# Foliar Browse Index Monitoring Report 2012 – Ohope Scenic Reserve

Prepared by Heather MacKenzie, Environmental Data Officer

Bay of Plenty Regional Council
Operations Publication 2012/02

July 2012

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Cover photo: Kohekohe (Dysoxylum spectabile) canopy at Plot 5 on Line 1 (Heather MacKenzie).

# Acknowledgements

Thank you to field teams comprised of various Bay of Plenty Regional Council staff over the monitoring period, including: Nancy Willems, Annabel Beattie and Richard Harris. Thank you to Nancy Willems who gave comments on the final draft of this report, and Dave Paine and Bruce Bancroft for providing information on possum control operations.

# Contents

# 1 Introduction

Foliar Browse Index (FBI) monitoring was established in Ōhope Scenic Reserve in February 2008 as part of a monitoring programme to assess the outcome of pest control operations. Re-measures were carried out in 2009, 2010 and 2012. In 2012 Kamahi *(Weinmannia racemosa)* was added as an extra tree species at existing plots as well as kohekohe *(Dysoxylum spectabile)* trees at plots where none were previously monitored, as recommended in Beattie (2010).

The following report gives an overview of the current levels of possum impacts on selected tree species within Ōhope Scenic Reserve, and looks at changes between the four measures of FBI monitoring lines.

# 2 Background

Ōhope Scenic Reserve is part of a larger area strategically important for biodiversity protection as it contains a relatively large example of pohutukawa *(Metrosideros excelsa)* - dominant forest, a nationally rare vegetation type, and supports populations of a number of nationally threatened and regionally uncommon flora and fauna species (Wildland Consultants, 2010). Possum browse alters habitat available for these species, causing canopy dieback and potentially the eventual death of plant species heavily targeted for food. Browsing of flowers and fruit also prevents regeneration of these preferred tree species, altering forest composition. Possums have been controlled sporadically in the Ōhope Scenic Reserve with traps and cyanide from 1991 through to 1997 when bait stations were established and treated with Brodificoum (Wildland Consultants, 2010). Possum control using a significantly improved bait station network (with two stations per hectare) was undertaken in spring 2008, 2009, 2010 but little control was undertaken during the preceding 5-6 years (David Paine, pers comm). The trap catch index (TCI) for Jan 2011 was <1%.

In order to determine the level of possum impacts and canopy vegetation response to possum control in the Ōhope Scenic Reserve, the FBI standard methodology (Payton et al., 1999) was used. For a more in-depth discussion of the background to this monitoring programme refer to Blackwell (2008), MacKenzie (2009) or Beattie (2010).

# 3 Methodology

FBI monitoring is a ground based method used throughout New Zealand to assess canopy health and possum browse levels on selected tree species. In the Ōhope Scenic Reserve kohekohe, mangeao (*Litsea calicaris)* and kamahi are surveyed. Trees are given scores for foliage cover, stem use, browse, dieback, fruiting and flowering based on an indicator species assessment sheet. For a more detailed explanation of the assessment sheet, and further detail on the FBI method, refer to Payton et al. (1999).

Five lines were established within the Ōhope Scenic Reserve on existing stoat trapping and bait station lines, with a total number of 63 plots, made up of a maximum of three trees per species at each plot. One plot is no longer surveyed, as the trees are either dead or obscured and therefore unable to be accurately scored, leaving 62 plots.

Kamahi was added as an additional tree species as recommended in Beattie (2010), along with some additional kohekohe at plots where they were not already recorded. This increased the sample size of kohekohe from 29 plots to 31 plots. These trees were not used in statistical analyses against previous measures, however they will give an increased sample size for future monitors to compare with 2012.

For further detail on the establishment of the FBI lines in the Ōhope Scenic Reserve, refer to previous years reports (see References). Monitoring was carried out in February 2008, February 2009, February/March 2010 and February 2012. Many parameters measured by the FBI methodology vary seasonally, so to maintain consistency in scores between years future measures should be carried out in February.

Data were analysed using the Statistica software package and an Excel spread sheet stored in Objective (Reference Number: A1366050).

# 4 Results

Results displayed in this report are calculated using plot means, making the plot rather than individual trees the sample unit. The minimum distance between plots of 100 m ensures independence between the samples (Payton et al., 1999).

