



Department of Conservation biodiversity indicators: 2013 assessment—supplementary material



OCTOBER 2013

newzealand.govt.nz

Department of
Conservation
Te Papa Atawhai

Department of Conservation biodiversity indicators: 2013 assessment—supplementary material
Cover: Princess Stream, Maling Pass near Lake Tennyson, St James Station, January 2012. *Photo: Steve Sutton.*

© Copyright October 2013, New Zealand Department of Conservation
In the interest of forest conservation, we support paperless electronic publishing.

CONTENTS

Introduction	1
Summary information on biodiversity indicators	1
Supplementary indicator reports	2
1. Percentage of environmental unit under indigenous vegetation and protected	2
2. Percentage of environmental unit in marine protected areas	5
3. Size-class structure of canopy dominants	5
4. Representation of plant functional types	5
5. Demography of widespread animal species	5
6. Representation of animal guilds	9
7. Extent of potential range occupied by focal taxa	9
8. Number of extinctions	9
9. Number of 'Threatened' and 'At Risk' species	9
10. Demographic response to management at a population level for selected 'Threatened' and 'At Risk' taxa	10
11. Number, extent and control of fires	12
12. Occurrence and intensity of mast flowering and fruit production	13
13. Distribution and abundance of exotic weeds and animal pests considered a threat	13
References	14
Appendix 1	14
Protected areas definition	14

Introduction

This report underpins the intermediate outcome *the diversity of our natural heritage is maintained and restored* in the Department of Conservation's (DOC's) Annual Report for the year ending 30 June 2013. It provides more detailed information on a subset of DOC's biodiversity indicators which are not covered in the Landcare Research report Department of Conservation biodiversity indicators: 2013 assessment¹ Both reports are summarised in DOC's Annual Report for 2012-13.

The DOC Annual Report and both technical reports are available on the DOC website.

Summary information on biodiversity indicators

Table 1 lists each indicator (by number) and describes where more detailed information about them can be obtained.

Table 1. List of biodiversity indicators and where more information about them can be obtained.

INDICATOR	LOCATION OF INFORMATION
1. % of environmental unit under indigenous vegetation and protected	Refer to this report for a general overview at LENZ 20 group level updated using protection data from July 2013 and more recent analyses at LENZ 500 group level.
2. % of environmental unit in marine protected areas	Refer to this report.
3. Size-class structure of canopy dominants	Refer to Landcare Research report.
4. Representation of plant functional types	Refer to Landcare Research report.
5. Demography of widespread animal species	This indicator contributes to the Landcare Research analysis on the status of New Zealand's biodiversity. However, this report provides a case study on South Island robins updated using data collected this past year.
6. Representation of animal guilds	This indicator is not being reported in 2011/12 The first report on the measure will be made in 2015/16 and annually thereafter.
7. Extent of potential range occupied by focal taxa	This indicator is not being reported in 2012/13 but will be reported in 2013/14 for selected taxa and thereafter every 5 years.
8. Number of extinctions	Refer to this report.
9. Number of 'threatened' and 'at risk' species	Refer to this report.
10. Demographic response to management at a population level for selected 'threatened' and 'at risk' taxa	Refer to this report.
11. Number, extent and control of fire	Refer to this report.
12. Change in extent and integrity of nationally uncommon, significantly reduced habitats/ ecosystems that are protected	Refer to the Landcare Research report.
13. Occurrence and intensity of mast flowering and fruit production	There was no significant mast flowering and fruiting this year requiring intervention. Please refer to summary in Annual Report.
14. Distribution and abundance of exotic weeds and animal pests considered a threat	Refer to Landcare Research report.

¹ 'DOC biodiversity indicators: 2013 assessment' by Landcare Research <http://www.doc.govt.nz/about-doc/role/corporate-publications/annual-reports-archive/annual-report-for-year-ended-30-june-2012/>

Supplementary indicator reports

The following text provides more detail on the indicators DOC reports on.

1. Percentage of environmental unit under indigenous vegetation and protected *Measures 6.1.1 and 6.1.2²*

Percentage of environmental unit under indigenous cover and protected.

Definition

Percentage of Land Environments of New Zealand (LENZ) environments in indigenous cover and legally protected. This measure is a quantification of the transformation of the New Zealand landscape and assesses the degree to which the potential for indigenous biodiversity is realised.

