Department of Conservation
Te Papa Atawhai

19-E-0625/ DOC 6096842

24 October 2019

[redacted]
Email: [redacted]

Dear [redacted]

We refer to the request you submitted to the Department of Conservation under the Official Information Act 1982 (OIA) on 8 September 2019. You asked that we provide the following information:

I would like to find out under Official Information Act just how many pests live in Mount Pirongia Forest Park area and, if any, what monitoring has been done to ascertain or assess that number over the past 12 months?

Before considering your request, we set out the following contextual information that is relevant to your request.

Proposed possum and rat control operation in Pirongia Forest Park / Te Kauri Park

The Department is planning to undertake a possum and rat control operation in Pirongia Forest Park and Te Kauri Park Scenic Reserve in 2020, for the purposes of protecting the forest by retaining indigenous ecosystems, species and habitats.

This operation sits within the Department's Tiakina Ngā Manu programme which is a nationally coordinated, landscape-scale predator control programme. It aims to ensure that a full range of New Zealand's ecosystems is conserved to a healthy functioning state, where the ecological processes are natural, and the species present are ones that would be expected to occur naturally.

The predominant forest ecosystems in Pirongia Forest Park are:

1) Tawa, Weinmannia podocarp forest – classified as "MF4";
2) Tawa, kohekohe and mangeao broadleaved podocarp forest – classified as "WF14"; and
3) Halls totara, pahautea and kamahi forest – classified as "CF11".[1]

Possums have a have serious impact on MF4 and CF11 ecosystems, and a severe impact on WF14 ecosystems. Rats and stoats have a severe impact on all three forest ecosystems in Pirongia Forest Park. It is the responsibility of the Department to ensure that possum, rat and stoat populations are reduced to minimise their impacts on the ecosystems in Pirongia Forest Park within available resourcing.

At present, the Department undertakes pest control in Pirongia Forest Park approximately every six years to enable a periodic knockdown of rat, stoat and

[1] For more information on the classification of forest ecosystems, see https://www.doc.govt.nz/documents/science-and-technical/sfc325entire.pdf.

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possum numbers.[2] The six-yearly pest control cycle is determined by taking the following into account:

1) the life expectancy of possums;
2) the resources available to the Department to undertake pest control operations; and
3) the native species that are present in Pirongia Forest Park and are likely to benefit from pest control operations.

Possums decimate native forests

Over the past few decades, possums have emerged as one of the major threats to the health and wellbeing of forests throughout New Zealand. They are the major cause of the decline of trees such as pōhutukawa, rewarewa, kāmahi, māhoe, tawa and rātā and can change the composition and structure of native forests.[3] They also prefer some of the smaller trees such as tree fuchsia and wineberry, along with mistletoe, forest herbs and a number of endangered shrubs.

Studies have demonstrated increased damage to palatable plant species at higher possum densities.[4] Possums usually focus their feeding on a small set of 'key species', and often only target particular individuals of those species at a site.[5] This can cause the progressive reduction and elimination of preferred food species and even lead or contribute to the collapse of forest canopies over large areas.[6]

Between 1994 and 2004, scientists studied the relationship between the level of possum browse and possum density by observing the proportion of kamahi leaves browsed and possum abundance across 21 locations in New Zealand (including Pirongia).[7] Results collected as a part of that study indicated that there was a strong relationship between possum density and browse damage on kamahi trees, and that some trees suffered repeated, heavy browse leading to severe defoliation, which greatly increased their mortality risk.[8]

Rats are a threat to New Zealand's native species

Ship rats and Norway rats have a major impact in New Zealand because they are omnivores, and eat birds, seeds, snails, lizards, fruit, weta, eggs, chicks, larvae and flowers. The varied diet of rats also makes them competitors with native wildlife for food sources.

Ship rats are found in many different habitats around New Zealand and are widespread in lowland podocarp-broadleaf forests. They are good climbers, so they can access bird nests that are located on tree branches that are well above ground

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[2] Noting that stoat populations are only controlled by secondary poisoning where 1080 is used as the pest control method.
[3] See https://www.doc.govt.nz/globalassets/documents/conservation/threats-and-impacts/animal-pests/foliar-browse-index-field-manual.pdf.
[4] See, https://newzealandecology.org/nzje/2050.pdf, https://newzealandecology.org/nzje/2139.pdf and https://newzealandecology.org/nzje/2207.pdf.
[5] See https://www.doc.govt.nz/Documents/science-and-technical/sfc304entire.pdf.
[6] See 3, above.
[7] See https://doi.org/10.1111/j.1442-9993.2010.02229.x.
[8] See 7, above.

level. On offshore islands, Norway rats are large enough to kill burrow-nesting adult seabirds and eat their eggs and chicks.

