sites

Site No	1	2	3	4	5
Locality	Williamson (Tugela River)	Williamson 12871	Williamson 12871	Williamson 12871	Tugela mouth and Tugela Estate
Local Name		Harold Johnson Nature Reserve	War Graves Hill	Harold Johnson Nature Reserve	Farm 4 Lot 1675
Latitude	29° 12-13′ S	29° 12′ 16″	29° 12′ 48″	29° 12′ 44″	29° 14′
Longitude	31° 25-26′ E	31° 25′ 23″	31° 25′ 46″	31° 25′ 13″	31° 28-29′
Date of Occupation Early/Middle/Late	Late Stone Age (LSA)		Middle Stone Age (MSA)		Early Stone Age (ESA)
Site Category	Riverine site	Eroded river terrace	River gravel	Surface pottery	Red Dune site
Pottery present and Amount			A few sherds of native pottery in the cemetery	Small sherds – all undecorated	Few crude Sangoan artefacts
Iron present					
Shells					
Stones	Scattered flakes		Flakes, end-scrapers, hollow scrapers	Present	
Other				1 pebble grind stone	

Site No	6	7	8	9	10
Locality	Tugela Mouth, Farm – Ihloko Bos	Havelock Farm, Darnall	Maccorkindales Grant 1810	Maccorkindales Grant 1810	Maccorkindales Grant 1810
Local Name			Zinkwazi River	Zinkwazi Estate	Zinkwazi Estate
Latitude	29° 13′ 45″	29° 14′	29° 14′ 55″	29° 14′ 18″	29° 14′ 14″
Longitude	31° 29′ 15″	31° 28′	31° 24′ 39″	31° 26′ 55″	31° 25′ 07″
Date of Occupation Early/Middle/Late	Late Iron Age (LIA)	LSA	Early, Middle, Late Stone Age; EIA	LIA	ESA
Site Category	Shell Midden		Surface, buried	Surface	Surface
Pottery present and Amount	One NC2 Sherd		EIA pottery; pots	Many sherds	
Iron present			Scatter of slag; Ore present.	Small concentration of ore and ochre	
Shells	Present				
Stones		Spherical, highly polished stone, flattened stone			Quartzite choppers, Flake-handaxe in slate
Other			EIA grindstones	several grindstones	

Site No	11	12	13	14	15
Locality	Maccorkindales Grant 1810	Fort Pearson	Fort Pearson	Fort Pearson	Tugela Mouth, Farm-Ihloko bos
Local Name	Zinkwazi Estate				
Latitude	29° 13′ 50″	29° 12′ 54″	29° 12′ 52″	29° 13′ 00″	29° 14′ 45″
Longitude	31° 25′ 18″	31° 25′ 50″	31° 26′ 03″	31° 26′ 15″	31° 28′ 25″
Date of Occupation Early/Middle/Late	LSA	MSA, EIA, LIA	Historic	EIA	
Site Category	Surface	Surface	Surface	Surface	Shell midden
Pottery present and Amount	Scattered sherds; 1 LIA rim sherd; some pottery	EIA pottery;		Very small sherds; 2 large pieces of daga; pieces of pottery	
Iron present	A piece of ore	Small piece of vitrified tuyere			
Shells					Mussels
Stones	Present	Present			
Other	3 grindstones	LIA broken grindstones	Historical – boot heels, rifles from Anglo-Zulu war		

Site No	16	17	18	19	20
Locality	Iti Bay	Zinkwazi Beach	Zinkwazi Beach	Zinkwazi Beach	Salt Rock Sheffield Beach
Local Name					Stevens Rock
Latitude	29° 17′ 30″	29° 17′ 10″	29° 17′ 12″	29° 17′ 20″	29° 29′ 20″
Longitude	31° 25′ 55″	31° 26′ 28″	31° 26′ 25″	31° 26′ 20″	31° 15′ 07″
Date of Occupation Early/Middle/Late	EIA				Undifferentiated Iron Age
Site Category	Stray	Shell middens	Shell middens	Shell middens	Shell middens
Pottery present and Amount	1 Incised sherd, NC3				Few sherds
Iron present					
Shells		Large mussels	Fragments of small mussels	Fragmentary large mussels; Large oysters	
Stones					
Other				1 Scrap of bone	Large dense midden

