Grasslands and Thickets: Bush Encroachment and Herding in the Kalahari Thornveld

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ABSTRACT

This paper addresses bush encroachment around Kuruman, South Africa. The 'received wisdom' is that bushes result from overgrazing, displace the climax community, and lower carrying capacity. In contrast, this paper is informed by non-equilibrium ecological and range management science, as well as recent challenges to degradationist interpretations about environmental change in Africa.

To what extent has bush encroachment occurred? Has a consequent drop in sustainability contributed to dependence upon wage labour among black households? Using documentary evidence, the paper establishes a broad chronology for change. It asserts that because of non-human and human factors black herders live in a bushier environment than they did when the first travellers arrived around 1800.

It concludes with oral evidence to consider the effects of the change. Interviews show that people do not consider bush encroachment to be an environmental problem. They are too poor to keep many grazing cattle, and the browsing small stock and donkeys they can afford are well suited to bushes. Also, because bushes survive drought better than grass, they are valued fodder for all animals. Dependence upon wage labour results from wider social factors and this environmental change has not degraded livelihoods.

KEYWORDS

Bush encroachment, herding economies, history of ecological change, South African homelands

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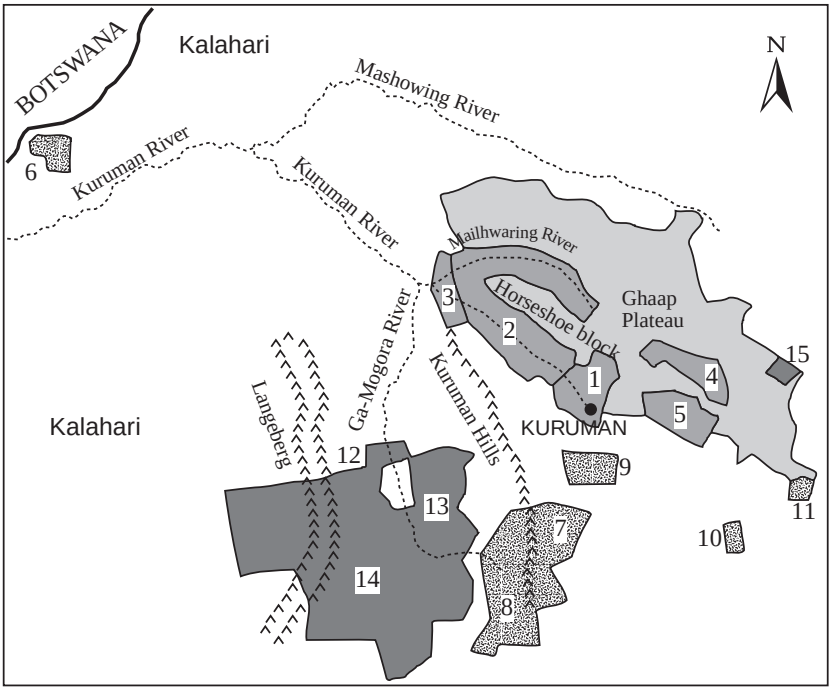
Herding in the Kalahari thornveld, the savanna in South Africa on the edge of the Kalahari proper, has experienced changes over the past century and a half. Human and stock population grew, access to land shrank, more animals on smaller areas ate and trampled the grass and bushes replaced some of it. Although these processes happened slowly with local variations, the developments were significant: the veld changed, people's access to it and the animals feeding on it changed, as did the human economy based on them. Major events brought this all about, but their gradual occurrence makes this history difficult to trace. Establishing the causal connection between these developments is also difficult. Yet over the long term it is possible, and it is important, for such changes have been decried as a decline in both human society and the natural environment. The story told so far is that because of heavy use, the desirable grass gave way to undesirable bushes, eroding carrying capacity.

If bush encroachment does represent a decline in carrying capacity, then its effects should be evident in local production. Indeed, subsistence production has been largely replaced by wage labour as the source of livelihood for black people in this area. The relationship between environmental degradation and wage labour is a significant but unresolved question. C. W. De Kiewiet linked environmental degradation with the decline of subsistence production, arguing in *A History of South Africa: Social and Economic* that soil erosion undermined peasant and subsistence production and forced people into urbanisation and wage labour.[1] Environmental factors have not been prominent in more recent explanations for the entrenchment of wage labour.[2] Although bush encroachment and dependence on wage labour have both happened, asserting a cause-and-effect relationship is problematic. An environmental history concerned with this question must be critical about what constitutes degradation, be cautious about the course of environmental change, and also explore the place of bushes and browsers in the contemporary human experience. People I interviewed gave little indication that bush encroachment has been a cause of their hardships. Their experiences, coupled with recent writings in the science of rangeland management and in African environmental studies, give cause to question ecological and economic arguments that bushes and browsing represent a degraded condition. The history built upon these new perspectives is one of people adapting to environmental change while other forces make them dependent on cash wages. The experience of black South Africans living amidst bushes on communal lands gives cause to think critically about the assertion that more grass would make their herding more sustainable and their environment more salutary for subsistence.



Reserves never confiscated

1. Kuruman Crown Reserve
2. Lower Kuruman Native Reserve
3. Extension to Lower Kuruman Native Reserve
4. Bothetheletsa Native Reserve
5. Manyeding Native Reserve

Reserves removed 1942–1977

6. Khuis Native Reserve
7. Ga-Tlhose Native Reserve
8. Maremane Native Reserve
9. Kono Native Reserve
10. Smauswane Native Reserve
11. Vlakfontein Native Reserve

Lands acquired by the South African Native Trust

Land available for occupation by whites

Reserves confiscated after the 1897 Langeberg Rebellion

12. Dibeng Native Reserve
13. Kathu Native Reserve
14. Langeberg Native Reserve
15. Tlaring Native Reserve

FIGURE 1. Segregation of land in Kuruman District, 1886–1960

BUSH ENCROACHMENT AS ECOLOGICAL DEGRADATION

This study centres on the area around Kuruman in South Africa, on the southern edge of the Kalahari (see Fig. 1). The majority of the human population is Tswana speakers, descendants of those who founded the Tlhaping and Tlharo chiefdoms there in the eighteenth century. The region is entirely made up of semi-arid savanna, classified as 'thornveld' by J. P. H. Acocks in his 1953 landmark *Veld Types of South Africa*.[3] A 1996 survey of vegetation, *Vegetation of South Africa, Lesotho and Swaziland*, includes this area in the savanna biome. The southern African savanna is a large environmental zone, and the scattered acacias and tall grass typify the ideal African landscape. Although typical, a savanna is an unstable and transitional environment; the grasses and trees defining it are in competition with each other. Therefore savannas display a range of gradation between the grassland and woodland biomes. The savanna in this area is said to be an intermediate form, called 'bushveld', with many tall bushes among the grass and trees.[4] It is semi-arid: the rainfall averages no more than 400 millimetres per year. Such low precipitation has had great impact on land use, making cultivation very risky and low yielding. The low rainfall has been more conducive to pastoralism, which has a long tradition in the region.

Impressionistic evidence suggests the presence of high numbers of bushes and pioneer grasses, the hardy plants that colonise an area and thus begin processes of succession in the thornveld.[5] Unfortunately, there has been no thorough survey of the ratio of trees, bushes and grass in the area, and also no specific study of the pressures toward, and course of, botanical change in this particular savanna. It must be emphasised that trees and bushes are better able to establish themselves at rivers and boreholes than they are on dry soils. They also grow successfully along dolaritic dikes, rock intrusions where sub-surface water collects. The first reason is propagation: flowing water and animal traffic spread tree and bush seeds to wet areas. Also important are differences in photosynthesis and transpiration. Photosynthesis and transpiration involve gaseous exchange through tiny pores called stomata: carbon dioxide (CO_2) enters photosynthesising leaves through stomata while oxygen and water vapour exit through them. Most plants (including trees, bushes and some grasses) use an inefficient enzyme to fix CO_2. Because the first detectable product of this reaction contains three carbon atoms, these are termed 'C_3 plants'. Stomata must open widely to provide enough CO_2 for C_3 photosynthesis, and this allows loss of water vapour through transpiration. In contrast, at least 95% of thornveld grasses are C_4 plants, whose first product of photosynthesis contains four carbon atoms.[6] Because C_4 grasses have a specialised leaf structure, called a Kranz anatomy, and an efficient enzyme able to bind CO_2 readily, they are able to photosynthesise effectively when their stomata are only partially opened and therefore transpiration is lessened. This is a great advantage in dry areas. However, on moist soils a higher rate of transpiration is less of a liability for

bushes and the C_4 advantage is diminished. For this reason C_3 plants such as bushes can better establish themselves at rivers, boreholes and near subsurface water sources.