1080 reduces possum and rat numbers

1080 is highly effective in controlling rat and possum populations which are the biggest threat to our native birds.

Between 1996 and 2004, researchers studied the effects of aerial 1080 operations on possum densities and tree conditions in New Zealand. The studies found that Trap Catch Indices of possum densities reduced after each aerial 1080 operation, but usually recovered to near pre-control levels within 6 years. That study also found that the overall mortality of possum-preferred tree species was about 25% lower in areas that were treated with 1080 (in comparison to mortality of trees in untreated areas).

The researchers also observed that the canopy condition in the treated areas improved after 1080 application and continued to improve even after possum numbers had substantially recovered. The study concluded that possum control reduced possum browse, and therefore, tree defoliation and, ultimately, tree mortality. More information on this study can be found in the published article *"Effect of one-hit control on the density of possums (Trichosurus vulpecula) and their impacts on native forest"*, which can be accessed via the following link: https://www.doc.govt.nz/Documents/science-and-technical/sfc304entire.pdf.

Similar observations were noted following a 1080 operation carried out in Tararua Forest Park in 2010.[9] The possum Bite Mark Index (bite marks made by possums on wax blocks) within the treated area reduced from approximately 40% prior to 1080 treatment, to near-zero after treatment. In comparison, there was no reduction in the Bite Mark Index ("BMI") in an untreated area that was observed at the same time. Two years after the 1080 operation, the BMI in the treated area was observed to have increased to approximately 25%, whereas the BMI in the untreated area increased to approximately 60%.

The 1080 operation in Tararua Forest Park also found that the rat tracking rate (from rat tracks recorded on paper in tracking tunnels) reduced from over 40% prior to the application of 1080 to zero after the application of 1080. Rat numbers have also decreased in other areas where 1080 operations have been carried out. For example, rat numbers reduced from 22.7% to 1.5% in the Hawdon Valley after the application of 1080. In comparison, rat numbers in an adjacent untreated area increased from 34% to 38% in that time.

Pest control history in Pirongia Forest Park and Te Kauri Park

Possum and rat control

Possum and rat control operations have previously been carried out in Mount Pirongia and Te Kauri Park. Monitoring data collected by the Department before and after each operation confirms that possum abundance has reduced after each pest control operation. We have set out the monitoring data collected by the Department prior to, and after, each operation in the tables below.

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[9] See https://www.doc.govt.nz/globalassets/documents/conservation/land-and-freshwater/land/project-kaka-report-to-2013.pdf.

Table 1: possum monitoring data

Year of operation	Possum abundance prior to operation (Residual Trap Catch Index)	Possum abundance after operation (Residual Trap Catch Index)
1996-1998	26.84% ± 9.58%	• Aerial control - 4.17% ± 3.91% • Ground control (toxin) - 2.9% ± 1.1%
2002	34.34% ± 6.96%	• Aerial control - 2.39% ± 1.85% • Ground control (toxin) - 4.84% • Ground control (traps) - 3.84% ± 1.91%
2007	10.4%	Aerial and ground control (toxin) - 0.42%
2014	6.95% ± 1.4%	Aerial and ground control (toxin) - 0.48% ± 0.7%

Table 2: rat monitoring data

Year of operation	Rat abundance prior to operation (Rat Tracking Index)	Rat abundance after operation (Rat Tracking Index)
2014	79%	Aerial and ground control (toxin) - 28%

The Department has also studied the effects of these pest control operations on the forest canopy in Pirongia Forest Park and found that kohekohe and kamahi foliar cover increased following the possum control operations in 1996-1998.[10]

Kohekohe foliar cover then began to gradually decrease as possum populations in the area began to recover, and increased again after the 2002 operation. Similarly, kamahi foliar cover increased in 1998, after the first pest control operation, but began to decrease after 1999. Kamahi foliar cover increased again after 2001, following further possum control in Pirongia Forest Park.[11]

Goat control

The Department carries out goat control operations in Pirongia Forest Park, as goats have a serious impact on CF11 and MF4 ecosystems and a severe impact on WF14 ecosystems. These operations are carried out by ground hunters accompanied by indicating/finding/bailer dogs. The Department does not, however, monitor goat numbers in the Pirongia Forest Park. Instead, goat numbers are tallied by the ground hunters during each goat control operation.

Your OIA request

We now consider your OIA request. For ease of reference, we have considered each part of your request separately.

[10] See "Pirongia Forest Condition Report 2008/09" (attached as 'Appendix 1' to this letter).

[11] See 10, above.