Methods

This measure combines three national datasets to produce a table showing the overall changes in New Zealand's native vegetation by Environment type, and changes in the amount of native cover protected. The percentage of LENZ environments under indigenous vegetation and legally protected was evaluated using the national Landcover Database (LCDB) categorised by indigenous versus modified vegetation for New Zealand as a whole. The data presented use Landcover information from 1996, 2001 and 2008. This information will be updated once LCDB₄ becomes available. The LENZ database, developed by Landcare Research and managed by the Ministry for the Environment, is being used. DOC previously used it at Level 1 scale to identify 20 types of 'Environment' across New Zealand—places that are grouped together because they are more similar to each other environmentally than they are to other places. A secondary analysis was also run at the Level 4 scale (500 groups) to detect changes at a higher resolution. The legal protection layer (see Appendix 1) includes DOC-managed land, Nga Whenua Rahui and QE2 covenants calculated in July 2013.

The landcover categorisation into native versus modified vegetation can be found in the DOC spreadsheet LCDB₃ LENZ Protected Summary, 6 July 2012 (DOCDM-1023236). There have been no updates on this information since 2012. The threat categories for environment types relate to the percentage of environments legally protected and/or the percentage of remaining native cover. Using this measure, two categories of threat were identified— acutely threatened (< 10% indigenous cover remaining) and chronically threatened (10–20% indigenous cover remaining). Environment types in the threatened categories are likely to contain some of our most severely reduced and poorly protected ecosystems, habitats and species.

Results

Table 2a shows the change in native cover from 1996/97 to 2001/02 and from 2001/2002 to 2008 by environment and legal protection (calculated in July 2013). As previously reported (DOC 2012), the data show that there was no marked difference in indigenous cover by environment unit or in protection status between 1996 and 2008 at the LENZ level 1 group. As of 2008, the lowland regions throughout the North Island and in the eastern South Island are the regions with the least area under protection (less than 10%). Of these, less than 1% of the eastern South Island plains and Western, Central and Southern North Island lowlands are covered by indigenous vegetation and protected. Table 2b shows the change in threat classification level of the LENZ level 4 groups. These results are consistent with those found by Landcare Research in a recent publication (Cieraad et al. 2013). Four of these environments have declined in their threat classification status from 2001–2008 and one environment has improved. See DOCDM-1259179 for a complete listing of all environments and their status.

² See chart in Biodiversity monitoring and reporting system technical fact sheet at <http://www.doc.govt.nz/upload/documents/about-doc/role/policies-and-plans/biodiversity-monitoring-and-reporting-system.pdf> for the full list of DOC measures.

Table 2a. Percentage of environmental unit under indigenous vegetation and protected.

LENZ CLASSIFICATION (LEVEL 1)	LAND ENVIRONMENT NAME	THREAT CLASSIFICATION	TOTAL AREA OF EACH LENZ LEVEL 1 CLASSIFICATION (ha) ACROSS ALL NEW ZEALAND, EXCLUDING OFFSHORE ISLANDS	PROPORTION PROTECTED IN 2008 (%)	PROPORTION INDIGENOUS AND PROTECTED IN 2008 (%)
A	Northern lowlands	Chronically threatened	1,853,478.5	5.5	4.7
B	Central dry lowlands	Chronically threatened	691,613.9	2.1	1.1
C	Western and southern North Island lowlands	Acutely threatened	636,262.4	1.2	0.9
D	Northern hill country		2,103,297.0	22.2	21.7
E	Central dry foothills		1,323,344.4	28.8	21.2
F	Central hill country and volcanic plateau	Under-protected	5,245,897.1	20.5	19.8
G	Northern recent soils	Chronically threatened	338,895.4	7.9	5.1
H	Central sandy recent soils		135,380.3	22.0	20.6
I	Central poorly-drained recent soils	Acutely threatened	121,102.8	3.2	2.0
J	Central well-drained recent soils	Acutely threatened	293,522.5	2.1	0.8
K	Central upland recent soils		160,771.1	28.3	15.6
L	Southern lowlands	Chronically threatened	802,598.3	8.1	7.1
M	Western South Island recent soils		220,661.7	50.9	45.1
N	Eastern South Island plains		2,044,918.0	1.0	0.4
O	Western South Island foothills and Stewart Island	Acutely threatened	1,415,944.3	82.6	81.7
P	Central mountains		3,248,187.3	77.4	76.2
Q	Southeastern hill country and mountains		3,277,240.1	22.5	21.1
R	Southern Alps		1,931,525.7	95.4	95.3
S	Ultramafic soils		33,513.4	93.4	92.9
T	Permanent snow and ice		157,155.9	97.8	97.8
Other*			211,421.7	21.6	14.1
Total			26,246,731.9	33.7	32.4

* Other is the NULL class in LENZ layer. These are predominantly in Rivers, Estuaries and Lakes.

Table 2b. Level 4 environmental units that have undergone change in threat classification status.

