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‘Enough to be considered useful’: John Acocks’ contribution to South African botany

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John Acocks died in 1979 after working for nearly 50 years as a botanist in South Africa. His scientific contributions have had a profound influence on southern African ecology and this introductory article which includes a biographical sketch of his life, places his contribution in perspective. The 10 articles which appear in this issue have been prepared not only as a tribute to his contribution but also as an assessment of its current utility. Scientific thought is constantly changing and an attempt has been made to indicate where Acocks’ views are still supported by current evidence and where revision is necessary. His contribution lay in three main areas. Firstly, his description of the vegetation (or Veld Types) of South Africa remains a work of considerable importance and will probably never be repeated at the same level of scale, by a single individual, again. Three articles show that when assessed at a smaller scale his Veld Type concept is robust in some, but not all, cases. Differences between Acocks’ views and current treatments of the data are highlighted for the Bankenveld and for the vegetation of the Subtropical Thicket and Nama-karoo biomes. Acocks’ second important influence concerns his views on pre-colonial vegetation and the extent of human impact. He could not have presaged the explosion of palaeoenvironmental techniques which have arisen since his death and which have provided a somewhat different view of pre-colonial environments from the one he articulated, particularly with regard to the influence of fire on grasslands, savannas and forests. Although his views on the expansion of the eastern Karoo are not upheld in the light of recent findings there is good evidence for significant changes in the fauna and flora of the Karoo over the last 300 years. Acocks’ final contribution lay in the field of veld restoration and grazing management where he continues to have an influence on a small sector of the farming and range science community today. Not only has John Acocks provided a rich theoretical framework for scholars to test but he has also left a legacy of well-organised data for future generations. The final two papers in this special issue indicate the utility of his archives which will gain in value over the years. Challenges to Acocks’ views will continue apace and much of what he has written will undoubtedly be revised. This doesn’t detract from his contribution in any way but serves to highlight the importance of the foundation that he created during his lifetime and which we acknowledge in this special issue.

Introduction

The publication, in 1953, of John Acocks’ Veld Types of South Africa (hereafter referred to as Veld Types) was a milestone in the history of South African botany. It reflected the most comprehensive treatment of the region’s rich vegetation and its classification of the country into 75 Veld Types remained the standard reference work for decades after its publication, and is still widely cited. It is considered a classic contribution to the scientific literature (Cowling 1999), an accolade conferred on few other South African publications. The carefully worded reference work, with its brief but fascinating introduction and comprehensive lists of species names, was accompanied by a beautifully coloured 1:1 500 000 scale map which has graced the walls of many university departments and research institutes ever since. Researched and written in only six years, the document ensured lasting esteem for its sole author and honours and awards were heaped upon him, in recognition of this and other contributions, in the last three years of his life (Table 1). Besides an MSc thesis completed nearly 20 years earlier, and several unpublished reports, Veld Types was Acocks’ first serious scientific contribution. He was 42 years old. However, much of what he had done up until then had prepared him for the task of compiling a vegetation map of the region. His botanical work on pasture research stations across the country and his associ-

Table 1: A general chronology of key events in the life of John Acocks. A more detailed biography may be found in Killick (1980)

