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# **USE OF KINLEITH FOREST BY NATIVE NEW ZEALAND BATS AND EFFECTS OF FORESTRY**

A thesis presented in partial fulfilment of the requirements for the degree of Master  
of Science in Ecology at Massey University, Palmerston North, New Zealand.

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**Frontispiece** The Redwood Reserve, Galaxy Rd, is frequented by long-tailed bats. Planted in 1927, the redwoods are among the oldest trees in the forest.

## ABSTRACT

New Zealand's vulnerable microbats, the long-tailed bat (*Chalinolobus tuberculatus*, Vespertilionidae) and short-tailed bat (*Mystacina tuberculata*, Mystacinidae), are typically tree-roosting and generally associated with indigenous forest. However, bats have been seen at the edge of Carter Holt Harvey Forests' central North Island Kinleith Forest, a 131,000 ha exotic forest predominantly in *Pinus radiata*. Requested by Carter Holt Harvey Forests, this study investigates bat presence and distribution in Kinleith Forest, forest use by long-tailed bats, and the effects of forestry practices on bats, with focus on tree felling operations. It is the first comprehensive study of native bats' use of exotic plantation forest in New Zealand.

A broad-scale bat detector-based survey of 32 disparate sites, and comprising 720.5 km of driving transects over three routes, found long-tailed bats to be widespread in Kinleith Forest. In places activity was high, on some nights exceeding 60 bat passes/hour, or 100 passes/night, and at one site, averaging 46.0 passes/night ( $n = 189$  bat detector-nights from throughout the year). Given the decline in this species elsewhere, it is significant that long-tailed bats are present in some areas from which they were known historically. Mapping of bat sites in relation to forest type indicates long-tailed bats may have a fairly continuous distribution in the central North Island. Results suggest that instead of approaching unsurveyed plantation forests with the expectation that long-tailed bats are absent, they should be assumed present until proven otherwise. Anecdotal evidence of short-tailed bats, and of *Dactylanthus taylorii* — a rare plant they naturally pollinate, indicates short-tailed bats could potentially be present in Kinleith Forest.

Bat activity monitoring in adjacent forest interior and road habitats showed long-tailed bats commonly used roads in young (without canopy closure) and mature *P. radiata* forest, and podocarp broadleaf forest. Bats probably favoured roads for reasons of habitat structure, though roads may also play a role in navigation. This behaviour can be used to advantage when surveying for long-tailed bats in plantation forest.

Survey work identified long-tailed bats to be present in all topographies and a range of habitats including harvested/unstocked land, young *P. radiata* forest, and mature ( $\geq 17$  years) *P. radiata*, *Eucalyptus* spp., *Pseudotsuga menziesii* and *Sequoia sempervirens* forest, wetlands, and native forest remnants. Comparison of 46 "bat habitats" with habitat availability along 194 km of transects revealed long-tailed bats to select older pine forest and generally avoid unstocked land or younger forest. This pattern is supported by findings from monitoring work in young and mature pine forest. Older pine forest retains more heat, has a different understorey, and may offer more shelter than younger forest, potentially influencing insect prey abundance and bat activity. Bats' differential use of habitat may partially explain the lower number of bat encounters in the Wainui area than the Galaxy area. Six sites, including a wetland, older pine forest, and areas in or adjacent to native forest, had high bat activity.

The relative importance of exotic plantation forest and native podocarp broadleaf forest reserve land to foraging long-tailed bats was investigated in a replicated bat detector-based study. Insect abundance and ambient temperature were also monitored. Bat activity and foraging activity were much greater in the plantation forest than the native forest, possibly because of the greater abundance of moths — important prey. Forest type was the best predictor of bat activity.

Anecdotal accounts indicated several bat roosts to be in production trees (*P. radiata*), including old crop trees. One record was of a roost in a barely noticeable crevice in a 30-year-old pine, others were from areas of native forest, rocky crevices and a cave. Four accounts were of communal roosts. There is evidence that maternity roosts may occur in production forest. Most observations were made during the process of habitat modification and so roosts no longer exist. At least one possible communal roost was identified from bat activity data. A review of roosting ecology suggests that while highly mobile, long-tailed bats use many roosts in a small area, often roost near forest edges, are highly selective of roosts, and may face inter- and intra-specific competition for roosts.

