Report on Rufford Small Grants Project
Rehabilitation of the Tropical Montane Rainforests along the Whitfield Hall/Blue Mountain Peak Area

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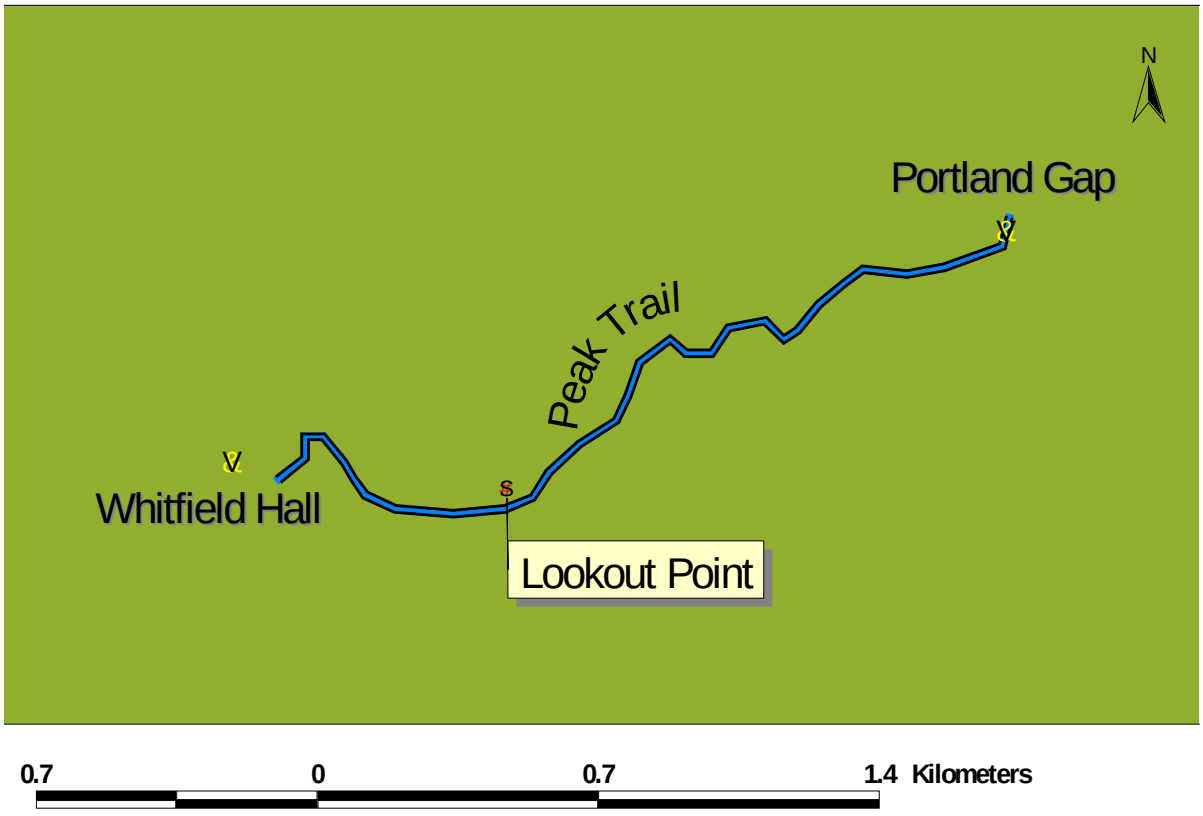
December 4, 2006.

Introduction

The invasive tree *Pittosporum undulatum* (wild coffee), has been advancing up the slopes of the Blue Mountains since the late 1800s. This alien tree has been identified as the most threatening invasive plant to the forests of the Blue Mountains, which are known for their biodiversity and endemism. One important route of spread for this invasive is along the Blue Mountain Peak Trail, where a small nucleus population at Whitfied Hall is making its advance. The forests alongside the trail are also invaded by *Gleichenia* sp. (net fern) and *Melinis minutifolia* (Wynne grass) which grow rapidly to colonise areas that have been burned.

Through this pilot project, a process of forest rehabilitation has been started in the area from Whitfield Hall to Portland Gap (Figure 1). This involved 2 main activities: (1) removal/control of invasive species and (2) replanting with native forest tree seedlings. The project focused on controlling *P. undulatum*, but areas invaded by *M. minutifolia* and *Gleichenia* sp. were also rehabilitated.