General theories about bush encroachment and overgrazing in southern African savannas are dependent upon climax theory. Regarding the thornveld, this thinking identifies a neat conjunction of human interest and natural integrity: the grassland, the desired community for cattle grazing, is also claimed to constitute the climax community.[7] This community is said to be threatened by grazing: since animals are drawn to palatable and nutritious moist grasses, these disappear when too many animals graze a field, or if the herd stays too long, or if sheep, which eat grass down to exposed roots, are not managed carefully. Also, hoof action tramples the soil, and bushes survive better than grasses on the packed surface soil. When the grass cover diminishes, surface soil moisture diminishes as well, making recovery of the climax species difficult.[8] In the thornveld these desirable grazing species are *Tarchonanthus camphoratus* (vaalbush, Tswana: *mohatlha*) and various grasses. The plants that replace them are pioneer grasses and woody shrubs. In this region they include *Acacia mellifera* ssp. *detinins* (blackthorn, *mongana*), *A. karoo* (mimosa, *mooka*), *A. hebeclada* (trassiebush, *sekhi*) and the bush *Rhigozum trichotomum* (driedoring, *mokuburwane*).[9]

The 'received wisdom' is that overgrazing and consequent changes in veld composition decrease grazing capacity.[10] The belief is that woody invaders are of little use to cattle, which are grazers, although browsing goats and sheep will eat twigs and shoots. Grazing capacity is believed to fall further because the pioneer grasses are less nutritious and less palatable than those requiring more optimum conditions are. Furthermore, selective overgrazing allows the proportion of poisonous plants including *Geigeria ornativa* (vermeerbush, *moremoshumi*) and *Orthnoglossum viride* (slangkop, *sekanane*) to increase. The most serious problem of succession in this region is held to result from an indigenous woody shrub *Acacia mellifera*, which has by one estimate, reduced grass in some areas by approximately fifty percent.[11] *A. mellifera* is an important character in this history and deserves a special introduction. It is: a 'very thorny shrub to small tree with rounded to spreading flat crown; occurring in the bushveld and semi-desert areas, often on Kalahari sand and forming impenetrable thicket in overgrazed areas'.[12] *A. mellifera* can be a superior competitor with grass: tests in the Molopo valley showed the yield of grass falling by approximately seventy-five percent as the density of *A. mellifera* increased from zero to 1071 trees per hectare.[13]

The thinking that identifies grass with climax and increased bush with degradation is part of a larger rangeland 'science of ecological calamity'.[14] Beginning in the 1920s, and increasing after the North American Dust Bowl, southern African ecologists and policy makers began to discuss environmental change, particularly soil erosion, but diminishing grass as well. They constructed

alarming accounts of degradation that attributed change solely to pastoral overuse and supported policies intended to prevent unsustainable land use.[15] Extension policy in the Kuruman area, both for privately held (until 1994 white-owned) and communal (always black) lands, has been to eradicate bush and foster grass.

Despite state sanction, the assertion that grasslands are a 'natural climax' in this area, and that the appearance of bush is less natural, is problematic. There are strong reasons to question arguments that an increase in bushes is grazing-induced degradation. In the science of ecology concepts of strict succession patterns and one stable climax are increasingly being dropped for theories that make allowance for greater dynamism.[16] In range management as well, there has been development of non-climax models, that ecosystems vary between states, depending upon disturbances. The recognition of some change as a natural phenomenon and an appreciation of variations in ecological systems, has made scientists hesitant to attribute all vegetation change to herding and to label these changes as 'degradation'.[17] Such thinking gives emphasis to rainfall levels, soil conditions, the fire regime, insects and other non-human factors that may cause changes in bush and grass levels. Recognising spatial variation is critical. The identification in *Vegetation of South Africa, Lesotho and Swaziland* of three veld types within ten kilometres of the town of Kuruman illustrates how non-human factors can vary even within a small area. Rainfall can also be a factor, supporting bush growth at the expense of grass: wet periods can give bushes an advantage that will last through dry cycles. A presumably anthropogenic change that has nothing to do with herding involves the rise in the level of atmospheric CO_2. The increase in this 'greenhouse gas' is believed to have affected grass-bush ratios worldwide. In the past two centuries CO_2 in the atmosphere has risen from approximately 275 parts per million to the current level of approximately 363 parts per million.[18] Presumably, under these circumstances C_3 photosynthesis is less of a disadvantage even on dry lands, and woody plants are better able to succeed against C_4 grasses.[19] The emphasis on biological and physical factors enhancing bush growth does not constitute a denial that grazing affects veld composition. But it demands a nuanced understanding of the many influencing factors, including natural and global anthropogenic. The definition of ecological degradation requires strict qualification. The mere fact that vegetation change has occurred cannot be taken as evidence for a degradation of the natural state.

A major point made in much recent writing on African human ecology is that social scientists and policy makers should be cautious about telling tales of environmental decline. Alarmist thinking about land use fails, a recently emerging school asserts, because it is too often based on received wisdom and scanty evidence rather than on empirical study. Furthermore, it does not consider how indigenous ecological knowledge informs practice, and thus, fails to recognise how African environmental management may be well suited to ecological processes. Rather than decrying change as degradation, the new writing consid-

ers whether change may be cyclical, or due to non-human factors, and to what extent people can adapt.[20] Some of these studies refute the received wisdom that environmental change has even occurred. It is not advisable to deny bush encroachment. It 'happens'.[21] Still, it is not caused solely by overgrazing and may not be uncritically taken as degradation of the natural state. Arbitrating ecological debates about whether change threatens biodiversity or is irreversible is beyond the scope of this historical study. Social scientists should be cautious about biological judgments and consider instead the effects of observed changes on people. Even if ecologists agree that a change constitutes biological degradation, social scientists may not assume it entails economic degradation.

The questions under consideration in this paper concern the evidence for change over the long term, establishing its chronology, suggesting causes and considering the social effects of the changes that did occur. In order to construct a more focused social history, this study restricts itself to the black population of Kuruman and how the composition of and changes in the grazing environment were part of its history. Certainly, bushes increased on lands used by whites as well, but because their access to land, production methods, relations with the state and place in the economy were very different than that of blacks, race becomes a useful category in the study of the effects of environmental change. Any evaluation of change must take place with reference to the logic of people's environmental management and the activities of their daily lives. We must also probe their perceptions to understand how they live in this particular landscape. Although the vastness of the Kalahari thornveld can dwarf humans, this story of their changing environment is, ultimately, a story of their experiences.[22]

GRASS AND BUSHES IN DOCUMENTARY RECORD: DETERMINING THE EXTENT, CHRONOLOGY AND CAUSE OF CHANGE

The earliest travellers' accounts of the thornveld show a different situation than today. More than any other environmental phenomenon, the huge expanses of grass made a great impression on travellers in the early nineteenth century. William Burchell, an 1812 visitor, records the country was 'abounding in tall dry grass, of so great a height that the oxen were half hid as they passed through it; and our party had exactly the appearance of riding through fields of ripe corn'.[23] An 1813 visitor recorded 'thousands of acres of long grass, or hay, reaching sometimes as high as the backs of the oxen'.[24] Travellers until mid-century found the grasslands amazing, describing, for example, 'long coarse grass, which being dry, gave to the plains the delusive appearance of ripe corn-fields;' or 'miles of grass up to one's waist, and the hills rounded off with masses of unwanted vegetation'.[25] It is clear that travellers were describing a savanna dominated by grass, not a grassland, for they also noted large *Acacia erioloba* (camelthorn; Tswana *mokala*) and *A. haematoxylon* (grey camelthorn; *mokholo*) scattered

across the region.[26] Camelthorns near settlements were largely reduced to stumps, and slow to regenerate.[27] Other species included *Tarchonanthus camphoratus*, 'the prevailing shrub in these places'.[28] Acacia shrubs and bushes do not dominate these accounts of veld composition, yet tendencies toward thickets were evident. There are reports that 'straggling thickets' slowed the first visitors from the Cape in 1801.[29] Burchell noted unspecified acacia at water sources, and Moffat noticed 'small acacia' around abandoned settlements.[30] Another traveller records that both *A. mellifera* and *A. erioloba* slowed his journey in the 1830s.[31] David Livingstone, who lived in Kuruman from 1841 to 1843, listed *A. mellifera* as a major species on rocky soil.[32]

The use of travellers for evidence can be problematic, for it has been observed that their writings, including nature writing, are fraught with representations of 'the other'.[33] This becomes a pertinent question to the history of vegetation change if there was a cultural pressure to exaggerate descriptions of grass. It was understood by the late eighteenth century that bush could replace grass in areas of heavy use,[34] but there is only one indication that visitors attributed greater meaning to the proportion of bushes and grass in the veld. The missionary John Campbell found the unclaimed wealth of the land disheartening, writing in 1813: 'It is grievous to see so much of the world remaining in a wilderness state, and so much of the annual productions of the ground perishing without being useful either to man or beast. . . I hope better times are coming to this miserable land'.[35] Missionaries did believe the landscape was in need of redemption. Foremost with such concerns was Robert Moffat, yet the proportion of grass and bushes was not an issue for him. Rather, he believed that cutting of large acacias had caused desiccation, and as evidence for this he cited geomorphology rather than the amount of grass or bush.[36] Although observers did not approach the landscape neutrally, there was no consistent meaning for grass in these writings, and there was no force to under-report bushes and trees.

There is also internal evidence within these sources that there were few bushes. Before arriving in the thornveld, Burchell gave *A. mellifera* ssp. *detinins* its scientific name, 'detinins', conveying that it detained him. South of the Orange River, he was caught in a thicket and freed only by cutting loose his clothes. 'In revenge for this ill-treatment, I determined to give to the tree a name which should serve to caution future travellers against allowing themselves to venture within its clutches'.[37] Someone so intimate with the species would have reported it as he saw it, and he mentioned *A. mellifera* ssp. *detinins* only once, in a footnoted list of species in the area.[38] His is strong evidence that the bush did not dominate the veld.

Compared with what was to follow, the environment in the early nineteenth century was grass-friendly. The first factor was the presumably lower CO_2 level. Second, large herbivores controlled trees. Elephants uprooted them, and giraffes kept them trimmed.[39] The great variety of wild species, which provided a large proportion of the meat in people's diet, had differing grazing and browsing preferences and patterns, and thus the impact was widely spread.[40] Human and

domesticated stock populations were low, for the Tlhaping and Tlharo had consolidated as late as the mid-eighteenth century and their settlements moved frequently, so their impact was also diffused.[41] Communal ownership of pastures also encouraged grassy cover by allowing men continually to move their herds and flocks, thus giving grazed land a chance to replenish itself. The seasonality of many natural water supplies prevented long damaging stays in any area, allowing grazed areas to recuperate. Fires and frost could slow bush growth without damaging the permanent grass cover or the largest trees. There were frequent, perhaps annual, burns (some man-made).[42]

Most of these environmental factors were subject to change, but the changes and their effects would be gradual. Two indications of new and larger thickets exist by the mid-nineteenth century. Gustav Fritsch, an 1864 traveller with a good eye for environmental and ethnographic detail, gives a description of the veld near Kuruman that differs from those of earlier travellers. Rather than uninterrupted grass, he saw bushes scattered in the tall grass, the shrubs thicker on the hillsides and the grass in the valleys.[43] Fritsch gives the first description of an *A. mellifera* thicket, dense enough to cause him to lose his way, north of Griquatown on his way to Kuruman.