LENZ (CLASSIFICATION LEVEL 4)	THREAT CLASSIFICATION 2001	THREAT CLASSIFICATION 2008	CHANGE FROM 2001-2008	TOTAL AREA OF EACH LENZ LEVEL 4 CLASSIFICATION (ha) ACROSS ALL NEW ZEALAND, EXCLUDING OFFSHORE ISLANDS	PROPORTION PROTECTED IN 2008 (%)	PROPORTION INDIGENOUS AND PROTECTED 2008 (%)
B1.1c	Chronically Threatened	Acutely Threatened	Decline	6,290.09	0.90	0.84
B3.1a	Chronically Threatened	Acutely Threatened	Decline	55,637.37	2.02	0.98
B3.1c	Chronically Threatened	Acutely Threatened	Decline	19,649.12	0.83	0.64
H1.2d	At Risk	Critically Underprotected	Improved	1,759.06	3.45	1.29
J2.1d	Chronically Threatened	Acutely Threatened	Decline	3,202.43	10.83	4.93

Interpretation and implications

These quantitative data on environment types, their degrees of representation in protected areas, and their threat status, will help conservation managers consider opportunities for protection. For example, if a landowner wants to sell or covenant an area of land, the question arises whether that Environment type is already well represented in protected areas and therefore a low priority, or whether it is a highly-threatened environment type and therefore a high priority for protection. Large land status changes would be needed to influence the threat classification at the Level 1 grouping, whereas at Level 4, small changes can influence the threat classification more readily. Lowland areas in the North Island and eastern South Island remain poorly protected and vulnerable to development.

2. Percentage of environmental unit in marine protected areas

Measures

Percentage of environmental unit in marine protected areas.

Definition

The area of marine reserves and marine mammal sanctuaries.

Methods

All data (marine reserve name, date and legal area) are taken directly from the relevant Order in Council. Please note that areas may not be completely accurate and may differ from other reported figures, particularly those calculated using GIS.

Results

Approximately 7%, or 1.28 million hectares, of New Zealand's Territorial Sea is protected within marine reserves. In 2012, the Subantarctic Islands Marine Reserves Bill was referred to the Local Government and Environment Select Committee. Submissions on the Bill were heard in early 2013 and the Select Committee reported back on the Bill in June 2013. The Bill would create three new marine reserves in the Subantarctic Biogeographic Region—around Campbell Island/Motu Ihupuku, Antipodes Island Group and the Bounty Islands. Applications for five marine reserves on the South Island's West Coast, and one marine reserve in Akaroa Harbour, were approved by the Minister of Conservation and statutory concurrence is now being sought from the Minister for Primary Industries and Minister of Transport. Table 3 lists gazetted marine reserves and Table 4 lists marine mammal sanctuaries as at 30 June 2013, while Table 5 summarises marine areas managed by DOC.

3. Size-class structure of canopy dominants

Refer to Landcare Research report 2012-13.

4. Representation of plant functional types

Refer to Landcare Research report 2012-13.

5. Demography of widespread animal species

Measure 5.1.

Demography of widespread animal species—case study, South Island robin (*Petroica australis*)

Note: Five additional indicator species were selected and their feasibility for sampling and reporting evaluated. Sampling programmes were designed for several of these in 2013/14. Pilot programmes for NZ Scaup (*Aythya novaeseelandiae*) and Mountain stone weta (*Hemideina maori*) were implemented in 2013.

Table 3. New Zealand marine reserves as at 30 June 2013 (34 marine reserves).

