The effect of possum control on northern rata in Tararua Forest Park

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by P. N. Crisp

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CONTENTS

Executive Summary

Northern rata (*Metrosideros robusta*) is thought to have undergone a large contraction in its natural distribution in Wellington Conservancy and possum browse has been implicated in this decline. The condition of northern rata trees was assessed at two locations in Tararua Forest Park where possums are being controlled on a seven-year rotation. These two locations differed in the time since possum control had occurred (one year and two years since control). Trees were also assessed in nearby areas where possums are not being controlled. It was found that northern rata trees in the area that had received possum control two years before assessment were in a better condition than those that grew in areas where no possum control had been undertaken. Differences between the two treated areas (one year and two years since control) were not significant for three of the four tree condition scores. It appears that improvement in northern rata following possum control is not consistently evident until two years after control has occurred, although a trend towards improvement in tree condition with time was evident. The results suggest that northern rata is a good indicator species for assessing possum impacts and the techniques used here may aid management decisions about an appropriate rotation time for possum control to protect northern rata from possum browsing.

1. Introduction

Northern rata (*Metrosideros robusta*) is still a major component of some forest types in the Wellington Conservancy, though it is thought to have undergone a large contraction in its natural distribution (McKessar & Sawyer, 1999). An emergent tree species, northern rata can reach 30 m in height (Wardle, 1991), and grows in mixed coastal, lowland and montane forest communities, at altitudes of up to 700 m (Allan, 1961). It is found throughout the North Island and southwards to Westport in the South Island. Northern rata usually begins life as an epiphyte perched on a host tree, such as rimu, but terrestrial trees may establish following a disturbance (Knightbridge, 1993). This tree species is important in forest ecosystems, as its high nectar output provides a food source for indigenous honey-eating birds and insects.

Possums have been implicated in the demise of northern rata trees. They are thought to feed preferentially on the foliage of epiphytic rata (Cowan, 1990). Possums eat leaves, buds, flowers and young shoots of the tree and studies have found that rata may constitute up to 30% of the possum diet (Fitzgerald, 1976; Meads, 1976). Northern rata studied in the Orongorongo valley have undergone episodic dieback, once between 1930 and 1950, and again during the 1970s (Cowan *et al.*, 1997). The second episode occurred when high possum numbers coincided with a major drought. Detailed recordings of possum browse on northern rata have been made by Meads, (1976), who also noted recovery in trees from which possums had been excluded. Other factors such as the synchronous senescence of cohorts of the species, insect browse and soil fertility may play a role in the local decline of northern rata populations (Knightbridge & Ogden, 1998).

A project to determine the status of northern rata in the Wellington Conservancy was funded by Project Crimson in 1998. An objective detailed in the resulting report, (McKessar & Sawyer, 1999) was to ensure the continued survival of northern rata throughout its current range.

The aim of the current investigation was to assess the effect of possum control on the condition of northern rata trees in the Tararua Forest Park. The Department of Conservation controls possums in the park by the aerial application of the pesticide 1080 and by ground control in some lowland areas. Each year, 8,000–10,000 ha are controlled, as part of a seven-year, rotational plan for possum control. In 1938, Zotov *et al.* (1938) recorded that rata was the dominant of the climax plant associations in the wetter areas of the Tararua ranges. The deaths of scattered northern rata in the Tararuas in the 1950s and the virtual elimination of this species from the nearby Aorangi Range has been attributed to possum browse (Brockie, 1992). In order to investigate the effect of possum control on the condition of northern rata, we selected trees from sites that had not received possum control and from sites that had received control prior to one growing season and to two growing seasons, in and around the Tararua Ranges.

2. Methods

SITES

Aerial surveys undertaken in January 1997 and January 1999 (at the time of flowering, when rata are conspicuous from an aeroplane) gave the locations of over 100 rata trees in and around the Tararua Forest Park. Grid references for rata trees recorded in previous plot surveys or by botanists/hunters/trampers were also obtained from database records (Wellington Conservancy database). This information was used to plan ground surveys at sites in the autumn of 2000 where it was expected that at least 30 trees could be located and assessed. The numbers of rata trees located aerially were regarded as only an estimate, as some trees identified may have been kamahi (which also had a red appearance at the time of the survey). Rata trees not flowering in January would have been missed, because they were not readily identifiable from the aeroplane. The three treatments selected were:

Non-treatment

No possum control received

Treatment 1

Possum control received prior to 1 growing season (1999)

Treatment 2

Possum control received prior to 2 growing seasons (1998)

There were difficulties in finding 30 accessible rata trees at Treatment 1 and the use of more than one location were needed for the non-treatment. These locations are detailed in Table 1 below.

