Report on the effectiveness of protecting baobab (*Adansonia digitata*) trees from elephant damage using diamond mesh and fermented elephant dung spray.

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30 November 2022

Executive Summary

Elephants are causing damage and death to baobab trees in Mapungubwe National Park. Baobabs are an important landscape, cultural and ecological feature of the park and Park Management are under pressure to find a solution to protecting the trees. An evaluation conducted in 2021 and 2022 showed that wrapping baobabs in diamond mesh is a practical, low maintenance and long-term solution to protecting baobabs from elephants. Therefore, it is recommended that this form of protection is introduced formally in the park.

INTRODUCTION

Mapungubwe National Park (MPNP) has a high population of baobab (*Adansonia digitata*) trees which are under threat from excessive debarking and trunk gouging by elephants (Figure 1). In other national parks, such as Gonarezhou National Park and Mana Pools National Parks in Zimbabwe high numbers of baobab trees as well as riverine habitats have been lost to elephant damage. A SANParks report (Khosa et al, 2020) estimated that 8 % of baobab trees were lost between 2009 and 2019 with a 50% increase in the extent of debarking.

Figure 1 Baobab tree recently destroyed by elephants

Why protect baobab trees

Baobabs are an important part of the historical-cultural landscape at Mapungubwe. Baobabs are found on many of the archeological sites around the park which is evidence that they played an important role in the lives of inhabitants of the area over the last thousand years. Baobabs provided food from fruit and fiber from the bark for weaving and rope making. The Mapungubwe hill archeological artifacts include beads threaded with string made from baobab bark (Sian Tilly pers comm) and many of the trees show sign of ancient debarking.

Today baobabs continue to be an important tree and sales of the fruit support many hundreds of rural livelihoods outside the park. In the park they are an important feature of the landscape and many old trees are tourist sites such as the “Honeymoon” tree on the Leokwe camp road. This tree has been heavily damaged by elephants including stripping bark inside the cavity of the tree.

Ecologically, baobabs are a keystone species that provide habitat for dozens of bird, mammal and reptile species. This is especially important in areas such as the vast mopane

veld in MPNP in which baobab trees are an emergent species and provide the only habitat to many of the faunal species in this landscape.

What can be done

Mapungubwe National Park authorities are under pressure from the public and ecologists alike to seek ways to protect both baobabs and riverine forest trees from elephants. Many methods exist and some have been tried like placing beehives in trees, hanging chili blocks from branches and packing rocks around trees (pers com Stefan Cilliers). It is important to know that each area is unique and that the solution is not only the use of one methods but may be a combination of several.

Testing Diamond Mesh on Mapungubwe baobab trees.

In June 2021, the then Park Manager, Conrad Strauss, invited Baobab Ecologist, Dr Sarah Venter, of the Baobab Foundation to test the diamond mesh method on the trees in the park. The Baobab Foundation is a Non-Profit Organization and focused on research and conservation of baobab trees. The Baobab Foundation were able to allocate R45 000 to buying mesh and with the help of the Senior Section Ranger, Stefan Cilliers wrapped 27 trees in diamond mesh in the eastern part of the park.

In addition, following a suggestion by an arborist, Mr Rian Van Zyl, who had been spraying baobab trees with fermented elephant dung to protect them from elephants in Botswana, the project decided to add this treatment to the controlled evaluation. Although we were aware of how impractical the treatment would be for the MPNP management, it was felt that if it was found to be successful it could be recommended as an alternative to land owners who did not want to use diamond mesh.

METHODS

Selection of trees

Trees were selected for evaluation in the eastern section of the park along the main road that runs from the main gate, past Schroda dam, Vhembe trails camp, the Confluence picnic site, Leokwe camp and back towards the main gate. GPS co-ordinates for the trees have been given to park management.

Fifty seven (57) trees were selected for the evaluation, 24 trees were meshed, 20 trees were sprayed with fermented elephant dung and 13 trees were used as controls. Four trees (not included in the above) had mesh stolen off the trees by neighboring Zimbabweans who illegally entered the park and thus these trees had to be excluded from the final evaluation.

Treatment methods

a) Control trees

Control trees were not sprayed and not wrapped in mesh.

b) Diamond mesh

Diamond mesh was stapled to the tree using U-nails and then fastened with wire. One length was placed from the base of the tree to 1.8 m off the ground and the second length was placed above the bottom length with an overlapping section in between the top and the bottom lengths (Figure 2). The total height of the mesh was 3 meters. A guide to how

to secure mesh to baobab trees has been provided to the Park Management and Honorary Rangers.

c) Fermented elephant dung

Fresh elephant dung was placed in a 200 liter drum and mixed with 40 liters water and 500g sugar. The mixture was left overnight to ferment and then sieved to remove the fiber. The "ferment" was sprayed onto the trees up to a height of 3 meters using a Hasqvarna backpack motorized sprayer (Figure 3).