IDENTIFIER	MARINE RESERVE NAME	DATE ESTABLISHED	LEGAL AREA (ha*)	PROPORTION OF NZ TS (%)
MR1	Cape Rodney-Okakari Point Marine Reserve	1975	547	0.003
MR2	Poor Knights Islands Marine Reserve	1981	2,410	0.013
MR3	Kermadec Islands Marine Reserve	1990	748,000	4.128
MR4	Kapiti Island Marine Reserve	1992	2,167	0.012
MR5	Whanganui A Hei (Cathedral Cove) Marine Reserve	1992	840	0.005
MR6	Tuhua (Mayor Island) Marine Reserve	1992	1,060	0.006
MR7	Long Island-Kokomohua Marine Reserve	1993	619	0.003
MR8	Te Awaatu Channel (The Gut) Marine Reserve	1993	93	0.001
MR9	Piopiotaahi (Milford Sound) Marine Reserve	1993	690	0.004
MR10	Tonga Island Marine Reserve	1993	1,835	0.010
MR11	Westhaven (Te Tai Tapu) Marine Reserve	1994	536	0.003
MR12	Long Bay-Okura Marine Reserve	1995	980	0.005
MR13	Motu Manawa-Pollen Island Marine Reserve	1995	500	0.003
MR14	Te Angiangi Marine Reserve	1997	446	0.002
MR15	Pohatu Marine Reserve	1999	215	0.001
MR16	Te Tapuwae o Rongokako Marine Reserve	1999	2,452	0.014
MR17	Auckland Islands (Motu Maha) Marine Reserve	2003	498,000	2.748
MR18	Ulva Island - Te Wharawhara Marine Reserve	2004	1,075	0.006
MR19	Te Hapua (Sutherland Sound) Marine Reserve	2005	449	0.002
MR20	Hawea (Clio Rocks) Marine Reserve	2005	411	0.002
MR21	Kahukura (Gold Arm) Marine Reserve	2005	464	0.003
MR22	Kutu Parera (Gaer Arm) Marine Reserve	2005	433	0.002
MR23	Taipari Roa (Elizabeth Island) Marine Reserve	2005	613	0.003
MR24	Moana Uta (Wet Jacket Arm) Marine Reserve	2005	2,007	0.011
MR25	Taumoana (Five Finger Peninsula) Marine Reserve	2005	1,466	0.008
MR26	Te Tapuwae o Hua (Long Sound) Marine Reserve	2005	3,672	0.020
MR27	Te Matuku Marine Reserve	2005	690	0.004
MR28	Horoirangi Marine Reserve	2006	904	0.005
MR29	Parinihihi Marine Reserve	2006	1,844	0.010
MR30	Te Paepae o Aotea (Volkner Rocks) Marine Reserve	2006	1,267	0.007
MR31	Whangarei Harbour Marine Reserve	2006	237	0.001
MR32	Tapuae Marine Reserve	2008	1,404	0.008
MR33	Taputeranga Marine Reserve	2008	855	0.005
MR34	Tāwharanui Marine Reserve	2011	394	0.002
Total			1,279,574	7.061

* Note: All figures are rounded to the closest zero, including the total.

Definition

This measure assesses the number and distribution of widespread species, and selected indicator species (e.g. robins), and is used as an early warning of long-term changes in populations so that action can be taken before it is too late.

South Island robins have been identified as a useful indicator for measuring changes in demography of a widespread forest bird species which is vulnerable to predation by rats (*Rattus* spp.) and stoats (*Mustela erminea*).

Table 4. Marine mammal sanctuaries in New Zealand as at 30 June 2013.

MARINE MAMMAL SANCTUARY NAME	DATE GAZETTED	LEGAL (CONSERVATION UNIT) AREA (ha)*
1 Banks Peninsula Marine Mammal Sanctuary	1988	407,696
2 Auckland Islands Marine Mammal Sanctuary	1993	505,710
3 Te Waewae Bay Marine Mammal Sanctuary	2008	34,884
4 Catlins Coast Marine Mammal Sanctuary	2008	65,388
5 Clifford and Cloudy Bay Marine Mammal Sanctuary	2008	138,600
6 West Coast North Island Marine Mammal Sanctuary	2008	1,193,542
	Total area	2,345,820

* These data are derived from the legal area of each marine mammal sanctuary (DOC Conservation Units), which likely differs from area calculated using GIS, due to aspects such as differing projection.

For the Auckland Islands Marine Mammal Sanctuary, the Conservation Unit area included the area of the islands themselves and so for this Sanctuary the area of the GIS shape area has been provided. This explains the discrepancy between the area calculated for the Auckland Islands Marine Mammal Sanctuary and the Auckland Islands Marine Reserve, which overlap spatially.

Table 5. Summary of marine areas managed by DOC.

		AT 30 JUNE 2013	CHANGE SINCE LAST ANNUAL REPORT
Marine reserves	Total area	1.28 million ha	No change
	Percentage of Territorial Sea	7.061%	No change
	Percentage of marine area	0.31%	No change
Marine mammal sanctuaries	Total area	2.35 million ha	No change
	Percentage of Territorial Sea*	12.946%	No change
	Percentage of marine area†	0.57%	No change

* Area of Territorial Sea is 18.12 million hectares

† Area of Territorial Sea and Exclusive Economic Zone ("marine area") is 414.57 million hectares (excludes New Zealand land masses and extended continental shelf).

Methods

The numbers of robins inhabiting two forest blocks (Walker Creek and Knobs Flat) within the Eglinton Valley, Fiordland have been monitored intensively since 2005. The data collected have provided a valuable time series useful for the real-time evaluation of various pest management regimes and the performance of monitoring methods. Sufficient data have also been collected to allow development of predictive population models to assess the long-term benefits of different conservation management techniques.

Results

Following the significant increase in the numbers of rats within the Eglinton Valley in 2006, intensive pest management was initiated at Walker Creek. Although robin numbers had declined by 48% to a low of 15 by 2008 (Fig. 1), there has been a steady increase in their numbers in subsequent years. The small decline in robins between August 2010 and August 2011 (from a peak of 39 to 27 birds) was thought to be the result of significant winter mortality (deep snow for prolonged periods) and increasing rat numbers (8% tracking rates). Pest control was subsequently implemented in the spring of 2011 and a particularly productive 2011/12 breeding season followed, with robin numbers at Walker Creek increasing by 36% to a total of 42 birds in August 2012. Pest control at Walker Creek has clearly contributed to an increasing trend in robin numbers and we anticipate further increases in future years.