TABLE 1: NUMBER OF TREES AT EACH LOCATION USED FOR EACH OF THREE TREATMENTS.

AREA	YEAR OF POSSUM CONTROL	NUMBER OF GROWING SEASONS SINCE POSSUM CONTROL	NUMBER OF RATA TREES
Kapakapanui Akatarawa Avro Road	No possum control (non-treatment)	0 0 0	10 11 9
Waingawa	1999	1	20
Totara Flats	1998	2	30

These locations are shown in Figure 1.

SITE HISTORY

Non-treatment area

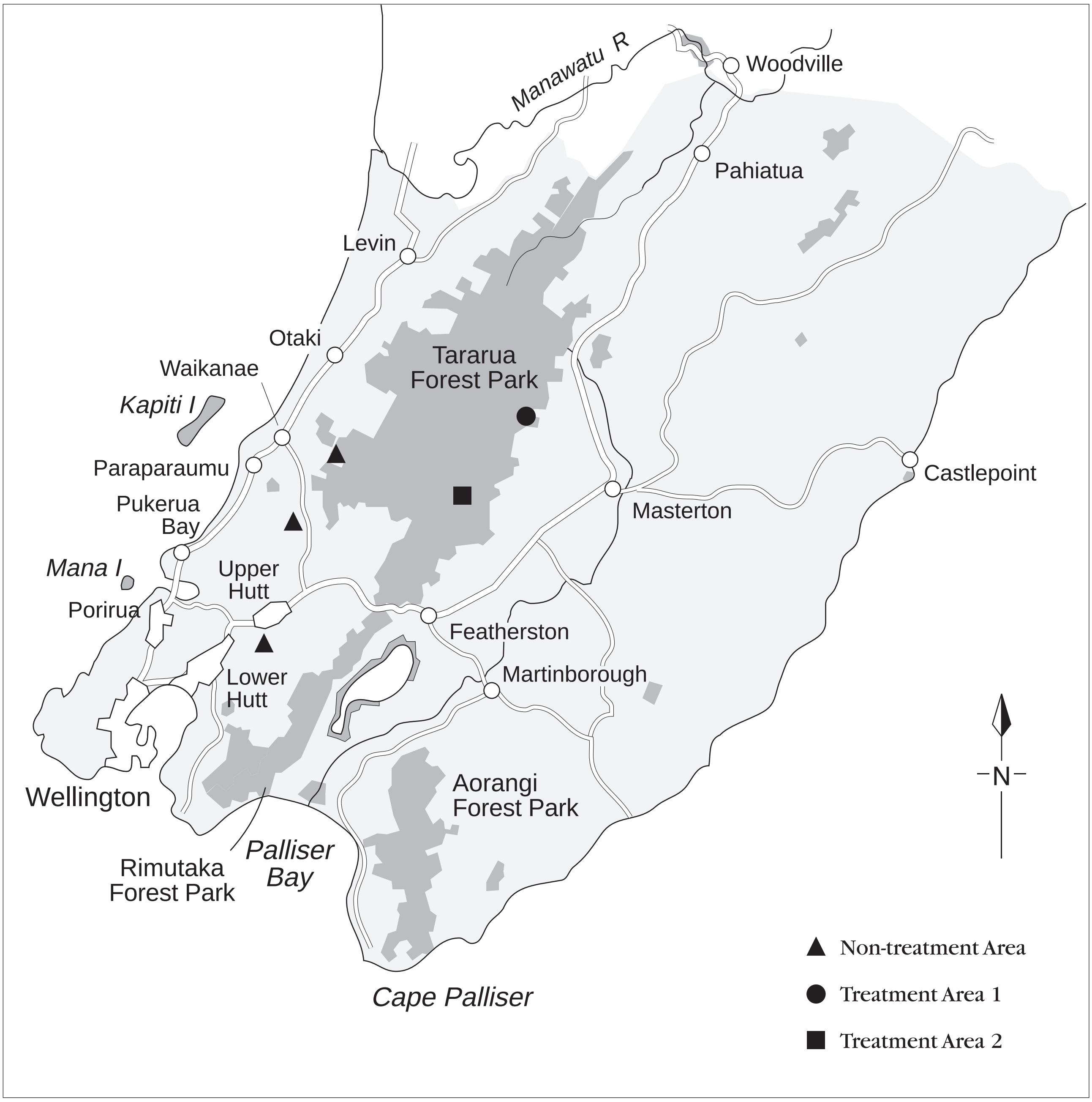
No official possum control has occurred in the non-treatment sites within at least the past 10 years (Department of Conservation files). Commercial possum hunters would have removed possums from areas but the numbers taken are unlikely to have been sufficient to have a consistent effect over the possum density of the area.

