African savanna elephant (*Loxodonta africana*) damage on large trees in a small, fenced reserve, South Africa

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Why is this project important? 💡

- To date, studies exploring how elephant density impacts the level of damage of vegetation in fenced reserves have been relatively scarce and narrow. The aim of this study was to assess whether introduced elephants have caused significant damage on various tree species in the small, fenced Karongwe Private Game Reserve (KPGR), South Africa.

How did we do this? 🕵️‍♂️

1. KPGR (8600ha) has had a managed elephant population since 1999 that are tracked daily. We monitor the change in vegetation for this study using ground data collection.

2. Vegetation transects were determined as the most suitable way to establish the extent of elephant composition damage and variation in tree species found in Karongwe Private Game Reserve in 2018.

3. 84 transects were located throughout the reserve consisting of 100m in length, with a distance of 10m on either side.

4. For every tree >5m in height we recorded: Species, height (m), DBH (cm), Elephant damage type, Tree recovery type.

Generalised linear mixed models (GLMMs; binomial distribution) were used to model the likelihood of a given damage type and recovery process.

'High-use' and 'low-use' areas were determined using elephant location data.

Sampled trees near the fence line were defined as being within 100m of the fence line.

What did we find? 🎯

- 5 species accounted for 80% of the total dataset and used for further analysis (*Acacia nigrescens* 30%, *Sclerocarya birrea* 19%, *Commiphora mollis* 13%, *Combretum apiculatum* 11%, *Combretum imberbe* 5%).

- The most damaged size class of trees were those between 5 and 7m in height.

- Tree height was not shown to correlate with the overall level of damage (Table 1).

- Trees close to the fence line were not more damaged than trees near the centre of the reserve (P>0.1 for all damage types tested).

- Trees in highly used areas had a higher level of damage (Table 1).

- Damaged trees showed low levels of recovery (Table 1).

Table 1: Key findings from the GLMM models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed Effects</th>
<th>GLMM coefficient</th>
<th>SE</th>
<th>z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branches Broken</td>
<td>Habitat Use</td>
<td>1.37</td>
<td>0.44</td>
<td>3.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Pushed Over</td>
<td>Height</td>
<td>-0.22</td>
<td>0.09</td>
<td>-2.41</td>
<td>0.02</td>
</tr>
<tr>
<td>Main Stem Broken</td>
<td>Height</td>
<td>-3.52</td>
<td>1.56</td>
<td>-2.28</td>
<td>0.02</td>
</tr>
<tr>
<td>Dibarking</td>
<td>Habitat Use</td>
<td>-2.54</td>
<td>0.40</td>
<td>-6.35</td>
<td>0.02</td>
</tr>
<tr>
<td>Alive</td>
<td>Height</td>
<td>0.26</td>
<td>0.06</td>
<td>3.37</td>
<td>0.01</td>
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<tr>
<td>Coping</td>
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<td>0.12</td>
<td>-1.73</td>
<td>0.03</td>
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<tr>
<td>Regrowth</td>
<td>Height</td>
<td>0.50</td>
<td>0.16</td>
<td>3.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Sprouting</td>
<td>Height</td>
<td>-0.59</td>
<td>0.25</td>
<td>-2.05</td>
<td>0.04</td>
</tr>
</tbody>
</table>

What's next? 🐻

- Our findings support the general belief that elephant feeding behaviours are the main drivers of tree damage on large (>5m) trees.

- We suggest exclusion areas for *Combretum apiculatum* and *Sclerocarya birrea* in high use areas, to reduce damage and enable recovery on these highly damaged species.

- We also suggest that future studies should consider the secondary effects of elephant damage.