Aloes in the Eastern Cape of South Africa: the value of natural history observations in biological sciences

Sir,—In a recent article in this journal, Parker and Bernard[1] pose some noteworthy questions concerning observations on the real and assumed impact of elephant-induced changes on the population structure of *Aloe ferox* Mill. in the Thicket Biome in the Eastern Cape province of South Africa. They also provide some thought-provoking comments on the long-term impact of elephant populations on the vegetation and flora of this biome in which the world-renowned Addo Elephant National Park is located. Over the past several years, elephant management in general has been high profile given the destructive influence that these large, generalist herbivores can have on their habitat. Their consequences for especially vegetation and selected plant species are of concern for the management of both established and recently proclaimed conservation areas, as well as beyond. Perhaps most significantly, Parker and Bernard[1] highlight the importance of a neglected and under-valued source of information—accurate and perceptive observations by naturalists, which can and should supplement other forms of environmental or scientific endeavour, notably experimental investigations.

Natural history observations have regionally been documented as ethnographic depictions (rock engravings and paintings), written accounts by European colonists during the past 500 years,[2] or as photographs and line drawings. We wish to highlight the great value of using a combination of these accounts, arguing that such observations can provide information that can be invaluable in several other types of investigation and that it requires more attention in holistic environmental studies, as demonstrated by Parker and Bernard.[1]

The lack of detail in written records from the 18th and 19th centuries has limited our understanding of what vegetation elements of the Eastern Cape (as in the present-day Thicket Biome) then looked like, so we consider that observations by artists such as Thomas Baines also provide us with much quantitative and qualitative information. By examining the accuracy of illustrations by Baines, we conclude that at least the botanical elements are properly represented.

The principal question posed by Parker and Bernard[1] was whether there is a need to be concerned about the loss of plant species, or size classes of such taxa, in the Thicket Biome in the Eastern Cape, as a result of elephant browsing. Let us briefly review what other observations, apart from the disappearance of *Aloe ferox* from accessible parts of conservation areas, could inform conservation decisions.

Aloes in the Eastern Cape

Aloe ferox is a tree-like, usually single-stemmed succulent with a stem up to 3 m tall that is topped by a rosette of large, boat-shaped, succulent leaves. It is one of five species of aloe that occur in the Eastern Cape that has this architecture, the others being *A. pluridens* Haw., *A. speciosa* Baker, *A. africana* Mill. and *A. lineata* (Aiton) Haw. var. *lineata*.[3] Three of these (*A. ferox, A. africana* and *A. speciosa*) do not habitually form plantlets along their stems. The significance of this is that once the growing tip of these plants is destroyed or severely damaged—for example by browsing elephants—they tend to be unable or very reluctant to sprout, and they do not produce plantlets that will root where they fall once stripped from the stem. But these are not the only alooids found in the Eastern Cape. The genus *Gasteria* Duval, a spineless close relative of *Aloe,* also occurs in the province's thickets in significant numbers. In fact, the Eastern Cape is today a centre of species diversity for the genus.[4] With the exception of one or two cliff-dwelling gasterias, such as *G. rawlinsonii* Oberm., representatives of the genus can all be grown from leaf cuttings. They will even sprout perfectly formed plantlets from very small pieces of severed leaves, such vegetative proliferation being an adaptation to browsing. The impact of elephants and other herbivores on these species is therefore negligible, if not beneficial. Gasterias, which rarely exceed knee-height, have spotted leaves that cryptically merge with the mottled shade of surrounding plants. Do elephants even see them? Whereas *Aloe ferox* is evidently a food source for elephants,[1] the consumption of gasterias by these herbivores has apparently not been documented, despite the absence of the 'bitter aloe' principle, aloin.[5] Trampling by animals, though, will be beneficial to their multiplication.

If we briefly look beyond the Thicket Biome, other aloes, notably *Aloe davyana* Schönland, a spotted miniature aloe from South Africa's highveld grasslands and savannas, is commonly known as *bankrot-aalwyn* (bankrupt aloe) or *oorbeweidings-aalwyn* (overgrazing aloe) in Afrikaans, which refers to the fact that this species tends to increase considerably in poorly managed natural pastures grazed by domestic stock. In the Faan Meintjies Nature Reserve near Klerksdorp in the North West province, however, this species is heavily utilized by grazing and browsing wild herbivores, particularly antelope, and virtually absent from the veld present in the reserve, whereas it increased markedly in the adjacent private farmland where cattle were the near-exclusive grazers. This small aloe species (amongst other plants) has become an indicator of farming practices and the quality of land management methods.[6–9]

Enter man

Parker and Bernard[1] focus on the impacts of fluctuating elephant numbers on vegetation, a relatively recent phenomenon essentially driven by anthropogenic actions. As with any broad-scale ecological research in sub-Saharan Africa, the key role that humans play in the shaping of the continent's vegetation, flora and fauna, not only in modern times, but over many past millennia, should not be underestimated—man, after all, evolved mainly in Africa.[10]

