

1 · *Anthropogenic Influences in Hluhluwe-iMfolozi Park: From Early Times to Recent Management*

MARISKA TE BEEST, NORMAN OWEN-SMITH, ROGER PORTER, AND JIM M. FEELY

1.1 Introduction

Early humans (*Homo* spp.) have been an integral component of African savannas since their origination around 2 million years ago. These early humans influenced their environment by harvesting edible plants, hunting large animals, and at some stage through igniting fires, during the prolonged period while their tools remained constructed of stone. People with implements and weapons made of iron immigrated into southern Africa from the north nearly 2000 years ago, absorbing some of the hunter-gatherers, and displacing wild ungulates from where they grazed their herds of domestic sheep and cattle. Over 500 years ago, people in ships travelling from Europe towards East Asia set foot on South African shores. They established temporary settlements that soon became permanent and spread to become initially Dutch and later British colonies. Firearms were brought and an expanding trade in ivory and other wildlife products developed. Eventually the disappearance of the wild animals prompted legislation to establish 'game reserves' where hunting would be prohibited. Two of these game reserves became consolidated to form the Hluhluwe-iMfolozi Park (HiP).

The initial history of these game reserves was turbulent, because local white farmers fought to have them deproclaimed to eliminate

Conserving Africa's Mega-Diversity in the Anthropocene, ed. Joris P. G. M. Cromsigt, Sally Archibald and Norman Owen-Smith. Published by Cambridge University Press.
© Cambridge University Press 2017.

the wildlife that formed a reservoir for cattle diseases. After a series of campaigns aimed at the eradication of tsetse flies (*Glossina* spp.), which transmitted blood parasites (*Trypanosoma* spp.) that infected cattle, a provincial authority was established to administer and eventually consolidate the game reserves. Management philosophies evolved from simply protecting the surviving wild animals to restoring the former fauna. This proved so successful that culling was introduced to alleviate perceived overgrazing. Eventually a more scientifically informed approach to management was adopted, aimed at fostering the ecological processes that had formerly operated on a vaster scale. HiP currently persists as a fenced island surrounded by increasingly dense human settlements.

It is the purpose of this chapter to describe these changing anthropogenic influences on the ecology of HiP as context for the chapters that follow. As will become evident, both the vegetation (Chapter 3) and wildlife (Chapter 4) have undergone continual flux. Expanding human populations and consequent land transformation in the surrounding region increasingly threaten conservation objectives within the protected area.

1.2 Archaeological History: Middle to Later Stone Age

Humans living as hunter-gatherers with tools made of stone were present in most parts of South Africa from far back in time, and had become anatomically modern around 120,000 years ago (Mitchell, 2002). Their presence in HiP is confirmed by stone implements or rock paintings recorded at more than 65 sites (Penner, 1970). It is uncertain until what time they inhabited the region that now includes HiP, but as recently as 1593 survivors of the wrecked Portuguese ship *Santo Alberto* met people armed with spears and arrows, who were not farmers, about 40 km northwest of HiP (Vernon, 2013). There are no historical reports of hunter-gatherers, i.e. people of Khoi-San ancestry, in this region of KwaZulu-Natal during the nineteenth century. Nevertheless, the click consonants that are typical of Khoi-San languages became incorporated into Zulu and related Nguni languages spoken by the people with Iron Age culture who displaced and absorbed these earlier inhabitants from around 500 AD.

It is unclear whether hunting by Stone Age people affected wildlife populations to any great extent. Humans were thinly scattered and their weapons were of short range with limited power. Probably more important ecologically would have been the practice of these people to use fire

to attract ungulates for hunting (Deacon and Deacon, 1999). As a consequence, humans would probably have changed the fire regime throughout the summer rainfall region of southern Africa and elsewhere (see Chapter 10). More-or-less random ignition by lightning in spring or early summer probably gave way to regular veld burning in autumn or winter, once the field layer became dry enough to burn. The changed fire regime probably commenced well before the appearance of anatomically modern humans in South Africa over 120,000 years ago and was perpetuated from then into modern times (Deacon and Deacon, 1999; Kingdon, 2003).

Some indication of the predominant animal species that Stone Age hunters killed is provided by archaeological excavations conducted at Sibudu Cave, located alongside the Tongati river approximately 150 km south of HiP (Plug, 2004; Clark and Plug, 2008). Sedimentary layers there span the Middle Stone Age from 77,000 to 38,000 years ago as well as more recent layers from 900 to 1000 AD, and contain abundant bones of large mammals, particularly Burchell's zebra (*Equus burchelli*), hartebeest (*Alcelaphus* sp.), African buffalo (*Syncerus caffer*) and the extinct giant buffalo (*Peleovis antiquus*) (see Chapter 4 for a detailed account). The people inhabiting this cave gathered plant material for bedding as well as for food, and thus had impacts on vegetation besides their use of fire (Wadley *et al.*, 2011).

1.3 Early to Late Iron Age

Early farmers with spears, axes, and hoes made of iron arrived in South Africa from the north nearly 2000 years ago (Hall, 1987; Huffman, 2007). Initially, their geographical distribution was confined to savanna and forest regions where fuel wood for their iron smelters was available (Feely, 2004). Two periods associated with metal smelting have been distinguished in South Africa as the Early Iron Age and the Late Iron Age. The Early Iron Age commenced around 300 AD and ended during the eleventh century. Settlements were clustered into villages, separated by half a kilometre or more, usually occupied for two or more generations, even for a century or longer (Maggs, 1984; Hall, 1987; Huffman, 2007). Indeed, the KwaGandaganda site near present Durban was continuously occupied for four centuries (Whitelaw, 1994). Besides constructing dwellings, clearing fields, and grazing livestock (initially sheep and soon after goats and cattle as well), these Iron Age people needed to gather huge amounts of wood for smelting iron ore (Feely, 1980).

Some of the earliest Iron Age sites, dated to the third–fifth centuries AD, occur along the coastal strip of KwaZulu–Natal, from the northern border with Mozambique southward to near the Mzimkhulu river mouth (Maggs, 1984). One example exists near Lake Mphangazi north of St Lucia estuary about 30 km east of HiP (Hall, 1981). Between the sixth and eighth centuries AD, farming settlements in KwaZulu–Natal expanded inland along the entrenched valleys of perennial streams (Maggs, 1984). In HiP, a seventh-century site from this period has been identified close to the Hluhluwe river (Hall, 1979a,b, 1981). Two other Early Iron Age sites have been found along the southern bank of the Black Mfolozi river (J. M. Feely, unpublished records, KwaZulu–Natal Museum). All three of these sites are located on fertile, valley bottom soils close to rivers, as is typical of this period elsewhere in south–eastern Africa (Hall, 1981; Maggs, 1984).

The Early Iron Age was succeeded by the Late Iron Age during the eleventh century AD (Maggs, 1984; Huffman, 2007), probably indicating the arrival of new settlers with a distinct culture. No sites between the tenth and fourteenth centuries have been firmly identified in KwaZulu–Natal, suggesting that farming people may have moved away from this region in response to unfavourable climatic conditions during this period (Prins, 1996). An archaeological survey conducted by Penner identified 134 sites representing the Late Iron Age within HiP, mapped by Hall (1979a,b; Figure 1.1). Artefacts from this period are relatively more obvious than those at sites from earlier in the Iron Age, which may have been buried by soil and revealed only after subsequent erosion or the activities of animals (J. M. Feely, personal observation, 1973–1982). Hence, mapped Late Iron Age sites are probably biased towards the youngest sites from the eighteenth and nineteenth centuries. The most important change occurring in KwaZulu–Natal during the Late Iron Age was in the size and location pattern of settlements. They were generally small and occupied by a single family for perhaps only one generation and were situated on the slopes and crests of hills and ridges (Maggs, 1984). The change in the location of settlements probably reflects Late Iron Age farmers wanting to avoid increased parasite infection risks for their cattle near rivers (Feely, 2004). Within HiP, Late Iron Age sites are commonly present near the 280-m contour, adjoining dolerite outcrops (Hall, 1981). The numerous Zulu place names for every hill, stream, or other place of note within HiP (see the Appendix in the Preface) attest to how thoroughly settled or traversed the region was by these Late Iron Age inhabitants.