The three locations are within 30 km of each other. No possum trap catch rates have been undertaken at these sites, but data obtained from the Wellington Regional Council in 1998, showed a trap catch mean of 20% in native bush in the general area.

Treatment area 1 (Waingawa)

Trees selected in this treatment came from two contiguous operational zones. Twelve trees were in an area controlled by a 1080 operation in May 1999, while the other eight trees were in an area controlled by 1080 in September 1999. The pre-control trap catch was 34% in the latter operation and the mean of the post-control trap catches for the two operations was 3.2%. A complicating factor in this treatment is that the area controlled in May 1999 had been controlled 5 years earlier, whereas no control had previously been undertaken in either the September, 1999 area or at the Totara Flats area (Treatment Area 2). Pre-control data is not available for the May operation, but it is assumed that possum numbers had returned to carrying capacity by the time the operation was undertaken. It is also assumed that there has been one season's growth (January to March), (see Discussion) on all trees since possum control was undertaken.

FIGURE 1: LOCATIONS OF NON-TREATMENT, TREATMENT 1 AND TREATMENT 2 AREAS



Treatment area 2 (Totara Flats)

Possum control was undertaken in the Totara Flats area using ground control techniques. A pre-operational trap-catch rate of 34% was recorded in June 1998 and possum control began in December 1998. The possum trap catch rate was down to 9.6% by March 1999. The contractor continued to work on the block throughout autumn and in May 1999, the trap catch rate was 3.5%. It is assumed that there has been two seasons' growth on all trees since possum control numbers were lowered in this area.

ASSESSMENT TECHNIQUES

Trees were selected throughout the site range, but the availability of viewing sites made random selection not viable. Trees were sampled from a range of aspects, slopes and altitudes. Individual trees were assessed using techniques described by de Monchy & Ogle, (1999). Trees were scored using 8x power binoculars at distances up to 500 m Three assessments were made: Rata View, which gives an indication of the general condition of the tree (Scores 1–6); Foliage Thickness, which estimates leaf growth (Scores 1–6); and Perimeter Dieback, which is a percentage estimate of dieback on the perimeter of the tree. The scoring systems for these assessments are shown in Appendix 1. An assessment of Foliage Cover (%), as described by Payton (*et al*., 1997) was also made and a photograph taken of each tree.

DATA ANALYSES

The Rata View and Foliage Thickness scores are numerical class score data without equal interval classes and were analysed using non-parametric tests. The Kruskal-Wallis test was used to determine whether there were significant differences between treatment means, while multiple comparisons of means were made using the Dunn test (Zar, 1996). Perimeter Dieback and Foliage Cover scores are numerical class score data with equal interval classes and Analysis of Variance was used to determine whether there were any significant differences between treatment means. The Newman-Keuls multiple comparison test was used for multiple comparisons of means.

The non-parametric testing procedure does not involve the estimation of means and their population variance, as observations are ranked and tests are made on the rank sums, not on the means. No confidence levels are calculated and theoretically means should not be tabled. Mean Rata View and Foliage Thickness scores will be presented here however, in order to compare these results with those of other workers (see Discussion).

