Te Uru Rākau New Zealand Forest Service

A Guide to the

# Field Measurement Approach

for Forestry in the Emissions Trading Scheme

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Ministry for Primary Industries

Te Kāwanatanga o Aotearoa
New Zealand Government

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## Updates

Refer to MPI's website for the latest version of this document available at:
**www.mpi.govt.nz/the-field-measurement-approach-fma/**

or contact Tel: 0800 CLIMATE (254 628) Email: **ForestryETS@mpi.govt.nz**

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## About this Guide

This guide provides information on the Field Measurement Approach (FMA) for post-1989 forest land participants and forest inventory providers. The FMA is a measurement-based method for assessing the carbon stocks in post-1989 forests registered in the New Zealand Emissions Trading Scheme (ETS), or in the Permanent Forest Sink Initiative (PFSI). This guide provides information to help participants in the ETS or PFSI meet the requirements of the FMA as specified in associated Regulations and Standards, and offers practical guidance on completing the overall FMA process.

The guide provides general guidance only, and does not purport to give advice regarding specific circumstances in relation to the ETS, New Zealand's climate change legislation in general, or the particular circumstances of individual land and forest owners.

## Acts and Regulations

The legal requirements relating to the FMA for post-1989 forests in the ETS are set out in:

- Climate Change Response Act 2002 ("the Act");
- Climate Change (Forestry) Regulations 2022 ("the Regulations").

The legal requirements relating to the FMA for the PFSI are set out in the documents above, and in addition in:

- Part 3B of the Forests Act 1949;
- Forests (Permanent Forest Sink) Regulations 2007;
- PFSI landowner covenants.

These acts and regulations are available at **www.legislation.govt.nz**

## Standards for the FMA

Information relating to the FMA must be collected, recorded, and submitted to the Ministry for Primary Industries (MPI) in accordance with prescribed rules and procedures. These rules and procedures are set out in Standards, available on the MPI website at **www.mpi.govt.nz/the-field-measurement-approach-fma/**

Two Standards apply:

1. The ***Field Measurement Approach Standard:*** prescribes the manner in which permanent sample plots allocated by MPI must be located and established by participants. The Standard also specifies the detail of the FMA information, and of any other information that MPI requires, that must be collected at and recorded for those plots.
2. The ***Field Measurement Approach Information Standard:*** prescribes the form and format of information exchanged between participants and MPI relating to the FMA.

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# INTRODUCTION 1

## Forestry and the ETS

The New Zealand Emissions Trading Scheme (ETS) allows forest owners to claim carbon credits (New Zealand Units or NZUs) for the increase in carbon stocks that occur in their forests over time as the forests grow. The Climate Change (Forestry Sector) Regulations 2022 ("the Regulations") provide for the essential administration of the forestry components of the ETS. Covenant holders in the Permanent Forest Sink Initiative (PFSI) with newer covenants are subject to the same Regulations as ETS participants, when calculating forest carbon stocks.

The Regulations specify the information that must be collected and reported by ETS forestry participants and PFSI covenant-holders. The Regulations also provide the calculation methodology that must be used to determine the number of carbon credits that can be claimed if forest carbon stocks increase, or that must be surrendered if stocks decrease.

## Assessing forest carbon stocks: A key requirement

To claim carbon credits, ETS participants or PFSI covenant holders – referred to hereafter as "ETS or PFSI participants", or collectively as "participants" – must determine forest carbon stocks, and the change in stocks over time. When the ETS was introduced, only one method was specified in the Regulations for determining carbon stock change: use of the "default carbon tables". These are a series of pre-calculated nationally or regionally averaged tables of forest carbon stocks by forest age, that for post-1989 forests are incorporated in Schedule 4 of the Regulations.

Although using pre-calculated (default) carbon tables is simple and low-cost; the tables do not reflect growing conditions for an individual participant's forest land. As a result, some participants with forests located in high-growth areas or being managed under a high-carbon regime would likely receive fewer carbon credits than the amount of carbon their forests sequester. Conversely, participants with forests located in poor growing conditions or grown at low stockings would likely receive more carbon credits than the amount of carbon sequestered.

## The Field Measurement Approach: More accurate carbon

The forestry components of the ETS were developed in anticipation of improved methods of forest carbon assessment becoming available. MPI, in consultation with New Zealand (NZ) experts on forest carbon assessment, has developed a measurement-based method for determining forest carbon stock change that is site-specific. The method is termed the Field Measurement Approach, or FMA.

The FMA is based on forest inventory and growth modelling techniques that are familiar to professionals in the NZ forestry sector, and is designed to:

- provide an accurate, forest-specific approach to forest carbon assessment;
- be equally applicable to exotic and indigenous forests; and
- deliver a more equitable approach that recognises entitlements and obligations vary between participants according to forest growth rates and management.

The Regulations introducing the FMA came into force on 1 September 2011.

# KEY CONCEPTS AND DECISIONS FOR PARTICIPANTS 2

## Purpose of this section

This section provides information on:

- who is required to use the FMA;
- what's involved in the FMA process;
- key FMA options, and decisions to be made by the participant; and
- when FMA information must be collected.

The intended audience for this section is:

- ETS participants or PFSI covenant-holders that are subject to the FMA under the Regulations (collectively termed "FMA participants");
- anyone submitting data or filing emissions returns on behalf of FMA participants;
- forestry consultants or any other providers of forest inventory or related forestry services to FMA participants.

## Who is required to use the FMA?

FMA participants have been required to use the FMA method of forest carbon assessment since 1 September 2011, where an FMA participant is defined as:

- any ETS participant who on or after 1 September 2011 has 100 hectares or more registered post- 1989 forest land at **any** time in a mandatory emissions return period;
- any ETS participant who has less than 100 hectares of forest land on or after 1 September 2011, and increases their registered forest land to 100 hectares or more;
- any PFSI covenant-holder that is subject to the Regulations, and on or after 1 September 2011 has a forest sink area of 100 hectares or more at **any** time in a mandatory emissions return period;
- any PFSI covenant-holder who has less than 100 hectares of forest land on or after 1 September 2011, and increases the forest land subject to that covenant to 100 hectares or more; and
- any ETS participant or PFSI covenant-holder who had 100 hectares or more at some time on or after 1 September 2011, but subsequently reduces their forest land area below 100 hectares, in this case they remain an FMA participant until the end of the mandatory emissions return period in which the forest land was reduced in area.

The 100-hectare threshold applies to all of the post-1989 forest land an ETS participant has registered, across both standard and permanent forestry.

When determining whether the 100-hectare threshold applies, the area of post-1989 forest land in the ETS and under each PFSI covenant is considered separately, not in total. ETS participants and PFSI covenant holders that do not meet the criteria for being an FMA participant must use the default carbon tables included in the Regulations when assessing forest carbon stocks.

## What's involved in the FMA process?

FMA participants comply with the FMA by completing the six-step "FMA process" shown in Figure 1. The objective of the process is to obtain a set of participant-specific tables of forest carbon stocks derived from data collected from the FMA participant's forest, and to use these tables in place of the default tables incorporated in the Regulations when preparing emissions returns. For the emissions return at the end of a mandatory emissions return period, FMA participants must use "definitive" participant-specific tables. These are tables created from data collected in the relevant mandatory emissions return period, at a plot set that covers the whole of the participant's registered land at the end of the mandatory emissions return period.

Each step in the FMA process shown in Figure 1 is briefly described below. FMA participants should ensure they have an overall understanding of the FMA process before proceeding to Section 3 of this guide, which provides greater detail about the process. The steps below also outline the key choices and decisions to be made by an FMA participant, which affect the cost-effectiveness of the FMA for a participant.

**Tip:** much of the FMA process is similar to completing standard mid-rotation or pre-harvest forest inventory. FMA participants should make contact with forest inventory providers well before the end of a mandatory emissions return period if they intend to use their services.

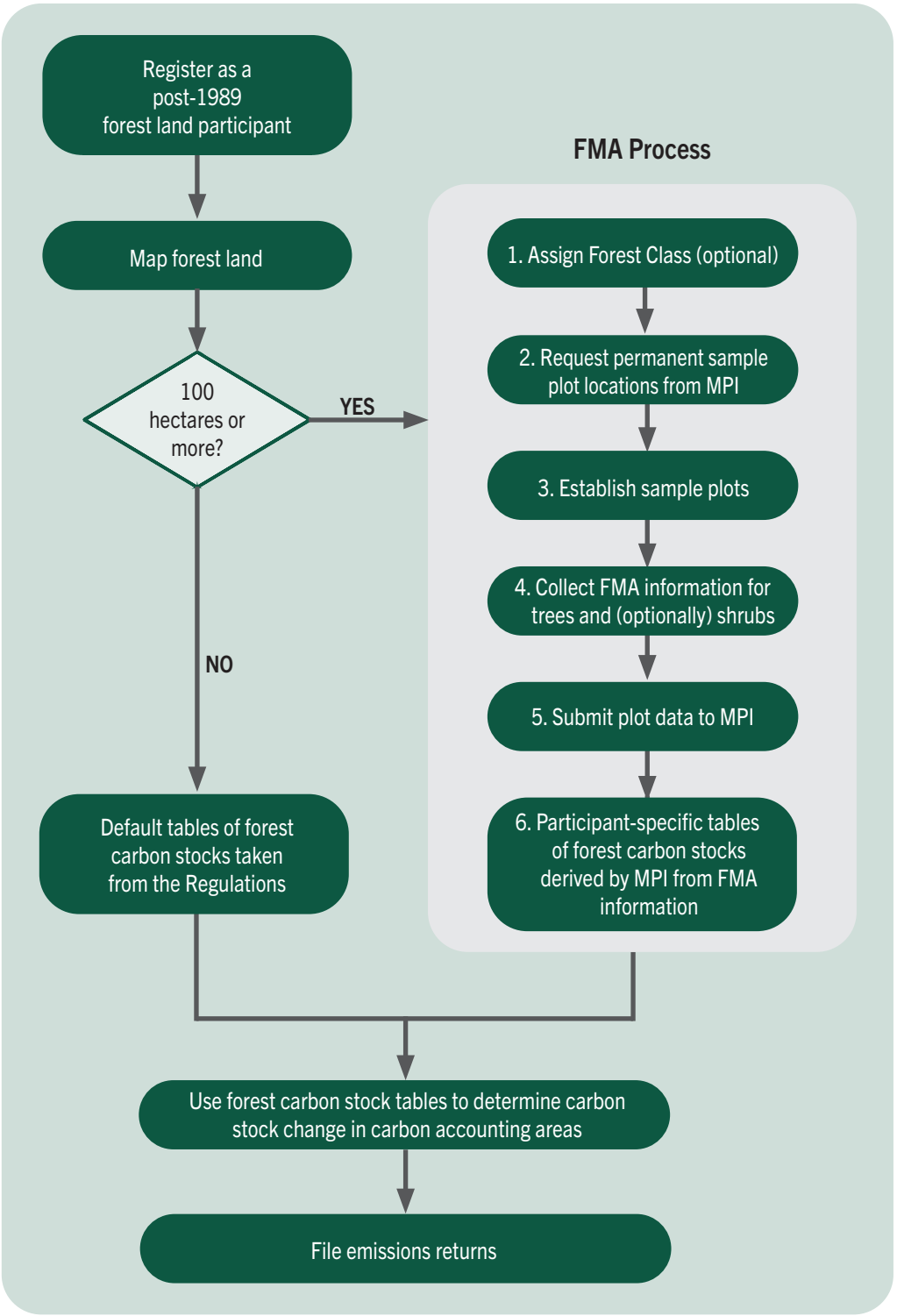
**Step 1 – Assign Forest Class (optional).** Prior to requesting permanent sample plot locations (Step 2), FMA participants must decide whether or not to assign Forest Class to their forest land. Forest Class is a high-level classification that categorises a participant's forest land as having an expected final state of exotic or indigenous forest land. If a participant assigns Forest Class, they may request a lesser number of sample plots for land in the Indigenous Forest Class, and thus lower the cost of forest inventory. If Forest Class is assigned, the *Field Measurement Approach Standard* also allows a number of other options that affect the cost- effectiveness of the FMA process to be chosen according to Forest Class.

**Step 2 – Request permanent sample plot locations.** Participants must request sample plot locations from MPI, once decisions on Forest Class are complete. To avoid possible bias, and to ensure all FMA participants are treated equitably, any pre-existing sample plots that were allocated to a previous participant may not be used. The Regulations specify a minimum number of sample plots, based on normal expectations of forest inventory accuracy. A lesser number of sample plots can be used for forest land that has been assigned a Forest Class of Indigenous, given the higher costs of sampling such land and the lower carbon returns. FMA participants may choose any higher number of sample plots than the minimum specified in the Regulations, if obtaining better inventory accuracy (relative to the additional cost) is important to them.

**Step 3 – Establish sample plots.** FMA participants must locate the permanent sample plots allocated by MPI in the field using a good-quality global positioning satellite (GPS) receiver, in accordance with procedures in the *Field Measurement Approach Standard*. The Standard also specifies how sample plots must be permanently marked, how to relocate plots if necessary, and when information must or may be collected from part of a plot instead of from the whole plot.

**Step 4 – Collect forest FMA information.** Once sample plots are established, FMA information for trees and (optionally) for shrubs must be collected at each plot at least once in each mandatory emissions return period. The information to be collected is specified in detail in the *Field Measurement Approach Standard*, and considered further later in this guide. A second standard, the *Field Measurement Approach Information Standard*, specifies the form and format in which the collected information must be recorded and submitted to MPI.

Figure 1: The FMA process



**Step 5 – Submit collected FMA information**. FMA participants provide FMA information collected and recorded at sample plots to MPI, either in an electronic form or by manually entering data using the online tools provided on the MPI website. All data submitted needs to comply with the FMA Information Standard.

**Step 6 – Generate participant-specific tables of forest carbon stocks.** The FMA information submitted to MPI, once checked for completeness and irregularities, is used to generate participant-specific carbon tables using a combination of proven NZ and international forest growth and carbon allocation models. These tables are then sent to the FMA participant.

Having completed the FMA process, FMA participants prepare their emissions returns in the same way as non-FMA participants – except by using participant-specific tables, rather than default tables, of forest carbon stocks (and if applicable of forest harvest residues). To ensure carbon accounting integrity, once participant-specific tables have been used for an emissions return the first time, they must be used for all emissions returns thereafter until a new set of tables is generated from updated FMA information.

## Key FMA options and decisions

The FMA offers a number of options that participants may choose to help improve the cost-effectiveness of applying the FMA to their forests. Different options will be applicable to different participants, depending on both the current and future state of their forests. The key options and decisions for FMA participants are discussed in this section, and relate to:

- whether to collect information for shrubs;
- whether to collect information for small trees;
- whether to collect information for all tree species, or only nominated species;
- whether to assign Forest Class – an important choice for FMA participants;
- whether to request more than the minimum number of sample plots.

Some of the options, once chosen, cannot be changed and so need careful consideration. Other options can be changed, but only if the FMA participant requests a completely new set of sample plots – which may usually only be done once in each new mandatory emissions return period. FMA participants must notify MPI of their choices for the various options when first submitting FMA information, and in some cases prior to requesting sample plot locations.

**Tip:** if FMA participants are not clear on which of the options presented below are best for their circumstances, it is suggested they seek the advice of a professional forestry consultant or forest inventory provider. A list of registered forestry consultants can be found on the NZ Institute of Forestry website. Participants may also contact MPI for further advice (tel. 0800 CLIMATE (254 628), or email **ForestryETS@mpi.govt.nz**).

### Collecting information for shrubs

*Collection of FMA information for shrubs is optional.*

If FMA information for shrubs is collected, it will be used to calculate carbon stocks in shrubs on the FMA participant's registered post-1989 forest land, and the carbon sequestered by shrubs will be included in their participant-specific carbon tables. An FMA participant must notify MPI whether or not they will

collect FMA information for shrubs when first submitting FMA information. Once this choice is made, it cannot be changed unless an FMA participant requests a completely new set of sample plots.

For most FMA Participants, the amount of carbon sequestered by shrubs will be a very small proportion of the total carbon sequestered by trees on their forest land. For exotic forests in particular, there is generally little net benefit in recording FMA information for shrubs. The trees will usually quickly out- compete the shrubs, and any carbon gained while the shrubs are growing will be lost as they die. Over a normal rotation, the net carbon contribution from shrubs is usually negligible relative to total exotic forest carbon stocks.

Where the shrub component of a forest is significant and persistent, FMA participants may wish to consider collecting FMA information for shrubs. For example, those FMA participants with regenerating indigenous forest, or with slow-growing or widely-spaced exotic trees, may find the shrub component of the total forest carbon stocks is significant – especially at younger forest ages. The FMA information required to be collected for shrubs is relatively simple to collect, comprising **estimates** of crown cover and canopy height for six readily identifiable shrub types.

## Collecting information for small trees

*i* *Collecting FMA information for small trees (DBH <25 mm and height of at least 300mm) is mandatory if FMA information is being collected for shrubs, otherwise optional.*

FMA participants must collect FMA information for trees that are forest species when the diameter at breast height (DBH) of a tree stem is 25 mm or more. They may also collect FMA information for small trees with DBH of less than 25 mm and a height of at least 300mm if they wish, and so have the carbon sequestered by those trees included in their participant-specific tables. This choice is not, however, available to FMA participants that elect to collect FMA information for shrubs. In that case, it is mandatory to collect information for small trees.

If FMA information for small trees is collected, stem collar diameter rather than DBH is recorded. An FMA participant that has a choice about collecting FMA information for small trees must advise MPI whether or not they will collect such information when first submitting FMA information. Once this choice is made, it cannot be changed unless an FMA participant requests a new set of sample plots.

When a forest comprises forest species which may take some time to reach 25mm DBH, or that have a high initial stocking of small stems with a height of at least 300mm, FMA participants may wish to consider including small trees when collecting FMA information. For example, when participants have indigenous forest, or highly-stocked Douglas fir stands.

Over a normal rotation, the net carbon contribution from small trees is usually very small relative to total forest carbon stocks. Collecting FMA information for small trees may therefore often not be cost-effective – particularly when tree species are fast growing, and inventory timing can be flexible enough to avoid making measurements until most trees in sample plots are above the 25 mm DBH threshold. FMA participants who wish to include small trees can chose a low-cost approach to determining carbon stocks if they wish, by collecting **estimates** of the average collar diameter, the average height of stems close to that diameter, and stocking. If FMA participants wish a more precise measure of carbon stocks in small trees, measurements of collar diameter can always be made.

## Collecting information for all tree species, or only nominated species

*FMA participants may choose to collect FMA information for specific tree species only.*

In planted forests, almost all of the carbon stock usually resides in just a few species. Under the *Field Measurement Approach Standard*, FMA participants can choose to collect FMA information for these few species only. A list of the species for which the participant wishes to collect FMA information ("the nominated tree species") must be supplied to MPI when first completing Step 5 of the FMA process (Submit FMA information to MPI). The species on the list must include those expected to account for at least 85 percent of the forest crown cover at harvest, or at forest maturity for a non-harvest forest. Species may be added to a nominated list at any time, but not removed.

Having a nominated species list is a way of reducing sampling costs while having little impact on net carbon benefit. For example, the owner of an exotic forest managed for both timber and carbon may choose to nominate only the exotic merchantable timber species as those for which FMA information will be collected – in which case FMA information would not be collected for any regenerating indigenous tree species or unwanted exotic species that would be thinned out or suppressed. By contrast, an owner of an exotic forest with numerous permanent gaps that fill with regenerating kānuka may choose to include kānuka as well as the exotic species on their nominated species list – in which case FMA information must always be collected for the kānuka as well.

A nominated species list will usually be less suitable for regenerating indigenous forest due to the species diversity, and consequent uncertainty as to which species will regenerate or predominate through the different stages of forest growth and development. However, use of a nominated species list may still be beneficial if natural regeneration is strongly dominated by one or a few species, or if important sub-dominant species are added to a nominated species list as they appear.

## Assigning forest class: an important choice

*Choosing to assign forest class, or not, affects other choices that impact FMA cost-effectiveness.*

Forest class is an optional high-level classification of an FMA participant's post-1989 forest land into areas that are defined as:

- **Exotic** – if exotic forest species are growing or being managed with the intention that an exotic forest species will be the predominant forest species on each hectare of the land (or part thereof).
- **Indigenous** – if indigenous forest species are growing or being managed with the intention that an indigenous forest species will be the predominant forest species on each hectare of the land (or part thereof).

Forest class can be assigned or removed with the request for plots to be allocated, or at any other time, by giving written notice to MPI.

The primary purpose of defining forest class is to provide a mechanism to reduce costs for FMA participants with indigenous forest land, as the Regulations allow half the number of sample plots to be allocated to such land in comparison to land with a forest class of exotic. The definition of forest class is deliberately forward-looking, allowing areas just planted in exotic species to be classified as having an exotic forest class even though those species may not yet be the predominant species. Similarly, the definition also caters for situations where exotic forest species are used as an initial nurse crop for what is intended to become an indigenous forest in the medium term.

Forest class also has an important secondary role. The *Field Measurement Approach Standard* uses forest class to provide more flexibility for FMA participants in respect of the choices available in relation to collecting FMA information for shrubs, small trees and nominated species. If forest class is assigned, these choices may made independently for each forest class. For example, an FMA participant may have a different nominated species list for land in the indigenous and exotic forest classes, or may wish to collect FMA information for shrubs and small trees only for that forest land in the indigenous forest class.