The Iron Age peoples harvested wood as fuel for cooking, smelting, and working metals, mainly iron, and for the construction of dwellings,

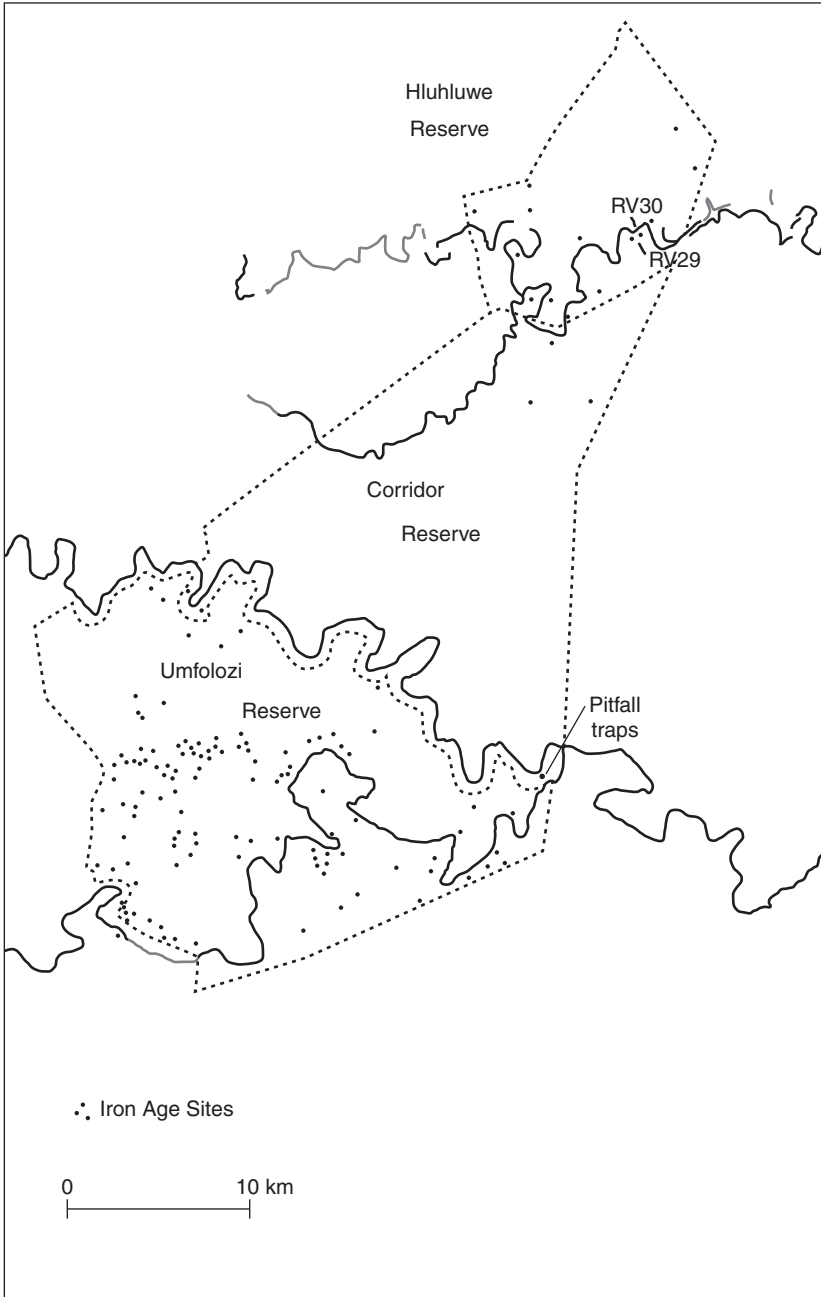


Figure 1.1 Positions of known Iron Age sites within HiP. RV29 and RV30 refer to two sites in the Hluhluwe river valley that were originally recorded by Penner (1970) and investigated and described in detail by Hall (1979b). The pitfall traps refer to a third site that has been investigated in detail by Hall (1977). It consists of a line of pitfall traps which lie near the confluence of the two Mfolozi rivers. (Reprinted with permission from Ezemvelo KZN Wildlife; Hall, 1979b.)

as well as grass for thatching (Maggs, 1984; Hall, 1987; Huffman, 2007). Staple crops grown were the grasses sorghum (*Sorghum bicolor*) and pearl millet (*Pennisetum glaucum*), and after the mid-seventeenth century also maize (*Zea mays*). Accumulations of cattle dung within the livestock enclosures and ash from cooking fires enriched mineral nutrients in soils around these settlements. Early African farmers would also have gathered plants for medicines, fruits, bark, and other natural resources, as rural people do today (van Wyk and Gericke, 2000). Fruits of marula trees (*Sclerocarya birrea*) were evidently esteemed as early as the first millennium AD in the nearby Thukela valley (Maggs, 1984). Pitfall traps for the hunting of large game remain evident near the confluence of the Mfolozi rivers within HiP (Figure 1.1). These probably date to the reign of King Shaka in the 1820s (Hall, 1977).

Among the Late Iron Age sites mapped by Penner (1970), 15% showed signs of being used either for smelting iron ore (Hall, 1980) or as forges for iron-working (Hall, 1979b, 1981; Huffman, 2007; J. M. Feely, unpublished records, KwaZulu-Natal Museum). Hardwoods such as tamboti (*Spirostachys africana*) and red bushwillow (*Combretum apiculatum*) would have been selectively felled to produce charcoal for smelting and forging. At a smelting site near the Hluhluwe river in HiP, clearance apparently initiated a succession over 200–300 years towards domination by magic guarri (*Euclea divinorum*) by the late 1970s (Hall, 1980, 1981, 1984).

Grazing and browsing by herds of domestic livestock kept by the Iron Age settlers would have had additional impacts on vegetation (Hall, 1987; Huffman, 2007). Besides selective grazing and browsing in the vicinity of settlements, a wider impact would have been the burning, in most years, of the grass layer (Hall, 1981). Burning would probably have been carried out in autumn or winter, once grasses were dry enough to burn. This would have reduced the incidence of lightning-caused fires during the following spring and early summer.

Natural vegetation would have been cleared for the cultivation of grain crops, although such fields are no longer evident (Hall, 1979b, 1981, 1984; Feely, 1980). Dwelling sites are indicated by the remains of pottery and grinding stones. Circular depressions in the ground, 1–2 m in diameter, indicate collapsed grain pits. These were dug beneath cattle kraals centrally placed in the dwelling area. Trees such as marula, jacket-plum (*Pappea capensis*), weeping boer-bean (*Schotia brachypetala*) and buffalo thorn (*Ziziphus mucronata*) left to provide fruit or shade, or for spiritual reasons, may still remain standing (Feely, 1980).

In Mfolozi, former Iron Age settlements show a distinct grass community characterized by bushveld signal grass (*Urochloa mosambicensis*) on the locally compacted soils (Hall, 1981, 1984; J. M. Feely, personal observation, 1973–1982). These sites are favoured by wild grazers including white rhinos (see also Chapter 6). Many of these sites could represent homesteads destroyed a century earlier, in 1883, during the southward invasion by Mandlakazi (Ndwandwe) people, under Zibhebhu kaMaphitha, from north of the Black Mfolozi river (Laband, 1995).

1.4 Early Historical Period 1790–1887

The historical record spans the last part of the Late Iron Age. The early history of KwaZulu-Natal has been recorded beginning sketchily from the sixteenth century in the form of reports by survivors of shipwrecks (Vernon, 2013), and expanded through the eighteenth to nineteenth centuries following the arrival of white explorers, hunters and later settlers. Towards the end of the eighteenth century, the region of KwaZulu-Natal north of the Thukela river, labelled Zululand, was partitioned among distinct chiefdoms who warred with one another over land and livestock. The territory north of the Black Mfolozi and combined Mfolozi rivers was the domain of the Ndwandwe, while the Mthethwa ruled to the south (Laband, 1995; Wright, 2008). The Zulu were a small group under the hegemony of the Mthethwa, occupying land to the west of current-day HiP in the basin of the White Mfolozi river. By the early nineteenth century, the Mthethwa had largely abandoned the low-lying land between the Mfolozi rivers, due either to the incidence of nagana (trypanosomiasis), transmitted by tsetse flies to their cattle (McCracken, 2008), or to tensions with the Ndwandwe (Wright, 2008). At that time the Mthethwa leader, Dingiswayo kaJobe, occupied a site south of the White Mfolozi river and east of uDadethu ('our sister') pan. He is said to have named this feature for his sister after she was killed by a crocodile while fetching water there (Magqubu Ntombela, personal communication to J. M. Feely in 1960). This would have happened before Dingiswayo's death in 1817 (Laband, 1995).

The Mthethwa and other groups became consolidated into the Zulu Kingdom after Shaka rose to power in 1819. Shaka's military forces drove out the remaining occupants between the Mfolozi rivers, leaving behind broken pottery and grinding stones. According to oral tradition, the hunting of wild animals thereafter became restricted seasonally. Species such as buffalo, greater kudu (*Tragelaphus strepsiceros*) and waterbuck (*Kobus*

ellipsiprymnus) were largely protected, and white rhino (*Ceratotherium simum*) were not regarded as edible (McCracken, 2008). Following Shaka's conquest of the Mthethwa, a great game drive took place between the Mfolozi rivers, with animals funnelled into concealed pits dug just above the confluence (Hall, 1977). Elephant hunts directed from uNqolothi hill overlooking the White Mfolozi river have been described (McCracken, 2008), although Shaka's royal hunting ground is reputed to have been in the Mbhekamuzi Valley, to the west of the present-day park boundary (Vincent, 1970). The killing of wild animals was restricted mainly to intermittent ceremonial hunts, such as 'the washing of the spears' following the death of a chief. Possibly the last such hunt took place in the Somkhele area a little to the east of HiP's present Nyalazi Gate in 1955, after the death of Chief Matubatuba. Some 300 men armed with spears and accompanied by many dogs took part (J. M. Feely, personal observation, May 1955). Killing was accomplished by spear, snare or pit trap before guns became available (McCracken, 2008).

