NMMU GEORGE CAMPUS

FORAGE TOLERANCE AND MANAGEMENT IMPLICATIONS OF THE AFRICAN ELEPHANT *(Loxodonta africana)* WITHIN NATURE RESERVES

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1. INTRODUCTION

This report investigates the ecology and status of the African Elephant *(Loxodonta africana).* By studying the physiology of these animals, its adaptations to tolerating low quality forage can be discerned. The report further studies the implications that come into play when managing the elephant within national reserves.

The African Elephant is the largest land mammal on earth, and is a charismatic animal that attracts many tourists to Africa to witness them in their natural habitat (Stuart, 2001; Knight *et al.* 2002). The elephant has adapted to the African habitat in many ways. For example, they use their ears as a cooling system to maintain their body temperature. The elephants ear flaps are enriched with shallow veins that dilate in hot weather and in turn release heat from the body as the ears are flapped or shaken (Carnaby, 2006).

The largest elephant populations are limited to the eastern parts of Southern Africa because of mass hunting in the 1980's for the tusks of the animals. This changed in 1989, when the Convention of International Trade in Endangered Species (CITES), banned the trade of ivory. Since then the elephant populations have slowly increased, and in an effort to control population numbers, the elephants were concentrated into national reserves. With this new approach, new management implications arose and today we face an "elephant problem" in many parts of Africa.

Following this introduction, the status and ecology of elephants in Southern Africa is discussed briefly. Thereafter, a short explanation of the digestive physiology of the African elephant is given. This explains why the elephant is a key stone species, and why it has the potential to change vegetation types within an ecosystem.

This report was written using various forms of literature to better understand, not only the physical attribute of an elephant but more so the management of this mammal and the implications there of.

2. STATUS AND ECOLOGY OF THE AFRICAN ELEPHANT

Southern Africa is home to the largest populations of the African elephant (*Loxodonta africana*) and is one of the biggest attractions for tourism in South Africa (Knight *et al.* 2002; Blanc *et al.* 2007). During the 1980's, however, almost half of the elephant populations within Southern Africa were hunted and killed due to the high demand for ivory (Conservation Ecology Research Unit, 2012). CITES then listed the

elephants on Appendix 1 of the convention in 1989 to ban the international trade in ivory (Conservation Ecology Research Unit, 2012). The elephant populations have since then been increasing (Blanc *et al.* 2007).

The African elephant is the largest land mammal on earth and is characterized by a dark grey color, long trunk, large ears and the presence of tusks (Stuart, 2001). They are well adapted to handle very high temperatures and are often observed near water or under shade during warmer days (Carnaby, 2006). Elephants have no sweat glands, which aids in prevention of water loss, however, they will seldom travel far from water sites (Carnaby, 2006

The status of the African elephant is changing yearly. They are now only found in parts of north, south and eastern areas of southern Africa (Stuart, 2001; Blanc *et al.* 2007). There are currently approximately 550 000 elephants in Africa, all of which occur in nature reserves. The Kruger National Park currently has the largest population in South Africa with approximately 12 000 elephants (Blanc *et al.* 2007). Recent studies show that more areas where elephants were driven to extinction (and have been unpopulated by elephants since the 1980's) have been repopulated by translocation to reserves such as Kwandwe and Shamwari (Sholto-Douglas, 2002; O'Brien, 2002).

3. ELEPHANT MANAGEMENT IN SOUTHERN AFRICA

In the following section, I discuss the elephant's physiology focusing on their tolerance of low quality foods. Following this, I discuss the management implications of elephants in National Reserves.

3.1 Forage tolerance of Elephants in relation to size and physiology

The African elephant is a mega herbivorous mammal. This means they require large amounts of foods daily in order to sustain themselves (Carruthers *et al.* 2008). A herbivore is an animal that feeds on plants, whether it is the reproductive parts of the plant (seeds and fruits) or the structural parts of the plant such as the stems, roots, and leaves. The African Elephant primarily feeds on the latter. This means it needs to find a way to break down the cellulose and lignin that form part of these structures (Sukumar, 2003). Cellulose is a complex carbohydrate that forms the cell wall of plant cells. In order for an herbivore to utilize the content of plant matter successfully, it needs to break down these cell walls (Bell, 1971). This is done using microbes that

possess the necessary enzymes required to break down cellulose (Bell, 1971). These microbes digest the ingested material and then die, allowing the herbivore to assimilate the nutrient enriched microbes (Sukumar, 2003).

Herbivores can be divided into two types of feeders: The ruminant, where the site for microbial digestion is within the stomach or rumen, and a non-ruminant, where digestion is achieved in the cecum or colon (Sukumar, 2003). As a non-ruminant, the elephant has no "rumen" to allow for the extended fermentation period that ruminants possess. However, studies have shown that concentrations of volatile fatty acids (which are the result of polysaccharide breakdown) in the elephants cecum or colon was at a similar concentration as that of a ruminant (Clemens & Maloiy, 1982, as cited in Sukumar, 2003, p. 209). In spite of this, Bell (1971), explains that the non-ruminant lacks the fermentation time found in ruminants, giving the elephant less time to assimilate the foods properly. This means that the elephant is an efficient feeder, but as they only digest 60 - 70 percent of the material, they consume; they are still less efficient than a ruminant (Conservation Ecology Research Unit, 2012). We can therefore distinguish a non- ruminant as being a more tolerant feeder, where as the ruminant is a more selective feeder (Bell, 1971).