If an FMA participant chooses not to assign forest class, the choices made in relation to shrubs, small trees and nominated species apply to their total registered post-1989 forest land. Assigning forest class may therefore be considered by FMA participants who:

- have now, or will have in the future, significant areas of indigenous forest land, and wish to minimise sampling costs by allocating fewer sample plots to that land – and are prepared to accept a less precise estimate of forest carbon stocks for that area;
- wish to have more sample plots than the minimum required by the Regulations, but specified separately for exotic and/or indigenous forest land – as the number of plots can be selected independently for land in each forest class (see next section below);
- wish to select different options for the forest land in different forest classes in relation to the choices available for collecting FMA information for shrubs, small trees or nominated species.

There may be no advantage in assigning forest classes if an FMA participant will only ever:

- have exotic forest land; or
- have indigenous forest land for which fewer sample plots than an equivalent area of exotic forest is not required; or
- make a single choice that applies to all of their registered post-1989 forest land in relation to collecting FMA information for shrubs, small trees and nominated species – and also wants sample plots allocated to their indigenous forest land in the same numbers as their exotic forest land.

## Selecting the number of sample plots to use

*i* *FMA participants can choose to have more sample plots allocated than the required minimum number specified in Regulations and Standards – for each forest class, if forest class has been assigned.*

The Regulations require that a minimum number of sample plots must be allocated to an FMA participant's registered post-1989 forest land, and the *Field Measurement Approach Standard* provides further details of the required number of plots by total forest area. Table 1 below provides examples of the minimum number of sample plots for particular areas of forest land where forest class has not been assigned.

The number of sample plots that are allocated to an FMA participant is determined as follows (see Section 3 of this guide for examples with forest class assigned, or not assigned):

(i) Sample plots are allocated **uniformly** to the total forest land area, according to Table 1 (with interpolation for intermediate forest land areas).

(ii) If forest class has not been assigned, or if the entire area has a forest class of exotic, the number of sample plots allocated will be that in Table 1 (interpolated if applicable) – or half that number if the entire area has a forest class of Indigenous.

(iii) If the participant has areas of land in both exotic and indigenous forest classes, the sample plots that fall on the area with a forest class of exotic are all allocated, whereas only half of the plots that fall on the area with a forest class of Indigenous are allocated.

The minimum number of sample plots specified in Table 1 is a compromise between sampling effort, cost, and accuracy. For most FMA participants with exotic forest, the minimum number of plots is expected to provide an estimate of forest carbon stocks consistent with NZ forest inventory practice – within 10 percent of the true value at 90 percent confidence. For FMA participants with indigenous forest, lesser accuracy will be achieved because of the lower minimum number of sample plots and higher forest variability – but as carbon gains are smaller and the cost of sampling higher, the smaller minimum number of plots usually represents a cost-effective compromise.

**Tip:** FMA participants wishing to achieve a better sampling accuracy than the default under the FMA, or that are concerned their forests are more variable and will likely require more sample plots to achieve normal NZ forestry sector practice, should contact a registered forestry consultant to develop a specific forest inventory design for them. A specific design will estimate the number of sample plots required to achieve a given level of accuracy, and that number can be requested from MPI.

**Table 1. Minimum number of sample plots by forest land area**

| Forest land area (hectares) | Number of sample plots |
|---|---|
| 100 | 30 |
| 150 | 34 |
| 200 | 37 |
| 300 | 42 |
| 500 | 50 |
| 700 | 56 |
| 1000 | 64 |
| 2000 | 84 |
| 5000 | 129 |
| 6000 | 143 |
| 7000 | 157 |
| 8000 | 171 |
| 9000 | 186 |
| 10 000 or more | 200 |

## When must FMA information be collected?

FMA information must be collected at each allocated permanent sample plot at least once in each mandatory emissions return period. Generally, the accuracy of the participant-specific carbon tables generated from the collected information will be greater if the trees are older. FMA participants may

therefore wish to delay collection of information until the final year of a mandatory emissions return period, although if trees are to be harvested during the period then collection of the information pre-harvest is usually most appropriate. However, FMA participants should ensure they do not collect information so late in a mandatory emissions return period that there is insufficient time to complete submission and processing of the information (by MPI), before the deadine for the emissions return.

FMA information only needs to be collected from plots that are "active". There are various reasons a plot may be considered inactive. These are explained in detail in Section 3, under step 4: "Collect FMA information at sample plots".

It is not necessary to collect FMA information from all permanent sample plots in the same year. There may be reasons – such as having a mix of replanted stands and other stands ready to harvest – that would make it more appropriate to complete information collection earlier for some stands than others.

**Important note: Participants who were subject to the FMA in the 2018 to 2022 period may not be required to collect FMA information in the 2023-2025 mandatory emissions return period**

If you add or remove post-1989 forest land during the 2023 to 2025 period, you can use your existing participant-specific tables (or if you do not have them for the forest type, the default tables) to calculate your emissions return due on 30 June 2026.

If your registered land in the ETS does not change between when you were last issued sample plots before 1 January 2023 and 31 December 2025, the following rules apply.

- If you had new participant-specific tables issued from information collected between 1 January 2018 and 31 December 2022 from all of your sample plots, you may resubmit the same data to get tables issued for the current period.
- If you had a temporary waiver for the emissions return at the end of the 2018 to 2022 mandatory emissions return period, you will need to measure your forest during the 2023 to 2025 mandatory emissions return period and submit the data to us to get carbon tables for the return due in 2026. However if you collected data from some of your sample plots between 2018 and 2022, you can resubmit that data instead of measuring them again.

If you have questions about how these rules apply to you, contact us at forestryETS@mpi.govt.nz

**Note:** The current period runs from 1 January 2023 to 31 December 2025, and is 3 years instead of the usual 5 years. It is shorter to realign New Zealand's ETS with global reporting periods.

When an FMA participant adds or removes forest land to or from their landholding, additional permanent sample plots may need to be allocated to meet the minimum required number of plots. These plots must be allocated before information can be collected to create definitive participant-specific tables for the emissions return at the end of the mandatory emissions return period (see Section 5 of this guide for details, under *Adding and removing Land*). The rules for collection of FMA information for the additional plots are the same as for any of the prior allocated plots: FMA information must be collected from the plots at least once in each mandatory emissions return period, and new information for any subset of plots (such as those newly allocated) may be submitted to MPI at any time if it is wished to have that information included in a new set of participant-specific carbon tables. Note that for all emissions returns other than the emissions return at the end of the mandatory emissions return period:

- participants must use their latest participant-specific tables, whether issued in a previous mandatory emissions return period or new participant-specific tables produced at their request, or
- if an FMA participant does not have any participant-specific tables, they must use the default tables from the Regulations.

# THE FMA PROCESS: A DETAILED GUIDE TO IMPLEMENTATION 3

## Purpose of this section

This section of the guide provides information on practical implementation of the FMA in addition to that available in the Regulations and FMA Standards. It also includes an overview of the administrative procedures provided by MPI that allow FMA participants to comply with key requirements of the Regulations and Standards.

For FMA participants, implementing the FMA involves completing the following six-step "FMA process":

1. Assign forest class (optional)
2. Request an allocation of sample plots
3. Establish the sample plots on the participant's forest land
4. Collect and record FMA information at those plots
5. Submit recorded FMA information to MPI
6. Generate participant-specific tables of forest carbon stocks

These six steps are described in detail in this section. The FMA participant completes the first five steps of the FMA process, and MPI completes the last step on the participant's behalf.

The intended audience for this section is:

- FMA participants that plan to complete FMA requirements themselves;
- anyone completing any administrative aspect of the FMA on behalf of an FMA participant;
- forestry consultants, or any other providers of forest inventory or related forestry services to FMA participants.

**Tip:** this section of the guide is an elaboration of, and not a replacement for, the Regulations and FMA Standards. Those reading this section of the guide are expected to have an overall working knowledge of the Regulations and Standards – with those providing professional advice on the FMA expected to have a thorough knowledge.

## The FMA process: A step-by-step guide


To meet the requirements of the Regulations and FMA Standards, FMA participants need to complete the six-step FMA process – shown above in schematic form. Before starting this process, FMA participants should already have made at least the following key choices and decisions (see Section 2):

(i) whether or not to collect FMA information for shrubs;

(ii) whether to collect FMA information only for trees with a DBH of 25 mm or more, or to also collect information for small trees with a DBH of less than 25 mm and a height of at least 300mm (with collection of small tree information being mandatory if FMA information is being collected for shrubs);

(iii) whether to collect FMA information for all tree species that meet the stem diameter criteria selected under (ii), or for only specific nominated tree species;

(iv) whether forest class is to be assigned, allowing:
- the choices available under (i) – (iii) above to be made independently for areas of forest land expected to comprise either predominantly exotic, or predominantly indigenous, forest species; and/or
- a smaller minimum number of sample plots to be allocated for forest land assigned to a forest class of indigenous – including for land registered in the future.

**Tip:** To obtain the forms needed to complete the FMA process steps, participants must request them through Tupu-ake – Forestry ETS online services or by email from ForestryETS@mpi.govt.nz

## Assign forest class


*FMA participants may either assign Forest Class(es) to their registered post-1989 forest land or confirm that Forest Class will not be assigned.*

The Regulations allow an FMA participant, if they wish, to assign forest class to their registered forest land[1]. A forest class of:

(i) **exotic** must be assigned to any area of the FMA participant's registered post-1989 forest land on which one or more exotic forest species are growing or being managed with the intention that an exotic forest species will be the predominant forest species on each hectare of the land (or part thereof);

(ii) **indigenous** must be assigned to any area of the FMA participant's registered post-1989 forest land on which one or more indigenous forest species are growing or being managed with the intention that an indigenous forest species will be the predominant forest species on each hectare of the land (or part thereof).

The Regulations also specify that:
- forest class, if assigned, must be assigned for every part of an FMA participant's registered forest land (including when any new land is registered in the future);
- forest class may be changed, assigned, or removed at any point by giving written notice MPI.

The issues of particular importance that FMA participants need to consider when deciding whether or not to assign forest class were discussed in Section 2: having smaller numbers of sample plots for indigenous forest land, selecting greater numbers of plots independently for indigenous and exotic forest land, or

1 See regulation 57

having different choices for exotic and indigenous forest land in relation to collecting FMA information for shrubs, small trees and nominated species. Some FMA participants may also need to consider assigning forest class if they wish to obtain a more precise estimate of carbon stocks when their forest comprises mostly indigenous species but includes a small proportion of exotic species sequestering carbon at much higher rates. This case is considered further in Step 2 of the FMA process below (**Request sample plots**).

In practical terms, assignment of Forest Class means that a Forest Class attribute must be attached to every forest land polygon that has been mapped as part of an FMA participant's registered forest land. Because of the importance of Forest Class, FMA participants are required to formally notify MPI whether Forest Class will be assigned, or will not.

**Assign forest class: Key steps**

**1-A.** Request a form to class areas of your forest as exotic or indigenous (optional; for all FMA participants)

**1-B.** Submit form to notify MPI of forest class assignment (optional; for all FMA participants)

### Step 1-A: Request a form to class areas of your forest as exotic or indigenous (optional)

The participant must select and submit the service **Classify forest** in Tupu-ake – Forestry ETS online services. MPI will generate a 'Class areas of your forest as exotic or indigenous' form and send it to them. The form provides FMA participants with a list of their forest stands that do not have forest class assigned yet, so that forest class can be assigned to all stands.

### Step 1-B: Submit form to notify MPI of Forest Class assignment (optional)

An FMA participant indicates that each of the stands listed on the form should be classed as either "exotic" or "indigenous".

The FMA participant then submits their completed form to MPI. If they do not want to assign forest class to their land, they must indicate in the following step (on their 'Request sample plot locations' form that they want to leave the forest class unassigned.

## Request sample plots


The rules in the Regulations[2] for allocating sample plots, as further detailed in the *Field Measurement Approach Standard* (Part 2), can be summarised as follows:

- a minimum number of sample plots is required, with the number varying by forest land area;
- the specified minimum number applies to areas of forest land assigned to a forest class of exotic or to which forest class has not been assigned;
- the minimum number is halved for areas assigned to a forest class of indigenous;
- an FMA participant may request more than the minimum number of sample plots – for all of their forest land if forest class is not assigned, or individually for each forest class if assigned;

2 See regulation 61.

- when an FMA participant has land in both forest classes, at least two sample plots must be allocated to the forest land in a forest class.

*i* *The minimum number of sample plots is expected to give an acceptably accurate value of forest carbon stocks for most FMA participants – unless their forest land is especially variable.*

### Minimum plot numbers

The minimum number of sample plots specified by the Regulations and *Field Measurement Approach Standard* is expected to result in forest carbon stocks for typical exotic plantation forests being determined to a level of accuracy that is consistent with NZ forestry sector good practice – without incurring the cost of a specific inventory design. Table 2 gives some examples of the minimum numbers of sample plots allocated for different total areas of forest land, with and without forest class assigned. For forest land areas not shown in the table the minimum number of sample plots will be interpolated by MPI.

The minimum number of sample plots allocated to forest land assigned to a forest class of indigenous is half that allocated to the same area assigned to a forest class of exotic (or to an area for which forest class has not been assigned). The lower minimum number of sample plots for the indigenous forest class recognises the reduced cost-effectiveness of the FMA for typical indigenous forest land due to more difficult access, higher measurement costs per sample plot (usually steeper slopes, and more stems to be measured), and lower carbon revenue.

Use of a smaller minimum number of sample plots for regenerating indigenous forest will result in less accurate estimates of forest carbon stocks than for exotic forest, not just because of smaller plot numbers but also because regenerating forest is more variable. However, the expected error limits (in tonnes of carbon dioxide per hectare) are not expected to differ greatly. Consider the following example:

Carbon stocks in radiata pine and indigenous forests at age 30 are about 750 and 250 t $CO_2$/ha respectively. It is expected that carbon stocks in a relatively uniform exotic forest will be estimated to within 5–10 percent of the mean, but in indigenous forests (once fully stocked) to within only about 25 percent of the mean, using the minimum number of sample plots. The likely error limits in carbon terms are similar in both cases – about 60 t $CO_2$/ha.

If an FMA participant's exotic forests are much more variable than a typical plantation, specific inventory design may be warranted. Specific designs for variable forests will result in more sample plots being required in order to improve accuracy – and will need to be completed by a forest inventory professional before sample plots are requested from MPI. Specific designs can also be performed for regenerating indigenous forest, but will not be as reliable as for exotic forest because of changes in stocking and composition over time. Designs for regenerating indigenous forest may be best performed using data from fully-stocked areas that have passed the juvenile growth stage, accepting that higher error limits may be encountered in the shorter term until the forest is well established.

**Tip:** FMA participants concerned about the effect of forest variability on the accuracy with which their forest carbon stocks will be determined, or who wish to have a specific inventory design, may wish to seek the advice of a professional forestry consultant or forest inventory provider. A list of registered forestry consultants can be found on the NZ Institute of Forestry website (**www.nzif.org.nz**).

Table 2. Examples of the minimum number of sample plots under different scenarios

| Forest land area (ha) | Number of plots allocated when the forest class of all land is: | | |
|---|---|---|---|
| | Not assigned | Exotic | Indigenous |
| 100 | 30 | 30 | 15 |
| 150 | 34 | 34 | 17 |
| 200 | 37 | 37 | 19 |
| 500 | 50 | 50 | 25 |
| 1000 | 64 | 64 | 32 |
| 2000 | 84 | 84 | 42 |
| 5000 | 129 | 129 | 65 |
| 10 000 or more | 200 | 200 | 100 |

### Participants with land in two forest classes

The rules for allocating minimum sample plot numbers when an FMA participant has forest land assigned in the *Field Measurement Approach Standard* (Part 2). Effectively, the minimum number of sample plots specified for the total forest land area is assigned in proportion to the area in each forest class, and then the number falling in the area with a forest class of indigenous is halved – provided there are at least two sample plots allocated to the land in each forest class. Table 3 gives some examples of sample plot allocation under different scenarios.

Table 3. Examples of the minimum number of sample plots allocated when two forest classes have been assigned

| Forest land area (ha) | | | Number of sample plots by forest class, and total plots | | | Number of plots allocated if forest class is not assigned |
|---|---|---|---|---|---|---|
| Total | In exotic forest class | In indigenous forest class | Exotic | Indigenous | Total | |
| 100 | 99 | 1 | 30 | 2 | 32 | 30 |
| 100 | 95 | 5 | 29 | 2 | 31 | 30 |
| 100 | 50 | 50 | 15 | 8 | 23 | 30 |
| 100 | 25 | 75 | 8 | 11 | 19 | 30 |
| 200 | 195 | 5 | 36 | 2 | 38 | 37 |
| 200 | 180 | 20 | 33 | 2 | 35 | 37 |
| 200 | 150 | 50 | 28 | 3 | 33 | 37 |
| 500 | 10 | 490 | 2 | 25 | 27 | 50 |
| 500 | 50 | 450 | 5 | 23 | 28 | 50 |
| 500 | 200 | 300 | 20 | 15 | 35 | 50 |
| 500 | 400 | 100 | 40 | 5 | 45 | 50 |

### Examples of situations in which increasing sample plot numbers may be warranted

Choosing more sample plots than the minimum may be appropriate for FMA participants who:

- require more certainty in their carbon stock assessments to allow more accurate forecasting of revenue and liabilities, or need to demonstrate better accountability to stakeholders;
- have forests that are expected to be very variable – such as those containing many gaps, or being spread across sites with a wide range of growing conditions;
- anticipate that due to the nature of their forest land access to some allocated sample plot locations is likely to be dangerous or impractical, and that such the plots will likely be eligible for a waiver from collection of FMA information (see Section 4 – Waivers and extensions). As fewer sample plots may reduce the accuracy with which forest carbon stocks are determined, FMA participants in such circumstances may wish to consider requesting more plots than the minimum number.

When an FMA participant has forest land in two forest classes, there is a further situation where choosing more sample plots than the minimum may be warranted. This is when a participant has a large area of land assigned to a forest class of indigenous, and a relatively small proportion assigned to exotic, but a large proportion of their carbon stock and carbon stock change is in forest in the exotic forest class. For example, consider the case in Table 3 of a participant with a total of 500 hectares of forest land – 50 and 450 hectares in the exotic and indigenous forest classes respectively. Exotic forest is likely to accumulate carbon, in the shorter term, at up to four to five times the rate of indigenous forest. That is, in carbon terms, the 50 hectares in the exotic forest class could be equivalent to as much as half the area in the indigenous forest class – yet only has about one-fifth the number of sample plots. The relatively small number of sample plots (five) in the exotic forest area is unlikely to give an acceptably accurate estimate of carbon stocks for what is an important area in terms of total carbon contribution.

Specific inventory design could always be used to provide an optimal outcome in cases similar to that outlined in the last paragraph. However, a simpler alternative, likely to be satisfactory in many circumstances, would be to consider the area assigned to a forest class of exotic to be the participant's only forest land, and to request sample plots be assigned to the area on that basis. That is, to assign plot numbers according to Table 1 (in Section 2) – on a pro-rata area basis if under 100 hectares.

Thus, for the example in the last paragraph above, 15 sample plots would be requested for allocation to the 50 hectares area assigned to a forest class of exotic, given that 30 plots would be allocated for 100 hectares according to Table 1.

**Request sample plots: Key steps**

**2-A.** Review requirements for sample plot numbers (optional; for all FMA participants)

**2-B.** Obtain and complete a 'Request sample plot locations' form (required for all FMA participants)

**2-C.** Notify MPI of requested sample plots – number of plots; file format (required for all FMA participants)

**2-D.** MPI allocates requested sample plots (required for all FMA participants)

**2-E.** MPI sends sample plot locations to the FMA participant (in the selected file format)

### Step 2-A: Review requirements for sample plot numbers

*i* *Once allocated, the number of plots can only be changed if a completely new set of plots is allocated in a different mandatory emissions return period, or if land is added or removed.*

FMA participants will need to consider if they wish to accept the minimum number of sample plots specified under the Regulations and *Field Measurement Approach Standard*, or want a greater number – by forest class, if forest class has been assigned. Increasing the number of plots will increase sampling accuracy, but also increase costs. Specific design of inventory requirements may be beneficial in some cases – and not expensive if forest inventory data obtained for other purposes, even if only from other (broadly similar) forest areas, already exists.

**Tip:** the minimum number of sample plots required for an FMA participant's registered forest land, by forest class if assigned, is always specified by MPI as part of Step 2-B, below.

### Step 2-B: Obtain and complete a *Request sample plot locations* form

Obtain a 'Request sample plot locations' form from MPI by selecting and submitting the service **Ask for sample plot locations** in Tupu-ake – Forestry ETS online services, or from ForestryETS@mpi.govt.nz). An analysis of the FMA participant's registered forest land is completed by MPI to determine the minimum number of sample plots, by forest class if assigned. MPI pre-populates a 'Request sample plot locations' form with these and other details about the registered land, and sends the form to the FMA participant.

The participant must then complete the form and upload it through the **Ask for sample plot locations** service.

The participant must specify:

(i) the number of plots required (by forest class if assigned) – either the minimum number calculated by MPI, or any greater number they wish;

(ii) the file format in which they would like to receive an electronic copy of the plot locations (i.e. the geographic coordinates of the plot centre points) for uploading to a GPS receiver. The file format options are specified in the *Field Measurement Approach Information Standard*, as:

  (a) a GPX file (GPS file exchange format);

  (b) a shapefile (ESRI GIS format);

  (c) a CSV file (comma delimited variable).

### Step 2-C: Notify MPI of requested sample plots

FMA participants must submit the competed form to MPI. If an FMA participant has chosen not to assign forest class, the minimum number of sample plots allocated will be the same as if the equivalent area of forest land was assigned a forest class of exotic.