During Shaka's rule, the first white settlers arrived at Port Natal (later renamed Durban), and were granted permission by Shaka to stay. In 1824, Messrs Farewell and Fynn met with Shaka, requesting permission to trade with his people in ivory (Laband, 1995). Trading in wildlife products was already ongoing by that time, with ivory being exported through Delagoa Bay (now known as Maputo) in southern Mozambique. Fynn remarked on the abundance of game in the Zululand region coexisting alongside the people (Fynn, 1950). Elephant and buffalo were targeted especially by the white hunters and the African hunters whom they employed. By 1832, hunting had greatly reduced the populations of these and other big game around Port Natal, but wildlife still abounded to the north of the Thukela river (Herman and Kirby, 1970; McCracken, 2008). Delegorgue described seeing buffalo, greater kudu, eland (*Taurotragus oryx*) and zebra, along with white rhino, elephant (*Loxodonta africana*), wild dog (*Lycyon pictus*), and spotted hyena (*Crocuta crocuta*) between the White and the Black Mfolozi rivers while hunting there in 1840 (Delegorgue, 1847). This area was apparently free of settlements at that time. Hunting expanded from the 1830s onwards, but wild ungulates remained abundant in wooded lowlands where malaria and tsetse fly inhibited occupation by people and their livestock into the 1850s.

Dutch-speaking farmers who had trekked from the Cape to avoid British rule (Boer Voortrekkers) had established a republic called Natalia at Port Natal in 1839. They fought the British in the Battle of Congella in 1840. In 1843, the area to the south of the Thukela river as far as

the Mzimkhulu river was formally annexed by Britain and became the colony of Natal in May 1844 (Laband, 1995). Until 1856 it was administered from the Cape Colony. The area north of the Thukela river remained the independent kingdom of Zululand under Shaka's successors, the kings Dingane, Mpande, and Cetshwayo.

During the 1870s, guns became more widely available and the abundance of wildlife declined due to the escalation in hunting (McCracken, 2008). The decimation of cattle by an outbreak of lung-sickness in 1874/5 (Laband, 1995) also forced people to rely more on wild ungulates for food. Ivory exports from Delagoa Bay and later Durban peaked in 1854 with an annual total of 85,000 kg and then declined during the 1880s. Hide exports from Durban peaked in 1872, representing 417,000 animals during that year (McCracken, 2008), but ceased in 1885. A substantial portion of these hides would have originated from inland parts of southern Africa rather than from Zululand (Boshoff and Kerley, 2013). Rhino horn exports peaked in 1884 at 679 horns, but declined after 1888 (McCracken, 2008).

1.5 Initiation of Game Protection: 1887–1897

The Anglo-Zulu war of 1879 ended with British victory and led eventually to the annexation of most of Zululand under British colonial rule in 1887 (Laband, 1995). The first game law came into effect in Natal in 1884 and was extended to Zululand in 1890 (Brooks, 2001). Wild animals were categorized into species designated as 'royal game', given maximum protection (e.g. black (*Diceros bicornis*) and white rhino, elephant, buffalo, kudu), 'closed season' (e.g. bushbuck (*Tragelaphus scriptus*), blue duiker (*Cephalophus monticola*), oribi (*Ourebia ourebi*), and steenbuck (*Raphicerus campestris*)), and 'not listed' (e.g. red duiker (*Cephalophus natalensis*) and mountain reedbuck (*Redunca fulvorufula*)) (McCracken, 2008). In subsequent proclamations (1893, 1897) many species were downgraded from 'royal game' to 'closed season', including black and white rhino, which reflected the growing concerns with the disease nagana killing large numbers of cattle (Brooks, 2001; McCracken, 2008).

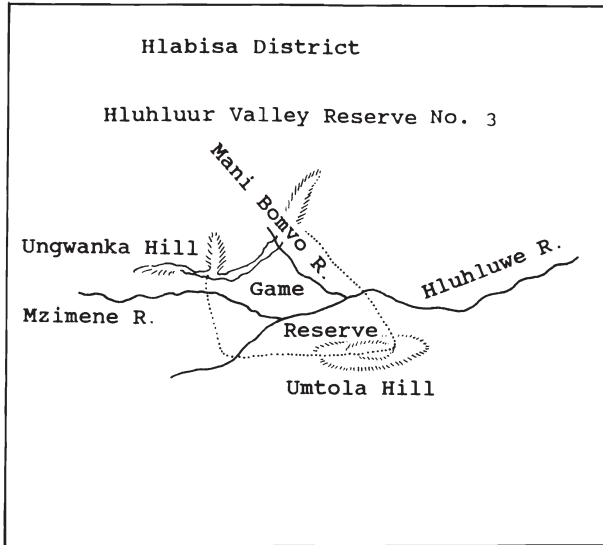
The Zulu people recognized the association between infection of their cattle with nagana, or animal African trypanosomiasis, and contacts with wild ungulates. They attributed an increase in the incidence of nagana to an increase in large game brought about by the protection afforded by the game laws (Pringle, 1982). In 1894 Dr David Bruce, who was stationed in Ubombo in northern Zululand, experimentally confirmed the role of the

tsetse fly in the transmission of the trypanosome parasites from infected wild ungulates to domestic livestock. With the arrival of Marshal Clarke as the new resident commissioner in Zululand in 1893, the concerns of the Zulu people regarding nagana were acknowledged. The new game law of 1893 allowed Zulu residents affected by nagana to reduce the numbers of game in their areas. To prevent the total destruction of game, Marshal Clarke wrote to the governor that ‘in light of the relaxed game laws it might be a good idea to create game reserves in areas already infested with nagana’ (Brooks, 2001).

By that time it was feared that white rhinos were on the brink of extinction. Following the shooting of six white rhinos near the confluence of the two Mfolozi rivers, in February 1895 Mr C. D. Guise wrote a letter to the Secretary for Zululand, for consideration by the Colonial Governor, requesting that ‘a particular range of country in Zululand which embraces the habitat of the white rhinoceros should be beacons off as a game reserve and no shooting or destruction of game be allowed therein’. He also requested that the white rhino be returned to the list of royal game and that no permits for their hunting be issued (Pringle, 1982; McCracken, 2008). Stirred by this letter, Commissioner Clarke submitted proposals for the establishment of game reserves within Zululand to the governor, who was sympathetic.

The Zululand Government Notice dated 30 April 1895 proclaimed five game reserves named as follows: Hluhluur Valley Reserve, Umfolosi Junction Reserve, St Lucia Reserve, Umdhletshe Reserve, and Reserve No. 5 between the Pongolo and Mkuze rivers to the east of the Lebombo mountains. Within them, the ‘killing of game will be altogether prohibited’ (Ellis, 1994). With the impending consolidation of the Natal and Zululand colonies, the status of four of these reserves (Umdhletshe, Hluhluwe, St Lucia, and Umfolosi) was reaffirmed by a proclamation dated 27 April 1897 (Pringle, 1982; McCracken, 2008). Maps showing the boundaries of the separate Hluhluwe and Umfolozi game reserves as originally proclaimed are reproduced in Figure 1.2 (Ellis, 1994). As noted in this figure, the boundaries of the original Hluhluwe and Umfolozi game reserves were defined somewhat vaguely using hills, homesteads, rivers, and footpaths. For instance, the Umfolozi GR was described as ‘The country between the Black and White Umfolozi rivers from the junction of the rivers to the Mandhlagazi [*sic*] footpath’ (Ellis, 1994; McCracken, 2008). The Mandlakazi footpath marked the route that was supposedly followed in August 1883 when the Mandlakazi people from north of the Black Mfolozi river invaded the people living to the south and destroyed their

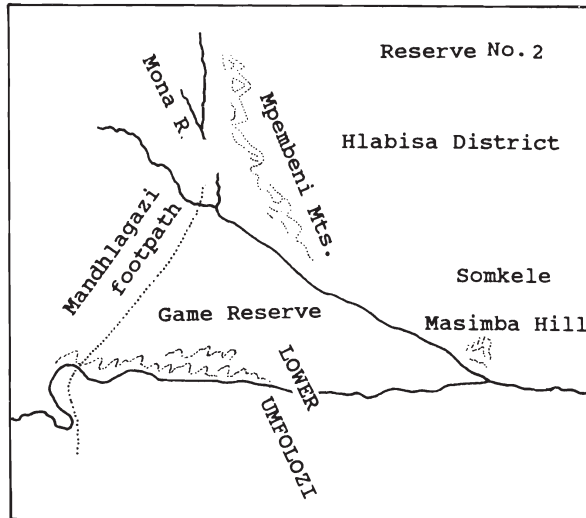
A



BOUNDARIES

A straight line from the highest point of the Zankomfe ridge to the Mpanzakazi hill; from thence to the present sites of the kraals of Umdimdwane, Mantunjana, Saziwayo, and Umswazi; from the latter kraal to the nearest point of the Mzinene stream; thence to the Mehlwana hill, south of the Hluhluwe river; thence to the Mtolo hill; from thence in a direct line with the same hill to the Hluhluwe river; and from there to the highest point of the Zankomfe hill.

B



BOUNDARIES

The country between the Black and White Umfolozi rivers from their junction to the Mandhlagazi.

Figure 1.2 Original maps and description of the location of the game reserves at the time of proclamation in 1895. (A) Hluhluur Valley Reserve (Hluhluwe GR).

(B) Umfolozi Junction Reserve (Umfolozi GR). (Reprinted with permission from the Natal Society Foundation (natalia.org.za); Ellis, 1994.)

homesteads. This path defining the original western boundary did not remain evident very long.

At the time of their proclamation the Hluhluwe and Umfolozi game reserves were largely uninhabited. However, it is doubtful whether the vicinity was ever completely uninhabited (McCracken, 2008). The Mthethwa people living to the south of the White Mfolozi river had vacated the region between the Mfolozi rivers in 1883 following raids by the Mandlakazi people, perhaps also prompted by a nagana outbreak among their cattle (Vincent, 1970, McCracken, 2008). Some people still occupied the high-lying area to the west of Umfolozi GR, which was incorporated into HiP during the 1960s. Human density in the region surrounding the two reserves was relatively low – about 2.5 people per km² in 1895, compared with almost 6 people per km² in Zululand as a whole (McCracken, 2008).