Site No	21	22	23	24	25
Locality	Blythedale Beach	Mvoti River – North Bank	Sheffield Beach	Tinley Manor Beach	Sheffield Beach
Local Name		Blythedale Beach	Elephant Rock	Headlands	Elephant Rock
Latitude	29° 22′ 10″	29° 22′ 40″	29° 29′ 07″	29° 27′ 16″	29° 29′ 12″
Longitude	31° 20′ 42″	31° 20′ 30″	31° 15′ 25″	31° 17′ 07″	31° 15′ 18″
Date of Occupation Early/Middle/Late			EIA		
Site Category		Red Dune Site	Shell midden	Shell midden	Shell midden
Pottery present and Amount	Few Sangoan pieces		Large quantity of pottery	NC3 sherd; Much pottery, undecorated	Present; 4 sherds
Iron present					
Shells			Small amount of shells	Mussels, oysters, few limpets	Mostly mussels; few oysters; small limpets
Stones		Small hammer stone			
Other					Possibility of a hearth; Scraps of charcoal; a little bone

Site No	26	27	28	29	30
Locality	Zinkwazi Beach	Zinkwazi Beach	Zinkwazi Beach	Zinkwazi Beach	Zinkwazi Beach
Local Name					
Latitude	29° 16′ 57″	29° 17′ 25″	29° 17′ 26″	29° 17′ 27″	29° 17′ 28″
Longitude	31° 26′ 38″	31° 26′ 20″	31° 26′ 20″	31° 26′ 19″	31° 26′ 19″
Date of Occupation Early/Middle/Late		Undifferentiated Iron Age (UIA)	UIA	UIA	UIA
Site Category	Shell midden	Shell midden	Shell midden	Shell midden	Shell midden
Pottery present and Amount					Small sherds; NC2 and NC3
Iron present					Few pieces of iron ore
Shells	*Perna*; limpets; oysters	*Perna*	Mostly *Perna*	Mostly *Perna*	Large *Perna*
Stones	Broken stones	Few small stones			
Other		Charcoal			

Site No	31	32	33	34	35
Locality	Zinkwazi Beach	Blythedale	Blythedale	Tinley Manor	Tinley Manor
Local Name				Headlands	Headlands
Latitude	29° 17′ 31″	29° 22′ 10″	29° 22′ 50″	29° 27′ 03″	29°27′ 12″
Longitude	31° 26′ 17″	31° 21′ 10″	31° 20′ 22″	31° 17′ 11″	31° 17′ 08″
Date of Occupation Early/Middle/Late	UIA				
Site Category	Shell midden	On beach, possibly from midden	Beach sand	Shell midden	Shell midden
Pottery present and Amount	No sherds			Few undecorated sherds	Much NC3 pottery
Iron present					
Shells	*Perna*; few burnt shells; few limpets		Present	Mussels	Mostly mussels; few limpets; few oysters
Stones	Few pebbles	2 Flat lydianite pebbles, flaked as "shell-openers"	Few small pebbles	Beach pebbles	
Other	Charcoal			Few grindstones	Grindstones

Site No	36	37	38	39	40
Locality	Zinkwazi Mouth	Zinkwazi Mouth	Hyde Park	Hyde Park	Hyde Park
Local Name				Nonoti Hill	Nonoti Beach
Latitude	29° 17′ 00″	29° 17′ 40″	29° 19′ 18″	29° 19′ 40″	29° 20′ 10″
Longitude	31° 26′ 40″	31° 26′ 00″	31° 24′ 05″	31° 23′ 15″	31° 23′ 10″
Date of Occupation Early/Middle/Late	EIA	UIA		LIA	
Site Category			Red dune	Dune site	Shell midden
Pottery present and Amount	NC3 pottery	Spherical pottery		NC2 sherds; glazed pottery	
Iron present				Kidney Iron ore; iron pot	
Shells	Present	Present		Limpet, mussel and conus; small local cowries	Mussels – intact, in good condition
Stones	Stone knife		Few Sangoan tools	Few Sangoan tools; broken stones	
Other	3 Human skeletons; animal bones; cut bone; Grindstone	Bones present		Beads; pieces of coiled brass bangle	