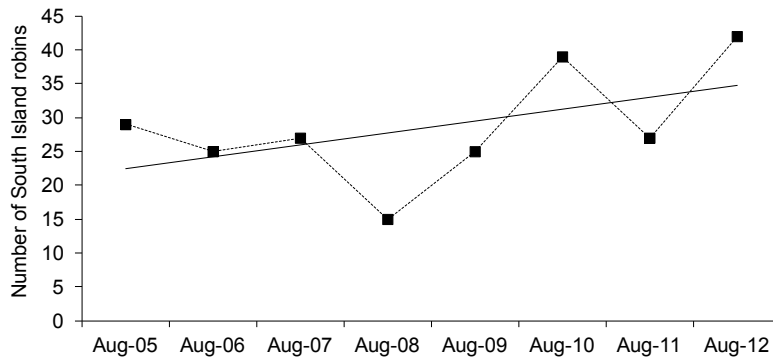


Figure 1. Estimate of number of robins derived from territory mapping at Walker Creek.

At Knobs Flat, where pest control was not initiated until 2011, the reduction in robin numbers was even more marked, with the population declining by 67% to 12 birds in 2008. Although there has been a subsequent increase in the number of robins, the rate of recovery has been slower than that seen at Walker Creek and is yet to surpass the known population (42 robins) reached in 2006 (Fig. 2). The overall trend has therefore remained one of slow decline. It is hoped that the initiation of pest control at Knobs Flat in 2011 (along with large areas in the rest of the Eglinton Valley) and good winter survival rates will reverse this trend within a relatively short period.

Interpretation and implications

Robins are an engaging presence within forests throughout New Zealand and are often attracted to human activities within them. Although robins are still widespread, their numbers and distribution contracted markedly over the previous century. Ongoing predation pressure, especially from periodic irruptions of rodents and mustelids, is particularly damaging. Rapid declines in robin numbers (and the numbers of many other forest birds), such as those observed in the Eglinton Valley, appear to be the inevitable consequence of these irruptions. Without the effective management of predator populations, particularly in peak predator years, the recovery and long-term survival of robins and other bird species at healthy levels within mainland forests remains uncertain.

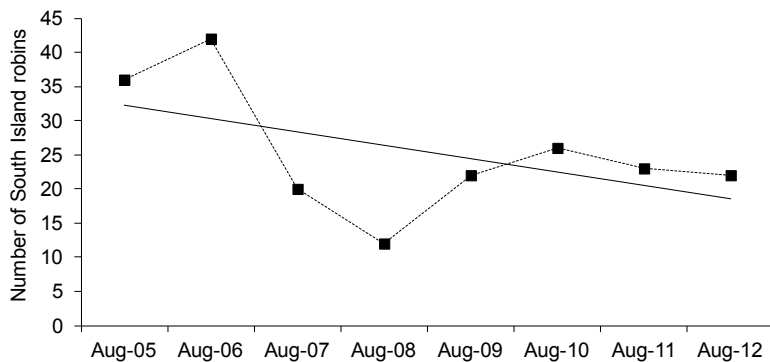


Figure 2. Estimate of the number of robins derived from territory mapping at Knobs Flat.

6. Representation of animal guilds

The first report on this indicator will be made in 2015–16 and annually thereafter.

7. Extent of potential range occupied by focal taxa

There has been a delay in progressing development of this indicator and it will now be reported in 2013/14 for selected taxa and thereafter every 5 years.

8. Number of extinctions

Measure

Preventing declines and reducing extinctions

Definition

Taxa (species, subspecies, varieties and forma) that have become extinct since human settlement (here defined as the last 1000 years).

Methods

Taxa are assessed as being extinct only if there is no reasonable doubt, after repeated surveys in known or expected habitats at appropriate times (diurnal, seasonal and annual) and throughout the taxon's historic range, that the last individual has died. Taxa that are extinct in the wild but occur in captivity or cultivation are not listed in this category; these are listed instead as 'Nationally Critical' with qualifier 'EW' (Extinct in the Wild)—for further information see Townsend et al. (2008).

Results

Information on extinct taxa is gathered over 3-year cycles. The assessment process for the 2012–2014 cycle is roughly halfway to completion. So far, one new species has been listed as 'Extinct'—a plant which became extinct many decades ago but has only recently been identified as a distinct species (during a taxonomic revision of the group it was realised that what had been considered one extinct species was actually two closely related extinct species). One bird has been removed from 'Extinct' to 'Data Deficient'; because, while it may indeed be extinct, there have been unconfirmed sightings which have raised some doubt about its status.