### Step 2-D: MPI allocates requested sample plots

Sample plot locations are generated by overlaying a grid with a random start point onto the FMA participant's registered post-1989 forest land – by forest class, if assigned. The grid origin and spacing is varied until the required number of sample plots is obtained. Some complex configurations of forest – for example, a land-holding that includes both well-clumped and highly fragmented land – may require use of more than one grid to obtain a distribution of sample plots that is as uniform as practicable over the participant's entire landholding.

### Step 2-E: MPI sends sample plot locations to the FMA participant

Once sample plots are allocated, MPI will send the FMA participant:

(a) a PDF file that contains the date at which sample plots were generated, the identifier of each plot (which must be used when collecting FMA information) and the location of each sample plot centre point as an Easting and Northing (e.g. 1934093E, 5587419N) in the New Zealand Transverse Mercator map projection (NZTM2000), in relation to the New Zealand Geodetic Datum 2000 (NZGD2000); and

(b) the same or equivalent information in the electronic file format selected by the FMA participant under Step 2 above (and as specified in the *Field Measurement Approach Information Standard*).

*i* *The PDF file is considered the definitive record of sample plot allocation for an FMA participant.*

An example of how sample plot grids are formed and plots are allocated is shown in Figure 2, for forest land to which forest classes have been assigned. Sample plot generation is straightforward when an FMA participant's entire registered post-1989 forest land is contiguous (i.e. clumped), as shown in the example.

## Establish Sample Plots


FMA participants must establish sample plots in accordance with the procedures specified in the *Field Measurement Approach Standard* (Parts 3 and 4). Establishing sample plots for the FMA is similar to practices widely used in the NZ forestry sector during mid-rotation or pre-harvest forest inventory. However, the plots established under the FMA are permanent sample plots, in the sense that they will be revisited and re-measured over time – and accordingly must be permanently marked.

**Establish sample plots: key steps**

**3-A.** Review the main rules (*Field Measurement Approach Standard*, Parts 3 and 4)

**3-B.** Locate the sample plot centre point, using a GPS (*Field Measurement Approach Standard*, Part 3)

**3-C.** Relocate the sample plot centre point if necessary (*Field Measurement Approach Standard*, Part 3)

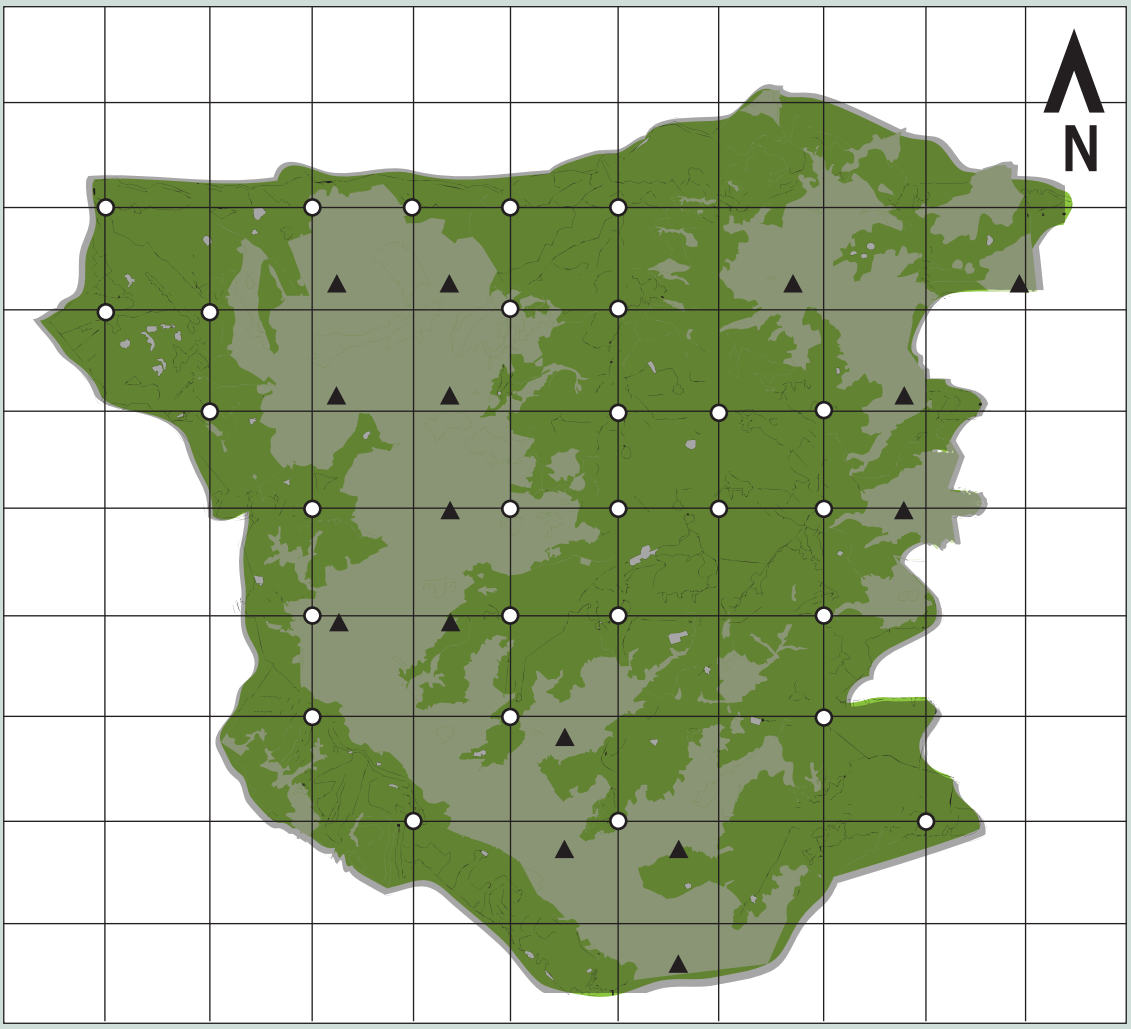
**3-D.** Permanently mark the sample plot centre point (*Field Measurement Approach Standard*, Part 3)

**3-E.** Determine the exact position of the sample plot perimeter (*Field Measurement Approach Standard*, Part 4)

**3-F.** Re-identify the sample plot centre point if collecting new FMA information at a future time (*Field Measurement Approach Standard*, Part 3)

*i* *If an FMA participant is collecting FMA information for nominated tree species only, all other tree species are ignored – including when exercising all rules below.*

Figure 2: Sample plot locations for forest land (indigenous and exotic)




Key

- Exotic forest
- Indigenous forest
- Sample plots – exotic
- Sample plots – indigenous
- Grid used for assigning exotic sample plots

*Rules relating to locating and laying out sample plots are summarised below, and formally specified in the Field Measurement Approach Standard, Parts 3 and 4.*

### Step 3-A: Review the main rules

(a) The shape of a sample plot:
  (i) must be circular only, if the plot contains any planted trees;
  (ii) may be either square or circular, if the plot contains only regenerated trees.

(b) The area of a sample plot is chosen on a plot-by-plot basis, and must be one of the following: 0.030, 0.040, 0.060, 0.080, 0.100, or 0.200 hectares.

(c) The area of a sample plot must be selected from the list in (b) above according to one of the following rules:
  (i) the smallest area expected to include at least 20 but not more than 30 live tree stems for which DBH must be measured at the time of harvest, or the time of forest maturity if a non- harvest forest; or
  (ii) if a plot larger than 0.200 hectares would be required to include 20 live tree stems at harvest or maturity, then a plot size of 0.200 hectares must still be used; or
  (iii) if the plot will contain regenerating indigenous trees only, a plot area of 0.040 hectares may be used irrespective of how many trees it includes (if the intent is to retain consistency with some historical inventory schemes though otherwise rules (c)(i) and (c) (ii) above should be applied.

(d) When determining the count of tree stems under paragraph (c) above, multi-stemmed trees must be treated as if contributing only a single stem to the count.

(e) If a sample plot contains a permanently or temporarily unstocked gap, then the gap is considered to have the same average stocking as the remainder of the plot for the purposes of determining the expected stem count at harvest or maturity under (c)(i) above.

*Once the area and shape of a sample plot are chosen, they may only be changed if the trees in the plot are cleared. It is accepted that determining the area of a plot on the basis of expected future tree stocking at harvest, or at maturity for a non-harvest forest, is subject to significant uncertainty. FMA participants should err on the side of larger rather than smaller plot areas, to ensure the FMA information collected satisfies good sampling practice.*

(f) A sample plot may be laid out:
  (i) in a horizontal plane; or
  (ii) parallel to the ground surface provided the average maximum slope for the plot is <10°; or
  (iii) in the plane of the average maximum slope if the average maximum slope for the plot is ≥10°; except
  (iv) a plot **must** be laid out in a horizontal plane if the average maximum slope of the plot is ≥10° and the average slope of the plot at right-angles to the direction of the average maximum slope is also is ≥10°.

(g) The average maximum slope of a sample plot is determined by taking the average of two angles measured relative to a horizontal plane from the centre of the plot to the perimeter of the plot, where:

(i) the first angle is measured in the direction of the steepest slope within the plot, and the second angle in the opposite direction; and

(ii) the first angle is taken as positive if above a horizontal plane or negative if below it; and

(iii) the second angle is taken as negative if above a horizontal plane and positive if below it.

Table 4 shows, for a range of final stockings (i.e. stocking at the time of harvest of a planted forest, or at maturity for a non-harvest forest) the plot area required to achieve 20-30 stems.

Table 4. Plot areas and final stockings that achieve the minimum number of tree stems

| Final stocking (stems per ha) | Plot area (ha) | Stem count |
|---|---|---|
| 100 | 0.2 | 20 |
| 150 | 0.2 | 20 |
| 200 | 0.1 | 20 |
| 300 | 0.1 | 30 |
| 250 | 0.08 | 20 |
| 375 | 0.08 | 30 |
| 334 | 0.06 | 20 |
| 500 | 0.06 | 30 |
| 500 | 0.04 | 20 |
| 750 | 0.04 | 30 |
| 667 | 0.03 | 20 |
| 1000 | 0.03 | 30 |

### Step 3-B: Locate the sample plot centre point, using a GPS

Sample plots must be located using a GPS with a minimum of 10-channels, and the GPS must have a coordinate averaging mode. The GPS must also be able to be set to a map projection of NZTM2000, with a geodetic datum of NZGD2000 (or if NZGD2000 is not available, a geodetic datum of WGS84). Forestry consultants and inventory providers can provide services for FMA participants who do not have access to a suitable GPS.

Using the GPS, the centre point of a sample plot allocated by MPI is located by:

(a) Navigating to a waypoint (termed the "navigated-to" waypoint) that has the geographic coordinates of a plot location specified by MPI .

(b) At the position of the navigated-to waypoint, setting the GPS to the mode that determines averaged geographic coordinates, and obtaining a set of averaged coordinates (Easting and Northing) by:

(i) if the GPS automatically calculates and displays the minimum time to obtain a reliable set of averaged geographic coordinates – take as the averaged coordinates those reported by the GPS receiver at the end of the minimum averaging time; or

(ii) if the GPS does not support automatic calculation of the necessary averaging time – take as the averaged geographic coordinates those obtained by averaging for at least 3 minutes.

(c) Determining the distance and true bearing (i.e. relative to true North) of the plot location from the averaged coordinates of the navigated-to waypoint – the GPS will usually be able to make this calculation automatically if the averaged coordinates are saved as an additional waypoint.

(d) If either the averaged Easting or Northing of the navigated-to waypoint is not within 10 metres of the coordinates of a plot location specified by MPI, moving towards the expected location of the plot,

treating the expected location as a new navigated-to waypoint, and repeating the procedure under paragraphs (b) and (c) above.

(e) Once the averaged Easting and Northing of the navigated-to waypoint are both within 10 metres of the coordinates of a plot location specified by MPI, recording:

  (i) the identifier of the plot being located; and

  (ii) a geotagged digital photograph of the screen of the GPS receiver showing the averaged Easting and Northing of the final navigated-to waypoint; and

  (iii) a geotagged digital photograph of the view from the final navigated-to waypoint, taken in landscape format parallel to the slope, in each of the true North, East, South and West directions; and

  (iv) a geotagged digital photograph of the view from the final navigated-to waypoint location, taken in landscape format, in the direction of the plot location specified by MPI; and

  (v) from the final navigated-to waypoint's averaged coordinates, and the coordinates of the plot location specified by the EPA, determining the horizontal distance and true bearing (i.e. relative to true North) to the plot location from the navigated-to waypoint location.

(f) Temporarily marking the navigated-to waypoint location with fluorescent material that will be visible from the plot location specified by MPI.

(g) Navigating the remaining distance to the plot location specified by MPI using a lineal tape and the true bearing from the final navigated-to waypoint.

(h) Recording:

  (i) the coordinates of the plot centre point, taken as the coordinates of the plot location specified by MPI; and

  (ii) the altitude at the plot centre point when it is later determined (see Step 3-D below); and

  (iii) the horizontal distance and true bearing from the final navigated-to waypoint to the plot location.

Any information required to be recorded above, even if not initially submitted to MPI (e.g., geotagged digital photographs) is considered to be FMA information, and as such must be retained as part of a FMA participant's records. It is also considered good practice to briefly describe, and retain as part of an FMA participant's records, any distinguishing features in the vicinity of either the final navigated-to waypoint or plot location, to assist with relocating the plot in the future.

*i* *If the plot location determined under the process above will fall in a hazardous or inaccessible location, a waiver from FMA requirements can be applied for – see Section 4 (Waivers).*

### Step 3-C: Relocate the sample plot centre point – if permissible

Sample plot centre points may be moved by an FMA participant, without prior permission from MPI, in the following circumstances only:

(a) where the plot extends beyond the boundary of the participant's registered post-1989 forest land, it **may** be relocated so that it is entirely within the boundary. Alternatively, FMA information is collected from only that part of the plot that is within the boundary – and if so any subsequent reference to a plot in this document means that part of the plot within the boundary only;

(b) where the plot extends onto land with a different Forest Class to that which it was allocated to, if forest

class has been assigned. In this case, the plot **must** be relocated so that it falls entirely on forest land with the forest class to which the plot was allocated;

(c) where part of the plot extends into an area subject to any kind of silvicultural or other experimental trial – for thinning, pruning, stocking, genetics, fertiliser, pest or disease management etc). In this case, the plot **must** be relocated so that no part falls within the trial area; and

(d) if there are old regenerated trees present in a sample plot that were present before the change in land management that resulted in an area of non-forest land being converted to forest land, the plot may if wished be relocated to avoid the old trees, or the plot may remain and the old trees must be omitted from measurement.

**Tip:** sample plots **must not** be relocated if the plot is otherwise in a valid location but includes a permanently unstocked area (e.g. a road, track, skid site, water body, bare rock etc), or a temporarily unstocked area. Neither must a plot be moved when the plot is located entirely within an area assigned to a single Forest Class but includes a small patch of trees that would be classified as a different Forest Class if the patch were a hectare or more (e.g. a plot in radiata pine forest that includes an area with kānuka regenerating in a gap that was not planted).

*If a sample plot that extends beyond a forest land boundary is not relocated, the plot area inside the boundary must be determined, and only that part used for collecting FMA information.*

The rules that apply to relocating a sample plot are given in the *Field Measurement Approach Standard* (Part 3) and must be carefully followed if relocation is required. The rules can be summarised as:

- locate the particular boundary that the sample plot perimeter extends beyond – either a forest land boundary (as shown in Figure 3), a forest class boundary, the edge of an experimental trial area, or the edge of an area that includes old regenerating trees;
- define the local position of the boundary the plot extends beyond:
  - according to the Geospatial Mapping Information Standard, if the boundary is a forest land boundary; or
  - by constructing a polyline placed on average equidistant between trees located on land assigned to different forest classes, or on land inside and outside an experimental trial area (as applicable) or on land with and without old regenerating trees;
- construct a line at right-angles to that part of the boundary that the plot extends beyond, and that passes through the originally-determined plot centre point – as shown in Figure 3.b for a forest land boundary;
- move the plot centre point along that line until the plot perimeter no longer extends beyond the boundary in question, and so is coincident with the boundary – as shown in Figure 3.b for a forest land boundary.

If as a result of first relocating a sample plot according to the rules above, the plot perimeter is still not entirely within the FMA participant's forest land boundary, or within forest land assigned to a single forest class, or outside of an area subject to an experimental trial, or outside of an area that includes old regenerating trees:

- further relocate the plot centre point in whichever true Northerly, Southerly, Easterly or Westerly direction will achieve this (as shown in Figure 3.c for a plot that originally extended beyond the eastern boundary, but when relocated into the stand then extends beyond the western boundary delineating a peninsula of forest land); and
- the direction chosen must be that which will result in the plot centre point being closest to the plot location specified by MPI.

Figure 3: Relocating sample plots

Figure 3a: Sample plot that extends beyond a forest land boundary

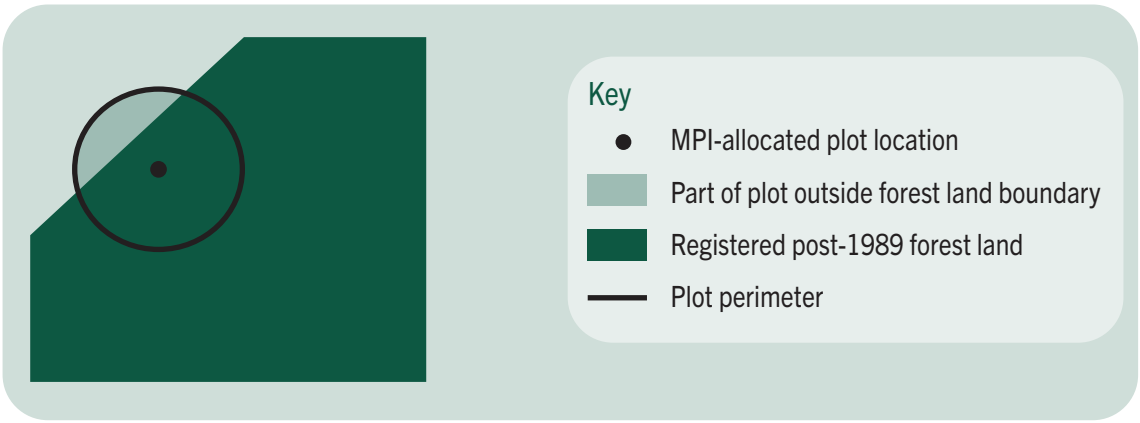



Figure 3b: Relocating the sample plot so that the plot perimeter is coincident with the forest land boundary

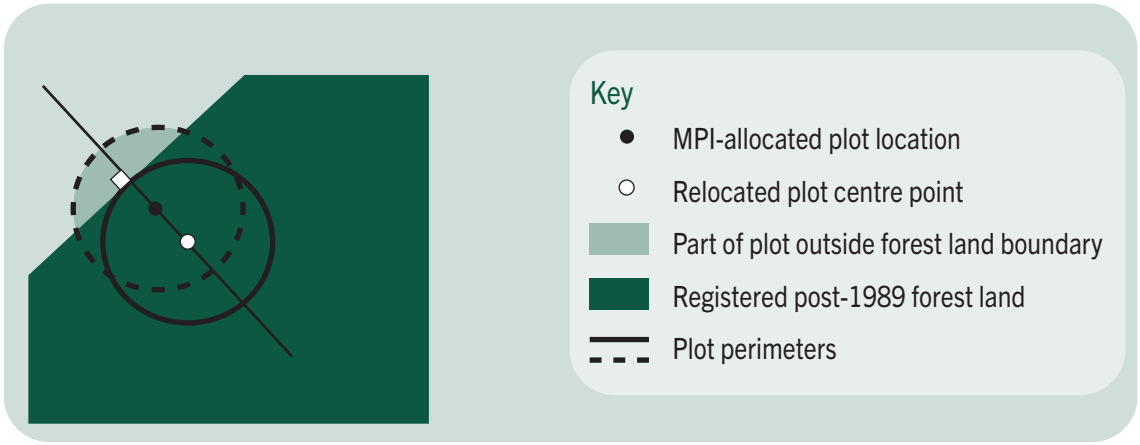
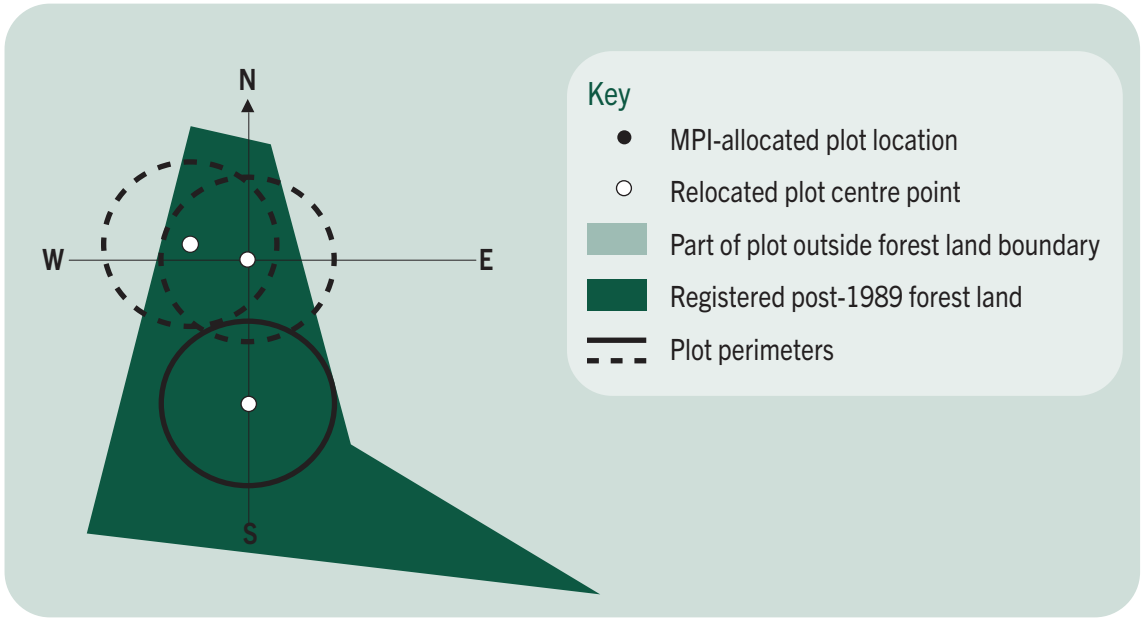



Figure 3c: Relocating a sample plot when shifting it along a line at right-angles to the forest land boundary would push another part of the plot outside the boundary



### Step 3-D: Permanently mark the sample plot centre point

Once the location of the sample plot centre point has been finalised, it must be marked as required by the *Field Measurement Approach Standard* (Part 3), by:

(a) driving a length of steel rod, of at least 25 centimetres length and 1 centimetre diameter, so that it is no more than 25 centimetres below the ground surface;

(b) marking the centre point also with a tanalised wooden peg or fibreglass peabout 50 millimetres square placed immediately to the North of the rod, and extending no more than 50 centimetres above the ground surface;

(c) permanently marking two witness trees visible from the plot centre point, located outside of the plot perimeter at about 90° to each other when viewed from the centre point;

(d) recording the bearing (relative to true north, to ±1°) and distances (to within ±2 centimetres) from the plot centre point to the centre of the stem of the witness trees.

