

National Environmental Monitoring Standards

Indigenous Cover

Measurement of Indigenous Cover (Extent)

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Change register

Version Number	Revision Date	Section	Topic	Revision Summary
0.0.1	30 November 2024			v1 Draft submitted to NEMS Project Manager
0.0.2	28 February 2025			Final draft following independent review

Table of Contents

The National Environmental Monitoring Standards	iv
About This Standard	vii
Introduction	vii
Objective	viii
Scope	viii
Terms, definitions and symbols	xi
Normative references	xii
Relationship to existing guidelines	xii
The Standard – Indigenous Cover	xiii
Minimum requirements for the application of all Standards	xiv
Requirements for indigenous cover data irrespective of quality	xv
Additional requirements for indigenous cover data of good quality	xv
Other requirements, guidelines, and recommendations	xvi
Quality coding of individual polygons in LCDB	xvii
1 Data validation.....	1
1.1 Validation of polygons.....	1
2 Metadata	2
2.1 Standardised format	2
2.2 Attribute tables	4
2.3 Version control and archiving	6
3 Reporting	7
3.1 Reporting requirements	7
References	11
Annex A – Quality Coding Matrices	12
Data validation matrix	13

The National Environmental Monitoring Standards

The National Environmental Monitoring Standards (NEMS), and associated codes of practice, Glossary, and National Quality Code Schema can be found at www.nems.org.nz.

Development

The strategy that led to the development of these Standards and associated documents was established by Jeff Watson (Chair) and Rob Christie (Project Director) of the initial National Environmental Monitoring Standards (NEMS) Steering Group, in 2014.

The NEMS initiative is supported by the Environmental Data Special Interest Group (ED SIG) (formerly the Local Authority Environmental Monitoring Group (LAEMG)), who contribute members to the NEMS Steering Group.

Implementation of the strategy is overseen by the NEMS Steering Group, which currently comprises Glenn Ellery (Chair), Jeff Watson (Technical Advisor), Phillip Downes, Rachel Herbert, Jon Marks, Charles Pearson, Jochen Schmidt, Clare Barton, Abi Loughnan, Sonja Miller, and Raelene Mercer (Project Manager).

The NEMS Steering Group directs preparation of NEMS documents on authority from the Chief Executives of the regional and unitary councils and the Ministry for the Environment (MfE).

The development of these documents involves consultation with regional and unitary councils across New Zealand, major electricity generation industry representatives, research institutes, and organisations providing supporting services such as laboratory processing. These agencies together are responsible for the majority of environmental monitoring in New Zealand.

Implementation

Stationarity

NEMS Standards are intended for long-term monitoring programmes. Stationarity of record, whereby changes to methods and instruments do not introduce bias over the lifetime of the record, is an essential property (see also NEMS *Glossary*), without which a record cannot be confidently analysed for temporal trends.

Because the methods of collecting and processing environmental data do change over time, the Standards include provisions for identifying and mitigating potential loss of stationarity.

Data fit for purpose

To facilitate data sharing, the NEMS Steering Group recommend that NEMS Standards are adopted throughout New Zealand and all data collected be processed and quality coded in accordance with the methodologies described in the Standards.

The quality code is determined from the Standard adopted and applied at the time of data acquisition. The degree of rigour with which requirements of the Standards are applied may depend on the quality of data sought. The highest quality code (QC 600) may be assigned to data that meet the stated requirements for good data.

Data of lesser quality are accommodated but are assigned a lower quality code (i.e. less than QC 600). They may be fit for the current intended monitoring purpose but restricted in their use for a range of other current and future purposes.

Measured data coded as QC 500 (fair), or QC 400 (compromised) may be the best practicably achievable due to site limitations and/or transient lapses in data quality.

Health and safety

When implementing the Standards, current legislation relating to health and safety in New Zealand and subsequent amendments shall be complied with.

NEMS Codes of Practice (COP) provide additional guidance on health and safety issues and structural design. Use only the most recent published version of any NEMS COP.

Limitations

It is assumed that, as a minimum, the reader of these documents has an understanding of environmental monitoring and data processing techniques, and some competency in their application.

The documents do not relieve the user (or a person on whose behalf they are used) of any obligation or duty that might arise under any legislation, and any regulations and rules under those Acts, covering the activities to which these documents have been or are to be applied.

Instructions for manufacturer-specific instrumentation and methodologies are not included in NEMS documents.

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- National Institute of Water and Atmospheric Research Ltd (NIWA)
- GNS Science
- StatisticsNZ
- Meridian Energy
- Ministry of Business, Innovation and Employment – Science and Innovation Group
- Genesis Energy
- Contact Energy
- Mercury New Zealand Limited

Review

This document will be assessed for review within one year of its initial release and thereafter will be assessed for review approximately once every two years. Document status and proposed review dates can be found at www.nems.org.nz.

Feedback

If you wish to provide feedback regarding this version of the document, please provide it to <https://www.nems.org.nz/feedback/>.

About This Standard

Introduction

Describing the extent of indigenous cover is important for tracking change over time and informing evaluation of the effectiveness of policy and restoration efforts.

This Standard uses the New Zealand Land Cover Database (LCDB) to identify the distribution of indigenous and non-indigenous land cover across New Zealand. The LCDB is a 1:50,000 scale national land cover map series that categorises different land cover into thirty-eight land cover classes (including Chatham Island and wetland vegetation classes). The LCDB is often used, by many agencies, as a starting point for many and varied outputs and is considered to be an appropriate tool as the primary indicator of indigenous cover extent for the purposes of this Standard. As this Standard is concerned with only with extent of indigenous cover (and not the condition, composition, or ecosystem representation) the spatial data only needs to differentiate between indigenous and non-indigenous (or artificial) land cover.

