Effect of elephants on vegetation in Pongola Game Reserve

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Contents

Key Findings

- Overall, the impact of elephants on the vegetation decreased slightly over time between 2012 and 2015
- This effect was not consistent between the different vegetation types, with some showing an increase in elephant impact from 2012 to 2015
- The was a marked decrease in elephant damage following the independent translocation of many of the elephants in 2016

Introduction

African elephants (*Loxodonta africana*) are listed as Vulnerable by the IUCN, and yet in many parts of South Africa reserves are facing the problem of too many elephants. The fencing off and high protection levels of many conservation areas across the country has led to local overpopulation of this iconic species. Being bulk browsers, elephants can cause a significant amount of damage to the environment when their movements are restricted. This causes large concerns for the landowners and reserve management, who need to balance the desire for elephants with the sustainability of the browse for other species.

Many South African reserves make income from tourism or hunting, and sometimes a combination of the two. For tourism purposes, elephants are all but essential as a relatively easy-to-spot member of the 'Big 5'. However, if the elephant populations are not controlled they can cause the landscape to look less picturesque and reduce the availability of browse for other species. Smaller herbivores, such as Kudu (SP) or Impala (SP) are often hunted in these small private game reserves, providing extra income. However, any reduction in browse caused by high elephant populations could have a negative impact on these species. Reserve managers, therefore, need to carefully monitor the effects large elephant populations are having in order to determine a long-term management plan allowing all aspects of the reserve to thrive.

Pongola Game Reserve is an example of a reserve requiring such careful management. Between 1997 and 2001, 20 elephants were translocated to PGR from Kruger National Park. In 2000 another 5 "orphan" elephants walked into the reserve and since then the overall elephant populations have flourished. Attempts have been made to curb the rise in elephant numbers through contraception. In 2008, seven of the nine adult bulls were vasectomised with the other two being deemed too large or not strong enough for the procedure. These two elephants were instead treated with hormonal contraception, which at first was unsuccessful. However, these two bulls were subsequently removed from the reserve in 2010 and 2013, and the last birth in the reserve happened in 2015, but the calf did not survive past six months.

In the spring of 2016 their populations were estimated at $\pm$ 85 individuals. Although no single method of determining elephant carrying capacity is dominant, keeping the elephant population at 15% of the large herbivore biomass is one such estimate. Based on the reserve size (10,000ha) and water availability (575mm rainfall/year and access to Lake Jozini), it was agreed that a population of 40 elephants would be sustainable. This is clearly much lower than the population, and so concerns were raised regarding the damage the high elephant population was causing on the habitat of PGR.

Since 2012, Opwall students have been collecting vegetation assessment data about PGR. As well as data on the type of vegetation in each area, the data also includes the estimated amount of elephant damage at each site. This allows a calculation of a site impact index, which gives an indication of the level of elephant damage at each site. A higher site impact index relates to a larger amount of elephant impact. In 2016, a large proportion of the elephants from PGR independently moved to the nearby Royal Jozini Big 6 Reserve. Data collection in 2016 therefore had to be split across the two sites, resulting in a reduced number of sampling sites in PGR for 2016. This report assesses any changes in elephant impact over the years in which the elephant population was relatively stable (2012-2015) and compares this with the elephant impact observed in 2016.

Research Site

Data was collected from 57 sites across Pongola Game Reserve (PGR) and Pongolapoort Nature Reserve (PPNR), randomly distributed throughout research area (Figure 1). Unfortunately, no individual site was assessed every year. However, each vegetation type was sampled multiple times each year with the exception of Pappea-Berchemia-Salvadora Bushveld/Woodland. The following analysis will therefore pool the data by vegetation type in order to provide a useful insight.