If the ground at the sample plot centre point is so rocky or stony that a steel rod cannot be driven to the required depth, or is otherwise unsuitable for permanent markers:

(a) place the rod and wooden peg at an alternative reference position that is as near to the plot centre point as possible;

(b) determine the distance and bearing (relative to true North) from the plot centre point to the alternative marked reference position (to within ±1 centimetre and ±1°, respectively), record the distance and bearing, and retain the information as part of the FMA participant's records.

**Tip:** road-marking paint makes a good permanent marking for witness trees. A band at the base allows former witness trees to remain identifiable if thinned.

Once the sample plot centre point is identified, place the GPS at the centre point and obtain a set of averaged coordinates (including altitude) as described for the navigated-to waypoint in Step 3-B(b) above. Record and retain as part of a FMA participant's records:

(a) the plot identifier; and

(b) a geotagged digital photograph of the screen of the GPS receiver showing the averaged Easting, Northing and altitude; and

(c) a geotagged digital photograph in landscape format of the view taken parallel to the slope in each of the true North, East, South and West directions; and

(d) a geotagged digital photograph of the view in the direction of the navigated-to waypoint such that the fluorescent material marking the waypoint's location is visible.

*The set of averaged plot centre point coordinates and geotagged photographs obtained above in step 3-D are part of a FMA participant's FMA information, and so must be retained as part of a participant's records. However, only the averaged altitude value is added to FMA information recorded in step 3-B and 3-C when submitting FMA information to MPI. During processing of the submitted FMA information, MPI will decide if the additional information collected in step 3-D, and held by the FMA participant, is needed – and will request it if required.*

### Step 3-E: Determine the exact position of the sample plot perimeter

Accurately locating the position of the sample plot perimeter is critical for determining which trees and (optionally) shrubs are considered to be within the perimeter – and thus are those for which FMA information will be collected. The position of the perimeter depends on whether a circular or square plot is being used, and whether the plot is being laid out in a horizontal plane or in the plane of the average maximum slope.

The dimensions of circular or square sample plots must be determined using the formulae for obtaining plot dimensions (radius of a circular plot, or side length of a square plot) from the selected plot area, as given in the *Field Measurement Approach Standard* (Part 4) and also in Appendix 2 of this guide. The procedures for laying out a sample plot and determining the position of the plot perimeter are also given in Part 4 of the *Field Measurement Approach Standard* – as summarised in Step 3-A, item (e), above.

Figure 4 shows some examples of laying out circular sample plots on a slope. The procedure for laying out square plots is similar to that for circular plots, except that two of the sides of the plot must be parallel to the direction of average maximum slope.

### Step 3-F: Identify the sample plot centre point if collecting FMA information at a future time

Every effort must be made to find the original plot centre point when collecting FMA information at future dates. Once the plot has been found, update the plot location description if this can be improved upon, and re-mark the witness trees (or establish new trees if they have been thinned) as necessary. Always collect a new set of averaged geographic coordinates (including altitude) when re-visiting a plot for collection of FMA information, for quality control purposes.

**Tip:** recording a description of the sample plot location and distinguishing features, a GPS waypoint trail of the access route, and the sample plot markings used will assist with locating the plot in the future.

The position of the centre point of a sample plot must be determined:

(a) by locating the peg, provided it is clear the peg has not been moved; or

(b) if the peg is absent or may have been moved, by locating the buried iron rod; or

(c) if the iron rod is also absent, by using the recorded bearings and distances from the centre of the stems of the witness trees to the plot centre point.

If using witness trees to re-establish the plot centre point, secure a lineal tape to the centre of each tree and trace an arc at the distance and centred on the bearing previously recorded. The intersection of the two arcs from the two witness trees should provide an accurate location for the plot centre point if care is taken with distance measurement (including making any necessary adjustments for departure of the lineal tape from horizontal – if a horizontal distance was previously recorded). If the position of an alternative reference point is being determined, rather than the plot centre point directly, then once the reference point has been determined temporarily mark the plot centre point using the previously recorded distance and bearing of the centre point from the reference mark.

Once the plot centre point is found, the plot perimeter must always be re-established. It cannot be assumed that trees that were within the perimeter previously have always remained within the perimeter – particularly those leaning in or out.

Figure 4: Laying out sample plots

Figure 4a: Circular plot laid out in the plane of the average maximum slope, for a simple slope

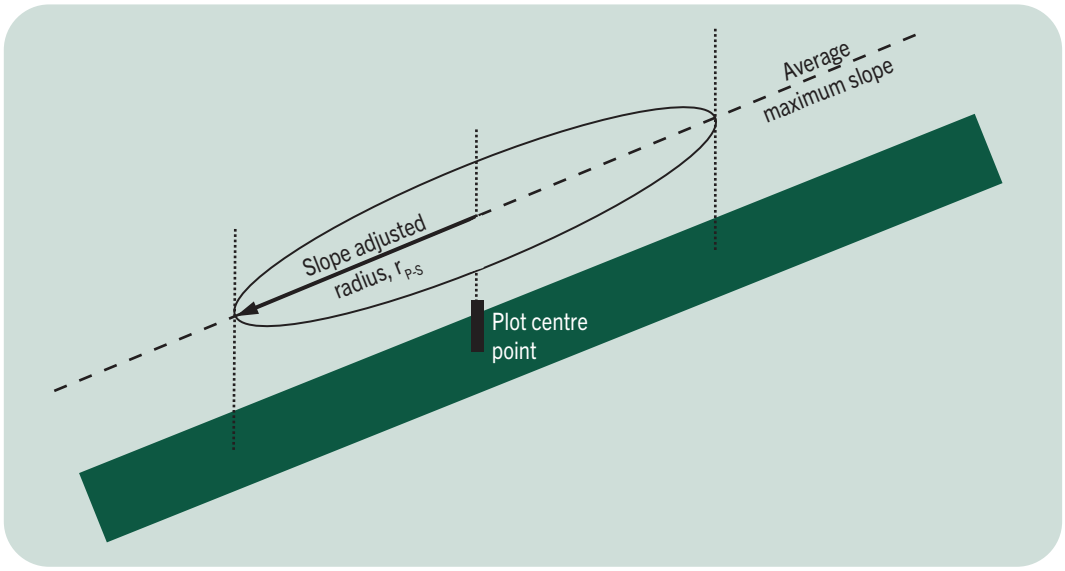
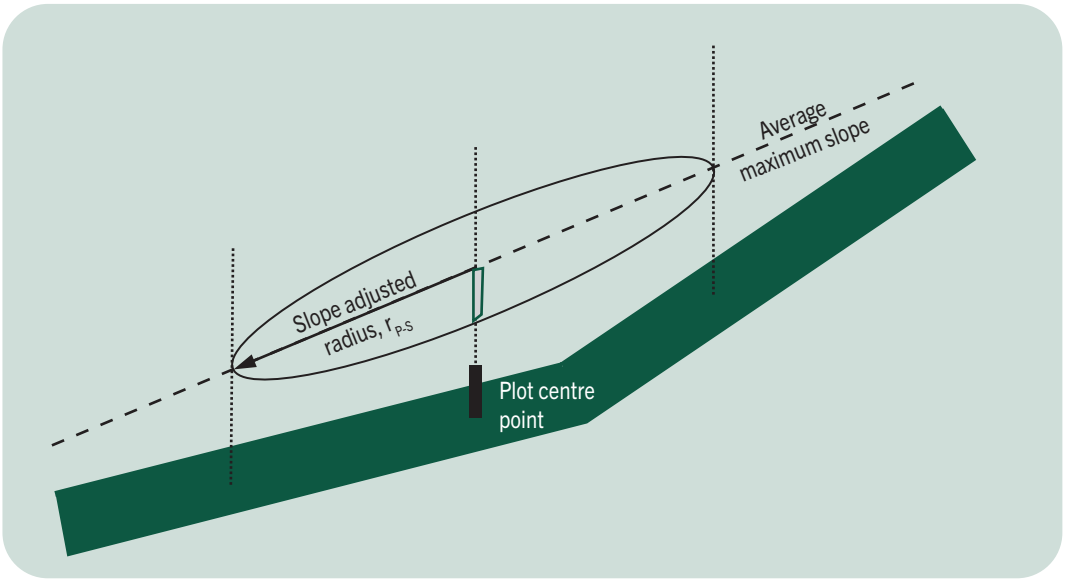



Figure 4b: Circular plot laid out in the plane of the average maximum slope, for a compound slope




Occasionally, there may be no trace of a previously established sample plot – most likely only after harvesting, and even then only if the stumps of the witness trees have been removed. In this case, the *Field Measurement Approach Standard* requires that the sample plot location be re-established, and marked, as if a new plot. If this occurs, record that the plot centre point has been re-established because previous plot markings could not be found, and repeat the procedure to determine the position of the plot centre point summarised in Step 3-B above (and described formally in the *Field Measurement Approach Standard*, Part 3).

### Practical considerations when establishing sample plots

- before establishing the sample plot, confirm that no navigation mistakes have been made by checking that the actual location of the plot on the ground (as best judged from the landform and features) matches the expected location as plotted on an aerial photograph or forest map;
- if a witness tree in a dense young stand cannot be seen from the sample plot centre point, use a height pole to mark the position of the tree;
- locating the sample plot as accurately as possible makes it easier to find during quality control, when re-visiting the plot in the future, or in case of an audit being conducted by MPI. To assist with finding the plot in future, consider also:
  - collecting GPS waypoints at intermediate locations, access points to the forest, and along routes taken;
  - recording a description of the access route, or of any distinguishing features in the vicinity of the plot – such as readily identifiable rocks, streams etc;
- marking (with pegs) the corners of square sample plots will help when laying out the plot in the future;
- keep tree markings to a minimum so the plot area is more likely to be treated the same as the surrounding forest (as required by the Regulations) during silvicultural operations, and the plots less likely to be disturbed by other forest users; and
- plot locations should be more visibly and permanently marked after the completion of silvicultural operations in the stand the plot is located within.

## Collect FMA Information at Sample Plots

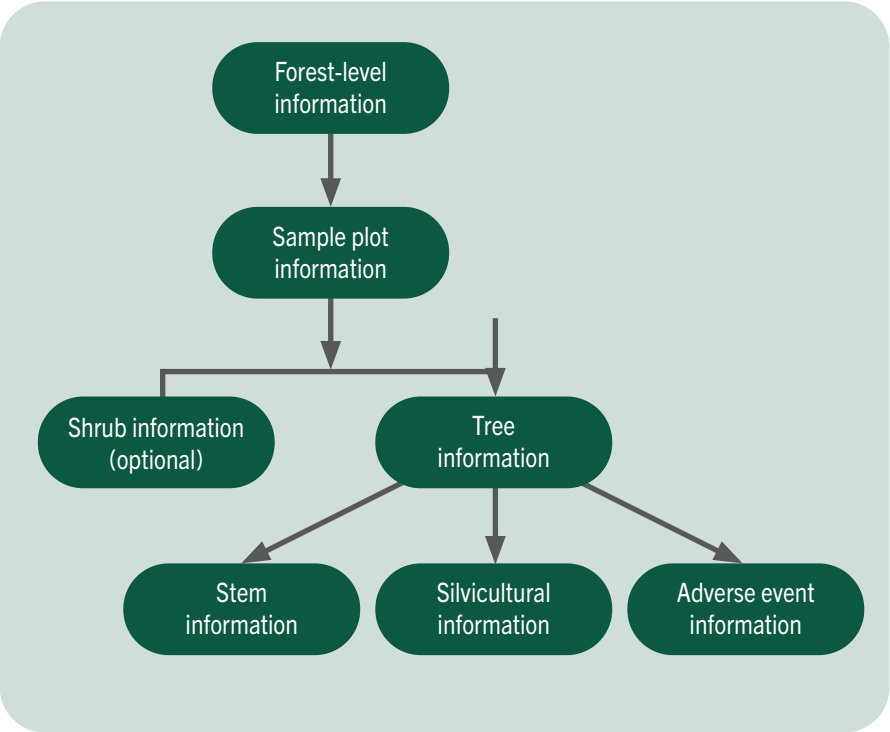

The Regulations, together with the *Field Measurement Approach Standard*, require that three primary categories of FMA information be collected, recorded and submitted to MPI:

- information about the FMA participant and their forest land-holdings – such as the participant's name and address; their choices made regarding collecting FMA information about their registered forest land (e.g. whether collecting FMA information for shrubs, collar diameters for small trees, and use of a nominated species list – by forest class, if forest class has been assigned);
- information about where the FMA information is collected from – information about each sample plot at which FMA information is collected, such as the plot identifier, centre point coordinates, area, dimensions, average maximum slope angle if on a slope, whether the plot includes shrubs or trees etc; and
- the actual FMA information collected about the shrubs (optional) and trees in each active sample plot – for shrubs, the shrub type, crown cover, and crown height; and for trees such things as the species, stem diameters, whether live or dead, a sample of heights, the past and future intended silviculture, and the impacts of any previous adverse events on stocking.

These categories of information can be envisaged as a hierarchy of seven information types as depicted in Figure 5.

A full description of the information that must be collected is given in the *Field Measurement Approach Standard*, (Part 8). The form and format in which the information must be submitted to MPI is to be given in the *Field Measurement Approach Information Standard*, which is particularly relevant for FMA

Figure 5: Types of information collected under the FMA




participants submitting data electronically. The *Field Measurement Approach Information Standard* also specifies the dimensions (metres, centimetres etc), and number of digits and decimal places that must be used, when information is collected and submitted.

The information to be collected under the seven information types depicted in Figure 5 is also summarised and described in Appendix 1, Tables A1 – A7 of this guide. To help ensure all relevant data is collected, it is recommended FMA participants, inventory providers or forestry consultants take a copy of the *FMA Information Checklist* into the field when collecting FMA information.

*When recording FMA information at sample plots, always reference the plot identifier specified by MPI during plot allocation.*

### Active and inactive sample plots

Sample plots established under the field measurmeent approach may be inactive at certain times. A plot is inactive if it's in a carbon accounting area where:

- the land is registered under averaging accounting and all of the forest in the carbon accounting area reached the average age for the forest type or was on a subsequent rotation before the start of the mandatory emissions return period, or before the carbon accounting area was created;
- the land has been approved as post-1989 offsetting land;
- the land has been approved as temporary adverse event land.

When a plot is inactive, it is not part of the FMA participant's definitive set of plots. The participant is not required to collect information at these plots.

**Important note: Collecting FMA information in more complex cases**

The stepwise description of collecting FMA information that follows deals only with the most common situation of a sample plot including trees that belong to a single Species Group[3], with all trees having the same age[4]. Collection of FMA information in more complex situations requires additional procedures to those described here, and is discussed in Section 5.

FMA participants must take account of the additional procedures in Section 5 if any of the following are found when collecting FMA information:

- the sample plot includes trees from more than one Species Group;
- there are trees in the plot that were not planted in the same year, or exotic regenerated trees that did not regenerate in the same year;
- part of a plot is unstocked as a result of harvesting.

**Collect FMA information: Key steps**

**4-A.** Determine if shrubs or trees are inside the perimeter of a sample plot (*Field Measurement Approach Standard*, Part 7)

**4-B.** Collect FMA information for shrubs (optional – *Field Measurement Approach Standard*, Part 8)

**4-C.** Collect FMA information for trees (*Field Measurement Approach Standard*, Part 8)

**4-D.** Obtain a sample of tree heights (*Field Measurement Approach Standard*, Part 8)

**4-E.** Collect FMA information on silviculture and adverse events (*Field Measurement Approach Standard*, Part 8)

*i* *Collection of FMA information for a sample plot must be completed within one month, and must not be started if silvicultural crews are operating nearby.*

### Step 4-A. Determine if shrubs or trees are inside the perimeter of a sample plot

FMA information is collected for only those trees and (optionally) shrubs within the perimeter of a sample plot. To determine consistently whether shrubs and trees are within the perimeter, a set of rules is given in the *Field Measurement Approach Standard* (Part 7). The rules are summarised below. For trees, the rules apply to all standing stems, whether live or dead, and are applied at the height at which stem diameter is to be measured (or estimated, if stem diameters of small trees are being estimated).

*i* *In most areas of New Zealand, mānuka and kānuka are considered forest species. In particular environments, they are considered shrub species. The participant must decide whether their mānuka and kānuka stands meet the definition of forest species in the given area.*

3 The Species Groups are: *Pinus radiata*, Douglas fir, exotic hardwoods, exotic softwoods, or indigenous species. The species in a Species Group are the same as those in a Forest Type. However, the definition of a Forest Type refers to species found within a minimum area of 1 hectare, whereas a Species Group refers to the species in any given area of interest – and in this guide usually refers to the species found in all or part of a sample plot.

4 The relevant age is that calculated according to regulation 52. For regenerating indigenous trees only, all trees are considered to have the same age (that of the trees to first regenerate following the change in land use that resulted in an area becoming forest land) – so trees in areas with regenerating indigenous species only are never considered to be intermingled trees.

**For shrubs** – any live shrub crown entirely within the perimeter of a sample plot, and any part of a live shrub crown that is within the perimeter (irrespective of the location of the shrub stem), is included when collecting FMA information for shrubs at a sample plot.

**For tree stems** – any live (or dead, if DBH is being measured) standing tree stem for which the centre of the stem is within the sample plot perimeter at the stem diameter measurement height, whether stem diameter is measured or estimated, is included when collecting FMA information for trees at a sample plot:

(a) if an electronic distance measuring device is being used which places the centre of the stem within 25 centimetres of the perimeter, a lineal tape must be used to check that the centre of the stem is within the perimeter; and

(b) if the lineal tape shows that the centre of the stem on one side of a tree is within 5 centimetres of the perimeter, the tape must be used to ensure that the centre of the tree on both sides is within the perimeter.

*If a tree has multiple stems that fork below the height at which DBH or collar diameter (as applicable) is determined, each stem is considered separately when deciding if it is within the sample plot perimeter.*

**Tip:** whenever using a lineal tape to determine if tree stems are in or out of a sample plot, the tape must be horizontal or if not the measured distance must be corrected for slope. Mark any trees that are near to but are determined to be outside of the plot perimeter (e.g. with a "X", using chalk) so they are not inadvertently measured.

### Step 4-B. Collect FMA information for shrubs

The FMA information required to be collected for shrubs, if shrub information is being collected, is summarised in Appendix 1, Table A3. The key parameters that need to be determined are estimates of crown cover and average crown height, for live shrubs in each of six shrub types that may be present. The crown cover value required is the total for a shrub type that is within the sample plot perimeter, expressed as a percentage of the plot area. (See Appendix 2, Figure A4, for a visual assessment scale that should be used when assessing crown cover.) The average crown height is calculated as an area-weighted average height, for all live shrubs in a shrub type.

*The definitions of crown cover, and crown height, in the FMA Standard mean that FMA information must be collected for live shrubs only.*

The default assumed during carbon calculations under the FMA is that any shrubs present are the same age as any trees present. However, shrub age must be estimated separately if shrubs are likely to be more than two years older or younger than the trees present. If no trees are present in a sample plot but there are shrubs, the shrub age must also be estimated. Since shrubs are regenerated species, the appropriate age to be recorded is that of the oldest shrubs that are present. It may be necessary to obtain an estimate of age by felling several shrubs of similar size to those in a permanent sample plot or sub-plot but somewhat outside of the plot perimeter, and determine their age by ring-counting. Historical photography with sufficient spatial detail may also sometimes be available to estimate when shrubs first regenerated.

### Step 4-C. Collect FMA information for trees

*If an FMA participant has a list of nominated tree species, FMA informaton for trees is only collected for species on the list – all other tree species are ignored.*

The FMA information required to be collected for trees is summarised in Appendix 1, Tables A4 and A7 – with some general information also required (e.g. on presence/absence) as summarised in Appendix 1, Table A1. Most of the information is simply obtained by direct observation, and needs no detailed guidance beyond the descriptions given in Appendix 1. The only other general guidance necessary is:

- when recording estimates of planted stocking based on stand records, for sample plots that include unstocked gaps, the stocking recorded for the plot should be estimated from the stocked area within the plot only;
- if trees for which FMA information must be collected are absent in a sample plot, the species group of the species expected to be present in the future (if any) must be recorded, or otherwise, that of the trees in the surrounding forest;
- if small trees with a DBH <25mm are present in a sample plot, they are only included in values recorded for stocking and average collar diameter if at least 300mm in height;
- FMA information for small trees must be collected if it is being collected for shrubs;
- if small trees below the diameter and/or height thresholds are growing in a sample plot, this fact must be recorded;
- if a tree species is not noted in the FMA information standard, record the relevant species group.