This indicator will be reported on again in 2015.

9. Number of 'Threatened' and 'At Risk' species

Measure

Improve status of 'Threatened' and 'At Risk' taxa

Definition

'Threatened' taxa are those that are facing imminent extinction. 'At risk' taxa are those that, although either declining, or having small populations or small areas of occupancy, are not facing imminent extinction.

Methods

The New Zealand Threat Classification System (NZTCS) is used to assess the threat status of New Zealand taxa, with the status of each taxon group being assessed over 3-year cycles. 'Threatened' taxa are grouped into three categories: 'Nationally Critical' (at greatest risk of extinction), 'Nationally Endangered' and 'Nationally Vulnerable'. 'At Risk' taxa are declining (though buffered by a large total population size and/or a slow decline rate), biologically scarce, recovering from a previously threatened status, or survive only in relictual populations. Four 'At Risk' categories exist: 'Declining', 'Recovering', 'Relict' and 'Naturally Uncommon'. There is no

ranking or hierarchy of threat status amongst these because 'At Risk' categories reflect different types of risk, not different levels of risk. See Townsend et al. for more information about the NZTCS and its categories.

Results

Information on NZTCS status is gathered over 3-year cycles. The assessment process for the 2012–2014 cycle is roughly halfway to completion. Incomplete interim results suggest an ongoing deterioration in status in many species in all groups, with some notable exceptions where species that are being actively managed have improved in status as a result.

This indicator will be reported on again in 2015.

10. Demographic response to management at a population level for selected 'Threatened' and 'At Risk' taxa

Measure 4.2.4

Demographic response to management at a population level for selected taxa

Definition

Robust demographic data for intensively managed species, in terms of births, deaths and population size, are related to management effort and variability in factors responsible for declines. The data presented can constitute actual current trend or predicted population trend with and without management. This measure provides a report for two forest-dwelling species vulnerable to predation by stoats, rats and cats (*Felis catus*):

- The long-tailed bat (*Chalinolobus tuberculatus*), one of only two forest-dwelling terrestrial mammals found in New Zealand and;
- Kākāpō (*Strigops habroptilus*), a flightless, ground-nesting parrot species.

Methods

Two methods are described:

- Predicted population from a population model (long-tailed bats)
- Complete census of number of individuals (kākāpō)

LONG-TAILED BATS

Predation, particularly by introduced rats, has been identified as the major cause of decline of the critically endangered South Island long-tailed bat. The response of long-tailed bats to rat control in beech (*Nothofagus* spp.) forest in the Eglinton Valley, Fiordland has been measured. This was done by estimating survival using mark-recapture field data from 1993 to 2013 in Program MARK. The survival of juvenile and adult female long-tailed bats, along with the proportion of females breeding, was recorded in three colonies each year and modelled using an age-classified population projection matrix. The effect of periodic predation by rats on long-term survival and population trends of bats was compared with bat-population response when rat population irruptions were managed. The intrinsic rate of increase, λ , was calculated for both management and no management scenarios and the results were projected over a 25-year scenario (Fig. 3). For a population to be stable or growing, management must result in λ being equal to or greater than 1. The confidence intervals were calculated using the variation of survival figures within each time period.

Results: The modelling was based on the current data of 13 years with low rat numbers, 3 years with medium rat numbers and 4 years with high rat numbers. The management of rats in the Eglinton Valley was instigated after a rat irruption was predicted in 2006 following heavy (mast) seeding of beech. Two more mast events have occurred since 2006, with rats having been controlled on both occasions. The intrinsic rate of increase for the time period with rat



Figure 3. Predicted population trends in numbers of female long-tailed bats in the Eglinton Valley over 25 years with and without management of rats (shaded areas represent 95% confidence intervals).

management is > 1.0 ($\lambda = 1.05$), therefore the population increases (Fig. 3), whereas the rate of increase for the time period without rat management is < 1.0 ($\lambda = 0.99$), causing the population to decline. These predicted trends are based on a start point of the 159 adult females that were known to be alive in 2006.

Interpretation and implications: Numbers of introduced predators in temperate beech forests fluctuate dramatically in relation to food availability. The beech trees flower and seed heavily (mast) at irregular intervals, usually every 3–5 years, dramatically increasing the food supply for introduced rodents. Irruptions in mouse (*Mus musculus*) and rat numbers that follow then trigger the prolific breeding of stoats and increase the predation pressure on native fauna even further. Effective management of predator irruptions is essential for improving the long-term survival of threatened native species in these forests. Our data indicate that the management regime instituted in the Eglinton Valley will be effective at reversing declines of long-tailed bats in the valley.