Figure 1. Map of work area along the Blue Mountain Peak Trail



Methods

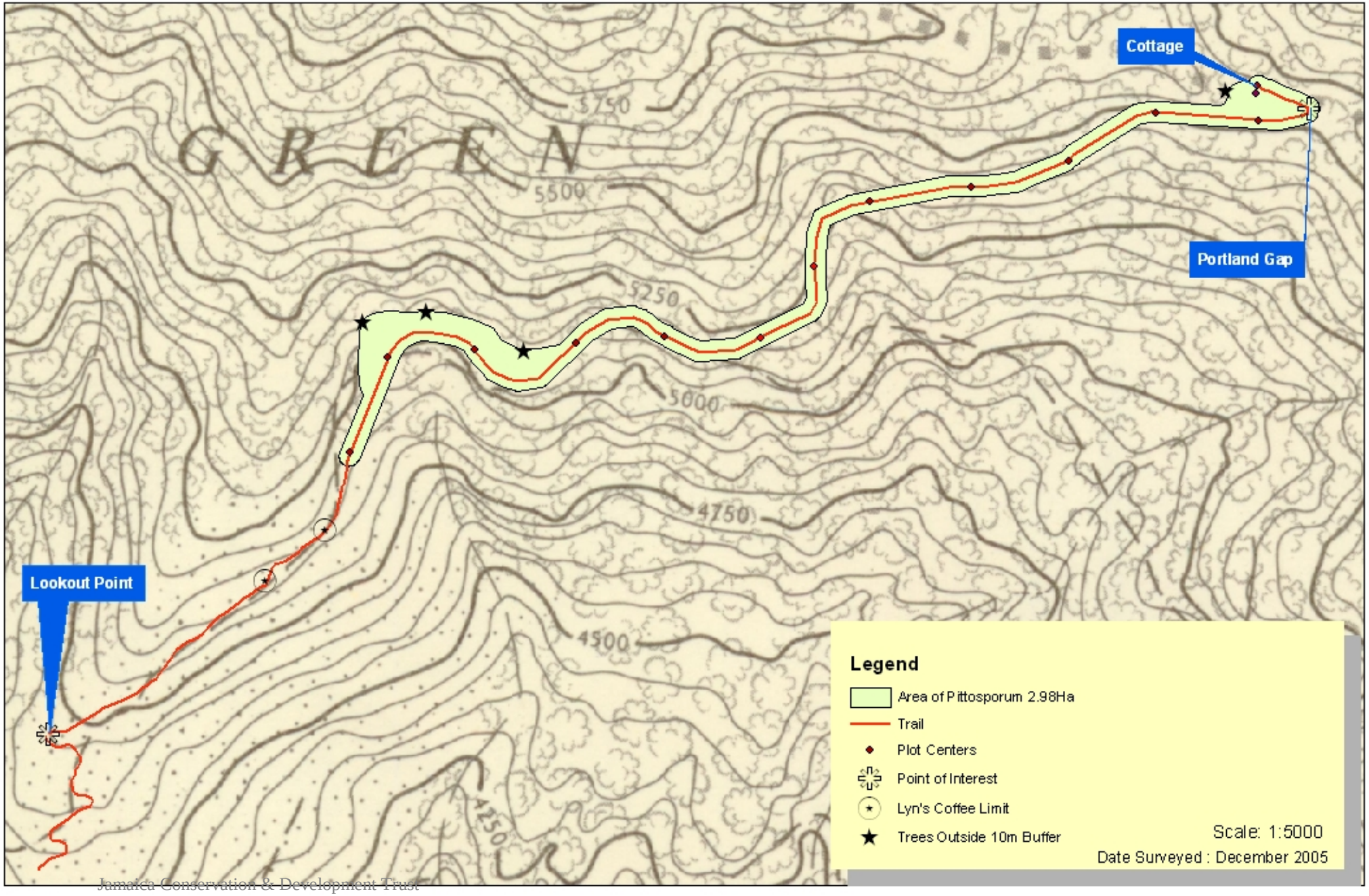
Pittosporum undulatum

Thirteen 20 x 25 m rectangular plots were established along the Blue Mountain Peak Trail from Lookout Point to Portland Gap (Figure 2). This area was lightly to moderately invaded, but was of primary concern in containing the spread of *P. undulatum*. An inventory of these plots was done *before* control treatments were administered in December 2005, and *after* treatments were administered in September 2006. Control treatments were given to *P. undulatum* beginning in December, 2005. Regeneration, sapling and adult life stages were treated as in Table 1.