Figure 2 Wrapping in diamond mesh

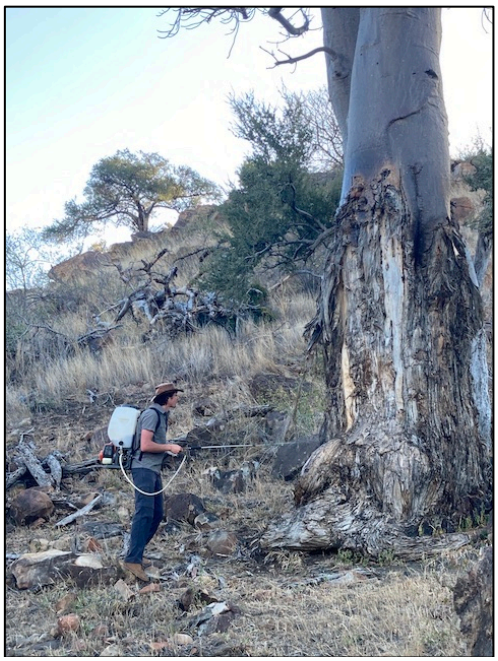

Figure 3 Spraying fermented dung

Evaluation method

Each tree was evaluated following a protocol in which age of the damage, extent and type of damage is quantified. Wounds were divided in four age stages: 1) Fresh: yellow and fibrous, which indicate damage of less than 1 year old, 2) Recent: grey and fibrous, which indicates 2-3 years-old damage, 3) Old: uneven and smooth, over which a thin coat of bark has developed, but has not yet got waxy, which indicates a wound of about 4-10 years old, and 4) Ancient: smooth and waxy scars which indicate a wound that is older than 10 years, (Figure 4). Each of these categories were then divided into bark damage and wood damage, where bark damage refers to stripping of bark off the surface of the trunk (Figure 5a) and wood damage where the elephants have gouged into the wood of the tree (Figure 5b). Trees were scored by allocating a % damage per category to of each side of the tree (north, south, east, west) up to 3 m and then averaged to give a total % extent of damage to the trees.

Trees were evaluated by this method before the treatments and then again after the following dry season, in November 2022. The November evaluation compared damage to

the trees that occurred over the last year to previous “fresh” damage. Recent, old and ancient damage was not included in the comparative analysis.