Long-tailed bats may be very sensitive to roost site disturbance and habitat fragmentation. Tree felling, an important part of forestry, could threaten long-tailed bats at an individual and a population level by causing injury or death, reducing available habitat, and isolating bat groups. However, tree felling could create foraging (e.g. edge) habitat and facilitate access for bats. Overall, effects are likely to depend on the scale of operations. Other forestry operations which could negatively affect long-tailed bats include site preparation, pesticide use, infrastructure works, transportation and quarrying. Pest mammal control operations and the conservation of cave, wetland and reserve areas potentially benefit long-tailed bats in Kinleith Forest. The complex habitat mosaic may be favourable to long-tailed bats. However, there are many questions yet to be answered. Sensitive management may be needed to ensure bat survival in Kinleith Forest.

Long-tailed bats probably prey on a number of forestry pests including *Helicoverpa armigera* and may be an effective biocontrol agent. Artificial roost boxes could be used to encourage bats in this role and reduce the number of bats potentially harmed in tree felling operations.



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## **AUTHOR'S NOTE**

In the interests of clarity and ease of reading, the following chapters are structured as eight interrelated but standalone papers. While this leads to some repetition of material, it is thought that the benefits of this format far outweigh its limitations. Style decisions have been guided by the recommendations of the Council of Biological Editors. Supplementary information, including statistical analyses, is included in appendices at the back of this volume.

# TABLE OF CONTENTS

Title page.....	i
Frontispiece.....	ii
Abstract.....	iii
Acknowledgements.....	v
Author's note.....	vii
Table of contents.....	viii
List of figures.....	xiv
List of tables.....	xvii
List of appendices.....	xix

## 1

<b>General introduction.....</b>	<b>1</b>
Abstract.....	1
1 Introduction.....	1
2 Bats.....	2
Why are bats special?.....	2
Ecological roles and importance of bats.....	2
3 New Zealand bats.....	2
Origins.....	3
Description.....	3
Conservation status, national distribution, and threats.....	5
4 Plantation forestry in New Zealand.....	7
5 Occurrence of bats in plantation forest and within the Kinleith Forest area.....	8
6 Initiation and significance of this study.....	9
7 Objectives.....	10
8 Thesis structure.....	11
9 References.....	11

## 2

<b>Study area.....</b>	<b>19</b>
Abstract.....	19
1 Introduction.....	19
2 Location.....	19
3 Geology and soils.....	19
4 Topography.....	22
5 Climate.....	22
6 Historic vegetation.....	22

7 Forest establishment.....	23
8 Current vegetation.....	23
9 Iwi.....	24
10 References.....	24

### 3

<b>Bat presence and distribution in Kinleith Forest, an exotic plantation forest in the central North Island, New Zealand.....</b>	<b>26</b>
Abstract.....	26
1 Introduction.....	26
2 Study area.....	27
3 Methods.....	28
Bat presence and distribution in Kinleith Forest.....	29
Putting the Kinleith results in context.....	37
Data analysis.....	37
Evaluation of driving transects.....	39
4 Results.....	40
Bat presence and distribution in Kinleith Forest.....	40
The Kinleith results in the context of the central North Island.....	45
Evaluation of driving transects.....	45
5 Discussion.....	45
Bat distribution in the Kinleith Forest area.....	45
Long-tailed bats are “still” present.....	51
Long-tailed bats are present in pine forest.....	52
Long-tailed bat activity.....	52
Possible explanations.....	53
Short-tailed bats.....	53
The Kinleith results in the context of the central North Island.....	53
Scope and limitations.....	56
Appraisal of main survey methods.....	59
Future work.....	61
6 Conclusions.....	62
7 References.....	62

### 4

<b>The use of roads by long-tailed bats (<i>Chalinolobus tuberculatus</i>) in different forest types, Kinleith Forest.....</b>	<b>72</b>
Abstract.....	72
1 Introduction.....	72

2	Study area.....	73
3	Methods.....	75
	Comparison of bat activity at road and forest interior habitats in two contrasting ages of exotic forest.....	75
	Investigation of bat activity at road and forest interior habitats in exotic and native forest.....	78
4	Results.....	80
	Comparison of bat activity at road and forest interior habitats in two contrasting ages of exotic forest.....	80
	Investigation of bat activity at road and forest interior habitats in exotic and native forest.....	83
	Proportion of foraging calls.....	84
	Reliability of coding.....	84
5	Discussion.....	85
	Bat response to habitat type.....	85
	Differences in bat activity among replicates.....	90
	Scope and limitations.....	90
	Development of methods for the study of long-tailed bats in plantation forests...	92
	Management implications.....	92
6	Conclusions.....	92
7	References.....	93

