The Recce method

for describing New Zealand vegetation – field manual

JM Hurst, RB Allen, and AJ Fergus

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JM Hurst, RB Allen, and AJ Fergus
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Contents

1 Introduction 1

2 Sampling 1

3 Pre-fieldwork planning 2

4 Recce description location 2

4.1 Overview 2

4.2 Locating Recce descriptions at systematic or random sample points 3

4.3 Locating Recce descriptions along transects 3

4.4 Establishing permanent fixed-area Recce quadrats 4

4.4.1 Fixed-area Recce quadrat orientation 4

4.4.2 Fixed-area Recce quadrats on transects 4

4.4.3 Laying out permanent fixed-area Recce quadrat boundary tapes 4

4.5 Permanently marking fixed-area Recce quadrats 5

4.5.1 Forest vegetation 5

4.5.2 Grassland or wetland vegetation 6

5 Measuring Recce descriptions 6

5.1 Plant species nomenclature and coding system 7

5.1.1 Naming species 7

5.1.2 Using the coding system 7

5.1.3 Documentation of plant species recorded in metadata 9

5.2 Recce description measurement 10

5.2.1 Recce identification information and location 10

5.2.2 Site description 13

5.2.3 Vegetation parameters 16

5.2.4 Additional biological information 18

5.2.5 Recce vegetation description 19

6 Collecting and recording unknown plants 27

6.1 Collecting unknown plant specimens 28

6.2 Storing unknown plant specimens 29

6.3 Identifying unknown plants and correcting field sheets 29

7 Quality control procedures for Recce inventory surveys 30

8 Data management and storage using the NVS Databank 30

9 Acknowledgements 31

10 References 32

Appendices list **34**
Appendix 1. Glossary 35
Appendix 2. Equipment required to establish and measure Recce descriptions 37
Appendix 3a. Recce field sheet: site description 39
Appendix 3b. Recce field sheet: vegetation description 40
Appendix 4. Non-standard species codes for the New Zealand vascular flora 41
Appendix 5. Canopy cover scale 44

1 Introduction

This manual describes field protocols for measuring Reconnaissance (Recce) descriptions, which are used to describe the composition and structure of a diverse range of vegetation. This field manual expands on, and updates, earlier versions of Recce description measurement protocols (Allen 1979, 1992; Allen & McLennan 1983). Specifically, this version of the manual is an update of version 4 (Hurst & Allen 2007).

At each Recce description the plant species present are recorded in height tiers, along with associated cover estimates. Site characteristics (e.g. altitude, aspect, and slope) and additional characteristics of the vegetation (e.g. animal browse) are recorded, because these are often required to interpret vegetation patterns.

This version of the Recce description manual is designed for use in the field. An expanded version of this manual is also available (Hurst et al. 2022b), which should be consulted before undertaking fieldwork. The ewxpanded Recce manual provides further detail on the principles of sampling, the use of fixed-area vs variable-area Recce descriptions, planning surveys, quality control procedures, and instructions for archiving data in the National Vegetation Survey (NVS) Databank.

2 Sampling

General guidelines on sampling are outlined in the expanded Recce manual (Hurst et al. 2022b). Key sampling decisions concern the arrangement and number of sample Recce descriptions. These decisions affect the statistical properties of the data (e.g. whether formal statistical tests will be valid), and the representation of dominant vs rare species and/or communities. They will also have practical implications, such as influencing the number of Recce descriptions that can be established in a given time frame.

It is also important to decide from the outset whether the Recce descriptions in a survey will be temporary (i.e. used for a one-off inventory only) or permanently marked (enabling remeasurement).

The fundamental factor when selecting the size and shape of Recce descriptions is to provide an adequate measure of the composition (i.e. species richness) and structure of the vegetation. Sampling decisions are crucial, and will determine both how the data can be used and the feasibility of undertaking the programme. Ultimately, the monitoring design must allow the objectives of the programme to be met.

3 Pre-fieldwork planning

Pre-fieldwork planning ensures fieldwork proceeds as efficiently and smoothly as possible, the data are of high quality and meet the intended purpose, and the work is completed within budgeted timeframes. Further details on pre-fieldwork planning are outlined in the expanded Recce manual (Hurst et al. 2022b).

The following planning tasks must be undertaken as part of the overall management of the inventory or monitoring programme and before undertaking fieldwork:

- develop the sampling design
- scheduling and logistics scoping
- organise and purchase equipment (see Appendix 2)
- select staff
- train staff
- pre-season operational briefing
- create a detailed field-plan
- allocate time to follow up work after fieldwork is complete
- obtain lists of species likely to be encountered in the survey area
- obtain permission to cross land and collect specimens
- address biosecurity risks.

4 Recce description location

4.1 Overview

When implementing representative sampling designs, the precise Recce description location in the field must be determined in a truly objective (unbiased) way to ensure the data collected are a representative sample of the study area. This can often be facilitated through the use of GPS to locate Recce positions. However, note that GPS receivers cannot always be used to determine location, particularly in mountainous terrain or beneath tall or dense forest canopies. In this case, alternative procedures to locate the Recce description must be followed, such as the use of a hip-chain and compass to locate the Recce description from a nearby landscape feature that is easily identified on a topographical map.

A predetermined Recce location may sometimes fall where it is unsafe or impractical to undertake a Recce description (e.g. bluffs, very steep terrain). The definition of unsafe lies with the field team and their collective experience and skills. Do not establish a Recce at the specified predetermined location where doing so would be likely to endanger the field party. For such Recces, use the Vegetation Description and Notes section of a Recce sheet to briefly describe the situation and vegetation, and archive this with the rest of the data from the survey. A Recce relocation protocol can be used if a site is unsafe. An example of a plot or Recce description relocation protocol currently used in New Zealand requires a field team to examine a hierarchical set of 30 alternative locations, derived from 10 random bearings at 200, 400, and 600 m intervals from the original point, and sampling the first safe location (DOC 2019).

4.2 Locating Recce descriptions at systematic or random sample points

Where Recce descriptions are to be established at points determined prior to fieldwork, enter the most recent grid reference into a GPS receiver before setting off. Check the coordinate system of the grid references before entering them. If they were collected in New Zealand Map Grid, they will need to be converted to New Zealand Transverse Mercator.

When GPS reception can be obtained, use it to navigate to within about 30 m of each Recce location. Set the direction function of the GPS receiver to magnetic, and use the GPS waypoint function to obtain a bearing and distance to the Recce. Follow the bearing and measure the distance using a hip-chain or tape. This procedure is recommended because the accuracy with which a GPS receiver can locate any specified point decreases as the point is reached (Burrows 2000).

When GPS reception cannot be obtained, follow a bearing and measured distance using a hip-chain (as above) to locate the Recce from a significant nearby landscape feature that can be accurately identified on a topographical map (e.g. stream confluence, high point, bush edge, ridge). Similarly, if there is no GPS reception at the Recce location, re-fix the position of an identifiable point (e.g. a prominent landscape feature). Where possible, re-fix each Recce position with the GPS receiver and record the coordinates on the Recce sheet (see section 5.2.1).

4.3 Locating Recce descriptions along transects

Where Recces are to be located along transects, navigate to the transect origin using a map, compass, and GPS receiver (where possible, as outlined above). Record the transect bearing (magnetic) and GPS reference for the transect origin (where

possible) on the Recce sheets of all Recces on the transect (see section 5.2). When moving along each transect, ensure the compass bearing is accurately followed. Measure the pre-specified distance to each Recce with a hip-chain or tape (typically 200 m). Where possible, fix each Recce position with the GPS receiver and record the coordinates on the Recce sheet (see section 5.2.1).

4.4 Establishing permanent fixed-area Recce quadrats

4.4.1 Fixed-area Recce quadrat orientation

If establishing *permanent fixed-area Recce descriptions*, establish a square quadrat, labelling the corners 'A', 'B', 'C' and 'D' clockwise around the Recce (e.g. Wiser & Rose 1997). One system for determining the quadrat orientation is to mark corner D at the selected point, and then establish the D–C quadrat boundary along the predominant contour of the slope. While standing at the Recce corner, determine the bearing by using a sighting compass to sight on somebody standing 10–15 m away along the contour of the slope.

Take 90° off the compass bearing of the D–C boundary to determine the compass bearing of the D–A and C–B boundaries, and lay out two boundary tapes at right angles to the first. Join the open end along the A–B boundary with a fourth boundary tape to form a square quadrat.

When a fixed-area Recce quadrat is located on flat terrain (average slope is less than 5°, see section 5.2.1), establish it so that the C–D boundary lies in a north–south direction (i.e. corner C is north of corner D).

4.4.2 Fixed-area Recce quadrats on transects

When fixed-area Recce quadrats are located on *transects,* establish the quadrat so that the D–A quadrat boundary lies along the transect in the direction of travel. Each quadrat should be established to the right of the transect (relative to the direction of travel). The D–C and A–B boundaries should be laid out perpendicular to the transect (i.e. add 90° to the compass bearing of the D–A boundary).

4.4.3 Laying out permanent fixed-area Recce quadrat boundary tapes

Use a sighting compass to lay out the fixed-area Recce quadrat boundary tapes to the correct magnetic bearings. The tapes should be pulled tight when laying out a Recce quadrat on even ground. When the Recce quadrat is in a gully or over a ridge, the tapes should generally follow the ground surface. Ignore small bumps or

depressions. Where possible take the tape under windfalls, or, if that is not possible, pull the tape above them.

Lay boundary tapes out as straight as possible. When trees are located along Recce quadrat boundaries, include them in the quadrat when their trunk is predominantly (>50%) rooted within the quadrat. Try to minimise disturbance to the Recce quadrat area and immediate surroundings to reduce the possibility that changes measured over time will result from measurement activities.

4.5 Permanently marking fixed-area Recce quadrats

For any Recce descriptions that are to be remeasured, adequate permanent marking is absolutely essential to ensure Recce quadrat boundaries can be accurately re-established during future measurements. Do not rely solely on GPS references for relocation purposes, as GPS fixes can be imprecise. It is important to adequately mark the route to each permanently marked Recce location so that they can be relocated easily by future field parties.

Where possible, use a GPS receiver to locate the Recce position and to record the location of significant landscape features along the route to the Recce; for example, transect origins (where applicable), stream confluences, bluffs, high points, campsites, helicopter landing sites. All access route and Recce location markers should be robust enough to withstand disturbance from animals (e.g. stock) and natural elements. Suitable marking depends on the vegetation of the study area.

