

## **‘Nature’s method of grazing’: Non-Selective Grazing (NSG) as a means of veld reclamation in South Africa**

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**Acocks was concerned with the past, present and future state of South Africa’s vegetation and in the 1960’s, together with several farmers in the eastern Karoo, developed a grazing system which he thought would restore the vegetation to its former pristine condition. Acocks felt that the grazing systems advocated by the Department of Agriculture at the time were partly responsible for the degraded vegetation of the region as these systems encouraged livestock to graze selectively, thereby overgrazing the more palatable species in the vegetation. He felt that by forcing animals to graze all species non-selectively, the more palatable elements would be able to out-compete the less palatable species and dominate the vegetation as he believed they once did in pre-colonial times. Acocks found theoretical support for his argument which also relied on relatively long rest periods between grazing events and suggested that this non-selective grazing system simulated the way in which the pre-colonial ungulate herds utilised the vegetation. Although Acocks never conducted the key experiments needed to test his ideas, his approach**

**was supported by several farmers in the eastern Karoo who conducted trials on their farms to test the principles of the method. The approach advocated by Acocks, however, was in direct contrast to that proposed by the Department of Agriculture who were concerned about the comparatively high stocking rates advocated under Acocks’ Non-Selective Grazing (NSG) system. Their own experiment on NSG found that it reduced plant cover and increased erosion and they believed that it would lead to further widespread degradation if implemented. Although Acocks was employed by the Department of Agriculture as a Botanical Survey Officer he was not a Pasture Research Officer and it was this latter group of employees who had the responsibility of researching and advocating appropriate grazing systems for South Africa’s rangelands. Acocks was, therefore, instructed not to promote NSG in his official capacity. Despite this, Acocks’ writing in the last ten years of his life is infused with the ideas of NSG which continue to influence the development of range management systems to the present.**

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### **Introduction**

John Acocks’ universally-acclaimed work on the Veld Types of South Africa was written in 1951 and published in 1953 (Acocks 1953). The breadth of this work, completed in only six years, ensured immediate recognition for its author for the industry and genius it had taken to produce. Acocks, however, was dissatisfied with the final product (see Hoffman and Cowling 2003) and immediately set about revising it with a focus on the more arid western parts of the country. Without the pressure to produce a hastily-prepared report Acocks could return to some of the key themes he had only touched on in the initial publication. One of these — how to restore the veld of South Africa to its former, pre-colonial condition — was to lead, not only to controversy for its author, but also to renewed interest by farmers and researchers in range management theory and practice which continues to the present (Beukes and Cowling 2000, *in press*, Beukes *et al.* 2002).

Throughout ‘Veld Types’ Acocks emphasised three main themes, the past, present and future state of South Africa’s vegetation, and his ideas are clearly summarised in the maps produced in this work (Acocks 1953). His entire career was devoted to a study of these three themes which provide a focus for his published contributions. The changes which he saw, in the many hours he spent walking in the veld, were of deep concern to him. He saw signs everywhere which indicated the full extent of the transformation of the vegetation of South Africa as a result of the farming practices of colonial farmers (Acocks 1979). The loss of palatable, climax species, particularly perennial grasses, was his main concern. He was convinced that grasses formed the heart of a productive landscape and should have been dominant throughout the country were it not for the impact of domestic livestock. Acocks considered the loss of grass cover a national tragedy and emphasised this loss at every opportu-

nity, particularly in his published papers, unpublished correspondence and during his many conversations with individual farmers, farmer study groups and range scientists. It was this that drove him to look for a solution to the problem of veld degradation and by the mid-1960's he was convinced that he had found the answer. He coined the grazing system that he developed, together with several farmers in the region, Non-Selective Grazing, and believed that this approach would restore the vegetation of the country to its former pre-colonial state.

Acocks felt that grazing management was of vital concern for every botanist (Acocks 1967a). He emphasised the role of the Botanical Survey Officer which he said was to collect, name and classify plants, to group them into plant formations or veld types and to map the distributions of each species. This work was impeded, however, by the selective grazing habits of domestic animals which seldom gave species palatable to livestock the chance to flower. He was critical of the contributions made by Pasture Research Officers, the group of scientists within the Department of Agriculture who at the time were charged with the responsibility of developing effective economic grazing management systems for the country. He firmly believed that the grazing practices of farmers and the management systems advocated by the Department of Agriculture were directly responsible for the degradation he saw in the veld. Although he never carried out the necessary experiments to test his method he spent more than ten years, centred on the decade of the 1960's, developing and presenting his arguments against the Department's management systems and in favour of his own approach. Ultimately he was unsuccessful in changing the way in which the majority of farmers managed their land although his ideas persist in various altered forms today and continue to influence range management theory and practice (e.g. Beukes and Cowling 2002, in press, Beukes *et al.* 2002).