## 5

<b>Broad-scale habitat use by long-tailed bats (<i>Chalinolobus tuberculatus</i>) in Kinleith Forest, central North Island, New Zealand.....</b>		<b>97</b>
	Abstract.....	97
1	Introduction.....	97
2	Study area.....	98
3	Methods.....	99
	General trends of habitat use.....	99
	Comparison of encounter rate in two contrasting areas of forest.....	99
	Habitat use by individual bats.....	99
	Habitat selection.....	99
	Comparison of bat activity in mature and young pine forest.....	100
	Specific sites of importance.....	101
4	Results.....	101
	General trends of habitat use.....	101
	Comparison of encounter rate in two contrasting areas of forest.....	102
	Habitat selection.....	104
	Comparison of bat activity in mature and young pine forest.....	104

Specific sites of importance.....	105
5 Discussion.....	106
General trends of habitat use.....	106
Habitat selection, differences in encounter rate, and differences in activity in mature and young pine forest.....	109
Important sites.....	111
Scope and limitations.....	112
Management implications.....	113
Future work.....	113
6 Conclusions.....	114
7 References.....	114

## 6

<b>The use of exotic plantation forest and native podocarp broadleaf forest by foraging long-tailed bats (<i>Chalinolobus tuberculatus</i>).....</b>	<b>120</b>
Abstract.....	120
1 Introduction.....	120
2 Study area.....	121
3 Methods.....	121
Comparison of bat activity in exotic and native forest.....	121
Investigation of bat activity at road and forest interior habitats in exotic and native forest.....	124
Reliability checking.....	126
Data analysis.....	126
4 Results.....	128
Comparison of bat activity in exotic and native forest.....	128
Investigation of bat activity at road and forest interior habitats in exotic and native forest.....	135
Reliability of coding.....	135
5 Discussion.....	135
Bat response to habitat type.....	135
Possible explanations.....	136
Predicting bat activity.....	139
Proportion of foraging calls.....	140
Scope and limitations.....	141
Management implications.....	142
Future work.....	142
6 Conclusions.....	143
7 References.....	143



## 7

<b>Roosting ecology of long-tailed bats (<i>Chalinolobus tuberculatus</i>) in Kinleith Forest, central North Island, New Zealand.....</b>	<b>148</b>
Abstract.....	148
1 Introduction.....	148
2 Study area.....	150
3 Methods.....	151
Radio-telemetry.....	151
Review of anecdotal records.....	152
Review of activity data.....	152
Tunnel inspection.....	152
4 Results.....	152
Anecdotal evidence of bat roosts.....	152
Areas of high bat activity.....	154
5 Discussion.....	154
The Kinleith results.....	154
Other potential roosting substrates in Kinleith Forest.....	158
Review of roosting ecology and social structure of long-tailed bats.....	159
Trapping bats.....	162
Future work.....	163
6 Conclusions.....	163
7 References.....	163

## 8

<b>Management influences and general discussion.....</b>	<b>169</b>
Abstract.....	169
1 Introduction.....	169
2 Effects of forestry on long-tailed bats.....	170
Tree felling operations.....	170
Other forestry operations and management influences.....	181
The Millennium Forestry regime.....	191
Overall.....	193
The unknowns.....	193
3 Benefits to forestry of long-tailed bats.....	194
4 Opportunities to work together.....	198
5 Findings and contributions of this study.....	199
Presence and distribution of bats in Kinleith Forest.....	199
Bats' use of the forest.....	200
The effects of forestry on bats.....	202

Other outcomes.....	202
Aiding conservation.....	203
6 Recommendations.....	204
CHHF.....	204
Plantation forest managers.....	205
The Bat Recovery Group.....	205
General.....	206
7 Conclusions.....	206
8 References.....	207
<b>9</b>	
<b>Appendices.....</b>	<b>220</b>

# LIST OF FIGURES

Frontispiece.....	ii
-------------------	----

**1**

<b>General introduction.....</b>	<b>1</b>
Figure 1 Location and extent of plantation forests in New Zealand.....	7

**2**

<b>Study area.....</b>	<b>19</b>
Figure 1 Location of Kinleith Forest.....	20
Figure 2 Commercial species of Kinleith Forest.....	24