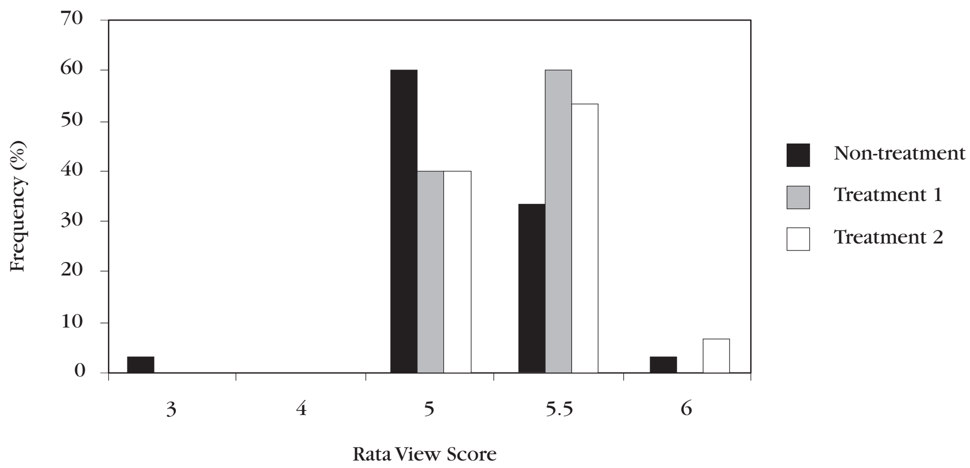
The raw data is shown in Appendix 2, while the records for tree locations and photographs are held at the Wellington Conservancy office. Grid references for each tree site have been entered onto the Wellington Conservancy Plants database.

3. Results

RATA VIEW

Only one tree of the 60 surveyed had a Rata View score below 5; this was a tree at Kapakapanui (no possum control). All other trees had at least 50% of their fine branches foliated (see criteria Appendix 1). No significant differences between rank sums (Zar, 1996) for Rata View scores in the non-treatment area and the treatment areas were found. A trend towards higher Rata View scores can be detected, however, in the areas that had been controlled for possums (see Figure 2).

FIGURE 2: FREQUENCY OF RATA VIEW SCORES FOR NORTHERN RATA TREES LOCATED IN NON-TREATMENT AREAS (NO POSSUM CONTROL) AND TREATMENT AREAS (POSSUM CONTROL).



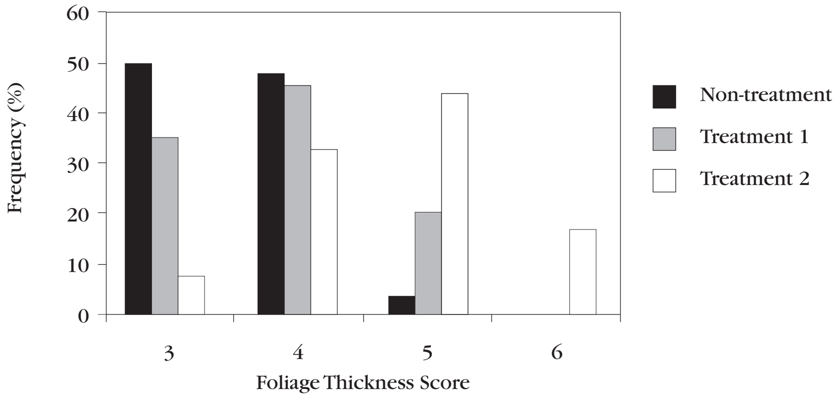
Mean Rata View scores were 5.13 (Non-treatment), 5.30 (Treatment 1) and 5.33 (Treatment 2).

FOLIAGE THICKNESS

The Kruskal-Wallis test showed a significant difference between treatments for Foliage Thickness (P=0.001). The mean rank sums for Treatment 2 were significantly higher than the mean rank sums for the non-treatment area (P=0.001) and for Treatment 1 (P=0.005). No significant differences were found between the non-treatment and Treatment 1. Mean Foliage Thickness scores were 3.53 (Non-treatment), 3.85 (Treatment 1) and 4.70 (Treatment 2).

Only one tree scored 5 for thickness in the non-treatment, whereas 5 trees had a foliage thickness score of 6 in Treatment 2. The trend towards higher foliage thickness scores with time since possum control can be seen in Fig. 3.

FIGURE 3: FREQUENCY OF FOLIAGE THICKNESS SCORES FOR NORTHERN RATA LOCATED IN NON-TREATMENT AREAS (NO POSSUM CONTROL) AND TREATMENT AREAS (POSSUM CONTROL)