The LCDB is imperfect in that, in its current delivery at four- to five-year intervals, it quickly becomes out of date, it is known to contain errors in its allocation of land cover classes, and the land cover classes are not explicitly constructed to differentiate between indigenous and non-indigenous land cover. Nevertheless, land cover classes can be assigned to those that are indigenous-dominant and those that are non-indigenous. While the coarse minimum mapping resolution of 1 ha limits the application of the LCDB, it is well suited for national-, regional-, and catchment-scale (greater than 50 km²) analysis.

Given the existing wide use and understanding of the LCDB and lack of a readily available alternative, it is appropriate to base this Standard on the LCDB, despite its known limitations. The LCDB is already extensively used by regional councils and other agencies (e.g. Ministry for the Environment (MfE), Department of Conservation (DOC), Ministry for Primary Industries (MPI), StatsNZ and Land Information New Zealand (LINZ)) for a variety of purposes including regional and national monitoring and reporting, policy development, and land-cover change analysis. This is an advantage as relevant agencies will be familiar with the database and its limitations. Therefore, the implementation of this Standard will not require a substantial shift in practice.

New versions of the LCDB are generally produced every four to five years, although long-term funding for the LCDB is not secure. However, the longevity of this product (first mapped for summer 1996/97) demonstrates its value and central government has invested in the delivery of the sixth version. MfE and MPI are also investigating options to improve the timeliness, resolution and accuracy of forthcoming versions, indicating a long-term commitment to maintaining this resource.

This Standard sets out the process by which councils and other agencies can utilise quality coding to provide an assessment of the certainty that any particular polygon is correctly assigned as having indigenous or non-indigenous land cover.

This Standard has been developed by the working group members: Fiona Hodge and Deborah Burgess (Ministry for the Environment); Roger Uys (Greater Wellington Regional Council); David Munro and Victoria Fox (Taranaki Regional Council); Andrew Steffert (Horizons Regional Council); and Amy Hawcroft (Department of Conservation). Review was undertaken by Shay Dean (Bay of Plenty Regional Council), and the NEMS Steering Group. Dr Fleur Maseyk (The Catalyst Group) was the lead writer.

Objective

The objective of this Standard is to ensure that indigenous cover (extent) is described, analysed, quality assured, and reported on at national and regional scales in a verifiable, consistent, and documented manner to a known standard over time throughout New Zealand.

Scope

This Standard focuses on the reporting of indigenous land cover classes (vegetated and non-vegetated) as an indicator of indigenous-dominant cover, at national and regional scales. Sub-regional reporting is also possible for defined areas (e.g. catchments) greater than 50 km².

This Standard assigns the LCDB land cover classes (as in version 5) as indigenous-dominant or non-indigenous (Table 1). The level of confidence in this assignment and the allocation accuracy (whether the land cover class on the ground is likely to match the land cover class within the LCDB) for each land cover class are also indicated. The allocation accuracy applies generally to the polygon classification and not specifically to the spatial accuracy (i.e. the polygon boundaries). Spatial accuracy is assumed to align within the resolution (1 ha) of the LCDB and is less of a concern when applying the LCDB at national and regional scales, or at sub-regional scales greater than 50 km²; however, spatial inaccuracies become more relevant at local (e.g. property) scales.

Indigenous-dominant vegetation can be deduced as a subset of indigenous cover, by reporting on the LCDB land cover classes known to comprise vegetation (i.e. excluding bare or lightly vegetated land cover classes) that have been assigned as indigenous. Under this Standard, consideration of indigenous dominance applies to canopy (aerial) cover only. Assumptions about the composition of understorey tiers (where they may be present) are not relevant to determining indigenous dominance for the purpose of this Standard.

The coastal boundary is taken as that embedded within the LCDB, which maintains parity with the Topo50 Map Series coastline. Onshore polygons are segregated from polygons seaward of the coast by an onshore indicator ('yes') in the LCDB attribute table. The LCDB is limited to New Zealand, including inshore islands but excluding offshore islands (e.g. the New Zealand subantarctic islands, Raoul Island). New Zealand's dependencies are also excluded from the LCDB. The Chatham Islands are included in the LCDB, mapped as their own layer.

Table 1 –Assignment of the Land Cover Database (version 5) cover classes as indigenous or non-indigenous cover and confidence level that this assignment is correct for each cover class. Allocation accuracy indicates the confidence level that the land cover class on the ground matches that depicted within the LCDB.

Broad classes	Medium classes	Detailed class	Assignment (indigenous or non-indigenous cover)	Assignment confidence level	Allocation accuracy confidence level
Urban/Bare/Lightly-Vegetated Surfaces	Artificial Bare Surfaces	Transport Infrastructure	Non-indigenous	High	High
		Surface Mine or Dump	Non-indigenous	High	High
	Natural Bare/Lightly Vegetated Surfaces	Alpine Gravel and Rock	Indigenous	High	High
		Coastal Sand	Indigenous	Medium	High
		Gravel and Rock	Indigenous	High	High
		Permanent Snow and Ice	Indigenous	High	High
		River and Lakeshore Gravel and Rock	Indigenous	High	High
		Landslide	Indigenous	High	High
	Urban Area	Built-up area (settlement)	Non-indigenous	High	High
		Urban parkland/open space	Non-indigenous	High	High
Water Bodies	Water Bodies	Estuarine Open Water	Indigenous	High	High
		Lake or Pond	Indigenous	High	High
		Open Water	Indigenous	High	High
		River	Indigenous	High	High
Cropland	Cropping/Horticulture	Orchards, Vineyards or Other Perennial Crops	Non-indigenous	High	High
		Short-rotation Cropland	Non-indigenous	High	High
Non-woody vegetation	Non-woody vegetation	Alpine Grass/Herbfield	Indigenous	High	High
		Depleted Grassland	Non-indigenous	Low	Low
		Fernland	Indigenous	Medium	Low