Number of pests in Pirongia Forest Park

You requested that we provide information on how many pests live in Pirongia Forest Park. Unfortunately, we are unable to respond to this part of your request because the Department cannot ascertain the exact number of pests that live in Pirongia Forest Park. Pest monitoring will only provide, at best, an *approximate* number of pests that live in a particular area at a given time, rather than the exact total number of pests.

Therefore, the information you seek does not exist, and we have no option but to refuse this part of your request under section 18(e) of the OIA. However, we note that the following information may assist your understanding of this issue.

Monitoring to ascertain number of pests

You asked whether any monitoring has been undertaken to ascertain the number of pests in Pirongia Forest Park in the past 12 months.

Some mammalian pest monitoring data is collected via the Department's terrestrial monitoring programme. Under this programme, the Department collects monitoring data from approximately 1,400 plot locations that are evenly spaced across public conservation land throughout New Zealand. Approximately 280 plots are measured each year, with each plot being measured on a 5-year rotation cycle. The most recent monitoring data we have collected as a part of this monitoring programme is published on the Department's website and can be accessed via the following link: https://www.doc.govt.nz/our-work/monitoring-reporting/plot-level-report/.

We note that possum and rat monitoring will normally only be undertaken prior to a pest control operation for the purposes of:

1) determining whether the operation should proceed, or be postponed; and

2) allowing a comparison of pre and post-operational pest population levels to determine whether the operation has been effective in reducing possum and rat numbers to below-target levels.

It is not standard practice for the Department to frequently monitor pest populations in Pirongia Forest Park when pest control operations are not scheduled to take place. This is because the detrimental effects of possums and rats on native plants and animals are already well known to the Department and it is not a prudent use of the Department's resources to monitor pest populations in the absence of pest control operations. The Department has not carried out a pest control operation in Pirongia Forest Park in the last 12 months, and therefore, it has not undertaken any pest monitoring in Pirongia Forest Park in that period.

The Pirongia Te Aroaro o Kahu Restoration Society carries out pest control (by trapping) in the Pirongia Forest Park, and undertakes possum and rat monitoring. The Society provides some of that monitoring data to the Department. We are providing you with copies of that data as it is relevant to this part of your request. That data is set out in appendices 2 and 3 (attached to this letter).

Please note that we have redacted names of individuals in the documents we are providing to you under sections 9(2)(a) and 9(2)(g)(ii) of the OIA to protect their privacy and to prevent any improper pressure or harassment of officials and employees. In making the decision to withhold this information, I have taken into account the public interest considerations set out in section 9(1) of the OIA.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how you can make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

Please note that this response (with your personal details removed) may be published on the Department's website.

Yours sincerely

[redacted]

Hilary Aikman
Director National Operations

Appendix 1

Pirongia Forest Condition Report 2008/09

An Assessment of Forest Canopy Condition and Possum Impacts

[redacted] s 9(2)(a), 9(2)(g)(ii)

Waikato Conservancy

Department of Conservation

RECOMMENDATIONS

Operational

- Carry out possum control in 2013/14 as planned.
- Consider monitoring relative possum abundance (RTCI) in 2010/11 or 2011/12 to ensure extending the interval between possum control operations is based on sound knowledge of possum abundance.

Monitoring

- Re-measure FBI lines in 2011/12 to assess trends in canopy condition.
- Consider establishing fauna monitoring to measure change in trends and condition of common forest bird species as part of a wider conservancy study.

SUMMARY

Possum control has been carried out in Pirongia Forest Park in 1996, 2002 and 2007. Vegetation monitoring to assess canopy tree condition and possum impacts has been carried out from 1996-2002 and in 2005 and 2009. Canopy condition improved following possum control in 1996 before declining from 2001-2002 prior to the second possum control operation. Kohekohe condition has continued to improve since 2002, while results for kamahi have been variable, which is potentially a result of environmental conditions as opposed to possum impacts. Potential exists for the interval between possum control operations to be extended out to seven years. Monitoring of both possum abundance and vegetation condition is necessary to ensure that any change in the management of Pirongia does not place conservation gains from previous management efforts at risk. Fauna monitoring should be established to assess trends in abundance of common forest bird species.

INTRODUCTION

The Mount Pirongia block of Pirongia Forest Park consists of 13,534 hectares of native forest and scrub. Pirongia is the largest continuous area of native forest in the Waikato basin, representing one of the three major latitudinal transition zones in New Zealand.