1.6 The Difficult Early Years: 1898–1952

Important contributions to the protection of game in these early years were made by local magistrates who did their best to enforce the game laws and ensure the protected status of the game reserves, in collaboration with local African chiefs, by restricting the issuing of hunting permits (McCracken, 2008). African people were generally supportive of the protection afforded to the wild ungulates, having lived alongside wild animals since early times. Moreover, during this time the game reserves were still remote and not readily accessible by white hunters. As late as 1916, only Hluhluwe GR could be reached by wheeled transport. Finally, the presence of tsetse flies probably kept livestock out of the reserves to a large extent.

Between 1895 and 1904, southern Africa was ravaged by the rinderpest epizootic (a viral disease transmitted from cattle to wild ungulates), which decimated buffalo, eland, kudu, and wildebeest (*Connochaetes taurinus*) populations as well as domestic cattle (McCracken, 2008). East Coast fever (theileriosis) followed among cattle, and people lost around 80% of their livestock. After this reduction in wild ungulates, the occurrence of nagana declined in Zululand, but resurged again following the recovery of wild ungulates. By 1907, the incidence of nagana had almost regained its former levels (Pringle, 1982; McCracken, 2008).

After the incorporation of Zululand into the colony of Natal in 1897, the report of a Delimitation Commission was eventually finalized in 1905, opening about a third of Zululand to white settlement (Ellis, 1994).

The remaining area, apart from the game reserves and 'Crown' land, was designated as tribal lands under communal tenure. The resident commissioner of Zululand at that time, C. R. Saunders, played an influential role in protecting the game reserves from land alienation (Brooks, 2001). A new reserve, Hlabisa, was proclaimed in 1905 to encompass the land between the Hluhluwe and Umfolozi GRs as far east as the shores of Lake St Lucia (Pringle, 1982). Part of it was later to become the Corridor Game Reserve. It was abolished in 1907 following complaints from transport riders that nagana killed the oxen pulling their wagons through this region. The Umdhletshe Game Reserve was also abolished in that year for the same reason.

In 1904, the Natal Game Protection Association was established to lobby for the protection of wildlife. In 1909 Dr Ernest Warren, the Director of the Natal Museum, changed its name to the Natal and Zululand Protection Association. Warren played an important role in conserving wildlife in Zululand by influencing public opinion to oppose the killing of wild animals (Brooks, 2001).

In 1910, Natal became a province of the newly established Union of South Africa. In the short term, not much changed. Like the old colonial administration, the new provincial government strongly supported the game reserves. Several members of the Natal Provincial Council were sport-hunters who had an interest in preserving the game. In 1911, the Provincial Council appointed Mr Frederick Vaughan-Kirby as Game Conservator for Zululand (Brooks, 2001). He became a strong advocate for conservation, emphasizing how few white rhinos remained in Umfolozi GR. White farmers who had settled in regions of Zululand became an influential counter-lobby. They resented both the sport-hunters, who belonged mostly to a privileged, often urban, elite, and the game reserves (Brooks, 2001). Their cattle were vulnerable to infection with nagana through contact with wild ungulates remaining outside the game reserves. Accordingly, tsetse flies switched from being the saviours of the wildlife to becoming the cause of much conflict (Pringle, 1982). The official strategy for resolving the 'nagana problem' became the 'elimination of all game' (McCracken, 2008).

Pressure increased after 1918, following the opening of farms in the Ntambanana district to the south of the Umfolozi GR for settlement by former World War I servicemen (Vincent, 1970; McCracken, 2008). The Umfolozi GR was abolished by provincial notice in 1920, but reinstated in 1930. In 1929, a campaign was mounted to eliminate wild ungulates from the area between Umfolozi GR and the Ntambanana

farms, by either shooting them or driving them into the game reserve (Mentis, 1970; McCracken, 2008) and over 25,000 animals were killed between 1929 and 1930 (the species breakdown is given in Chapter 4). This slaughter failed to prevent cattle from being infected with nagana. In 1932, administration of Umfolozi GR (but not Hluhluwe GR) was transferred from the province to the national Department of Veterinary Services (McCracken, 2008). Nevertheless, field rangers remained stationed there to prevent any shooting of white rhinos.

In 1921, the entomologist R. H. T. P. Harris had been assigned to Umfolozi GR to undertake research on the tsetse fly problem (Brooks, 2001). Recognizing that these flies found their animal hosts by sight rather than smell, he invented the Harris Fly Trap. This was a V-shaped structure, which was open beneath with a gauze trap above. Flies entering the trap from below moved up towards the light and into the gauze trap, where they died. To prevent damage to these traps, fires were suppressed during the two decades during which they were deployed. Millions of flies were destroyed, reducing their numbers but not eliminating them. In 1931, the Minister of Agriculture stated that ‘The only solution to the problem is to eliminate the host of the fly, which can only be done by eliminating the game reserves. Hluhluwe and Mkuzi must be abolished. The white rhino can be preserved at Umfolozi, but the rest of the game there must be reduced . . .’ (quoted by McCracken, 2008). The Zululand Game Reserves and Parks Board, the Wildlife Society of South Africa and individual conservationists and scientists challenged the threat that this standpoint posed to the wildlife of Zululand. Nevertheless, a second operation to eliminate most wild ungulates within Umfolozi GR as well as in the adjoining lands was launched in 1942 and continued until 1950, under the management of the veterinary authority (see Chapter 4 for detailed account). Wildlife within Hluhluwe GR retained its protected status, but significant numbers were killed in buffer zones surrounding it (see Chapter 4).

Eventually, a veterinary scientist conceded that ‘The reduction of the thicket-inhabiting species (of ungulates) to the level where they could no longer support a population of this species of tsetse fly was ultimately found to be so formidable a task as to be almost impossible of achievement’ (R. du Toit, cited by Vincent, 1970). A different intervention was then launched: aerial spraying with insecticides. This drew on the finding that tsetse flies bred only in confined, shaded sites. Hence, a 3-km wide strip was cleared of all woody vegetation along parts of the perimeter of the game reserves, to confine and prevent the shade-dependent flies

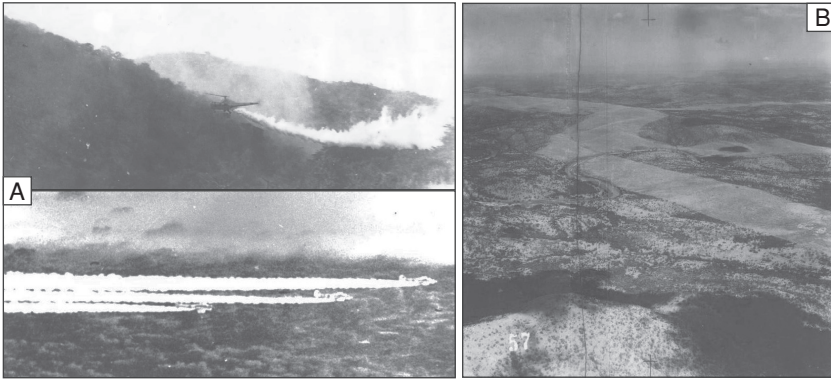


Figure 1.3 Actions aimed at eradicating tsetse flies from the Hluhluwe-iMfolozi Park during the 1930s, 1940s, and early 1950s. (A) Insecticides being sprayed from aircraft; (B) 3-km wide strip cleared of all woody vegetation along the western boundary of Umfolozi Game Reserve to prevent dispersal by surviving flies. (Photographs taken by an unknown photographer, figure made by C. Staver and J. Graf.)

from dispersing (see also Chapter 3). Areas of dense woodland within the reserves were also cleared. People settled in parts of the Corridor between the two game reserves were removed in the 1940s, supposedly temporarily while the aerial spraying took place. This led to much discontent when they were not allowed back at a later stage (Brooks, 2001). Aerial spraying was undertaken between 1947 and 1951 initially with dichlorodiphenyltrichloroethane (DDT), and later with benzene hexachloride (BHC), throughout Umfolozi GR, the Corridor region and low-lying parts of Hluhluwe GR (Figure 1.3). This finally eradicated the tsetse fly species mainly responsible for the transmission of nagana from the Umfolozi region, although pockets of forest-inhabiting flies persisted in Hluhluwe GR and towards the coast. Effects of the insecticide spraying on other insects and birds were not investigated.

In 1929 Captain Harold Potter, who succeeded Vaughn-Kirby as Game Conservator, established his headquarters within Hluhluwe GR. He appointed field rangers and enforced the protection of the wildlife. The first rest huts for visitors were built in 1934, and a road network was established. In an attempt to promote the increase of ungulate populations, Potter poisoned spotted hyenas. Lion (*Panthera leo*), cheetah (*Acinonyx jubatus*), and African wild dog were extinct in the region and leopard (*Panthera pardus*) were scarce (see Chapter 12). Potter brought in nyala (*Tragelaphus angasi*) and impala (*Aepyceros melampus*) from the Mkhuze

region on the eastern coastal plain, although neither antelope had been recorded historically within HiP (see Chapter 4 for more details on introductions).