Broad classes	Medium classes	Detailed class	Assignment (indigenous or non-indigenous cover)	Assignment confidence level	Allocation accuracy confidence level
		Flaxland	Indigenous	High	Low
		Herbaceous Freshwater Vegetation	Indigenous	Medium	Low
		Herbaceous Saline Vegetation	Indigenous	High	Medium
		Low Producing Grassland	Non-indigenous	High	High
		High Producing Grassland	Non-indigenous	High	High
		Tall Tussock Grassland	Indigenous	High	High
Scrub and/or Shrubland	Scrub and/or Shrubland	Dune Shrubland (Chatham Island)	Indigenous	High	High
		Gorse/or Broom	Non-indigenous	Medium	Medium
		Mānuka and/or Kānuka	Indigenous	Medium	Medium
		Mangrove	Indigenous	High	High
		Matagouri or Grey Scrub	Indigenous	Low	Low
		Mixed Exotic Shrubland	Non-indigenous	Low	Low
		Peat Shrubland (Chatham Island)	Indigenous	High	High
		Sub Alpine Shrubland	Indigenous	High	Medium
Forest	Forest	Broadleaved Indigenous Hardwoods	Indigenous	High	High
		Deciduous Hardwoods	Non-indigenous	High	Medium
		Exotic Forest	Non-indigenous	High	High
		Forest – Harvested	Non-indigenous	High	High
		Indigenous Forest	Indigenous	High	High

Exclusions

This Standard does not cover:

- designing a monitoring network for determining indigenous vegetation extent,
- measuring ecosystem representation,
- measuring condition of indigenous vegetation,
- measuring connectivity between areas of indigenous-dominated vegetation or indigenous land cover,
- assessing conservation value or importance of different indigenous covers relative to each other or to other land covers,
- measuring and reporting on exotic-dominated vegetation cover or non-indigenous cover,
- measuring and reporting on indigenous-dominated vegetation or indigenous cover at the property scale, or
- measuring and reporting on indigenous-dominated vegetation or indigenous cover solely within urban environments.

Terms, definitions and symbols

Relevant definitions and descriptions of symbols used in this Standard are contained within the NEMS *Glossary* available at www.nems.org.nz.

Additional definitions and descriptions relevant to this Standard are listed below.

Allocation Refers to the allocation of polygons to the land cover classes within the LCDB. *Allocation accuracy* indicates the confidence level (Low, Medium, High), assumed by this Standard, that the land cover allocated to the LCDB polygon matches the land cover on the ground.

Assignment Refers to the assignment of land cover classes as indigenous or non-indigenous. *Assignment confidence level* (Low, Medium, High) refers to confidence in the assignment as indigenous or non-indigenous (see Table 1).

Exotic-dominant vegetation Vegetation where the canopy (aerial layer) is predominantly ($\geq 50\%$) comprised of exotic plant species that do not naturally occur in New Zealand.

Indigenous land cover Land cover that is dominated by naturally occurring substrate and/or indigenous vegetation.

Indigenous-dominant vegetation Vegetation where the canopy (aerial layer) is predominantly ($\geq 50\%$) comprised of indigenous plant species naturally occurring in New Zealand.

In-field plot data Quantitative data that have been collected in the field using standardised, repeatable, plot-based methods.

Land cover class The classification classes within the **LCDB** that describe land cover. Land cover classes are mutually exclusive and additive to 100% of the surface area of New Zealand. First-order classes are based on the physiognomy of the land cover (e.g. forest), with lower order divisions providing further information based on other characteristics such as phenology (e.g. evergreen) and floristic composition (e.g. broadleaved).

New Zealand Land Cover Database (LCDB) A multi-temporal, thematic and hierarchical classification of New Zealand's land cover that is periodically updated. The latest version of the LCDB and associated documents are found in the Land Resource Information Systems (LRIS) Portal (IRIS.scinfo.org.nz/). Land cover is classified into **land cover classes**.

Non-indigenous land cover Land cover that is dominated ($\geq 50\%$) by artificial and/or manufactured substrate and/or exotic vegetation.

Normative references

This code of practice shall be read in conjunction with the following references:

- NEMS *Glossary – Terms, Definitions and Symbols*
- NEMS *National Quality Code Schema*
- The New Zealand Land Cover Database *Metadata and User Guides* (IRIS Portal 2024)
- Department of Conservation's vegetation inventory and monitoring toolbox (Department of Conservation 2024b).

Relationship to existing guidelines

The NEMS *Soil Quality and Trace Elements* recognises 'indigenous vegetation' as a land use type defined as "Native forest, tussock, shrubland and scrub dominated by indigenous species. Undisturbed or unfertilised in recent decades".

In this Standard, indigenous vegetation is recognised as a land cover (rather than a land use) and the definition of what constitutes indigenous vegetation is broader. Thus 'indigenous vegetation' in the NEMS *Soil Quality and Trace Elements* is a subset of the indigenous vegetation cover captured by this Standard.

The Standard – Indigenous Cover

Requirements and recommendations for the application of this Standard are summarised in the following tables:

- Minimum requirements for the application of all Standards.
- Requirements for indigenous cover data irrespective of quality.
- Additional requirements for indigenous cover data of good quality.
- Other requirements, guidelines, and recommendations.