Below are results for foliage cover, possum browse and canopy dieback for monitored kohekohe and mangeao trees within the Ōhope Scenic Reserve for 2008, 2009, 2010 and 2012, and for kamahi for 2012. Only brief results are given for kamahi as this was the initial monitor. Dead trees have been excluded from the standard analyses, and trees that died between 2010 and 2012 are discussed separately. Thus, the number of mangeao plots has declined from 57 to 54. Data from previous years has been recalculated to exclude these plots, to allow comparison of results between sampling periods; therefore results may vary from previous year's reports. Wilcoxon matched pairs test was used to test the significance of changes in mean foliage cover, browse and dieback scores for plots over the monitoring period, based on a 95% confidence interval.

## 4.1 Foliage Cover

*Table 1 Mean foliage cover (plot) for 2008-2012 of monitored trees in Ōhope Scenic Reserve. With two values for kohekohe in 2012 (including plots).*

| Species | Year | n (plots) | Mean Foliage Cover (%) | Standard Deviation |
|---|---|---|---|---|
| Kohekohe | 2008 | 29 | 66.72 | 10.91 |
| | 2009 | | 68.28 | 10.03 |
| | 2010 | | 75.52 | 9.52 |
| | 2012 | 29 (31) | 71.66 (71.40) | 11.57 (11.25) |
| Mangeao | 2008 | 54 | 63.64 | 12.12 |
| | 2009 | | 60.80 | 12.86 |
| | 2010 | | 58.67 | 14.87 |
| | 2012 | | 52.21 | 20.24 |
| Kamahi | 2012 | 29 | 58.39 | 7.49 |

### 4.1.1 Kohekohe

Current mean foliage cover of 71% for kohekohe (Table 1) is good. Wilcoxon sign rank tests were used to test the significance in changes in foliage cover scores for both kohekohe and mangeao. The increase in foliage cover for kohekohe between 2008 and 2012 is not significant (P=0.046).

This can be seen in Figure 1 where the 2008 and 2012 boxplots cover a similar range. Stewart (2000) suggests a benchmark target for kohekohe on the mainland of 65% as being realistic, which indicates that kohekohe in Ōhope Scenic Reserve are in good health in terms of foliage cover.

### 4.1.2 Mangeao

Current mean foliage cover of 52% for mangeao is moderate. The decrease in foliage cover of mangeao from 2008 to 2012 is significant (P=0.000), this can be seen in Figure 1 where the boxplot is visibly lower in 2012. Mangeao boxplots cover a much wider range than both kohekohe and kamahi, showing that the foliage cover varies more widely across the plots.