In this paper I provide an account of the development of Non-Selective Grazing (NSG) as a grazing system. The principles of NSG, as espoused by Acocks (1966a), are discussed and the controversy which surrounded the publication of the idea is explored.

### **The development of Non-Selective Grazing as a grazing management system**

While the exact number of wild animals which inhabited southern Africa in pre-colonial times will never be known, early traveller's diaries and hunter's records indicate that this number was substantial (Raper and Boucher 1988). For the Karoo, Cronwright-Schreiner's (1925) account suggests that many millions of animals might have aggregated from time to time as part of the extensive springbok 'treks' in the region (see also Skinner 1993, Dean and Milton 2003). The movement of these large herds of animals through an area during these treks, as well as the wide diversity of animals grazing the veld at any one time (McCabe 1987) meant that all plants were periodically utilised and their biomass reduced. In developing his concept of Non-Selective Grazing as a management system it was this episodic, heavy and non-selective utilisation that Acocks was trying to

simulate. To him, therefore, NSG was simply 'nature's method of grazing' (Acocks 1967a).

The vast herds of wild animals disappeared very soon after the arrival of European settlers on the subcontinent who initially emulated the nomadic, transhumance grazing patterns of Khoi herders in the region (Van der Merwe 1937). However, as they settled the landscape, particularly from the late 18<sup>th</sup> century onwards, they introduced an entirely different grazing pattern to the vegetation. Initially colonial farmers stayed close to available water sources such as rivers, fountains and dug wells and animals were corralled at night to avoid predators and thieves. With the arrival of borehole technology and fencing in South Africa from the 1870's (Archer 2000) farmers were at last able to utilise the full extent of the range. Livestock numbers climbed steadily in the first half of the 20<sup>th</sup> century (Hoffman *et al.* 1995) despite warnings of the Drought Investigation Commission (Anonymous 1923) that land degradation in South Africa was the direct result of human impact on the veld. It was against this historical backdrop that the Department of Agriculture initiated grazing trials in 1934 at Pasture Research Stations across the country to develop the most appropriate grazing systems for each vegetation type (Roux and Vorster 1983). Results from the trials advocated the reduction of stock numbers to levels at or below the long-term carrying capacity of the region set by the Department of Agriculture and suggested further that animals should not be allowed to graze continuously on any one patch of vegetation. Two, three, four and five camp systems were thus developed (Figure 1a) which aimed to reduce the impact of livestock on the veld as well as to provide sufficient rest periods for the vegetation to recover (Tidmarsh 1956). These systems were primarily based on the results of key experiments, many of which had been started in 1934.

Acocks was fully aware of the developments on the Pasture Research Stations having started out as a Pasture Research Officer in 1936. His task then was to develop an appropriate grazing system for the farmers in the Griqualand West region who were plagued by an abundance of toxic vermeerbos plants (*Geigeria ornativa*). His findings suggested that the best way to deal with this problem was to institute non-selective grazing through a short, heavy grazing period followed by a long rest period (Acocks 1967a). He was critical of other approaches to grazing management which allowed for long periods of occupation of a paddock by fewer animals. Senior officials within the Department of Agriculture, however, thought little of the work of botanists in this regard as they were 'chasers of rare plants, unpractical people who want to mess about with basic research instead of getting on with finding something that will work' (Acocks 1966b). Between 1936 and 1945, when Acocks was seconded to the Botanical Survey to start his work on the Veld Types of South Africa, he retained an interest in the development of grazing systems and carried out many detailed vegetation surveys on Pasture Research Stations such as Towoomba, Escourt and Dohne. When he left to start his Veld Types work in 1945, Acocks took with him a long-standing interest in grazing systems and picked up on the theme again soon after the publication of the first edition of the Veld Types of South Africa in 1953.



detailed experiments necessary to test the effect of his approach on, for example, animal and plant production, soil properties and erosion but relied instead on whole farm trials for supporting evidence.