Possum control has been carried out on Mt Pirongia in 1996, 2002 and 2007 using both ground control and aerial methods. The 1996 aerial operation reduced possum abundance from a residual trap catch index (RTCI) of 26.84% ± 9.58% to 4.17% ± 3.91%. Possum control in 2002, using a combination of both ground and aerial control methods, successfully reduced possum abundance from 34.34% ± 6.96% to below the 5% RTCI target. Aerial possum control occurred again in 2007, successfully reducing possum abundance from 10.4% to 0.42% RTCI. Foliar Browse Index (FBI) monitoring was carried out in March 2009 to assess the canopy condition and possum impacts on canopy tree species in Pirongia.

METHODS

The current FBI standard methodology (Payton *et al.*, 1999) for ground-based assessment of possum preferred canopy tree species was used to measure levels of possum impacts and canopy vegetation response to possum control. The FBI methodology measures levels of foliage cover, possum browse, possum trunk use, dieback and fruiting and flowering on individually tagged trees. Foliage cover is measured based on a scoring system of 10% intervals ranging from 5-95%. Browse and dieback are measured on a categorical rating system ranging from 0-4, representing percentage margins of <5%, 5-25%, 26-50%, 51-75% and > 75% respectively. Trunk use scores are based on a categorical rating system ranging from 0-3 indicating nil, light, moderate and heavy use respectively. The placement of FBI plots on Pirongia does not follow the current protocols as many lines were established in a non-random fashion, with unequal distances between plots and non-random selection of tagged trees.

Indicator Species

Only data collected from kohekohe (*Dysoxilum spectabile*) and kamahi (*Weinmannia racemosa*) trees has been presented in this report. In past measurements five finger (*Pseudopanax arboreus*), pohutakawa (*Metrosideros excelsa*), Hall's totara (*Podocarpus hallii*), mahoe (*Melicytus ramiflorus*) and mangeao (*Litsia calicaris*) trees were also scored, however, this has been discontinued due to small sample sizes and uncertainties regarding the suitability of these species for FBI measurements.

Data Analysis

Change in foliar cover condition since 1996 has been analysed using a Linear Mixed-Effects model, using "time" (years) and "treatment" (number of possum control operations) as explanatory variables.

The three possum control operations on Pirongia have been included in the model as an ordered category using the values 0-3. This approach takes into account the cumulative influence of each successive treatment. Therefore, data from the initial FBI measure in 1996 equals "0" (prior to initial possum control), data in between the first and second possum control operations (1997-2002) equals "1", between second and third control operations (2005) equals "2" and data from the most recent re-measure (2009) equals "3". Change in foliar cover as a result of possum control was tested with "treatment" as an explanatory variable. Results were considered significant if t values were greater than ± 2.1. Model selection was based on a comparison of AIC values, with the model with the lowest AIC scores selected as the most appropriate model (Buckland *et al.*, 1997).

It must be stressed that the approach outlined above is still in a developmental phase, however, it does show significant potential. While this model described kohekohe foliar cover reasonably well, it did not describe the data for kamahi very well and so has not been used. Instead kamahi foliar cover data has been analysed using the traditional significance test approach using a paired t-test at a 95% confidence interval with results considered significant when the p value was less than 0.05.

Browse and trunk use have been analysed using the Wilcoxin-sign rank test for non-parametric data. All changes in mean values have been tested at a 95% confidence interval, with results considered significant when the p value was less than 0.05.

Data was analysed using the program *R* version 2.8 (R Development Core Team 2008).

Monitoring Objective

To determine if the current possum control regime on Pirongia has been effective as indicated by the canopy condition and extent of possum impacts on monitored kohekohe and kamahi trees.

RESULTS

Foliar Cover

Changes in foliar cover following possum control

<u>Kohekohe</u>

Kohekohe foliar cover has increased significantly as a result of possum control on Pirongia. The linear mixed model shows a significant decline occurring in kohekohe foliar cover in the absence of possum control. The model indicates that the first treatment was not sufficient to halt the decline in foliar cover; however, the second control operation had a significant effect in stabilising foliar cover levels and facilitating an increase which continued into the third treatment operation which has resulted in a highly significant increase in foliar cover levels and recovery above that first recorded in 1996 (Fig. 1).

Comparing this approach with results from paired *t*-tests, kohekohe foliar cover declined significantly from 1996-97 before increasing significantly from 1997-98. Foliar cover continued to increase through to 2001 before decreasing significantly from 2001-2002. Foliar cover again increased significantly from 2002 until the present.