Data that are collected, processed, and archived to meet requirements of the first three tables, in a verifiable and consistent manner, can be assigned quality code QC 310 (the majority of land cover classes) or QC 300 (land cover classes with a 'low' or 'medium' confidence rating as described in Table 1). If requirements of the first table (minimum requirements) are not met the data cannot meet this Standard and cannot be assigned a quality code.

Quality assurance requirements ensure the measurement system is robust so that the impact on data quality of unexpected circumstances or unanticipated combinations of factors is minimised.

Additional guidelines and recommended practices are those considered relatively easy to implement to enhance data quality, but are not mandatory and do not alter the quality code assigned to the data.

Minimum requirements for the application of all Standards

Table 2 – Minimum requirements for the application of all Standards.

Health and safety	Scope	All current legislation, including relevant amendments, shall be complied with.
Stationarity		• Maintained wherever possible. • Documented in metadata if change occurs or is likely to occur.
Units of measurement		• Metric system to the nearest hectare (ha). • Percentage cover (%).
Dating changes and updates	Date stamp	• Date reference of each version of database to follow that released with relevant version of LCDB. • Validation of, and other updates to, polygons are to be date stamped using the dd/mm/yyyy format.
Metadata	Scope	Permanently archived and discoverable.
	Identification of Standards	Standards and versions applied shall be tracked over time in time-stamped Stationarity Comments.
	Identification of data	All data shall be identified by a minimum of: • the variable's name and units (as defined in this Standard), and • date and time of the version update and any polygon validation.
	Quality coding	All data shall be quality coded using the Quality Code Schema set out in this Standard, as adapted from the NEMS <i>National Quality Code Schema</i> .
Archiving	Original and final records	Store, retain indefinitely, and back up regularly: • Original copy of the LCDB as released. • Local copy of the LCDB, including any updates to polygons and relevant quality coding. • Supplementary measurements. • All required metadata (including all calibration, validation, verification and editing information). • Additional time series and/or metadata used and/or generated during data processing.

Requirements for indigenous cover data irrespective of quality

Table 3 – Requirements for indigenous cover data irrespective of quality.

Application of LCDB	Scope	All onshore polygons of LCDB land cover classes assigned to be indigenous dominant.
	Resolution	Comparison of indigenous cover between LCDB versions must be conducted at a 1 ha resolution to avoid asymmetric errors that manifest in the LCDB at lower resolutions. If the LCDB is refined locally to a higher resolution, it should be resolved to a 1 ha resolution to undertake analysis and reporting on indigenous cover under this Standard.
	Mapped area	Onshore polygons defined by the coastal boundary embedded within the LCDB.
	Scale	National, regional and sub-regional catchments greater than 50 km ² . Localised (i.e. areas less than 50 km ²) applications are to be avoided.
Classification	Land cover classes	Labelling of land cover classes must adhere to those inherent within the LCDB to retain ability to revise earlier versions if a new scheme emerges.

Additional requirements for indigenous cover data of good quality

As a means of achieving QC 600 under this Standard, the following requirements apply in addition to the requirements for the application of all Standards and the requirements for indigenous vegetation cover data irrespective of quality.

Table 4 – Additional requirements for indigenous cover data of good quality.

Data validation	In-field ground-truthing	Data validation must be based on in-field plot data for polygons and be accompanied with associated metadata to achieve QC 600.
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Other requirements, guidelines, and recommendations

The following table summarises other requirements and guidelines (e.g. for quality assurance or lower quality codes), and additional recommended practices that are either not relevant to or not required for QC 600 but if implemented will enhance work practices and data quality.

Table 5 – Other requirements, guidelines, and recommendations

Data validation	In-field ground-truthing	Visual in-field data validation should be used for individual polygons and be accompanied with associated metadata to achieve QC 500.
	Desktop validation	Desktop methods of validation should be used to validate individual polygons and be accompanied with associated metadata to achieve QC 400.
	Low confidence polygons	Polygons categorised as 'low' in either assignment confidence level and/or allocation accuracy should be prioritised for data validation. Polygons categorised as 'medium' in either assignment confidence level or allocation accuracy should be a secondary priority.

