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Indicator M15: Indigenous ecosystems released from vertebrate pests

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Overview

In 2010, the Technical Group of the Regional Council Biodiversity Forum worked with Landcare Research to develop the Regional Council Terrestrial Biodiversity Monitoring Framework.[1]

This framework is designed as part of 'a national, standardised, biodiversity monitoring programme, focusing on the assessment of biodiversity outcomes, to meet regional council statutory, planning and operational requirements for sustaining terrestrial indigenous biodiversity'

The terrestrial biodiversity monitoring framework adopts the same approach as the ecological integrity framework designed by Landcare Research for the Department of Conservation (DOC) and consists of three components: (i) indigenous dominance, (ii) species occupancy, and (iii) environmental representation.[2] To inform the framework, there are four broad areas: (i) state and condition, (ii) threats and pressures, (iii) effectiveness of policy and management, and (iv) community engagement.

A standardised monitoring framework ensures that data for each measure are consistent among regional councils, which allows for reliable State of Environment reporting. Furthermore, to enable national reporting across public and private land, it is also desirable that where possible, measures can be integrated with those from DOC'sBiodiversity Monitoring and Reporting System (DOC BMRS).[3] The monitoring framework covers most categories of essential biodiversity variables[4] recommended for reporting internationally, addressing species populations, species traits, community composition, and ecosystem structure adequately, but does not address genetic composition and only in part ecosystem function.

This report contains descriptions of 18 terrestrial biodiversity indicators developed within this framework by scientists who worked with regional council counterparts and representatives from individual regional councils. Each indicator is described in terms of its rationale, current efforts to evaluate the indicator, data requirements, a standardised method for implementation as a minimum requirement for each council, and a reporting template. Recommendations are made for data management for each indicator and, for some, research and development needed before the indicator can be implemented.

The terrestrial biodiversity indicators in this report are designed to enable reporting at a whole-region scale. Some of the indicators are also suitable for use at individual sites of

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[1] Lee and Allen 2011. Recommended monitoring framework for regional councils assessing biodiversity outcomes in terrestrial ecosystems. Lincoln, Landcare Research.

[2] Lee et al. 2005. Biodiversity inventory and monitoring: a review of national and international systems and a proposed framework for future biodiversity monitoring by the Department of Conservation. Lincoln, Landcare Research.

[3] Allen et al. 2013. Designing an inventory and monitoring programme for the Department of Conservation's Natural Heritage Management System. Lincoln, Landcare Research.

[4] Pereira et al. 2013. Essential biodiversity variables. Science 339, 277–278.

interest within regions. Each indicator is described in terms of a minimum standard for all councils. If implemented by all councils, each measure can then be aggregated to allow national-scale reporting (e.g., for State of Environment reports, or for international obligations such as reporting on achievement of Aichi Targets for the Convention on Biodiversity). Individual councils could add additional measurements to supplement the minimum standards recommended.

Three of the 18 terrestrial biodiversity indicators – Measures 1 'Land under indigenous vegetation', 11 'Change in temperature and precipitation', and 18 'Area and type of legal biodiversity protection' – were implemented and reported on for all regional councils in June 2014. An attempt to implement and report two others at that time – Measures 19 'Contribution of initiatives to (i) species translocations and (ii) habitat restoration' and 20 'Community contribution to weed and animal pest control and reductions' – was unsuccessful because the data needed for these indicators was either not readily available or not collected in a consistent way, and investment will be needed to remedy these issues before they can be reported successfully.

12 Indicator M15: Indigenous ecosystems released from vertebrate pests

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12.1 Introduction

Indicator M15 reports the area and number of indigenous ecosystems fenced to exclude vertebrate pests and in which pest control against veterbrate pests has been conducted. This definition is reduced in scope from the original 'indigenous ecosystems released from pests' to render reporting tractable, i.e. not requiring councils to report on areas and numbers of ecosystems in which weed control or exclusion has been conducted, likewise of invertebtrate pests and diseases. Evalating this measure requires each council to coordinate records from their own vertebrate pest control activities in spatially explicit databases. It also requires reporting these activities in the context of indigenous ecosystems consistent with their definitons in other measures (i.e. M1, Land under indigenous vegetation and M5 Vulnerable ecosystems).

