Pilot Study of Arboreal Rat Density within Ark in the Park, Waitakere Ranges, New Zealand.

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Ami Maxwell ascending a tree.

Abstract

Ark in the Park (AiP) is a mainland sanctuary centered on Cascade Kauri, in the Waitakere Ranges Regional Park, New Zealand. AiP aims to restore a functioning ecosystem through intensive pest control and reintroduction of native species. The AiP aims to obtain zero density for rats. AiP uses ground based monitoring and pest management methods, but has never monitored within the forest canopy for rat activity. This study aimed to see if the canopy is harboring a large population of rats, which could be a source of reinvasion. As AiP tries to manage its rat population, it needs to know where to focus its resources. This study monitored for rats by deploying 25 tunnels in the canopy and 25 tunnels on the ground over 3 nights in January 2012. No sign of rats were found within the 20 tunnels within AiP, a good indication that "canopy rats" are not a significant issue within AiP. However, sample size was too small to be wholly conclusive, and further research is indicated. Funding was received from Auckland Council Biosecurity, and in kind support from Forest & Bird and the AiP volunteers.

Introduction

Rats, mice, possums and mustelids have plagued the New Zealand ecosystem since their introduction (Brockie, 1992). These animals have prospered in a country naturally defenseless to these predators (Wilson, 2004). This has lead to the reduction of many of New Zealand's native and endemic species, and to the extinction of many others (Innes 2001; Bell, 1978). In an attempt to curb the decline in biodiversity in New Zealand, the Department of Conservation (DOC), has eradicated pests on several offshore islands; these islands greatly contribute to genetic diversity and serve as a haven for many species (Towns & Broome, 2003). After the success of these offshore islands, DOC has invested further time and money to develop 'mainland islands' of biodiversity (Innes, et al., 1995).

Ark in the Park (AiP), is a partnership between Forest & Bird and the Auckland City Council, and is supported by Te Kawerau a Maki. AiP is restoring a functioning ecosystem through intensive pest control, recovery of remaining native species, and reintroduction of native animals and plants lost from the region. The AiP pest control

area is approximately 2300 hectares (as of October 2011) in the Waitakere Regional Park, centered around Cascade Kauri. In addition, there is a buffer zone of approximately 600 hectares where owners of neighboring private properties also carry out some pest control.

Since the inception of AiP in 2003, the rat density has plummeted from 60%-90% to 1%-5% due to intensely ground based pest management methods (De Poorter, 2010). *Rattus rattus*, (R. rattus) is the most common rat species trapped at AiP. Of the 861 rats that had been trapped between 2003-2010, only one was ever found to be a *Rattus norvegicus* (Colgan, 2010). *R. rattus* are excellent climbers (Innes, 1990). Radio tracked *R. rattus* have been found to be mostly arboreal, with 73% of tracked locations being above 2m (Dowding & Murphy, 1994).

The rodent and mustelid monitoring guidelines set forth by DOC (Gillies, 2002) only advise on the use of monitoring tunnels on the ground. Current literature on arboreal rat biology is sparse. AiP conducts its pest control methods via the ground. However, as research has shown, *R. Rattus* live and feed both on the ground and in trees (Innes, 2001). AiP has greatly lowered its rat population, but not reduced numbers to zero. This research aims to see if the canopy is a likely source of reinvasion. By getting a better understanding of arboreal rat abundance, we can better understand where the few remaining pests are surviving. Once we understand where they are persisting, more targeted pest control methods can be used and AiP can focus its limited resources in the most effective manner.

Materials and Methods

In order to establish the arboreal rat density within AiP, the climbing group followed the nationally standardized rodent and mustelids monitoring guidelines set forth by Gillies and Williams (2002). The guidelines are simple when carried out on the ground, but these basic procedures are rapidly complicated once within the canopy. The AiP climbing group monitored 20 trees within AiP and 5 control trees (Figure 1, all maps courtesy of Maurice Colgan). These trees were in four separate areas, near the Whatitiri stream, Waitakere Dam, Anderson's track and the control trees within

the Sharps Bush area, 2 km from AiP (Figures 2, 3, 4, and 5 respectively). A total of 50 tunnels were deployed, 25 within the canopy and 25 on the ground, 2 for each tree.

Figure 1. Ark in the Park within yellow lines and climbing tree groups, circled in red.

Figure 2. Whatitiri group of trees.