Meanwhile, adjustments took place to the boundaries of HiP, which as originally proclaimed excluded a large area of prime wildlife habitat along the southern bank of the Hluhluwe river. Hunters entered this region during the 1930s and shot animals coming to drink. In 1939, the boundary of Hluhluwe GR was extended to incorporate the entire river (marked as 'original boundary' in Figure 1.4). A proposal to move it further to include the corridor between the two reserves was rejected, because the Minister of Lands was prepared to do this only on condition that Mkuzi GR was abolished, which was opposed by the conservation lobby. The matter was resolved when it was decided to extend the southern boundary of Hluhluwe GR to a position well short of the Mtubatuba–Hlabisa road. Further extension would be considered later when nagana and tsetse fly were under control (Vincent and Porter, 1979). In the early 1960s there was a further adjustment of the boundary which was moved south in compensation for the area that was to be lost to the Hluhluwe dam (marked as 'present boundary' in Figure 1.4). In 1941, a five-strand barbed wire fence was completed along the boundary of Hluhluwe GR and the northern edge of the Corridor, leaving a gap to allow animals to move between both areas (Vincent and Porter, 1979). Due to increased poaching, a section of this fence was electrified in 1950. Another fence was constructed to the south of the White Mfolozi river in 1952 to stop white rhinos from straying towards the Ntambanana farms, enclosing a buffer zone that eventually became incorporated within the game reserve.

1.7 Consolidation of the Hluhluwe-iMfolozi Park after 1952

The Zululand Game Reserves and Parks Committee had been established in 1937 to oversee conservation in the game reserves, with William Power as its chairman. During the 1940s, moves were made towards ceding control of the provincial game reserves to the National Parks Board headquartered in Pretoria. This strengthened lobbying for unified control of conservation in the province, including inland and coastal fishing, led by Power together with the Administrator of Natal, Mr Douglas Mitchell. This led to the establishment of the Natal Parks, Game and Fish Preservation Board in December 1947.

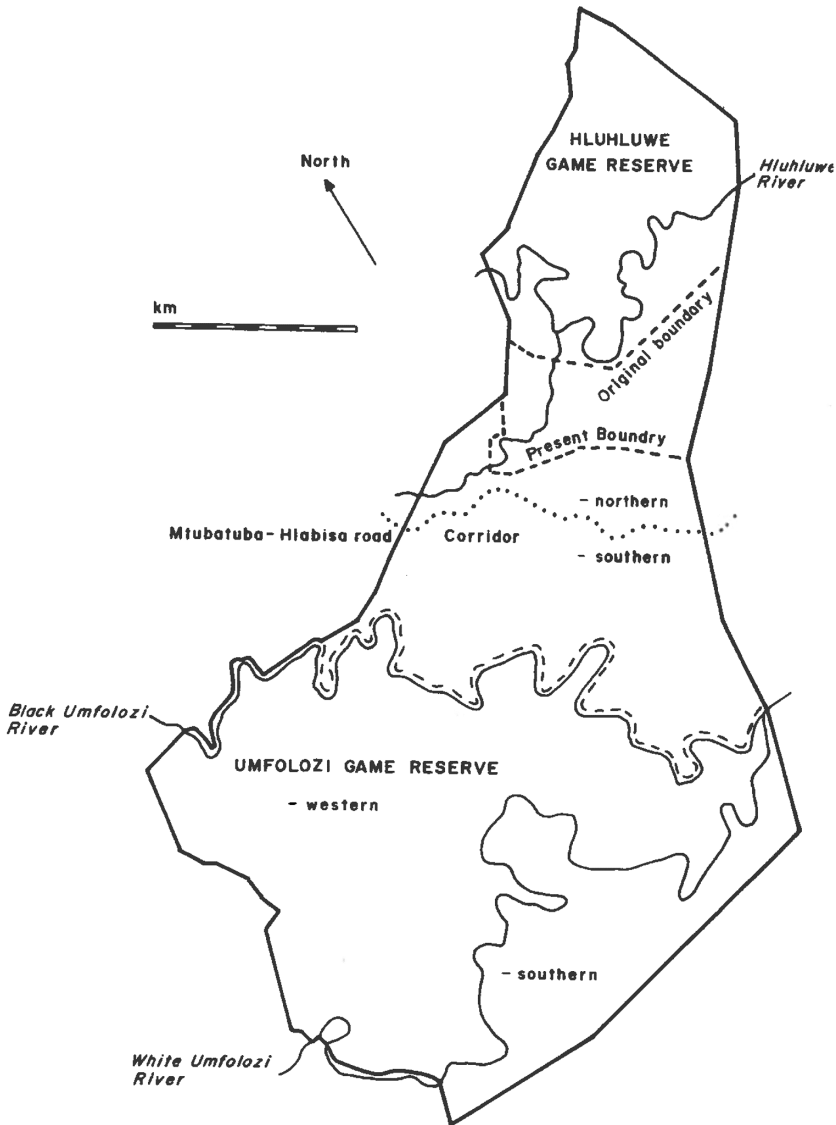


Figure 1.4 Map of the game reserves in 1983, showing the division between Hluhluwe GR, Umfolozi GR, and the Corridor, with major rivers. For Hluhluwe GR the proclaimed boundary after the 1939 extension ('original boundary') and the later 1960s extension ('present boundary') are shown. (Drawn by Ms A. Ludbrook and reprinted from Brooks and Macdonald, 1983.)

On 1 January 1953 control of Umfolozi GR passed back to the province (Vincent, 1970). The corridor between Umfolozi and Hluhluwe GRs remained State land, although fenced on the north to prevent rhinos from moving out. Following the handing back of Umfolozi GR the major concern was for the protection of the white rhino, particularly the relatively small population present in the former hunting area to the south of the reserve boundary. Poaching was rife during the whole of the 1950s both within Umfolozi GR and in adjacent areas. In addition, incursions of cattle into southern Umfolozi GR became a major problem. In an attempt to intensify security a ranger outpost was built south of the White Mfolozi river in the 'Southern Buffer Zone' and game guard outposts were strategically placed near the boundaries. With Umfolozi GR reverting back to a protected area in 1953 there was confusion regarding the hunting of wild animals among local communities given that they had been allowed to kill animals during the nagana control period but were now being arrested and charged for poaching. Resentment and hostility grew among these people and management staff undertook meetings with the tribal leaders in an effort to explain the change in policy in order to get their cooperation and reduce the incidence of poaching.

In 1954, a botanical ecologist, Mr C. J. (Roddy) Ward, was appointed research officer and based in Hluhluwe GR. The section of Umfolozi GR to the south of the tourist road, including the White Mfolozi river basin, became designated as a 'wilderness area' free of roads and buildings. This idea was instigated by Ranger Jim Feely, inspired by the concept after reading the principles of the US Wilderness Society, and implemented vigorously by the ranger-in-charge, Ian Player (Player, 1997). Tourists were allowed to enter only on foot on conducted wilderness trails, camping in tents. This practice is maintained today. In 1958, huts for the accommodation of visitors travelling in motor vehicles were established in Umfolozi GR on Mpila hill.

During the 1950s and 1960s poaching remained a serious problem, particularly by young men hunting and snaring warthog (Annual Reports, 1951–1960). This trend became more prevalent with the use of dogs by poachers. Towards the end of the 1950s gangs of poachers, usually armed with .303 rifles, became more frequent, and night poachers operated using spotlights. In 1961 the first black rhino was snared and killed by a poacher who was subsequently arrested, convicted and sentenced to a year's imprisonment or fine of R200. Strategic placing of guard camps in the more troubled areas, the increased use of mounted

patrols, and possibly the ‘restraining influence of the presence of lions’ since the early 1960s, led to a decline in poaching. In subsequent years from 1967 to 1970, poaching was considered to be largely under control (Annual Reports, 1969–1973). In addition to poaching of animals, certain plant species used in traditional medicine were also gathered inside the Park. *Warburgia salutaris* was particularly sought after and is now extremely rare as a result of overharvesting. Bark, roots, corms, bulbs, and leaves of several plant species were collected. After 2000, the anti-poaching system was improved by the establishment of Anti-Poaching Units that operated secretly and independently of other management staff. Intelligence has proved to be essential in anti-poaching operations and a Rhino Security Intervention Strategy was developed making use of CyberTrackers (software installed in hand-held computers), which enabled efficient analysis of patrol data to make them more strategic and effective.