> This type of umbrella-shaped acacia, which is between two to six feet tall, is decorated with pairs of hooked thorns, whose sharpness and strength has no equal in the plant world. . . As we gradually lost our way and the thorns pressed nearer and nearer, our hopeless struggle began to resemble a droll play, lacking only an audience. The thick coat of the oxen felt the hooks just as sharply as we did, protected only by our clothes. Nothing proved itself thick enough to resist the pressure of the thorns, and anything they fastened on came loose only in shreds.
>
> … So we pressed through by performing caprioles and a bit of bloodletting, until the falling darkness made the struggle too uneven and we outspanned, still encircled by a terrible row of thornbushes. As morning broke, I rode back to Griqua Town … and by full daylight we found a tolerable way out of the cursed bushes.[44]

South of Kuruman Fritsch missed a waterhole, until a passing Griqua man pointed out the obvious markers, the *A. karoo* and other water-dependent bushes. Thereafter Fritsch noticed other acacia in river valleys. North of the Kuruman mission, however, the landscape began to resemble the savanna seen by previous travellers.[45] In the 1880s another traveller, Parker Gillmore, also described dense bush. Approaching Kuruman from another Griqua town, Boetsap, to the south-east he found:

> The early part of the route is most uninteresting, the track being surrounded by the most dense description of thornbush, in which three persons who left the path (either in pursuit of game or otherwise) have never since been heard of . . . After leaving this impenetrable bush the country becomes open, undulating and park-like; water, although scarce, is not absolutely wanting.[46]

The comparison of these accounts with earlier ones strongly suggests that change in veld composition had occurred along roads. It seems that Fritsch saw less grass and more bushes on the open veld than earlier travellers did. It is a reasonable hypothesis that by the 1860s and 1870s, greater thicket formation had occurred along roads on the southern approaches to Kuruman. The serious hindrance that thickets posed to Fritsch and the impression they made on Gillmore make it unlikely that the earlier writers would have experienced but collectively failed to record such good stories. It is significant that these thickets were south of Tlhaping and Tlharo areas, where there had been immigration of Korana, Griqua and Boer populations, and on roadsides. Roads are areas of highest seed distribution, so bushes were more frequent there.

By the end of the nineteenth century there were further fundamental changes in the way people related to the veld. Beginning in the mid-century, the diversity of wild species diminished behind the expanding hunting frontier.[47] Especially significantly, elephants and giraffes disappeared. Three species, cattle, sheep and goats, replaced the many different wild grazers and browsers, so their impact was more concentrated than that of a similar-sized, but mixed population of domestic and wild animals. Second, the wood market in Kimberley consumed many if not most of the large camelthorns within a few days' journey of the mines.[48] Their cutting gave advantages to other woody species. Third, the region came under the control of the British empire. The British annexed it as the Crown Colony of British Bechuanaland in 1885, and their policies had a major impact on Tswana stock keeping. First, the colonial land settlement of 1886 granted blacks only eleven percent of the total 36,053 square kilometres in the Kuruman district. The reserves, when completely surveyed in 1895, amounted to 461,055 morgen.[49] This land included most river valleys and springs in the district, and could be considered the 'best land', from an agricultural point of view. From a pastoral perspective, however, this was not the case. Because of their size and grassy nature, the wide expanses of grazing veld were essential to herders, and their loss was to be devastating.

Important political changes that would have repercussions for how people herded continued: in 1895 the British turned the Crown Colony of British Bechuanaland over to the Cape Colony. The most dramatic impact of imperial takeover was the cattle plague rinderpest. This sudden blow ended the viability of a pastoral subsistence. According to Cape Colony estimates, the disease took almost ninety-three percent of the cattle in the Vryburg and Kuruman area![50] The government attempted to control its spread by shooting cattle, sparking a rebellion among the Tswana in 1897, which resulted in the further loss through confiscation and 'consolidation' of 240,086 morgen, fifty-two percent of the district's reserve area.[51] Almost all of this land was in the Langeberg, where rainfall was low and there were few springs. The Langeberg was, however, prized grazing and whites quickly moved onto the confiscated lands.[52] Black

herders acutely felt the loss of the Langeberg because it had the healthiest grazing of all the reserves.

Obviously, the loss of practically all cattle through rinderpest would have reduced grazing pressure, albeit on a reduced land base. The loss of cattle was not, however, the end of pastoralism: sheep and goats survived and donkeys became significant for the first time after rinderpest. Only thirty donkeys were counted on reserves in 1906 yet their numbers increased to 5076 by 1937.[53] Small stock and donkeys remained important to household livelihoods after rinderpest and land alienation made subsistence cattle herding less viable. Cattle slowly recovered into the twentieth century, but their market value made it more difficult for cash-poor people to accumulate and retain herds.

After this point, the narrative departs from the veld given over to white settlement and switches to river valleys. The evidence about veld conditions in the first few decades of the twentieth century is thin and not consistent. This inconsistency represents actual veld conditions, for in different areas of the reserves, varying non-human factors and human impact would have created different conditions. Although it is impossible to pinpoint locations and a precise chronology of change, it is possible to identify new factors that would have challenged the grass cover. Colonial officials decried the 'pernicious' practice of annual burning,[54] criminalising man-made fires and extinguishing natural ones. This lack of fires would have enhanced shrub growth. Additionally, since the river valleys given over to reserves were the territory most prone to bush growth, the environment for black herders was bushier than it had been before land alienation.

There is some evidence from the turn of the century about botanical composition, and it suggests the veld on the reserves was not dominated by grass. An 1891 tree list gives prominence to small thirsty trees such as *A. mellifera* ssp. *detinins, A. karoo* and *Terminalia serica* (yellowwood or silver cluster, *magonona*).[55] There are also reports of poisonous plants, which were indigenous, and non-palatable exotics, which were introduced around the turn of the century, and their existence presented difficulties for herders in the area.[56] An 1899 report summarises the situation succinctly: 'The best waters appear to be in possession of the natives, but by compensation of nature the inferior veld. The best veld appears to be where there is no surface water'.[57]

Reserve residents did complain that the land allotted to them was insufficient for their support. A petition from inhabitants of one reserve to Queen Victoria soon after the reserves were surveyed expressed stress over land alienation and the inability to practice the old system of extensive pastoralism, as well as concern over the quality of the veld in reserves. It read: 'Queen! We are in great straits, for there is no place for an ox to graze, or a goat, or even a kid. . . We are in the very centre of the valley. . . There is no place where we can get firewood or grass'.[58] Blacks continued to make use of lands earmarked for but still

unoccupied by whites.[59] In 1908 to make good on promises to demarcate one more reserve, the government added 15,000 additional morgen to reserve areas.[60] Because of the general poverty of black people in Kuruman, only three farms were black owned in 1913, and people on the reserves continued to complain of overcrowding.[61] With increasing white settlement the land informally available for black use shrank. As Telesho Mogonarin, a reserve resident, wrote to the Governor-General in 1921:

> May your royal Highness know that the people live by tilling the land, we live along a river, when the rains fell it became full, and whenever it was full we used to be ploughing there out in the west since our ploughing lands were there, but they have been taken by the Dutch. Moreover we are poor because even the stock which we do possess lacks pasturage.[62]

In 1924 the government land surveyor noticed a shortage in available grazing along the Kuruman river. He reported grazing to be 'lamentably inadequate'.[63] The situation, he argued, was not due to subsistence herding, but to trek animals in the increasing traffic through the reserve to the Kalahari, and for asbestos mining. To mitigate the situation, he recommended buying the unoccupied farms in the 'horseshoe block', between the two arms of the Lower Kuruman reserve, where reserve stock grazed, 'there being no alternative'. Farm owners had been impounding stock that grazed over the boundary and collecting large pound fees.[64]

Despite these conditions, it is unwarranted to argue that there was a general decline of the grass supply across the reserves as a whole. The local inspector of natives claimed in 1909 that the reserves were understocked, with an adequate grass supply.[65] In 1919 the American botanist Homer Shantz passed near Kuruman in his research travels, but he travelled by rail and therefore came no closer than Vryburg. He records hearing of generally excellent grazing in Kuruman.[66] Yet, he records seeing 'overgrazing' characterised by compacted soil and depletion of grass on both white farms and black reserves in Taung and Vryburg. Shantz recorded that grazing conditions were localised, and this must have been true in Kuruman as well. The evidence for scarce fodder comes from along roads and rivers, areas with some combination of the following conditions: heavy grazing, high rates of seed propagation, much moisture. These factors converged at water supply points and until the 1930s water was restricted to natural sources, so the dry veld on reserves would have remained grassy. The fact that most of the veld remained grassy does not mean that there was no impact on pastoralism. It could be a long walk between food and water for stock on the Lower Kuruman Reserve: in 1931 it was as far as eight miles.[67] African testimony to the Native Affairs Commission in 1937 stressed that congestion was a problem.[68]