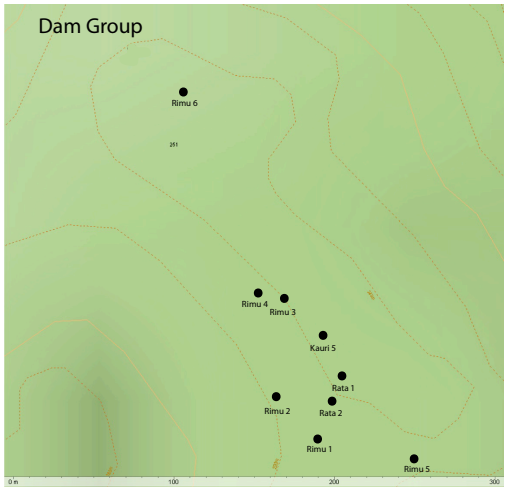

Figure 3. Waitakere dam group of trees

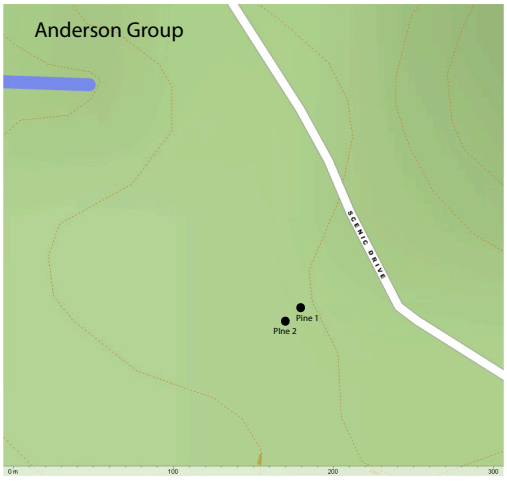

Figure 4. Anderson group of trees.

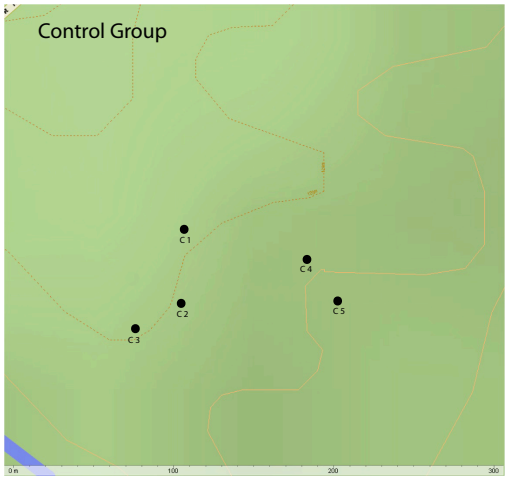

Figure 5. Control group of trees.

The AiP climbing group had established climbing routes within twenty AiP trees before this project began. The trees were chosen with the idea of monitoring for geckos. The climbing trees were composed of kauri, rimu, kahikatea, pukatea, tawa, miro, rata and radiata pine. Fifteen of these trees had monitoring tunnels within their

canopy and the remaining five were set up. Ground based monitoring tunnels were placed within 3m of the base of each tree. Five additional trees were set up for the control in the Sharps Bush area. The climbing team attempted to duplicate the species variety of the initial climbing trees for the control area. The tunnels were placed at various heights, based on climber accessibility, height of tree and a suitable location to place the tunnel (Table 1). The monitoring tunnels were not used for at least 3 weeks, as rats are neophobic (Innes, 1990).

The 'black trakka' monitoring tunnels were modified to withstand being left in the canopy for an extended period of time (Figure 6). The tunnels were secured to a wooden plank, which was fastened to the tree with rope. Tyre tubing was attached to this rope for additional tension. Due to the canopy being windier than the ground, the inkpads were paper clipped into the tunnels and the lure, peanut butter, was securely fastened (Figure 6).

Figure 6. Monitoring tunnel secured to a tree and peanut butter securely fastened to an ink card.

All AiP climbers received climbing training before carrying out this research project. We had two days of climbing training from an experienced climber, and one day of practical. The AiP climbing group has a strict safety protocol, which requires there be at least 2 trained climbers and a safety person for all climbs. The AiP climbing group

supplied the climbing gear for this project. To set a tree up for climbing, an initial thin line is hand thrown or shot over the safest looking branch. This thin line is then used to pull up builders' line, which is then used to pull up the two thick climbing lines. Once the two climbing lines are in place, weight tested and securely tied off, the climber can begin their ascent.

Figure 7. Clockwise from top left, Ami Maxwell descending a radiata pine (photo courtesy of Stuart Park). View from the top. Some of the AiP climbing team; Ami Maxwell, Jeff Ninnes, Stuart Park, Grant Capill and safety assistant Ben Hayes. Ami Maxwell with a tunnel secured in place.

Results

This project found no rats tracked in the canopy, or on the ground within AiP (Table 1 and 2). One rat was tracked in the canopy, and 3 rats tracked on the ground within the control area (Table 1 and 2). Also, for comparison, the data from AiP's quarterly monitoring, carried out over the 14th and 15th of January 2012 is included (Table 3). Volunteers monitored 170 tunnels within AiP, 10 control tunnels in each Sharps Bush, Spraggs Bush and Wainamu Bush Track.