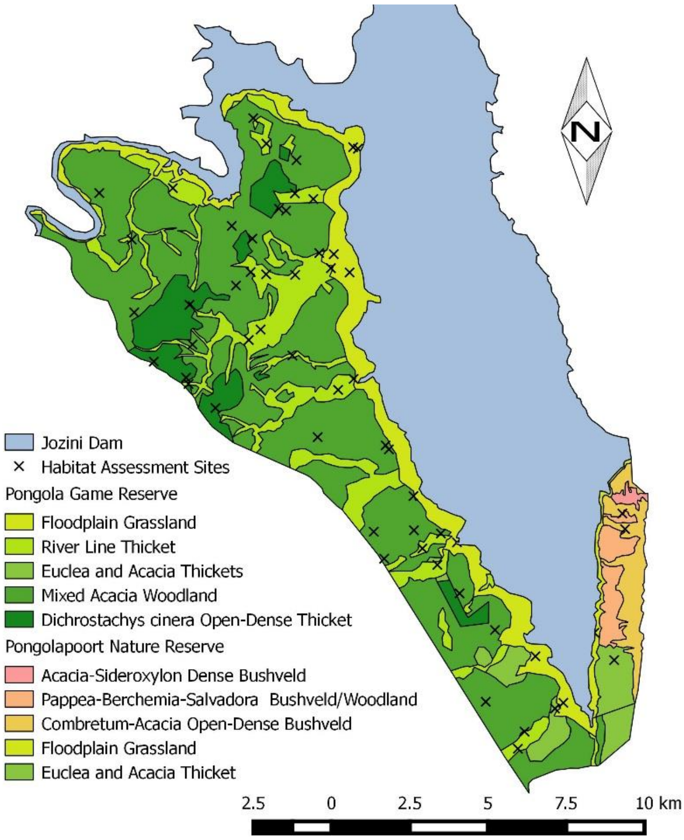

Figure 1. Map of the research areas surrounding Jozini Dam including Pongola Game Reserve and Pongolapoort Nature Reserve. The distribution of the seven main vegetation sites are displayed (see legend) along with the 57 research sites (black crosses).

Results and discussion

A site impact index was calculated for each of the habitat assessment sites. This index takes into account the extent of damage observed on each woody plant within the 20 x 20m plot set up at each site. Damage from all sources was recorded (i.e. rhino, kudu, fire, insect) but only elephant damage was included in this analysis. Therefore here, a high site impact index indicates a high level of elephant damage to the vegetation.

Changes over time

The average site impact index over all habitat types has decreased slightly over time between 2012 and 2015 (Figure 2). This is not a strong relationship, and seems heavily influenced by the large amount of elephant damage observed in 2012. When the data is separated by vegetation type, it becomes clear that the impacts in different habitats have changed in different ways over the years (Figure 3). Of the six vegetation types surveyed across the two reserves, only two show the decrease in elephant impact observed in the overall results. Riverline thicket and mixed acacia woodland both had large mean site impacts in 2012, leading to the apparent drop in elephant impact in subsequent years. The downward trends observed in these two vegetation types were the only ones that were close to reaching significance in a general linear model (Mixed Acacia Woodland: df $= 43$, $p = 0.05$ and Riverline Thicket: df $= 42$, $p = 0.05$). For the two vegetation types that showed a general in increase in site impact over time, this trend did not reach significance (*Dichrystachy cinera* open-dense thicket: df $= 6$, $p = 0.80$ and floodplain grasslands: df $= 22$, $p = 0.30$). This is likely due to the high level of variability in the data, which is particularly apparent for *Dichrystachy cinera* open-dense thicket. Combretum-acacia open-dense thicket and euclea & acacia thicket both had two few assessments to perform any meaningful analyses.

This data demonstrates the complex nature of assessing elephant impact. While generally the elephant impact is higher in *Dichrystachy cinera* open-dense thicket, many of the other vegetation sites have a very similar level of impact in at least one year (Figure 3) and there is no clear 'favourite' vegetation for these herds. This is due to elephants being bulk browsers who can easily adapt their diet to local availability. This trait also manifests itself in the lack of seasonal trends on the movement patterns of the elephants (data not shown). This lack of predictability should have removed any bias effect that could have been caused by the annual nature of the data collection.