Life stage	Adult (dbh≥3 cm)	Sapling (dbh≤3 cm)	Regeneration (height< 2m)
Control treatment	5 cm^3 herbicide (Roundup) was injected into holes drilled in tree trunks. Holes were 1 cm in diameter and were drilled at an angle of $45^0$and 8cm apart. Holes were drilled below all tree branches.	These were cut down about 20 cm above ground, and their stump was immediately painted with Roundup	Uprooted, bagged and removed from site

Table 1. Control treatments given to *P.undulatum*

Figure 2. Map showing plot establishment from Lookout Point to Portland Gap



In the heavily invaded areas from Whitfield Hall to Lookout, only adult *P. undulatum* trees were controlled, as this life stage has a tremendous reproductive capacity, being able to fruit and produce millions of seeds for dispersal and increased invasion.

After treating adult *P. undulatum* trees, 1 or 2 native forest tree seedlings were planted at the base of the invasive tree to replace it and occupy the gap that will be created when the invasive dies back.

Gleichenia sp.

Approximately 0.75 of an acre of forest along the Blue Mountain Peak trail, near the Peak burned and invaded by *Gleichenia* sp. was rehabilitated. Workmen from nearby communities were hired to remove the fern by chopping and digging out the rhizomes. The area was replanted with *Podocarpus urbanii* each planted 4m apart.

Melinis minutiflora

Approximately 1 acre of woodland along the Blue Mountain Peak trail was invaded by *M. minutiflora*. In this area, native tree seedlings were planted, and a 1m radius around the seedling was weeded to exclude *M. minutiflora*. Tree seedlings were planted 4m apart.

Results and Discussion

To contain the spread of *P. undulatum*, all 3 life stages were given control treatments over an area of 4.8 ha from Lookout to Portland Gap along the Blue Mountain Peak Trail. In total, (from Whitfield Hall to Portland Gap) 237 adult *P. undulatum* were given the control treatment. Appendix 1 shows the tree injection record for these 237 trees. The mortality of trees treated was found to be 80% from sample plot results. Based on this mortality, 190 trees were actually eradicated. If treated trees showed signs of springing back, a booster treatment was administered a few weeks later. The mean diameter at breast height (DBH) of adult *P. undulatum* treated was 14.0 cm. The DBH ranged from 3 cm – 36.5 cm. Injected trees died standing, avoiding the sudden creation of forest gaps.

The sample plots show that the density of *P. undulatum* before control treatments was 15.1 stems (saplings and adults)/ha. After control treatments were administered, the density was found to be 7.1 stems/ha 9 months. The density of *P. undulatum* was therefore decreased by approximately 50% during this 9 month period.

Figures 3-5 show that native plant species in the regeneration and adult life stages increased after control treatments were administered. Native regeneration doubled after invasive control, which can be attributed to replanting and natural regeneration. There was a slight decrease in the number of saplings after control.

Figures 6-8 show results for *P. undulatum* from the 13 sample plots in the lightly to moderately invaded area between Lookout Point and Portland Gap before and after control treatments. For *P. undulatum*, after control, a large number of seedlings (less than 10 cm in height) of this species resulted. This may be attributed to the gaps created as adult *P. undulatum* trees died back, as seedlings were observed in the more open areas, and were found to be absent in shaded areas. Saplings and adults decreased significantly after control, with the number of saplings down by approximately 50% and the number of adults decreasing by about 60%.

Areas invaded by wynne grass and net fern will be monitored in the long-term to observe the effects of the rehabilitation treatments.