Quality coding of individual polygons in LCDB

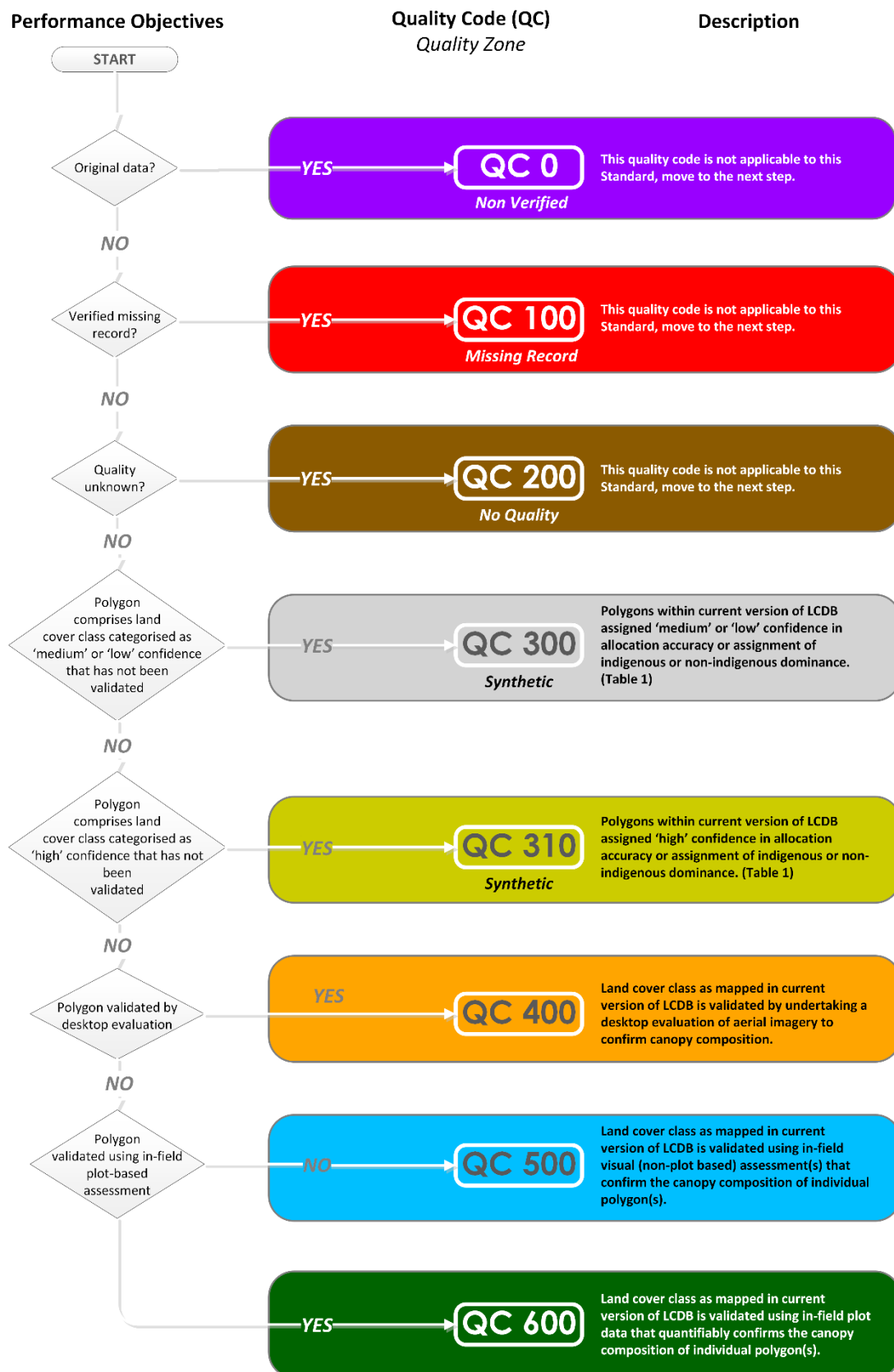


Figure 1 – Quality code flowchart

The LCDB is considered synthetic data under the NEMS *National Quality Code Schema* in that it is a thematic classification of land cover derived from satellite imagery and visual mapping.

For this Standard, the QC 300 series has been expanded to include a child code of QC 310 to differentiate between polygons within LCDB land cover classes where confidence varies (**Error! Reference source not found.**).

Table 6 – Parent code, expanded with child code

NQCS Quality Code	NQCS Quality Zone <i>Parent</i>	Child Code	Child Summary
QC 300	Data estimated from any of the following: - relationships, - calculations or models, or - limited measured data	300	Polygons categorised as 'medium' or 'low' in either assignment confidence level and/or allocation accuracy, and which have not been validated.
		310	Polygons categorised as 'high' confidence in either assignment confidence level and/or allocation accuracy, and which have not been validated.

Application

All data produced and archived under NEMS Standards shall be filed with all required metadata, including a quality code assigned in accordance with the Quality Code Schema set out above. The schema permits valid comparisons within and across multiple data series. Quality coding also allows those interpreting analysis and reporting on indigenous cover to understand how confident they can be in the accuracy of the underlying data.

The quality coding flowchart (

Figure 1) shall be used as the framework to assign quality codes to individual polygons within local copies of the LCDB.

An initial quality code in the QC 300 series is assigned to individual polygons by default, depending on level of confidence in allocation accuracy or indigenous/non-indigenous assignment (Table 1). This initial quality code reflects the default confidence in the LCDB; the final quality code may be higher (as summarised above and detailed in Annex A).

Individual polygons within local copies of the LCDB can be assigned a higher final quality code of either QC 400, QC 500, or QC 600 if the polygon(s) have been validated in accordance with the coding matrix.

The final quality code cannot be higher than QC 310 unless the polygons have been validated as described in this Standard.

The quality coding matrix identifies that the LCDB does not initially meet a quality code higher than QC 310, but that the quality coding of individual polygons can be improved through validation. It should be noted that polygons with lower quality coding should be prioritised for validation, but can still reliably be incorporated in analysis and reporting of indigenous cover at regional and national scales.

Quality codes are determined from the Standard(s) applied at the time data are acquired. As Standards are updated there is no requirement to review and possibly revise the quality codes of data already archived. The Standard(s) and version(s) applied must therefore also be tracked in the metadata by way of a Stationarity Comment. It is recommended that practitioners maintain in-house copies of the version of the Standard that they are utilising to enable future users of the data easy access to the version of the Standard that was used at any point in time.

Data validation

In this section

This section sets out the requirements to validate polygons within local copies of the LCDB.

Validation of polygons

Validation of polygons is undertaken to confirm that:

- the land cover on the ground matches the land cover classification of the polygon within the LCDB, and
- the assignment of dominance (indigenous or non-indigenous) of the land cover (aerial layer) is correct.

Within this Standard there are three accepted methods for validating polygons, which are placed on a spectrum of increasing accuracy:

1. Desktop evaluation of polygons against imagery of suitable quality that provides enough information to enable validation of canopy composition. For example, high quality aerial (including oblique), satellite, drone imagery, etc.
2. In-field visual assessment of canopy composition. This can include on-the-ground visual assessments such as walk overs, observations from vantage points (including with the assistance of binoculars), helicopter fly-overs etc.
3. In-field plot-based data collection that describes the canopy composition. Existing data and/or data from current monitoring programmes designed for another purpose (e.g. Tier 1 monitoring; Department of Conservation 2024a) can be used to validate polygons for the purpose of this Standard where that data is suitable to describe the canopy composition.