KĀKĀPŌ

Methods: Data on live individuals were estimated for the period between 1974 and 1990. Since about 1990, the whole population has carried transmitters, so from 1990 on, the number of birds known to be alive is approximately equal to the total population size, so data presented from 1990 onwards represents the whole population.

Results: The kākāpō is the world largest parrot, the only flightless one and the only one to exhibit lek breeding (where males gather to display and entice females to mate). It is confined to New Zealand and its flightlessness, ground nesting and infrequent breeding have made it particularly vulnerable to hunting and introduced stoats, rats and cats. Kākāpō are good food and were enthusiastically hunted by Māori and their dogs and were in decline even in Māori times. Europeans continued the hunting pressure, but the arrival of their associated mammalian predators in the mid to late 1800s had the greatest impact, accelerating the rate of decline of kākāpō such that by the 1970s they were thought to be confined to remote parts of Fiordland where only a few male birds were known to survive. In 1977 a population of more than 100 birds was discovered on southern Stewart Island. Between 1977 and the late 1980s, these birds were

transferred from Stewart Island, where they were being eaten by cats, to islands that were mostly predator-free (Maud, Codfish (Whenuahou) and Te Hauturu-o-Toi / Little Barrier). The rate of decline decreased, but the population still did not increase. In 1995, in response to this lack of increase, kākāpō management was intensified, and spending on research increased. Six new management techniques were developed: nests were monitored intensively; chicks that did not thrive were rescued and hand raised; rats were controlled around nests and eventually eliminated from the islands; breeding effort became predictable from the fruiting of forest trees; and birds were moved between islands to make the most of fruiting. By 2009, kākāpō management had become so successful that there were now more young birds than old ones and management moved to a new phase—recovery rather than rescue.

Interpretation and implications

Kākāpō research and management is now focused on overcoming the bird’s low fertility, which is a consequence of inbreeding and very low genetic diversity. Matings between kākāpō are planned and manipulated to maximise genetic diversity of offspring, and artificial insemination has been developed and used also to maximise genetic diversity. The 2012/13 financial year was not a kākāpō breeding year (they breed only once every 3 or 4 years) so no chicks were produced. One old female kākāpō of unknown age died and the population decreased by less than 1% to 124 birds (Fig. 4).

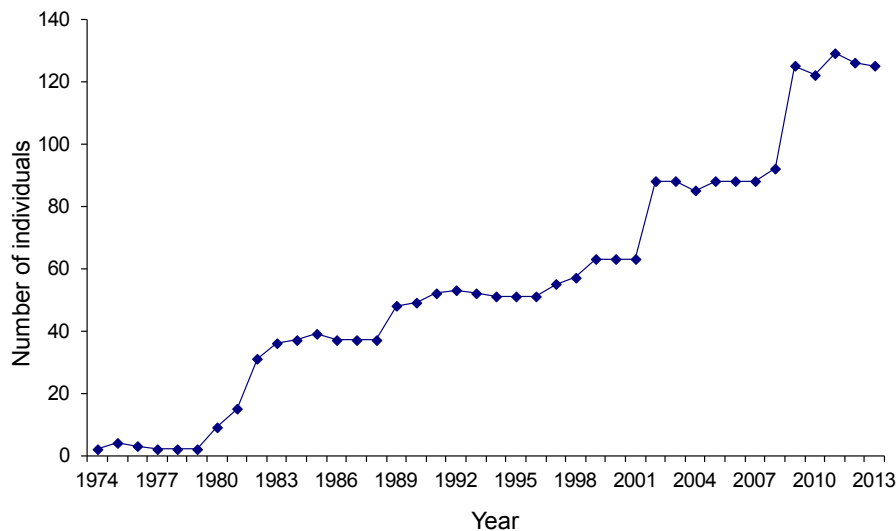


Figure 4. Total number of kākāpō.

11. Number, extent and control of fires

Measure 1.4.1

Number, extent and control of fires

Definition

This measure records the extent of areas burnt on public conservation land. Fire on DOC-managed land, or fire from DOC-managed land that affects other landowners (or vice versa), is crucial input to assessing risks, DOC management, and community relations.

Methods

Data were compiled from the Fire Occurrence Database maintained by DOC staff. A number of agencies are involved in fire control. Spatial extents of area burnt are maintained by DOC on behalf of the National Rural Fire Authority.

Results

The estimated number of fires during 2012/13 was 151. The total area burnt was approximately 564 ha (Table 6). Half of the area burnt (283 ha) was public conservation land. The rest was land within the 1-kilometre fire safety margin around public conservation land where DOC typically also manages any fires that occur (102 Fires, 278 ha). The majority of fires (120—79%) occurred within the South Island—83 (55%) in Canterbury and 33 (22%) in Otago. However, in terms of actual land area burnt, the North Island accounted for 79% of the total area.