4.5.1 Forest vegetation

Mark each fixed-area Recce quadrat corner with a large strip of Permolat attached to an aluminium peg (e.g. 7 mm diameter, 45 cm long) placed in the ground. Ensure you scratch or stamp onto the Permolat strips the appropriate corner letter (i.e. 'A', 'B', 'C', 'D' clockwise around the Recce). Do not use permanent marker pens. The aluminium peg should be bent at the top to reduce the likelihood of the Permolat falling off.

At each corner peg, select the nearest live tree outside the Recce quadrat area on which to nail a strip of Permolat and provide corner location information. Label each Permolat strip with the measured distance along the ground, the magnetic bearing *from* the centre of the base of the tree *to* the corner peg, and the appropriate corner letter (e.g. 'Corner A 1.6 m @ 205º'). Nails should protrude by at least 2 cm to allow for tree growth. Adequate Permolat marking near corners is invaluable when Recce descriptions are to be remeasured, as corner pegs can be lost over time.

4.5.2 Grassland or wetland vegetation

Recce quadrat corners may be marked using 50 × 50 mm wooden stakes, angled aluminium standards, or waratahs (Y-posts/steel standards), as appropriate. Such corner pegs should protrude from the ground by 0.8–1.0 m so that they are easily visible to assist relocation. Aluminium pegs are lighter to carry and may be suitable, particularly where the interval between quadrat establishment and remeasurement will be short. Brightly coloured, recycled-plastic waratahs are similarly easily transportable. Rock cairns and photographic records can assist with quadrat relocation. The coloured Permolat strips often used to mark study sites in forest vegetation are not recommended in South Island alpine zones because they attract kea.

A combination of the above approaches may need to be taken in vegetation composed of scattered grassland and shrubs.

5 Measuring Recce descriptions

Always thoroughly document Recce measurement protocols in the metadata for a survey and give details of any intentional variations to standard Recce description measurement protocols. Further details on what to include and how to capture metadata are outlined in the expanded Recce manual (Hurst et al. 2022b).

The equipment required to undertake Recce descriptions is detailed in Appendix 2. A Recce description can generally be undertaken most efficiently by two people. Each Recce is recorded on a double-sided Recce description sheet (see Appendix 3), which can be obtained from the NVS Databank website (http://nvs.landcareresearch.co.nz/). Two alternative field sheets are available with different sets of fixed-height tiers for the Recce vegetation description (see section 5.2.5). Print field sheets onto both plain and waterproof paper or card for use in the field.

Note that collecting data over extended periods in wet or cold weather is not advisable, as data quality generally suffers. When the ground is wet, measurement activities can also cause considerable damage to the vegetation in the Recce, especially on steep terrain. This concern is especially relevant where permanently marked, fixed-area Recce quadrats are used to monitor vegetation change.

5.1 Plant species nomenclature and coding system

5.1.1 Naming species

The recommended nomenclature authority for New Zealand is Ngā Tipu o Aotearoa – New Zealand Plants database. The database annually releases date-stamped species lists, which are available from https://datastore.landcareresearch.co.nz/organization/plant-names-database-reports. The use of a date-stamped species lists permits a work programme to achieve taxonomic consistency over a specified time period. The Biota of New Zealand portal (https://biotanz.landcareresearch.co.nz/) can be used to search nomenclatural details in the database (filter the record source to Names_Plants to improve search outcomes).

Plant species should be identified and recorded to a level of taxonomic resolution the field botanist can confidently recognise as a unique taxon. Where appropriate, record taxon identifications below species level (i.e. to subspecies or variety, if relevant). Although subspecies and varieties are sometimes raised to species level during data analysis, recording the most accurate identification possible can capture valuable distribution data for subspecies and varieties that are threatened, and also future proofs data against potential taxonomic changes (e.g. a subspecies becomes recognised as a distinct species).

5.1.2 Using the coding system

Plant species must be recorded using a standard species-coding system to guarantee that data can be interpreted in the long term. Key requirements of the species coding system are that:

- each taxon is recorded using a unique code that applies *only* to that taxon
- codes used for each taxon are *consistent* within and between surveys.

Before beginning fieldwork, all survey participants should be familiar with the species-coding system, be aware of potential non-intuitive species codes (Appendix 4), and know how to check that the species codes used are correct. Rules for constructing species codes are outlined below.

(a) Coding species

- Each plant species is represented using a unique six-letter NVS code on field sheets and in electronic form once the data are entered. The species code usually consists of the first three letters of the plant genus (upper case), followed by the first three letters of the species name (lower case). For example,

Pseudopanax crassifolius is recorded as PSEcra on all field sheets. The current catalogue of species codes is maintained by the NVS Databank team and is directly linked to Ngā Tipu o Aotearoa – New Zealand Plants database (https://nvs.landcareresearch.co.nz/Resources/NVSNames).

- Where only the genus can be determined due to a lack of identifying features (e.g. *Parsonsia*), use the first six letters of the generic name (written in upper case on field sheets; e.g. PARSON).
- Some taxa have not been formally described (e.g. *Coprosma* sp. (d)) but are generally recognised as distinct and are listed on the Ngā Tipu o Aotearoa – New Zealand Plants database (https://biotanz.landcareresearch.co.nz/)). For such species, the code should consist of the first three letters of the genus (upper case) followed by the letter used to identify the informal species (lower case) (e.g. COPd).

(b) Non-intuitive species codes

- The simple species-coding system outlined above provides a unique code for most taxa. However, following this coding system, some six-letter codes could denote more than one taxon. For example, the intuitive code for both *Pseudopanax colensoi* and *Pseudowintera colorata* is PSEcol. To ensure each taxon receives a unique code, non-intuitive codes are used for some species (e.g. the code for *Pseudopanax colensoi* is NEOcol).
- Be aware of any non-intuitive codes for species you are likely to encounter during the survey. A list of some common non-intuitive codes for vascular plants in the New Zealand flora is given in Appendix 4, but others may be devised as a result of ongoing taxonomic revisions.
- *Do not* use *ad hoc*, non-standard plant species codes, because at a future date these are likely to be misinterpreted by people unfamiliar with the data set. Where there is any possibility of ambiguity, or if you are in doubt about the correct six-letter species code, write out the plant name in full.

(c) Coding subspecies and varieties

- For subspecies and varieties, various methods have been used to construct unique species codes. The species code usually consists of the first three letters of the plant genus (upper case), followed by the first letter of the species name (lower case), followed by either an 's' or a 'v' (to denote subspecies or variety), followed by the first letter of the subspecies or variety name (lower case).
- For example, *Polystichum neozelandicum* subsp. *zerophyllum* is denoted as POLnsz on field sheets, while *Ascarina lucida* var. *lanceolata* is denoted as ASClvl. These conventions ensure the intended taxonomic concept is clear and

unambiguous. In contrast, note that if a plant was identified in a wider sense (i.e. to species level), then, for the previous examples, *Polystichum neozelandicum* would be recorded as POLneo, and *Ascarina lucida* as ASCluc.

- Because of the potential for duplicate species codes, the codes used for some subspecies and varieties do not follow the standard system (e.g. *Olearia virgata* var. *lineata* is denoted as OLEvli). Always refer to the list of six-letter species codes to check that the species code recorded is correct.

(d) Coding hybrids

- For hybrids with a recognised hybrid name (e.g. *Coprosma cunninghamii = Coprosma propinqua* × *C. robusta*), the code consists of the first three letters of the genus (upper case), followed by an x (to denote the hybrid status of the plant) and the first two letters of the hybrid name (e.g. COPxcu for *Coprosma cunninghamii*).
- For hybrids without a recognised hybrid name (e.g. *Fuscospora cliffortioides* × *F. truncata*), the code should consist of the first three letters of the genus (upper case) followed by the first letter of each putative parent (lower case) separated by an x (e.g. FUScxt).

5.1.3 Documentation of plant species recorded in metadata

Despite the general rules outlined above, achieving consistency in the use of species codes within and among surveys has proven difficult. Ongoing taxonomic revisions mean that historical data normally include out-of-date species codes, and the uptake of taxonomic name changes can be slow. The following 'best-practice' guidelines are recommended to help ensure species codes are used consistently within a vegetation survey, and that the intended meaning of each species code used in a survey is documented.

- During the survey, maintain a list of the full taxonomic names of every species recorded, along with the six-letter codes used on field sheets. An easy way to create and maintain this list during fieldwork (e.g. at the field base) is to mark species off on the master list of species codes currently used in the NVS Databank as they are recorded in the survey.
- Document the basis of nomenclature followed for individual species or logical groups of species (e.g. ferns, grasses), preferably conveyed by reference to a standard authoritative work. In lieu of an authoritative reference for each species, plant identification texts can be referenced where they are used to identify all species within certain groups of plants (e.g. all fern species). Include information on the edition and year of publication.

Refer to the expanded Recce manual (Hurst et al. 2022b) for steps to ensure the species codes used in a survey are correct.

5.2 Recce description measurement

Record Recce identification information and descriptive data on the site and vegetation (sections 5.2.1–5.2.4) on the front side of the sheet. An example of a completed Recce sheet is provided in Appendix 3a. Take the following steps when measuring and recording the Recce identification and site data.

- Define the boundaries of the area that will be described before undertaking any measurements. Where variable-area Recce descriptions are to be used, mentally take note of the features forming the boundaries of the area that will be described. If using fixed-area Recce quadrats, use tapes to define the Recce area (see section 4.4).
- Limit data to constrained categories (where these are supplied). For example, do not record drainage as 'okay'; always record it as 'good', 'moderate', or 'poor'. Use the Notes section where justification or further detail is required.
- Confer with other field-party members if you are at all unsure of the value for a data field. This applies especially where subjective visual assessments are required (e.g. surface characteristics and ground cover).
- Ensure data are legible. Neatly record data to minimise any possibility they will be misread or unable to be interpreted.
- Do not leave any field on the data sheet blank. Where data are intentionally not recorded in a data field (e.g. the sub-catchment in which the Recce is located is unnamed), record a dash ('—') or 'none' to ensure the data are not interpreted as missing. Record 'not measured' where data were not measured for some reason.

5.2.1 Recce identification information and location

Recce identifier: Record the unique identifier for the Recce (including the transect line number where appropriate). Ensure the unique identifier is recorded on both sides of the Recce sheet in case it is photocopied onto separate sheets.

Survey: Record the name of the survey (e.g. Kokatahi).

Region: Record the region (e.g. Westland).

Catchment: Record the name of the catchment in which the Recce is located

(e.g. Whitcombe River).

Sub-catchment: If the Recce is located in a named river or creek running into the main catchment, record this as a sub-catchment (e.g. Vincent Creek).