The 1930s marked a new, segregation-oriented phase of intervention in Kuruman reserves. Segregation motivated additional land purchases, more technocratic planning about land use, and greater control over how land was used. Beginning in the 1930s a significant reorganisation of black- and white-held lands in the Kuruman district occurred. In response to local needs, 93,564 morgen of land, in the 'horseshoe block' farms, the Khuis reserve and the Lower Kuruman Crown Reserve, were officially added to black areas in the 1930s.[69] Tswana people had long used some of this land, so much of the increase represented a recognition of, rather than an extension of, the actual land base. Greater intervention came as a result of the Natives Trust and Land Act of 1936. The Act mandated that the government purchase farms for black use in 'released' areas. By 1960, the trust had purchased 116,211 morgen in Kuruman.[70] Yet, most of this huge increase was not motivated by local needs. Rather, political pressure to fill a provincial quota and the lobbying of white farmers who wanted to sell unprofitable farms concentrated many trust land purchases in Kuruman, rather than in areas which were more overpopulated but had higher land prices.[71]

Only the first farms purchased by the trust had natural water; however, each previously occupied farm had a well or borehole. A more intensive use of this land by black herders required further water development, and the Native Affairs Department refurbished old wells and drilled new ones to increase the water points on the dry veld. Efforts to provide artificial water increased as the policy of Separate Development dictated a more intensive use of trust lands. Native Affairs Department records suggest that only six artificial water sources existed on Kuruman communal lands before 1930. After a drought in 1932–33 the government began drilling boreholes to supply dry areas on the reserves. Sixty-four wells and boreholes were added in the 1930s (perhaps half of which yielded water), 156 in the 1940s, (perhaps two-thirds of which yielded water), eighty good wells in the 1950s, and seventy-two good wells in 1960–61.[72]

In this period stock populations were also rising. Figure Two shows goat, sheep and cattle populations for selected years. Between 1927, the first year for which complete data is available and 1969, when reorganisation of district boundaries made it impossible to follow continuing trends, the number of goats rose by 67%, sheep by 95% and cattle by 176% (see Fig. 2). The total grazing pressure may be estimated by converting all animals to Large Stock Units (LSUs). In the most simple and most common calculation, one LSU equals one cow, horse or donkey or five sheep or goats. Calculated thus, there was a 108% increase in domesticated animals from 21,837 LSUs in 1929 to 45,551 LSUs in 1969. This population increase accompanied land acquisitions and water drilling on trust farms, but the animals were not distributed evenly across the new land. In fact, so few people settled on the trust lands, that in the early 1940s the government offered a subsidised settlement scheme to people from overcrowded

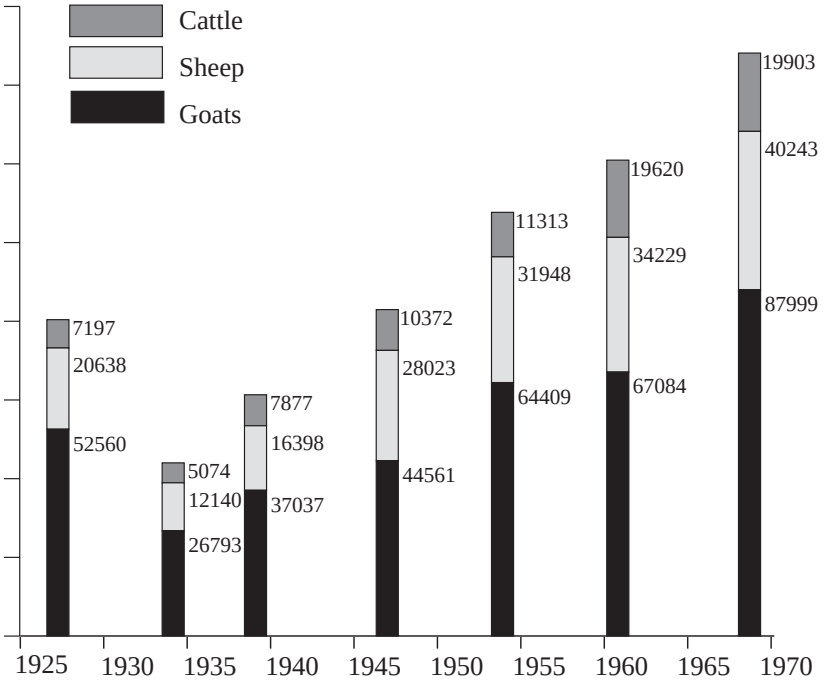


FIGURE 2. Stock on Communal Lands[73]

areas in the Ciskei, but an unenthusiastic recommendation by the delegation which visited Kuruman limited applicants to two or three families.[74]

Since people on reserves had petitioned for more grazing land, and since herds were growing, the under-utilisation of trust lands requires some explanation. There were disincentives preventing the movement of people from reserves to the trust farms. First, a lack of irrigable land and a ban on dry land ploughing on trust farms (which did not apply to the older reserves) discouraged farming households from moving. The more successful stock-owners had other reasons for hesitating: only the first 25 LSUs could be grazed without charge. Unlike on reserves, fees were due for larger herds.[75] However, most households did not have 25 LSUs, and this also gave them less interest in moving to potentially greener pastures. In 1959 as the government prepared for the removal of Kono Reserve, it made a survey of herd size by household.[76] It shows that ninety-four of the 123 households had ten or fewer LSUs (see Fig. 3). Small-scale herders would have been very reluctant to threaten the viability of their herds through sales, and therefore would have felt little pressure to keep their herds in peak

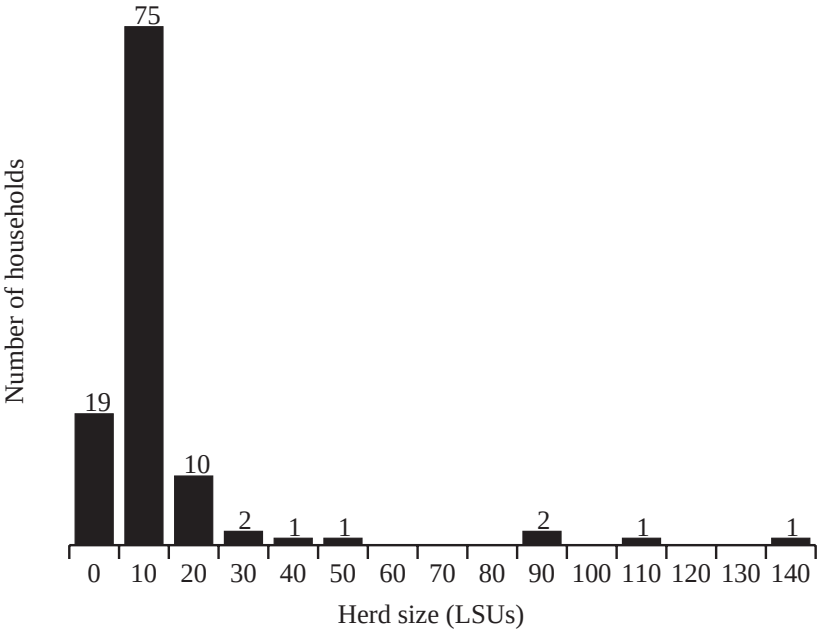


FIGURE 3. Herd size (LSUs) by number of households: Kono Reserve, 1959

condition, fattened on good grazing for the market. Moving from reserves to trust farms had costs: leaving relatives, communities, schools, churches, and river valley gardens. The benefits to just a few animals could not outweigh these costs.

Herd composition was also a factor impeding voluntary movement to trust farms in search of better grazing. Since browsing goats and sheep far outnumbered grazing cattle, even if river valleys were bushier than trust lands, most stock-owners would not have felt a strong impetus to seek grassier pastures. In 1927 the ratio of cattle : sheep : goats was 1 : 2.9 : 7.3. In 1946 it was 1 : 2.7 : 6.5 and in 1969 it was 1 : 2 : 4.4. The dominance of goats allowed people to live in a bushy landscape. Also important is the increasing number of donkeys. Omnivorous and hardy, donkeys provided transport, draft power, dung for floors or fertiliser, milk for sick children and, at times, meat. The new dispensation included a reorganisation of time and space, and so the donkeys' contribution to transport alone was vital. More than the other species, donkeys filled the space left by cattle after rinderpest. By 1946 there were 11,000 donkeys on reserves.[77] With donkeys humans found a new and important way to extract value from a veld that was not grassy.

A terrible drought throughout the country in 1942 prompted the Native Affairs Department to lease unused Kuruman, Vryburg and Mafikeng trust farms to white stock-owners. Kuruman trust lands thus became a regular source of grazing, often at bargain rates, for white farmers until the 1960s.[78] Unlike black farmers, who did not have the means, these herders drilled their own boreholes for water in the dry but grassy portions of the trust lands they hired. In 1958 a committee of local Native Affairs officials reported that areas of the 'horseshoe block' rented to whites were showing signs of serious overgrazing, the only such report of degradation on communal land in this period. As evidence for overgrazing this committee took photographs of bare, tramped surfaces, but they did not report bushes appearing in overused areas.[79] Apart from the areas rented to white farmers, veld quality on black communal lands is difficult to ascertain. There was an observation in 1949 that *A. mellifera* was supplanting other species: 'In some regions it is so thick that it has become impossible to move from place to place in the veld'.[80] Local officials who did record veld quality were most concerned with poisonous plants.[81] In fact, concern about excessive woodcutting caused the government to restrict cutting of live trees. Regulations passed in the 1910s and 1920s allowed people to collect only dry wood for domestic use.[82] The ban on cutting *A. mellifera* was lifted in 1951.[83]

Concern about degradation existed in the 1930s, and after the 1940s black lands came under the policy of 'Betterment', a coercive conservation program enacted to prevent environmental decline. Highly technocratic, betterment gave officials in the Department of Native Affairs (later Bantu Administration and Development) authority to 'plan' land use on all reserves and trust lands. This involved calculating a carrying capacity (determined in LSUs) for the grazing veld, enforcing that herds did not exceed the mandated level, stipulating where cultivation was allowed, and relocating the human population into compact platted villages.[84] Betterment grazing management divided each community's pastures into four camps and rotated herds between them to allow the grass a chance to rejuvenate. In Kuruman bureaucrats planned unoccupied trust lands in preparation for forced removals.[85] In fact, betterment was entirely designed to support segregation, because politicians and bureaucrats believed that a more rational use of communal black areas would increase the number of people able to live on them. A significant population settled on Kuruman trust lands only when they became the dumping grounds for 'black spot' removals, both from Kuruman and other districts. At least 8,500 people suffered forced removal to trust farms from the Kuruman reserves Smauswane, Kono, Khuis, Vlakfontein, Ga-Tlhose and Maremane.[86] In addition, approximately 12,000 people from communities in other districts were also resettled on Kuruman trust lands.[87]

The carrying capacity of Kuruman reserves was pegged at ten or twelve morgen per LSU.[88] For example, in 1960 it was calculated that Tlharo areas were overstocked by 152%, and Tlhaping areas by 105%.[89] The resultant stock culling

was limited to donkeys in the late 1950s and early 1960s,[90] prefiguring a massive slaughter of these useful animals in Bophuthatswana in 1983. Conservation concerns did not inspire officials to gather data on the rationale behind or effects of herding management on the reserves. The determination of carrying capacity rested upon rainfall measurements rather than a survey of veld conditions, and there were no inspections to determine how sustained overuse was possible. Therefore betterment interventions cannot be uncritically taken as a sign of environmental decline.