### The principles of Non-Selective Grazing

Besides simulating what Acocks felt were the natural grazing patterns of early migratory herds, under which southern African plants and plant communities had developed, he sought additional ecological and physiological support for his approach. At the heart of the matter was his belief (Acocks 1966a) that the conventional two, three, four and five-camp grazing systems, with their relatively long periods of stay and low stocking densities, increased the selectivity of the most palatable species. While there is some doubt that he fully acquainted himself with the details of the grazing systems advocated by the Department of Agriculture at the time, he believed nonetheless that they were more detrimental to plants than rangelands that were grazed continuously by large numbers of domestic livestock. Selective grazing was, he believed, the primary cause of the widespread degradation that he observed in South Africa's rangelands and the approaches advocated by the Department of Agriculture would, in his view, only exacerbate the problem. Even though he never carried out the appropriate experiments, he believed that NSG would eliminate this selectivity and proposed that by stocking heavily for short periods, all species would be grazed equally. This brief, high stocking density period under NSG would, he maintained, eliminate the competitive advantage unpalatable species enjoy under a selective defoliation regime and the recruitment of palatable species would subsequently be enhanced. Acocks' observations on the NSG farms that he visited supported his views.

Acocks (1966a) also found support for NSG in physiological models which described the post-defoliation allocation of stored, non-structural photosynthate (Weinman 1955, Troughton 1957). Acocks adopted the root-reserves theory (see Brown 1985) and used a 'depletion-replacement' model to explain the movement of photosynthate following defoliation. He relied exclusively on the experimental observations of Sullivan and Sprague (1943, 1953) and, based on these data from annual  $C_3$  pasture grasses (no work had as yet been carried out on the more robust  $C_4$  African grasses), Acocks (1966a) suggested that after defoliation, plants draw on soluble carbohydrate root reserves to produce new growth. Furthermore, 21–22 days were needed for this new photosynthetically-active material to produce enough photosynthate to replenish depleted root reserves. Repeated defoliations, however, prior to full replenishment, which occurs under a selective grazing regime, ultimately exhausts the reserves and the plant dies. The periods of occupation and rest are thus crucial to the theoretical considerations of NSG.

Armed with what he believed was a sound theoretical framework Acocks developed four key principles for NSG (Acocks 1967a). Firstly, he suggested that the grazing period should be short enough to prevent the depletion of the root reserves of especially the palatable plants. Secondly,

the period between grazing should be long enough to enable the replenishment of the root reserves of the key, palatable species. Thirdly, the rest period should also be long enough to allow palatable plants to produce seed during the appropriate season. Finally, within practical limits, the stocking density should be high enough so that all plants, including the unpalatable species, are evenly grazed during the short grazing period.

In practical terms Acocks (1967a) provided the following guidelines for each of the four principles (Figure 1b). Evidence from the farms that he visited indicated that the maximum grazing period should not exceed two weeks, while the period between grazing, 'to keep veld vigorous' should be about six weeks. He suggested that eight to 10 weeks was enough time to allow for seeding. He cautiously suggested as a guideline that a stocking rate of one sheep per morgen for every inch of average rainfall would achieve the desired non-selective grazing effect provided that at least 12 paddocks per herd were available. In practice, a paddock would be grazed twice, for two weeks at a time, separated by six weeks and then rested for five months before being grazed again.

For farmers serious about NSG several additional and perhaps impractical guidelines were recommended (Acocks 1966a). Before starting on NSG, a 12 month rest period was advised. In addition, a start with NSG should only commence once good rains had fallen. Also, if there were no climax species remaining in the veld then these should be re-sown at a density of one plant every 2m to 3m. Since NSG forced animals to graze the vegetation non-selectively, supplementary feeding was recommended to maintain animal condition, particularly during the early stages. Advice about burning and the protection of 'soft plants' such as *Portulacaria afra* was also provided in his seminal paper read out to delegates of the first congress of the Grassland Society of South Africa in February 1966 (Acocks 1966a).