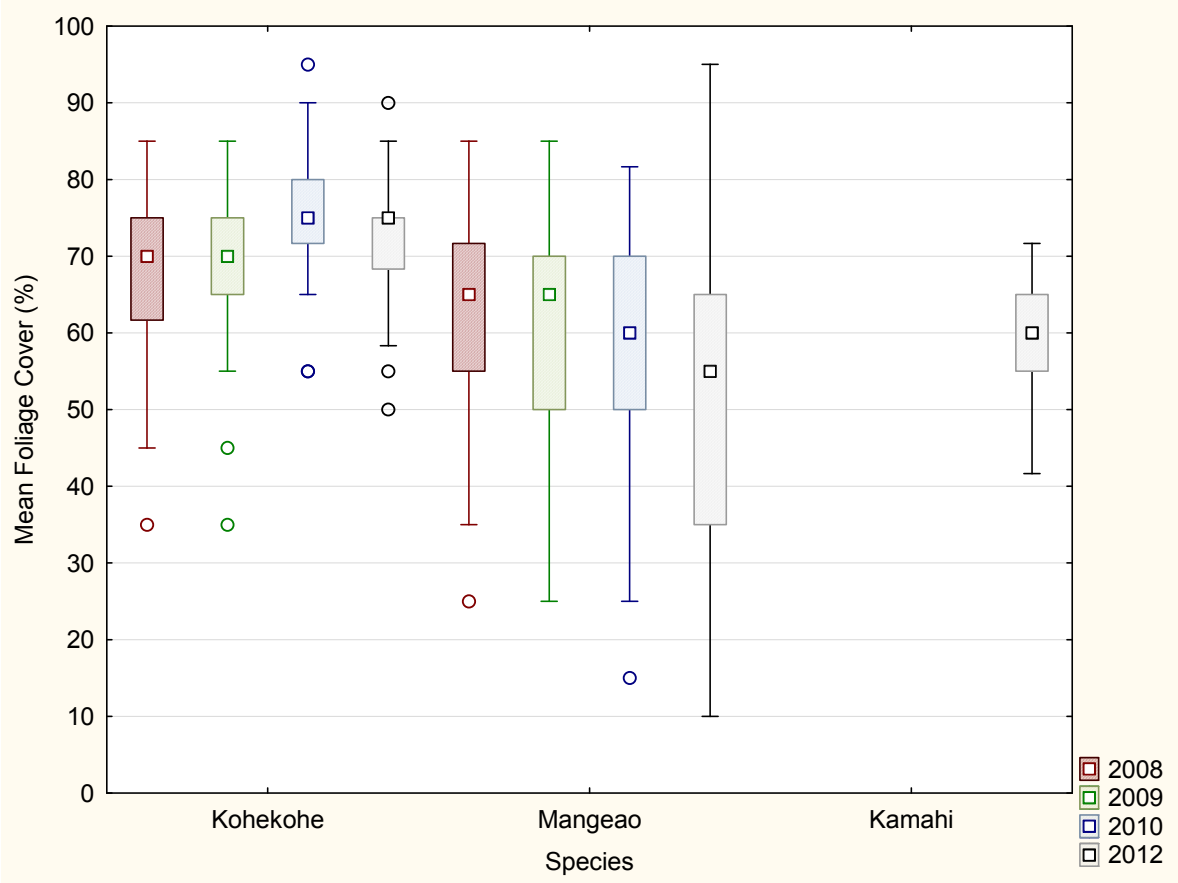


*Figure 1* *Boxplot showing mean foliage cover (plot) of monitored trees. The box represents the middle 50% of the data (between lower and upper quartiles), with the whiskers indicating lowest highest values. The means are shown squares and outliers are shown as circles.*

### 4.1.3 Kamahi

Current mean foliage cover for kamahi is 58% this is moderate. Figure 1 shows the relatively small range of mean kamahi foliage cover (plot). This suggests that all the trees are in similar condition in terms of foliage cover.

## 4.2 Browse

*Table 2 Mean browse whole (plot) and percentage of plots with browse for monitored trees in Ōhope Scenic Reserve. With two values for kohekohe in 2012 (additional plots).*

| Species | Year | n (plots) | % Mean Browse Whole | % Plots with Browse |
|---|---|---|---|---|
| Kohekohe | 2008 | 29 | 5.53 | 27.59 |
| | 2009 | | 1.31 | 34.48 |
| | 2010 | | 0.09 | 3.45 |
| | 2012 | 29 (31) | 0 (0) | 0 (0) |
| Mangeao | 2008 | 54 | 0.06 | 1.85 |
| | 2009 | | 0.07 | 9.26 |
| | 2010 | | 0.00 | 0 |
| | 2012 | | 0 | 0 |
| Kamahi | 2012 | 29 | 0 | 0 |

### 4.2.1 Kohekohe

The number of kohekohe plots with possum browse has decreased by more than 25% (to 0%) between 2008 and 2012 (Table 2). The browse scores have also decreased. The highest browse score recorded for kohekohe in 2008 of 3 (51-75% of leaves browsed) dropped to 0 (0% leaves browsed) by 2012.

Wilcoxon sign rank tests were used to test the significance in changes in mean browse scores for both kohekohe and mangeao. Percentage mean browse whole on kohekohe plots dropped from 5.5% in 2008 to 0 % in 2012, and this was statistically significant (P=0.008). The decrease in percentage of mean browse on kohekohe from 1% in 2010 to 0% in 2012 was not significant (P=0.077).