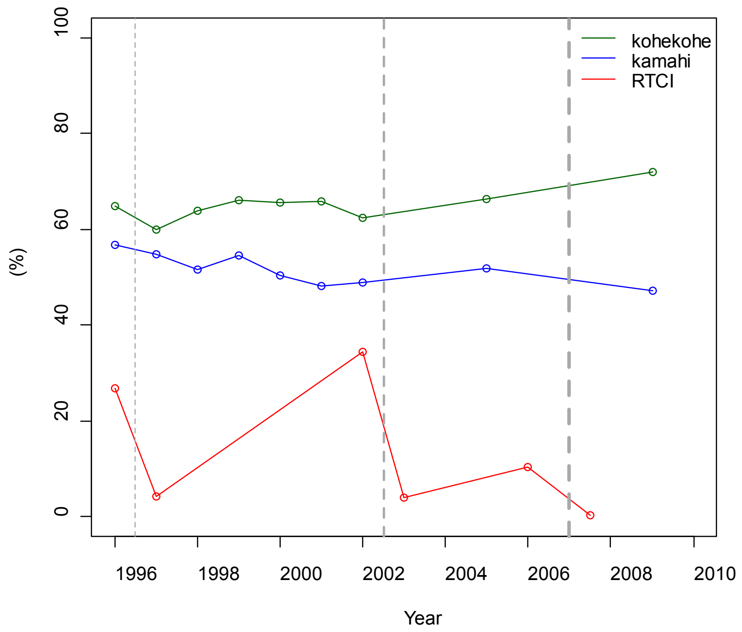
<u>Kamahi</u>

Kamahi foliar cover continued to decline significantly for the two years following initial possum control in 1996 before increasing after 1998 (Fig 1). This increase was significant, but not sustained as after 1999 foliage cover declined significantly. Kamahi foliar cover increased significantly after 2001, following further possum control. This gain was sustained until 2005, after which foliage cover again began to decline (Fig. 1). Foliar cover of kamahi remains lower now than prior to possum control being initiated.

Browse and Trunk Use

Changes in possum impacts following possum control

Trunk use and browse decreased significantly for both species after the initial possum control operation and remains significantly lower up to 2009 (Fig 2). The initial reduction in possum browse after 1996 was sustained for 3-4 years (kohekohe and kamahi respectively) before increasing significantly. Possum browse again decreased significantly after control in 2002. The decrease in browse has continued for kamahi and was sustained for >3 years in kohekohe, but has since increased significantly. The initial reduction in trunk use was more or less sustained for 4-5 years in kamahi and kohekohe respectively, followed by a significant increase up until the possum control operation in 2002 (Fig 3). Reduction in trunk use after the 2002 operation lasted for >3 years and following control in 2007 is less than at any time in the past.



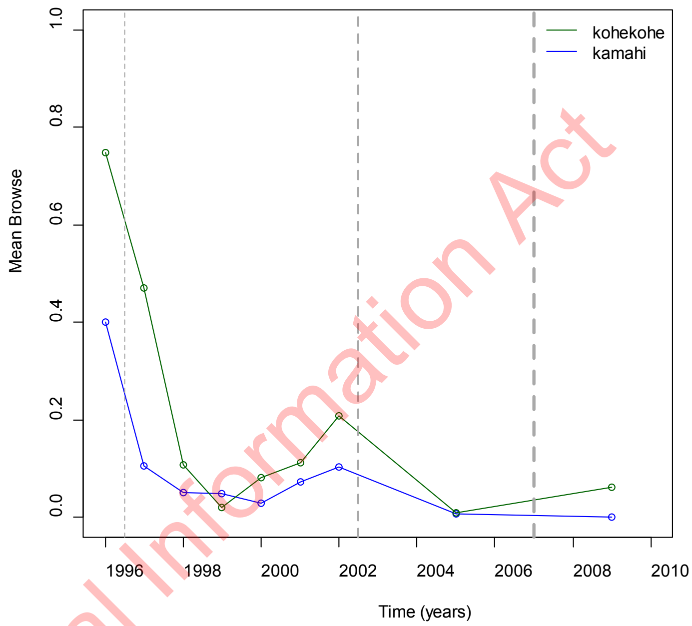


Figure 1: Mean RTCI (red) and kohekohe and kamahi foliar cover levels. The hatched lines represent possum control operations.