PERIMETER DIEBACK

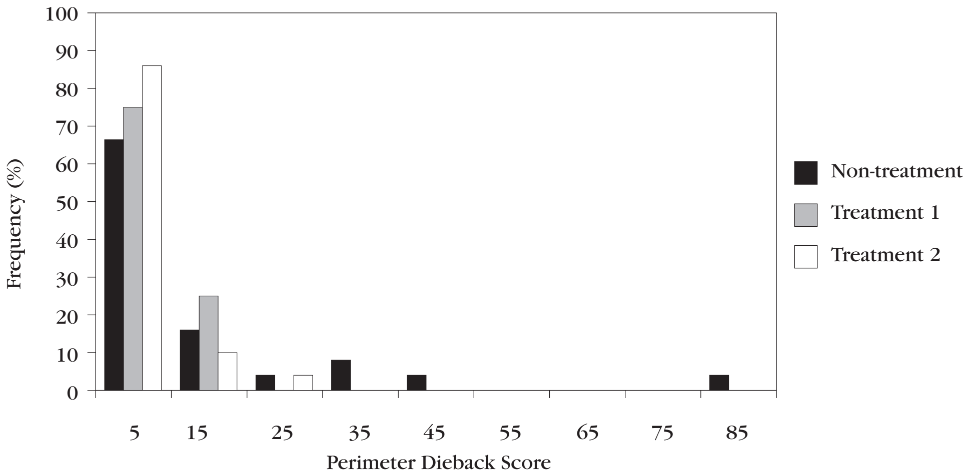
The analysis of variance for Perimeter Dieback showed significant differences between treatments at P=0.05. Mean Perimeter Dieback in Treatment 2 was significantly lower than in the non-treatment area (P=0.025), There were no significant differences between Treatment 1 and the non-treatment area or between Treatment 1 and Treatment 2. Mean Perimeter Dieback scores and the standard errors are shown in Table 2.

TABLE 2: MEAN PERIMETER DIEBACK IN TREATMENT AND NON-TREATMENT AREAS.

TREATMENT	MEAN PERIMETER DIEBACK SCORE	NUMBER OF TREES	STANDARD ERROR
Non-treatment	13.3	30	3.1
Treatment 1	7.5	20	1.0
Treatment 2	6.6	30	0.8

The trees in the non-treatment area showed a much greater variability in Perimeter Dieback scores than those in possum controlled sites, as can seen in Fig. .4.

FIGURE. 4: FREQUENCY OF PERIMETER DIEBACK SCORES IN NORTHERN RATA TREES LOCATED IN NON-TREATMENT AREAS (NO POSSUM CONTROL) AND TREATMENT AREAS (POSSUM CONTROL)



FOLIAGE COVER

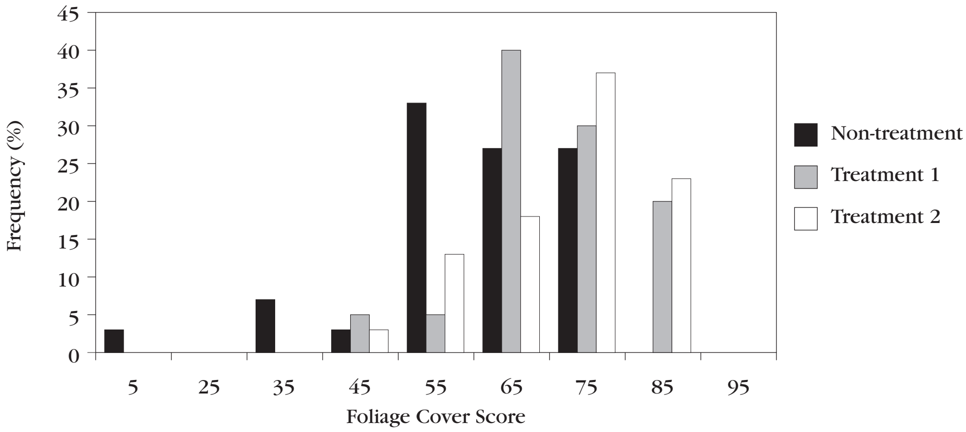
An analysis of variance for Foliage Cover showed significant differences between treatments at P=0.001. Mean Foliage Cover scores in Treatment 2 and Treatment 1 were significantly higher than in the non-treatment area at P=0.001 and P=0.005, respectively. No significant differences were found between Treatment 1 and Treatment 2. The mean Foliage Cover scores are shown in Table 3.

TABLE 3: MEAN FOLIAGE COVER SCORES IN TREATMENT AND NON-TREATMENT AREAS

TREATMENT	MEAN FOLIAGE COVER SCORES	NUMBER OF TREES	STANDARD ERROR
Non-treatment	59.6	30	2.8
Treatment 1	70.5	20	2.4
Treatment 2	71.3	30	2.0

Three trees in the non-treatment area had very low Foliage Cover scores, as can be seen in Fig. 5.