The parameters that most strongly influence the calculation of forest carbon stocks, and as such must be most carefully and consistently determined, are tree age, stem diameter, height and species.

### Determining tree age

The age of planted trees should in most cases be able to be accurately determined from planting records held by FMA participants – including in some cases from invoices submitted by contractors or bank statements indicating payment to contractors. In the absence of suitable records, it is likely to be necessary to determine age by ring-counting of a core sample, of a felled tree in the same stand that is likely to be thinned in the future and is well away from any permanent sample plot location. The stumps of trees felled during recent thinning can also be a useful source of age information obtained by ring-counting, if it can be determined when the thinning occurred.

In the case of regenerated trees, the *Field Measurement Approach Standard* requires that the age to be determined is that of the oldest trees that have regenerated following the land-use change which has allowed an area of non-forest land to become forest land. If the site being considered is one in which regeneration conditions are favourable, it will usually be sufficient to assume the trees regenerated in the year after the land-use change.

In areas with regenerated trees, older trees may be encountered in a sample plot that established significantly before the change in land management that allowed an area of former non-forest land became forest land. Typically, these older trees will be remnants from some earlier cycle of land clearance, which have acted as seed sources once the change in land management occurred that promoted the present conversion to forest land. It is not appropriate to use the date of establishment of such older seed-source trees to determine the age of first regeneration of trees in a sample plot. Conversely, recording the date of establishment for regenerated trees in the plot as the date of the land management change

(under good regeneration conditions) will result in the participant-specific carbon table for the plot being substantially overestimated, if older trees that regenerated much earlier are included in collected FMA information. Given these issues, when collecting FMA information for regenerating trees the following approach should be used:

(a) if the regenerated trees in a plot are likely to have established in a largely continuous sequence over time, from after a change in land management which has allowed an area of former non-forest land to become forest land, record as the date of first regeneration that of the oldest trees present; or

(b) if the regenerated trees in a plot are unlikely to have regenerated in a continuous sequence due to past land management practices (e.g. clearing or grazing) having largely suppressed past regeneration, yet the trees present nonetheless include any older (typically remnant, "seed source") trees likely to have established at least two years prior to the change in land management which has allowed an area of former non-forest land to become forest land:

- if including the older trees in reported FMA information, the date of first establishment of the regenerated trees that is recorded must relate to those older trees – which may however lead to a lower estimate of the average carbon sequestration rate for the plot; or
- the older trees may be excluded from the reported FMA information, and the date of first establishment recorded for the regenerated trees in the plot would be that of those trees first regenerating after the change in land management that promoted the conversion of non-forest land to forest land; or
- the sample plot may be relocated (according to the allowable relocation rules in the *Field Measurement Approach Standard*) so that it just excludes the older trees, and in which case the situation becomes equivalent to the last case above.

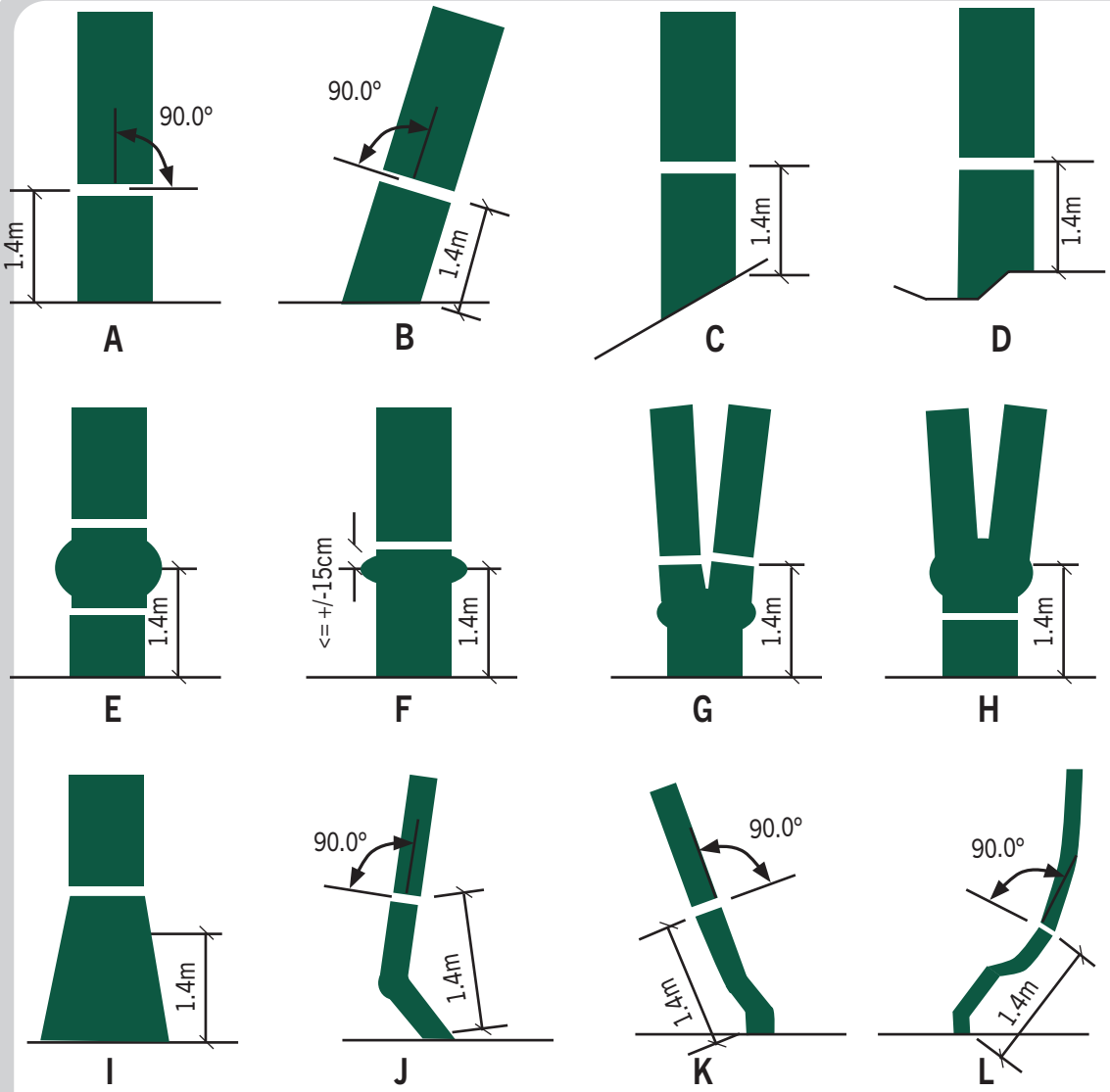
**Tip:** Although unusual, it is possible the date of first establishment recorded for regenerating trees could be before 1990. This could occur where a change in land management allowed regeneration to proceed before 1990, but the rates of establishment at the site were so low that the stocking of trees on 31 December 1989 would not (if those trees reached maturity) have been sufficient to qualify the area as forest land. Participants would be expected to have good supporting evidence of the land-use history and regeneration rates in such cases, for an area to be considered valid post-1989 forest land.

### Measuring tree diameters

As stems are often mis-shapen, or may be standing other than exactly vertical, situations that can lead to recording of anomalous values of stem diameter need to be identified and if unable to be avoided treated in a consistent manner. The guidelines given below, including those given in pictorial form in Figure 6, are considered good practice when determining stem diameters by measurement, and should be followed whenever possible:

- the height at which a stem diameter is measured is a height measured parallel to the direction of the tree stem from ground level – after any woody debris has been removed from the ground – and is taken from the uphill side of a tree stem if the tree is on a slope;
- stem diameters (DBH or collar diameter) are measured over the bark, perpendicular to the stem direction;
- the diameter tape must be kept at right angles to the axis of the stem as any deviation from this position will produce an incorrect measurement;
- all debris should be cleared from the stem before diameter measurement, so the tape sits flat over the bark;

Figure 6: Standard points of DBH measurement




## Key

| | |
|---|---|
| A | 1.40 m above ground level; 90 degrees to the stem axis |
| B | Leaning stem on flat ground; 1.40 m on the side of the tree leaning towards the ground |
| C | Sloping ground; taken from ground level on the high side |
| D | Uneven ground; taken from ground level on the higher side |
| E | Large swelling; two diameters taken at equal distances from breast height that are the nearest positions on the stem that are normally shaped – record average diameter |
| F | Small swelling; single diameter taken above at the nearest position on the stem that is normally shaped if moving less than ±15cm from breast height |
| G | Forked significantly below breast height; the diameter of each stem is measured |
| H | Fork at breast height; single diameter taken at the nearest position on the stem that is normally shaped below fork |
| I | Butt flaring or buttressing at breast height; single diameter taken at the nearest position on the stem that is normally shaped above |
| J, K L | Small bent or crooked stems; breast height of 1.40 m measured in a straight line parallel to the average direction of the lower stem section. |

- where there is nodal swelling, uneven taper, or malformation at the measurement height, if possible the measurement should be shifted to the nearest position on the stem that is normally-shaped and is within 15 cm of the standard measurement height (i.e. shifted up or down for DBH, but only up for collar diameters);
- if when determining DBH the nearest position on the stem that is normally-shaped is more than 15 cm from breast height, two stem diameter measurements must be taken just clear of the malformation and equidistant above and below breast height. The recorded DBH must be the average of the two measured stem diameters. (For collar diameters only one diameter measurement is taken, as far above any malformation as necessary);
- when a tree has forked below the standard measurement height, it is treated as two separate stems, and diameter measurements are completed for each stem – and if any stem is below the 25 mm diameter threshold for a DBH measurement, its diameter measured just above the fork may be treated as a collar diameter if collar diameters are being determined; and
- where a tree forks at or immediately above the standard measurement height, measure the diameter of the stem below the fork.

**Tip:** when the diameter of a stem has been measured, the stem should be temporarily marked (e.g. with chalk) to reduce the risk of double counting, and to assist with quality control. The point at which stem diameter is measured should also be marked. Permanent markings should be avoided until after final thinning, to reduce the risk of plots being identified and treated differently by silvicultural crews. Once thinning is complete, permanent marking is considered good practice.

**Tip:** FMA participants that have elected to record collar diameters may determine these by estimation rather than measurement, if wished. If estimation is used, it is the average diameter of those stems with a height of at least 300mm that is determined (together with an estimate of the stocking of those trees).

**Step 4-D. Obtain a sample of tree heights**

*If an FMA participant has a list of nominated tree species, tree heights are only collected for species on the list – all other tree species are ignored.*

To determine forest carbon stocks, both the diameter and height of trees must be known. As measuring tree height is much more time-consuming than measuring stem diameters once the trees are relatively tall, the *Field Measurement Approach Standard* (Part 8) provides for just a sample of tree heights to be measured – for a selection of those stems for which stem diameter is measured. The selection of trees for the sampling of heights is governed by rules in the Standard, which can be summarised as:

(a) the trees must be live, and must not have suffered significant breakage or have any other malformation that would significantly impact height development;

(b) only stems with a measured diameter (either a DBH, or collar diameter if collar diameters are being measured) can be used in the sample of measured height trees;

(c) a minimum of 8 trees with stem diameters spread across the range in the sample plot must be selected, for each species group represented in each sample plot;

(d) if there are less than 8 trees in a species group, in a given sample plot, all trees in the species group must be selected (subject to (a) and (b) above);

(e) for each species group, there must be at least 50 heights recorded across all of the FMA participant's sample plots unless there are fewer than 50 tree stems in a species group in total – in which case heights must be recorded for all tree stems in that species group (subject to (a) and (b) above);

(f) if sets of trees with DBH and collar diameters are being measured within a sample plot, the rules for selecting a sample of height trees apply to both sets individually – and also to the rule for the minimum total number (50) of tree stems selected across all sample plots.

*i* *If a plot has less than eight stems eligible for height sampling, make a note that all eligible stems in the plot have been selected. If the required sampling number is not met, MPI may request further information as to the reasons why the required minimum was not met.*

*i* *Although tree heights are sampled, the height of all broken-topped trees (live and dead) that are less than two-thirds their expected height in an unbroken state must also be measured – and not used as part of the sample of height trees.*

*i* *The heights of all tree ferns, cabbage trees and nikau palms must also be measured.*

When determining the height of trees, in addition to the requirements of the *Field Measurement Approach Standard*, the guidelines given below in this section are considered good practice and should be followed whenever possible – including those given in pictorial form in Figure 7:

- height trees must not have excessive lean (more than 5° from vertical);
- avoid multi-stemmed trees, though this will sometimes not be possible for regenerating indigenous trees, and in such cases choose the dominant stem of a multi-stemmed tree;
- to minimise possible measurement errors, ensure there is a clear view of the top of the tree and the bottom of the tree or datum, and keep the sighting-angles within the manufacturer's specifications for the equipment;
- leaning trees (5° or less from vertical) must be measured with the observer at 90° to the direction of the lean, with the datum positioned on a line drawn vertically from the tree tip to intersect ground level;
- height poles may be used, especially where trees are less than 5.0 m tall;
- measurement procedures must comply with any manufacturers' specifications for the equipment.

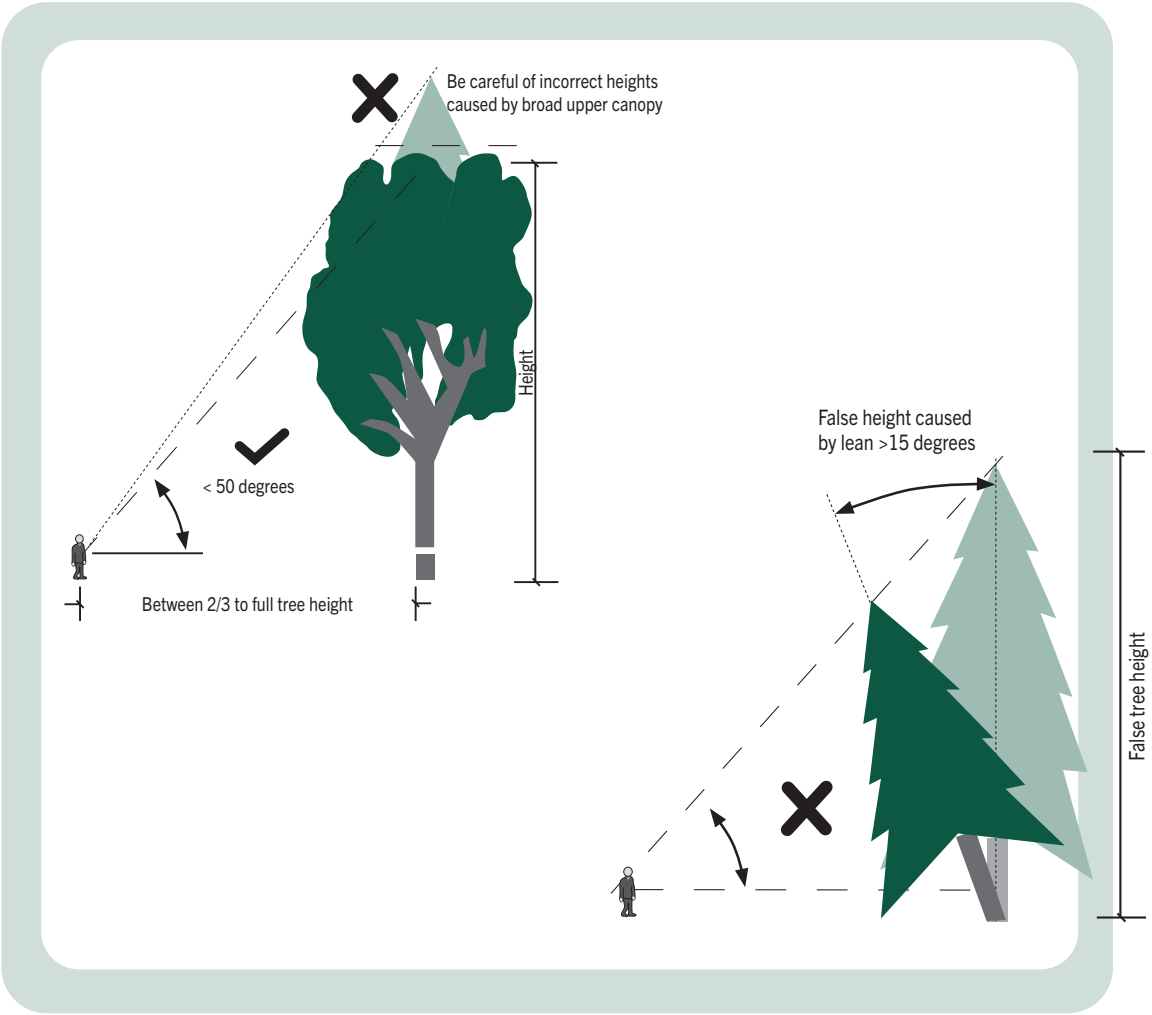
**Tip:** if an FMA participant has elected to record collar diameters of small trees as an estimate of the average diameter, the average height of those trees close to the average collar diameter is also estimated.

### Step 4-E. Collect FMA information on silviculture and adverse events

The FMA information required to be collected for silviculture and adverse events is summarised in Appendix 1, Tables A5 and A6. Most of the information is simply obtained and needs no detailed guidance. Note however that if both planted and regenerated trees are present, the information recorded must relate to the planted tree component only.

*i* *If intermingled trees are present, there are additional requirements on the sets of trees for which silvicultural or adverse event information is collected. Further information is given in 5 of this Guide, under Collecting FMA information for intermingled trees.*

Figure 7. Determining tree height




When determining residual stocking after silvicultural or adverse events, it should be noted that the *Field Measurement Approach Standard* (Part 8) requires:

(a) for the most recent thinning or adverse event – that the residual stocking be determined simply by counting the live stems that likely remained within the sample plot at the date of thinning or of the adverse event (i.e. including making allowances for any natural mortality since that date and the date FMA information is being collected); or

(b) for a thinning or adverse event prior to the most recent – that the residual stocking should if possible be determined by identifying and counting the stumps of cleared trees expected to have been within the sample plot after a particular prior thinning or prior adverse event.

If there are no stumps visible, or the stumps are too decayed to associate uniquely with a particular thinning or adverse event, the residual stocking may be estimated. In this case, both the estimated value and method of estimation must be recorded.

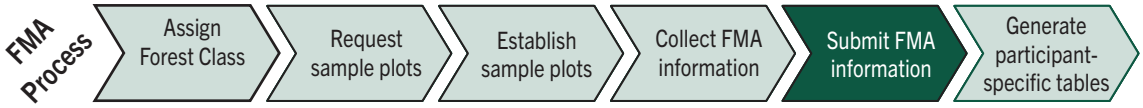
**Example (counted residual stocking):** according to forest records, a forest stand has been thinned when 6 and 11 years old, and is now 13 years old. When collecting FMA information, the counted stocking in a sample plot in the stand is found to be the equivalent of 500 stems per hectare (st/ha), and no natural mortality appears to have occurred since the thinning 2 years ago. Stumps from the thinning when the stand was 6 years old are just still discernible, and a count of these added to the count of live standing stems that remain at present puts the residual stocking after the earlier thinning at the equivalent of 730 st/ha – and this is the value recorded for the sample plot. A check shows this is consistent with stand records, that recorded the target stocking set for the thinning contractor was 750 st/ha.

Estimation of residual stocking after thinning should be performed using the following information sources and records (in order of preference):

- stand records;
- quality control data for the thinning operation;
- contractor payment records;
- personal knowledge of the owner or consultant.

More generalised information from damage surveys, or records of visual impact assessments, will likely have to be used when estimating residual stocking after adverse events.

## Submit FMA Information




FMA participants are required to submit FMA information to MPI so that participant-specific carbon tables can be generated for use in preparing emissions returns. Participants are required to supply their FMA information, and any additional information required by the FMA Standards, using MPI's on-line transaction system. From late January 2023, there is a new online system for forestry in the ETS called Tupu-ake. This new system does not have the data entry functionality for submitting FMA information. FMA participants must use the old online transaction system to submit their FMA information only. Participants must request access to the old online transaction system when they need to submit their information. The online system allows for supply of information using two methods:

(a) manual data entry;

(b) by uploading an electronic data file – for those FMA participants that have collected their information electronically.

*i* *The form and content of files provided by or submitted to MPI in relation to the FMA must comply with requirements given in the Field Measurement Approach Information Standard.*

### Submission of complete sets of FMA information

FMA information must be collected at all allocated sample plots, and submitted to MPI, at least once in every mandatory emissions return period – and in time to use definitive participant-specific tables for the emissions return that must be filed after the end of each mandatory emissions return period. FMA participants may collect FMA information more frequently if they wish. Forest growth rates can be quite accurately modelled forward in time once trees are well-established, provided key silvicultural information such as the timing, intensity and type of thinning are known.

Generation of a set of participant-specific carbon tables requires that valid data for all sample plots allocated to an FMA participant's forest land-holding be used (unless there is a waiver from some or all FMA requirements). FMA participants must formally declare the complete set of data used for generation of such tables is true and correct, in terms of both data content and compliance with all aspects of the Regulations.