Date	Event
7 April 1911	John Phillip Harison Acocks born in Cape Town to John Martin Acocks and Sarah Phoebe (neé Petty)
1928	Matriculated from the South African College Schools (SACS)
1929–1932	Undergraduate at the University of Cape Town (UCT) majoring in Botany, Physics, Chemistry and Latin
1933	Graduated with MSc degree from UCT, entitled 'Vegetation of a portion of the Cape Flats and a list of plants so far found there'
1934–1935	Started, but never completed, a PhD on the effect of burning, resting, clearing and cultivation of mountain fynbos on the Cape Peninsula
1936	Joined the Department of Agriculture, Division of Plant Industry in Pretoria as a Pasture Research Officer. Stationed (until Jan 1939) at the McGregor Museum in Kimberley and tasked with the investigation of the vermeerbos (*Geigaria ornativa*) livestock poisoning problem. Surveyed many farms in the Upper Karoo, Kalahari Thornveld, Bushveld and Grassveld areas
1938	Seconded for four months to Swedish plant collector, Adolf Hafstrom and travelled from Cape Town to Victoria Falls and back. Joint collection amounted to 2 340 specimens
1939	Stationed in Pretoria and involved in the establishment of Rietvlei Pasture Research Station
1940–1942	Transferred to Towoomba Pasture Research Station (Limpopo Province) and worked with Louis Irvine to establish grazing effects on natural vegetation. Assisted Professor JM Hector with an update of his vegetation map of South Africa. This work was never completed but formed the basis for Acocks' Veld Types of South Africa
1942	Transferred to Dohne Research Station near Stutterheim, Eastern Cape Province and continued with pasture research and veld survey
1943–1944	Transferred to Escourt Pasture Research Station, KwaZulu-Natal and married Ellaline Mai Moody (neé Smith), on 11 September 1943
1945	Stayed on at Escourt but transferred to the Division of Botany and Plant Pathology, later to become the Botanical Research Institute (now the National Botanical Institute) with the task of compiling a vegetation map of the country
1948–1949	Participated in the work of the Desert Invasion Committee and contributed, together with Charles Tidmarsh, to the drafting of a minority report
1948	Transferred from Escourt to Middelburg, Eastern Cape Province, where Acocks worked at the Grootfontein College of Agriculture until his retirement in 1976
1952	First published work (Acocks 1952) appears as part of the proceedings of the Southern African Grass Conference held under the auspices of the National Veld Trust in collaboration with the Union Department of Agriculture
1953	The Veld Types of South Africa (Acocks 1953) published to critical acclaim
1954–1979	Acocks continued with his revision of the Veld Types of South Africa. Although never published, a revised manuscript for the arid western parts of the country does exist
1964	Publication of Acocks' work on the impact of agriculture on the arid and semi-arid areas of South Africa (Acocks 1964)
1966	First conference of the Grassland Society of South Africa at which Acocks presented (and published) his ideas on non selective grazing (Acocks 1966a)
1966	Published his paper entitled 'Agriculture in relation to a changing vegetation' in the South African Journal of Science (Acocks 1966b)
1967	A synthesis of his Veld Types memoir published (Acocks 1967)
1970	Key grasses of South Africa written. Published posthumously (Acocks 1990)
1971	Published a paper on the distribution of certain grasses that was presented at the AETFAT Congress in Munich in 1970 (Acocks 1971)
1975	Awarded a Gold Medal by the Fertilizer Society of South Africa for his outstanding contributions to Agriculture. Revised edition of Veld Types published with photographs (Acocks 1975)
1976	Retired from Department of Agricultural Technical Services; re-employed a week later to complete his revision of Veld Types. Soon after retiring, however, Acocks suffered a heart attack which effectively prevented further field work. Awarded medal of the Wildlife Society of Southern Africa for notable contributions to conservation and the South African Medal for Botany awarded by the South African Association of Botanists. Also received the Senior Captain Scott Memorial Medal from the South African Biological Society for outstanding scientific research. Made an honorary member of the Grassland Society of Southern Africa and honorary life member of the South African Association for the Advancement of Science. Published an article on the riverine vegetation of South Africa and how it has been affected by centuries of heavy grazing (Acocks 1976)
1977	Volume 43 (1) of the Journal of South African Botany dedicated to the contribution that John Acocks had made to South African botany. Receipt of award from the South African Institute of Forestry
20 May 1979	Acocks died of heart attack in his Middelburg home a few weeks after the completion of his revised Veld Types for the western part of South Africa
1979	Acocks' 'Flora that matched the fauna' paper published posthumously (Acocks 1979)
1981	Commemorative plaque to Acocks was mounted on a boulder on the slopes of Compassberg, near Middelburg, by his friends and family. John Acocks Veld Association (JAVA) launched by his friends
1988	Third printing of Acocks' Veld Types of South Africa (Acocks 1988)
1990	Publication of Acocks' manuscript entitled 'The Key Grasses of South Africa' by the Grassland Society of South Africa (Acocks 1990)
1997	Vegetation of Southern Africa, published by Cambridge University Press (Cowling *et al.* 1997), is dedicated to the memory of Acocks '...whose seminal work, Veld Types of South Africa, inspired two generations of southern African plant ecologists'
1999	Publication of tribute to Acocks in the international literature (Cowling 1999)
2003	Publication of a Special Issue of South African Journal of Botany dedicated to John Acocks' contribution to South African botany

ation with esteemed range scientists, had given him a good grounding, not only in the diversity of the South African flora, but also in an understanding of the impact of livestock grazing on plant composition. In fact, it is this cross-disciplinary aspect of his preparatory work, which blends both botanical survey approaches with range management science, that provided the foundation for much of what he wrote in the remaining quarter of a century.