12.2 Scoping and analysis

12.2.1 Definitions

A primary requirement for providing a national, standardised method of reporting Indicator M15 is to obtain consensus on appropriate definitions for the terms used in the description of the Measure and Element. Regional council experts were contacted and invited to respond to questions relating to the terms used in this measure. We summarise their responses and recommend definitions.

1. *M15 definition* – it was agreed that the definition of the measure should change from 'indigenous ecosystems released from pests' to 'indigenous ecosystems released from *vertebrate* pests'. Although weeds and non-vertebrate pests are also recognised as important, as currently described in the Element, M15 will initially consider only vertebrate pests for national reporting. An additional factor relating to the definition is that councils must decide whether an ecosystem has been released from vertebrate pests if (a) a key focal pest species is removed/intensively controlled or (b) all vertebrate pest species have been removed/intensively controlled.

   M15 element – we have included the word 'pest' in the element to emphasise that it is vertebrate pest densities that are of interest, not vertebrate densities *per se*. We have removed the word 'predator' from the element because intensive control can target vertebrate pests (e.g. brushtail possums) that incidentally depredate some native animal species. We define 'intensive control' as exclusion fencing, trapping or poisoning that is sufficient to meet the outcomes defined by regional councils for indigenous ecosystems (see 3 and 4 below).

2. *Indigenous ecosystem* – critical to reporting area and land cover class or habitat released from vertebrate pests is defining what is meant by 'indigenous ecosystems'. The definition of 'ecosystem' will suffice as 'a biological community plus all of the abiotic factors and processes influencing that community'. Measure 15 requires further refinement of the definition as an 'indigenous ecosystem'.

   Definition of 'indigenous ecosystem' – we recommend that this definition must include recognition that the ecosystem has indigenous dominance. Indigenous dominance should be defined as ecosystems comprised predominantly of native fauna and flora. Following M1, tables of exotic/indigenous vegetation by LCDB classes relative to natural vegetation, as well as field site inspections (used in conjunction with implementation of M2 and M3), should be used to determine indigenous dominance.

3. *Released from vertebrate pests* – the term 'released' implies that vertebrate pest populations are being monitored to assess whether control programmes have reduced their densities to a level where target objectives or thresholds set by the council are being met. Determining such thresholds is challenging. For most species and ecosystems, acceptable thresholds or target densities are non-linear functions, with benefits accruing only at very low pest densities (Norbury et al. 2015). For others, thresholds or target densities are unknown. Where applicable, pest target densities should be estimated using national monitoring protocols, such as the National Pest Control Agencies protocol for monitoring possums and the modified MacLean scale rabbit index.

   Requirement – councils must recognise that for M15 to be useful (i.e. ecosystems can be termed released from pests), they must demonstrate that vertebrate pest densities have been reduced sufficiently in the indigenous ecosystems they manage to produce a change in pest impact. However, setting up rigorous population monitoring programmes can be difficult and expensive. Consequently, we recommend that councils keep and report details on what vertebrate pest population monitoring they do in the indigenous ecosystems they manage, and whether target objectives set by the council are being met (see Table 12-1). Initially councils might not be able to implement rigorous pre- versus post-control vertebrate pest population monitoring programmes for all indigenous ecosystems managed as part of M15. However, the aim should be to progressively increase the amount of population monitoring done, with the intent of demonstrating that indigenous ecosystems have been released from vertebrate pests.

4. *Outcomes of exclusion fencing or intensive vertebrate pest control* – vertebrate pests should be controlled for beneficial outcomes for indigenous ecosystems. Thus, councils must define intermediate and longer-term outcomes, as well as the indicators or impact measures they will use to demonstrate the effectiveness of their vertebrate pest control. Methods of defining outcomes for regional councils have been developed for New Zealand, and we direct those councils that have not yet defined outcomes to the following website: http://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/vertebrate-pests/measuring-performance. Outcome monitoring can be reported in a similar way to population monitoring, using indicators such as M2 and M3, or other methods focused on taxa of interest (see Table 12-1).