Site No	41	42	43	44	45
Locality	Blythedale Beach	Blythedale Beach	Blythedale	Mvoti Mouth	Kearsney
Local Name			Jex Estates		
Latitude	29° 22′ 02″	29° 22′ 30″	29° 22′ 35″	29° 23′ 35″	29° 24′ 10″
Longitude	31° 20′ 50″	31° 21′ 00″	31° 19′ 45″	31° 20′ 09″	31° 19′ 30″
Date of Occupation Early/Middle/Late			LIA		
Site Category	Raised Beach	Shell midden	Shell midden	Stratified shell midden	Shell midden
Pottery present and Amount			NC2 Sherds		
Iron present					
Shells		Mussels, some burnt	Mussels present	Mussels in good condition	Mussels, soft and compacted
Stones	Rough flakes and choppers – Sangoan pieces	Burnt stones	Broken stones		
Other		Charcoal	Animal bones	Lower levels abundant charcoal	Black, humic sand

Site No	46	47	48	49	50
Locality	Tinley Manor	Tinley Manor	Tinley Manor	Tinley Manor	Tinley Manor
Local Name			Skea's Rock		
Latitude	29° 25′ 25″	29° 26′ 00″	29° 26′ 40″	29° 27′ 00″	29° 27′ 02″
Longitude	31° 18′ 34″	31° 17′ 15″	31° 17′ 30″	31° 16′ 57″	31° 16′ 55″
Date of Occupation Early/Middle/Late	EIA, LIA	EIA			LIA
Site Category	Shell midden	Pottery midden	Shell midden	Shell midden	Shell midden
Pottery present and Amount	NC2, NC3 sherds	NC3 pottery	Some sherds		NC2 sherds
Iron present					
Shells	Mussels, in good condition		*Perna*	Mussels in poor condition	*Perna*
Stones	Few smashed pebbles		Few dolerite pebbles		
Other					Wood charcoal; animal bones

Site No	51	52	53	54	55
Locality	Tinley Manor	Tinley Manor	Tinley Manor	Sheffield Beach	Zinkwazi Beach
Local Name	Headlands		Dune		
Latitude	29° 27′ 07″	29° 27′ 10″	29° 27′ 15″	29° 29′ 01″	29° 17′ 40″
Longitude	31° 16′ 09″	31° 16′ 56″	31° 17′ 11″	31° 15′ 00″	31° 25′ 30″
Date of Occupation Early/Middle/Late	EIA	LSA, EIA, LIA	ESA, MSA, LSA, LIA	UIA	
Site Category	Shell middens	Shell midden	Red dune & midden site	Shell midden	Shell midden
Pottery present and Amount	NC3 sherds	NC2 pottery	Present	Few NC2 sherds	
Iron present					
Shells	*Perna*	Mussels	Present	Mussels and limpets	*Perna*
Stones	Pebbles	Broken boulders	Pebbles		
Other		Little charcoal; little bone	Bones and teeth	Broken, large grindstone	

Site No	56	57	58	59	60
Locality	Sheffield Beach	Mvoti Mouth	Tinley Manor	Tinley Manor Beach	Maccorkindales Grant 1810
Local Name					Sinkwazi Estate
Latitude	29° 29′ 03″	29° 22′ 58″	29° 27′ 00″	29° 27′ 22″	29° 15′ 33″
Longitude	31° 15′ 27″	31° 20′ 13″	31° 17′ 13″	31° 16′ 55″	31° 24′ 30″
Date of Occupation Early/Middle/Late	UIA	UIA	EIA	EIA	MSA, USA, LIA
Site Category	Shell midden	Surface	Open site – midden	Midden	Surface
Pottery present and Amount	Present		Present	Present	Present
Iron present		Iron hoe			
Shells	Broken shells				
Stones			Present	Present	Present
Other				Bone present	

Site No	61	62	63	64	65
Locality	Hyde Park	Maccorkindales Grant	Tinley Manor	Ballito Bay	Willard's Beach
Local Name			Headlands	Compensation Beach	
Latitude	29° 18′ 40″	29° 16′ 10″	29° 27′ 08″	29° 32′ 45″	29° 31′ 35″
Longitude	31° 21′ 40″	31° 24′ 10″	31° 17′ 12″	31° 12′ 52″	31° 13′ 37″
Date of Occupation Early/Middle/Late	LIA	LIA	EIA, LIA	EIA	
Site Category	Surface	Surface	Midden	Shell midden	Shell midden
Pottery present and Amount	Small sample of pottery	Present	LIA pottery	Abundant sherds	
Iron present					
Shells				Small mussels, few oysters	Shells in patches
Stones		Present	Present		
Other			Evidence of grinding		