Acocks' published scientific output was small by today's frantic standard, yet the handful of papers he did publish continue to influence our thinking along three main lines. These concern the past, present and future vegetation states of the country (Cowling 1999). In this special issue, dedicated to the contribution made by John Acocks to the study of botany in South Africa, we have invited contributions from authors who have addressed one or more of these three aspects. In an attempt to deepen our understanding of his contributions and to place them in a more current context, authors were asked to be critical of his work. Hagiography has little place in scientific thought and a rigorous analysis of Acocks contribution is long overdue. Many of his ideas were never fully developed (e.g. the inter-relationships of the veld types) and some addressed subject material that had only begun to be investigated by other scientists (e.g. palaeobotany). It should be remembered that although Acocks corresponded widely, he worked largely alone. He was not associated directly with any university department and did not interact with or train postgraduate students, those great demolishers of unstable ideas. He developed many of his hypotheses through long hours spent in his beloved veld and in conversation with practical people — farmers and pasture scientists. He was undoubtedly influenced by the training he received in the early 1930's at the University of Cape Town in plant ecology — steeped in the Clementsian paradigm — and plant geography, under the tutelage of RS Adamson and Margaret Levyns, respectively. This collection of papers attempts to place his contribution in a more critical framework than has been the case to date. Some of Acocks' ideas have endured but others have collapsed under the weight of new evidence. Notwithstanding this, John Acocks has influenced profoundly two generations of South African plant ecologists and range scientists.

Veld Types Today

Acocks' (1953) Veld Types was arguably his greatest contribution to South African botany. While it was widely acclaimed and used, Acocks was not especially satisfied with his product, which he felt pressured to complete. In a letter to a colleague in March 1954 he called his memoir '…a half-baked washout and a disgrace to the Division that was inept enough to hustle me into writing it before my data were complete enough even for a preliminary paper.' He spent much of the rest of his life revising this work. Although finished a few weeks before his death in 1979 and never published, a manuscript exists in his archives at the National Botanical Institute, which details his revision for the arid and semi-arid western part of the country (see Rutherford *et al*. 2003a).

Acocks' (1953) veld type concept, described as an agro-ecological unit of vegetation '...whose range of variation is small enough to permit the whole of it to have the same farming potentialities', has attracted surprisingly little criticism since its publication. Martin and Noel (1960) were the first to point out that the criteria for distinguishing veld types were never fully defined and often incorporated vague and untested statements on history, utilisation and Clementsian dynamics, a criticism echoed years later by Cowling (1984). This latter paper also identified problems with Acocks' hierarchy where vegetation types of widely different phytogeographical affinities were placed in the same higher order units, e.g. Knysna Forest with Coastal Tropical Forest Type and Valley Bushveld (subtropical thicket) with Karroid Types. Perhaps the greatest puzzle was the placing of False Fynbos (Macchia) and Fynbos in different units owing to the formers presumed derivation from mountain grassland, thicket and forest. Acocks' (1953) view that contemporary vegetation patterns and dynamics over much of western South Africa were underpinned by the anthropogenic demise of 'climax' grasslands and forests of tropical origin, and their subsequent replacement by shrublands of karroid and fynbos affinity, confused a generation of range managers and plant ecologists. In defence of his views, it must be borne in mind that the major phytochorological (Werger 1978) and biome (Rutherford and Westfall 1986) units of southern Africa, which have provided broad-scale biogeographical and ecological contexts for plant ecological research from the 1980's, only became available after Acocks' death.

This issue includes three papers that re-evaluate the veld type concept, each using a different approach. Bredenkamp and Brown (2003) use detailed phytosociological data to evaluate Acocks' Bankenveld, a mosaic of sour grassveld and savanna with pockets of temperate forest, found along the northern rim of the Highveld. Acocks classified Bankenveld as a False Grassland Type, assuming that the grassland component was derived, as a consequence of frequent fires, from an original savanna state. Bredenkamp and Brown (2003) show convincingly that most of the finer-scale patterns within this veld type are associated in a predictable way with underlying habitat variation rather than anthropogenic impacts. They also stress the phytochorological complexity of Bankenveld and demonstrate floristic links to the Afromontane, Sudano-Zambezian and Kalahari-Highveld phytochoria (Werger 1978).