By mid-century there were certainly conditions which favoured bushes over grass, on dry soils as well as moist ones. It is possible that sustained heavy grazing did tax the grass cover. Additionally, burning remained illegal and there were reports of 'conservatives who want the veld to be burnt every year'.[91] In the 1950s neighbouring farmers made an issue about fires on Kono reserve, and used them as an argument for removal, but reports of this problem arose only after discussion of removals had already begun.[92] Although both whites and blacks set fires, and some started after lightning strikes, fire was no longer an acceptable way for humans to shape the savanna. Also, by 1960, CO_2 levels had risen to 317 ppm.[93] Certainly, CO_2 alone would not explain an increase in bushes, but in conjunction with heavier use, periods of heavy rain, efficient propagation, and fewer fires, it could be a factor making the veld bushier.

Thus far, the argument that the herding environment became bushier has rested upon infrequent localised descriptions, an understanding of the microenvironments where people lived and upon an analysis of factors which would have given grass or bush an advantage. Such evidence has allowed only cautious conclusions about where bushes formed thickets and where grass rippled like grain. After the 1950s, however, more reliable evidence for the entire area is available – aerial photographs. While it is difficult to calibrate aerial photographs with earlier verbal descriptions of horizontal views, a longitudinal comparison of the photographs from 1958, 1965, 1972 and 1981 reveals changes over this period.[94] As expected, the heaviest bushes are always along rivers and dolaritic dikes. The 1958 photographs show clumps of bushes on dry lands as well. Additionally, circles of grass depletion, judged by reflection of light from the bare surface, are evident around water sources. In subsequent years flights moved to higher altitudes, and so the thickets become less distinguishable. Yet, the increased albedo around human settlements and water holes remains evident. Over time, the photographs reveal many changes. Resettlement after forced removals in the 1950s, 60s and 70s finally caused large numbers of people to live on the trust farms. The aerial photographs show new villages on the betterment grid, more roads and an end to dry land cultivation as lands owned by whites became trust property. The 1972 photographs also show the effect of betterment, as fences dividing the veld into separate 'camps' and new water sources appear. In every set of photographs fences dividing heavily and less intensively grazed areas are visible.

In this period there were great changes in how people used and settled the veld, and this is evident in the aerial photographs as well. The later photographs show many new villages appearing and the areas around them coming under intensive human use: each village had a great impact on its immediate environment. This is not the degradation predicted by the received wisdom, that unsustainable subsistence production diminishes the resource base. De Kiewiet's theory was that environmental degradation caused people to move to cities. The aerial photographs show a different and unrelated phenomenon: that moving large numbers of people to a virtually empty veld will transform the environment. Yet even under these conditions not all change was unidirectional. The 1972 photographs show that areas that had been heavily grazed regained surface vegetation. In some areas, bush even diminished. To what extent the improvement in grazing was due to the rotational system, and to what extent it was due to recovery from the 1965 drought is impossible to say. Once again, the effect of grazing on the veld proves to be mediated by other factors and difficult to gauge.

Despite the lack of precise descriptions of changes in particular areas over the long term, a combination of documentary evidence with an understanding of environmental factors sustains a theory about vegetation change. In the second half of the twentieth century black people lived in a bushier veld than their ancestors in the early nineteenth century had. Unfortunately, the documentary record gives few suggestions about what the effects of this environmental change were on local households. The conclusion by those who have argued that overgrazing has made herding less sustainable would be that decreasing grass caused increased reliance on cash wages and food purchases. However, it is necessary to consider local testimony before concluding that economic degradation took place. In fact, the perspective of people living and herding in the thornveld refutes any conclusion that vegetation change has been a cause for hardship.

GRASS AND BUSHES IN ORAL TESTIMONY: DETERMINING THE SIGNIFICANCE OF CHANGE

I expected fieldwork on communal lands near Kuruman to yield good evidence on the timing, location and causes of change. However, asking people who live on reserves (even in bushy parts of reserves) about their memories of vegetation change, did not yield such information. If people recall historical changes in the vegetation, they describe an overall decline of all fodder, not a change in the bush-grass ratio. They attribute the change to progressive desiccation. The meteorological record does not corroborate the stories of climatological change. Rainfall has not declined in the nineteenth or twentieth centuries.[95] Less rainfall than in earlier days is a ubiquitous explanation for hardship and I believe stories

of drought should be read as a code for social and economic troubles rather than as evidence of environmental change. Perhaps because the rain that does fall supports more bushes and less grass, people think there is less rain. Another possible explanation for why people do not recall bush encroachment is that rotational grazing has offset the process in their lifetimes. At any rate, vegetation change is an extremely gradual and localised process that many observers might not recognise as a cumulative one.

Interviews with people in Kuruman in 1991 and 1997 did not yield an entirely consistent veld-*anschauung*, but they do indicate a predominant perspective that differs from that of veld specialists or conservation officials.[96] Valuation of veld conditions is dependent upon perceptions of possible and desired uses and local people do not decry bushes as a degraded grazing environment. Compared with the conventional wisdom among range ecologists, herders in the thornveld look at the different species with more tolerance. Perhaps the greater equanimity in their thinking on grazing conditions arises from their belief that human use has little effect on veld composition. Veld composition, most people assert, is determined by soil and rainfall and not affected very much by animals owned by people. Only infrequently did anyone mention the disadvantages of many bushes or assert that they had increased relative to grass. One man's description of a zero-sum relationship between bushes and grass was unique: 'Where there are more *mongana* [*Acacia mellifera*, ssp. *detinins*] trees you find less grass'.[97] Infrequently, some people contradicted the prevalent view of vegetation change; such as 'In the olden days there were not so many *mongana* as you find today'.[98] Only rarely did people emphasise that there were disadvantages of herding in this veld. As one man said, 'There are more bushes and less grass'. He emphasised that animals eat bushes only 'because of drought … because there is less grass'.[99]

Far more typical was the response by a group of men when asked their estimation of the proportion of grass and bushes in a relatively bushy area, 'It is all right for the animals. It's all right because there is grass for cattle, and bushes for goats and sheep'.[100] People in different villages consistently valued grass, known simply as '*bojang*' or 'grass' as the best grazing for cattle. However, they also valued species that are undesirable to the mainstream range management. In one interview *mongana*, the scourge of the overgrazed thornveld, was said to be the best fodder for goats. *Sekhi* (*A. hebeclada*), another species common in areas said to be disturbed, was listed as the most desirable species for sheep.[101] An added benefit of *sekhi*, a low-growing sprawling shrub, is that is provided a secure egg-laying spot for chickens.[102] Given the high proportion of sheep and goats owned by people on reserves, these are strong endorsements. In addition, these and other bushes were also said to be important to cattle herding, because their leaves stay green after drought wilts the grass. Cattle may be classified as grazers rather than browsers, but even bovines innovate when they are hungry, and, in a pinch, Kuruman cattle are adept browsers. When asked what the ideal herding veld for all animals would be, one group responded the most important

item would be *bojang*, but after agreeing on this, a woman quickly said the ideal veld must include trees, explaining 'if the grass died, then trees remain'.[103]

These examples of how local people value their grazing veld are key to understanding the significance of environmental change, to understanding how it affected their daily lives. This testimony refutes any thesis that this form of environmental change created a greater dependency on wage labour. The gradual appearance of bushes cannot compete with imperial conquest, rinderpest, violence, taxation, debt, land alienation, changing consumption patterns, the lack of political rights and forced removals as causes for poverty and economic dependence. Contemporary Kuruman herders suggest that bushes were not even a contributing factor. At the least, people were able to adapt advantageously to the increasing bushes.