**3**

<b>Bat presence and distribution in Kinleith Forest, an exotic plantation forest in the central North Island, New Zealand.....</b>	<b>26</b>
Figure 1 Location of Kinleith Forest.....	28
Figure 2 Location of bat survey sites in Kinleith Forest.....	31
Figure 3 Driving transect routes, Kinleith Forest.....	34
Figure 4 Bat sites and sightings in the Kinleith Forest area.....	41
Figure 5 Short-tailed bat ( <i>Mystacina tuberculata</i> ) and <i>Dactylanthus taylorii</i> sightings in the Kinleith Forest area.....	43
Figure 6 Bat sightings, central North Island, New Zealand, 1990–2000 inclusive in relation to vegetation type.....	44

**4**

<b>The use of roads by long-tailed bats (<i>Chalinolobus tuberculatus</i>) in different forest types, Kinleith Forest.....</b>	<b>72</b>
Figure 1 Location of Kinleith Forest and of study sites.....	74
Figure 2 Generalised investigation design.....	76
Figure 3 Generalised investigation design.....	80
Figure 4 Comparison of bat activity at roadside and forest interior habitats in mature pines, Pipeline Rd, Oct–Nov 1999.....	81
Figure 5 Comparison of bat activity at roadside and forest interior habitats in young pines, Kangaroo Rd, Nov–Dec 1999.....	81
Figure 6 Nightly activity profile of bats at roadside and forest interior habitats, mature pines, Pipeline Rd, Oct–Nov 1999.....	82

Figure 7	Nightly activity profile of bats at roadside and forest interior habitats, young pines, Kangaroo Rd, Nov–Dec 1999.....	83
Figure 8	Comparison of bat activity at roadside and forest interior habitats in exotic and native forest, Capricorn Rd, Apr–May 2000.....	84

## 5

### Broad-scale habitat use by long-tailed bats (*Chalinolobus tuberculatus*) in

<b>Kinleith Forest, central North Island, New Zealand.....</b>	<b>97</b>
Figure 1 Location of Kinleith Forest.....	98
Figure 2 Comparison of habitats sampled by the Galaxy and Wainui transects.....	103
Figure 3 Habitat selection by long-tailed bats, Kinleith Forest, 1998–1999.....	104
Figure 4 Nightly activity profiles for areas with high bat activity.....	107

## 6

### The use of exotic plantation forest and native podocarp broadleaf forest by foraging long-tailed bats (*Chalinolobus tuberculatus*).....

		<b>120</b>
Figure 1	Location of Kinleith Forest and of study site.....	122
Figure 2	Generalised investigation design.....	123
Figure 3	Generalised investigation design.....	125
Figure 4	Comparison of bat activity in exotic and native forest, Capricorn Rd, Mar–May 2000.....	128
Figure 5	Foraging activity of long-tailed bats in exotic and native forest, Capricorn Rd, Mar–May 2000.....	129
Figure 6	Comparison of moth and fly abundance from replicate light traps in exotic and native forest, Capricorn Rd, Mar–Apr 2000.....	130
Figure 7	Comparison of bat activity among monitoring sites, Capricorn Rd, Mar–Apr 2000.....	131
Figure 8	Bat activity detected by each ABM, Capricorn Rd, Mar–Apr 2000.....	131
Figure 9	Representation of the relationships between bat activity and environmental variables based on correlation analysis.....	132
Figure 10	Relationship between bat activity and moth and fly abundance.....	134
Figure 11	Comparison of bat activity at roadside and forest interior habitats in exotic and native forest, Capricorn Rd, Apr–May 2000.....	135

## 7

### Roosting ecology of long-tailed bats (*Chalinolobus tuberculatus*) in Kinleith

<b>Forest, central North Island, New Zealand.....</b>	<b>148</b>
Figure 1 Location of Kinleith Forest.....	150
Figure 2 Nightly activity profiles of areas with high bat activity.....	155



Figure 3 Communal long-tailed bat roost in 30-year-old *Pinus radiata*, near Upper Atiamuri, Kinleith Forest, 1996..... 158

**8**

**Management influences and general discussion..... 169**

**9**

**Appendices..... 220**



# LIST OF TABLES

## 1

General introduction.....	1
---------------------------	---

## 2

Study area.....	19
-----------------	----

## 3

<b>Bat presence and distribution in Kinleith Forest, an exotic plantation forest in the central North Island, New Zealand.....</b>	<b>26</b>
Table 1 Driving transect survey effort.....	35
Table 2 Driving transect survey effort.....	36
Table 3 The contributions of central North Island bat site data from the literature, species files and National Bat Database.....	39
Table 4 Comparison of the efficiency of an ABM-based survey and driving transects in finding new bat sites in Kinleith Forest.....	46
Table 5 Review of bat sightings in the Kinleith Forest area.....	47