### The controversy around Non-Selective Grazing

Although Acocks' 1966a publication is the only peer-reviewed, scientific article he produced on NSG, several unpublished reports and popular articles provide additional insight to the development of his thinking about NSG (see for example, Acocks 1966b, 1966c). Also, his letters to a wide range of correspondents are everywhere infused with his ideas on NSG, particularly during the 1960's. This concern for NSG prompted his line managers within the Botanical Research Institute to remark with despair in 1968 that his annual progress report contained little information on his registered project (a revision of Veld Types) but '...invariably gives most information about non-selective grazing.' His continued belief in the importance and power of NSG as a tool to reclaim the degraded rangelands of South Africa also emerges in all of his subsequent articles, some of which were heavily edited prior to their final publication (e.g. Acocks 1967b, 1976, 1979). In addition to Acocks' considered publications on NSG, however, there was a flood of popular articles by other writers, primarily in the English-language Farmer's Weekly and other popular agricultural journals (e.g. Howell 1966, 1967a–f, McNaughton 1967) and

particularly from 1965 to the end of the decade. The Afrikaans agricultural press was less effusive although a few accounts were published (e.g. Anonymous 1969). Denise Howell, in particular, wrote comprehensively about NSG providing both theoretical and practical details of the system they had helped develop (Howell 1966, 1967a–f). Her contribution to firing the imagination of the farming community should not be underestimated and since she and her husband Len Howell were at the forefront of the development of the system she wrote with authority and conviction about both the positive and negative aspects of NSG. She also maintained a productive and extensive correspondence with the agricultural Director of the Karoo Region, Dr Piet Roux, whose important and scientifically-rigorous contribution to the debate has yet to be properly acknowledged. Correspondence and articles from local farmers, mostly in support of NSG, poured into the *Farmer's Weekly* and other agricultural magazines at this time and the ground swell of support for the idea of NSG was clearly widespread. Acocks himself remained relatively aloof from the sometimes heated debates in the agricultural press, preferring to meet with the occasional farmer study group in the field or correspond with individual farmers over specific problems that they had found with the system.

Acocks could not, however, avoid the attention of the Department of Agriculture since NSG blamed the conventional grazing systems, developed and advocated by the Pasture Research Officers within the Department, directly for the state of the rangelands in South Africa. In the eyes of the Department, however, the widespread practice of NSG was considered dangerous for the future conservation status of the region. The Karoo had just emerged from a period of very high stocking levels between 1920–1940, which had seen much of the area lose plant cover and topsoil. The 1946 Soil Conservation Act sought to restrict the number of animals on the range and the Stock Reduction Scheme introduced in the 1960's (Van der Merwe 1974) also required farmers to reduce stock numbers by a third before they were able to qualify for state subsidy during the drought of the 1960's. Soil conservation planning had taken root across the country and the Department was keen to see it broadened and strengthened. Because of the increased demand for fencing under NSG, officials within the Department of Agriculture were also concerned that the system would threaten the state fencing subsidy scheme. By advocating high stocking rates, in their eyes, NSG had the potential to undo all the efforts that had so painstakingly been put in place during the previous two decades. Most importantly, there was no experimental evidence to support the claims of NSG.

Prompted by several articles which appeared in the popular agricultural press in the early 1960's, the Department of Agriculture requested Acocks to elaborate on his ideas and to substantiate some of his claims concerning NSG. He completed his reply in August 1965 and used this as the basis for his 1966 address to the Grassland Society of South Africa. This article was immediately sent to Pasture Research Officers in the Highveld and Natal Regions for comment. Responses were mixed. While it was suggested that Acocks' ideas were 'nothing new' and had already been advocated

by the Department in the 1930's and 40's, some respondents felt that NSG would result in the eradication of all desirable species. The general consensus, at least from the Natal Region's Pasture Research Officers was that it would be worth testing out in various Veld Types. Over the next few months Acocks drafted a detailed response to each and every query raised by the different regions. In 10 typed pages to Professor Scott at the University of Natal, Pietermaritzburg, for example, Acocks went to great lengths to explain his main principles further and provided extensive practical examples of why he thought his approach was suitable as a grazing system.

Acocks produced several additional articles on the theme of NSG between 1966 and 1967 (Acocks 1966a, 1966b, 1967a, 1967b). Support for the system within the farming community continued to grow and the Department grew increasingly anxious that NSG would scupper their well-developed proposals to enforce conservation in the country. Their own experiments on NSG (Roux 1967) (and the only experimental test of the principles of NSG carried out in South Africa prior to the work of Beukes (1999)) had shown it to be a complete failure which would lead to widespread degradation if advocated and implemented by the Department. In the experimental trial on NSG carried out at Grootfontein plant cover was reduced under the high stocking densities proposed by the NSG system and soil erosion and livestock foot paths were significantly greater in NSG paddocks than in paddocks with lower stocking densities.