Rutherford *et al.* (2003a) use ACKDAT, a computerised data base comprising Acocks' plant inventories sampled for his Veld Types research (see below and Rutherford *et al.* (2003b), to re-evaluate veld types in the Nama-karoo biome. Their multivariate analyses provide good support for many of Acocks' Veld Types and their subdivisions, but do not uphold his typology in the phytochorologically and ecologically complex south-eastern parts of the biome. They also demonstrate the transitional nature of the False Karoo types, suggesting that physiographic rather than anthropogenic factors may be responsible for their composition.

Vlok *et al.* (2003) use intuitive, expert-based techniques — rather similar to those used by Acocks — to map and describe vegetation loosely associated with Acocks' (1953) Valley Bushveld and related types in the southern and south-eastern parts of South Africa. Owing to its peculiar

composition, unusual structure and elusive dynamics, the origin and affinity of Valley Bushveld (now known as Subtropical Thicket) has long intrigued South African plant ecologists. Vlok *et al.* (2003) greatly expande the subtropical thicket concept relative to Acocks' (1953) Valley Bushveld, Spekboomveld and Noorsveld, by including in it mosaics of thicket and other vegetation types. They also provide interesting insights on the origin, affinities and dynamics of subtropical thicket but conclude that much more research is required to understand this complex and fascinating vegetation.

Has Acocks' Veld Types withstood the test of time? Yes and no. His remarkable map, not unlike the world's first geology map produced in 1815 by William Smith, another headstrong maverick (Winchester 2001), has had a profound effect on its parent science. And like Smith's map, and all other great advances in science, pattern was linked, via theory, to process. That some of the hypothesised processes were wrong, is beyond doubt. Acocks was a product of his time, constrained by paradigms (such as the Clementsian one) and knowledge. However, it is nonetheless remarkable that at scale of 1:100 000 or more, his vegetation map is little different to those produced today.

Vegetation Transformation

Acocks was acutely aware that much of South Africa's vegetation had been significantly transformed by several centuries of agricultural and pastoral impacts. He developed a spatially explicit model — a map — of vegetation in a 'pristine' state at AD 1400 assuming, and consistent with the historical mythology of the day, that this period predated the migration into the region of Bantu-speaking people. He did not believe that hunter-gatherers or pastoralists had a significant impact on southern African environments (but see Sampson (1986) and Deacon *et al*. (1992)) and of course had no idea of the timing of their occupation of the sub-continent. At this time there were no palaeodata and only a scattering of archaeological evidence to influence his theories. He was influenced profoundly — as were most of his peers — by the Clementsian concept of deterministic succession and climax (Cowling 1999) and interpreted his observations in relation to the 'potential vegetation' of climax state that could be supported in any particular area largely by the prevailing climatic and temperature regimes. He was convinced firstly, that grass cover had been lost from most veld types and secondly, that this loss was greatest in the eastern Karoo which was expanding in a north easterly direction towards the grasslands of the highveld plateau.

Meadows (2003) reviews the debate on this theme and indicates that while Acocks' views of the eastern Karoo galvanised the state into action, through the development of subsidy schemes, conservation planning and an improved agricultural extension service, the continued focus on this region as South Africa's desertified heartland, is misplaced. Meadows (2003) reviews the recent literature which suggests that other areas of the country (e.g. many of the communally-managed former homeland areas) are more deserving of this focus. In defence of Acocks, however, this may not have been the case at the time when he was active; there is little doubt that the eastern Karoo has endured considerable degradation in the past. It must be further pointed out that these interventions by the state in the eastern Karoo have yielded massive benefits: veld condition has improved almost everywhere (e.g. Hoffman and Cowling 1990), saving the country undocumented millions of rands in the restoration of ecosystem services, especially soil retention and increased livestock production.

Although there are indications of what a pre-colonial South African landscape might have looked like in Acocks' AD 1400 map (Acocks 1953), he developed a more comprehensive analysis only towards the end of his career in a paper that was published shortly after his death (Acocks 1979). Many towns and farms in South Africa are named after indigenous plant and animal species that were observed in their vicinity. Using the place names that appeared on 1:500 000 topographical maps published in the 1940's, Acocks compiled a list of species derived from these place names and used these data to infer past vegetation states. This reconstruction of precolonial vegetation states is repeated in this issue by Dean and Milton (2003) using a similar approach. Their analysis supports Acocks' central hypothesis that the arid western part of South Africa has been transformed to such an extent that it is today unlikely to be able to support the teeming herds of large grazing mammals that once roamed there.