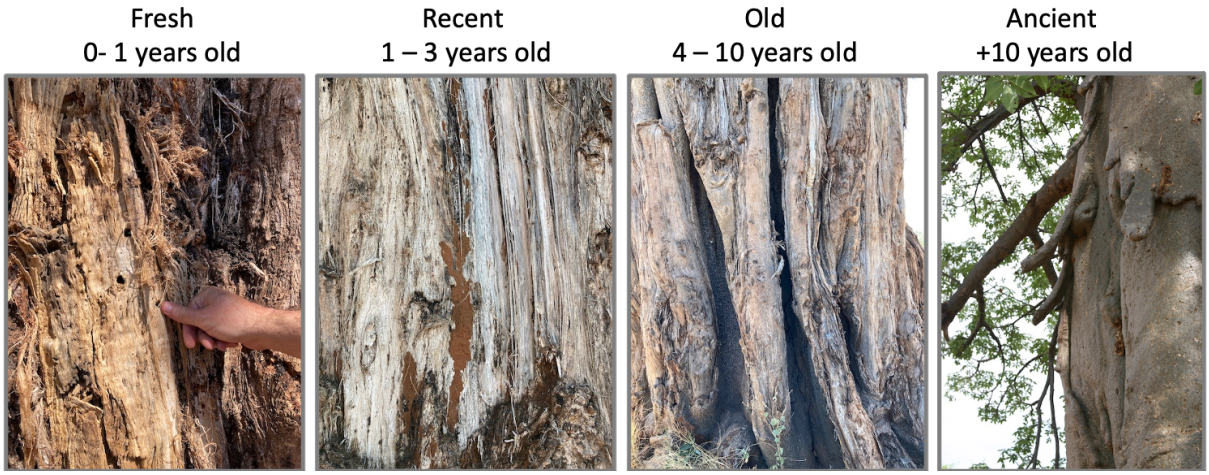

Figure 4 Illustrations of elephant damage age categories

Figure 5a Bark damage

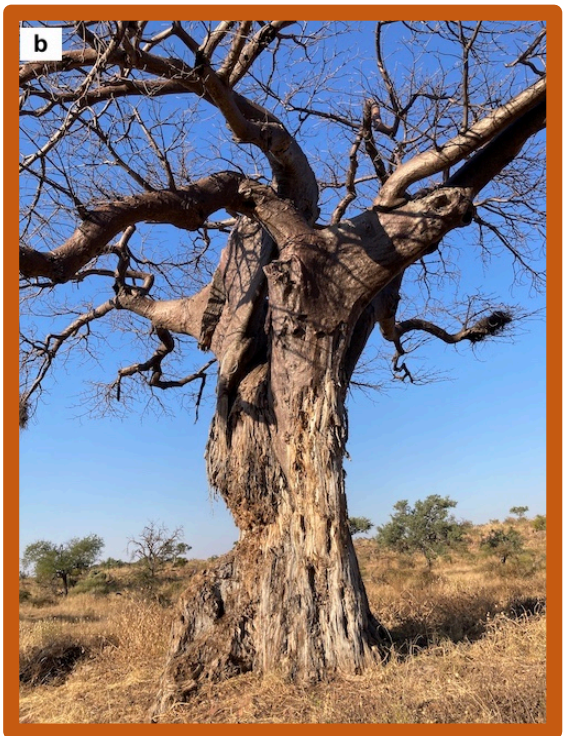

Figure 5b Wood damage

RESULTS

a) Number of trees with bark and wood damage before and after treatments

All the trees surveyed in 2021 and before protection treatments were applied show a varying degree of fresh, recent and old damage to both the wood and bark. Figure 6 gives the percentage of trees that exhibited different ages of damage in 2021 before the trial started. It is interesting to note that the percentage of trees that exhibited 1 – 3 year-old

damage was much higher than the percentage of trees that exhibited 4-10 year-old damage. In the last 2021 dry season 2% of trees exhibited fresh wood damage and 10% of trees had bark damage.

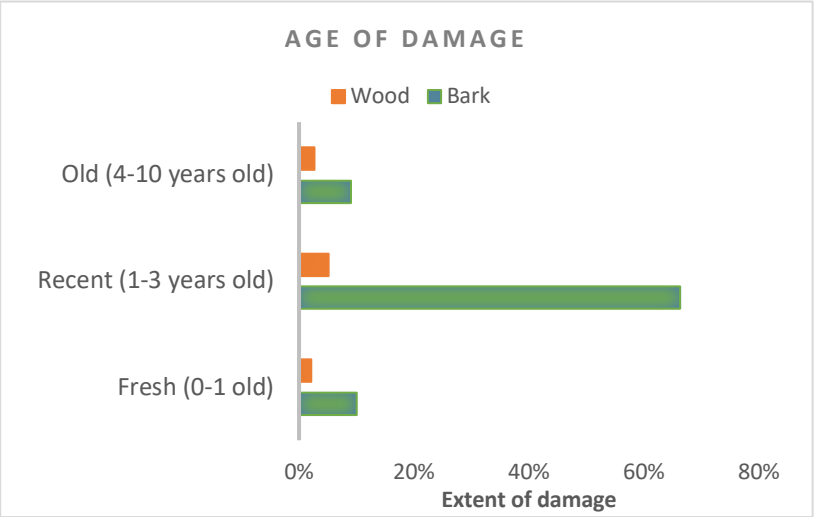

Figure 6 The percentage of trees that exhibited fresh, recent and old damage before treatments were applied.

The results of the evaluation in November 2022, after the protection treatments were applied, showed that trees that were meshed had no fresh bark and wood damage (Figure 7a and 7b). The proportion of spray and control trees with bark damage increased by 30% and 7% respectively and wood damage by 35% and 17% respectively.