Measured by: Record the *full* name of the person(s) doing the Recce measurement (e.g. Larry Burrows).

Recorded by: Record the *full* name of the person(s) recording the descriptive data (e.g. Susan Wiser).

Permanently marked: Circle Y (yes) or N (no) to indicate if the Recce is permanently marked.

Date: Record the day, month, and year in *full* (e.g. 3 March 2005).

Topographical map: Record the topographical map series, map sheet number, and name (e.g. Topo 50 BV18 – Kokatahi).

GPS reference: Record the make and model of the GPS receiver (e.g. Garmin 64S). Where possible, a GPS reference should be recorded using a GPS receiver; for consistency this should be taken at corner D when measuring the Recce as a fixed-area quadrat. This provides accurate location information (important for some data analyses, and facilitates future relocation, where applicable). Record the Easting and Northing in the space provided, preferably using seven-figure New Zealand Transverse Mercator coordinates; for example, (Easting) 1652112, (Northing) 5319823.

GPS fix: Circle whether a single position was measured or if the position was averaged (see GPS accuracy below). Circle if it was a 2D or a 3D fix: this is relevant for older model receivers only – a 2D fix requires only three satellites and cannot measure altitude (i.e. it assumes sea level). It is important to ensure the GPS receiver is set to the datum relevant to the topographical maps used. Early topographical maps (1972–2000) used the New Zealand Map Grid projection, defined in terms of the New Zealand Geodetic Datum 1949 (NZGD1949). Contemporary topographical maps (e.g. NZTopo50, 2001 onwards) produced by Land Information New Zealand use the New Zealand Transverse Mercator projection, based on the New Zealand Geodetic Datum 2000 (NZGD2000). Circle which geodetic datum was used to obtain

the GPS reference (i.e. NZGD1949 or NZGD2000). Be aware that older GPS references (pre-2001) were probably taken using the New Zealand Map Grid projection (NZGD1949) and will differ substantially in position when plotted onto contemporary maps that use the New Zealand Transverse Mercator projection (NZGD2000) (see http://www.linz.govt.nz/).

Ensure the Recce location is correctly marked on a topographical map and, if applicable, on an aerial photograph (where available). Note that there will be times and places (e.g. mountainous terrain) where it is very difficult to obtain a GPS fix at a Recce location. In these instances, try to obtain a reading from the nearest high point or canopy gap where good reception can be found. Record this position in the approach notes and mark it on the location diagram. Measure the distance and direction to the Recce using compass and hip-chain or tape, and record this information in the approach notes. More detailed information on using GPS receivers can be found in Burrows 2000.

GPS accuracy: For Garmin GPS receiver units that are 60 series or older, average a waypoint, allowing 30 measurements. For Garmin 62 units or newer, use the multi-sampling averaging function. The unit will display 100% once the averaging process is complete; circle Y (yes) on the Recce sheet to confirm 100% averaging. To obtain the accuracy displayed in metres, immediately scroll through to the satellite page after averaging. For greater accuracy, average the waypoint twice, waiting for a minimum of 90 minutes between. Record the accuracy obtained (e.g. ±4 m).

GPS location: Circle CORNER D if this is where the GPS reference was taken (preferred), or record the GPS reference location.

Approach: For Recce descriptions that are not permanently marked, record brief information on the location of the Recce in relation to prominent features of the landscape or vegetation.

Where the Recce is permanently marked, record detailed instructions on how to get to the Recce location. Include information on the location of the Recce in relation to prominent features of the landscape or vegetation. Record any important GPS waypoints along the approach route. Where the Recce is located on a transect, record the compass bearing of the

transect and the GPS or map reference for the transect origin. Also, record if you found the line start (where applicable), how this was marked and if you followed a Permolat line to the Recce description location, and record the colour of the Permolat.

Accurate and detailed approach notes are very important for the future relocation of Recce description locations. *Do not* assume that GPS references will be completely adequate for relocation purposes. The description should be sufficiently detailed to enable people who have not previously been to the Recce site to locate it without extensive searching. Do not copy previous approach notes, but ensure that any points of confusion or misleading notes from the previous measurement are clearly explained.

Location diagram: Where the Recce is permanently marked, sketch the route to the Recce, emphasising prominent landscape or vegetation features (e.g. ridges, gullies, streams, slips, bluffs, roads, large tree-fall gaps). Indicate all features for which GPS grid references are provided in the approach notes.

Location diagrams should always have an arrow indicating north (magnetic), and the direction of flow of any streams or rivers should be indicated.

Size of Recce: For 'variable-area' Recces record the approximate (±10%) size of the area described (e.g. 100 m^2). If bounded to a fixed-area Recce quadrat, record the quadrat dimensions (e.g. 20 × 20 m).

Vegetation description and notes: Provide a short description of the vegetation on the Recce and any additional observations or impressions, such as evidence of erosion, disturbance, pest impacts or notable features of the topography. Information recorded here should provide a general impression of what the Recce looks like (see example in Appendix 3a).

5.2.2 Site description

Site data collected provide important information on abiotic factors that may influence vegetation structure and composition. As a minimum, a set of basic, readily obtainable measures is required, as outlined below.

Altitude: Determine the altitude using a barometric altimeter, or use the GPS coordinates to determine the Recce position on a topographical map (or the map loaded onto the GPS), and then use the map contour lines to determine the altitude. Record altitude to the nearest 10 m. If using a barometric altimeter, it should be calibrated from a known spot-height on the topographical map each morning before work starts, and more frequently in changeable weather.

Altitude should not be directly read from GPS receivers because the reading can be inaccurate. Some models of GPS receiver contain in-built barometric altimeters: check the specifications of the GPS receiver used.

Physiography: Circle the applicable option from: ridge (including spurs), face, gully, or terrace. When more than one category could apply, circle the predominant physiography and record any major change in physiography within a Recce in the Notes section.

Aspect: Determine the physiography of the Recce before measuring the aspect. Use a compass to measure the predominant aspect at right angles to the general lie of the Recce, to the nearest 5º (magnetic). Aspect cannot be determined on flat or almost-flat sites (slope <5º) and should be recorded as 'X'. Do not use zero to record aspect on flat Recces, as this will be misinterpreted as a northerly aspect. Where there is a major change in aspect across the Recce, record the predominant aspect.

Slope: Use a clinometer (or equivalent instrument) to measure the average slope of the Recce along the predominant aspect, to the nearest degree. From the middle of the Recce, sight the clinometer on an object at eye level near the upslope and downslope boundaries of the Recce and average the two readings.

Parent material: Identify the predominant bedrock type or parent material. This can often be determined prior to fieldwork from geological survey maps. Copies of geological survey maps are available in libraries and can be obtained from GNS Science (http://www.gns.cri.nz/). Where available, the QMAP geological map series at 1:250,000 scale should be used, which supersedes the Geological Map of New Zealand 1:250,000 ('four miles to the

inch') series.

Where the field party contains staff with expertise in identifying rock types, any disagreement with the broad map classifications can be noted in the field, particularly when there are extrusive/intrusive rocks. Circle the relevant option to record whether parent material was derived from the mapped classification or observed in the field. If you are unaware of the parent material while in the field, record 'Unknown'.

Drainage: Circle the applicable option from good (fast runoff and little accumulation of water after rain), moderate (slow runoff, water accumulation in hollows for several days following rain), or poor (water stands for extended periods).

Mesoscale topographic index: Use a clinometer (or equivalent instrument) to measure the angle from the centre of the Recce to the horizon at eight equidistant (45º) magnetic compass bearings. Record whether each angle is above (+) or below (−) the horizontal. Move around the Recce description area if necessary. When the horizon angle is obscured (e.g. by low cloud or dense vegetation), estimate the horizon angle and make a note that the recorded value is an estimate (e.g. −8° (est)). An estimate of the horizon can be made by projecting ridges using your knowledge of the Recce description area based on your observations as you travel to and around the site (lowest visible light is not necessarily the horizon). If measuring or estimating the horizon is impossible, then record 'obscured'. When all eight values are averaged, the resulting value provides an indication of the relative protection (e.g. high values) or exposure (e.g. low values) of the site (McNab 1993). It is also possible to calculate a metric of Recce protection in the landscape using a Digital Elevation Model in a geographic information system.

Terrain shape index: Use a clinometer (or equivalent instrument) to measure the angle from the centre of the Recce to eye-level 20 m from the centre of the Recce at eight equidistant (45º) magnetic compass bearings. Record whether each angle is above (+) or below (−) the horizontal. The index is a quantitative description of surface shape and is used in forestry as an explanatory variable for metrics such as tree height (McNab 1989). It would be useful to have a second person and an extra 20 m tape for measuring

terrain shape index. To save time, measure the terrain shape index while measuring the mesoscale topographic index.

Surface characteristics: Record the following for the Recce.

Percentage bedrock, percentage broken rock: estimate the percentage of the Recce ground surface comprising bedrock and broken rock (>2 mm) to the nearest 5%. Include all rock that is evident, even if covered by vegetation, moss, or a thin layer of litter.

Size of broken rock (>2 mm): record whether rocks greater than 30 cm (>30 cm) or less than 30 cm (<30 cm) form the predominant cover of broken rock by circling the relevant option. If there is no broken rock, cross out both options.

Mode of transport of broken rock: classify (if possible) whether broken rock was mostly deposited as a result of alluvial (river deposits), colluvial (erosion debris), moraine (glacial deposits), or volcanic activity.

5.2.3 Vegetation parameters

Note that the following vegetation parameters are estimated visually and so are relatively subjective. They are included because of their use in demonstrating marked differences between sites and provide a data user with a better impression of what the Recce looks like. These variables have been used in studies of vegetation dynamics (e.g. Harcombe et al. 1998; Wiser et al. 1998).

Ground cover: Estimate the percentage of the Recce area (to the nearest 5%), below 1.35 m, that is covered by the following.

Vascular vegetation: live, vascular vegetation, including foliage, tree trunks and exposed roots. Note that tree trunks and exposed roots normally comprise only a very small portion (usually <1%) of vegetative cover. As this estimate is of actual vegetation cover, any gaps in the vegetation are excluded from it.

Non-vascular vegetation: all non-vascular vegetation, including mosses, liverworts, hornworts, lichens (including crustose species) growing on soil, litter, coarse woody debris, and rock, and non-vascular plants growing as epiphytes on other living plants, stems and roots, and on dead-standing stems.

Litter: visible dead plant material that is detached from the live

plant (including leaves, dead logs, and branches) that is in contact with the ground. This includes litter among low-growing vegetation.

Bare ground: exposed soil not covered by litter, vegetation, moss or rocks.