This Standard does not prescribe the sampling method and level of effort that should be applied to validate polygons, but leaves these to professional judgement. These are important considerations, however, particularly for very large polygons. Guidance can be sought from existing monitoring manuals and tool boxes, for example, the vegetation module of the biodiversity inventory and monitoring toolbox (Department of Conservation 2024b).

Validation of the LCDB is not obligatory to enable reporting on indigenous cover, and unvalidated local copies of the latest version of the LCDB can be confidently relied on for the purposes of reporting on indigenous cover at scales greater than 50 km².

Should councils or other agencies wish to validate polygons it is recommended that land cover classes with assigned low or medium confidence (Table 1) are prioritised. Alternatively, unrelated investigations targeted at specific areas or land cover classes may provide the opportunity to validate the relevant polygons in the LCDB. Such synergies should be encouraged.

Metadata

In this section

This section prescribes the metadata requirements to comply with this Standard and provides an example of the standardised format for recording metadata, the bespoke fields that will need to be added to the attribute table of local copies of the LCDB, and recommendations for version control and archiving multiple versions of local copies of the LCDB.

All datasets created under this Standard should be publicly discoverable and all archived datasets accompanied with metadata that describes the quality and origin of the data. The following subsections set out those requirements.

Standardised format

The metadata style required under this Standard is based on the Dublin Core set of fifteen generic metadata elements (Dublin Core 2024). An example is provided below (Table 7) using the LCDB metadata, with slight modifications as fit for purpose for this Standard.

Table 7 – Example metadata against the Dublin Core elements

Dublin Core Element	Example
Title	LCDB v5.0 – Land Cover Database version 5.0, Mainland, New Zealand
Date	First published: Released in January 2020 Date parent database updated: 11 November 2021 Data downloaded: <i>[date local copy was downloaded]</i> Data last updated: <i>[date that any updates to the local copy were created]</i>
Creator	Landcare Research Manaaki Whenua New Zealand Ltd.
Contributor	Local copy of the LCDB was created by <i>[agency]</i>
Publisher	Landcare Research Manaaki Whenua via LRIS Portal
Language	English
Format/Projection	The data set is designed to complement in theme, scale and accuracy, New Zealand's 1:50,000 topographic database (www.linz.govt.nz/land/maps/topographic-maps/topo50...)
Subject/Purpose	Subject: Land cover classes, New Zealand Purpose: This copy of the LCDB is for the purpose of reporting on indigenous cover

Dublin Core Element	Example
Description	The New Zealand Land Cover Database (LCDB) is a multi-temporal, thematic classification of New Zealand's land cover. The classification was revised between versions 1, 2 and 3 but has been consistent thereafter, and always with backward compatibility maintained. Land cover features are described by a polygon boundary, a land cover code, and a land cover name at each nominal time step: summer 1996/97, summer 2001/02, summer 2008/09, summer 2012/13 and summer 2018/19. LCDB Version 5.0 includes corrections to all time steps 1996/97, 2001/02, 2008/09, 2012/13 and 2018/19 for both the New Zealand mainland and Chatham Islands. A description of work undertaken for this release (including that of all earlier releases) is presented in the Lineage section. Of particular note at version 5.0 is the addition to the LCDB of attributes designed to readily identify and monitor wetlands over time and a similar capability to manage significant coastal changes. <i>Further detail is provided at https://lris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/</i>
Identifier	https://lris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/
Relation	<i>[Local version is copy of LCDB with locally applied modifications, available as a layer]</i>
Source	Landcare Research Manaaki Whenua via LRIS Portal https://lris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/
Type	Vector polygon layer
Coverage	New Zealand, including rivers and open water bodies and inshore islands. The LCDB maintains parity with the Topo50 Map Series coastline. Onshore polygons are segregated from polygons seaward of the coast by an onshore indicator ('yes') in the LCDB attribute table. <i>[describe parameters / boundaries of local copies of LCDB]</i>
Rights	Creative Commons Attribution 4.0 International. You may use this work for commercial purposes. You must attribute the creator in your own works.
Keywords/tags	Thematic tags: land cover Geographic tags: <i>[region]</i> Temporal tags: 2019

It is recommended that four additional metadata elements (Table 8) are also included for users of ArcGIS Online (AGOL).

Table 8 – Recommended additional metadata elements to include when using ArcGIS Online

Element	Example
Extent	Regional extent
Status	Active / Inactive
Folder	Name of folder where stored
Categories	Environment [<i>include category tags as relevant to local use</i>]

2.2 Attribute tables

For the purposes of conducting analysis and reporting under this Standard, additional fields will need to be added to local copies of the LCDB attribute tables. These are set out in Table 9.

Table 9 – Additional fields to include in local copies of the LCDB attribute tables

Required field	Values	Explanation
<i>Correction to parent LCDB</i>	Yes No n/a	A 'yes' entry indicates a change to the polygon in the local copy has occurred due to improved data accuracy in the parent LCDB. This confirms changes in polygons are due to a change in measurement methods or improved data accuracy rather than an actual change (e.g. loss) on the ground.
<i>Date of correction</i>	dd/mm/yyyy n/a	Date of change to local copy.
<i>Explanation for correction</i>	Free text	Brief detail of reason for correction within the LCDB (e.g. revised spectral imaging).
<i>Allocation accuracy confidence level</i>	Low Medium High	If the polygon is unvalidated, the value for entry in this field will be informed by Table 1 of this Standard. If the polygon is validated, confidence level will be 'high'.
<i>Assignment of land cover class</i>	Indigenous Non-indigenous	Indicates if polygon is indigenous dominated (aerial layer) or not.