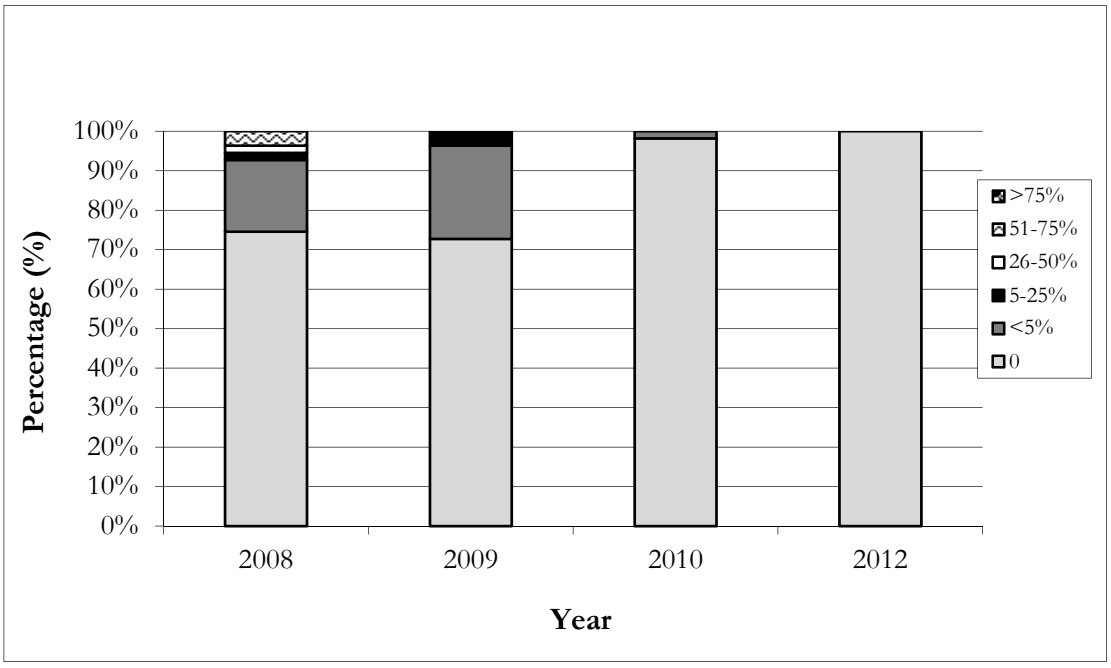


*Figure 2 Percentage of kohekohe with differing percentages of leaves browsed (whole tree) in Ōhope Scenic Reserve for 2008-2012.*

### 4.2.2 Mangeao

There is no significant change in mean browse recorded on mangeao. Percentage mean browse has remained at very low levels throughout the monitoring period at <1%. Of the monitored mangeao trees 95% have had no browse over the monitoring period.

### 4.2.3 Kamahi

No browse was observed on monitored kamahi trees in 2012.

## 4.3 Dieback

*Table 3 Mean dieback whole (plot) and percentage of plots with dieback for monitored trees in Ōhope Scenic Reserve. With two values for kohekohe in 2012 (additional plots).*

| Species | Year | n (plots) | % Mean Dieback Whole | % Plots with Dieback |
|---|---|---|---|---|
| Kohekohe | 2008 | 29 | 3.82 | 13.79 |
| | 2009 | | 3.36 | 3.45 |
| | 2010 | | 5.11 | 24.14 |
| | 2012 | (29) 31 | 2.93 (2.90) | 3.45 (3.23) |
| Mangeao | 2008 | 55 | 10.43 | 66.67 |
| | 2009 | | 12.31 | 50.00 |
| | 2010 | | 20.79 | 94.44 |
| | 2012 | | 15.89 | 50.00 |
| Kamahi | 2012 | 29 | 8.76 | 44.83 |

### 4.3.1 Kohekohe

The number of kohekohe plots with dieback recorded increased from 14% in 2008 to 24% by 2010, and decreased to 3% in 2012 (Table 3). The 10% increase in dieback from 2009 to 2010 has been attributed to observer variation (Beattie, 2010).

Wilcoxon sign rank tests were used to test the significance in changes in mean dieback scores for both kohekohe and mangeao. The change in percentage mean dieback for kohekohe was not significant (P=0.418), mean dieback scores have remained in the “no dieback” category (<5% of canopy) over the monitoring period.

### 4.3.2 Mangeao

Of the monitored mangeao plots, the number with dieback present has almost halved from 94% 2010 to 50% in 2012 (Table 3). The increase in percentage of mean dieback over the monitoring period from 10% in 2008 to 16% in 2012 is not significant (P=0.261). The decrease from 2010 to 2012 is significant (P=0.000).

Eight mangeao trees died between 2010 and 2012, these have been excluded from the analysis for the whole data series (see *4.5 Dead Trees* for data analysis).