Table 1. Tree number, species, group, tunnel height (measured from high side of tree) and number of arboreal and ground rat prints, respectively.

Tree Number	Tree Type	Tree Group	Tunnel Height (m)	Arboreal Rat Prints	Ground Rat Prints
1	Kauri	Whatitiri	17.9	0	0
2	Kauri	Whatitiri	13	0	0
3	Kauri	Whatitiri	11	0	0
4	Kahikatea	Whatitiri	9.1	0	0
5	Pukatea	Whatitiri	7.6	0	0
6	Kauri	Whatitiri	12.2	0	0
7	Kauri	Whatitiri	15.2	0	0
8	Miro	Whatitiri	10	0	0
9	Tawa	Whatitiri	8.4	0	0
10	Pine	Anderson	13	0	0
11	Pine	Anderson	14.8	0	0
12	Rimu	Dam	10.1	0	0
13	Rimu	Dam	8.5	0	0
14	Rimu	Dam	10.2	0	0
15	Rimu	Dam	9.2	0	0
16	Rimu	Dam	9.8	0	0
17	Rata	Dam	12.2	0	0
18	Rata	Dam	9.1	0	0
19	Kauri	Dam	10	0	0
20	Rimu	Dam	8.1	0	0
C 1	Rimu	Control	14.7	0	0
C 2	Kauri	Control	9.1	0	0
C 3	Miro	Control	13.1	0	1
C 4	Kauri	Control	9.5	0	1
C 5	Rimu	Control	12.5	1	1

Table 2. Calculation of rat presence

Calculation of rat presence = (tunnels tracked / total number of tunnels) X 100
AiP arboreal rat presence = 0% AiP ground rat presence = 0%
Control arboreal rat presence = (1/5) X 100 = 20% Control ground rat presence = (3/5) X 100 = 60%

Table 3. Calculation of rat presence from quarterly AiP monitoring data, January 2012 (Courtesy of AiP monitoring archives).

AiP = (5/170) X 100 = 3%
Control area = (18/30) X 100 = 60%

Discussion

The monitoring was conducted over three consecutive weekends, January 14th, 15th, 21st, 22nd, 28th and 29th, 2012. The monitoring was only possible with the help of volunteers, and as such monitoring days were dictated by their schedule. All three weekends had fluctuating weather with sun, clouds and light rain. However, the canopy monitoring coincided with the AiP quarterly monitoring on January 14th and 15th, 2012. The weather was not ideal, but quarterly rat monitoring within AiP is volunteer run, and is conducted regardless of weather. The project attempted to monitor on 'fine nights,' but due to volunteer availability, this was not always possible.

The results indicate that the AiP canopy is not harboring a large population of rats. The presence of rat prints within the arboreal tunnels in the control area confirms the monitoring technique used was successful. I have included the AiP quarterly monitoring data (Table 3). This shows a 60% rat presence in the control area, the same rat presence I found in my ground control area, there is a similarity between these datasets. However, the very small scale of this project means only a small proportion of trees were monitored within AiP. Gillies and Williams (2002) suggest 150 tunnels for monitoring 2000 hectares; this project only monitored 20 trees within AiP's 2000 hectares. Hence, while this study resulted in a good indication that canopy

rats, are not a significant issue within AiP, sample size was too small to be wholly conclusive, and further research is warranted.

Recommendations for further study

I believe further arboreal monitoring would be advantageous to understanding this little understood and complex habitat.

Selection of location: the trees used for monitoring the canopy were chosen by the AiP climbing group in the search for geckos. The trees were chosen for potential gecko harboring areas and relatively easy accessibility. Further study would benefit from targeting specific areas in the AiP where, in spite of ongoing pest control, residual rats are found or where bait consumption is consistently higher than the surrounding areas.

Selection of trees: AiP's climbing group chose the climbing trees within AiP before I started my project. Some of the climbing trees had large masses of epiphytes, and habitat suitable for rats, while others were relatively bare, with no protected area for a rat to linger. As the team developed climbing efficiency, they were able to monitor in more challenging trees, i.e. more epiphytes and larger. In future studies, I recommend monitoring trees with epiphytes, as they provide more potential rat habitat. Due to the logistically complicated nature of conducting any survey within the canopy, I think it would be beneficial to maximize potential rat harboring areas.

Monitoring Duration: We also recommend monitoring for 7 nights, as much work is required for arboreal monitoring. Monitoring over a longer period of time would yield a better picture of what is happening in the canopy, while reducing climbing time.

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