Table 12-1 An example method of recording site-specific population and outcome monitoring details for M15. Using this system, regional councils can easily report the total area (ha) included in M15, as well as details about how much of the total area has received vertebrate pest population monitoring and whether defined outcomes have been achieved. *Note: this table is not for national reporting purposes; rather it should be used as a guide to compiling statistics to be reported for M15 (see Table 12-2). Councils can add data to additional columns in this table for intra-regional purposes, if required.*

Indigenous ecosystem	Area released (ha) [a]	Area treated (ha) [b]	Monitoring of pest population – based on national or best practice protocols	Defined outcomes met – evidence of release from pests
Rimu Downs	275	350	Yes	Yes
Kauri Flats	2,785	3,500	Yes	No
Gecko Gorge	765	0	No	No

[a] Area released is the total area of the indigenous ecosystem released from vertebrate pests.
[b] Area treated is the total area of the indigenous ecosystem *and* any buffer surrounding that indigenous ecosystem that needed to be treated in order to achieve release.

5. *Spatial data* – M15 requires reporting of the area and land cover class or habitat where vertebrate densities have low ecological impacts following exclusion fencing or intensive control. Area should be reported in hectares. We recommend that land cover classes rather than habitat should be used for national reporting for M15. In addition, broad-scale land cover classes for M15 should align with those identified in M1, M8 and M9. Regional councils can further stratify land cover classes for intra-regional purposes if deemed necessary, and report within naturally uncommon ecosystems and wetlands (as defined in M12); regional assessments within widespread naturally uncommon ecosystems and wetlands can be aggregated nationally.
6. *Community group contributions* – we recommend that where community groups are (1) contributing to vertebrate pest reductions (i.e. as defined in M20) in indigenous ecosystems, and (2) using comparable monitoring methods to estimate reductions in those areas, these data should also be included in M15.

12.3 Statistics to report

1. The total number and total area (ha) (plus mean and range) of indigenous ecosystems within a region in which councils are reducing vertebrate pest densities with the aim of releasing the site from pests for indigenous ecological benefits. This requires spatially explicit databases of areas in which pest control has been applied for each vertebrate pest species.
2. The number of indigenous ecosystems, and their total area (ha; defined in indicators M1 and M5), also expressed as percentages of the total number of indigenous ecosystems and their total area (ha) in a region (a) in which councils are conducting rigorous, ongoing vertebrate pest population monitoring, and (b) where defined outcomes for indigenous ecosystems have been achieved (see Table 12-1 above).

   Note that outcome monitoring should only be conducted if vertebrate pests are being intensively controlled; thus, the percentage of sites where both types of monitoring occurs should match the percentage of sites where outcome monitoring occurs.

Councils might choose to monitor ecosystem condition when no pest control is carried out but such sites should not be included in M15.

3. The total area (ha) of indigenous ecosystems that have been (a) fenced to exclude only livestock; (b) fenced to exclude livestock and wild ungulates; (c) fenced to exclude all vertebrate pests; and (d) where intensive pest control has occurred (i.e. poisoning or trapping).
4. The top five vertebrate pest species that are being controlled for indigenous ecosystem protection, reported as a percentage of the total area of each indigenous ecosystem in which each vertebrate pest species is being controlled.
5. A summary of broad land cover classes where vertebrate pest control or exclusion fencing is occurring (reported as total hectares for each broad land cover class, as used in M1). If there are too many land cover classes in a region to report all of them, then the three most common broad land cover classes and two representative vulnerable ecosystems (as defined in M5) could be reported. Note that reporting for this statistic will be dependent upon selected land cover classes, as used in M1, M8 and M9.

We provide an example half-page schematic of how to present these five summary statistics at the end of this document (Table 12-2).

12.3.1 Reporting frequency

Regional councils should update statistics relating to Indicator M15 on an annual basis, and these should be incorporated into a national report and made available to the public.

12.3.2 Hierarchies

Reporting for M15 should be at the level of vertebrate species. Outcome monitoring is not the purview of M15.

12.3.3 Spatial and temporal analyses

The time-series of the number and area of indigenous ecosystems released from vertebrate pests should be used to assess changes across years. Similarly, time-series of spatial data should be used, delineating the boundaries of indigenous ecosystems released from vertebrate pests, colour coded by land cover classes.