Required field	Values	Explanation
<i>Source of assignment</i>	Default Validation	'Default' indicates assignment has been categorised in accordance with Table 1 of this Standard. 'Validation' indicates the polygon has been validated (as detailed in subsequent columns).
<i>Assignment confidence level</i>	Low Medium High	If the polygon is unvalidated, entry will be informed by Table 1 of this Standard. If the polygon is validated, confidence level will be 'high'.
<i>Validated</i>	Yes No	Indicates if the polygon has been validated.
<i>Date of validation</i>	dd/mm/yyyy n/a	Date of update to local version of the LCDB, if applicable. NB: if using versioning control this field will not be required.
<i>Method of validation</i>	Free text	Provides information on source of validation.
<i>Quality Code</i>	QC 300 QC 310 QC 400 QC 500 QC 600	In accordance with this Standard: • All unvalidated polygons of land cover classes assigned a 'low' or 'medium' confidence rating in Table 1 of this Standard are to be coded QC 300. • All other unvalidated polygons are to be coded QC 310. • Any polygon validated using desktop methods is to be coded QC 400. • Any polygon validated using in-field visual assessment methods is to be coded QC 500. • Any polygon validated using in-field plot data is to be coded QC 600.
<i>NEMS version</i>	Version number	As located on the cover of the Standard utilised at the time quality coding was assigned.

Version control and archiving

Acceptable methods for version control are either the addition of fields into the attribute table of the local copy of the LCDB or 'versioning'.

It is recommended that agencies have only one **official copy** of the LCDB that is treated as the final version at any given time stamp for the purposes of reporting and sharing externally, and that a 'bulk update' process is undertaken from the **working copy** to the official copy of the LCDB at regular intervals (no longer than annually) or as required for reporting purposes.

At the time that a new version of the LCDB is released by Manaaki Whenua Landcare Research (or any other future producer of the database), a manual update to local copies of the LCDB will be required.

It is highly recommended that all versions of local official copies are archived. If data storage is restricted and it is not possible to keep all versions, it is recommended that a rolling archive is maintained such that the most recent versions are retained and the oldest versions are replaced with newer versions as dictated by the available storage space. Where it is not possible to retain versions, shapefiles should be created and these archived.

Reporting

In this section

This section provides a checklist of reporting requirements and a series of statements that are recommended to be included when reporting on indigenous cover.

Reporting requirements

Analysis and reporting of indigenous cover is straightforward and can be summarised in tabular format with brief accompanying statements. This report may be presented as a stand-alone item, or inserted into a more detailed report. In either case, the specifications set out in this Standard should be followed when reporting on indigenous cover at national and regional scales.

Analysis is conducted by overlaying the LCDB spatial layers with the area of interest within a GIS programme and calculating the area (ha) and proportion (%) of indigenous cover occurring within the defined area of interest, using the indigenous/non-indigenous attribute in the GIS layers (see section 2.2). Indigenous cover can then be reported for an individual land cover class, or by summing all indigenous land cover classes to give a total area of indigenous cover within the area of interest generically.

In reporting on indigenous cover, non-indigenous cover may also be presented for completeness or comparison.

Reporting agencies may also wish to report the portion of land area within each quality code to provide an indicator of the accuracy of the reporting. It is recommended that distribution tables are used to do this. The distribution of land area that falls within each quality code can be tabulated by assignment:

Assignment	QC 300	QC 310	QC 400	QC 500	QC 600
Indigenous	5%	70%	15%	5%	5%
Non-indigenous	5%	90%	5%	0%	0%

or by land cover class:

Land cover class	QC 300	QC 310	QC 400	QC 500	QC 600
Broadleaved indigenous hardwoods	0%	75%	0%	10%	15%
Deciduous hardwoods	100%	0%	0%	0%	0%
Etc.					

Reporting agencies may wish to consider deriving an area-weighted average quality code to provide a coarse indication of the accuracy of the reported total indigenous cover extent.

Similar analysis can be undertaken for the proportion of polygons within each quality code to provide an indication of effort required to validate polygons and improve quality coding.

Reporting on the distribution of land area within each quality code will also enable the change over time in data quality to be tracked and reported on. However, it is recommended that any reporting on the quality of data is also accompanied by a statement reiterating that all quality codes used in this Standard (QC 300 to QC 600 inclusive) are adequate for reporting on indigenous cover at scales greater than 50 km², and, in particular, national and regional scales (see **Error! Reference source not found.**).

There is no set time period within which to undertake analysis and reporting under this Standard as the timing (and frequency) will be dictated by the driver for the reporting (e.g. legislative requirements, regional investigations, development of integrated catchment management plans etc.). Further, as this Standard only applies to the use of the LCDB, comparative analysis over time is restricted by the frequency at which update versions of the LCDB are produced. However, in the instances where validation of polygons within local copies of the LCDB has occurred in the interim period between versions of LCDB, more frequent reporting can be informative.