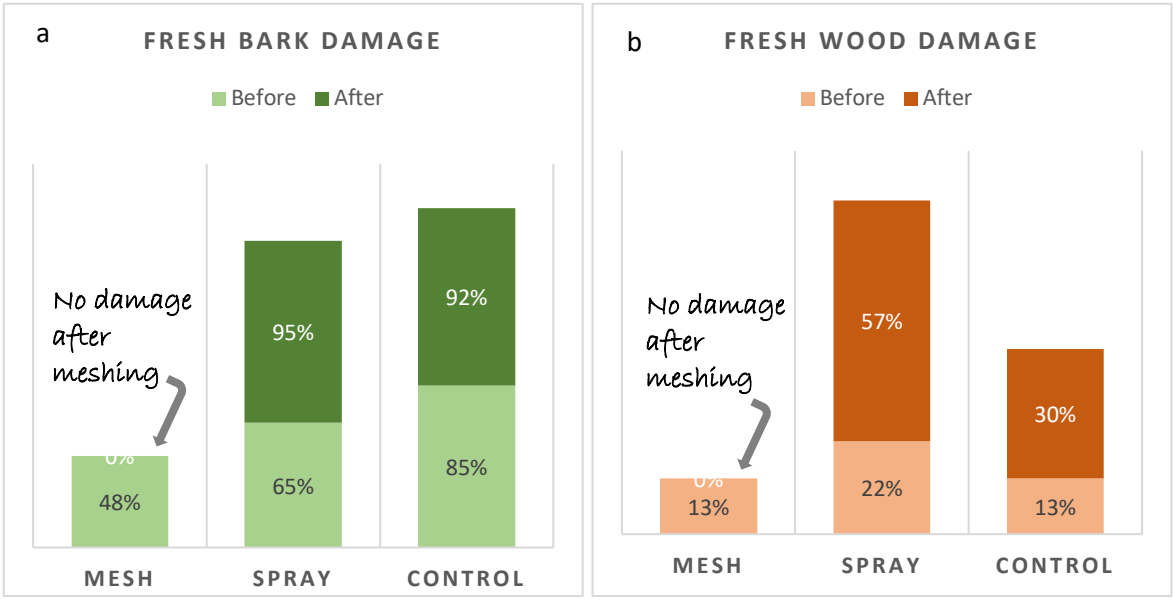

Figure 7 Percentage of trees with fresh bark (a) and wood (b) damage before and after treatment.

b) Extent of bark and wood damage before and after treatments

As can be seen in Figure 8, the extent of bark damage of the sprayed trees increased in the 1 – 24% "extent of damage" category and the extent of damage to the control trees did not change much between the two years. However, the extent of wood damage to both the sprayed and control trees increased substantially the 2022 dry season (Figure 9). In both categories the proportion of trees with no fresh damage reduced and increased in both the 1 – 24% and 25 – 75% categories. The meshed trees were left untouched and so the number of trees in the no damage category is 100% after meshing.