Rock: exposed rock, either broken rock or bedrock, not covered by vegetation, moss or litter.

The above five values must sum to at least 100%, but because of multiple layers of overlapping cover they will normally sum to more than 100%. As Recce description locations are seldom flat (e.g. there may be hollows or cliffs present), it is best to imagine flattening these features and estimating ground cover as a proportion of the entire flattened surface.

Average top height: Estimate the average top height of the dominant vegetation on the Recce, to the nearest metre. For low-statured communities (i.e. where average top height is <1 m), these are recorded to the nearest 0.1 m. The dominant vegetation is defined as all vegetation in the tallest tier (as recorded on the Recce vegetation description; see section 5.2.5) with an overall cover of >25% (i.e. overall cover class of ≥4). Where none of the tiers have cover >25%, average top height should be calculated across all height tiers.

Height estimates should be calibrated regularly, with heights measured using a tape (e.g. 8 m builder's tape), height pole, hypsometer or equivalent instrument.

Canopy cover (%): Visually estimate the total canopy cover of the Recce area above 1.35 m, to the nearest 10%. Canopy cover is the vertical projection over the Recce area of all vascular and non-vascular live or dead material (leaves, trunks and branches) >1.35 m above the ground. This measure reflects how much light to the ground surface is blocked. Use the Canopy Cover Scale (Appendix 5) to help arrive at this estimate. For Recce descriptions with a dense subcanopy, several estimates may need to be made from different positions around the Recce and then averaged.

Basal area: In forest vegetation, stand basal area (m^2/ha) may be estimated where relevant to the survey objectives, and can be recorded in the Notes section. In relatively open forest, basal area can be

determined using angle-gauge sampling. With angle-gauge sampling, a tree is included if the angle its diameter subtends at the Recce description centre is greater than the angle-gauge-specific critical angle. The contribution of each included tree is determined from a basal-area factor that is specific to the instrument being used (Allen 1992). For detailed instructions on conducting angle-gauge sampling, refer to Goulding & Lawrence 1992.

5.2.4 Additional biological information

Cultural: Record direct evidence of human interference using the categories provided (logged, burnt, tracked, cleared, mined, grazed [by domestic stock], none). Use the Notes section to justify your choice(s), where necessary, or to record indirect evidence of human activity.

Treatment: Has a treatment been applied to the Recce description area (e.g. 'fenced' or 'not fenced' for Recces that are part of a grazing exclosure trial). Record not applicable (NA) when Recces are not part of an experimental trial.

Fauna: Record the presence of any mammalian, bird, reptile, or invertebrate species that can be positively identified by sight or sound. Note that only birds may have been noted on historical Recce descriptions (Allen 1979, 1992; Allen & McLennan 1983).

Browse: Record conspicuous browsing damage in all height tiers to plant species on the Recce using the following categories.

Light (L): browse on one or two shoots only, on only a few of the plants of the species present.

Medium (M): browse on more than one or two shoots, but most plants of the species not browsed.

Heavy (H): browse on most accessible shoots on most plants of the species.

Record the animal responsible where this can be reliably determined (e.g. ungulate, goat, deer, tahr, chamois, possum, insect, rabbit, hare), or record 'unknown'. If necessary, use binoculars to closely observe canopy foliage. Possum-browsed leaves often have torn edges and jagged leaf stubs, while insect

damage typically consists of holes and wavy, clean-edged browse or straight, finely milled edges (Payton et al. 1999). Refer to Payton et al. 1999 for examples of typical insect and possum browse on some common tree species.

General observations on animal impacts can also be recorded in the Notes section (e.g. bark stripping and the height of browsing).

5.2.5 Recce vegetation description

On the reverse side of the Recce field sheet, vegetation structure and composition are described in height tiers (strata) using cover classes (Appendix 3b).

Fixed-area Recce quadrats are bounded (i.e. include everything within the boundaries of the fixed area). All vegetation within the three-dimensional bounded area is included in the Recce vegetation description, including any foliage overhanging from plants rooted outside boundary tapes. For variable-area Recce descriptions, define the bounds of the homogeneous area that will be described before beginning the vegetation description.

Observe the following guidelines when completing the Recce vegetation description.

(a) General guidelines

- *Apply high taxonomic standards:* reporting changes in plant biodiversity over time and between areas requires consistent, accurate taxonomic standards. Follow the rules for assigning standard six-letter species codes when recording data (section 5.1) or record species' names in full. When a species is not known, collect a specimen for later identification at the field base or office (section 6).
- *Make a thorough attempt to record all live vascular plant species present on the Recce:* where identifiable, dead annual species or browned-off geophytes (i.e. terrestrial orchids) are to be included in height tiers. To capture these, record the species as present (cover score of 'P') against the relevant height tiers. Record a note 'dead' to the left of the species code (Appendix 3b). Do not include dead plants of other perennials.
- *Non-vascular species* (i.e. mosses, liverworts and hornworts) can also be included on Recce vegetation descriptions as an addition to the standard method.

(b) Cover classes and height tiers

- *Use the standard fixed-height tiers* (Figures 1 and 2 and Table 1): fixed-height tiers provide standardised and repeatable data that are readily comparable between Recce descriptions within a survey and between surveys. Fixed-height tiers follow a contour that is perpendicular to the ground surface, and the tiers occupied by a plant are relative to its rooted position (Figure 3). For fixed-area Recce quadrats, boundaries are defined vertically with respect to the ground surface (Figure 3). For foliage overhanging the Recce area from plants rooted outside the Recce boundary tapes, estimate the height tier relative to the plant's rooted position.
- Before beginning the field survey, *determine the predominant structure of vegetation within the survey area and select the appropriate set of standard height tiers* based on the predominant vegetation (see Table 1). Note that the tiers used for study areas dominated by non-woody vegetation (Figure 1) can be combined into the tiers used for areas dominated by woody vegetation (Figure 2).
- *Use the standard cover-abundance scale* (Table 2) to assign a cover class to each species with live foliage in each tier (tiers 1–7): the standard cover-abundance scale is modified from the Braun-Blanquet cover-abundance scale (Mueller-Dombois & Ellenberg 1974).
- The cover class assigned to each species in each tier represents the percentage of the Recce area covered by a vertical projection downwards of the outermost perimeter of the crown of each plant (Daubenmire 1968; Jennings et al. 1999). Small openings within the crown of each plant are included in cover-class estimates, and care should be taken not to bias the estimate because of high or low foliage density. Cover class estimates are less susceptible to seasonal variation in leaf phenology than indices that take foliage density into account.
- Plant species are deemed to be present in a height tier only when they have living foliage within that tier. For example, if a thin layer of *Rubus cissoides* only occurred c. 10 m above the ground, it would be recorded in tier 3 (5–12 m); and if a *Weinmannia racemosa* had foliage in each of tiers 1 through 6, then it would be recorded in all these tiers.
- *Use the canopy cover scale* in Appendix 5 to help determine percentage canopy cover and assign cover classes.
- An exception to the living foliage rule that applies to fixed-area Recce quadrats is if a species is rooted in the bounded Recce area but all the foliage is outside the Recce area (leaning out). To capture this, record the species as present (cover score of 'P') for tier 6 only (regardless of the height of the foliage outside of the bounded Recce area). Record a note 'leaning out' to the left of the species code (Appendix 3b).

- Note that cover estimates represent the absolute rather than relative proportion of vegetation present in a stratum. For example, if mountain beech formed a monospecific canopy, with a cover of 40%, it would be recorded with a cover class of 4, not as 100% of the stratum (cover class of 6).
- *For parasitic plants with no foliar cover* (e.g. *Gastrodia* spp.): record the species as present, and record a cover score using the standard cover-abundance scale for the corresponding height tiers where plant parts occur (excluding reproductive material).
- *Fallen dead trees* (i.e. logs) are considered ground substrate as they are touching the ground surface, and any plants growing on these should be recorded in the appropriate tiers 1–6.
- *The epiphyte tier (tier 7)* includes any plant growing on another living or dead standing plant/branch that is suspended off the ground surface. Parasitic plants (e.g. mistletoes), where present, are also recorded in the epiphyte tier. Plants growing on live roots of other plants should also be listed as epiphytes if they are growing on the root itself, not in soil or litter that has accumulated around it.
- *Record lianas* in all tiers in which their foliage occurs.
- *Use the standard cover-abundance scale (Table 2) to assign an overall cover class to each tier (tiers 1–6):* for each height tier the overall cover class is the total canopy cover of all species collectively in that tier (*not* the sum of the cover classes for each individual species). The overall canopy cover of each tier will therefore never exceed 100% (cover class of 6), but must always be equal to or greater than the highest of the cover classes recorded for any individual species in the tier. For each tier, record the overall cover class in the row labelled 'Overall cover' (see Appendix 3b).

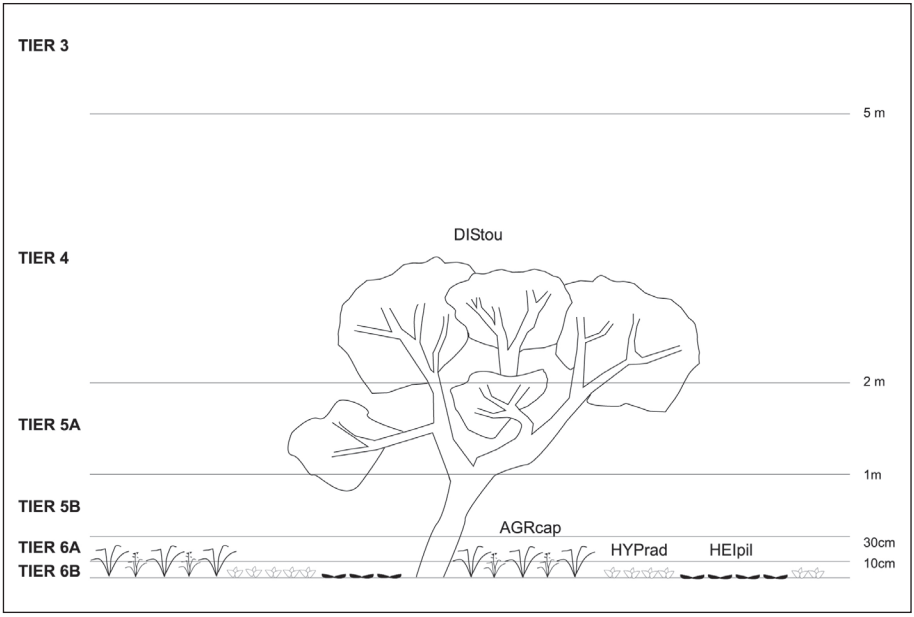

Figure 1. Height tiers used for Recce vegetation descriptions in study areas where vegetative cover is predominantly non-woody (see Table 1). In this simplified example, *Discaria toumatou* (DIStou) would be recorded in tiers 4 (2–5 m), 5A (1–2 m) and 5B (0.3–1 m) as it has foliage in these tiers. *Agrostis capillaris* (AGRcap) would be recorded in tier 6A (0.1–0.3 m) and tier 6B (<0.1 m), and both *Hypochaeris radicata* (HYPrad) and *Hieracium pilosella* (HIEpil) only in tier 6B (<0.1 m).