12.3.4 Relationships with present patterns and other measures

It would be useful to compare GIS overlay of sites where indigenous ecosystems are being released from vertebrate pests with sites where similar control is being undertaken by DOC or other agencies. This would show the full extent of the area within each region where vertebrate pests are being managed in indigenous ecosystems, albeit with possible differences in methodology, intensity and rigour. Spatially explicit definitions of indigenous ecosystems derive directly from indicators M1 and M5.

As previously mentioned, where community groups (M20) contribute to vertebrate pest reductions in indigenous ecosystems, this information should be summarised, and included by regional councils for national reporting of M15.

12.3.5 Assessment of existing methodologies

A questionnaire was sent to experts of participating regional councils. From their responses, we collated information on how regional councils define indigenous ecosystems and how they (1) quantify reductions in vertebrate pests in those areas and (2) determine release from vertebrate pests.

For the purpose of providing a national, standardised method of reporting M15, we provide standard definitions for the main terms and components of M15 (see section 12.2.1).

12.3.6 Development of a sampling scheme

There is no sampling scheme associated with M15. Regional councils must report the total number and total area (ha) of all indigenous ecosystems that they manage to reduce vertebrate pest densities (i.e. it is a census).

Regional councils must develop a common data collection framework for population monitoring and outcome monitoring for M15 so that it can be aggregated for national reporting purposes.

12.3.7 Data management and access requirements

Initially, data collected on (and aggregated from) M15 should be from regional councils and unitary authorities only, not other agencies. This does not preclude data being collected from additional agencies in the future and included in regional council national reporting once the regional council data collection and reporting process is operational. These could include activities of government agencies (especially DOC), quangos (e.g. TBfree NZ), NGOs and community groups. We recommend coordination with DOC and TBfree NZ to develop consistent data standards for reporting M15.

If community groups contribute to vertebrate pest reductions in indigenous ecosystems (see M20), relevant data should also be included in M15. Councils therefore need to coordinate reporting of M15 and M20.

Consideration will need to be given to management and access of regional council data, and the resulting recommendations will likely need to be aligned with other Indicators.

12.3.8 Reporting indices and formats

For national reporting, councils should report annually the area (ha) and land cover classes where vertebrate pest densities have low ecological impacts following exclusion fencing or intensive control. Information about pest population monitoring and outcome monitoring should be stored and updated as required in a spreadsheet similar to Table 12-1. The simple summary statistics reported in Table 12-2 can be derived from information stored in Table 12-1.

Methods to evaluate pest populations and outcomes that support M15 require further research and development. There has been considerable investment in this research across a range of ecosystems; we recommend a consensus approach across regional councils, DOC and research providers so that a consistent, defensible data set on pest populations and biodiversity outcomes supports the data tabulated in item 2 of Table 12-2.

Table 12-2 Example half-page schematic of how to present the five summary statistics that need to be reported for Indicator M15

1. Indigenous ecosystems released from vertebrate pests	
Total number	16
Total area of indigenous ecosystems	6768 ha
Mean and range of above	390 (27–638) ha
Total area treated to achieve release (includes buffers surrounding indigenous ecosystems)	12,965 ha
2. Percentage and area of indigenous ecosystems with:	
Vertebrate pest population monitoring	65%; 4,279 ha
Defined outcomes achieved[1]	37%; 2,542 ha
3. Total area of indigenous ecosystems that have been:	
Fenced to exclude only livestock	501 ha
Fenced to exclude livestock and wild ungulates	763 ha
Fenced to exclude all vertebrate pests	1,453 ha
Poisoned or trapped to reduce vertebrate pests	5,315 ha
4. Top five vertebrate pests and the percentage of sites at which they are being controlled:	
Possums	100%
Ship rats	100%
Feral cats	63%
Stoats	58%
Hedgehogs	40%
5. Total area of key indigenous land-cover classes in sites where vertebrate pests are being controlled:	
Indigenous forest	5,834 ha
Subalpine shrubland	479 ha
Dunes	265 ha
Coastal wetlands	143 ha

12.4 Reference

Norbury GL, Pech RP, Byrom AE, Innes J 2015. Density-impact functions for terrestrial vertebrate pests and indigenous biota: guidelines for conservation managers. Biological Conservation 191: 409–420.