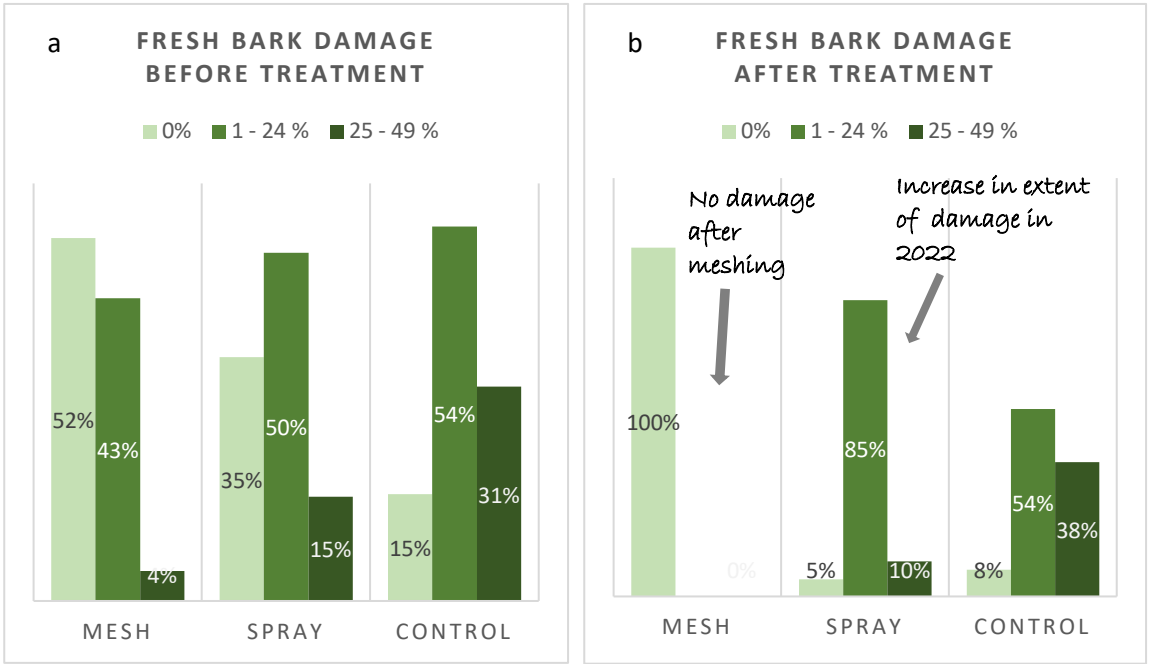

Figure 8 The extent of fresh bark damage before (a) and after (b) treatments

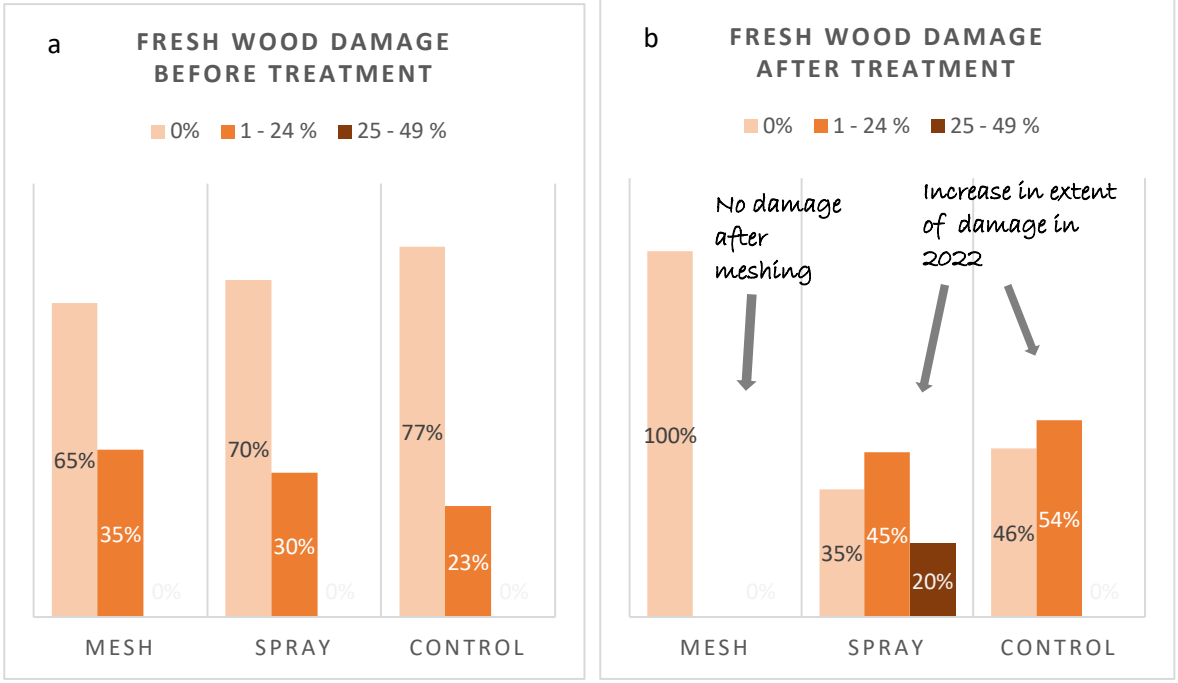

Figure 9 The extent of fresh wood damage before (a) and after (b) treatments

DISCUSSION

Wrapping of baobab trees in diamond mesh was found to be an effective practical solution to protecting baobabs from elephant damage in the park. The baobab trees that were wrapped in diamond mesh were completely untouched by elephants compared to the trees which did not have mesh (control and sprayed trees). The mesh is unobtrusive, and many people only notice the mesh when they are a few meters away from the tree. Visitors viewing the trees from a vehicle will probably not notice the mesh unless the tree is right next to the road and they were looking carefully at it.

In dry environments, such as in MPNP, baobab trees are known to be extremely slow growing, thus adjusting mesh around the trees may only need to be done every 10 years or so. Evidence from a growth monitoring plot (Skelmwater Research Plot) near Musina shows that trees with a girth of over 100 cm grew on average 3 cm in diameter in 10 years.

Costs and implementation

On average one tree uses one roll of mesh and costs about R1800 per tree. Small trees only use a third of a roll of mesh and very large trees can use up to three rolls of mesh. The Honorary rangers based at Lephalale attended a training session in October 2022 on how to wrap trees in mesh and they have taken it upon themselves to raise funds and buy more mesh to protect as many trees as they can. However, it should not be left to volunteers to protect the trees, the responsibility should be taken by SANParks.

CONCLUSION

Diamond mesh is a practical, low maintenance and long-term solution to protecting baobab trees from elephants. Therefore, it is recommended that this form of protection is introduced formally in the park as it is a suitable, low visibility solution in this landscape.

Spraying baobabs with fermented elephant dung did not protect the baobabs in anyway, in fact it appears that trees that were sprayed seemed to be more damaged than the control trees. We noticed that many of the trees which we sprayed had been rubbed with mud by elephants.

The park should prioritize the protection of the baobab population from elephants and develop a plan to protect the riverine forest and the baobabs with an adequate budget and ongoing maintenance.