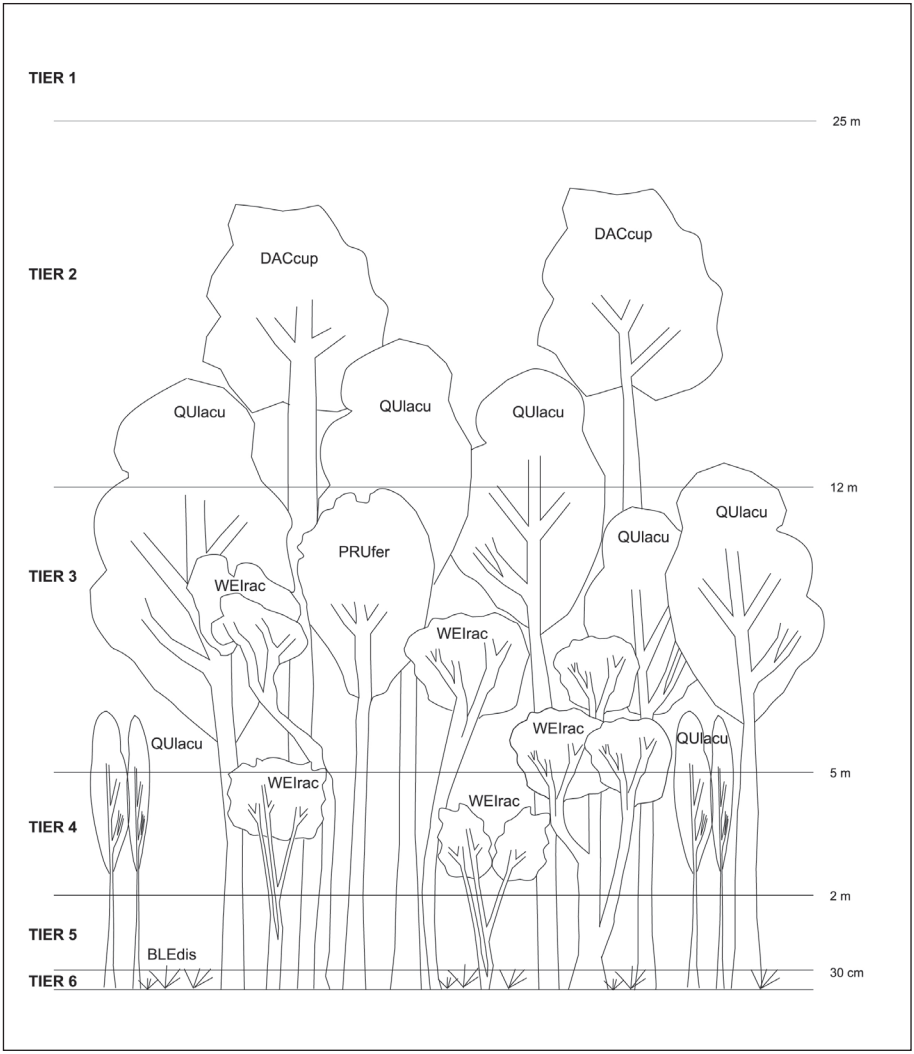

Figure 2. Height tiers used for Recce descriptions in study areas where vegetative cover is predominantly woody (see Table 1). A seventh 'tier' includes all epiphytes (not shown). In this example, *Quintinia acutifolia* (QUIacu) would be recorded in tiers 2 (12–25 m), 3 (5–12 m), and 4 (2–5 m) as it has cover in all of these tiers. By contrast, miro (*Prumnopitys ferruginea*, PRUfer) would be recorded only in tier 3 (5–12 m), and rimu (*Dacrydium cupressinum*, DACcup) only in tier 2 (12–25 m). Crown fern (*Blechnum discolor*, BLEdis) would be recorded in both tiers 5 (0.3–2 m) and 6 (<0.3 m).

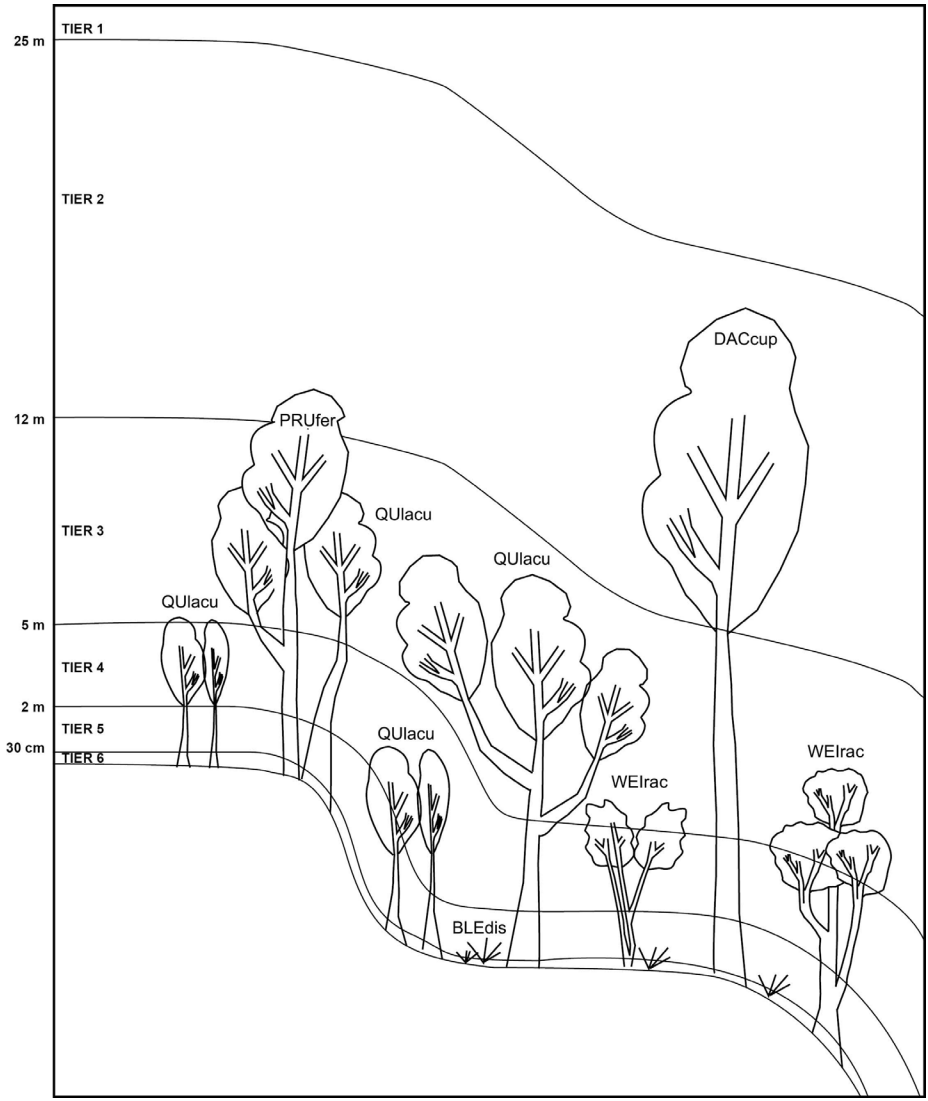

Figure 3. Fixed-height tiers follow a contour that is perpendicular to the ground surface, whereas for fixed-area Recce quadrats, Recce boundaries are defined vertically with respect to the ground surface.

Table 1. Standard height tiers used when vegetation within the study area is: (a) predominantly non-woody (e.g. grassland, some grassland–shrubland mosaics, and some wetlands); these tiers are consistent with those used in standard grassland monitoring methods (Wiser & Rose 1997); and (b) predominantly woody (e.g. forests and tall shrublands); note that these tiers are consistent with those used on standard (20 × 20 m) permanent forest plots (Hurst et al. 2022a).

Tier	(a) Standard tiers used when vegetation within study area is predominantly non-woody	(b) Standard tiers used when vegetation within study area is predominantly woody
1		>25 m
2		12–25 m
3	5–12 m	5–12 m
4	2–5 m	2–5 m
5		0.3–2 m
5A	1–2 m	
5B	0.3–1 m	
6		<0.3 m
6A	0.1–0.3 m	
6B	<0.1 m	
7	Epiphytes (at any height)	Epiphytes (at any height)

Notes: Within any one vegetation survey all Recce descriptions should be measured using the same set of height tiers. However, note that the standard height tiers in (a) can be supplemented as necessary with tiers 1 and 2 to deal with any isolated occurrences of plants taller than 12 m.

Table 2. Cover classes applied to the species present in each height tier on the Recce vegetation description. Cover classes are modified from the Braun-Blanquet cover-abundance scale (see Mueller-Dombois & Ellenberg 1974).

Cover class	Percentage canopy cover
1	<1
2	1–5
3	6–25
4	26–50
5	51–75
6	76–100

(c) Practical tips for completing the Recce vegetation description

- When recording data, each species occurring should be allocated one row on the field sheet, so that if the species occurs in more than one height tier it can be ticked on the same row (see Appendix 3b). Use a dash (i.e. '–') where a species does not occur in a shorter tier (see Appendix 3b), to allow the field sheet to be readily checked for completeness before finishing the Recce.
- Where the number of plant species present exceeds the number of rows on the Recce field sheet, use a second sheet, and ensure that both sheets contain the same header information (e.g. unique Recce identifier, date) and that they are cross-referenced (e.g. 'Page 2 of 3').
- Work in pairs, where possible, particularly if field staff are new to the method.
- If a species has been collected for identification, record a collected symbol (©) in the empty cell to the immediate left of the species name (see Appendix 3b). If the species occurs in tier 1 or tier 7, and there is no empty cell to the immediate left, record the collected symbol (©) in the same cell as the species name, in the upper right corner of the cell.
- Adopt systematic procedures when completing the Recce vegetation description to ensure that species present are not missed. Take the following steps.
  - Start by listing species present in the uppermost (tallest) height tier and work your way down through to the lowermost (shortest) tiers.
  - Once all obvious species are recorded, traverse the Recce description area, recording additional species in each tier as you see them. It is usually necessary

to move around to gain better vantage points of the canopy, particularly in dense or complex vegetation.