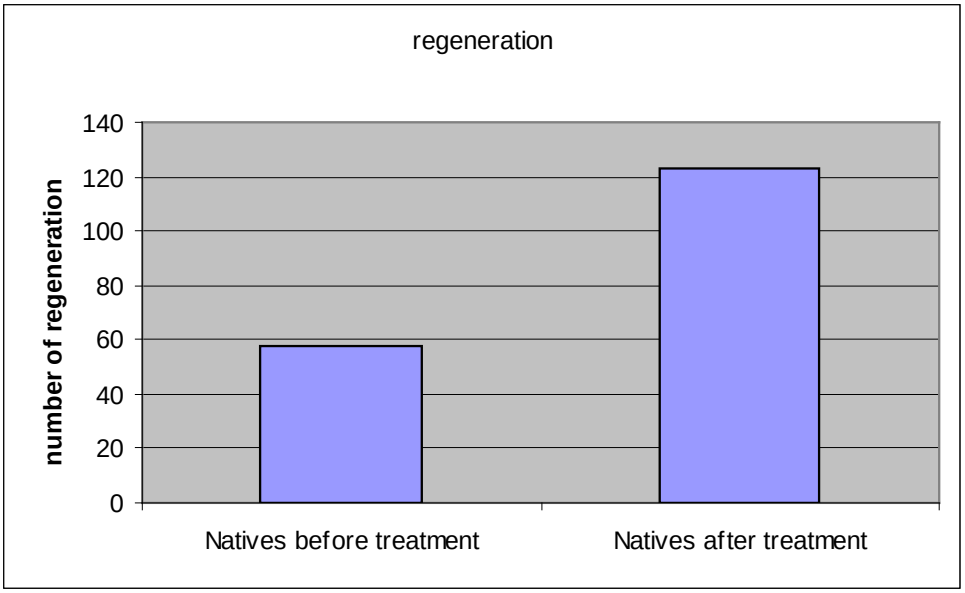


Figure 3. Regenerative native forest tree seedlings before and after *P. undulatum* control