FIGURE. 5: FREQUENCY OF FOLIAGE COVER SCORES IN NORTHERN RATA LOCATED IN NON-TREATMENT AREAS (NO POSSUM CONTROL) AND TREATMENT AREAS (POSSUM CONTROL)



RESULTS SUMMARY

Statistical differences between treatments are summarised in Figure 6. It can be seen that there were significant differences between Treatment 2 and the non-treatment for three of the four assessment methods. Differences between the non-treatment and Treatment 1, and between Treatment 1 and Treatment 2 were not significant for three of the four tree condition scores.

TABLE 4: STATISTICAL DIFFERENCES BETWEEN TREATMENTS FOR ALL FOUR ASSESSMENT SCORES.

DIFFERENCE	RATA VIEW	FOLIAGE THICKNESS	PERIMETER DIEBACK	FOLIAGE COVER
Non-treatment vs Treatment 1	Ns[1]	Ns	Ns	Sig[2] 0.005
Non-treatment vs Treatment 2	Ns	Sig 0.001	Sig 0.025	Sig 0.001
Treatment 1 vs Treatment 2	Ns	Sig 0.005	Ns	Ns

[1] *Ns: Not significant*
[2] *Sig: Significant difference*

4. Discussion

Northern rata trees growing in sites that had received possum control two growing seasons prior to assessment were in better condition than those that were located in areas that had not received possum control. Significantly greater mean Foliage Thickness and Foliage Cover scores and significantly lower mean Perimeter Dieback scores were found in Treatment 2, in comparison to the mean scores for the non-treatment area. While significant differences between treatments were not consistent for the four parameters assessed, a trend was seen towards improvement in tree condition over time.

A negative relationship between Foliage Thickness and possum trap-catch rate has been found by de Monchy & Ogle, 1999, who also noted a positive relationship between Perimeter Dieback scores and possum trap-catch rates. These authors scored northern rata tree condition at various sites in the Waikato in 1998. Trees on Little Barrier Island, where no possums are present, were also scored and mean Rata View and Foliage Thickness were 5.65 and 5.4 respectively. These mean scores are higher than those found in our Treatment 2 area of 5.3 for Rata View and 4.7 for Foliage Thickness. However, similar mean scores to those found here were found in Moehau, Coromandel, where possums were controlled to 2% trap-catch rates (5.6 for Rata View and 4.8 for Foliage Thickness). Mean Perimeter Dieback Scores were 4.4% on Little Barrier Island and 6.5% at Moehau, while the mean score for Treatment 2 in this investigation was 6.7%. The condition of tree species, such as fuchsia, as measured by foliage cover, has previously been related to the density of possums measured at the site (Pekelharing *et al.*, 1998).

Greater Foliage Thickness and Foliage Cover scores in possum-controlled sites suggest that the trees in the possum controlled area have been able to produce new growth in the absence of possum browse. The work of Meads, (1976) in the Orongorongo valley showed that leaves may remain on northern rata trees for up to 3–4 years, but possum browsed leaves were shed earlier than undamaged leaves.

New growth is not produced in response to the browse (Fitzgerald, 1976) and any response to possum control will not be seen until after the new season's vegetative growth. This vegetative growth generally occurs after flowering (December, January), (Meads, 1976). Treatment 1 did not have significantly greater foliage thickness or perimeter dieback than the non-treatment area. This may be because more time is needed before significant foliage growth occurs. Possum control occurred only six months prior to assessment for 8 of the 20 trees in this treatment. It was assumed in this investigation that the trees in Treatment 1 have been able to produce at least one season's growth, while those in Treatment 2 were able to produce two seasons' growth.

There is variation between individuals in the degree of possum damage found on trees in the no possum control area. This is in agreement with observations made by Meads, (1976) and Knightbridge, (1996). The trees in the non-treatment localities used here were in better condition than was expected. Only one tree showed greater than 50% defoliation. It is difficult to compare these data with areas described by de Monchy & Ogle, 1999, as a trap-catch rate for our non-treatment area is not available. In general, however, the Rata View and Foliage Thickness scores found in the non-treated sites in Waikato were lower (and Perimeter Dieback scores higher) than those found in this study. The mean Foliage Cover of 59.7% found in our non-treatment area is higher than that found by Knightbridge, (1996) in nearby Eastbourne Bay forests (51%), where 81 terrestrial northern rata trees were assessed prior to possum control in the area. The sampling technique used in this study may have contributed to the differences mentioned above, as dead or nearly dead trees were not selected in this investigation. One goal of this work was to obtain information about tree condition that could be reassessed over time and it was considered that the inclusion of dead trees would be less useful. The number of trees assessed in each area in this investigation was not high (30 trees). It would have been preferable, statistically, to have more trees, but there were difficulties in finding a greater number of accessible trees in each treatment.