- For small or cryptic canopy foliage, gain a good vantage point and use binoculars if necessary to help ensure each species is correctly identified.
- Small and rare species are important to record. Be aware that in the understorey tiers, uncommon and small species can easily be overlooked. At the conclusion of the Recce vegetation description, conduct a systematic search of the entire Recce description area to ensure that all species present have been recorded.

- Develop straightforward approaches to arrive at your estimates of cover for each species in each height tier.
  - In each tier, mentally move plants of each species to an edge of the area described, and then estimate what proportion of the area they cover. Use the canopy cover scale (see Appendix 5) to help arrive at accurate cover estimates.
  - When the cover of a species within a tier is very high, it may be easier to estimate the proportion of the Recce area *not* covered by the species.
  - For species with very few individuals present, estimate the proportion of the Recce area covered by each individual in each tier, add these together within each tier, and assign a cover class.
  - Visualise the canopy of each species squashed into a flat plane, and then estimate the proportion of the Recce area covered by the species (i.e. avoid biasing cover estimates because of high or low foliage density).
- Take care to ensure that species are assigned to the correct height tiers. Observers should calibrate height estimates frequently against heights measured using a tape, height pole, hypsometer, or equivalent instrument.
- Observers should regularly compare their cover class estimates with one another. As a balance between the repeatability and accuracy required for cover estimations, trained field staff should generally be able to estimate cover classes consistently and repeatedly to within one class of each other.
- Note that viewing the cover of trees obliquely rather than vertically can result in overestimation of cover. Move around as necessary when making cover estimates.

6 Collecting and recording unknown plants

Reporting changes in plant biodiversity over time or between areas requires consistent, accurate taxonomic standards. Whenever you are unsure of the identity

of a plant species on a Recce description, collect it and have the identity of the plant properly checked at the field base or office. Adopt a systematic approach to collecting and storing specimens, recording specimens on field sheets, and correcting field sheets once the specimen identifications are resolved.

Prior to fieldwork, field staff should become familiar with the range of species likely to be encountered within the survey region. This will help guide staff on the important identifying features that must be included when collecting specimens. Be aware of any regionally or nationally threatened species that may be encountered, and ensure that collecting activities do not contribute to the decline of populations at risk. Before making collections, ensure you have the necessary permission or permit from the landowner or administrator.

6.1 Collecting unknown plant specimens

- *A specimen should be collected whenever the identity of a species on a Recce is unknown or uncertain.* If Recce descriptions are to be remeasured to monitor vegetation change, collect specimens from outside the Recce area, where possible. Do not collect a specimen if doing so would eliminate the species from the Recce area and immediate surroundings.
- Aim to collect as much of the vegetative and floral parts as practical. The specimen should include (where appropriate and available) root, stem, leaves, flowers, fruits and seeds, and should provide an adequate example of the overall habit of the plant.
- Give each collected species a provisional 'tag name' that reflects a notable feature of the plant or a potential genus or species. Each tag name should be considered specific to the Recce description at which it was created. When you are confident of the genus, include this in your tag name. If you have some confidence about the species, use the six-letter NVS code for that species. If you are collecting multiple taxa within a genus, combining the genus code with a notable feature of the plant can help generate distinct tag names for all specimens collected at that Recce description location (e.g. ASTgrey).
- *Every* time a collected unknown species occurs on the field sheets, annotate the tag name record with the symbol '©' to indicate that a specimen was collected. When the tag name is assigned to more than one individual plant, ensure the plants really are the same species. Where there is any doubt whatsoever, collect an additional specimen and assign it another unique tag name.
- While *at the Recce description area*, label the plant specimen using a suitable label (e.g. a plant nursery label). Record the tag name (*exactly* as it appears on field sheets), survey name, Recce description name/number, collection date, and

collector's name, as well as any notable features of the plant's habit, height or substrate. Attach the labels to the specimens and ensure they cannot be separated during transportation back to the field base.

- Use a portable plant press (e.g. hard-covered book with absorbent pages, or a smaller version of a standard plant press) or plastic bags to temporarily store collected specimens until arrival at the field base.

6.2 Storing unknown plant specimens

- At the field base, transfer each collected specimen into a plant press as soon as possible. A plant press can easily be constructed using plywood, sheets of corrugated cardboard (and/or corrugated aluminium sheet), and absorbent paper (e.g. newspaper), held together using belts or straps.
- While transferring specimens, systematically check that all collected specimens were recorded on the field sheets, and that the tag name recorded for the species was used consistently across all field sheets, *and was annotated with a '©' symbol every time it occurred.*
- Carefully place each specimen within a folded piece of plain newsprint, and separate specimens using sheets of cardboard and additional paper. Ensure the natural habit of each plant is retained and that features important for the specimen's identification are not obscured. Fold large specimens neatly so that they fit inside the plant press. Place seeds or other loose material in a labelled envelope.
- Change the paper in the plant press regularly to prevent specimens from going mouldy, particularly in damp climates or where specimens were wet when pressed. Specimens will dry most quickly when the plant press is stored in a well-ventilated, sunny location.

6.3 Identifying unknown plants and correcting field sheets

Take a systematic approach to identifying collected specimens and ensuring that tag names on all field sheets are corrected. When amending field sheets, do not rub out the '©' symbol, but put a line through it to indicate that the identity of the specimen was resolved. For further details, refer to the expanded Recce manual (Hurst et al. 2022b).

7 Quality control procedures for Recce inventory surveys

Quality control procedures are an essential part of any monitoring programme. Quality control should consist of internal systems of routine technical activities and procedures to ensure data consistency, comparability, and completeness, and so that inventory and monitoring programmes are efficient and will ultimately satisfy the requirements of data users. Refer to the expanded Recce manual (Hurst et al. 2022b) for an example of a quality control procedure for vegetation inventory and monitoring programmes using Recce descriptions.

8 Data management and storage using the NVS Databank

Systematic data storage is essential to ensure data are easily accessible and safeguarded against loss. Storage of permanent Recce description data is facilitated by the NVS Databank, which is recognised as New Zealand's primary repository for data on the structure and composition of indigenous vegetation.

Further information on depositing Recce data into the NVS Databank can be obtained from the NVS website (http://nvs.landcareresearch.co.nz/), or by contacting the NVS Databank Manager (nvs@landcareresearch.co.nz).

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10 References

Allen, R.B. 1979: Vegetation assessment. Part 1: Forest vegetation. Protection Forestry Division, Forest Research Institute, Christchurch.

Allen, R.B. 1992: Recce: an inventory method for describing New Zealand vegetation. Ministry of Forestry, Christchurch.

Allen, R.B.; McLennan, M.J. 1983: Indigenous forest survey manual: two inventory methods. Forest Research Institute, Christchurch.

Burrows, L.E. 2000: Guidelines for fixing co-ordinates of NVS (National Vegetation Survey) databank plots using GPS (Global Positioning System). In Allen, R.B.; Wiser, S.K; Burrows, L.E.; Brignall-Theyer, M. eds. Silvicultural research in selected forest types: a black beech forest in Canterbury. Landcare Research Contract Report LC0001/01, for the Ministry of Agriculture and forestry, Wellington. Pp 53–59.

Daubenmire, R. 1968: Plant communities: a textbook of plant synecology. Harper and Row, New York.

DOC. 2019: Field protocols for DOC Tier 1 Inventory & Monitoring and LUCAS plots, Version 14. Department of Conservation, Wellington.

Goulding, C.; Lawrence, M.E. 1992: Inventory practice for managed forests. Forest Research Institute, Christchurch.

Harcombe, P.A.; Allen, R.B.; Wardle, J.A.; Platt, K.H. 1998: Spatial and temporal patterns in stand structure, biomass, growth and mortality in a monospecific Nothofagus solandri var. cliffortioides (Hook. f.) Poole forest in New Zealand. Journal of Sustainable Forestry 6: 313–345.

Hurst, J.M., Allen, R.B. 2007: The Recce method for describing New Zealand vegetation – field protocols. Landcare Research, Lincoln.

Hurst, J.M., Allen, R.B., Fergus, A.J. 2022a: A permanent plot method for monitoring indigenous forests – expanded manual. Version 5. Manaaki Whenua – Landcare Research Contract Report LC3604 for Department of Conservation.

Hurst, J.M., Allen, R.B., Fergus, A.J. 2022b: The Recce method for describing New Zealand vegetation – expanded manual. Version 5. Manaaki Whenua – Landcare Research Contract Report LC4102 for Department of Conservation.

Jennings, S.; Brown, N.; Sheil, D. 1999: Assessing forest canopies and understorey illumination: canopy closure, canopy cover and other measures. Forestry: An International Journal of Forest Research 72: 59–74.

McNab, W.H. 1989: Terrain shape index: quantifying effect of minor landforms on tree height. Forest Science 35: 91–104.

McNab, W.H. 1993: A topographic index to quantify the effect of mesoscale landform on site productivity. Canadian Journal of Forest Research 23: 1100–1107.

Mueller-Dombois, D.; Ellenberg, H. 1974: Aims and methods of vegetation ecology. John Wiley, New York.

Payton, I.J.; Pekelharing, C.J.; Frampton, C.M. 1999: Foliar browse index: a method for monitoring possum (Trichosurus vulpecula) damage to plant species and forest communities. Landcare Research, Lincoln.

Wiser, S.K.; Allen, R.B.; Clinton, P.W.; Platt, K.H. 1998: Community structure and forest invasion by an exotic herb over 23 years. Ecology 79: 2071–2081.

Wiser, S.K.; Rose, A.B. 1997: Two permanent plot methods for monitoring changes in grasslands: a field manual. Manaaki Whenua – Landcare Research, Lincoln.