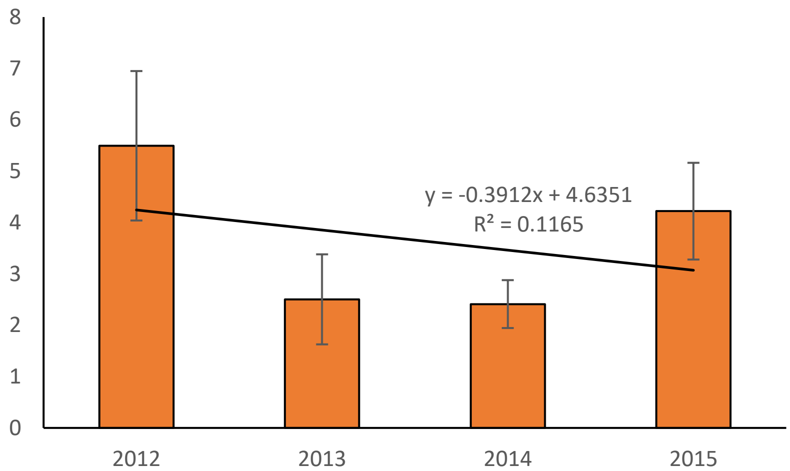

Figure 2 Mean site impact by year. The bars show the mean site impact pooled across all vegetation types, with the error bars representing the standard error of the mean. A linear regression shows a slight reduction in mean site impacts over time, however this is not a significant effect ($R^2 = 0.1165$, $p = 0.436$).