The data obtained in this investigation provides a baseline for further studies. The differences in tree condition found here may be due to differences between areas, but further monitoring will detect whether this is a continuing trend. When changes in individual trees can be tracked over time, differences due to site will be minimised. In the operational areas used for this investigation, it is assumed that possum numbers will rebuild over time until a level is reached where they again impact on the health of the northern rata trees. At present, the possum plan for the Tararua Forest Park has a return time for possum control of 7 years. The northern rata trees may be a good indicator species to use to determine if this return time is suitable. It was noted in the field work for this project that very few small northern rata were observed, even in areas that supported large numbers of rata trees. The data set contains only four epiphytic rata, all larger than their rimu hosts (the rest were all self-standing mature trees). No epiphytic rata smaller than the host species were seen. While this pattern may result from the episodic-seeding nature of rata, it is possible that possums selectively feed on such small rata and are contributing to the long-term decline of species. A survey of northern rata trees from a perspective of age or development would give a clearer picture of the health of the population.

5. Acknowledgements

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Appendix 1

RATA VIEW SCORING CRITERIA (FROM DE MONCHY & OGLE, 1999)

Rata View Score

Score	*Criterion*
1	Definitely dead, no fine branches
2	Probably dead, no foliage observed, fine branches present
3	Very poor condition, no foliage seen at first glance, fine branches present
4	Poor condition, less than 50% of fine branches foliated
5	Moderate condition, more than 50% of fine branches foliated but significant dieback present, foliage generally thin
5.5	Good condition, some dieback, generally thick foliage
6	Very good condition, little or no dieback, thick foliage

Foliage Thickness Score

Score	*Criterion*	*Mean foliage thickness (approx)*
0	No foliage present	
1	Very poor condition	4 cm
2	Poor condition	8 cm
3	Moderate condition	12 cm
4	Good condition	16 cm
5	Very good condition	20 cm
6	Excellent condition	24 cm

Perimeter Dieback Score

Score	*Percentage dieback on tree perimeter*
5	<10%
15	>10% and <20%
25	>20% and <30%
35	>30% and <40%
45	>40% and <50%
55	>50% and <60%
65	>60% and <70%
75	>70% and <80%
85	>80% and <90%
95	>90%

Appendix 2

RAW DATA FOR RATA TREES ASSESSED

NON-TREATMENT AREAS OBSERVERS: CRISP/HORNE

TREE NO.	PHOTO NO.	RATA VIEW SCORE	FOLIAGE THICKNESS	PERIMETER DIEBACK	ABUND	TIER	STAGE	FOLIAGE COVER	COMMENT
KAPAKAPANUI		16/5/00							
Kap 1	14	5	4	25	O	E	T	55	
Kap 2	15	5	3	35	O	E	T	55	
Kap 3	17	5	3	45	O	E	T	35	
Kap 4	18	5.5	4	5	O	E	T	65	
Kap 5	19	5.5	3	5	O	E	T	75	
Kap 6	20	5	3	15	O	E	T	65	
Kap 7	23	5.5	5	5	O	E	T	75	
Kap 8	24	5.5	4	5	O	E	T	65	
Kap 9	21	3	3	85	O	E	T	5	
Kap 10	25	5	3	5	O	E	T	65	
AKATARAWAS		10/3/00							
Aka 1	1,2	5	4	5	O	E	T	55	
Aka 2	3	5.5	4	5	O	E	T	55	
Aka 3	4	5.5	4	5	O	E	T	55	
Aka 4	5,6	5	4	5	O	E	T	55	
Aka 5	7	5.5	4	5	O	E	T	55	
Aka 6	8	5	3	15	O	E	T	55	
Aka 7	9	5.5	4	5	O	E	T	65	
Aka 8	10	6	4	5	O	E	T	75	
Aka 9	11	5	3	5	O	E	>50%	75	Epiphytic/rimu
Aka 10	12	5	4	15	O	E	T	75	
Aka 11	31,32	5.5	4	5	R	E	>50%	55	Epiphytic/rimu
Aka 12	33,34	5	4	35	R	E	T	75	
AVRO ROAD		10/5/00							
Avr 1	1	5	4	5	C	E	T	75	
Avr 2	2	5	3	15	C	E	T	65	
Avr 3	3	5	3	15	C	E	T	75	
Avr 4	7	5.5	3	5	C	E	T	65	
Avr 5	8	5	3	5	C	E	T	65	
Avr 6	9	5	3	5	C	E	T	55	
Avr 7	10	5	3	5	C	E	T	45	
Avr 8	11	5	3	5	C	E	T	35	