There are circumstances where FMA participants may need to supply a new or updated set of FMA information for only a few individual sample plots. For example, after sample plots are allocated to new forest land but FMA information for plots on the prior land has already been collected during the mandatory emissions return period. MPI provides a process whereby a complete set of FMA information for an individual sample plot may be supplied, if wished. To satisfy the requirement that participant-specific tables must be generated using information for all allocated sample plots, the process combines new information for a plot with FMA information already held by MPI for all other sample plots, to form a complete dataset for submission. This can only be done if the information already held by MPI for all other sample plots remains valid and compliant with the Regulations.

### Updating silvicultural and adverse event information only

Accurate forecasting of forest carbon stocks, for completion of emissions returns, is a key objective of the FMA. As such, silvicultural information must not only be included when collecting FMA information at sample plots, but also updated if future silvicultural intentions recorded in that information change before the emissions return following the end of the mandatory emissions return period is due.

Similarly, if adverse events result in the clearing of a significant number of the trees in a sample plot after the FMA information for the mandatory emissions return period is collected, the impacts of such events must be estimated and the FMA information held by MPI updated. MPI provides a process whereby silvicultural and/or adverse event information can be updated for individual sample plots, and combined with all other data held to form a complete set of FMA information for formal submission. All information other than that updated must remain valid and compliant with the Regulations, when this is done.

The rules that specify how updated silvicultural or adverse event information can be determined, and when it must be provided, are given in the *Field Measurement Approach Standard* (Part 8) – and can be summarised as follows:

(a) the required FMA information may be estimated from other records, or may be new information collected at affected sample plots if wished;

(b) updated FMA information for silviculture must be submitted if FMA information for the mandatory emissions return period has already been submitted, and any of the following has occurred since:
- the year in which any thinning that was expected to occur is no longer valid;
- the residual stocking of any thinning that was expected to occur has changed by more than 10 percent;
- there has been a change in whether stems that are expected to be thinned would remain on site or be removed from the site;

(c) updated FMA information for adverse events must be submitted if FMA information for the mandatory emissions return period has already been submitted, and since then, there has been one or more adverse events that are expected to have resulted in total in the clearing of more than 10 percent of the basal area[5] of tree stems within a sample plot.

5 "Basal area" means the cross-sectional area of the stem of a tree measured over bark at a point that is 1.4 metres from ground level on the uphill side of the tree and expressed in square metres.

**Submit FMA Information: key steps**

**5-A.** Log on to Tupu-ake – Forestry ETS online services and select the service to request participant-specific tables

**5-B.** MPI provides access to the online transaction system where FMA information must be submitted

**5-C.** Add forest-level information (and FMA choices, when first made)

**5-D.** Enter or upload FMA information

**5-E.** Complete validation processes

**5-F.** Complete declarations

### Step 5-A. Log on to Tupu-ake – Forestry ETS online services and select the service to request participant-specifc tables

FMA participants use their usual RealMe log-on and password to gain access to Tupu-ake – Forestry ETS online services. In the services menu, they must select **Post-1989 forest land** > **Measure the forest** > **Ask for participant-specific tables**.

### Step 5-B. MPI provides access to the online transation system where FMA infomation must be submitted

MPI enables the participant's access to the online system where they need to upload FMA information. Participants may recognise this online system as the previously used system for all forestry ETS transactions. Participants can use this system to upload their information only when enabled by MPI.

### Step 5-C. Add forest-level information

Enter the forest-level information summarised in Appendix 1 (Table A1) , including (if this is the first time data is to be entered in relation to an area of forest land) any choices that have not previously been notified for that land in relation to collecting FMA information for shrubs, small trees, and use of nominated tree species.

### Step 5-D. Enter or upload FMA information

Supply the sample plot, shrub (if being collected) and tree information summarised in Appendix 1 (Tables A2 – A4), together with the tree stem, silviculture and adverse event information summarised in Tables A5 – A7 of Appendix 1 – either entered manually, or by uploading a datafile containing the information in the format specified in the *Field Measurement Approach Information Standard*. The FMA participant first selects which sample plots FMA information is being supplied for, and whether it is a completely new set of information for those plots or updated silvicultural and/or adverse event information only. More information can be found in the *FMA Online Use Guide*, available at: www.govt.mpi.nz/the-field-measurement-approach-fma/

### Step 5-E. Complete data checking processes

MPI completes a series of format, completeness and consistency checks on the submitted FMA information to ensure compliance with the *FMA Information Standard*, followed by rule-based checks to identify any possible anomalies in the information. The submitter must correct any issues found, either

on-line or by uploading an amended XML file if submitting data electronically. All error messages must be resolved (and warning messages reviewed and acknowledged as arising from genuine but unusual data) before the submission can proceed.

*MPI may seek confirmation of submitted FMA information that appears unusual, and may require supporting evidence before such information is accepted. Best practice to minimize delays to the production of participant-specific tables is to address validation warnings either in the submitted data or in an email.*

### Step 5-E. Complete declarations

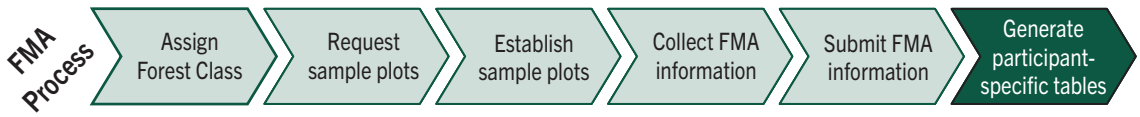
Once checking of the format, completeness and consistency of submitted information is complete, FMA participants are required to formally declare that:

- the information submitted is true and correct;
- it has been collected from the sample plots to which it is attributed;
- the management and silvicultural regime within the plot is consistent with that for the participant's registered post-1989 forest land of the same forest type and age in that locality.

MPI then completes the process of constructing participant-specific carbon tables from the submitted information.

*It is the responsibility of FMA participants to ensure that all information they submit is correct and compliant with the Regulations and FMA Standards.*

## Generate participant-specific tables




This step is carried out by MPI on behalf of an FMA participant, by using the MPI Carbon Calculator to generate participant-specific tables of forest carbon stocks, and carbon stocks in harvest residues – for each forest type that FMA information exists for. Each set of tables is unique to an FMA participant's registered forest land, having been derived from the FMA information collected at sample plots on that land.

*If an FMA participant's registered post-1989 forest land area changes, their participant-specific tables must usually be updated. FMA participants must be familiar with the relevant sections of the Regulations if making changes to their forest land area – see also Section 5 of this guide.*

### MPI carbon calculator

The MPI carbon calculator uses the participant's FMA information, and data derived from that information, to model forest growth and carbon yield over time – including taking account of past and intended future silviculture, and the impacts of any adverse events. The carbon yield curves for tree species in individual sample plots that belong to a single forest type are averaged, and the fraction of harvest residues that would normally be expected to remain on site if trees of a given age were harvested is calculated.

The calculations above produce two participant-specific carbon tables for each forest type that is represented by the tree species in the sample plots allocated to an FMA participant's forest land:

- a participant-specific table of forest carbon stocks, in tonnes of carbon dioxide per hectare; and
- a participant-specific table of residual carbon stocks, in tonnes of carbon dioxide per hectare.

These tables are formulated in the same way as the default carbon tables given in Schedule 4 of the Regulations for post-1989 forest land, except that they are derived from the FMA information submitted by each FMA participant. The forest carbon stock table includes, as do the tables in the Regulations, the contribution from above-ground residual wood and below-ground roots that remain on site after clearing of trees when thinning or harvesting occurs. If an FMA participant has collected FMA information for shrubs, the shrub component is included in the tables.

The carbon yield curves that the participant-specific tables are derived from are calculated using New Zealand and international forest growth and yield models, and allometric equations. The process takes into account good industry practice in the New Zealand and international forestry sectors for determination and forecasting of forest carbon stocks. Well-proven New Zealand-specific models are used whenever possible. The Regulations require the overall process and outputs to be peer reviewed by experts in the fields of forest inventory, forest growth modelling, and forest carbon stock estimation.

### Using the participant-specific tables

Once participant-specific tables of carbon stocks are produced for an FMA participant, the participant must use the tables when calculating forest carbon stocks for all future emissions returns. If an FMA participant has small areas of land with a forest type that a participant-specific table was not produced for (because by chance, being a small area, no sample plots landed on it) carbon stocks are calculated using the default carbon tables for that forest type given in Schedule 4 of the Regulations.

Sample plots may be inactive in certain circumstances. If an FMA participant has less than two active plots (or, if they have both forest classes assigned to their land, less than two plots on either forest class) at the end of a mandatory emissions return period, they must use the default carbon tables in Schedule 4 of the Regulations for the emissions return at the end of the period. For all other emissions returns, they must use their latest participant-specific tables, regardless of whether the sample plots they are based on are active or not.

FMA participants prepare emissions returns in exactly the same way as non-FMA participants, except that they use participant-specific carbon tables whenever available instead of the default tables. Guidance on the calculation of carbon stocks using either participant-specific or default carbon tables is available at www.mpi.govt.nz/calculating-the-amount-of-carbon-in-your-forest-land/

FMA participants must make an additional declaration when submitting their emissions return at the end of a mandatory emissions return period: that the silvicultural and adverse event information provided at the time the tables being used were generated remains valid.

# OTHER FMA PROCEDURES AND REQUIREMENTS 4

## Purpose of this section

This section provides information on practical implementation of the FMA in addition to that available in the Regulations or FMA Standards. It covers procedures and requirements that are not a direct part of the six-step FMA process, but that may have implications for that process. FMA participants should be aware of these implications to ensure they comply with the wider requirements of the FMA under the Regulations. Described here are procedures and requirements for:

- selecting and notifying nominated tree species;
- obtaining a temporary or permanent waiver from FMA requirements;
- requesting an extension for collecting and submitting FMA information;
- requesting a new set of sample plots – once in a new mandatory emissions return period;
- applying the FMA under the Permanent Forest Sink Initiative (PFSI);
- compliance and audit in relation to the FMA.

The intended audience for this section is:

- FMA participants that plan to complete FMA requirements themselves;
- anyone completing any administrative aspect of the FMA on behalf of an FMA participant;
- forestry consultants or any other providers of forest inventory or related forestry services to FMA participants.

**Tip:** this section of the guide is an elaboration of, and not a replacement for, the Regulations and FMA Standards. Those reading this section of the guide are expected to have an overall working knowledge of the Regulations and Standards – with those providing professional advice on the FMA expected to have a thorough knowledge.

## Nominated tree species

To reduce sampling costs, FMA participants may choose to nominate a list of specific tree species they wish to collect FMA information for. If forest class has not been assigned, a single list of nominated species applies to all of an FMA participant's registered forest land. In all cases, sufficient tree species must be nominated such that at the time of harvest or maturity they are expected to comprise at least 85 percent of the crown cover of an FMA participant's registered forest land (in each forest class, if forest class is defined).

*i* *Nominating a tree species is a one-time decision that cannot be revoked.*

FMA participants need to give careful consideration to the decision to have a nominated species list, as species cannot be removed from the list, and species not on the list must be ignored when collecting FMA information. For example, an FMA participant with an exotic forest managed for both timber and carbon may choose to nominate only the exotic merchantable timber species as those for which FMA information

will be collected. In this case, FMA information must not be collected for any regenerating indigenous tree species, or other exotic tree species, that are not on the nominated species list.

Nominating tree species is likely to be less suitable for regenerating indigenous forest, due to the species diversity and resulting uncertainty over which species will predominate through the different stages of forest growth and development. However, forest species can always be added to a nominated species list if they become important. By contrast, exotic forests that have gaps in which a regenerating indigenous forest species such as kanuka occurs may or may not benefit from including kanuka on the nominated species list. If the gaps are numerous and large enough that kanuka is not suppressed by the surrounding exotic forest species, inclusion may be worthwhile. Alternatively, if the gaps are relatively small, the kanuka is likely to die out as the exotic forest canopy closes, without any net medium-term carbon gain – in which case including kanuka on the nominated species list is unlikely to be cost-effective.

Excluding a tree species from a nominated tree species list may however result in lower forest carbon stocks being determined than if the species was included. This could occur if an excluded species accounts for a significant fraction of total crown cover (e.g. 10 percent) and is unlikely to be suppressed by other surrounding species. In such a case, FMA information for the excluded tree species would not be collected at sample plots, nor would its carbon contribution be included in participant-specific carbon tables generated. FMA participants will need to weigh the relative merits of having a nominated species list in terms of reduced sampling costs versus any reduction that may result in forest carbon stocks determined under the FMA.

**Tip:** MPI's on-line system allows FMA participants to create a nominated tree species list when they submit their FMA information. Participants can also add further tree species to the list, but they cannot delete tree species from the list.

## Waivers and extensions

An FMA participant may, in unusual circumstances only, be granted a waiver from FMA requirements or an extension for requesting the allocation of plots or collecting their FMA information[6]. Two types of waivers are available: permanent, and temporary.

### Permanent waivers – from FMA requirements for individual sample plots

Permanent waivers are a dispensation from the requirement to establish an allocated sample plot, and/or to submit FMA information for an allocated sample plot. If an FMA participant finds that establishing a sample plot in the location specified by MPI, or collecting FMA information from a plot that has already been established, is dangerous or impractical, they may apply for a permanent waiver from meeting FMA requirements for that plot. Dangerous or impractical conditions might include:

- sample plots located on cliffs, or slopes greater than 45 degrees;
- where there are conditions at the sample plot location posing a long-term hazard (e.g. water, marshland, wind-thrown stems caught up in the canopy of other trees);
- where a hazard exists because the sample plot falls partly on an arterial road that has not been excluded when mapping forest land (whereas it to allow plot establishment and collection of FMA information would be expected that traffic management to allow plot establishment and collection of FMA information would be a viable option for plots extending onto secondary roads or access tracks).

Applications for a permanent waiver must be made and approved before FMA information from the

6 See regulations 74 and 75.

sample plot is required to be submitted to MPI, and must specify:

- why it is dangerous or impractical to establish a sample plot and/or collect FMA information at a plot;
- whether it is possible to **estimate** the FMA information for the sample plot reliably, and if so how that estimate is to be made and any adjustment factor(s) that may be necessary;
- the location of the centre point of any alternative equivalent sample plot – as an Easting and Northing in NZTM2000, using a datum of NZGD2000 or WGS84 – the FMA participant proposes to establish and use instead, and a justification of why the alternative plot would be in an equivalent area of forest.

If a permanent waiver is granted for a sample plot, MPI will also decide whether to require any proposed estimation of FMA information for the plot, or allow the establishment of an alternative equivalent plot. MPI may also, as a condition of the waiver, remove any requirement to establish an alternative sample plot and/or to provide any estimate of FMA information in relation to the plot. In this case, only the FMA participant's remaining plots will be used to generate participant-specific carbon tables. However, the use of fewer plots may result in forest carbon stocks being determined with less accuracy. FMA participants with difficult sites who want to maintain accuracy may wish to consider requesting a small number of additional sample plots above the minimum number required to be allocated, if they anticipate some plots may be excluded from collection of FMA information under a permanent waiver.

Permanent waivers will not be granted where a reasonable estimate of the forest carbon stocks can be made without visiting the plot location, nor where forest carbon stocks are negligible or zero. For example, a waiver will not be granted for a sample plot that falls entirely on an area permanently without trees – such as a road, bare rock, sand, or water body. Neither will waivers be granted for established plots that have been completely cleared due to adverse events. These are still considered valid plots, albeit with above-ground (and possibly also below-ground) carbon stocks of zero, and as such must be included in the set of plots for which FMA information is submitted to MPI.

## Temporary waivers – from FMA requirements for MERP-end emissions returns

Temporary waivers are a dispensation from the requirement for FMA participants to use definitive participant-specific tables for a emissions return that is due at the end of a mandatory emissions return period. A temporary waiver may be sought when additional sample plots have been allocated as a result of adding or removing registered forest land, and there is insufficient time before the end of the mandatory emissions return period to establish the sample plots and/or to collect and submit FMA information for those plots. A temporary waiver may also be sought when there are circumstances beyond an FMA participant's control that prevent the collection and/or submission of FMA information to MPI for sample plots already established.

Applications for a temporary waiver must be made at the same time as adding or removing land, if this is what has caused the need for a waiver. Otherwise, an application for a temporary waiver must be made as soon as practicable after the need for the waiver becomes apparent, and before the deadline for submission of the associated emissions return. Applicants seeking a temporary waiver must describe the circumstances that are preventing compliance with the Regulations within the available timeframes, and the steps they have taken to attempt to meet those requirements.

Where a temporary waiver is granted because an FMA participant is unable to complete FMA requirements they must use in their calculations for the MERP-end emissions return[7]:

- their latest participant-specific tables, or;
- if they do not have any participant-specific tables, the default tables in the Regulations.

7 See regulation 74.

## Requesting an extension for collecting and submitting FMA information

An FMA participant may apply for more time to meet their FMA requirements of:

- applying for the allocation of permanent sample plots, or
- collecting FMA information from their sample plots.

An extension may be granted only if they are unable to meet the requirements due to circumstances beyond their control.

Participants must apply for an extension as soon as it becomes clear that they are unable to meet the requirements on time, and before the end of the mandatory emissions return period. In their application, they must explain why they are unable to meet the requirements. They must also provide evidence of this.

## Supporting information

Applications for permanent or temporary waivers must include evidence supporting the reasons the waiver is sought, such as:

- photographs that clearly confirm the location of a sample plot, or collection of FMA information at the plot, is dangerous or impractical – including the GPS coordinates of the point at which the photos were taken, and the direction of view;
- information from land-owner or forest-owner hazard registers, or correspondence or statements from qualified forest health-and-safety professionals regarding the safety of the site;
- correspondence from forest inventory providers or consultants showing they are not available to undertake FMA requirements within the required timeframe – contact with at least three providers is expected.

More information about applying for a waiver or extension is available at:
mpi.govt.nz/waivers-and-time-extensions-for-measuring-sample-plots-and-using-carbon-tables/

# Requesting a new set of sample plots

FMA participants may if they wish request a completely new set of sample plot locations once in any new mandatory emissions return period[8]. Reasons for requesting a new set of sample plots might include that carbon prices have risen considerably, and more plots are required to obtain a more accurate estimate of forest carbon stocks. . Another reason may be that multiple additions or removals of forest land over time have resulted in more plot locations allocated than the minimum required, resulting in increased costs for collecting FMA information.

MPI allocates the new sample plots as if the FMA participant is receiving sample plots for the first time – by forest class, if forest class has been assigned. Once MPI has allocated new plots, the FMA participant must follow the normal FMA process for those plots, and use new participant-specific carbon tables generated from FMA information collected at those plots for future emissions returns. These new participant-specific tables must be acquired in time for the emissions return at the end of the mandatory emissions return period. The old sample plots are no longer used for any FMA requirements.

8 See regulation 59(3).

Before making an application for new sample plots, an FMA participant may wish to assign forest class if previously unassigned, or to un-assign any previously assigned forest classes. If continuing with use of forest classes, any updating required of assigned classes due to changes in forest species must be completed before new sample plots can be allocated. The participant may also at this time change two of their key choices made in relation to collecting FMA information – whether to collect information for shrubs, and for small trees (noting that if information for shrubs is being collected, information for small trees must also be collected).

*i* *When a new set of sample plots is allocated, FMA participants may not remove any tree species from a list of nominated tree species.*

## Applying the FMA under the PSFI

A forest owner with a forest sink area of at least 100 hectares covenanted under the PFSI is considered to be an FMA participant, and must meet all FMA requirements if subject to the FMA under the terms of their covenant. If forest owners with land covenanted under the PFSI also have forest land registered in the ETS, PFSI forest sink areas and ETS registered post-1989 forest areas are considered independently when deciding if the 100-hectare threshold for the FMA applies[9].

Except as indicated in this section, the Regulations and FMA Standards apply to PFSI covenant holders in exactly the same way as to ETS participants. However, some of the terminology used in the PFSI Regulations and covenants is different to that used in the ETS – as given in Table 5 below.

### Table 5. Equivalent terms for the ETS and PFSI

| PFSI term | ETS term | Explanation |
|---|---|---|
| Forest sink area | No equivalent | The PFSI forest sink area determines whether the 100 hectare threshold for using the FMA is met or not, and if met is the area to which sample plots are allocated. If Forest Class is to be assigned, it must be assigned to the entire forest sink area.<br>There is no equivalent ETS term to the PFSI forest sink area, as a forest sink area need not all qualify as forest land at the time the PFSI covenant is issued – whereas only areas that qualify as forest land may be registered in the ETS. |
| Eligible forest | Registered post-1989 forest land | For both schemes, this means the area that qualifies as post-1989 forest land – for the PFSI, at any given present or future time; and for the ETS at the time of registration. |
| Block | Forest stand | The terms forest stand and block both mean the smallest unit for which spatial records are held by MPI (i.e. a single mapped forest polygon) under the respective schemes. The area within a PFSI block may or may not yet be forest land, whereas the area within a forest stand must be forest land. |
| Request for units | Emissions return | Both terms refer to the mechanism by which changes in net carbon stocks are reported, and an entitlement to receive or surrender carbon units is quantified. |
| Mandatory return period | Mandatory emissions return period | Both terms refer to the reporting period set by law, which is usually five years long. |

9 If a PFSI covenant-holder has multiple PFSI covenants, the forest land area under each covenant is also considered independently for the purposes of the Regulations.

## Sample plot allocation and collection of FMA information

Sample plots are allocated by MPI to a PFSI covenant holder's forest sink area using the same rules and approach as described for ETS participants in Section 3. However, FMA information is only collected from those sample plots that are located within areas of eligible forest, and information from those plots is the only information used when producing participant-specific tables. Because forest sink areas may sometimes include large areas of land that are not yet eligible forest, the number of sample plots that FMA information is initially collected from may sometimes be too small to accurately determine forest carbon stocks. FMA participants in the PFSI may therefore wish to request more than the minimum number of sample plots initially. Once all of the forest sink area becomes eligible forest, a new set of sample plots with fewer plots can be requested in a subsequent mandatory emissions return period.