Appendices list

Appendix 1.	Glossary
Appendix 2.	Equipment required to establish and measure Recce descriptions
Appendix 3.	Recce field sheet
	a. Site description
	b. Vegetation description
Appendix 4.	Non-standard species codes for the New Zealand vascular flora
Appendix 5.	Canopy cover scale

Appendix 1. Glossary

Basal area (BA)	The cross-sectional area of a tree stem at breast height (e.g. 1.35 m along the stem), which may be calculated using a diameter measurement. The term may be used to describe the area occupied by an individual tree or species, as well as the area occupied by all trees in a stand (often expressed as m^2/ha).
Canopy cover	The percentage of ground covered by a vertical projection over the Recce area of all vascular and non-vascular live or dead material (leaves, trunks and branches) >1.35 m above the ground.
Clinometer	An instrument for measuring slope.
Density	A value describing the number of individuals of a species on a unit/area basis.
Epiphyte	A non-parasitic plant that grows on another plant. See section 5 for specific details regarding epiphytes for Recce and stem diameter protocols.
Extrusive	Relating to or denoting rock that has been extruded at the Earth's surface as lava or other volcanic deposits.
Flora	All the plant species present within a particular area or region.
Global Positioning System (GPS)	A navigation system that provides satellite signals that are processed in a GPS receiver to compute its location.
Hectare	10,000 square metres (approximately 2.471 acres).
Hip-chain	A piece of equipment used to measure distance, consisting of a distance counter and spool of cotton. The device operates by measuring the length of cotton drawn from the spool.
Intrusive	Relating to or formed by the intrusion of rock.
Metadata	Often defined as 'data about data'. Metadata includes all important information about a data set that may have a bearing on its use.
Non-vascular plant	A general term for those plants without a vascular system for transporting water and nutrients (i.e. xylem and phloem). Although lacking such tissues, some non-vascular plants possess other tissues specialised for the internal transport of water.
Permolat	A painted aluminium strip, often brightly coloured, used to mark transects, Recce description and plot locations in the field and to mark understorey subplots on permanent plots. Plastic markers (robust and suitably sized) may be used if Permolat cannot be obtained.

Plot	In a general sense, any area of land of any shape (e.g. circle, square, rectangle) or size, which may be used for any purpose (e.g. sampling). In this manual, 'plot' is mainly used in the context of instructions for measuring permanent 20 × 20 m plots.
Quadrat	A specific ecological sampling term that usually refers to a square (or rectangular) sampling plot of a predetermined area or size.
Recce description	A site and vegetation description, similar to those undertaken on ecological relevés or phytosociological descriptions (see Mueller-Dombois & Ellenberg 1974).
Taxa	Plural of 'taxon'.
Taxon	Any unit of any rank within a taxonomic classification (e.g. genus, species, family).
Tier	As used in this document, a horizontal layer of vegetation bounded at fixed heights, for which cover of each species present is recorded on the Recce vegetation description.
Vascular plant	A term used to describe any plant with a vascular transport system for water and nutrients.

Appendix 2. Equipment required to establish and measure Recce descriptions

Equipment

- Recce field manual
- Plant identification texts and a species list from other studies in the area
- Lightweight plant press or hard-covered book for temporarily pressing unknown plants
- Hip-chain
- Laminated copy of the canopy cover scale (Appendix 5)
- Global Positioning System (GPS) receiver
- Topographical maps and aerial photographs
- Geological Survey map
- Clipboards
- Altimeter
- Clinometer or equivalent instrument (e.g. abney level or hypsometer)
- Binoculars, for viewing canopy foliage to identify cryptic, small-leaved species, and for examining browse in the canopy
- Bum-bags or toolbelts for carrying equipment around the Recce

Consumable items

Adequate supplies of the following consumable items should be available and the field kit restocked each day as necessary:

- pens, pencils, erasers, etc.
- batteries for GPS,
- waterproof plant labels and waterproof marker
- plastic bags for transporting large plant specimens
- plastic bags for storing and transporting Recce sheets
- hip-chain cotton and flagging tape.

Field sheets required per Recce

- Four Recce description sheets are required (two on normal paper and two on waterproof paper)

Permanently marked and fixed-area Recce quadrat descriptions

- Sighting compasses (two)
- Tapes to establish the Recce description boundaries
- Permolat or equivalent markers to mark the route to the Recce
- Aluminium corner pegs (e.g. 7 mm diameter, 45 cm long, pre-bent at the top) or stakes to mark quadrat corners
- Permolat or equivalent markers for marking quadrat corners and corner trees

- Hammer and nails for attaching Permolat to trees (corner trees and trees on the route to the Recce)
- For remeasurement, photocopies of all field sheets from previous measurements

Other items required at the field base

- Species lists and reports from previous vegetation surveys in the area
- Access and/or collection permit from the Department of Conservation and/or other agencies/landowners
- Plant storage and identification equipment – includes plant press, newsprint, blotters, nursery tags, plant identification texts, hand lenses, large plastic bags
- Envelopes and boxes to temporarily store completed field sheets

Appendix 3a. Recce field sheet: site description

RECONNAISSANCE (RECCE) SHEET

National Vegetation Survey Databank (http://nvs.landcareresearch.co.nz/) Page 1 of 2

RECCE IDENTIFIER: 11-2
DAY/MONTH/YEAR: 7 March 2007
SURVEY: Mt Fyffe
TOPO. MAP NO. & NAME: Topo 50 BT27 Kaikoura
REGION: Kaikoura
GPS REFERENCE: GPS Make & Model: Garmin 645
CATCHMENT: Hapuku River
Easting: 1652112
SUB-CATCHMENT: unnamed
Northing: 5319823
MEASURED BY: Roger Carran
GPS FIX: Single / (Averaged) 2D / (3D) Datum: NZGD49 / (NZGD2000)
RECORDED BY: Alex Fergus
GPS ACCURACY 100%: (Y) / N ; ± 4 m
PERMANENTLY MARKED: (Y) / N
GPS LOCATION: (CORNER D) / other: NA

SIZE OF RECCE	20 x 20 m
ALTITUDE (m)	760 m
PHYSIOGRAPHY	Ridge, (Face) Gully, Terrace
ASPECT (1–359°)	130°
SLOPE (°)	30°
PARENT MATERIAL	Greywacke. Mapped / (Observed)
DRAINAGE:	(Good) Moderate, Poor
CULTURAL	(None) Burnt, Logged, Cleared, Mined, Grazed, Tracked
TREATMENT:	NA

MESOSCALE TOPOGRAPHIC & TERRAIN SHAPE INDEX (°, record +/–)

	MTI	TSI
N	+32	+18
NE	+16	−6
E	+6	−16
SE	+21	−27
S	+27	−12
SW	+20	+3
W	+36	+22
NW	+40	+32

SURFACE CHARACTERISTICS:

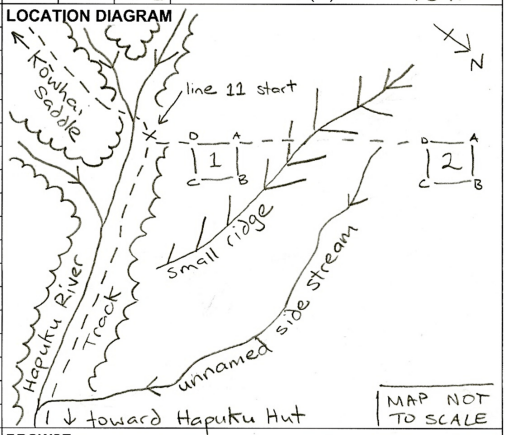
Bedrock %	0 %
Broken rock %	10 %
Size of broken rock	<30cm / (>30cm)
~~Alluvial~~, (Colluvial), ~~Moraine~~, ~~Volcanic~~	

GROUND COVER %:

Vegetation	85 %
Non-vascular	5 %
Litter	90 %
Bare Ground	1 %
Rock	1 %
AVERAGE TOP HEIGHT (m)	17 m
CANOPY COVER (%)	45 %

APPROACH: From Hapuku Hut (E 1653720 N5319765) follow track 1.7 km toward Kōwhai saddle. Line start is marked on the track. Follow a bearing of 315° from plot 1 corner A (E 1652185 N5319654) for 200m to plot 2. The line start and line are marked with red on white permolat. Corner C was not found and was replaced.

LOCATION DIAGRAM



VEGETATION DESCRIPTION & NOTES:

POD lge dominates the canopy. There is no subcanopy. The browse tier and understorey are dominated by POLves, with occassional CARser and FUCexc saplings. Sparse non-vascular cover.

BROWSE

Species	Severity	Herbivore	Species	Severity	Herbivore
VERONIC	L (M) H	possum		L M H	
GRI lit	L (M) H	red deer		L M H	
ASP gra	L (M) H	red deer		L M H	
VERfra	(L) M H	red deer		L M H	
	L M H			L M H	
	L M H			L M H	
	L M H			L M H	
	L M H			L M H	
	L M H			L M H	

FAUNA (e.g. mammal, bird, reptile, invertebrate)

piwakawaka, korimako, kakaruwai, pig-sign, possum-fur, cast red deer antler

Appendix 3b. Recce field sheet: vegetation description

Page 2 of 2

RECCE IDENTIFIER: H171 MEASURED BY: Brian Rance

DAY/MONTH/YEAR: 03 December 2013 RECORDED BY: Alex Fergus

Cover-classes: 1= <1%, 2=1–5%, 3=6–25%, 4=26–50%, 5=51–75%, 6=76–100%.
For a 20×20-m plot area: 1% = 2×2-m (i.e. 4 m²); 5% = 4×5-m (i.e. 20 m²).

	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Tier 6
	>25 m	12–25 m	5–12 m	2–5 m	0.3–2 m	<0.3 m
Overall Cover		2	3	4	5	4
		METumb 2	✓ 2	✓ 3	✓ 2	✓ 1
Tier 7			FUScli 2	✓ 3	✓ 2	✓ 1
Epiphytes			HALbif 2	✓ 3	✓ 3	✓ 3
ARCtra 1				LEPint 3	✓ 4	✓ 3
HYMarm 1				LEPsco 2	✓ 1	✓ 1
HYMlya 1				PSElin 1	✓ 1	—
PSElin 1				DRAlon 1	✓ 2	✓ 1
RAUsim 1				WEIrac 1	✓ 2	✓ 1
DRAlon 1				COPfoe 1	✓ 1	✓ 1
HYMmul 1				DRAmen 1	✓ 2	✓ 2
GRIlit 1				LEPjun 1	✓ 1	—
METumb 1				RUBcis 2	—	—
NOThet 1				(c)	GAHpro 3	✓ 2
HYMfla 1					MYRdiv 2	✓ 1
EARmuc 1					COPcol 1	✓ 1
					RAUsim 1	✓ 1
						ASTner 1
						ANDemp 1
						GRIlit 1
						TMEtan 1
						LIBmic 1
						GASsun 1
						LUZpor 1
					(dead)	WAIste P
					(c)	THELYM 1
						APObif 1
						HYMmul 1
						HYMarm 1
						HYMlya 1
				(leaning out)		ARCtra P