The science of palaeoenvironmental reconstruction has moved at a lightning pace over the last few decades and Acocks could not have imagined the diverse techniques and array of approaches used to investigate the past. The distinction between C_3 and C_4 photosynthetic pathways and the palaeo-signal that these different types have left in soil organics was unheard of when Acocks formulated his hypotheses on vegetation change, nor was the world aware of the likely impacts on vegetation change of increasing CO_2 levels in the then clear South African skies. While Acocks clearly acknowledged the role of fire in determining the composition and boundaries of certain veld types (Acocks 1953, 1979), he viewed this primarily as an anthropogenic influence. The possible influence of low CO_2 on fire regimes and hence C_4 grass development, as advocated by Bond *et al.* (2003), was way beyond his ken. Bond and colleagues suggest that Acocks' pre-colonial vegetation reconstruction is likely to be substantially revised as our knowledge of Quaternary environments improves. In particular, his suggestion that much of the eastern part of the country would have supported dense forest vegetation before agricultural activity in southern Africa might not be the case. There is evidence that fire-determined grassland ecosystems developed long before modern humans arrived in southern Africa and the palaeo-record further supports the idea of a generally tree-less southern African landscape before agricultural settlement (Bond *et al.* 2003).

Restoring South Africa

Acocks was distressed by the transformation that he saw in South African vegetation as a result of pastoral abuse. In the 1960's, in particular, he was concerned with developing a grazing system that he believed would restore the vegeta-

tion to its former 'pristine' state, one dominated by climax grasses and palatable shrubs (Acocks 1966a). He argued most persuasively that simulating at the farm scale the grazing patterns of the vast pre-colonial migratory herds would increase the cover of palatable plants, stabilise the soil and boost animal production — a real 'win-win' situation. He teamed up with several farmers in the region and developed the theoretical and practical grounds for his approach. Called non-selective grazing (NSG) his system was ultimately to lead to conflict with officials from the Department of Agriculture since it was at variance with their approach to restoration. Hoffman (2003) points out that Acocks never carried out the experiments needed to test his claims, and relied instead on whole-farm trials and observation. Some of his colleagues in the Department of Agriculture, however, did carry out the experiments and discovered that NSG increased rather than decreased the deleterious impacts of livestock on the veld. Acocks was silenced by his seniors, and wrote little directly on the theme again although his views on veld restoration are evident in subsequent publications (Acocks 1971, 1976, 1979). Hoffman (2003) exposes this rangeland management debate, which continues to the present.

ACKDAT: A Valuable Tool for Monitoring and Analysis

One of Acocks' most significant contributions to South African botany is his meticulously archived data records, including field note books, plant distribution maps, photographs and unpublished correspondence. Researchers in the National Botanical Institute (NBI) have recognised this asset and have spent the last decade sorting through his archival material and compiling data sets that can be used for further analyses. Acocks' knowledge of the hugely diverse southern African flora was (and is) without parallel. The computerised database of Acocks' plant distribution data contained in his field note books, prepared by NBI staff, is now available as ACKDAT. Rutherford *et al*. (2003b) provide a description of this database and O'Connor *et al.* (2003) provide an application. While both contributions suggest that Acocks' abundance scores and unbounded and inexplicitly located plots are problematic, the value of the floristic data and site photographs for monitoring the impacts of land use and climate change is unquestioned. O'Connor *et al.*'s (2003) unequivocal demonstration of the extensive transformation of KwaZulu-Natal's grasslands through afforestation, cultivation and heavy grazing pressure of sites that Acocks sampled in the 1940's, provides a comprehensive account of how Acocks' data can be used to good effect.

Concluding Remarks

What is missing from the pages of this special issue is a fuller picture of John Acocks in the context of his family, friends and colleagues. Even though he lived an isolated existence in a small Karoo town for the last 30 years of his life, he had strong views on most subjects dealing with South African vegetation. He was frequently away from home and the support he received for his work from his wife, Ellaline, is an important reason for his success as a botanist. Personal tragedies, such as the loss of his young daughter, Jean, soon after he moved to Middelburg in 1948 and his conflict with his superiors over several intellectual and political issues have also been kept out of the pages of this special issue. One of us (MTH) is preparing a comprehensive account of his life in which some of these more personal aspects will be raised. They in no way detract from his contribution. On the contrary they add detail and meaning to a life that was above all intensely passionate about the diverse flora and vegetation of South Africa and which has left an enduring legacy.

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