Figure 2: Mean kohekohe and kamahi browse levels

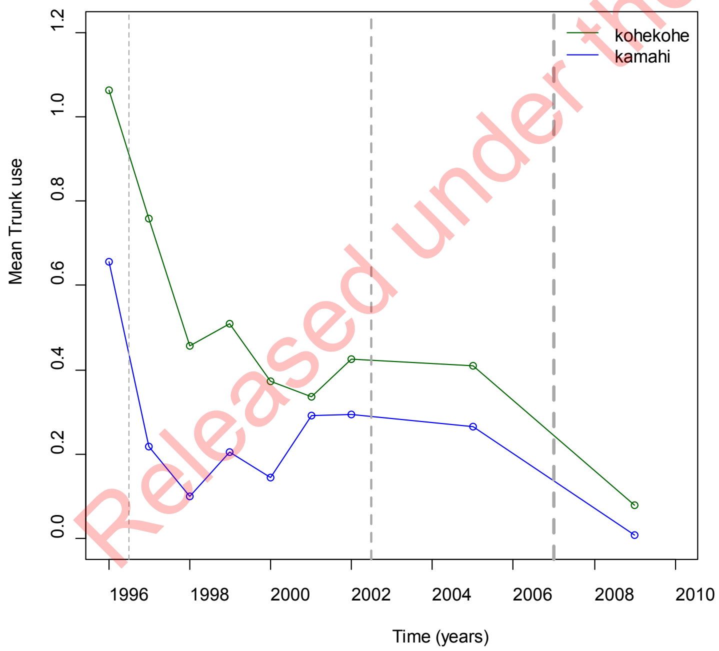


Figure 3: Mean kohekohe and kamahi trunk use levels.

DISCUSSION

Changes in canopy condition and possum impacts in relation to possum control

The lack of any clear trend in kamahi foliar cover levels that could be directly attributed to possum control is likely to be a result of factors other than possum browse. Previous research has shown that kamahi stands in a degraded condition are more susceptible to attacks by insects and fungal disease. Therefore, once kamahi foliar cover levels are reduced through possum browse they can still be vulnerable to continuing damage by environmental conditions and natural pests (Payton, 1988; Stewart & Veblen, 1982). The continued decline in kamahi foliar cover is most likely not attributable to possum impacts. This situation has also been found in kamahi on nearby Mt Karioi ([redacted], 2008).

Kohekohe foliar cover increased following the first possum control operation before declining two years prior to the second operation. Kohekohe foliar cover has continued to increase since the time of the second operation. Possum impacts have shown the reverse trend to foliar cover, with large decreases in trunk use and browse levels for two-three years following the first control operation followed by increasing impacts in the two years prior to the 2002 operation. This pattern of sharp decreases followed by a gradual increase in possum impacts three-four years following initial aerial possum control is consistent with results seen elsewhere in the Waikato (Broekema, 2007; [redacted], 2008*a*).The second and third possum control operations have resulted in greater declines in possum impacts, with the benefits lasting longer after each operation.

The increased benefit seen from the second and third operations could be a result of increased resilience of the forest as tree health has improved and/or possum control has maintained possum abundance at low levels for an increasing length of time. The results from the model describing kohekohe foliar cover indicate that it was not until the third operation that kohekohe condition began to improve above levels first recorded in 1996. This demonstrates the value of implementing possum control well before possum abundance and impacts reach pre-control levels, thereby maintaining and building on conservation gains from previous operations.

Conclusion

The current possum control regime has clearly been effective in reducing possum impacts and improving canopy condition in kohekohe and kamahi in the operational area.

The current management objective for Pirongia is to “protect and retain indigenous ecosystems, species and habitats”, with the targeted outcome of possum control being the maintenance and improvement of possum preferred canopy tree species (Patterson, 2008). If outcomes continue to focus on the maintenance and protection of canopy tree species only, then the current management regime is clearly achieving the desired outcomes, and potential exists to extend the period between possum control operations. However, the current monitoring regime provides no information regarding trends and condition of fauna species. If conservation outcomes that the Department wishes to report on change to encompass maintenance of fauna communities then more targeted monitoring will be required to ensure management outcomes such as this are met.

Kohekohe condition can decline rapidly when possum abundance increases above 10%, and conservation gains from previous management efforts can be lost if possum populations are allowed to persist at this level ([redacted], 2009; Nugent, 2002). Therefore it is important that changes to management regimes and the period between possum control operations be based on robust information derived from RTCI and vegetation monitoring, to ensure that the investment the Department has already made to improve and maintain canopy condition is sustained.

References

Buckland, S.T.; Burnham, K.P. & Augustin, N.H., 1997. *Model Selection: An Integral Part of Inference*. Biometrics 53: 603-618.

[redacted] 2007. *Awaroa/Hauturu – Forest Condition Report 2007. Assessment of Possum Impacts in Awaroa Scenic Reserve, Hauturu Forest, W.G. Johnson Scenic Reserve, Mahoe Forest and Te Rauamoa Block (Pirongia Forest Park).* Unpublished report for the Department of Conservation, Hamilton, New Zealand.

[redacted]. 2008. *Karioi Forest Condition Report 2007/08. An Assessment of Possum Impacts in the Karioi block, Pirongia Forest Park.* Unpublished report for the Department of Conservation, Hamilton, New Zealand.