An argument could be made that bushes actually benefited people by allowing them to continue the small stock pastoralism affordable to them. This region is notoriously unhealthy for cattle, with endemic bovine botulism and periodic anthrax outbreaks. Animals living on phosphate-deficient grasses, such as grow in Kuruman, contract these diseases because they ingest bones to assuage their cravings for phosphate. This behaviour is in itself not unhealthy, unless the bones are contaminated, when disease can result. In 1919 it was determined that clearing fields of bones and dosing stock with sterile bonemeal were effective preventatives. However, the former requires labour and the latter requires cash. On reserves, therefore, the proportion of small stock, less susceptible than cattle to botulism, remained higher than on white-owned farms.[104] Furthermore, goats and sheep reproduced quickly, required little capital and thrived on the bushes. Small stock could be slaughtered more frequently than cattle and they provided an easily accessible supplement to the livelihood provided by low wages. The cattle herding which continued under these circumstances was also predicated on a veld with bushes. People too poor to purchase supplementary feed relied on the less nutritious and palatable bushes to keep their herds alive during drought. People recognise that this is not the best of all possible pastoral worlds. 'The land supports all the animals, but they don't get full up'.[105] Cattle tend to be bony in dry seasons and plump when rain makes the grass thicker. This has been acceptable because these herds served more as investments than as commodities. Cultural and economic factors slowed regular sales of cattle, and although not ideal, lean but living beasts fed on bushes have been tolerable. Given a choice, Kuruman people (and cattle, goats, sheep and donkeys) might choose a veld with more grass, but they have never had that choice, and the veld they do have has proven useful to them. Whatever the disadvantages of the current herding environment, poor people in the late twentieth century would not find the grassy expanses early travellers described entirely well suited to their needs.

The herding patterns developed in the thornveld in the twentieth century offer a critique of the unqualified preference for grass among some range ecologists. Enthusiasm for grass conflates economic and ecological arguments, for the agenda supporting grass does not just arise from a concern about preserving the climax community, but also for promoting capitalised beef production. The economic advantages of grass are strongest for those with access to capital, who can purchase feed in years of drought when grass, despite careful management, will die out. Since most people on communal lands do not have the means to acquire grazing cattle and would have difficulties maintaining them, the association of grasslands and higher carrying capacity does not hold. Unfortunately, agricultural extension on black communal lands still aims to reduce bushes. This policy does not acknowledge that a savanna is an unstable environment, that the grasses and trees that define it are naturally in competition with each other. It does not recognise that savannas display a changing range of gradation between the grassland and woodland biomes, depending on physical factors and non-human interventions as well as human use. This history of bush encroachment, of its causes and its effects, suggests that resources for extension programs would be better used in other ways, perhaps improving small stock production.

If a human population on a reduced land base hopes to support itself through food production, it must find an environmentally suited form of intensification. Colonial and segregationist rule prevented Kuruman people from using the environment as their ancestors had or from making their own decisions about how to intensify. Their constricted power to determine their use of the environment echoed their disenfranchisement in wider society. Perhaps, if people had been able to continue with grazing methods and settlement patterns of the early nineteenth century there would be fewer bushes today, but if they had had power to control their herding, their entire existence, not just the veld, would be very different.

NOTES

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[1] C. W. De Kiewiet, *A History of South Africa: Social and Economic* (Oxford: Oxford University, 1941; reprint ed., 1957), 178–207. For a moving and poetic restatement of this thesis, see the opening of Alan Paton, *Cry, The Beloved Country: A Story of Comfort in Desolation* (New York: Charles Scribner's Sons, 1948), 3–4.

[2] A highly influential study with almost no environmental considerations, is Colin Bundy, *The Rise and Fall of the South African Peasantry* (Berkeley: University of California, 1979). One historian who does emphasise the role of environmental pressures is Charles Ballard, 'The Repercussions of Rinderpest: Cattle Plague and Peasant Decline in Colonial Natal', *The International Journal of African Historical Studies* 19 (1986): 421–50.

[3] J. H. Acocks, *Veld Types of Southern Africa* (Pretoria: Botanical Research Institute, 1988), 44–49. The Kalahari thornveld is type 16 in Acocks's classification. The subtypes found in this region are 16.a.4 (the Kalahari thornveld proper, northwestern subdivision) and 16.b.1 (Vryburg Shrub bushveld subtype *Tarchonanthus* subdivision).

[4] The new survey identifies four veld types in this area: Kalahari Plains Thorn Bushveld (30), Kalahari Mountain Bushveld (31), Kimberley Thorn Bushveld (32) and Kalahari Plateau Bushveld (33). Noel Rooyen and George Bredenkamp in *Vegetation of South Africa, Lesotho and Swaziland: A Companion to the Vegetation Map of South Africa, Lesotho and Swaziland*, ed. A. Barrie Low and A. G. Rebelo, second edition. (Pretoria: Department of Environmental Affairs and Tourism, 1998), 35–37. Other sources about this environmental zone are A. A. Gubb, 'An Evaluation of Landsat MSS Data for Ecological Land Classification and Mapping in the Northern Cape', (Ph. D. dissertation, University of Cape Town, 1989), 1: 11–18; B. R. Roberts and J. H. Fouries, *Common Grasses of the Northern Cape* (Vryburg: Noordkaap Lewende Hawe Kooperasie, 1975). On bush encroachment and soil erosion over a wider region, see: D. Grossman and M. V. Gandar, 'Land Transformation in South African Savanna Regions', *South African Geographical Journal* 71(1989): 38–44. I am grateful to Lerato Thahome of the biological faculty of the University of North-West for sharing expertise gained in her research on these environmental zones.

[5] P. H. R. Snyman, *Kuruman: Vervloë Pad na Afrika* (Pretoria: Human Sciences Research Council, 1991), 8–10.

[6] Regarding the predominance of C_4 species in the thornveld, see J. C. Vogel, A. Fuls and R. P. Ellis, 'The Geographical Distribution of Kranz Grasses in South Africa', *South African Journal of Science* 74 (1978): 209–215. I thank Stephanie Wand for bringing this subject to my attention and Peter Heywood for explaining the processes.

[7] N. M. Tainton, 'Introduction to the Concepts of Development, Production and Stability of Plant Communities', in *Veld and Pasture Management in South Africa*, ed. N. M. Tainton (Pietermaritzburg: Shuter and Shooter. 1981), 7.

[8] Tainton, 'Introduction', 33.

[9] Common and scientific names were cross-checked in Christo Albertyn Smith, *Common Names of South African Plants*, Republic of South Africa, Department of Agricultural Technical Services, Botanical Research Institute, Botanical Survey Memoir, No. 35, (Pretoria: Government Printer, 1966). Setswana names were determined during field-work in October 1997 and checked in F. H. Ferreira, 'Bantu Customs and Legends Protect Trees', *African Wildlife*, 3(1949): 59–64; Ferreira, 'Setlhapin Nomenclature and Uses of the Indigenous Trees of Griqualand West', *Bantu Studies* 3(1929): 349–356; and Desmond Cole, *Setswana–Animals and Plants* (Gaborone: Botswana Society, 1995). I am especially grateful to David Phalatse, of the biological faculty at the University of the Northwest, who identified specimens for me.

[10] On 'received wisdom' regarding degradation, see Melissa Leach and Robin Mearns, 'Environmental Change and Policy' in *The Lie of the Land: Challenging Received Wisdom on the African Environment*, ed. Leach and Mearns (Portsmouth: Heinemann, 1996), 1–33.

[11] C. H. Donaldson, *Bush Encroachment with Special Reference to the Blackthorn Problem of the Molopo Area* (Pretoria: Government Printer, 1969). Quoted by W. S. W. Trollope 'Application of Grassland Management Practices: Savanna' in *Veld and Pasture Management*, ed. Tainton, 404.
[12] Braam van Wyke and Piet van Wyk, *Fieldguide to Trees of Southern Africa* (Cape Town: Struik, 1997), 484.
[13] C. H. Donaldson and D. M. Kelk, 'An Investigation of the Veld Problems of the Molopo Area: I. Early Findings', *Proceedings of the Grassland Society of Southern Africa* 5(1970): 53.
[14] Ian Scoones, 'Range Management Science and Polity' in *Lie of the Land*, ed. Leach and Mearns.
[15] See also William Beinart, 'Soil Erosion, Conservation and Ideas about Development: 1900–1960', *Journal of Southern African Studies* 11(1984): 52–83.
[16] For example, see essays in D. C. Glenn-Lewin, R. K. Peet and T. T. Veblen, eds., *Plant Succession Theory and Prediction* (London: Chapman and Hall, 1992). See also a popular undergraduate text, Peter Raven, Ray Evert, Susan Eichhorn, *Biology of Plants*, sixth edition, (New York: W. H. Freeman, 1999), 792.
[17] R. H. Behnke and Ian Scoones, 'Rethinking Range Ecology: Implications for Rangeland Management in Africa' in *Range Ecology at Disequilibrium: New Models of Natural Variability and Pastoral Adaptation in African Savannas*, ed. R. H. Behnke, I. Scoones, and C. Kerven (London: Overseas Development Institute, 1993), 11.
[18] The estimate of atmospheric carbon dioxide levels at 275 ppm before the industrial revolution is commonly accepted. Levels for 1997 are reported by Seth Dunn, 'Carbon Emissions Resume Rise' in *Vital Signs: Environmental Trends that are Shaping our Future*, ed. Lester Brown, Michael Renner, and Christopher Flavin (New York, Norton, 1998), 66.
[19] See H. Wayne Polley, Herman S. Mayeux, Hyrum B. Johnson and Charles R. Tishler, 'Viewpoint: Atmospheric CO_2, Soil Water and Shrub/Grass Rations on Rangelands' *Journal of Range Management* 50(1997): 278; and Stephanie Wand, 'Physiological growth responses of two African species, *Acacia karoo* and *Themeda trianda*, to combined increases in CO_2 and UV-B radiation', *Physiologia Plantarum* 98(1996): 882–890.
[20] For examples see articles in *Lie of the Land*, ed. Leach and Mearns. See also, James Fairhead and Melissa Leach, *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic* (Cambridge: Cambridge University, 1996); James McCann, 'The Plow and the Forest: Narratives of Deforestation in Ethiopia, 1840–1992', *Environmental History* 2(1997): 138–159. M. T. Hoffman and R. M. Cowling, 'Vegetation change in the semi-arid eastern Karoo over the last 200 years: An expanding Karoo – fact or fiction?' *South African Journal of Science* 86(1990): 86–294.
[21] This is Michael Stocking's observation about soil erosion. Although erosion occurs, he does not take an alarmist position. 'Soil Erosion: Breaking New Ground', in *Lie of the Land*, ed. Leach and Mearns, 140–154.
[22] On the relationship of social and environmental history, see Alan Taylor 'Unnatural Inequalities: Social and Environmental Histories', *Environmental History* (1996): 6–19.
[23] William J. Burchell, *Travels in the Interior of Southern Africa*, ed. I. Schapera (London: Batchworth, 1953; Reprint of 1822-24 edition), II: 186. See also II: 243.
[24] John Campbell, *Travels in South Africa Undertaken at the Request of the Missionary Society* (London Black and Parry, 1815), 176. Campbell also described the grass on a

second, 1820 journey. John Campbell, *Travels in South Africa Undertaken at the Request of The London Missionary Society; Being a Narrative of a Second Journey into the Interior of That Country* (London: The London Missionary Society, 1822; reprint edition NY: Johnson Reprint Co. 1967), I: 60.