Appendix 4. Non-standard species codes for the New Zealand vascular flora

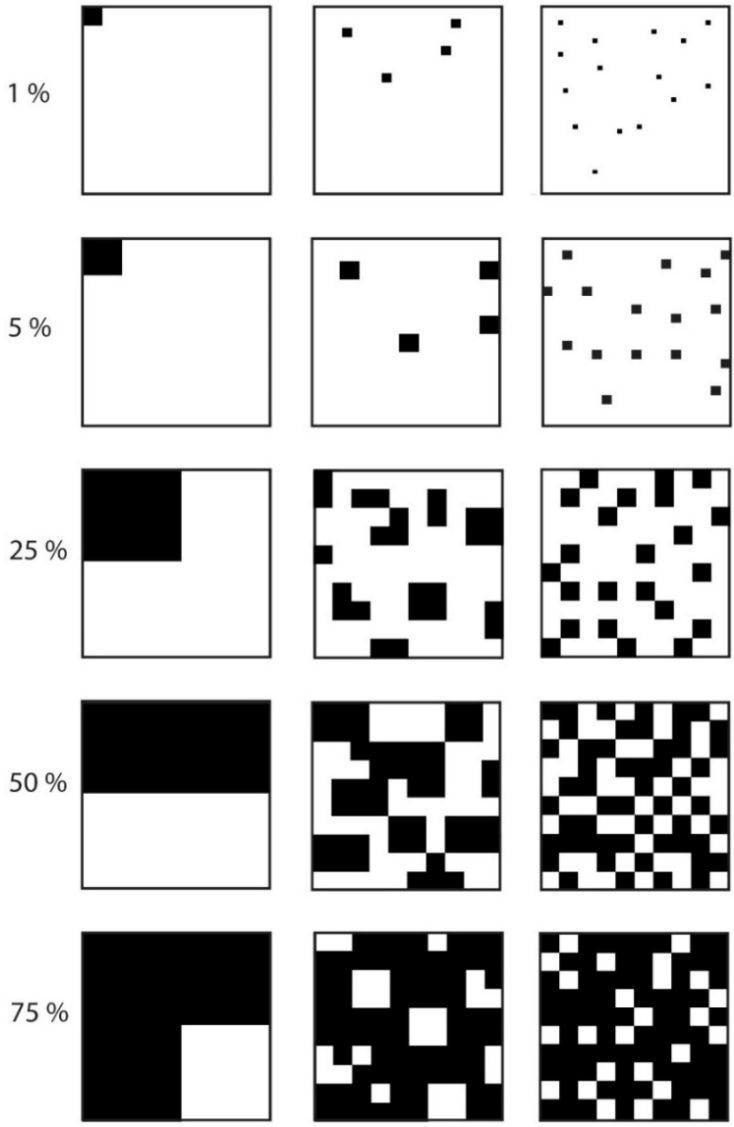
Use this list (current July 2021) to check unintuitive NVS codes (see section 5.1 for details). The taxon that holds the intuitive NVS code has been included in the table below for reference. These have not been included if the taxon name is no longer the preferred name. A full list of species codes used in the NVS Databank can be obtained from the NVS website (http://nvs.landcareresearch.co.nz/).

Taxon name	NVS code	Taxon with intuitive NVS code
Abrotanella rostrata	ABRrst	NA
Abrotanella rosulata	ABRrsl	NA
Aciphylla montana	ACImot	*Aciphylla monroi*
Aciphylla simplex	ACIsmp	*Aciphylla similis*
Aciphylla traversii	ACItrv	*Aciphylla traillii*
Agrostis personata	AGRpes	NA
Anisotome aromatica var. *incisa*	ANIinc	NA
Asplenium flabellifolium	ASPflb	*Asplenium flaccidum*
Astelia graminea	ASTgrm	*Astelia grandis*
Brachyscome montana	BRAmnt	*Brachyglottis monroi*
Brachyglottis species	BRACHG	*Brachyscome* species
Cardamine corymbosa	CARcoy	*Carex coriacea*
Carmichaelia corrugata	CARcog	*Carex coriacea*
Carmichaelia appressa	CRMapp	*Carex appressa*
Carex carsei	CRXcar	*Carmichaelia carmichaeliae*
Carex divisa	CARdvs	*Carex divulsa*
Carex flacca	CARflc	*Carex flaviformis*
Carex flagellifera	CARfgl	*Carex flaviformis*
Carpobrotus glaucescens	CARglc	*Carmichaelia glabrescens*
Cardamine lacustris	CARlct	*Carex lachenalii*
Carmichaelia kirkii	CRMkir	*Carex kirkii*
Carex muricata	CARmrc	*Carmichaelia muritai*
Carex petriei	CARptr	*Carmichaelia petriei*
Cardamine subcarnosa	CARsbc	*Carex subdola*
Carex traversii	CARtrv	*Carex trachycarpa*
Carmichaelia uniflora	CRMuni	NA
Cardamine unicaulis	CARunl	NA
Celmisia cordatifolia	CELcrd	*Celmisia coriacea*
Celmisia graminifolia	CELgrm	*Celmisia gracilenta*
Celmisia lindsayi	CELlnd	*Celmisia xlinearis*
Celmisia macmahonii	CELmcm	*Celmisia mackaui*

Taxon name	NVS code	Taxon with intuitive NVS code
Celmisia macmahonii var.	CELvmc	*Celmisia macmahonii*
Celmisia spedenii	CELspd	*Celmisia spectabilis*
Cenchrus purpurascens	CENpup	*Cenchrus purpureus*
Chenopodium trigonon	CHEtrg	*Chenopodium triandrum*
Chionochloa crassiuscula subsp.	CHIscr	*Chionochloa conspicua* subsp.
Chionochloa flavicans	CHIflv	*Chionochloa flavescens*
Clematis marmoraria	CLEmmr	*Clematis marata*
Coprosma distantia	COPdst	*Coprinus disseminatus*
Coprosma dumosa	COPdmo	NA
Coprosma macrocarpa subsp.	COPmcm	*Coprosma macrocarpa* subsp. *minor*
Coprosma petiolata	COPptl	*Coprosma petriei*
Coprosma pseudociliata	COPpsc	*Coprosma pseudocuneata*
Coprosma tenuicaulis	COPtec	NA
Coprosma tenuifolia	COPtef	NA
Corunastylis pumila	CORpml	*Cordyline pumilio*
Corokia macrocarpa	CORmcc	*Corybas macranthus*
Craspedia uniflora var. *maritima*	CRAvmr	NA
Cyperaceae	CYPSPP	*Cyperus eragrostis*
Deschampsia species	DESCHM	*Deschampsia chapmanii*
Dracophyllum prostratum	DRAprs	*Dracophyllum pronum*
Echinochloa species	ECHLOA	*Echinopogon* species
Epilobium brunnescens	EPIbrn	*Epilobium brunnescens* subsp.
Epilobium brunnescens subsp.	EPIbru	*Epilobium billardiereanum* subsp.
Euchiton delicatus	EUCdlc	*Eucalyptus delegatensis*
Genista monspessulana	GENmns	*Gentianella montana*
Hakea salicifolia	HAKslc	NA
Hectorella species	HECTOL	NA
Juncus acutiflorus	JUNact	*Juncus acuminatus*
Juncus acutus	JUNacs	*Juncus acuminatus*
Juncus gerardii	JUNgrd	*Jungermannia* species
Leptinella intermedia	LPTint	*Lepidothamnus intermedius*
Leptostigma setulosum	LEPstl	*Lepidozia setigera*
Linaria maroccana	LINmac	NA
Linum trigynum	LINtrg	*Lindsaea trichomanoides*
Machaerina articulata	MACatc	*Machaerina arthrophylla*
Malus sylvestris	MLSsyl	*Malva sylvestris*
Melilotus officinalis	MLLoff	*Melissa officinalis*
Microsorum scandens	MICscn	*Microseris scapigera*
Microsorum species	MCROSO	*Microseris* species
Myrsine aquilonia	MYRaql	*Myriophyllum aquaticum*

Taxon name	NVS code	Taxon with intuitive NVS code
Nephrolepis species	NEPHRL	*Nephroma* species
Ourisia macrocarpa	OURmcc	NA
Ourisia macrophylla	OURmap	NA
Ourisia macrophylla subsp.	OURmsp	NA
Pachycladon latisiliquum	PACltq	*Pachyschistochila latiloba*
Persicaria maculosa	PERmcl	NA
Pittosporum crassifolium	PITcrf	*Pittosporum crassicaule*
Plantago lanigera	PLAlng	*Plantago lanceolata*
Plantago unibracteata	PLAunb	NA
Poa anceps subsp. *anceps*	POAsan	*Poa acicularifolia* subsp. *acicularifolia*
Pseudognaphalium species	PSEUDG	*Pseudopanax* species
Pseudopanax colensoi	NEOcol	*Pseudowintera colorata*
Pseudotsuga species	PSEUDT	*Pseudopanax* species
Pseudowintera species	PSEUDW	*Pseudopanax* species
Ranunculus grahamii	RANgrh	*Ranunculus gracilipes*
Ranunculus maculatus	RANmcl	*Ranunculus macropus*
Raoulia subsericea	RAOsbs	*Raoulia subulata*
Rumex acetosa	RUMact	*Rumex acetosella*
Schoenus nitens	SCHnte	NA
Stellaria graminea	STEgrm	*Stellaria gracilenta*
Stenostachys gracilis	STEgrc	*Stellaria gracilenta*
Trifolium striatum	TRIstt	*Trichomanes strictum*
Triglochin palustre	TRIpls	*Triglochin palustris*
Triglochin species	TRIglc	*Trifolium glomeratum*
Triglochin striata	TRIsta	*Trichomanes strictum*
Veronica catarractae	VERcaa	*Veronica catenata*
Veronica colostylis	VERclo	*Veronica colensoi*
Veronica decumbens	VERdcm	*Veronica decora*
Veronica hookeri	VERhok	*Veronica hookeriana*
Veronica macrantha	VERmcr	*Veronica macrocarpa*
Veronica macrocarpa var.	VERmvc	*Veronica macrantha* var. *macrantha*
Veronica notialis	VERnol	NA
Veronica stenophylla var.	VERssv	*Veronica stricta* var. *stricta*
Veronica strictissima	VERsts	*Veronica stricta*
Veronica subfulvida	VERsbf	*Veronica subalpina*
Veronica tetrasticha	VERttr	*Veronica tetragona*
Veronica vernicosa	VERvrn	*Veronica verna*

Appendix 5. Canopy cover scale



Divisions of the standard cover abundance scale (showing the proportion of the Recce area represented by each division). Use this scale when assigning cover-classes for the Recce description.

Manaaki Whenua
Landcare Research