## 4

<b>The use of roads by long-tailed bats (<i>Chalinolobus tuberculatus</i>) in different forest types, Kinleith Forest.....</b>	<b>72</b>
Table 1 Bat activity in each forest type.....	82
Table 2 Ambient temperature by habitat in each forest type.....	83
Table 3 Summary of bat activity and foraging activity by habitat in each forest type.....	84

## 5

<b>Broad-scale habitat use by long-tailed bats (<i>Chalinolobus tuberculatus</i>) in Kinleith Forest, central North Island, New Zealand.....</b>	<b>97</b>
Table 1 Number of ABM-nights analysed per site.....	101
Table 2 Bat encounters on paired Galaxy and Wainui transects.....	103
Table 3 Comparison of the occurrence of key forest types along the Galaxy and Wainui transects.....	103
Table 4 Comparison of bat activity in mature pines (Pipeline Rd, Oct–Nov 1999), and young pines (Kangaroo Rd, Nov–Dec 1999).....	105
Table 5 Areas of Kinleith Forest with high hourly long-tailed bat activity.....	105
Table 6 Areas of Kinleith Forest with high nightly long-tailed bat activity.....	106

## 6

<b>The use of exotic plantation forest and native podocarp broadleaf forest by foraging long-tailed bats (<i>Chalinolobus tuberculatus</i>).....</b>	<b>120</b>
Table 1 Comparison of ambient temperature in exotic and native forest.....	129
Table 2 Comparison of invertebrate abundance in exotic and native forest.....	130
Table 3 Comparison of the median number of bat passes detected by each ABM with the overall median.....	132
Table 4 Forward and backward stepwise regression of mean bat activity.....	133
Table 5 Forward stepwise regression of mean bat activity.....	133
Table 6 Forward and backward stepwise regression of mean bat activity with two influential data points removed.....	134

## 7

<b>Roosting ecology of long-tailed bats (<i>Chalinolobus tuberculatus</i>) in Kinleith Forest, central North Island, New Zealand.....</b>	<b>148</b>
---	------------

## 8

<b>Management influences and general discussion.....</b>	<b>169</b>
--	------------

## 9

<b>Appendices.....</b>	<b>220</b>
------------------------	------------

# LIST OF APPENDICES

<b>Appendices.....</b>	<b>220</b>
1 General introduction.....	220
1.1 Further information about bats.....	220
2 Study area.....	226
3 Bat presence and distribution.....	226
3.1 Bat sighting form distributed to recreational hunters.....	226
3.2 Revisions made to the National Bat Database data set before mapping.....	226
4 Use of roads by long-tailed bats.....	228
4.1 Site description (exotic forest of two contrasting ages).....	228
4.2 Pre-study comparison of temperature loggers.....	228
4.3 Assessment of the normality of differences of nightly minimum temperatures for road and forest sites.....	229
4.4 Site description (exotic and native forest).....	230
4.5 Bat activity at road and forest interior habitats in mature and young forest.....	231
4.6 Proportionate use of habitat.....	239
4.7 Ambient temperature by habitat in mature and young forest.....	239
4.8 Proportion of foraging calls by habitat in mature forest (Pipeline Rd).....	241
5 Habitat use by long-tailed bats.....	242
5.1 Assessment of habitat selection.....	242
5.2 Comparison of bat activity in mature and young pine forest.....	243
6 Use of exotic/native forest by foraging bats.....	243
6.1 Description of bat activity monitoring sites (comparison of bat activity in exotic and native forest) .....	243
6.2 Description of bat activity monitoring sites (investigation of bat activity at road and forest interior habitats in exotic and native forest).....	245
6.3 Assessment of normality of differences of nightly minimum temperatures for exotic and native forest sites.....	246
6.4 Comparison of bat activity in exotic and native forest.....	246
6.5 Comparison of foraging activity in exotic and native forest.....	250
6.6 Comparison of ambient temperature between exotic and native forest.....	250
6.7 Correlations between bat activity and environmental variables.....	252
6.8 Correlations between bat activity and environmental variables (with influential points omitted).....	254
7 Roosting ecology of long-tailed bats.....	255
8 Management influences and general discussion.....	255