Bell (1971) explains that the elephant has a high tolerance for low quality forage because of its size. The larger the animal, the slower the metabolic rate, and as a result, the less energy is required per day (Bell, 1971). As a non-ruminant, the elephant will feed on larger amounts of forage (tolerating a lower quality) and as their metabolic rate is slower than a smaller herbivore, the elephants lack in their digestive systems efficiency can still be sustained, provided there is sufficient forage to consume (Bell, 1971; Sukumar, 2003).

3.2 Management implications for elephants on National Reserves

The elephant as a non-ruminant is a major determinant for management methods on national reserves (Sukumar, 2003; De Boer, 2012). These animals are capable of changing whole habitats as a consequence of their feeding habits (Sukumar, 2003). These habits include debarking or pushing over large trees (Scholes, 2007) and changing the Height of vegetation (Lessing, 2007). Although the construction of fences to keep elephants within reserve boundaries has its advantages (tourism and poaching prevention), this safety and insurance has lead to limitations on natural distribution of elephant populations (Conservation Ecology Research Unit, 2012). Furthermore, these reserves accommodate the animals by ensuring ample quantities

of water, which reduces natural die-offs during dry seasons (Sukumar, 2003). The Conservation Ecology Research Unit (2012) stated that these manmade conditions could be the cause of the problems that are arising from elephants today.

Hoare (2001) discusses how one would assume that an increase in the number of elephants would mean an increase in problems. However, he discourages this belief by using Barnes *et al.* (1995), who mention that one can argue this only if there is certainty in the fact that elephants causing any problems are density dependent. Studies have shown that individual elephants, as opposed to entire troops, are the cause of problems within agricultural and private properties (Hoare, 2001).

This report focuses on the implications that can arise from management on national reserves within South Africa, where all known elephants are contained by reserves to prevent the movement of populations (Blanc *et al.* 2007). Most of the larger populations of elephants are limited to the eastern part of Southern Africa, of which Kruger National park and Addo Elephant National Park are home to the largest populations (Knight *et al.* 2002). The impact of elephants on a reserve depends more on the habitat of the area, including the vegetation types, climate, soils types and other herbivores within the same area (Lessing, 2007).

The greatest concerns regarding elephant management and the implications thereof include the impact they have on the appearance and ecological functioning of the landscape, the potential impact on other plant and animal species, and the livelihood and safety of people near elephant populations (Scholes, 2007). The following text discusses six implications that come with the management of elephants in national reserves.

The erecting of fences will be discussed first. Fences are a very effective way to control the distribution of elephants in a given area, and although it aids in the protection of the species from ivory poachers, it still brings forth implications. By fencing in elephants, one is faced with a lack of dispersal of elephant populations (Conservation Ecology Research Unit, 2012). Elephants then move over the same land more frequently, resulting in more damage to the vegetation of the area. More so, the construction of electrified fencing and the maintenance thereof can be very costly and time consuming (Scholes, 2007).

Artificial watering holes also have an effect on the elephants, as they tend to stay close to water to drink every day (Scholes, 2007). With no natural regulation of population numbers (such as die-offs during dry spells), damage to the vegetation

surrounding the water holes can occur as elephant numbers increase to a point where the vegetation value starts to deteriorate (Scholes, 2007; Sukumar, 2003).

Elephant feeding is another major impact on ecosystems that needs to be taken into account as they feed on a great variety of forage including grasses, fruits and tree bark (Cowling & Kerley, 2002; Landman & Kerley, 2006). The daily forage consumed is between 150 kg for cows, and 300 kg for bulls. As these animals are non-ruminants they pass foods faster than ruminants which causes them to be wasteful feeders (Cowling & Kerley, 2002; Sukumar, 2003).

Another impact to be recognised is the trampling effect that elephants have while travelling long distances each day to find food and water (Cowling & Kerley, 2002; Landman & Kerley, 2006). During this time, they compact the soils and crush vegetation to create pathways, which effects many microhabitats and often alters the suitability of an area for many species (Cowling & Kerley, 2007; Kerley *et al.* 2008).

The final implication of elephant management is that they can act as potential seed dispersers, as they feed on large quantities of forage and travel long distances (Cowling & Kerley, 2002). This can be very useful to an ecosystem as it promotes the spread of vegetative species.

4. CONCLUSION

In conclusion, to this report, the elephant is a mega herbivore capable of changing its surrounding ecosystem because of its feeding habits. They are able to tolerate low quality forage, which is related to their digestive physiology and size. The management implications that arise from these physiological adaptations are vast, causing controversy among conservationists and national reserve managers in many parts of Southern Africa. Overall, efforts should be made to concentrate on the range of elephants in relation to waterholes and the placement of fencing to better mimic the natural conditions of the elephant habitat. By doing this, the elephants will be challenged resulting in more natural die-off to better regulate population size.

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