Influxes of homesteads into the State land adjoining the western boundary of Umfolozi GR took place from 1955 to 1961 (Annual Reports, 1956–1959). These were people relocated by the government from the Msinga district in the Thukela river basin to the area bordering this State land. This settlement of the western State land caused much tension, with repeated attacks on field rangers, leaving one game guard killed, and led to increased poaching, veld burning, and cattle problems. In 1959 a Boundary Commission made recommendations to the national government, under whom unreserved State land fell, to solve the position of the boundaries (Figure 1.5 shows the boundaries as they were in 1960). Settlement was finally reached in 1962 and the western and southern boundaries of Umfolozi GR were officially extended to encompass portions of the State land that had separated it from the adjoining tribal land (reflected by the ‘desirable boundary’ in Figure 1.5). People were forcefully evicted from occupying the State land along the western boundary in 1962 (Annual Reports, 1960–1963; Vincent, 1970). With the final fixing of the reserve’s southern and western boundaries, a start was made on erecting a fence. Between 1962 and 1965, a 2.8-m high fence consisting of four to five strands of heavy cable was constructed along the new boundaries. The status of the Corridor remained unresolved. It was officially State land, but full of wildlife. Protracted negotiations with the Veterinary Department, who insisted on the construction of a game-proof fence to ensure that diseases carried by buffalo (Corridor disease, which is a form of East Coast fever or theileriosis) and wildebeest (bovine malignant catarrhal fever or snotsiekte) were confined to the game reserves,

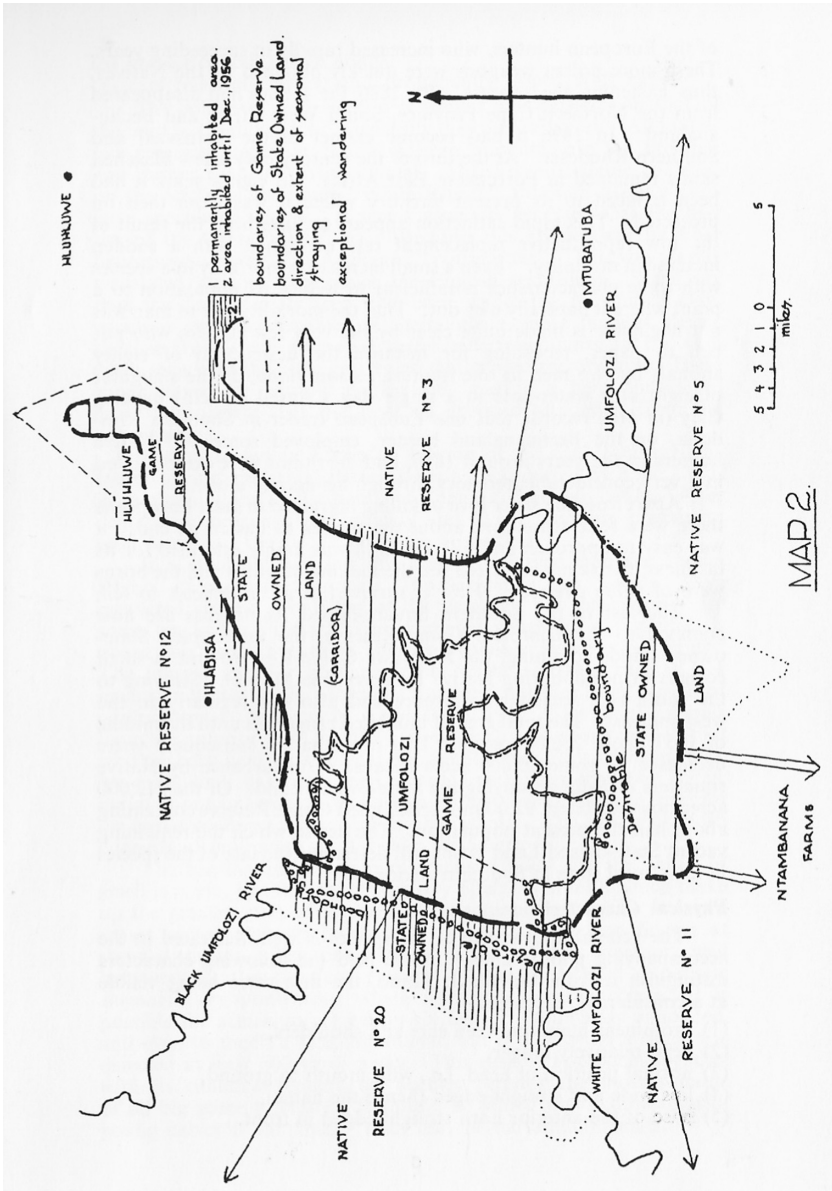


Figure 1.5 Map of the game reserves, State land, and native reserve boundaries as they were in 1960. This map was originally drawn up to illustrate the distribution of white rhino, which is represented by the thick black dashed line (area permanently inhabited by white rhino). The boundary of Hluhluwe GR is shown by the thin dashed line, and the boundary of the State land by the thin dotted line. The desirable boundary of Umfolozi GR is shown with open circles. (Reprinted with permission from Ezemvelo KZN Wildlife; Player and Feely, 1960.)

continued until an agreement was finally reached in 1968. Fencing then commenced on the eastern Corridor boundary to confine rhino to the reserve and stop encroachment by people. The veterinary game-proof fence was completed at great expense in 1970 and was successful in preventing invasion by cattle, and disease transmission to domestic animals, as well as protecting people's crops from the depredations of buffalo and elephant. This fence was consolidated in 1973 by a rhino- and lion-proof fence completely enclosing the borders of the Corridor and Hluhluwe GR as well (Figure 1.4 shows the boundaries as they were in the 1980s).

In February 1988 a land surveyor was appointed to survey the boundaries of the tribal authority areas that adjoined Hluhluwe GR. It was found that the boundaries between the tribal authorities and Hluhluwe GR were vague and that the only legal boundary was the one given in the 1897 proclamation (Isherwood, 2002). However, local communities had established their homesteads and croplands inside the proclaimed game reserve boundary. The 1970 veterinary game-proof fence that took cognizance of the occupation by the people was considered to be in the ideal position and had been accepted by local community leaders, traditional authorities, and all other government parties. A recommendation that the two areas now occupied by communities be excised from the Hluhluwe GR was agreed upon in 1997 after negotiations with the neighbouring tribal authority.

In 1989, the Corridor Game Reserve was formally proclaimed, joining Hluhluwe GR and Umfolozi GR into a unified protected area, divided only by a pre-existing dirt road through the Corridor joining the towns of Mtubatuba and Hlabisa. This road was upgraded and tarred around 2003–2004. The extent of the land originally comprising Hluhluwe, Umfolozi, and Corridor game reserves was 934 km². However, after the adjustments of the final boundaries decided upon in 1997, the consolidated 'Hluhluwe-Imfolozi Park' [*sic*] as legally promulgated in 2012 enclosed a reduced fenced area of 897 km².

Meanwhile, the land surrounding HiP under communal tenure has become increasingly densely settled with dispersed homesteads, following Zulu custom. The associated land transformation from rangelands to agricultural fields means that the protected area has become effectively an ecological island in a matrix of human-modified landscapes (Figure 1.6), with implications for animal movements (see Chapters 4, 11, 12, and 14), invasive alien plants (see Chapter 15), fire management (Chapter 10), and the social and economic benefits the park is expected to provide.

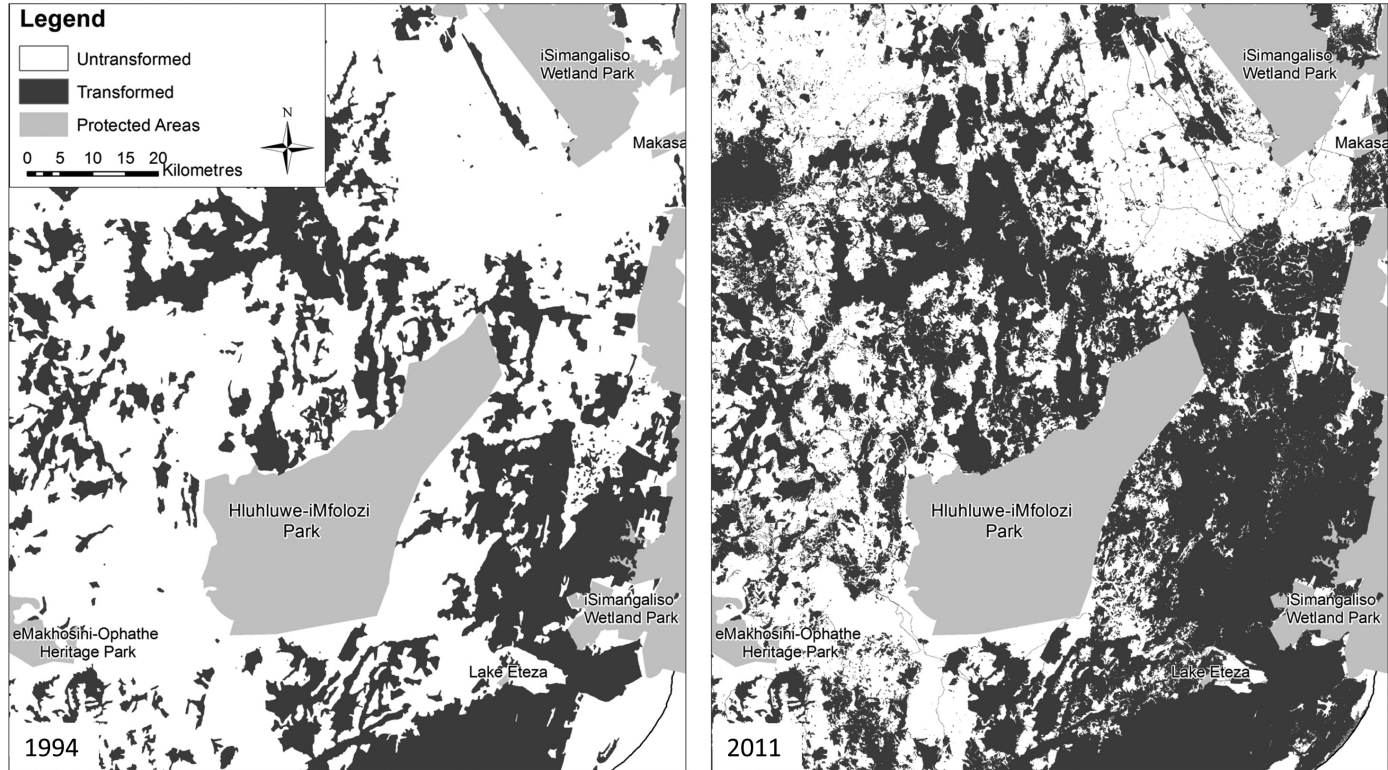


Figure 1.6 Changing transformation of landscapes surrounding HiP in the last two decades (map redrawn by Debbie Jewitt from data presented in Jewitt *et al.*, 2015).