[25] The first passage is a description of the veld just east of the Kuruman mission station in 1836. W. C. Harris, *Wild Sports of Southern Africa* (London: Henry G. Bohn, 1852; reprint edition Cape Town: C. Struik, 1963), 41. The second description is by John Smith Moffat, son of Robert, who was born on the Kuruman London Missionary Society station, and was describing a homecoming in 1859. J. R. Wallis, ed., *The Matabele Mission: A Selection from the Correspondence of John and Emily Moffat, David Livingstone and Others* (London: Chatto & Windus, 1945), 52–53.

[26] John Barrow, *Voyage to Cochinchina* (London: Cadel and Davies, 1806; reprint edition Kuala Lumpur: Oxford, 1975), 388. This is an account of an 1801 journey by J. Truter, Barrow's father-in-law. See also, Burchell, *Travels*, II: 209; Harris, *Wild Sports*, 41.

[27] Burchell, *Travels*, II: 219, II: 361, II: 372; Robert Moffat, *Missionary Labours and Scenes in Southern Africa*, (London: John Snow, 1842), 330. Moffat's observations date from the 1820s; David Livingstone, *Missionary Travels and Researches in South Africa* (London: Murray 1857; reprint edition Freeport, NY: Books for Libraries 1972), 112. Livingstone lived in Kuruman between 1841 and 1843.

[28] Burchell, *Travels*, II: 193. Burchell was slightly south of Ga-Tlhose when he made this observation. See also, II: 219; II: 243.

[29] Barrow, *Voyage*, 388. These were probably *A. erioloba* rather than *A. mellifera*, since giraffes favoured them.

[30] Burchell, *Travels*, II: 219; Moffat, *Missionary Labors*, 330.

[31] Andrew Smith, *The Diary of Dr. Andrew Smith, Director of the 'Expedition for Exploring Central Africa', 1834-36*, ed. Percival R. Kirby, 2 vols. (Cape Town: the Van Riebeeck Society, 1939), I:296.

[32] Livingstone, *Missionary Travels*, 126.

[33] Mary Louise Pratt, 'Scratches on the Face of the Country; or what Mr. Barrow Saw in the Land of the Bushmen', *Critical Inquiry* 12(1985): 119–143.

[34] T. D Hall showed that people in the Cape Colony recognised the process of bush encroachment by the mid-eighteenth century. 'South African Pastures: Retrospective and Prospective', *South African Journal of Science* 31(1934): 59–97.

[35] Campbell, *Travels in South Africa*, 177.

[36] Richard Grove, 'Scottish Missionaries, Evangelical Discourses and the Origins of Conservation Thinking in Southern Africa', *Journal of Southern African Studies* 15(1989): 22–39.

[37] Burchell, *Travels*, I: 217.

[38] Burchell, *Travels*, II: 370.

[39] Grossman and Gandar, 'Land Transformation', 43–44.

[40] R. L. Liversidge and M. Berry, 'Game Ranching in the Arid Regions', in *Game Ranch Management*, ed. J. du P. Bothma (Pretoria: van Schaik 1989), 620–625.

[41] Martin Legassick, 'The Griqua, the Sotho-Tswana and the Missionaries, 1700–1840: The Polities of a Frontier Zone', (Ph.D. dissertation, UCLA, 1969), 61–71. Kevin Shillington, *The Colonisation of the Southern Tswana* (Johannesburg: Raven, 1986), 14–15.

[42] W. S. W. Trollope, 'Fire in Savanna', in *Ecological Effects of Fire in South African Ecosystems*, ed. P. de v. Booysen and N. M. Tainton, (Berlin: Springer-Verlag, 1984),

156. Moffat, 330. Other writers witnessed fire which may have been set by people or lightning. Burchell describes seeing an area recently burned, see *Travels*, II: 193. An 1884 traveller recorded the wild animals fleeing before the intense heat of a Kuruman grass fire. See William Cotton Oswell, 'South Africa Fifty Years Ago', in *Big Game Shooting*, ed. Clive Phillipps-Wolley, 2 vols. (London: Longmans Green, 1894), I:40.

[43] Gustav Fritsch, *Drei Jahre in Süd-Afrika: Reiseskizzen nach Notizen des Tagebuchs Zusammengestellt* (Breslau: Ferdinand Hirt 1868), 262. My translation.

[44] Fritsch, *Drei Jahre*, 260–261.

[45] For further observations of the environment, see Fritsch, *Drei Jahre*, 264–6, 284–5.

[46] Parker Gillmore, 'The Territories Adjacent to the Kalahari Desert', *Proceedings of the Royal Colonial Institute* 14 (1882–83), 134–135. The story of people disappearing in the thickets is somewhat fantastic, but Gillmore suggested that lions were responsible.

[47] For an account of game depletion in southern Africa see John M. MacKenzie, *Empire of Nature* (Manchester: Manchester University, 1988), 89–116. Regarding Kuruman, see Zimbabwe National Archives, Frederick Courtenay Selous Journal, 1/4, 5 February 1872; John Mackenzie, *Ten Years North of the Orange River* (Edinburgh: Edmonston and Douglas 1871, reprint edition London: Frank Cass and Company, 1971),70; A. A. Anderson, *Twenty-Five Years in a Waggon* (London: Chapman and Hall, 1888),87.

[48] On the wood trade, see Shillington, *Colonisation*, 136–143.

[49] Snyman, *Kuruman*, 53. CTAR (Cape Town Archives Repository) BCC (Bechuanaland Crown Colony) 117 'Surveyed Native Reserves in British Bechuanaland' 6 August 1895. A morgen is a Cape Dutch unit of area equaling 2.116 acres.

[50] CC (Cape Colony Publication) G 72 – '98, *Rinderpest Statistics for the Colony of the Cape of Good Hope*.

[51] The confiscated reserves were Dibeng, Kathu, Langeberg and Tlharing. The land area was calculated from survey information CTAR BCC 117 'Surveyed Native Reserves in British Bechuanaland'.

[52] A Langeberg Farmers' Live Stock Improvement Association was founded in 1907, and the Kuruman Farmer's Association followed it only in 1914. Snyman, *Kuruman*, 89. The Langeberg was prized because it was healthier than eastern parts of the district, where cattle suffered high rates of bovine botulism, or lamsiekte. On the significance of this disease in the history of herding in this area, see: P. H. R. Snyman, 'Die Bydrae van Droogtes en Veesiektes tot die Verarming van die Landboubevolking in Noord-Kaapland', *Tydskrif vir Geestewetenskappe*, 29 (1989), 32–49.

[53] CC G. 36 – 1907 *Blue Book on Native Affairs for 1906*, 27. UG (Union Government Publication) 18 '39 *Agricultural Census No. 17, 1936–7.*

[54] CTAR BBLC (British Bechuanaland Land Commission) 94, 23 July 1887.

[55] CC G 13–'91 *Report of Commission to Select Land in British Bechuanaland, under Railway Agreement of 23rd January 1890.*

[56] It is difficult to say which species is meant by the term 'khaki bush', which is the term for several species whose seeds are held to have been introduced in fodder during the Boer war. On its presence, see CTAR 1/KMN (Kuruman Magistrate Series) 10/9, 15 October 1908. On *Argemone mexicana* (Mexican poppy, *spanise*), see CTAR 1/KMN 10/9, 9 July 1908. On *Xanthium spinosum* (burrweed) see CTAR NA (Cape Colony Native Affairs Series) 586, 3 March 1906. On slangkop, see *Bechuanaland News*, 'Kuruman District Farmers' Association', 16 December 1916, 4.

[57] CC G.67 –'99 *Reports of Inquiry into Agricultural Distress in Herbert, Hay, Barkly West, Vryburg and Kimberley*, 8.

