Goat Excluder Project in the Quill National Park
Year 2

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July 2014

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Background and Project Overview

The presence of feral goats (*Capra hircus*) can have detrimental effects to island ecosystems where native plants have evolved in the absence of these animals (Melendez-Ackerman et al., 2008). Feral goats are implicated in habitat destruction and alteration of species composition on sensitive island ecosystems. In the absence of population control, goats have become the ecologically dominant species on many islands, with the results that numerous endemic or native plant species have been extirpated, or are threatened by excessive grazing (Appendix 1). It is demonstrated that the removal of goats can lead to rapid recovery of suppressed vegetation (Coblentz, 2003).

In April 2012, nine excluders and nine controls were established randomly in three areas of the Quill: White Wall, Mazinga and Around the Mountain North (RTM N) trails (Table 1). This is part of a long-term (minimum ten-year) study to assess the effects of roaming goats on native vegetation within the Quill National Park. Data is collected annually every April. The size of each excluder and control is approximately $3m^2$.

Table 1: Coordinates of the excluder and control plots.

White Wall (W)		**N**	**W**
WA		17^o28.332	62^o57.905
WB		17^o28.322	62^o57.856
WC		17^o28.321	62^o57.758
Mazinga (M)			
MA		17^o28.536	62^o57.978
MB		17^o28.374	62^o57.843
MC		17^o28.361	62^o57.797
RTMN (N)			
NA		17^o28.637	62^o57.242
NB		17^o28.606	62^o57.244
NC		17^o28.489	62^o57.299

1. Methods

We visited all the excluders and controls during the month of April 2014. Within each, the number of trees and plants with woody stems was counted and their height measured to the nearest quarter inch. The number of herbs, vines and bromeliads was also noted. Where possible species were identified. If identification was not possible, plants were categorized as 'species 1', 'species 2' etc.

The excluders were enclosed with fence to prevent grazing by goats while the controls were not enclosed, therefore remaining exposed to grazing. The control is a similar size to the excluder, is located within five meters of a goat-excluded plot, and is marked with metal rebar and flagging tape.

2. Results

Overall a slight difference is apparent between the Quill control and excluder sites in 2014, with more plants present in the excluder plots than in the control plots. In the Mazinga plots the total number of plants has decreased from 2013 to 2014. Nevertheless, the plots from which goats were excluded contained many more plants than the control plots. There was an average of almost 30 plants in each of the three Mazinga excluder plots, but an average of less than five plants per control Mazinga plot (Table 2).

At White Wall, the average number of plants has decreased from 2012 to 2014 as well (Table 3). However, the average number of plants growing within each of the excluders (20.3) is much higher than in the control plots located at White Wall (4.0).

The plots located at RTM N differed in that the average number of plants has increased (Table 4). Overall at RTM N the total number of plants in the three excluder plots was slightly greater than in the three control plots combined; however two of the individual control plots contained more than nearby excluder plots. Therefore, we have yet to observe any real differences in plant numbers between the excluders and controls at RTM N.

Table 2: total number of plants at the Mazinga sites.

Mazinga	Total plants 2012	Total plants 2013	Total plants 2014
MA - Excluder	28	118	47
MA - Control	29	28	13
MB - Excluder	23	34	23
MB - Control	20	3	2
MC - Excluder	41	39	15
MC - Control	16	10	1

Table 3: total number of plants at the White Wall sites.