The Department of Agriculture was convinced that NSG would be the ruin of South Africa's rangelands and decided to act. In an article published in *Agricultural News* on 28 July 1967 and again in September in *Farming in South Africa* the Department's attitude towards Non-Selective Grazing management and utilisation was spelled out. The article welcomes the debate and based on the results of its own research programmes questions some of the basic principles of NSG. It bemoans the fact that few farmers have any grazing system in place at all and states that it is '...at present unable to make any specific recommendation regarding [NSG]'. It warns, however, that '...to avoid serious damage to the veld, injudicious application of [NSG] must be strictly guarded against.'

Four days before the publication of this article, however, a letter from the Department of Agriculture was sent to Acocks' superiors in Pretoria. In this letter they are told that Acocks '...should refrain from making positive, specific recommendations in advocacy of any particular system or method of grazing management, and he should ensure that he remains within the bounds of the Department's statement in this regard.' He is further instructed to send copies of all his technical correspondence with the public to his line managers who are then asked to send it on to the 'Chief of the particular [agricultural] Region from which the enquiry emanated.'

Although the same brief states that the Department does not wish to '...muzzle any of its officers...' this is effectively what happened. It is not surprising that Acocks did not publish anything else directly on NSG and for the next few years at least his correspondence with individual farmers concerning NSG always ends with the statement that his views are given in his personal capacity and should not be construed

as reflecting those of the Department of Agriculture. He also grew tired of the controversy and except for one final address on NSG to a grazing management conference organised at Grootfontein in November 1967 he never spoke publicly on the theme again. He continued to visit farmer study groups, however, and walked with farmers in the veld sharing his views on the most appropriate systems of grazing. His friendship with several farmers in the region who continued to experiment with NSG also provided an outlet for his ideas and observations.

His revolutionary approach to grazing had also sparked the imagination of several range scientists who began to publish on the theme soon after his 1966 Grassland Society of South Africa address (Booyesen 1969, Roberts 1969). They usually offered Acocks the courtesy of commenting on early drafts of their manuscripts and Acocks usually obliged with direct and scathing criticisms of their interpretations of NSG.

### Non-Selective Grazing today

The shift by the Howells from a standard 12 camp layout to a 16 camp layout from 1966 signalled a shift in their philosophical approach as well. NSG began to be subsumed within the general concept of short duration grazing (SDG) where the emphasis fell on grazing palatable species often to increase production and vigour. Allan Savory's influence on southern African range ecology also started at this time (Savory 1967, 1988) and his wagon wheel layout and fast rotational grazing system captured the imagination of several farmers in the region. Savory (1988) has graciously acknowledged the important influence that Acocks had on the development of his own thinking. With Acocks no longer able to advocate NSG directly and with clear differences of opinion between him and other former advocates of NSG emerging Acocks returned to his prime responsibility — to complete a revision of the Veld Types of South Africa. He felt that he had spent too much time, thought and energy on trying to explain NSG to Pasture Research Officers and farmers and his energy was re-directed again to his life's work. However, Acocks continued to believe that NSG was the key to veld reclamation and expressed these views wherever he could, in published papers, reports and private correspondence. However, Acocks had no interest in stirring up the controversy again while the region was in the grip of one of the longest droughts in living memory. He declined at least two invitations to talk on the theme in the early 1970's preferring to let the vegetation 'talk for itself' once the drought had broken. However, even after the widespread heavy rains which fell across South Africa between 1974–1976 Acocks refused to be drawn on the theme and busied himself instead with completing his revision of Veld Types. NSG, however, continued to influence his writing and many of the core ideas around NSG are expressed in his later publications (Acocks 1971, 1976, 1979, 1990).

After John Acocks' death in 1979, interest in NSG dwindled although a few farmers continued to write about its successes (e.g. McCabe 1987). A comprehensive experimental test of the effect of NSG on ecosystem processes (Beukes and Cowling 2000, in press) and economic viability (Beukes

*et al.* 2002) has recently emerged (see also Burger 2001). Interest in NSG is likely to continue for decades to come and it is hoped that future contributions will be mindful of the important role that John Acocks played in the debate.

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