TREATMENT AREA 1: WAINGAWA OBSERVERS: CRISP/HORNE 13/3/00, 14/3/00

TREE NO.	PHOTO NO.	RATA VIEW SCORE	FOLIAGE THICKNESS	PERIMETER DIEBACK	ABUND	TIER	STAGE	FOLIAGE COVER	COMMENT
Don[1] 1	3,4	5	3	5	R	E	T	65	
Wan 1	1,3	5	3	15	O	E	T	85	
Wan 2	4	5.5	4	5	O	E	T	85	
Wan 3	5	5.5	5	5	O	E	T	75	
Wan 4	6	5	3	15	O	E	T	65	Puka on tree
Wan 5	7	5	3	5	O	E	T	65	
Wan 6	9	5.5	4	5	O	E	T	65	
Wan 7	10	5.5	3	5	O	E	T?	65	May be 2 trees
Wan 8	11	5	4	5	O	E	T	65	Dead leaders
Wan 9	12	5.5	5	5	O	E	T	75	
Wan 10	13	5.5	5	5	O	E	T	85	
Wan 11	14	5	4	15	O	E	T	75	
Wan 12	16	5.5	4	5	O	E	T	75	
Wan 13	17	5.5	4	5	O	E	T	55	
Wan 14	18,19	5.5	4	5	O	E	T	65	
Wan 15?	20	5	3	15	O	E	T	85	Not certain
Wan 16?	21	5.5	5	5	O	E	>50%	75	On rimu >50%
Wan 17?	22	5	3	15	O	E	T	65	Not certain
Wan 18	23	5.5	4	5	O	E	T	45	Dead leaders
Wan 19	24,25	5.5	4	5	O	E	T	75	

[1] *Donnelly Flat*

TREE NO.	PHOTO NO.	RATA VIEW SCORE	FOLIAGE THICKNESS	PERIMETER DIEBACK	ABUND	TIER	STAGE	FOLIAGE COVER	COMMENT
Tot 1	–	5	4	15	C	E	T	55	
Tot 2	2	5.5	5	5	C	E	T	75	
Tot 3	3	5.5	5	5	C	E	T	65	
Tot 4	4	5.5	5	5	C	E	T	65	
Tot 5	5	5.5	6	5	C	E	T	85	
Tot 6	6	5.5	6	5	C	E	T	85	
Tot 7	7	5.5	6	5	C	E	T	85	
Tot 8	8	5.5	5	5	C	E	T	75	
Tot 9	9	5	4	5	C	E	T	65	
Tot 10	10	5	4	15	C	E	T	65	
Tot 11	11	5	3	25	C	E	T	55	
Tot 12	12	5	5	5	C	E	T	85	
Tot 13	13	5.5	5	5	C	E	T	85	
Tot 14	14	5.5	5	5	C	E	T	55	
Tot 15	15	5	4	5	C	E	T	55	
Tot 16	16	5.5	5	5	C	E	T	85	
Tot 17	17	5.5	5	5	C	E	T	85	
Tot 18	18	5	3	15	C	E	T	75	
Tot 19	19	5.5	4	5	C	E	T	75	
Tot 20	20	5.5	5	5	C	E	T	75	
Tot 21	21	6	6	5	C	E	T	75	
Tot 22	22	5.5	5	5	C	E	T	65	
Tot 23	23	5.5	6	5	C	E	T	75	
Tot 24	24	5	4	5	C	E	T	45	
Tot 25	25	5	4	5	C	E	T	75	
Tot 26	27	5	4	5	C	E	T	75	
Tot 27	28	5	4	5	C	E	T	65	
Tot 28	29	5.5	5	5	C	E	T	75	
Tot 29	30	6	5	5	C	E	T	75	
Tot 30	31	5	4	5	C	E	T	65	