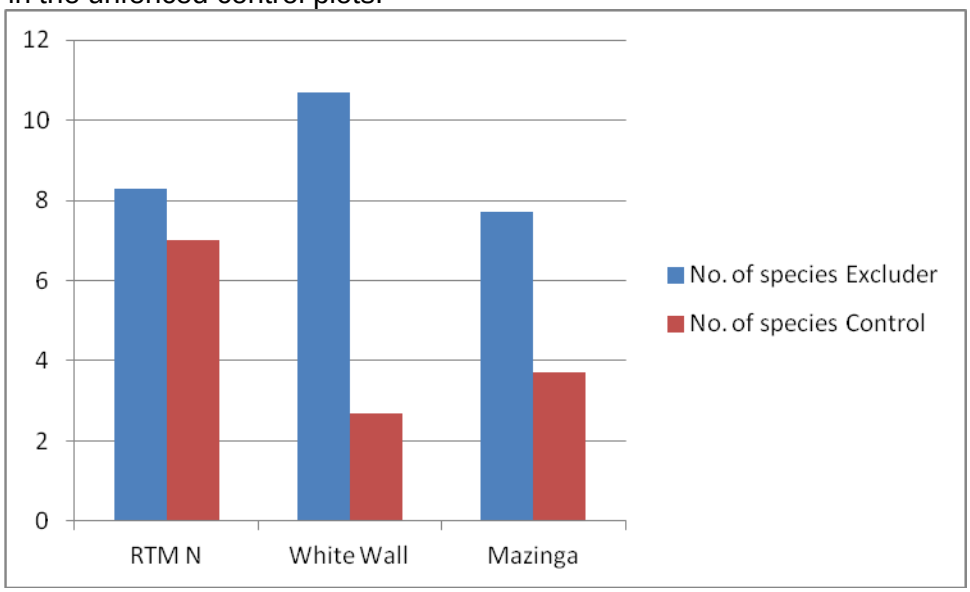
White Wall	Total plants 2012	Total plants 2013	Total plants 2014
WA - Excluder	34	12	22
WA - Control	27	9	5
WB - Excluder	14	24	9
WB - Control	14	5	0
WC - Excluder	65	31	30
WC - Control	52	9	7

Table 4: total number of plants at the Around the Mountain North (RTM N) sites.

RTM N	Total plants 2012	Total plants 2013	Total plants 2014
NA - Excluder	97	68	104
NA - Control	32	25	26
NB - Excluder	20	47	24
NB - Control	37	36	25
NC - Excluder	105	144	186
NC - Control	108	124	248

Generally, the average height of plants with woody stems was higher within the excluders than in the control plots. The average species diversity in all areas is higher within the excluders than in the unfenced control plots (Figure 1).

Figure 1. Average number of species per plot. The species diversity is higher in all excluded areas than in the unfenced control plots.



3. Discussion

The reason for a decrease in the average number of plants at White Wall is not known, however this area is the driest part of the Quill and St. Eustatius suffers from regular droughts, especially between February and June.

The average height of plants being higher within the excluders than in the control plots indicates that plants growing within a fenced off area have a greater chance of survival than those outside. While not all plants will become mature shrubs or trees, our preliminary analysis shows that survivorship inside the excluders tends to be higher than outside.

4. Conclusion

The results of year 2 analysis show that generally the excluders contain more plants and have a higher species diversity than the controls.

Compared with 2012 and 2013 data there are less plants in both excluders and controls, the cause of which is unknown but could be attributed to drought or other natural causes.

The results of this project will be made available to the Island Council, the Agriculture & Fisheries department (LVV) and other relevant stakeholders. LVV is responsible for contacting the owners of goats that roam the Quill. STENAPA no longer has a gun license and therefore relies on LVV to assist with goat eradication.

5. Recommendations

STENAPA will continue to revisit the excluders every April for at least the coming seven years in order to collect consistent data. In the meantime, a goat-culling program should be initiated in the Quill/Boven National Parks as a matter of urgency. This program will require the support of the local government, LVV, local goat-owners and other stakeholders.

STENAPA recommends that additional excluders are installed in other areas of the island (cultuurvlakte, Boven National Park, town) in order to assess the impact of roaming herbivores elsewhere. This will also require the support of the local government and LVV.