Site No	66	67	68	69	70
Locality	Cottonlands	Cottonlands	Umdloti Beach, Verulam Road	Umdloti Beach, Verulam Road	Lot A39 1532
Local Name					
Latitude	29° 37′ 13″	29° 37′ 35″	29° 40′ 17″	29° 40′ 10″	29° 42′ 07″
Longitude	31° 06′ 19″	31° 06′ 38″	31° 05′ 56″	31° 05′ 50″	31° 04′ 28″
Date of Occupation Early/Middle/Late		EIA	LIA	LIA	EIA
Site Category	Unstratified	Pottery scatter	Pottery scatter	Scatter of pottery and molluscs	Red Dune Rock interface
Pottery present and Amount		6 sherds	7 sherds	Sherds present	
Iron present			2 pieces of iron slag; 1 piece tuyere		
Shells				Mussels	
Stones	Pebble tools and 1 flake		1 flake	Pebbles	
Other		Very little bone; 2 grindstones		Bones	Geological

Site No	71	72	73	74	75
Locality	Mzonjani	Tongaat Beach Westbrook	Genezzano	Genezzano Beach	Emberton Way
Local Name					
Latitude	29° 44′ 05″	29° 35′ 50″	29° 36′ 47″	29° 36′ 40″	29° 32′ 22″
Longitude	31° 03′ 15″	31° 10′ 05″	31° 09′ 27″	31° 09′ 30″	31° 13′ 12″
Date of Occupation Early/Middle/Late	EIA	EIA			EIA
Site Category			Shell midden	Shell midden	
Pottery present and Amount	Present	Dense NC3 pottery		Very little pottery	EIA sherds
Iron present					
Shells	EIA Shells	Concentration of *Perna* shells	Mussels, oysters	*Perna, Patella*	Densely composted and decalcified shells (mussels)
Stones			Flakes	Flat pebbles	
Other					Some charcoal

Site No	76	77	78	79	80
Locality	Salt Rock	Salt Rock	Umhlali	Tongaat Beach Hotel	Umhlanga Lagoon – North bank
Local Name					
Latitude	29° 30′ 08″	29° 30′ 19″	29° 30′ 45″	29° 34′ 58″	29° 42′
Longitude	31° 14′ 20″	31° 14′ 15″	31° 13′ 50″	31° 10′ 40″	31° 06′
Date of Occupation Early/Middle/Late	EIA		EIA	EIA	
Site Category	Shell middens (2)	Shell midden	Midden	Shell midden	Midden
Pottery present and Amount	Few plain sherds	A few sherds	Plain sherds	A few coarse sherds	NC2 sherds
Iron present					
Shells	Large mussels	Mussels	Broken shells	Broken mussels	
Stones		Sharp piece of stone			
Other	Great deal of charcoal		Few bones		

Site No	81	82	83	84	85
Locality	Tongaat River Mouth North Bank	Tongaat River Mouth North Bank	Umdloti Beach	Port Zimbali	Port Zimbali
Local Name					
Latitude	29° 36′ 25″	29° 33′ 03″	29° 41′ 20″	29° 33′ 08″	29° 33′ 24″
Longitude	31° 09′ 36″	31° 12′ 04″	31° 06′ 30″	31° 12′ 17″	31° 11′ 46″
Date of Occupation Early/Middle/Late		LIA, EIA	ESA, EIA	EIA	ESA, EIA, LIA
Site Category	Midden	Dune sites	Coastal middens	Midden	Midden
Pottery present and Amount		NC2, NC3 fragments of pottery	NC2 pottery	Present	Pot present
Iron present				Metal	
Shells	Present			Present	Present
Stones	NC2, NC3 pebbles		Flakes	Present	Present
Other				Bone	Bone

Site No	86	87	88	89	90
Locality	Port Zimbali	La Lucia	La Lucia	La Lucia	Lot 31 1560
Local Name					
Latitude	29° 33′ 34″	29° 45′ 00″	29° 45′ 00″	29° 45′ 06″	29° 42′ 57″
Longitude	31° 11′ 47″	31° 02′ 05″	31° 03′ 16″	31° 02′ 50″	31° 04′ 02″
Date of Occupation Early/Middle/Late	LSA, USA	LIA	LIA	LIA	LIA
Site Category	Midden	Surface precipitate	Surface precipitate	Surface precipitate	Surface
Pottery present and Amount	Present				Present
Iron present					
Shells	Present				Present
Stones	Present				Present
Other	Bone				Bone