*i* *PFSI covenant holders may if they wish assign forest class prior to being allocated sample plots, on the basis of the forest species listed in the covenant holder's forest sink plan.*

## Determining whether sample plots are within eligible forest

The area of eligible forest in a forest sink area may be determined by mapping, or by sampling.

If mapped, determining whether a sample plot falls within the current area of eligible forest is straightforward. If the eligible forest area is to be determined by sampling, the sample used must be the set of sample plots allocated as part of the FMA process. A sample-based determination of the area of eligible forest is completed as follows:

(a) At each sample plot, delineate an area of one hectare centred on the sample plot location, and of the same shape as the sample plot. If the perimeter of the one hectare area extends beyond the boundary of the forest sink area, or extends beyond the boundary of forest land in the forest class the sample plot is allocated to, only the area within the forest sink or forest class boundary is considered. When establishing the perimeter of the one hectare area, dimensions must be adjusted for slope, if applicable.

(b) Assess whether there is a sufficient stocking of forest species present within the area delineated in (a) above for the area to qualify as eligible forest. As a rule-of-thumb, the minimum number of stems of forest species for land to qualify as eligible forest is typically 150 stems per hectare. However this may vary with the species and site conditions. The stocking assessment can be made:

  (i) visually, where it is evident that the stocking is not close to the likely threshold-stocking qualifying an area as eligible forest – that is, when it is evident the stocking is significantly lower, or higher, than required; or

  (ii) by systematically counting stems – that is, starting in one location and systematically working through the delineated area to avoid double counting, and stopping once the minimum number of stems of forest species is reached; or

  (iii) by sub-sampling the area, using the same procedures for establishing sub-sample locations as available when collecting FMA information (see Section 5), but using sub-samples sufficiently large that at least 10 percent of the area delineated in (a) above is sampled.

(c) Take as the area of eligible forest in the forest sink area: the fraction of total sample plots that are located in a hectare (or any lesser area delineated under (a) above) that qualifies as eligible forest, multiplied by the forest sink area.

For those sample plots that are considered to be located in eligible forest, as determined by mapping or sampling, FMA information must be collected in the usual way – see Section 3. For those not located on land that is eligible forest, FMA information is not collected, and the plots are reported to MPI as being located on "PFSI non-eligible forest".

*The spatial variability of regenerating forest may mean FMA information is sometimes not collected from a sample plot that includes forest species – because the surrounding area is not eligible forest.*

### Implications of variations to the forest sink plan of a PFSI covenant

In their forest sink plan, a PFSI covenant holder declares their intent to establish either exotic or indigenous forest over their forest sink area. If their intent changes, they must seek a variation to the forest sink plan, which must be approved by MPI before it can proceed. When sample plots have been allocated to a PFSI covenant holder who later obtains approval to change their forest sink plan, there may be implications for the FMA. For example, if plots were allocated by forest classes assigned according to an original forest sink plan which specified an area would become exotic forest, whereas now indigenous forest is to be established, there will be more sample plots allocated to the area than the minimum required. Similarly, for an area originally intended to be indigenous forest that changes to exotic forest, fewer sample plots than the required minimum will have been allocated.

PFSI covenant-holders wishing to change their total allocation of sample plots can do so in the same way as ETS participants – by requesting a new set of sample plots in a subsequent mandatory emissions return period. Forest class would also need to be confirmed or updated at that time, before sample plots can be allocated.

## Compliance and compliance audits

### Participant responsibilities

FMA participants are responsible for ensuring they comply with FMA requirements specified in both the Regulations and FMA Standards. There are both civil and criminal penalties for non-compliance in relation to the ETS, and FMA participants are required to declare that the information they provide in relation to the FMA is true and correct. To assist with compliance, MPI provides a range of information and guidance material to promote awareness and understanding of FMA requirements and timeframes.

FMA participants may choose to engage a forestry consultant or forest inventory service provider to give advice on the FMA, or to complete collection and submission of FMA information. However, the participant remains responsible for the accuracy and completeness of the FMA information submitted. FMA participants are required to keep records of their FMA information for 20 years, including all information collected at and recorded for sample plots, and any other information used to derive associated values (e.g. stand records or contractor's reports used to determine planted stocking or residual stocking after thinning). Sufficient information to derive values reported as summaries must also be kept (e.g. for the set of sampled collar diameters and heights collected for small trees, if recording the average diameter and height for such trees).

FMA participants are also subject to standard infringement notices and penalties in the ETS.

More information about infringement offences is available at:
www.mpi.govt.nz/infringement-offences-in-the-ets/

More information about penalties is available at:
www.mpi.govt.nz/penalties-and-the-emissions-trading-scheme/

### Compliance audits

MPI has a responsibility to audit information collected and submitted by FMA participants, and may undertake enquiries to establish whether an FMA participant is complying with the FMA process –

including the use of participant-specific carbon tables for preparing emissions returns. Compliance audits may include:

- interviewing FMA participants, their advisors, or those collecting FMA information;
- reviewing procedures for, and placement of, sample plots;
- conducting an independent collection of FMA information;
- inspecting all FMA information and related records held by a participant;
- auditing systems and procedures used by FMA participants, their inventory providers, or their forestry consultants;
- reviewing equipment calibration and maintenance schedules and procedures.

As with normal forest inventory, collection of FMA information is a relatively complex undertaking and FMA participants (or their consultants) are expected to have adequate quality control procedures in place. Standard measures considered to be good practice by the NZ forestry sector, such as independent remeasurement of a small sample of sample plots, are expected to be evident – especially for larger forests.

## Standards of precision/tolerance

In discharging their FMA-related responsibilities, FMA participants are encouraged to adopt forest inventory procedures considered good practice by the NZ forestry sector. Considering these practices, and the additional requirements of the FMA (e.g. in terms of plot location using a GPS), the following standards of precision/tolerance are considered by MPI to be acceptable in relation to collecting key FMA information at sample plots.

### Table 6. Standards of precision/tolerance expected

| Attribute | Tolerance |
|---|---|
| Altitude | ±20 m |
| Sample plot centre points | Standard deviation of plot centre points from plot locations specified by MPI not exceeding 8 m, after excluding plots subject to relocation or waivers |
| Sample plot dimensions | 1% of radius or side-length |
| Slope measurement | ±2°, for slopes >5° |
| Stem diameter | <100 mm: ±2.5 mm<br>100 – 500 mm: ±5 mm<br>>500 mm: ±10 mm |
| Stem height | 5% of height or ±0.1 m – whichever is greater |
| **Equipment** | **Tolerance** |
| Field compass | ± 2° over a minimum distance of 15 m |
| Hip chain | ± 4% of actual length |
| Lineal tape | ± 0.5% of actual length |
| Diameter tape | ± 0.5% of actual length |
| Height pole | ± 0.5% of actual length |
| Vertical angle measurement equipment | ± 1° over a minimum distance of 8.0 m |
| Direct height measurement equipment | ± 2.0% of actual height over a minimum distance of 18 m |

# THE FMA PROCESS: MORE COMPLEX CASES

# 5

## Purpose of this section

This section of the guide provides information that will help FMA participants apply the FMA process in the more complex situations that arise when:

- FMA information is collected from sub-plots within sample plots;
- FMA information is collected by sub-sampling a sample plot or sub-plot;
- trees from different species groups and/or with different ages ("intermingled trees[10]") are present;
- adding post-1989 forest land to, or removing it from, the ETS (or PFSI).

The intended audience for this section is:

- FMA participants that plan to complete FMA requirements themselves;
- anyone completing any administrative aspect of the FMA on behalf of an FMA participant;
- forestry consultants or any other providers of forest inventory or related forestry services to FMA participants.

**Tip:** this section of the guide is an elaboration of, and not a replacement for, the Regulations and FMA Standards. It provides information for those that have to deal with more complex forest situations when applying the FMA process. Those who need to read this section of the *Guide* are advised to first gain a thorough knowledge of the Regulations and the FMA Standards.

## Collecting FMA information for sub-plots


Production of participant-specific tables of forest carbon stocks, and harvest residues, requires that FMA information be collected from areas where the trees comprise the same species group[11] and age. The silvicultural regime applied to the group of trees must also be known, as well as the effect of any adverse events. If a sample plot includes discrete areas of trees with different species groups, or from a single species group but with different ages[12], the sample plot must be split into parts, with each part having trees from the same species group and same age.

Occasionally, trees in a sample plot may occur as mixtures of species from different species groups, and/or with different ages – which are referred to as "intermingled trees". If intermingled trees occur in a discrete area within a sample plot, the area is considered to be a sub-plot and treated separately. There

10 The term "intermingled trees" is defined in the *Field Measurement Approach Standard*, to mean a mixture of trees of different species groups but with the same age, or in the same species group but with different ages, or with both different species groups and different ages.

11 The term "species group" is used in connection with the FMA rather than forest type. This is because the forest type definition refers to tree species within a one hectare area only, whereas the area of interest for the FMA is the smaller area of a sample plot. Apart from the different areas considered, species groups and forest types are otherwise the same.

12 The relevant age is that calculated under regulation 52. As such, note that all regenerated indigenous trees in a permanent sample plot or subplot are considered to have a single age – that of the oldest trees that regenerated after the change in land.

are additional requirements when collecting FMA information for intermingled trees, that are considered further in a separate section below (see *Collecting FMA information for intermingled trees*).

The final situation in which part of a sample plot is treated as a sub-plot is when an area is temporarily unstocked as a result of harvesting. The temporary absence of trees in such areas is taken into account when calculating forest carbon stocks as part of determining participant-specific carbon tables.

*Only **temporarily** unstocked areas within sample plots are treated as sub-plots. **Permanently** unstocked areas are just considered as a normal feature of sample plots.*

## Identifying sub-plots and sub-plot boundaries

FMA participants must define any sub-plots required at the time they collect FMA information. Rules for identifying sub-plots are given in the *Field Measurement Approach Standard* (Part 5). The rules require that each discrete area within a sample plot that qualifies as a sub-plot be identified, and the boundary of the area defined. FMA information relating to shrubs (if applicable) and trees is then collected for each sub-plot, instead of for the sample plot.

The procedure for forming sub-plots can be summarised as follows:

(a) Identify **discrete areas** within the sample plot that:

- have trees with the same species group and the same age; or
- have intermingled trees – a mixture of trees from the same species group but with different ages, or from different species groups but the same age, or with different species groups and different ages; or
- are temporarily unstocked as a result of harvesting.

(b) Define the boundary (i.e. perimeter) of each sub-plot, so that any shrubs or trees in the sub-plot for which FMA information is to be collected can be identified. The area of each sub-plot, estimated as a percentage of the sample plot area, must also be determined once the boundary is defined.

*Sub-plots do not have to be permanently marked, and their boundaries may change between inventory cycles.*

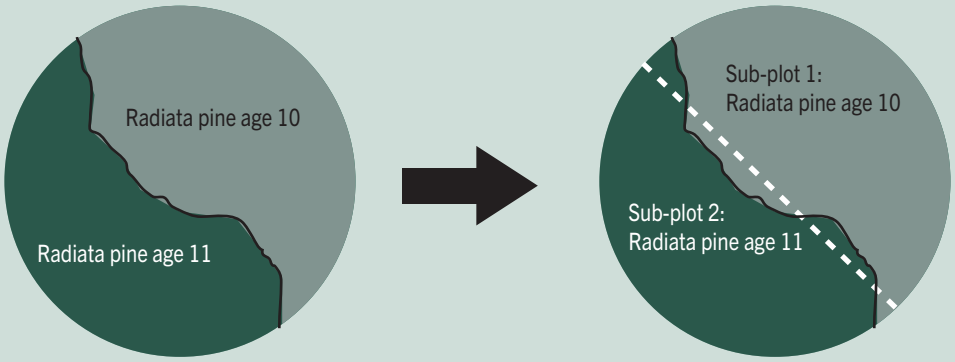
### Defining sub-plot boundaries

A sub-plot boundary is either the perimeter of the sample plot it is located within, or a division between the different sets of trees in adjacent sub-plots. The *Field Measurement Approach Standard* provides an important rule to simplify placement of boundaries that are within a sample plot perimeter: boundaries are constructed as a line placed such that it is **on average equidistant** from the stems of trees in adjacent sub-plots. Using this rule, boundaries within sub-plots can often be constructed as just one, or a few, straight lines. Figure 8 shows examples of boundary construction in a number of situations expected to be commonly encountered.

When more complicated arrangements of sub-plots occur than shown in Figure 8, a more structured, stepwise approach is required to boundary formation – though still using the simplifying principle of placing boundaries within sample plots as located on average equidistant from the different sets of trees in adjacent sub- plots. A detailed stepwise procedure for defining sub-plots is given in the *Field Measurement Approach Standard* [Part 5, clause (5)]. This procedure must be followed exactly if sub-plots exist in complicated arrangements, and as such is not repeated here.

Figure 8: Defining sub-plot boundaries within sample plots: Simple cases

8a: Defining sub-plot boundaries within sample plots, as a line on average equidistant from trees in each sub-plot

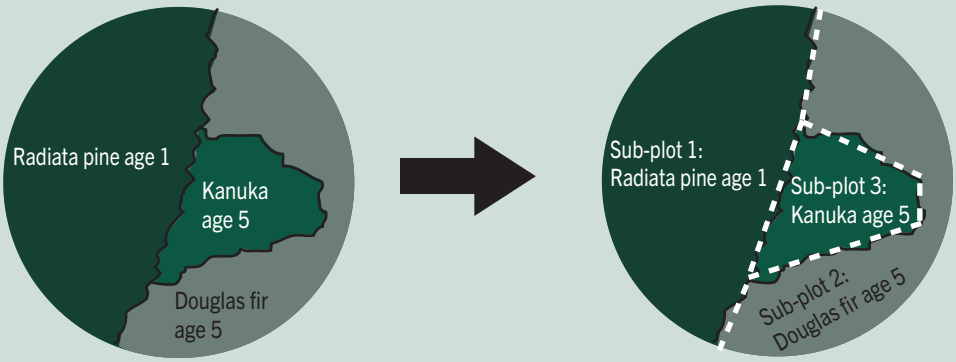



Sample plot | Divided into sub-plots

8.b: Defining a sub-plot boundary when two stands are separated by a permanently unstocked area

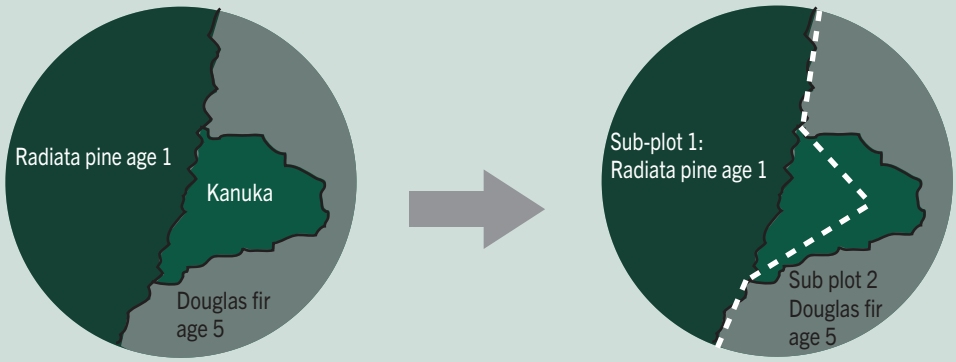

Sample plot | Divided into sub-plots

8.c: Defining sub-plot boundaries when FMA information is collected for all tree species



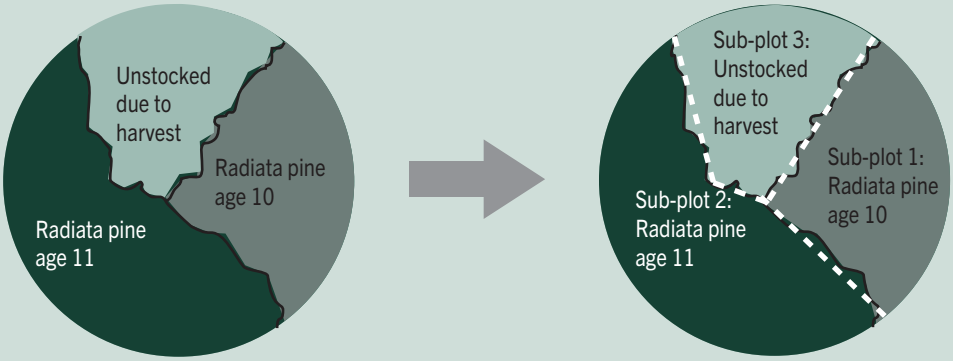

Sample plot | Divided into sub-plots

8d: Defining sub-plot boundaries when only some tree species are nominated species (the area with kanuka, which is not a nominated species in this example, is treated as permanently unstocked)




Sample plot — Divided into sub-plots

8e: Defining sub-plot boundaries when the sample plot includes an area temporarily unstocked due to harvesting




Sample plot — Divided into sub-plots

## Collecting FMA information for sub-plots

For the purposes of collecting FMA information, sub-plots can be considered small sample plots. That is, the same FMA information is collected as for an entire sample plot, but for each sub-plot. To accommodate sub-plots as a defined FMA information type, and to distinguish them from sample plots, the hierarchy of FMA information types – introduced in Section 3 – is extended by introducing a "Sub-plot information type" as shown in Figure 9.

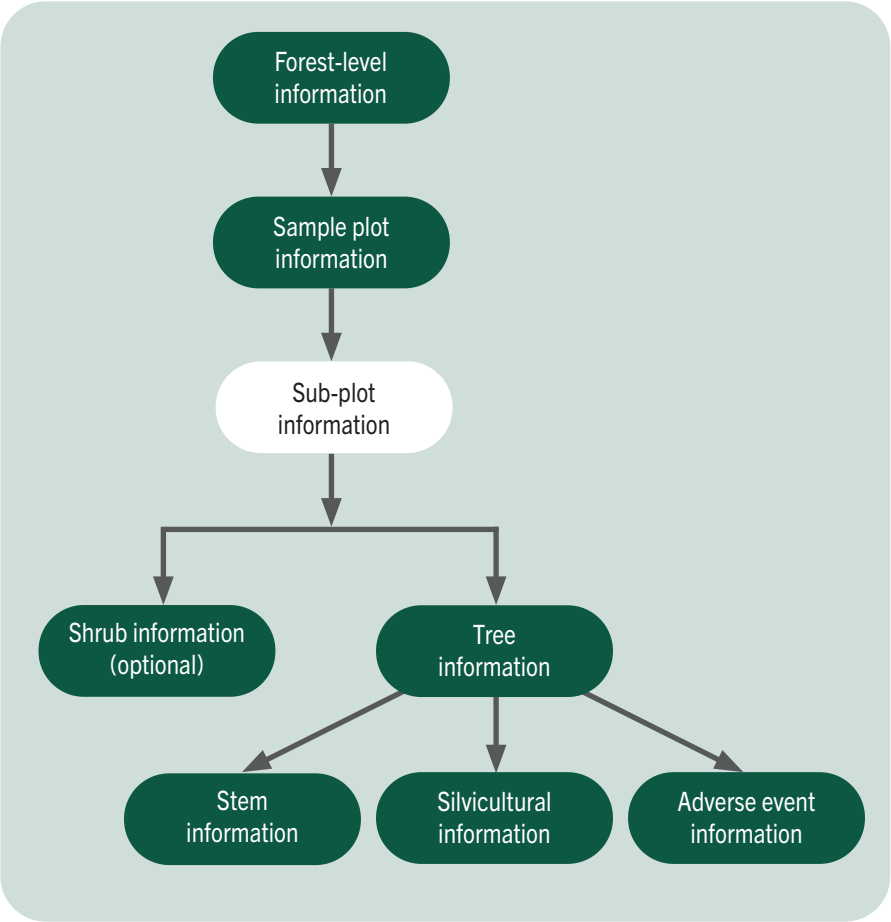
Information relating to the sub-plot itself must also be collected, as follows:

- an identifier for the sub-plot;
- the sub-plot area (expressed as a percentage of the sample plot area);
- the identifier of the sample plot the sub-plot is located within.

A full description of the requirements for collecting this information is given in the *Field Measurement Approach Standard* (Parts 5 and 8), and summarised in Appendix 1, Table A9.

*The Field Measurement Approach Standard requires a sketch showing sub-plot boundaries, identifiers and percentage areas within a sample plot to be drawn and retained as part of an FMA participant's records.*

Figure 9: Types of information collected under the FMA when sub-plots are present




## Collecting FMA information for trees using sub-samples


When trees are young, stocking may be high in sample plots or sub-plots, making collection of FMA information more expensive if the diameter of every tree stem is to be measured. To reduce costs, there are options to limit the numbers of stem diameters that must be measured when collecting FMA information, as already discussed in Section 2, by allowing the FMA participant to:

- nominate which particular tree species will be measured;
- choose whether or not to collect FMA information for small trees (stems less than 25 mm DBH that have heights of at least 300 mm) – if not collecting FMA information for shrubs;
- make estimates of, rather than measure, average stem diameters and heights for small trees (if collecting FMA information for small trees).

There is a further option for reducing the cost of collecting FMA information when stocking is high – which is to use sub-sampling. This involves defining one or more small areas ("sub-samples") within a sample plot or sub-plot, that are considered representative of conditions in the plot, and recording information for the sub-sampled area only. When calculating forest carbon stocks, the information for the sub-samples is scaled to the sample plot or sub-plot level.