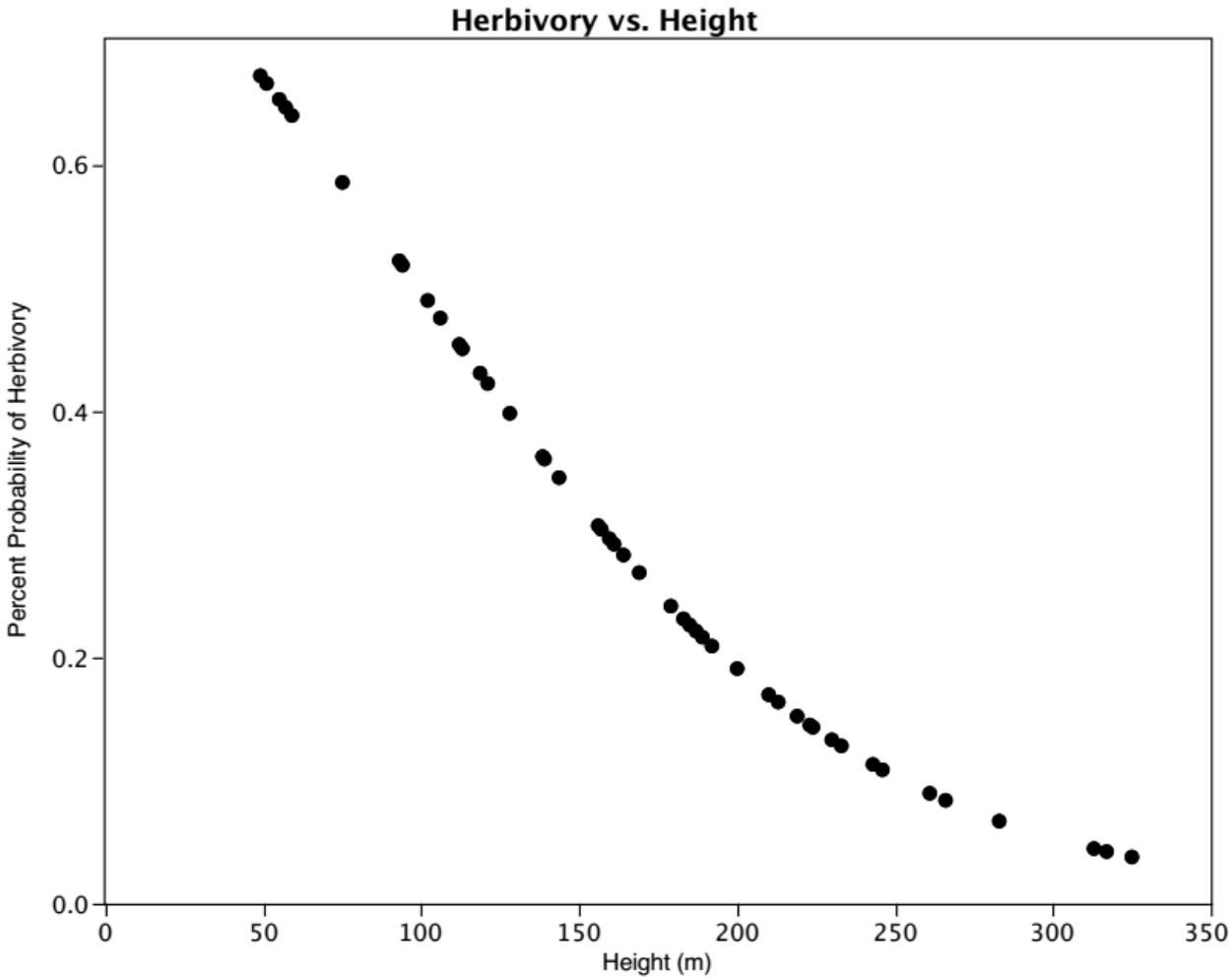
References

Coblentz, B. (2003), *The effects of feral goats (*Capra hircus*) on island ecosystems,* Department of Fisheries and Wildlife, Oregon State University.

Melendez-Ackerman. E, C. Cortes, J. Sustache, M. Morales-Vargas, S. Aragon, M. Garcia-Bermudez and D. S. Fernandez (2008), *Diet of feral goats in Mona Island Reserve, Puerto Rico*, Caribbean Journal of Science.

Appendix 1

Probability of herbivory of orchids by goats according to height at which the orchids grow in the Quill National Park



(Courtesy James Ackerman/Raymond Tremblay, University of Puerto Rico, unpubl. data)