Site No	91	92	93	94	95
Locality	Lot 31 1560	Lot 31 1560	Lot 31 1560	Lot 31 1560	Lot 31 1560
Local Name					
Latitude	29° 43′ 16″	29° 43′ 24″	29° 43′ 14″	29° 43′ 15″	29° 43′ 18″
Longitude	31° 03′ 54″	31° 03′ 50″	31° 04′ 02″	31° 04′ 27″	31° 04′ 20″
Date of Occupation Early/Middle/Late	LIA	LIA	LIA	LIA	LIA
Site Category	Surface	Surface	Surface	Surface	Surface
Pottery present and Amount	Present	Present	Present	Present	Present
Iron present					
Shells	Present	Present	Present	Present	Present
Stones		Stone	Present		Present
Other	Bone				

Site No	96	97	98	99	100
Locality	Lot 31 1560	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank
Local Name					
Latitude	29° 43′ 20″	29° 34′ 00″	29° 33′ 50″	29° 33′ 43″	29° 33′ 42″
Longitude	31° 04′ 14″	31° 11′ 11″	31° 11′ 26″	31° 11′ 37″	31° 11′ 42″
Date of Occupation Early/Middle/Late	LIA	EIA	EIA	LSA	LIA
Site Category	Surface	Midden	Midden	Dune	Coastal midden
Pottery present and Amount	Present				
Iron present					
Shells	Present				
Stones	Present				
Other	Bone				

Site No	101	102	103	104	105
Locality	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank
Local Name					
Latitude	29° 33′ 41″	29° 33′ 30″	29° 33′ 25″	29° 33′ 25″	29° 33′ 04″
Longitude	31° 11′ 42″	31° 11′ 43″	31° 12′ 00″	31° 11′ 57″	31° 12′ 02″
Date of Occupation Early/Middle/Late	LSA, LIA	LSA	LSA	LIA	LSA, EIA
Site Category	Coastal midden	Open	Dune	Midden	Dune
Pottery present and Amount					
Iron present					
Shells				Present	
Stones					
Other					

Site No	106	107	108	109	110
Locality	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank
Local Name					
Latitude	29° 33′ 06″	29° 33′ 08″	29° 33′ 08″	29° 33′ 15″	29° 33′ 16″
Longitude	31° 12′ 15″	31° 12′ 15″	31° 12′ 05″	31° 12′ 02″	31° 12′ 05″
Date of Occupation Early/Middle/Late	EIA	LSA, EIA	LSA, EIA	LSA, EIA	LIA
Site Category	Dune	Shell midden	Dune	Dune	Dune
Pottery present and Amount					
Iron present					
Shells		Present			
Stones					
Other					