[redacted]. 2008*a*. *Whareorino and Moeatoa Forest Condition Report 2006/07. An Assessment of Possum Impacts in Whareorino and Moeatoa Forests, Western King Country.* Unpublished report for the Department of Conservation, Hamilton, New Zealand.

[redacted] 2009. *Papa Aroha Forest Condition Report 2008/09. An Assessment of Forest Canopy Condition and Possum Impacts*. Unpublished report for the Department of Conservation, Hamilton, New Zealand.

Nugent, G.; Whitford, J.; Innes J. & Prime, K. 2002. *SHORT COMMUNICATION: Rapid recovery of kohekohe (Dysoxylum spectabile) following possum control.* New Zealand Journal of Ecology 26(1): 73-79.

Patterson, D. 2008. *Operational Report for Possum Control in the Pirongia (2006/07): 15 Apr 2007 - 30 Jul 2007*. Pestlink Report: 0708WAI02.

Payton, I.J., 1988. *Canopy closure, a factor in rata (Metrosideros)-kamahi (Weinmannia) forest dieback in Westland, New Zealand.* New Zealand Journal of Ecology. Vol. 11, 1988.

R Development Core Team (2008). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna.

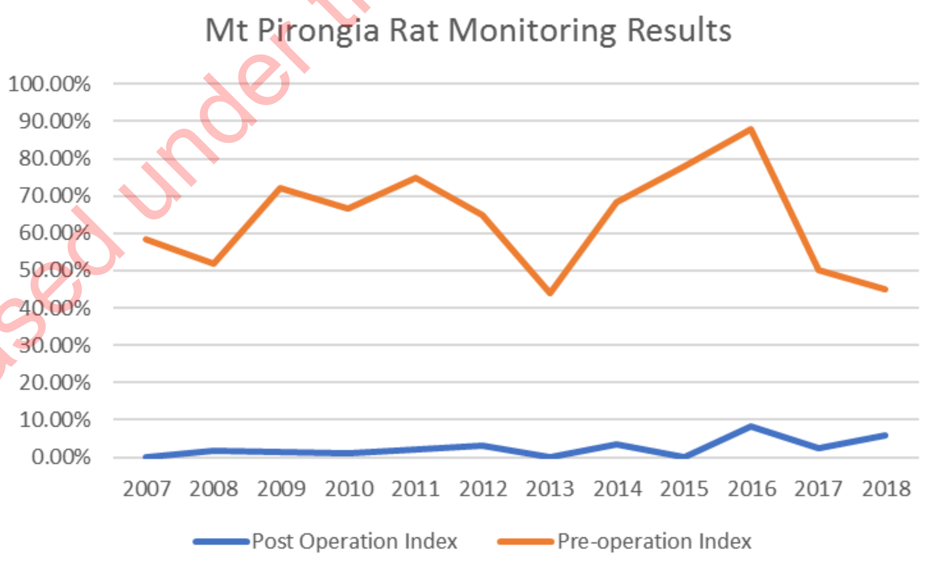
Stewart, G.H. & Veblen, T.T., 1982. *A commentary on canopy tree mortality in Westland Rata-Kamahi protection forests*. New Zealand Journal of Forestry. Vol. 27, no. 2, pp. 168-188.

Appendix 2: rat monitoring data collected by the Pirongia Te Aroaro o Kahu Restoration Society

Table 1: Mt Pirongia rat monitoring data

Year	Pre-operation Index (% residual trap catch)	Post-operation Index (% residual trap catch)
2007	58.50%	0.00%
2008	52.00%	1.60%
2009	72.00%	1.25%
2010	66.70%	1.10%
2011	75.00%	2.00%
2012	65.00%	3.00%
2013	44.00%	0.00%
2014	68.30%	3.33%
2015	78.00%	0.00%
2016	88.00%	8.30%
2017	50.00%	2.50%
2018	45.00%	5.80%
2019	65.00%	28.88%

Graph 1: Mt Pirongia rat monitoring results



Appendix 3: possum monitoring data collected by the Pirongia Te Aroaro o Kahu Restoration Society

Possum Monitoring Results Nov 2018

(1) Chew cards

- 15 lines of 10 cards 20m apart out for 7 nights.
- One possum chew (at line 2 near Corcoran Rd Track) giving a Chew Card Index of **0.7%**
- Rat chews: 12 on 150 cards (some could be the same rat) giving a rat index of 8%.