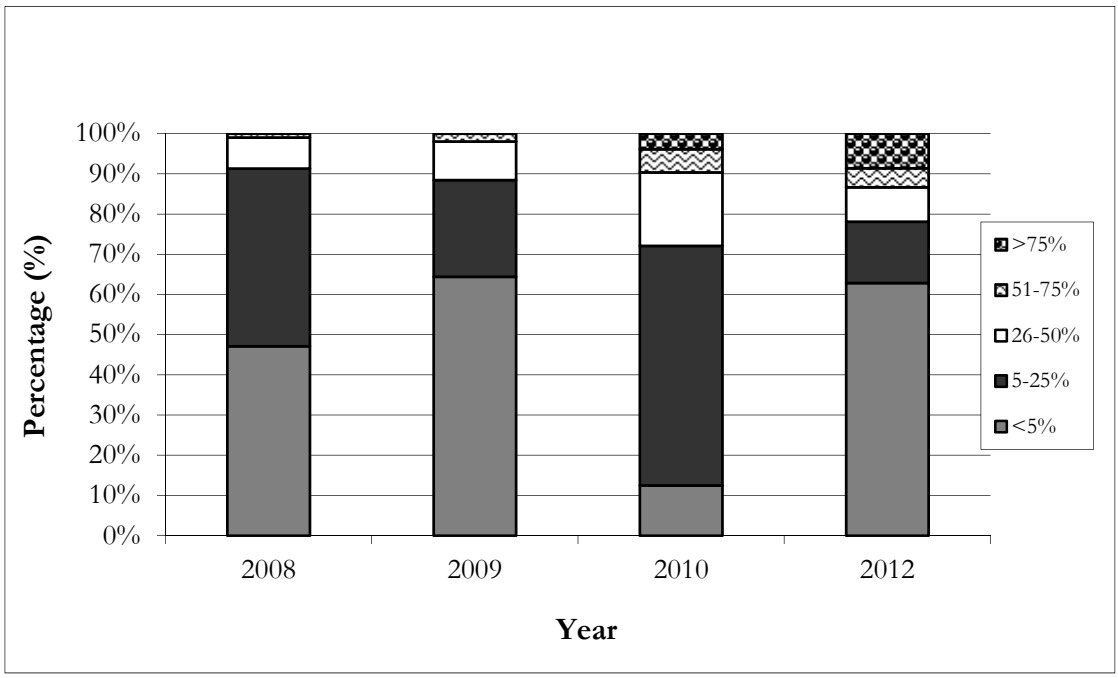


*Figure 3* *Percentage of mangeao with differing percentages of canopy dieback (whole tree) in Ōhope Scenic Reserve for 2008-2012.*

### 4.3.3 Kamahi

Mean dieback whole for kamahi was 9%. The highest score observed on only one tree was 3 “heavy” (51-75% of the canopy). Dieback affected 45% of the plots.

## 4.4 Dead Trees

Eight mangeao trees died over the period from 2010 to 2012 and were excluded from the whole data series for analyses in 2012. This small number does not allow for in depth statistical analysis, however, it is interesting to note that prior to 2012 half of the trees had canopy scores of <35% (Figure 5), and only one had a score >55%. Browse and stem use was not observed on any of the eight trees over the monitoring period.

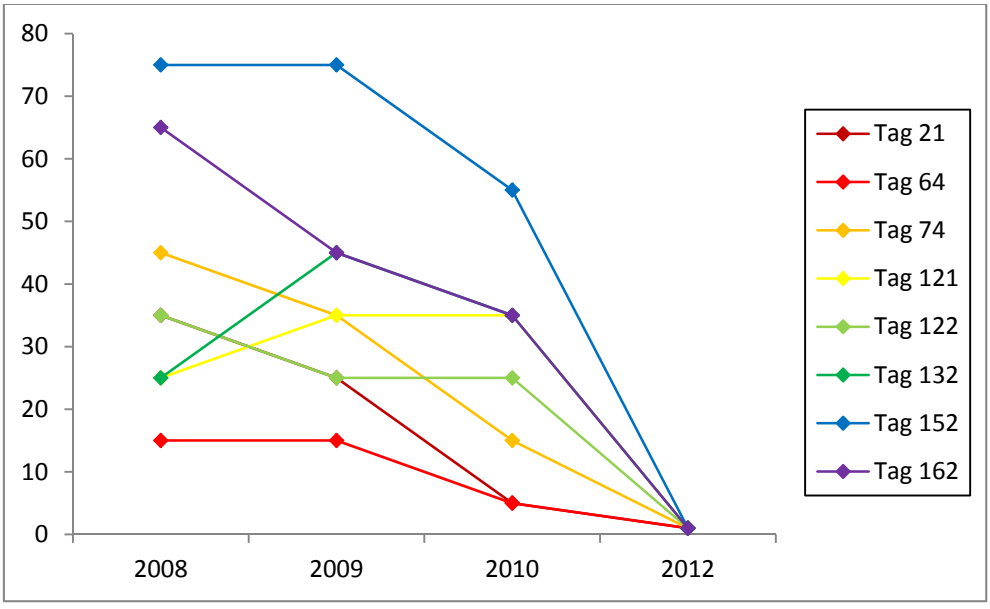


*Figure 5* *Foliage cover changes over the monitoring period for the eight mangeao trees recorded as dead in 2012.*