Site No	111	112	113	114	115
Locality	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	Tongati River Mouth North Bank	La Mercy Township
Local Name					
Latitude	29° 33′ 08″	29° 33′ 35″	29° 33′ 25″	29° 33′ 25″	29° 38′ 36″
Longitude	31° 11′ 59″	31° 11′ 42″	31° 11′ 48″	31° 11′ 56″	31° 07′ 32″
Date of Occupation Early/Middle/Late		LSA, EIA, LIA	LIA	LIA	
Site Category	Coastal	Stratified	Dune	Dune	Marine gravel
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	116	117	118	119	120
Locality	La Mercy Township	La Mercy Township	La Mercy Township	Umdloti Beach	Umdloti Beach
Local Name					
Latitude	29 ° 38′ 15″	29° 37′ 56″	29° 37′ 36″	29° 40′ 10″	29° 40′ 05″
Longitude	31° 07′ 13″	31° 07′ 18″	31° 06′ 36″	31° 05′ 53″	31° 07′ 00″
Date of Occupation Early/Middle/Late				ESA	LSA
Site Category	Beach gravel	Beach gravel	Beach gravel		
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	121	122	123	124	125
Locality	Umdloti Beach	Umdloti Beach	Umdloti Beach	Umdloti Beach	Umdloti Beach
Local Name					
Latitude	29° 40′ 00″	29° 40′ 00″	29° 40′ 00″	29° 38′ 40″	29° 39′ 41″
Longitude	31° 07′ 15″	31° 06′ 58″	31° 06′ 27″	31° 07′ 42″	31° 06′ 08″
Date of Occupation Early/Middle/Late	EIA	LIA	UIA		LSA, EIA, LIA
Site Category	Shell midden	Midden		Beach gravel	Dune middens, NC2 and NC3 sherds
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site no	126	127	128	129	130
Locality	Umdloti Beach	Umdloti Beach	Umdloti Beach	Umdloti Beach	Ballito Bay
Local Name					
Latitude	29° 39′ 07″	29° 39′ 45″	29° 39′ 49″	29° 39′ 52″	29° 32′ 49″
Longitude	31° 07′ 27″	31° 07′ 00″	31° 07′ 22″	31° 07′ 03″	31° 12′ 43″
Date of Occupation Early/Middle/Late	LSA, LIA	MSA, LSA		LIA	EIA
Site Category	Stratified	Middens	Shell midden		Shell midden
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	131	132	133	134	135
Locality	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay
Local Name					
Latitude	29° 32′ 43″	29° 32′ 43″	29° 32′ 42″	29° 32′ 42″	29° 32′ 42″
Longitude	31° 12′ 54″	31° 12′ 37″	31° 12′ 58″	31° 13′ 01″	31° 12′ 43″
Date of Occupation Early/Middle/Late	EIA		USA, UIA	EIA, LIA	LIA
Site Category	Shell midden	Shell midden	Shell midden, 2 burials	Shell midden	Shell midden
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	136	137	138	139	140
Locality	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay
Local Name					
Latitude	29° 32′ 41″	29° 32′ 39″	29° 32′ 37″	29° 32′ 20″	29° 32′ 13-15″
Longitude	31° 13′ 00″	31° 13′ 01″	31° 12′ 45″	31° 13′ 15″	31° 13′ 22″
Date of Occupation Early/Middle/Late	EIA, LIA			UIA	
Site Category	Shell midden	Shell midden	Shell midden	Human burials and middens	Shell midden
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	141	142	143	144	145
Locality	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay	Ballito Bay
Local Name					
Latitude	29° 32′ 15″	29° 32′ 13″	29° 32′ 12″	29° 32′ 12″	29° 32′ 15″
Longitude	31° 13′ 00″	31° 13′ 16″	31° 13′ 10″	31° 13′ 21″	31° 13′ 19″
Date of Occupation Early/Middle/Late	LIA	UIA	LIA		
Site Category	Shell midden	Shell midden	Shell midden	Shell midden	Shell midden
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	146	147	148	149	150
Locality	Ballito Bay	Ballito Bay	Ohlanga River Mouth (North Bank)	Ohlanga River Mouth (North Bank)	Ohlanga River Mouth (North Bank)
Local Name					
Latitude	29° 32′ 06″	29° 32′ 10″	29° 41′ 32″	29° 41′ 43″	29° 41′ 48″
Longitude	31° 13′ 24″	31° 13′ 01″	31° 06′ 23″	31° 06′ 17″	31° 06′ 11″
Date of Occupation Early/Middle/Late		LIA			
Site Category	Shell midden	Shell midden	Shell midden	Shell midden	Shell midden
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	151	152	153	154	155
Locality	Ohlanga River Mouth (North Bank)	Ohlanga River Mouth (North Bank)	Ohlanga River Mouth (North Bank)	Sunningdale Extension	Sunningdale Extension
Local Name					
Latitude	29° 41′ 54″	29° 42′ 10″	29° 42′ 08″	29° 44′ 24″	29° 44′ 16″
Longitude	31° 06′ 00″	31° 06′ 02″	31° 05′ 49″	31° 03′ 24″	31° 03′ 30″
Date of Occupation Early/Middle/Late	LSA	EIA, LIA	MSA, LSA	LIA	LIA
Site Category	Shell midden	Shell midden	Shell midden	Surface	Surface
Pottery present and Amount				Present	Present
Iron present					
Shells					
Stones				Present	
Other				Bone	