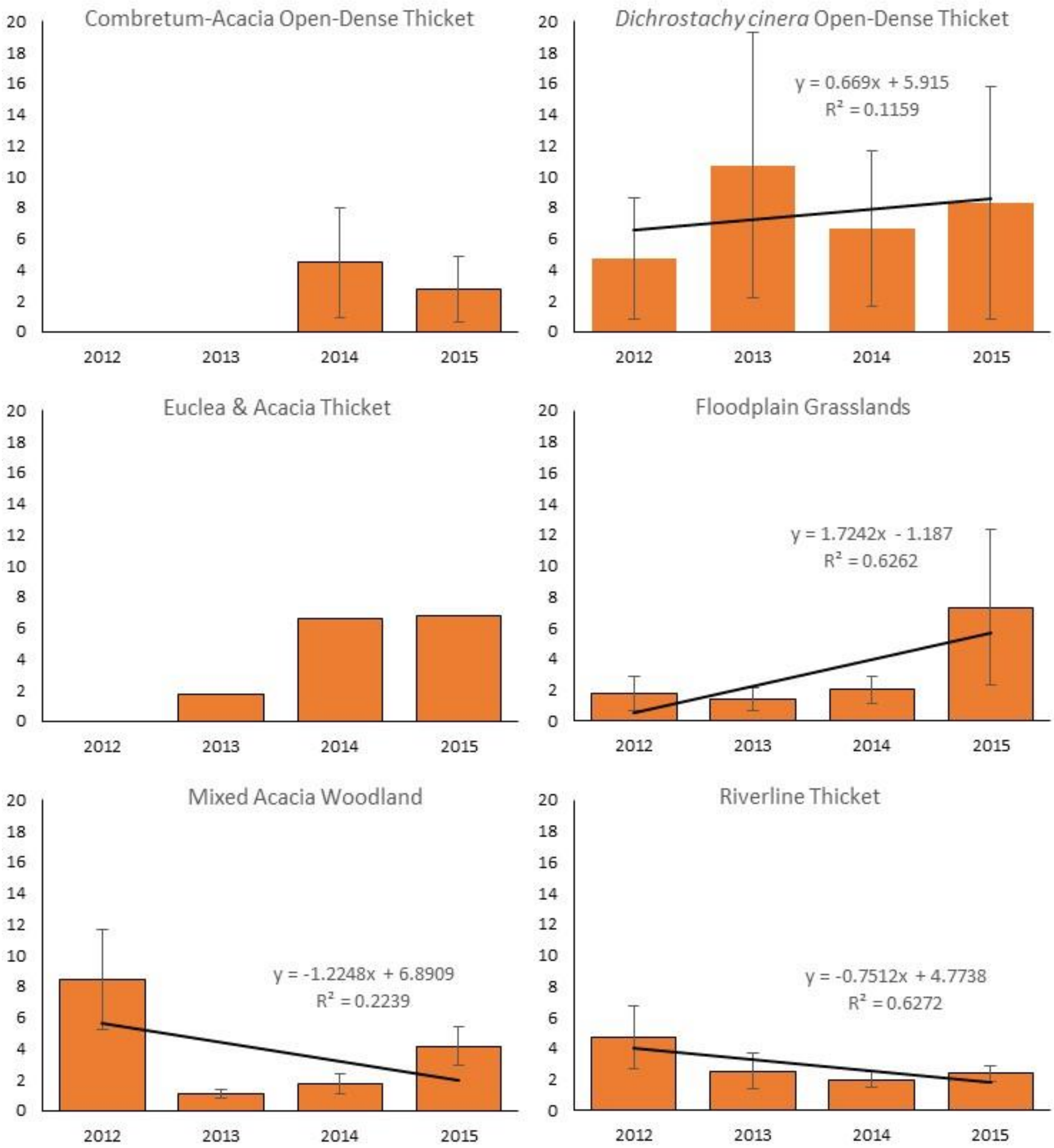

Figure 3 Mean site impacts each year separated by vegetation type. The mean and standard error of the mean are shown in each example. Where no error bars are shown, only one or two data points were available. Trendlines show the linear relationship where sufficient data was available. None of these relationships reached significance, however two results were marginal: Mixed Acacia Woodland (df = 43, $p = 0.05$) and Riverline Thicket (df = 42, $p = 0.05$).

Translocation Effects

In order to compare elephant impact pre- and post-translocation, the site impact indices from 2012-2015 were combined into one average and then compared to the average site impact index from 2016 (Figure 4). Only the fourteen sites that were surveyed in 2016 were included in this calculation. The post translocation damage appears to be much lower than that which occurred pre-translocation. However, due to the large variation in pre-translocation site impact scores this effect does not quite reach significance according to a Welch's two sample t test ($p = 0.09$). This result does, however, show the validity of the sampling method. With most of the elephants no longer present in PGR, the stark drop in elephant impact is to be expected. The damage recorded in 2016 would have taken place prior to the translocation, and shows our sampling method is capable of detecting damage caused more than four months prior to data collection. This is very important for a method that is implemented annually.

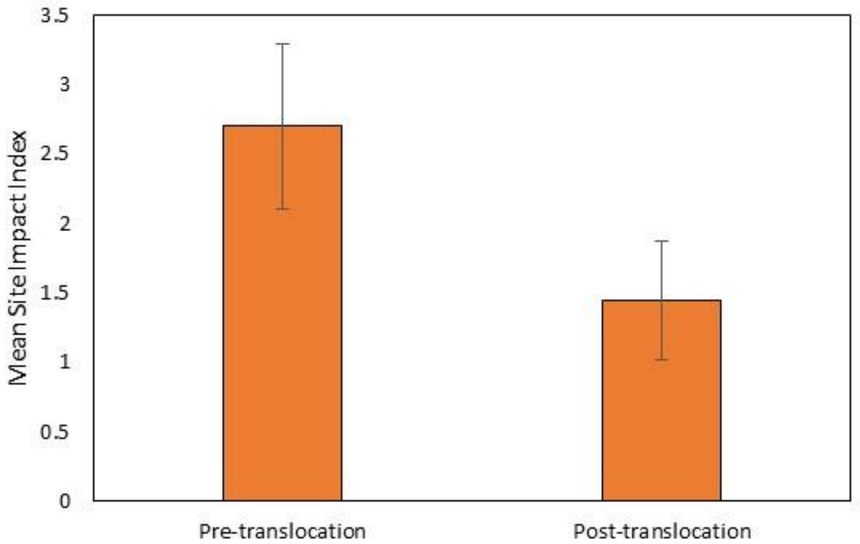

Figure 4 Mean site impacts across the fourteen sites that were surveyed both pre- and post-translocation. The error bars represent the standard error of the mean and a Welch's two-sample t test showed the difference between these means is close to significance ($p = 0.09$).

Recommendations

It is to be expected that the vegetation will recover and flourish over the coming years with such low elephant impact. It is important to monitor this by continuing annual vegetation assessments across the reserve. This will also help to determine the damage done by other herbivore species on the reserve. In addition, monitoring the populations of these herbivore species will allow an insight into how these species react to the sudden reduction in elephant numbers.