Moreover, fire is an important natural factor in Africa. Many vegetation types are fire-dependent for their proper functioning and maintenance. In addition to lightning fires, man must have increased fire frequency through his controlled use of fire for well over a million years.[11] Stands of even-aged trees in especially the savanna regions of southern Africa may not only result from fluctuations in animal numbers and extreme climatic events (as Parker and Bernard[1] speculate), but also the impact of fire. Indeed, it is well known that our savanna regions are mainly resprouting systems with relatively little regeneration from seed in the case of trees.[12] As far as aloes are concerned, localized dense stands of *Aloe marlothii* A.Berger, a tall species similar in habit to *A. ferox,* are frequently encountered throughout its range in the savanna regions of the subcontinent. Observations suggest that at least some of these stands, especially those that contain many old, more or less even-aged individuals, occur on Iron Age archaeological sites. Seeds were brought to villages with aloe material used for a variety of traditional purposes and it is believed that large-scale establishment of *A. marlothii* took place once these sites were abandoned.[13]

One of the most important results in which natural history observations can make an impact is in research on conservation biology, as pointed out by Parker

and Bernard.[1] A classic example from the Eastern Cape is the record of *Aloe bowiea* Schult. & J.H.Schult., arguably the most threatened of all the aloe species indigenous to South Africa. Nothing more than accurate observations by naturalists were (and are) required to show that it is hovering on the brink of extinction in the wild.[14–18]

Declining numbers of naturalists, taxonomists and publication outlets

Effective scientific observations, especially when dealing with holistic ecological patterns and processes, require a good academic background.[19] But there is a great concern—natural historians, or naturalists with creative minds and a broad scientific knowledge, are on the decrease in this country and elsewhere. The numbers of these, both professional and amateur, have been declining over the last 30 years (see ref. 20 for sources on this issue). This outcome is linked to the crisis in taxonomy, a science that many universities no longer include in their courses. Today, taxonomy has little appeal to students, it seems. Jobs for professional taxonomists are scarce and the science itself does not appear to have the glamour that is associated with molecular biology or ecology nor does it attract the research funding these other sciences do. Furthermore, it has been claimed that the typical taxonomist is proverbially uncommunicative and secretive, doing his/her best to avoid other people by hiding in old-fashioned and gloomy herbaria and natural history museums. Few taxonomists have the capacity to raise interest in students and entice them to pursue a career as their successors.

This disturbing trend is fuelled by subject specialization and the reductionistic approach, which has become so prevalent in many branches of biology. Today there is also a tendency for sound observations and in particular the observational-comparative method to be overlooked in favour of experimentation. Yet, observations in biology have probably produced more insights than all experiments combined.[21] Although mere observations by themselves are not sufficient, a comparative and synthetic approach inevitably gives rise to questions. By asking questions, tentative hypotheses are established which can then be tested by experiments or further observations. This sequence of events—observations, questions, hypotheses, testing to confirm or refute—forms the basis of the hypothetico-deductive method, the foundation of scientific discovery.[21] It is nevertheless also a reality that in biology (and in particular ecology and biogeography) many causal factors, of variable importance, often makes it difficult, if not impossible, to determine the cause of a given distribution pattern or biological phenomenon.[22]

The decline in the numbers of natural historians is accompanied by growing impediments to publishing their field observations. This is due to both the small number of periodicals serving the discipline, and current concerns with readership ratings that make editors think about the possible citation rating for a submitted paper instead of its contribution to advancing knowledge or its usefulness to other researchers. Some decades ago it was possible to publish papers which simply contributed to greater knowledge of a particular taxonomic group, with observations on its area of distribution, for example—today that is almost impossible. A point has been reached where even a journal specializing in taxonomy has been known to reject papers describing species new to science because molecular analyses had not been performed. Of course, it can be argued that nowadays it is easier to disseminate information through the internet, if not in print journals. But researchers are often in precarious job positions and are evaluated by their publication record in highly rated journals, and not by the information they disseminate via the internet. Unlike taxonomists of previous generations, they often can no longer concentrate on sharing their knowledge in the simplest way, by using their institutions' journals. All this contributes to the decline in both numbers of naturalists and documented observations.

Finally, it is important to include natural history observations in studies concerned with the impact of herbivores on vegetation structure; such endeavours should be encouraged. All possible forms of information regarding the natural vegetation of an area before large-scale human influences, such as from hunting, modern agricultural practices and urban development, should be incorporated. This is the best way to establish if changes caused by the reintroduction of megaherbivores into an area are detrimental to the habitat and biodiversity or if the changes represent a reversion to a vegetation structure that existed before human interference.

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