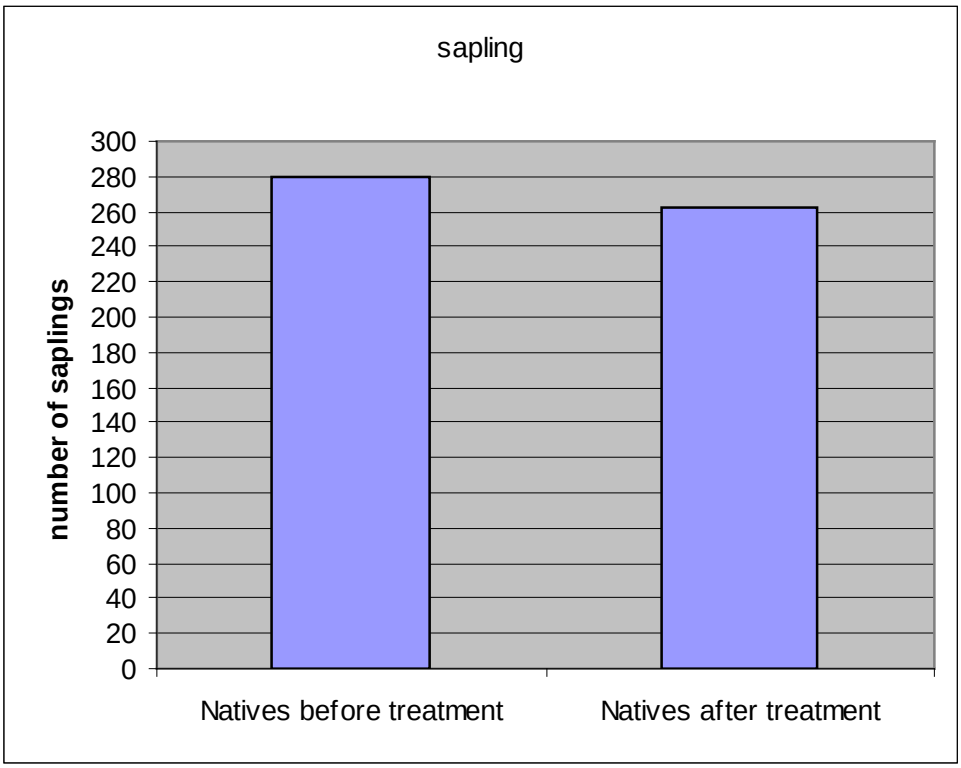


Figure 4. Native forest tree saplings before and after *P. undulatum* control

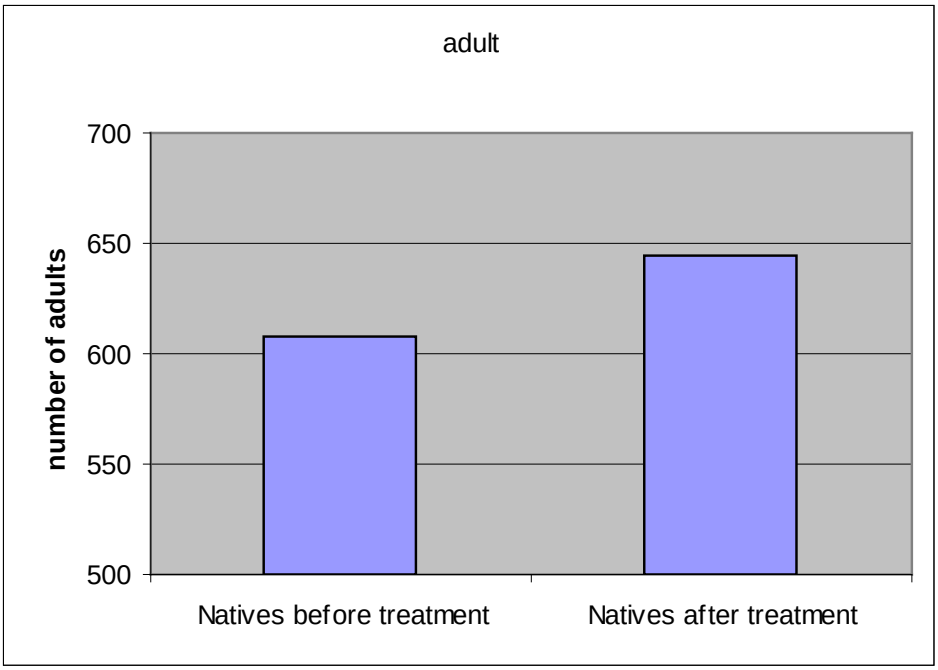


Figure 5. Native adult forest trees before and after *P. undulatum* control

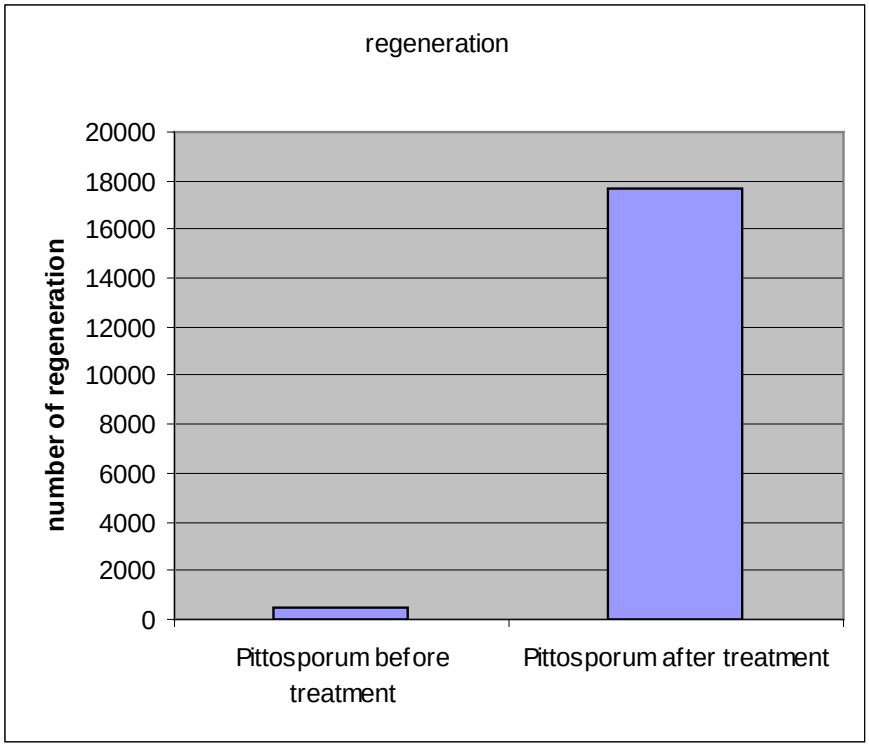


Figure 6. Regenerative *P. undulatum* before and after control

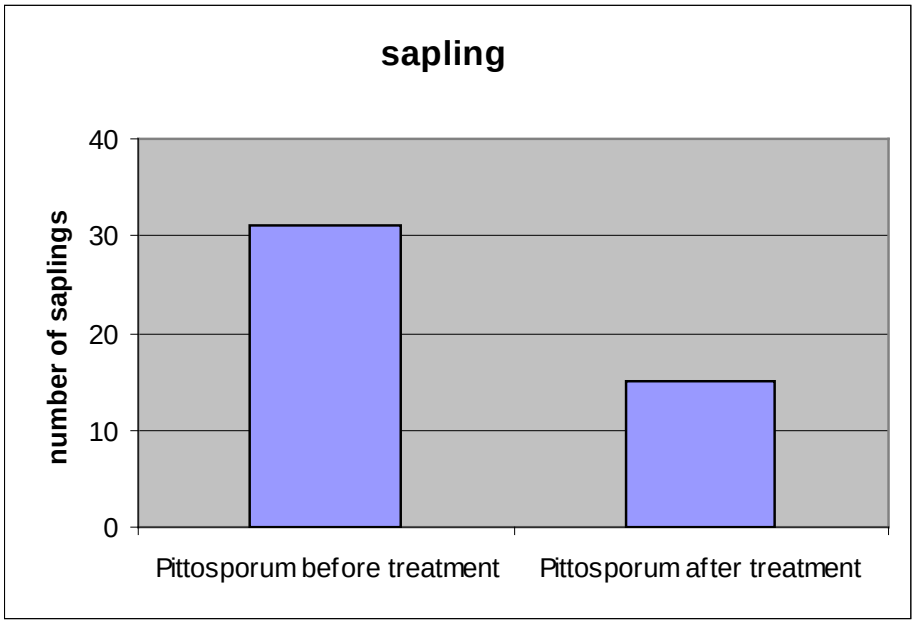


Figure 7. *P. undulatum* saplings before and after control

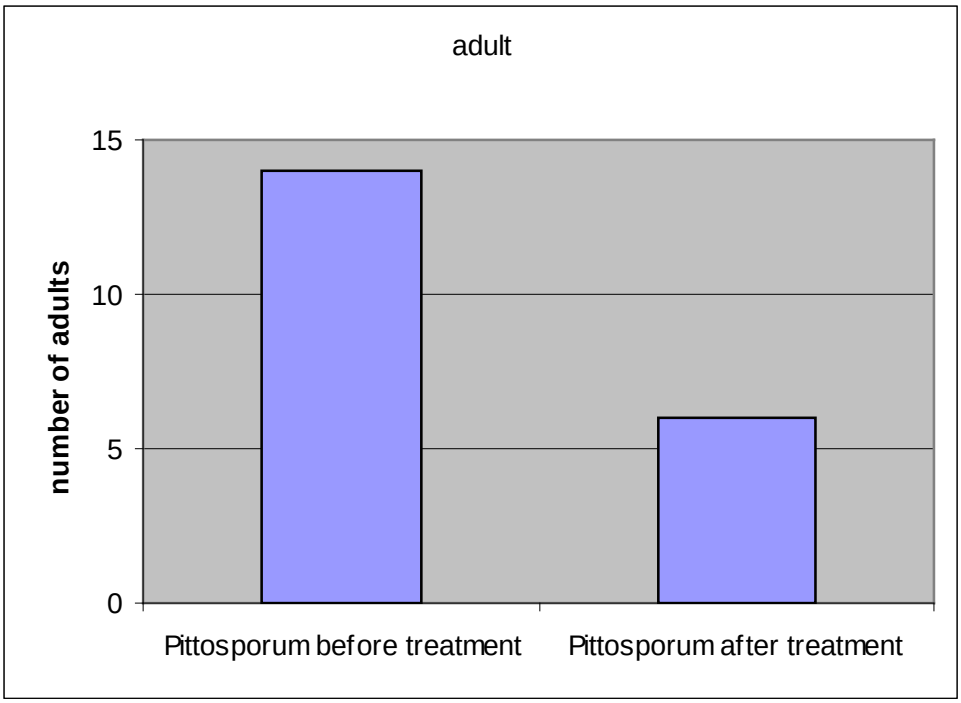


Figure 8. Adult *P. undulatum* before and after control

A total of 766 native fast-growing forest tree seedlings were replanted in the rehabilitated areas, and these seedlings have demonstrated an impressive 90% survival rate (Table 2).

Native tree seedling	**Number planted**
Alchornea latifolia	400
Clethra occidentalis	115
Podocarpus urbanii	180
Sapium jamaicensie	71
TOTAL	**766**

Table 2. Native fast-growing forest tree seedlings planted in rehabilitated areas

The montane rainforest along the Blue Mountain Peak Trail

Plots being established by the Forest Department

Interpretive Sign erected along the Peak Trail to educate hikers

Park Ranger taking measurements of large *P. undulatum* tree

Community worker removing *P. undulatum* seedlings from the Trail

Park Ranger administering control treatment to adult *P. undulatum*

***P. undulatum* being injected with herbicide**

Community worker transporting native tree seedlings to be planted out in the area

***P. undulatum* dying back approximately 8 weeks after being given control treatment**

***Podocarpus urbanii* seedling growing well after being planted out to replace invasive plant**

***Alchornea latifolia* (dovewood) seedling planted out along the Peak Trail**

***Gleichenia* sp. removed from invaded area**

***Podocarpus urbanii* seedling planted out after *Gleichenia* sp. removal**

Native seedlings planted out in circle weeded area invaded by Wynne grass