58 CTAR BCC 82, Petition from fifty-three signatories at Bothetheletsa, 11 August 1890.
[59] On Tswana settlement on unclaimed farms in Kalahari see LMS School of Oriental and African Studies, London, Council for World Mission Archive, London Missionary Society, Africa South, Incoming Letters Box 66 John Tom Brown, 6 June 1905.
[60] This was the extension to the Lower Kuruman Reserve. CTAR GH (Government House) 35/250 'The Bechuanaland Native Reserve Disposal Act' (Number 8 of 1908).
[61] UG 22 – '14 *Blue Book on Native Affairs*, 104.
[62] NAR (National Archives Repository, Pretoria) NTS (Native Affairs Series) 7752 22/335, 24 October 1921.
[63] NAR NTS 7752 22/335, 16 April 1924
[64] NAR NTS 7752 22/335, 5 November 1921.
[65] NAR NA (Cape Colony Native Affairs Series) 223 1/1910/F527, Inspector of Native Reserves, monthly report, July 1909, September 1909. Unlike other Native Affairs papers for the period before 1910, these are housed at the National Archives Repository in Pretoria.
[66] Homer Shantz Collection, Special Collections in the Main Library, University of Arizona, Tucson. His first journey through the Northern Cape and North-West provinces took place from 19 September to 1 October 1919. For references to Kuruman, see his journal for 26 September 1919. I am grateful to Barry Morton for visiting this collection and copying documents. Shantz returned to Africa in 1956 and a book was published posthumously with comparisons of his observations on the two trips. H. L. Shantz and B. L. Turner, *Photographic Documentation of Vegetational Changes in Africa over a Third of a Century*, (Tucson: University of Arizona, 1958).
[67] NAR NTS 7930 159/337, 4 March 1931.
[68] Testimonies are recorded in NAR NTS 3007 368/305 I.
[69] P. L. Breutz, *The Tribes of the Kuruman and Postmasburg District*, Republic of South Africa, Department of Bantu Administration and Development Ethnological Publications, no. 49 (Pretoria: Government Printer, 1963), 58. On the segregation of the Kuruman Crown Reserve and water from the Eye, see Nancy Jacobs, 'The Flowing Eye: Water Management in the Upper Kuruman Valley, South Africa, c.1800–1962', *Journal of African History* 37 (1996): 237–260.
[70] Breutz, *Tribes*, 62.
[71] On white farmers, see NAR NTS 3007 368/305, 10 May 1939.
[72] CTAR 2/KMN (Kuruman Native Affairs Commissioner correspondence) 40 N 5/1/2, contains a list of all boreholes and wells on black lands by 1961. The Native Affairs Department numbered each water point drilled or acquired through land purchase. Unfortunately, it is difficult to tell which boreholes were preexisting, or when they were drilled. Also, the output of the early wells varied greatly. Because of irregular data about boreholes, it is not possible to analyze how the increasing land and water base corresponded to rising stock populations. I am grateful to Richard Madsen of the Department of Statistics, University of Missouri, for statistical consulting.
[73] See correspondence in NAR NTS 3079 1003/305 Part I.
[74] On settlement and management of Trust Farms in Kuruman see NAR NTS 5404 H62/15/1/1363; NAR NTS 3079 1003/3–5 I–II.
[75] Data from UG 37 – '28 *Agricultural Census No. 10, 1927*; UG 44 – '35 *Agricultural Census, No. 14, 1934*; UG No. 18. '39 *Agricultural Census No. 17, 1936–37*; UG 77/48 *Agricultural Census No. 20, 1945–46*; Special Report Series No. 1 – No. 7 *Agricultural Census No. 28, 1953–54*; RP (Republic of South Africa publications) 10 ' 64 *Agricultural*

Census No. 34 1959–60; Report No. 06–01–06 *Agricultural Census No. 43, 1968–69*. Donkeys and horses not included in this chart because their numbers were only irregularly recorded.

[76] NAR NTS 10251 40/423 Undated report [1959] on planning for removal of Kono reserve.

[77] UG 77 – 48 *Agricultural Census No. 20, 1945–46*.

[78] On renting land to white farmers, see NAR NTS 36/336, 2 March 1942; NAR NTS 8134 377/340 Parts III–IV; NAR NTS 8133 376/340 Parts I–III. White farmers also leased Trust land in Thaba Nchu. Colin Murray, *Black Mountain Land, Class and Power in the Easter Orange Free State, 1880s–1980s* (Washington, DC: Smithsonian, 1992), 163.

[79] NAR NTS 8134 377/340, 3 September 1958.

[80] NAR NTS 6022 213/312, 12 November 1949.

[81] NAR NTS 7351 176/327 (1), 20 November 1933. NAR NTS 1948 256/278, 31 March 1940.

[82] On regulations for wood use in the region see a file on Setlagoli Reserve in Vryburg, NAR NTS 57/321.

[83] CTAR NTS 2/KMN 20 N. 1.15.4 part 2. Quarterly meeting of Chiefs, Headmen and People, minutes for 28 March 1951.

[84] On betterment, see: Joanne Yawitch, *Betterment: The Myth of Homeland Agriculture* (Johannesburg: South African Institute of Race Relations, 1981); C. J. De Wet, *Moving Together, Drifting Apart: Betterment Planning and Villagisation in a South African Homeland* (Johannesburg: Witwatersrand University Press, 1995).

[85] See for example, the planning of trust lands in preparation for the removal of the human and stock population of Kono and Vlakfontein, NAR NTS 10251 40/423(3). See also CTAR 2/KMN 33N. 2/11/4 parts 1–2.

[86] Breutz, *Tribes*, 56–62.

[87] *Forced Removals in South Africa: The Surplus People Project Report*, 5 vols. (Pietermaritzburg: Surplus People Project. 1983), 3: 89.

[88] The carrying capacity for Kuruman reserves was mandated in Government Notice 625 of March 25 1948. CTAR 2/KMN 48 N.8/5/2 part 1.

[89] Breutz, *Tribes*, Table XV. Range scientist now believe that carrying capacity cannot be fixed so precisely and permanently see Behnke and Scoones, 'Rethinking Range Ecology' in *Range Management*, ed. Behnke and Scoones, 2–8.

[90] On donkey reduction in Vlakfontein, see correspondence in NAR NTS 10251 40/423(1).

[91] NAR NTS 1948 256/278 (3), 13 October 1938; NAR NTS 6378 23/215, 31 March 1944.

[92] NAR NTS 7791 228/335, 8 March 1955. Yet, evidence from other areas warns against arguing that fire was part of black, but not white, herding management. On complaints about veld burning by whites and blacks, see correspondence in the following files: NAR NTS 6695 4/335, NAR NTS 6694 3/334, NAR NTS 6694 5/334.

[93] Michael Begen, John Harper and Colin Townsend, *Ecology: Individuals, Populations and Communities* second edition. (Boston: Blackwell, 1990), 709.

[94] I would like to thank Kim Euston-Brown for helping to interpret aerial photographs. The photographs were all taken along east-west flight paths, however at different altitudes and different latitudes. As far as possible, I chose flight paths which covered the same east-west strips, one on the northern portion of the Lower Kuruman Native Reserve and neighboring Trust Farms, and one on the southern portion of that reserve, extending to Trust Farms and the Bothetheletsa reserve. The photographs were: 1958 – Job 414.

Southern portion –strip 10, photos 6890–7707; 1890–1899. Northern portion – strip 4, photos 2802–2824. 1965 – Job 537. Southern portion – strip 5, photos 210–220. Northern portion – strip 2, photos 062–73. 1972 – Job 700. Southern portion – strip 6, photos 9599–9611. Northern portion – strip 3 photos 9385–9400. 1981 – Job 854. Southern portion – strip 2, photos 441–448. Northern portion – strip 1, photos 521–532.

[95] Mark Majodina, 'Rainfall variability over Kuruman'. Mr. Majodina, a meteorologist, was contracted to analyse rainfall data for Kuruman, 1932–1992. His report is available at the Moffat Mission library in Kuruman. For an analysis of rainfall patterns throughout southern Africa, see: P. D. Tyson, *Climatic Change and Variability in Southern Africa* (Cape Town: Oxford, 1987), 68–80. For an argument that rainfall patterns and levels in the southern and eastern Cape have not changed in the nineteenth and twentieth-centuries, see Coleen Vogel, '160 Years of Rainfall of the Cape – Has There Been a Change?' *South African Journal of Science* 84(1988): 724–26.

[96] My research assistants, Bhangi Mosala, Kristin Russell, Kgomotso Tshetlho, Megan Waples, and I conducted group interviews using the techniques of Rapid Rural Appraisal (RRA) for fieldwork. I am deeply grateful to this research team and others who helped in this research, especially the people we interviewed. RRA was designed for development planning, but is conducive to interviews on the history of land use and environmental change. RRA does not use questionnaires, but is based upon exercises intended to foster group discussions. Regarding vegetation change, my interviews had several steps. First, local men and women identified the most common fodder plants. Using field guides, we determined the scientific names. Next, we did ranking exercises in groups to bring out preference of cattle, sheep and goats for different plants. Last, people used dried beans on a time line to model their memories of changes in grass-tree ratios. Interview notes are held at the Moffat Mission, Kuruman. Interviews are catalogued by village.

[97] Gasebolao C, by Nancy Jacobs (Kgomotso Tshetlho interpreting) 29 October 1997.

[98] Maphiniki B, by Kristin Russell and Megan Waples (Kgomotso Tshetlho and Bhangi Mosala interpreting) 4 November 1997.

[99] Ncweng E, by Nancy Jacobs (Bhangi Mosala interpreting) 20 October 1997.

[100] Batlharos D, by Nancy Jacobs (Bhangi Mosala interpreting) 15 October 1997.

[101] Gamopedi E, by Nancy Jacobs (Bhangi Mosala interpreting) 16 October 1997. One group rated *mongana* best and *sekhi* third for goats, Ncweng E, by Nancy Jacobs (Bhangi Mosala interpreting) 20 October 1997. Another group listed both plants among the top five species for herding, Gasebolao A by Nancy Jacobs (Benjamin Barnette interpreting) 22 October 1997.

[102] Seodin B, by Nancy Jacobs (Kgomotso Tshetlho interpreting) 1 December 1997.

[103] Sedibeng B, by Nancy Jacobs (Kgomotso Tshetlho interpreting) 28 October 1997.

[104] M. W. Henning, *Animal Diseases in South Africa*, 2nd ed. (Pretoria: Central News Agency, 1949), on anthrax see 3–13, on botulism see 324–353; H. T. B. Hall, *Diseases and Parasites of Livestock in the Tropics* (London: Longman, 1977), on anthrax, see 129–131, on botulism, see 131–133.

[105] Maphiniki B, by Kristin Russell and Megan Waples (Kgomotso Tshetlho and Bhangi Mosala interpreting) 4 November 1997.