1.8 Management History

The Natal Parks Board (as it became known) was the official management authority for all of the game and nature reserves in the Province from its inception in 1947 until December 1997, when a new authority, the KwaZulu-Natal Nature Conservation Board, was formed following South Africa's first democratic elections in April 1994. The organization operates as Ezemvelo KZN Wildlife, incorporating the Zulu word for conservation.

Management policies for the park have undergone changes over time. During the 1950s they were stated for Hluhluwe GR as being 'to maintain a balance among the animals and between them and the soil, the vegetation and the water supplies . . . interpreted as maintaining the habitats as they occurred in the days prior to the restriction of game movements' (Ward, 1961 as cited in Brooks and Macdonald, 1983). With the appointment of qualified natural scientists, the first one appointed for Hluhluwe GR in 1953, and many research and monitoring projects undertaken, management interventions became better informed.

As a result of effective wildlife protection, by 1953 animal numbers within Hluhluwe GR had reached levels raising concerns about degradation of soils and vegetation and the emaciated appearance of impalas and warthogs (Cowles, 1959). Predation was solely by relatively few spotted hyenas and leopards, until a male lion settled in the Umfolozi GR in 1958, followed by two lionesses a few years later (see Chapter 12). Soil erosion caused by overgrazing, trampling, and poorly positioned tracks and roads was noted in 1955 in Hluhluwe GR (Annual Report, 1955–56). Areas perceived to be overgrazed were also recorded in Umfolozi GR, although only white rhinos and warthogs were abundant at that time. Various reclamation methods were used, including stone packs, gabion structures and thorn scrub packs, to rehabilitate gullies formed along roads, streams, and fence lines. In addition, animal removals were initiated in Hluhluwe GR and the northern Corridor in 1954 and extended to Umfolozi in 1959, aimed at alleviating grazing pressure by species besides white rhinos (see Chapter 4 for details). Removals initially tracked rainfall variation, increasing in dry years and decreasing in wet years (Brooks and Macdonald, 1983).

In 1955 a controlled burning programme was instituted and annual firebreaks were cut to protect infrastructure and to prevent fires from entering HiP. Fires were generally ignited after the first spring rains in early to mid-September (see Chapter 10 for details on history of fire

management). During the same period, the encroachment of woody plants into grassland became a recognized problem (see Chapter 3), particularly in Hluhluwe GR as it reduced visibility of wildlife for visitors. Management-related factors that may have contributed to bush encroachment might have been the removal of large numbers of impala and nyala from the late 1960s to 1980s, and possibly the elimination of invertebrate seed predators as a result of the aerial spraying of insecticide during the nagana campaign, resulting in higher seed viability of *Acacia* and other tree species. From 1959 to 1962 bush-clearing operations were undertaken, especially in the northern Hluhluwe section. Later, the removal of bush was associated with gully rehabilitation activities, to make scrub packs (*Acacia* and *Dichrostachys* spp.) in eroded areas.

In 1961 the Department of Water Affairs started work on the construction of the much-disputed dam on the Hluhluwe river downstream of HiP to supply water to farms and Hluhluwe village. The dam had a full level, extending into Hluhluwe GR, but confined largely within the banks of the river and its main tributaries (Isherwood, 2002). In February 1972 the dam flooded extensive areas of *Ficus sycamorus*–*Schotia brachypetala* riparian forest, which subsequently died (Porter, 1981). In recent years (from 2009), a number of boreholes in the Hluhluwe river upstream from HiP have led to increasingly low water levels in Hluhluwe river and the dam.

The growth of the white rhino population under effective protection raised concerns about overgrazing and the risk of a disease outbreak. Pioneering trials with the use of chemical immobilization led to the initiation of a live capture and translocation programme in 1967, which was greatly expanded from 1970 onwards (Brooks and Macdonald, 1983). This programme, initiated by the park warden, Ian Player, became known as ‘Operation Rhino’ and is one of the greatest conservation success stories of the last century. By translocating rhinos from Umfolozi GR to other reserves, such as Kruger National Park, the Southern white rhino population increased 20-fold in the last 30 years or so (see Chapter 11). In 1970 an effective method of live capture was developed for other ungulates, driving herds into temporary enclosures formed by plastic sheeting, which enabled populations of, particularly, wildebeest and zebra to be reduced in subsequent years (Annual Report, 1970–1971).

During the late 1970s, the management policy was to hold herbivore populations below the estimated carrying capacity of the park, guided by agricultural norms. This policy was challenged following animal removals so excessive that few animals died during the extreme drought

conditions that prevailed through 1981–1983 (Walker *et al.*, 1987). Thereafter, a ‘process-based’ philosophy was adopted, allowing animal populations and the incidence of fires to fluctuate in response to rainfall variation to the extent that they might have done in the past, before the park became fenced (Ezemvelo KZN Wildlife, 2011). During drought years, animal removals were curtailed to allow for natural mortality. From 1999, disease management within the park has focused on restricting the incidence of bovine tuberculosis in buffalo herds, acquired from surrounding cattle (Chapter 13). Elephants, which had been absent for a century, were brought back in 1981 (Chapter 14). The first alien invasive plant survey was conducted in 1978 (Macdonald, 1983). *Chromolaena odorata* was identified as the plant of greatest concern, which unfortunately proved true (Chapter 15). Given the concerns regarding invasive alien plants, a list of species that were prohibited from being brought into HiP was included in the Management Plan (Ezemvelo KZN Wildlife, 2011).

The first formal management plan was produced in 1972. Currently such plans must comply with the requirements of the National Environment Management: Protected Areas Act of 2003 and undergo periodic review and updating every 5 years. The most recent integrated management plan for HiP (Ezemvelo KZN Wildlife, 2011) stated the following objectives.

1. To contribute to the achievement of provincial and national nature conservation objectives and targets, as a component of the national protected area system, through protection of a representative sample of the indigenous ecosystems, communities, ecotones, and representative landscapes of the area, their indigenous biodiversity, and the ecological and evolutionary processes that generate and maintain this diversity.
2. To protect and conserve species of conservation significance (e.g. endangered, rare, and endemic plant and animal species) indigenous to the area.
3. To conserve the ecological integrity and the wild character of the park.
4. To conserve the integrity of the iMfolozi Wilderness Area.
5. To safeguard the archaeological, historical, paleontological, and living cultural heritage of the area.
6. To promote awareness and appreciation of the natural environment, scenic beauty, and outstanding aesthetic value of the area.
7. To provide controlled access by the public to the area and its resources.

8. To contribute to local, regional, and national economies through the provision of ecosystem services, eco-cultural tourism, and the sustainable use of natural resources.
9. To provide a major destination for eco-cultural tourism in SA.
10. To provide opportunities for management-orientated and other forms of research, monitoring, education, interpretation, and awareness programmes that contribute to improved understanding and awareness of the values of the area and excellence in the management of the park.

Management actions implemented towards achieving these objectives include:

1. protection of animals and plants from poachers;
2. arresting and rehabilitating areas of active soil erosion;
3. controlled use of fire to remove moribund pasture and suppress bush encroachment (Chapter 10);
4. eradication of alien invasive plants (Chapter 15);
5. animal population management, particularly of rhino and elephant (Chapters 11 and 14);
6. re-introduction and management of predators (Chapter 12); and
7. disease control programmes (Chapter 13).

How successfully these objectives can be achieved in the future remains uncertain. With lands surrounding the protected area mostly densely occupied by people (Figure 1.6), HiP has become a fenced island in a matrix of human-modified landscapes. Close interactions with, and socioeconomic development of, the park's neighbouring communities are thus perhaps the most urgent issues to safeguard the future of HiP. Climate change, shrub encroachment, invasive species, and disease are all issues that need to continue to be addressed. Mining activities on the boundaries of HiP have increased enormously. However, most disturbing at the current time is the strong rise in poaching of rhinos prompted by the enormous price fetched by their horns in the Far East. This threatens to reverse one of the most renowned conservation successes of the twentieth century.

1.9 Summary

The area that became the Hluhluwe-iMfolozi Park was not a wilderness free of human influences. Stone Age hunter-gatherers were present from

probably as far back as the origins of the earliest humans, killing animals, and igniting fires. Immigrants with implements made of iron harvested wood for smelting iron ore, constructed dwellings, cleared land for crops, and grazed livestock. Nevertheless, a rich abundance of wild ungulates continued to persist alongside these farmers and pastoralists, gaining protection from the local presence of tsetse flies and the disease that these flies transmitted from wild ungulates to cattle. White settlers with guns decimated the wildlife, assisted by African hunters. Rinderpest, spread from Eurasia into Africa via cattle, contributed further to the reduction in wild ungulates. White farmers near the reserves mounted campaigns to eradicate wild ungulates outside the game reserves and later within them, to wipe out the tsetse flies and the blood parasites that they carried. Aerial spraying with insecticides eventually eliminated tsetse flies, and eradicated nagana. Protected, but without effective predators, herbivore populations grew to levels causing perceived overgrazing of vegetation and associated soil erosion. Ungulate populations became restricted by live capture and sales, while large predators and elephants were restored. Through much of this history, the white rhino has been pivotal, initially for the proclamation of the game reserves and continuing protection afforded to the land, subsequently for management interventions and successful conservation, and currently once again because of their vulnerability to poaching due to the monetary value of their horns.