Table 6. Number, area and cost of fires managed by DOC during 2012–13.

CONSERVANCY	AREA BURNT (ha)	NUMBER OF FIRES	PROPORTION OF FIRES (%)	PROPORTION OF COST (%)	ESTIMATED COST (\$)
Canterbury	47.4	83	55	6	77,259
East Coast Bay of Plenty	12.2	15	10	5	62,400
Nelson Marlborough	2.9	2	1	1	12,000
Northland	208.0	1	1	56	761,000
Otago	33.1	33	22	6	82,582
Tongariro Whanganui Taranaki	226.7	12	8	25	344,105
Waikato	0.3	3	2	0	100
West Coast Tai Poutini	33.0	2	1	1	13,000
Total	563.6	151	100	100	1,352,446

Interpretation and implications

During 2012/13, the total number of fires recorded more than doubled from the previous year's total (from 62 in 2011/12 to 151 in 2012/13). The 2012/13 summer was notable for being extremely dry over all of the North Island and considerable parts of the South Island due, in part, to a neutral Southern Oscillation Index.

12. Occurrence and intensity of mast flowering and fruit production

There is no report for 2012/13 because there was no significant mast flowering and fruiting requiring intervention.

13. Distribution and abundance of exotic weeds and animal pests considered a threat

Refer Landcare Research report 2012/13.

References

- Cieraad, E.; Walker, S.; Barringer, J.; Price, R. 2013: Indigenous cover remaining and biodiversity protection in New Zealand's land environments: an update using LCDB3 and current information on protected areas. Landcare Research Contract Report LC1380
- DOC (Department of Conservation) 2012: Department of Conservation biodiversity indicators—2012 assessment: supplementary material. Department of Conservation, Wellington. <http://www.doc.govt.nz/Documents/about-doc/annual-report-2012/doc-biodiversity-indicators.pdf>
- Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D.A. 2008: New Zealand Threat Classification System manual. Department of Conservation, Wellington, New Zealand.

Appendix 1

Protected areas definition

Protected areas are defined as:

natis1.NATISADM.ADMINISTRATIVE_NAPALIS_ProtectedArea: PCL

(Vested = 'No' AND Control_Managed = 'No' AND Overlays = 'No' AND Private_Ownership = 'No') AND Section IN ('S25_STEWARDSHIP_AREA', 'S19_CONSERVATION_PARK', 'S24_3_FIXED_MARGINAL_STRIP', 'S23B_WILDLIFE_MANAGEMENT_AREA', 'S4_NATIONAL_PARK', 'S23A_AMENITY_AREA', 'S22_GOVERNMENT_PURPOSE_RESERVE', 'S18_HISTORIC_RESERVE', 'S23_LOCAL_PURPOSE_RESERVE', 'S20_NATURE_RESERVE', '17_RECREATION_RESERVE', 'S19_1_A_SCENIC_RESERVE', 'S19_1_B_SCENIC_RESERVE', 'S21_SCIENTIFIC_RESERVE', 'S2_WAITANGI_ENDOWMENT_FOREST', '20_WILDERNESS_AREA', 'S22_SANCTUARY_AREA', 'S21_ECOLOGICAL_AREA')

natis1.NATISADM.ADMINISTRATIVE_NAPALIS_ProtectedArea: PPL

(Vested = 'No' AND Control_Managed = 'No' AND Overlays = 'No' AND Private_Ownership = 'Yes') AND Section IN ('S25_STEWARDSHIP_AREA', 'S19_CONSERVATION_PARK', 'S24_3_FIXED_MARGINAL_STRIP', 'S23B_WILDLIFE_MANAGEMENT_AREA', 'S4_NATIONAL_PARK', 'S23A_AMENITY_AREA', 'S22_GOVERNMENT_PURPOSE_RESERVE', 'S18_HISTORIC_RESERVE', 'S23_LOCAL_PURPOSE_RESERVE', 'S20_NATURE_RESERVE', '17_RECREATION_RESERVE', 'S19_1_A_SCENIC_RESERVE', 'S19_1_B_SCENIC_RESERVE', 'S21_SCIENTIFIC_RESERVE', 'S2_WAITANGI_ENDOWMENT_FOREST', '20_WILDERNESS_AREA', 'S22_SANCTUARY_AREA', 'S21_ECOLOGICAL_AREA')

natis1.NATISADM.ADMINISTRATIVE_NAPALIS_CovenantArea

Type = 'PPL Agreement'

natis2.NATISADM.ADMINISTRATIVE_NWR_Kawenata

natis2.NATISADM.ADMINISTRATIVE_QEII_Covenants