(2) Trapping RTC

- Trapping done by Waikato Regional Council contractor.
- 13 lines, 3 catch nights.
- 6 possums caught giving RTC of **1.54%**

Line No.	Possums trapped	Chew card sign
1	0	0
2	0	**1**
3	0	0
4	0	0
5	**2**	0
6	**1**	0
7	0	0
8	**2**	0
9	0	0
10	0	0
11	0	0
12	**1**	0
13	0	0
X1	Not done (spares)	0
X2	Not done (spares)	0
X3	Not done (spares)	Not done
TOTALS:	6	1

Comparison of results

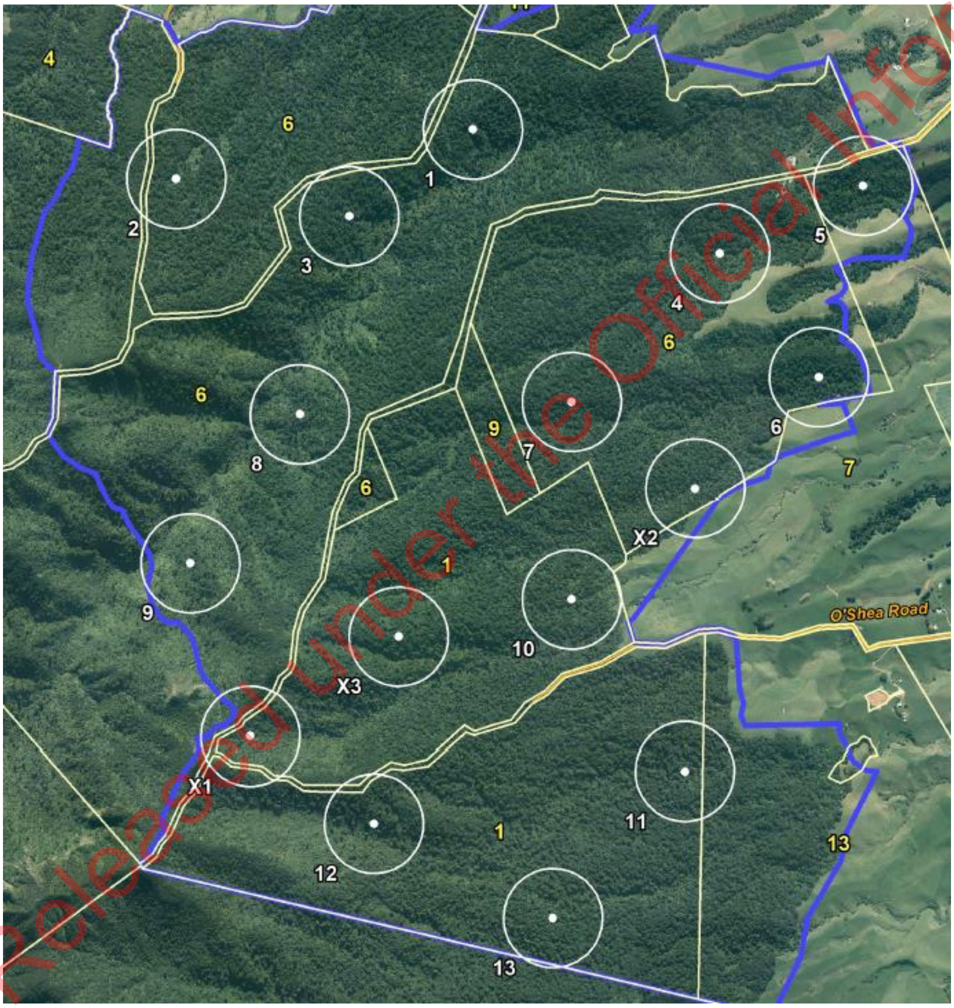
- Fewer possums were detected with the chew cards.
- Chew cards have been found to be an accurate way of measuring possum abundance. Because these are different methods (trapping and chew cards), a correction is required to compare the results. This correction is uncertain when possum densities are very low, as in our pest control area.

s 9(2)(a) [redacted] 19.11.18

- The index from chew cards should be higher than the trapping RTI but it was much lower. Therefore, the chew card method we used didn't work well. The reasons for this aren't known; some of it could be chance, some the different weather windows (the chew cards were deployed and retrieved before the trapping started). It has been found that leaving the cards out for 14 nights gives a better result than the 7 nights we used (Hawkes Bay results).

Main conclusions

The trapping RTC index result shows we have low possum numbers overall close to the 1% target. Four of the seven possums were found within 500 metres of the forest boundary, but they were also found in the interior of our control area. From the map below and the table above you can work out where the possums were found (use the white line numbers).



A question is, do we need to do extra possum trapping within these hot spots or in areas where bait stations are being raided (on the southern and northern boundaries), or just around kokako nests? Our seven GoodNature A12 traps have been shifted recently to the Corcoran Rd boundary.

s 9(2)(a) [redacted] 19.11.18