1.10 Acknowledgements

For comment and information we thank André Boshoff, Peter Hitchens, Tim Maggs, Eugene Moll, Terry Oatley, Ken Tinley, Gillian Vernon, and John Vincent. We thank Debbie Jewitt for creating Figure 1.6.

1.11 References

- Annual Reports. Reports of the Natal Parks, Game and Fish Preservation Board to the Administrator of Natal. Unpublished reports, Natal Parks Board, Pietermaritzburg.
- Boshoff, A. F. & Kerley, G. I. H. (2013) *Historical incidence of the larger mammals in the Free State Province (South Africa) and Lesotho*. Centre for African Conservation Ecology, Nelson Mandela Metropolitan University, Port Elizabeth.
- Brooks, P. M. & Macdonald, I. A. W. (1983) The Hluhluwe-Umfolozi Reserve: an ecological case history. In: *Management of large mammals in African conservation areas* (ed. R. N. Owen-Smith), pp. 51–77. Haum, Pretoria.

- Brooks, S. J. (2001) A critical historical geography of the Umfolozi and Hluhluwe Game Reserves, Zululand, 1887–1947. PhD thesis, Queens University, Canada.
- Clark, J. L. & Plug, I. (2008) Animal exploitation strategies during the South African Middle Stone Age: Howieson's Poort and post-Howieson's Poort fauna from Sibudu Cave. *Journal of Human Evolution* **54**: 886–898.
- Cowles, R. B. (1959) *Zulu journal. Field notes of a naturalist in South Africa*. University of California Press, Berkeley, CA.
- Deacon, H. J. & Deacon, J. (1999) *Human beginnings in South Africa: uncovering the secrets of the Stone Age*. David Philip, Cape Town.
- Delegorgue, A. (1847) *Voyage dans l'Afrique Australe*, reproduced as *Adulph Dele-gorgue's travels in Southern Africa*, Vol. 1 (F. Webb. (transl.), S. J. Alexander & C. de B. Webb (eds), 1990). University of Natal Press, Pietermaritzburg.
- Ellis, B. (1994) Game conservation in Zululand, 1824–1947. *Natalia: Journal of the Natal Society* **23/24**: 27–44. Available at natalia.org.za.
- Ezemvelo KZN Wildlife (2011) *Integrated management plan: Hluhluwe-iMfolozi Park, South Africa*. Ezemvelo KZN Wildlife, Pietermaritzburg.
- Feely, J. M. (1980) Did Iron Age man have a role in the history of Zululand's wilderness landscapes? *South African Journal of Science* **76**: 150–152.
- Feely, J. M. (2004) Prehistoric use of woodland and forest by farming peoples in South Africa. In: *Indigenous forests and woodlands in South Africa: policy, people and practice* (eds. M. J. Lawes, H. A. C. Eeley, C. M. Shackleton, & B. G. S. Geach), pp. 284–286. University of KwaZulu-Natal Press, Pietermaritzburg.
- Fynn, H. F. (1950) *The diary of Henry Francis Fynn*, compiled from original sources and edited by J. Stuart and D. McK. Malcolm. Shuter & Shooter, Pietermaritzburg.
- Hall, M. (1977) Shaka's pitfall traps: hunting technique in the Zulu Kingdom. *Annals of the Natal Museum* **23**: 1–12.
- Hall, M. (1979a) A list of known Iron Age archaeological sites in the Umfolozi, Corridor and Hluhluwe Reserves. Unpublished report, Natal Parks Board, Pietermaritzburg.
- Hall, M. (1979b) The Umfolozi, Hluhluwe and Corridor reserves during the Iron Age. *The Lammergeyer* **27**: 28–40.
- Hall, M. (1980) An iron-smelting site in the Hluhluwe Game Reserve, Zululand. *Annals of the Natal Museum* **24**: 165–175.
- Hall, M. (1981) *Settlement patterns in the Iron Age of Zululand: an ecological interpretation*. Cambridge monographs in African archaeology, Volume 5. British Archaeological Reports, Oxford.
- Hall, M. (1984) Prehistoric farming in the Mfolozi and Hluhluwe valleys of south-east Africa: an archaeo-botanical survey. *Journal of Archaeological Science* **11**: 223–235.
- Hall, M. (1987) *The changing past: farmers, kings and traders in southern Africa, 200–1860*. David Phillip, Cape Town.
- Herman, L. & Kirby, P. R. (1970) *Travels and adventure in eastern Africa: descriptive of the Zoolus, their manners, customs, with a sketch of Natal, by Nathaniel Isaacs*. Struik, Cape Town.
- Huffman, T. N. (2007) *Handbook to the Iron Age: the archaeology of pre-colonial farming societies in southern Africa*. University of KwaZulu-Natal Press, Pietermaritzburg.

- Isherwood, H. B. (2002) Umfolozi-Hluhluwe Game Reserve and adjoining State land. Unpublished report to Director: Survey Services.
- Jewitt, D., Goodman, P. S., Erasmus, B. F. N., O'Connor, T. G., & Witkowski, E. T. F. (2015) Systematic land-cover change in KwaZulu-Natal, South Africa: implications for biodiversity. *South African Journal of Science* **111**: 1–9.
- Kingdon, J. (2003) *Lowly origin: where, when and why our ancestors first stood up*. Princeton University Press, Princeton, NJ.
- Laband, J. (1995) *Rope of sand: the rise and fall of the Zulu Kingdom in the nineteenth century*. Jonathan Ball, Johannesburg.
- Macdonald, I. A. W. (1983) Alien trees, shrubs and creepers invading indigenous vegetation in the Hluhluwe-Umfolozi Game Reserve Complex in Natal. *Bothalia* **14**: 949–959.
- Maggs, T. (1984) The Iron Age sequence south of the Zambezi. In: *Southern African prehistory and paleoenvironments* (ed. R. G. Klein), pp. 329–359. Balkema, Rotterdam.
- McCracken, D. P. (2008) *Saving the Zululand wilderness. An early struggle for nature conservation*. Jacana Media, Johannesburg.
- Mentis, M. T. (1970) Estimates of natural biomasses of large herbivores in the Umfolozi Game Reserve area. *Mammalia* **34**: 363–393.
- Mitchell, P. (2002) *The archaeology of southern Africa*. Cambridge University Press, Cambridge.
- Penner, D. (1970) Archaeological survey in Zululand game reserves. Unpublished report, Natal Parks Board, Pietermaritzburg.
- Player, I. C. & Feely, J. M. (1960) A preliminary report on the square-lipped rhinoceros (*Ceratotherium simum simum*). *The Lammergeyer* **1**: 3–24.
- Player, I. C. (1997) *Zululand wilderness: shadow and soul*. David Philip, Cape Town.
- Plug, I. (2004) Resource exploitation: animal use during the Middle Stone Age at Sibudu Cave, KwaZulu-Natal. *South African Journal of Science* **100**: 151–158.
- Porter, R. N. (1981) A preliminary impact assessment of the environmental effects of proposed dams in the Mfolozi catchment, Natal. Unpublished report, Natal Parks Board, Pietermaritzburg.
- Pringle, J. A. (1982) *The conservationists and the killers: the story of game protection and the Wildlife Society of Southern Africa*. T. V. Bulpin and Books of Africa, Cape Town.
- Prins, F. E. (1996) Aspects of Iron Age ecology in the Eastern Cape and KwaZulu/Natal. In: *The growth of farming communities in Africa from the equator southwards* (ed. J. E. G. Sutton), pp. 71–90. *Azania* special volume 12.
- Van Wyk, B. E. & Gericke, N. (2000) *People's plants: a guide to useful plants of southern Africa*. Briza Publications, Pretoria.
- Vernon, G. N. (2013) *Even the cows were amazed: shipwreck survivors in south-east Africa 1552–1782*. Jacana Press, Johannesburg.
- Vincent, J. (1970) The history of Umfolozi Game Reserve, Zululand, as it relates to management. *Lammergeyer* **11**: 7–49.
- Vincent, J. & Porter, R. N. (1979) The boundaries of Hluhluwe–Corridor–Umfolozi (Central Complex) and the background to their present situation. Unpublished report, Natal Parks Board, Pietermaritzburg.
- Wadley, L., Sievers, C., Bamford, M., et al. (2011) Middle Stone Age bedding construction and settlement patterns at Sibudu, South Africa. *Science* **334**: 1388–1391.

- Walker, B. H., Emslie, R. H., Owen-Smith, N., & Scholes, R. J. (1987) To cull or not to cull: lessons from a southern African drought. *Journal of Applied Ecology* **24**: 381–401.
- Ward, C. J. (1961) Burning as it affects veld management policy of the Hluhluwe Game Reserve. Unpublished report, Natal Parks Board, Pietermaritzburg.
- Whitelaw, G. (1994) KwaGandaganda: settlement patterns in the Natal Early Iron Age. *Natal Museum Journal of Humanities* **6**: 1–64.
- Wright, J. (2008) Rediscovering the Ndwandwe kingdom. In: *Five hundred years rediscovered: southern African precedents and prospects* (eds. N. Swanepoel, A. Esterhuysen, & P. Bonner), pp. 217–235. Wits University Press, Johannesburg.