Site No	156	157	158	159	160
Locality	Sunningdale Extension	Sunningdale Extension	Sunningdale Extension	Sunningdale Extension	Sunningdale Extension
Local Name		Tongaat Hulett Office			
Latitude	29° 44′ 20″	29° 43′ 55″	29° 44′ 16″	29° 44′ 14″	29° 44′ 00″
Longitude	31° 03′ 21″	31° 03′ 46″	31° 04′ 06″	31° 03′ 05″	31° 03′ 24″
Date of Occupation Early/Middle/Late	LIA		LIA	EIA	UIA
Site Category	Surface	Surface		Surface	Shell midden
Pottery present and Amount	Present		Present	Present	
Iron present					
Shells			Present		
Stones			Present		
Other					

Site No	161	162	163	164	165
Locality	Sunningdale Extension	Sunningdale Extension	Sunningdale Extension	Sunningdale Extension	Avendale
Local Name			Office	Office	
Latitude	29° 43′ 54″	29° 43′ 55″	29° 44′ 03″	29° 43′ 54″	29° 32′ 14″
Longitude	31° 03′ 26″	31° 03′ 34″	31° 03′ 45″	31° 03′ 46″	31° 12′ 52″
Date of Occupation Early/Middle/Late	LIA	LIA	LIA	LIA	UIA
Site Category	Surface	Surface	Surface	Surface	Shell midden
Pottery present and Amount	Present	Present	Present	Present	Few small sherds
Iron present					
Shells			Present	Present	*Perna*
Stones			Present		
Other			Bone		

Site No	166	167	168	169	170
Locality	Tongati Beach – South Bank	Genezanno	Genezanno	Genezanno	Newsel-Umdloti crossroads
Local Name					
Latitude	29° 34′ 23″	29° 36′ 25″	29° 36′ 32″	29° 36′ 33″	29° 40′ 16″
Longitude	31° 10′ 58″	31° 09′ 30″	31° 09′ 37″	31° 09′ 36″	31° 06′ 22″
Date of Occupation Early/Middle/Late	LSA	LSA, EIA	EIA	LSA	UIA
Site Category	Shell midden	Shell midden	Shell midden	Shell midden	Pottery site and midden
Pottery present and Amount		NC3	NC3		NC2
Iron present					
Shells	Mussel, oyster, limpet.	Mussels	Mussels	*Perna, Patella*	Mussels
Stones		Flakes	Broken stones	Shell opener, Blade.	
Other	Little charcoal, Fish bones, few fragments of animal bones.			Vertebra of large mammal, bone.	

Site No	171	172	173	174	175
Locality	Selection Beach	Smerdon's Flat	Huletts Sugar Estates	Ballito	Sunnyside
Local Name					
Latitude	29° 40′ 24″	29° 42′ 00″	29° 42′ 02″	29° 32′ 37″	29° 30′ 00″
Longitude	31° 06′ 58″	31° 05′ 30″	31° 04′ 50″	31° 12′ 57″	31° 12′ 10″
Date of Occupation Early/Middle/Late		MSA	USA	UIA	LIA
Site Category	Shell midden	Dune Site		Midden	Middens
Pottery present and Amount		Absent	Present	Present	
Iron present					Tuyeres
Shells	Mussels				Mussels
Stones	Pebbles, marine sandstone.	Basalt arrow-head and flakes	Stone chips		
Other				Human skeleton	Bones

Site No	176	177	178	179	180
Locality	Madelaine Ave, Ballito	Newsel Beach	Thompsons Bay	Blackburn	Umhlanga Lagoon
Local Name					
Latitude	29° 32′ 04″	29° 40′ 32″	29° 31′ 26″	29° 41′ 13″	29° 42′ 35″
Longitude	31° 12′ 54″	31° 06′ 55″	31° 13′ 41″	31° 05′ 43″	31° 05′ 40″
Date of Occupation Early/Middle/Late	UIA	EIA	LIA	LIA	LIA
Site Category	Midden	Midden	Midden	Surface	Midden
Pottery present and Amount	Present	Present	Present	Present	Present
Iron present					
Shells			Present	Present	Present
Stones	Present			Present	
Other	Bone	Bone		Bone	