A checklist of matters that must be included when reporting on indigenous cover is provided in **Error! Reference source not found.**

Table 10 – Checklist of information that must be included when reporting on indigenous cover

Confirmation that the latest version of the LCDB was used for the analysis.	☐
A clear description of the area of interest (region, catchment etc.), including the boundaries and inclusion of any inshore islands.	☐
Where reporting applies to sub-regional areas (e.g. catchments >50 km ²) a unique identifier must be assigned to the defined area of interest to enable comparative analysis through time.	☐
A clear statement of the relevant date stamps and reporting time period (if reporting on change over time), including any necessary explanation of confidence in, or limitations of, historic versions of the LCDB being used as the baseline against which change (current version) is being evaluated. If polygons have been retro backdated through earlier versions of the LCDB this must also be stated.	☐
The total area (ha) that was assessed (area of interest), the area (ha) and the proportion (%) within the area of interest for each of the indigenous-dominant land cover classes being reported on. When reporting on change over time, the area (ha) and proportion (%) of change between the end date and the starting date of the time period to which the analysis applies.	☐
Where administrative boundaries of areas of interest have changed over time, include a description of the change and how this impacts on comparison of indigenous cover over time. A statement should also be included in reporting to confirm there has been no change in reporting boundary if this is the case.	☐
The level of certainty applied to the analysis (based on the quality coding). If using distribution tables, explicitly state whether quality code distribution tables are reporting on proportion of polygons or land area (or both) within each quality code. When reporting on quality coding, also include a copy of the Quality Coding Schematic (Figure 1) to illustrate what the quality codes mean.	☐
Description and justification of any areas or land cover classes excluded from the analysis and the influence this has on the results.	☐
Where validation of a local copy of LCDB polygons has occurred, an explanation that associated regional reporting may differ from national reporting due to this validation.	☐

It is recommended that the following statements are included when reporting on indigenous cover:

Scope of analysis

This analysis has been compiled from a copy of the LCDB [v5] that includes all vegetated and non-vegetated land cover, including beds of rivers, ponds, lakes, and other open water bodies where they fall within the [*boundaries of the defined area of interest*] and within the coastal boundaries embedded within the LCDB (which maintains parity with the Topo50 Map Series coastline). Inland islands are also included in this analysis [*when reporting on areas of interest that include islands*].

Quality coding of polygons within local copies of the LCDB

Quality codes are applied to individual polygons within local copies of the LCDB, in accordance with the quality coding protocols set out in the NEMS *Indigenous Cover*. Consequently, a local copy of the LCDB may have several different quality codes, and the quality codes may differ across polygons of the same land cover class where some, but not all, polygons have been validated, or the source of validation is varied. All of the quality codes assigned under the NEMS *Indigenous Cover* are deemed sufficient for the purposes of reporting on indigenous cover at national and regional scales and sub-regional scales >50 km². That is, in interpreting reporting on indigenous cover at national and regional scales, greater confidence can be had in those polygons that have been validated while confidence in unvalidated polygons does not drop below an acceptable level. Therefore, all polygons, regardless of the assigned quality code, have been included in this analysis.

Variance between national- and regional-scale reporting

Regional reporting may differ from national reporting where validation of polygons within local copies of the LCDB has been undertaken. Where this is the case, a greater level of confidence can be assigned to the regional analysis, for the polygons and land cover classes that have been validated. Further variance between national and regional reporting may also be derived from differences in application of administrative boundaries when defining the area of interest.

References

Department of Conservation 2024a. DOC's monitoring and reporting system. Accessed 22 November 2024 from <https://www.doc.govt.nz/our-work/monitoring-and-reporting-system/>

Department of Conservation 2024b. Vegetation inventory and monitoring. Accessed 22 November 2024 from <https://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/vegetation/>

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IRIS Portal 2024. New Zealand Land Cover Database (LCDB) v5.0, Mainland, New Zealand 2024. Database, metadata and user guides available from <https://iris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/>. Manaaki Whenua Landcare Research.

Annex A – Quality Coding Matrices

Quality coding matrices determine an initial quality code for the data based on confidence in the allocation (that the land cover class on the ground matches that within LCDB v5) and assignment (that the assigned dominance as indigenous or non-indigenous cover) of the land cover classes is correct. Confidence levels are set out in Table 1.

For any quality code, the requirements of Table 2 and Table 3 of ‘The Standard – Indigenous Cover’ must also be met.

Quality coding applies to individual polygons of land cover classes within the LCDB, and not to the LCDB as a whole.

The matrices require only yes (Y) or no (N) (or tick and cross) responses, where “yes” indicates achieved and “no” indicates not achieved. Use of the matrices follows the concept of hierarchy in the NEMS *National Quality Code Schema*.

- Start with the QC 600 column, noting a response to each criterion.
- Any “yes” in the QC 600 column elevates initial quality code to QC 600.
- Any “no” in the QC 600 column retains the initial quality code (that as described beneath the matrix).
- Then consider the QC 500 column.
- Any “yes” in the QC 500 column elevates the initial quality code to QC 500.
- Any “no” in the QC 500 column retains the initial quality code (that as described beneath the matrix).
- Then consider the QC 400 column.
- Any “yes” in the QC 400 column elevates the initial quality code to QC 400.
- Any “no” in the QC 400 column retains the initial quality code (that as described beneath the matrix).

Data validation matrix

Criteria	QC 600	QC 500	QC 400
Source of validation (assignment of dominance and allocation accuracy, but not spatial accuracy)	In-field plot data obtained describing canopy composition of individual polygon(s) and accompanied by metadata ☐	In-field visual assessment of canopy composition of individual polygon(s) and accompanied by metadata ☐	Desktop evaluation of individual polygon(s) and accompanied by metadata ☐

Initial quality code of all polygons of land cover classes categorised as 'high' confidence in either allocation accuracy or assignment of dominance (indigenous/non-indigenous) as listed in Table 1	QC 310
Initial quality code of polygons of land cover classes categorised as 'low' or 'medium' confidence in either allocation accuracy or assignment of dominance (indigenous/non-indigenous) as listed in Table 1	QC 300