# 5 Discussion

## 5.1 Kohekohe

Mean foliage cover of kohekohe in Ōhope Scenic Reserve is similar to that measured on Red Mercury Island (Stewart, 2000), a possum free island in the Coromandel. This score shows that possums at their current density are not having a significant effect on kohekohe within the reserve. This is supported by the observation of no browse on kohekohe this year and the low canopy dieback scores. It is important to maintain low possum numbers, as kohekohe is a preferred species for possums and increased numbers are likely to directly affect kohekohe canopies, and also the regeneration and recruitment processes. Changes in possum impact levels should show up relatively quickly on kohekohe, as increased browse levels are relatively easily observed on this species.

The small sample size of kohekohe due to the restricted distribution throughout the reserve (29), was increased (31) in 2012 with the addition of trees at two plots (three trees). These plots were not used in comparison statistics, but results including them can be viewed in tables above. Comparisons after the next monitor will be possible. The increased sample size still does not reach the ideal 50 for reliability to detect whether a 10% change in foliage cover is statistically significant (Payton *et al*., 1999). However, it does still provide information as to the condition of these trees and impacts of possums across the sample.

## 5.2 Mangeao

Due to the low levels of possum impacts (browse and stem use) recorded on mangeao over the monitoring period (2008-2012), it is not possible to conclusively link them to overall dieback and subsequent death of mangeao trees within Ōhope Scenic Reserve. Only one tree that died over the monitoring period previously had browse recorded. This theory is supported by the New Zealand Forest Research institute into regional mangeao dieback which found no link to possum browse and mangeao dieback (Gardner and Dick, 2002). Where a systematic study of plots at Lakes Tikitapu and Okareka was unable to pinpoint a cause, but eliminated a number of possibilities including possum browse. Their results suggest mangeao was experiencing physiological stress, which could be related to local environmental changes (Gardner and Dick, 2002), a process which may also be impacting on mangeao in Ohope Scenic Reserve. Mangeao dieback has been noted since the 1970s throughout the Waikato and Bay of Plenty regions.

Foliage cover estimates, which are closely linked to dieback scores, changed by up to 15% between measures on possum-free Waiheke Island (Payton *et al*., 1999), indicating that foliage condition and dieback variation can be due to a wide range of environmental factors such as insects, fungi, wind or salt spray (Stewart, 2000). The observed decrease in foliage cover and increase in dieback in Ōhope Scenic Reserve therefore do not provide evidence for increased possum impacts, and illustrate the variability inherent within the FBI methodology. The data collected on mangeao during FBI monitors is still valuable and should be continued, but need to be applied with caution in regard to possum impacts.

## 5.3 General Discussion

Current possum levels are very low within Ōhope Scenic Reserve. There was no possum browse or stem use observed in 2012 and the latest trap catch index (TCI) carried out in January 2011 was <1%. If kohekohe canopy is at similar levels to that of predator free offshore islands it is unlikely that it will change significantly if low possum numbers are sustained.

There is inherent variability in the FBI methodology due to observer and seasonal variability, and background noise, discussed in detail by Payton *et al*. (1999). This was demonstrated through the use of a non-palatable species in FBI monitoring by Nugent *et al*. (2010). Efforts were made throughout the monitoring period to minimise this variability, by having multiple observers scoring the same tree and calibrating the final score, but the subjective nature of the scoring system means it cannot be eliminated entirely.

The addition of another species (kamahi) was carried out to improve the robustness of the FBI monitoring within Ohope Scenic Reserve. Data for kamahi will be analysed more in-depth following the next FBI monitor.

It is likely that due to current canopy condition and low possum densities within the reserve, that instead of observing significant changes in canopy cover, browse and stem use will be the most notable measures in future monitors.

# 6 Recommendations

Carry out FBI monitoring in 2014 (every two years), using as an indicator for control if possum browse is observed.

# References


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