Site No	181	182	183	184	185
Locality	Ballito Bay	Willard Beach	Umhlanga Lagoon	La Lucia	La Lucia
Local Name					
Latitude	29° 32′ 05″	29° 31′ 14″	29° 43′ 40″	29° 44′ 15″	29° 44′ 43″
Longitude	31° 13′ 10″	31° 13′ 44″	31° 05′ 28″	31° 03′ 41″	31° 04′ 35″
Date of Occupation Early/Middle/Late	UIA		EIA		EIA
Site Category	Shell midden	Shell midden	Coastal midden	Dune	NC3 settlement or midden
Pottery present and Amount			NC3 sherds		
Iron present					
Shells			Mussels		
Stones			Broken stones		
Other					

Site No	186	187	188	189	190
Locality	Tongati Mouth – North Bank	Shakasraal	Shaka's Rock	Umhlanga Rocks	La Lucia
Local Name					1 Homeford Road
Latitude	29° 33′ 20″	29° 30′ 26″	29° 31′ 12″	29° 43′ 42″	29° 45′ 00″
Longitude	31° 12′ 00″	31° 14′ 08″	31° 13′ 44″	31° 05′ 28″	31° 04′ 30″
Date of Occupation Early/Middle/Late	LSA, LIA			LSA	LIA
Site Category	Dune site	Shell midden	Shell midden	Shell midden	Burial
Pottery present and Amount					
Iron present					
Shells					
Stones					
Other					

Site No	191	192	193	194	195
Locality	Peace Cottage	La Lucia Ridge	Mzonjani 2	Mzonjani Extension	Zimbali 1
Local Name					
Latitude	29° 41′ 01″	29° 44′ 50″	29° 44′ 20″	29° 44′ 24″	29° 32′ 50″
Longitude	31° 06′ 44″	31° 02′ 53″	31° 03′ 06″	31° 02′ 58″	31° 11′ 50″
Date of Occupation Early/Middle/Late	UIA	LIA	EIA, LIA	LIA	EIA
Site Category	Midden	Surface	Surface	Surface	Surface, midden
Pottery present and Amount		Present	Present	Present	Present
Iron present				Slag	
Shells	Present				
Stones				Present	
Other				Daga, smoking pipe	

Site No	196	197	198	199	200
Locality	Zimbali 4	Ballitoville	Tongati Beach	Willard Beach	Athlone, Durban North
Local Name		Boulder Bay			
Latitude	29° 33′ 34″	29° 32′ 22″	29° 34′ 40″	29° 31′ 25″	29° 48′ 31″
Longitude	31° 11′ 30″	31° 13′ 12″	31° 10′ 40″	31° 13′ 30″	31° 02′ 30″
Date of Occupation Early/Middle/Late	ESA	EIA	LIA		
Site Category	Surface	Midden	Midden	Marine terraces	Swamp stray find
Pottery present and Amount		Present			A number of sherds
Iron present					
Shells		Present			
Stones	Present	Pebbles			
Other					

Site No	201	202	203	204	205
Locality	Glen Anil 909	Durban North	Durban North	Greenwood Park	Durban North
Local Name		Virginia Aerodrome	Old Reservoir		
Latitude	29° 45′ 55″	29° 46′ 30″	29° 46′ 42″	29° 47′ 20″	29° 48′ 13″
Longitude	31° 03′ 42″	31° 03′ 20″	31° 02′ 02″	31° 01′ 15″	31° 02′ 26″
Date of Occupation Early/Middle/Late	EIA	LSA, LIA	EIA	MSA	MSA
Site Category	Sherds from destroyed midden			Boulder bed	Dune site
Pottery present and Amount	6 EIA sherds	NC2 pottery	NC3, NC2 pottery	MSA artefacts	
Iron present					
Shells					
Stones					Sangoan and Smithfield material
Other					

Site No	206	207	208	209	210
Locality	Riverside Road	Riverside	Effingham	Effingham	Effingham
Local Name					
Latitude	29° 48′ 25″	29° 48′ 18″	29° 45′ 50″	29° 45′ 59″	29° 46′ 08″
Longitude	31° 02′ 04″	31° 01′ 16″	31° 00′ 36″	31° 00′ 25″	31° 00′ 07″
Date of Occupation Early/Middle/Late		UIA	LIA	LSA, EIA	LIA
Site Category	Estuarine terrace	Surface	Surface	Surface	Surface
Pottery present and Amount		Present	Present	Present	Present
Iron present				Slag, tuyere.	Slag, tuyere.
Shells					
Stones			Present	Present	
Other					