Sub-samples are established at the time FMA information is collected, and do not have to be permanently marked or retained between inventory cycles. Sub-sampling can be particularly cost- effective in naturally regenerating forest, where the stocking of tree species in the earlier stages of regeneration can be much higher than at maturity.

The rules and procedures governing the use of sub-samples are given in the *Field Measurement Approach Standard* (Part 6). In summary, these rules are:

(a) General requirements:

(i) sub-samples must be circular in shape, and must be laid out – and the position of the perimeter identified – in the same manner as if laying out a circular sample plot;

(ii) the radius of a sub-sample must be selected from the following list: 1.00, 1.50, 2.00, 2.50, 3.00, 3.50, 4.00, 4.50, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 12.0, 14.0, 16.0, 18.0 or 20.0 metres;

(iii) when multiple sub-samples are used within a sample plot or sub-plot, they must all be the same area and must not overlap either each other or the boundary of the sample plot or sub-plot;

(iv) as far as practicable, the area of a sub-sample (or sub-samples, if multiple sub-samples are present) used must be large enough to include trees with the range of stem diameters that occur in the sample plot or sub-plot.

(b) If a sample plot is to be sub-sampled:

(i) the number of live tree stems for which DBH would otherwise have to be measured in the plot must be at least 30;

(ii) the area selected for a sub-sample must be such that DBH is measured for a total of at least 20 live tree stems for the set of valid sub-samples in the sample plot;

(c) If a sub-plot is to be sub-sampled:

(i) the number of live tree stems for which DBH would otherwise have to be measured must be more than 0.3 multiplied by the percentage area of the sample plot occupied by the sub-plot;

(ii) the sub-sample area must be such that DBH is measured for a total number of live tree stems of at least 0.2 multiplied by the percentage area of the sample plot occupied by sub-plot, for the set of valid sub-samples in the sub-plot.

(d) When determining the count of live tree stems under paragraphs (b) or (c) above, multi-stemmed trees are treated as if contributing a single stem to the count.

*i* *Sub-sampling will only provide a good estimate of carbon stocks if the sub-sample is large enough to be representative of conditions in the plot or sub-plot. Particularly in naturally regenerated stands, sub-samples larger than needed simply to satisfy minimum stem counts will often be needed, to ensure both the variation in stem diameter and stocking (including the presence of unstocked gaps) are adequately sampled. Failure to do so can lead to large variations in calculated carbon stocks over time if, as is usual, sub-samples must increase in area to maintain minimum tree counts as trees age and stocking falls due to natural mortality.*

Figure 10: Sub-sampling sample plots with planted trees

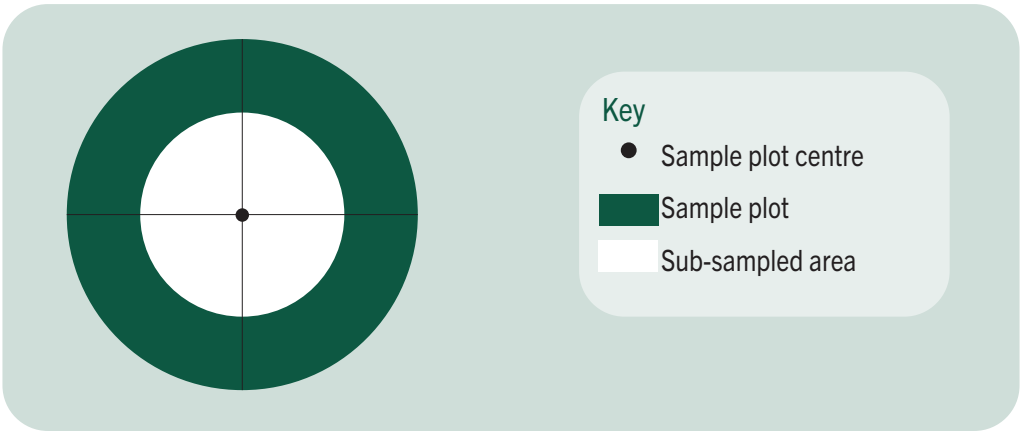



Figure 11: Sub-sampling sample plots with regenerated trees

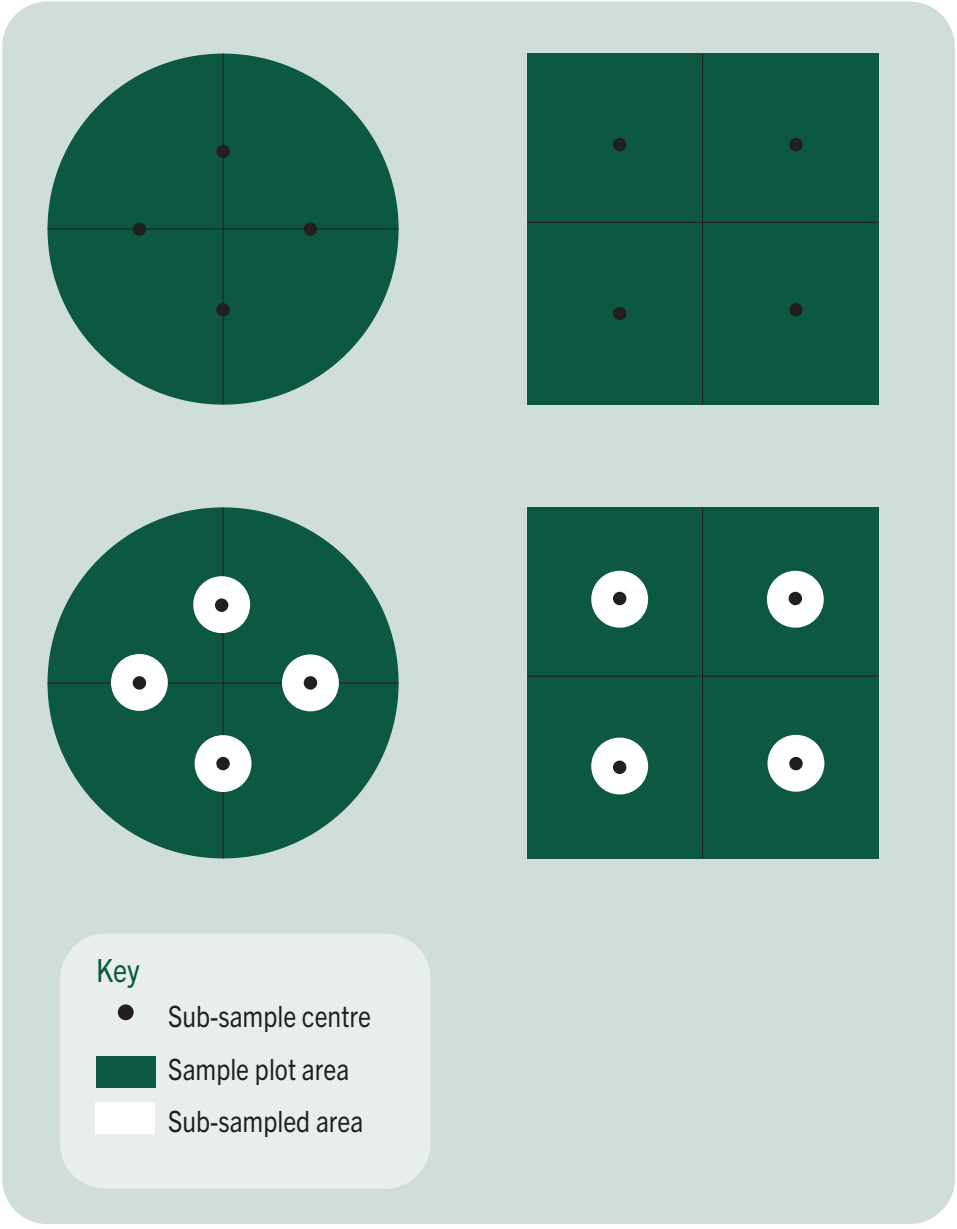
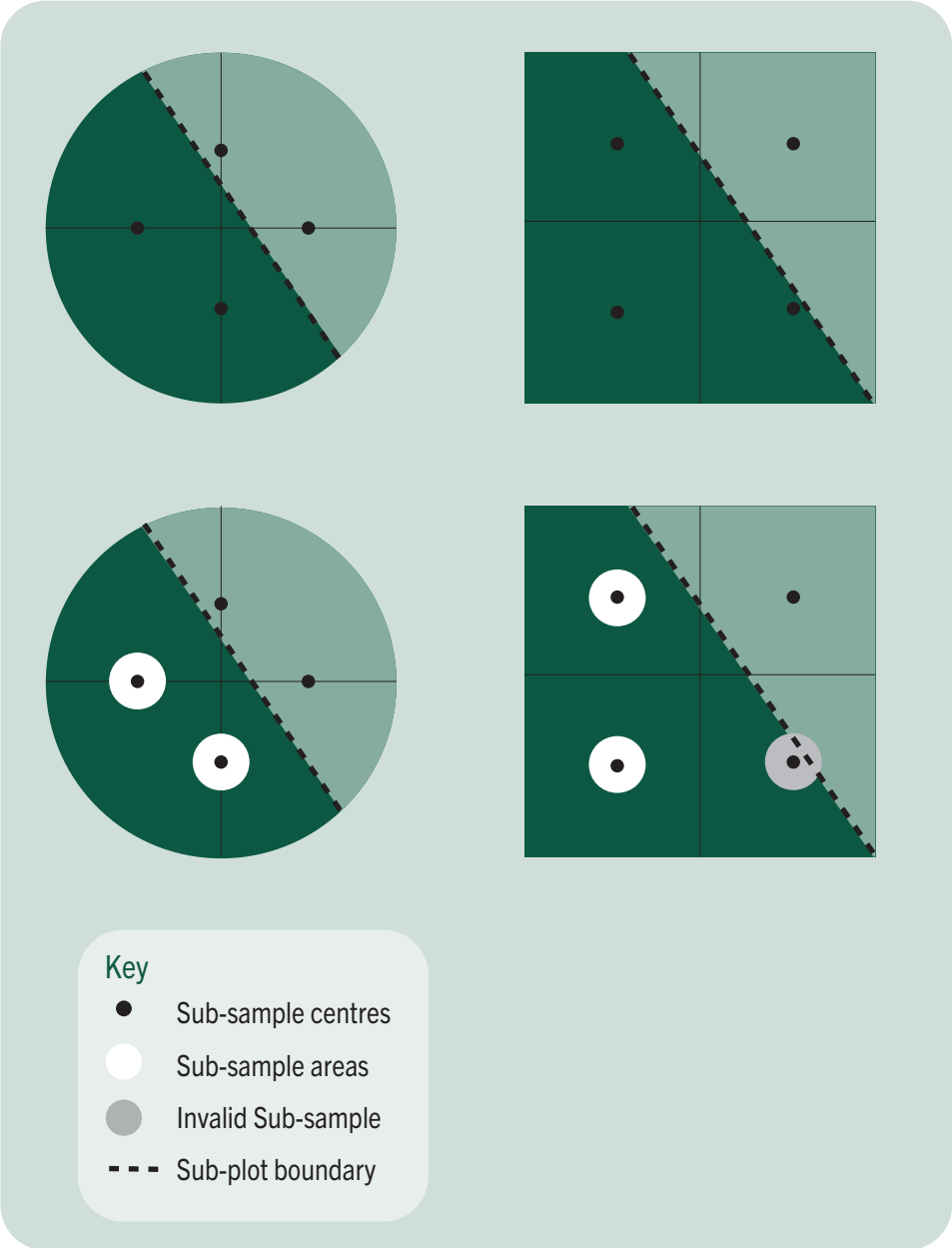


Figure 12: Establishing sub-samples within a sub-plot




## Locating sub-samples in sample plots and sub-plots

To help avoid FMA information collected using sub-samples being biased, sub-samples must be placed at specified points within a sample plot or sub-plot. The number and location of sub-samples also depends on whether planted or regenerated trees are present; that is, on whether conditions are expected to be more, or less, uniform. The rules specifying the location and number of sub-samples are given in the *Field Measurement Approach Standard* (Part 6), and can be summarised as follows:

(a) For sample plots containing any planted trees, a single sub-sample is used, placed coincident with the sample plot's centre point as shown in Figure 10.

(b) For sample plots containing only regenerated trees, the sample plot is divided into quadrants (if circular) or quadrats (if square). One sub-sample is placed at the centre point of the line that forms the common boundary of each quadrant, or at the centre point of each quadrat, as shown in Figure 11.

(c) If a sample plot includes sub-plots, the sample plot is first divided into quadrants (if circular), or quadrats (if square) as shown in Figure 12. The centre point of the line that forms the common boundary of each quadrant, or the centre point of each quadrat, is then identified, and a sub- sample placed at each identified centre point that falls within the particular sub-plot of interest (see Figure 12).

If a sub-sample placed according to the rules above overlaps the sub-plot boundary, it is not a valid sub-sample, and must not be used when collecting FMA information. Figure 12 shows an example of a sub-sampled sub-plot where only two of the three sub-samples is valid (see lower right diagram).

**Tip:** when sub-sampling a sub-plot, selecting the sub-sample radius may require some trial and error to best meet the requirements of measuring DBH for the required number of live stems, obtaining a representative range of stem diameters and stocking, yet not including so many stems that measurement costs rise unacceptably.

Table 7. Examples of the reduction in stem numbers required to be measured when sub-sampling a sample plot of area 0.04 hectares

| Stocking (st/ha) | Stems in sample plot | Sub-sample radius (m) | Sub-sample area ($m^2$) | Stems in sub-sample |
|---|---|---|---|---|
| 1,600 | 64 | 7.0 | 154 | 25 |
| 2,000 | 80 | 7.0 | 154 | 31 |
| 2,500 | 100 | 6.0 | 113 | 28 |
| 3,500 | 140 | 4.50 | 63.6 | 22 |
| 5,000 | 200 | 4.00 | 50.3 | 25 |
| 7,500 | 300 | 3.00 | 28.3 | 21 |
| 10,000 | 400 | 2.50 | 19.6 | 20 |

## Collecting FMA information for sub-samples

Sub-samples are used only to collect FMA information relating to tree stems. The information collected remains as previously given for an entire sample plot (Appendix 1, Table A7) but is collected for each sub-sample within a sample plot or sub-plot only. To accommodate sub-samples, the hierarchy of FMA information types – introduced in Section 3 – is extended by introducing a "Sub-sample information type" as shown in Figure 13. Other FMA information continues to be collected at the sample plot or sub-plot level – as also depicted in Figure 13.

Information relating to each sub-sample itself must also be collected: including an identifier for each sub-sample, the radius selected, how the sub-sample is laid out, and the area used within it if line- transect sub-sampling is used. A full description of the required information is given in the *Field Measurement Approach Standard* (Parts 6 and 8), and summarised in Appendix 1, Table A10.

# Collecting FMA Information for Intermingled Trees


Intermingled trees[13] may occur within an entire sample plot, or as a discrete area within a sample plot that is then identified as a sub-plot. Calculation of forest carbon stocks is more complicated for intermingled than non-intermingled trees, and for practical reasons is simplified under the Regulations by requiring that the full set of FMA information be collected only for the intended predominant tree species – defined as the single tree species expected to have the largest basal area at the time of harvest, or at maturity if a non-harvest forest. Having completed calculations for the intended predominant species, carbon stocks in other trees present are then included simply on a pro-rata basis. The single exception to this is when the intended predominant species is not also the actual predominant species at the time of measurement – that is, is not the species with the largest basal area at that time. In this situation, additional FMA information is also collected for the predominant species, given that this species will be contributing a substantial proportion of the total carbon stocks at that time.

**Tip:** FMA participants with planted forests can usually avoid having to deal with intermingled trees if they select the crop species as a nominated species. Regenerating indigenous trees never qualify as intermingled because all indigenous species are included in a single Species Group, and for a given area are considered to have one age – the age of the oldest trees for which FMA information is required to be collected.

*i* *When collecting FMA information for intermingled trees, Tables A4 and A8 in Appendix 1 are **not** used; Tables B4 and B8 are used instead. Some additional requirements also apply to Tables A5 and A6.*

The rules for collecting FMA information when there are intermingled trees present in a permanent sample plot or sub-plot (or when a plot or sub-plot with intermingled trees is being sub-sampled) are given in the *Field Measurement Approach Standard* (Part 8, clauses (6) and (7)). The key rules may be summarised as follows:

(i) record that intermingled trees are present (see Appendix 1, Table B4 for details);

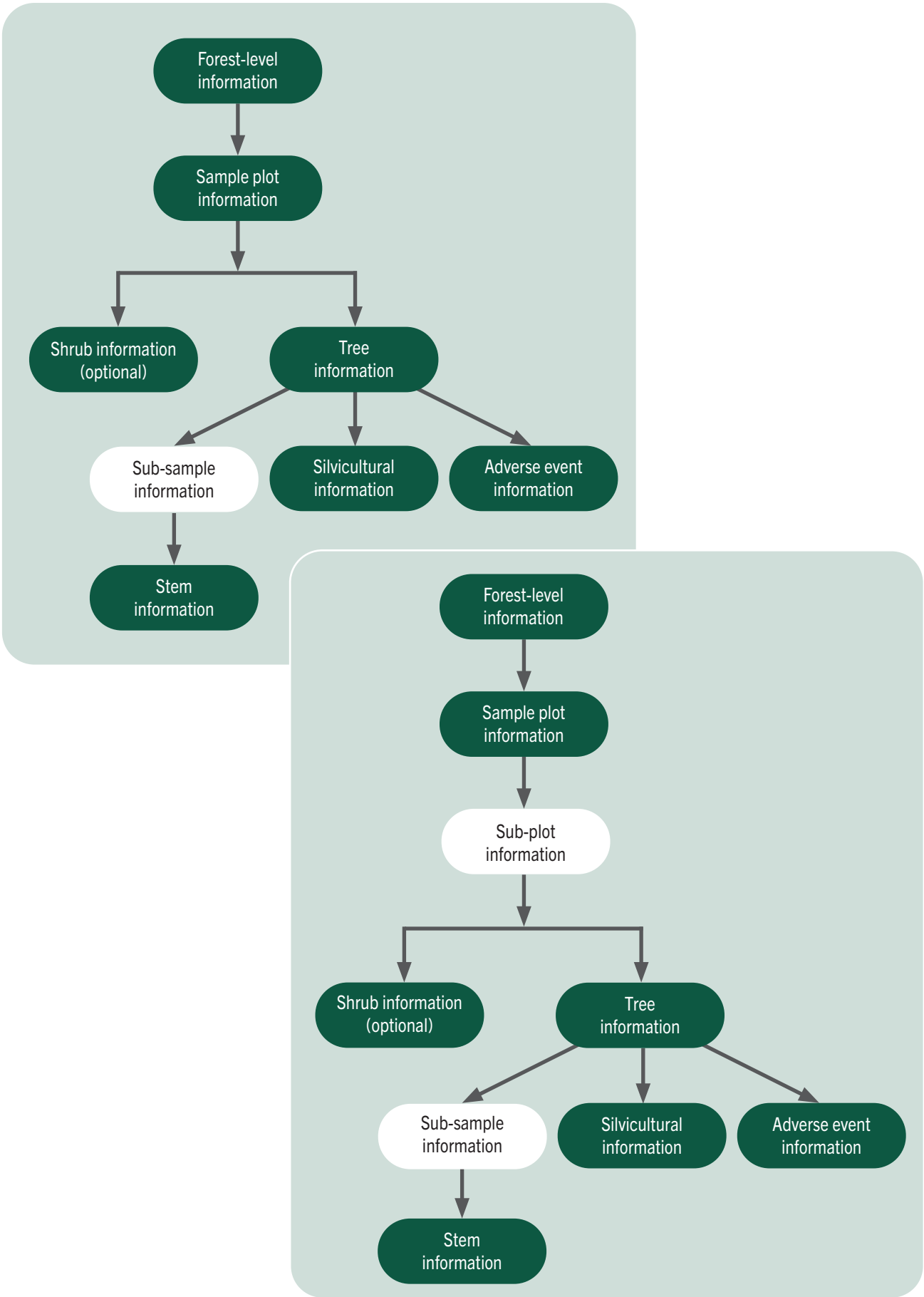
(ii) identify and record the name of the single tree species that is the intended predominant species under the planned management of the stand at the time of harvest, or at maturity if a non-harvest species (see Appendix 1, Table B4 for details);

(iii) record the usual set of tree, silvicultural and adverse event FMA information (see Appendix 1, Tables A4, A5 and A6 for details) for the trees that are the intended predominant species only – except that if the trees that comprise the intended predominant species include planted trees that were planted in more than one year, the silvicultural and adverse event information that is recorded must be that for the trees planted in the earliest year only;

(iv) if the intended predominant tree species is not the actual predominant tree species at the time of measurement (i.e. a tree species other than the intended predominant species has the largest basal area at that time) some additional information is also recorded about the species that is currently predominant (see Appendix 1, Table B4 for details):

13 The term "intermingled trees" is defined in the *Field Measurement Approach Standard*, to mean a mixture of trees in different species groups but with the same age, or in the same species group but with different ages, or with both different species groups and different ages.

Figure 13: Types of information collected under the FMA when sub-samples are present



- identify and record the name of the tree species that is the predominant species at the time of measurement (see Appendix 1, Table B4 for details).

Note that when intermingled trees are present, irrespective of whether or not the intended predominant species is actually the predominant species at the time of measurement:

- silvicultural and adverse event information recorded relates to the intended predominant species only – except that if the intended predominant species includes planted trees that were planted in more than one year, the silvicultural and adverse event information recorded for planted trees is that for the trees planted in the earliest year only (see Appendix 1, Tables A5 and A6 for details);
- tree stem information (species/species group, diameters, and heights if applicable) is always recorded for all trees present for which FMA information must be collected (see Appendix 1, Table A7 for details).

**Tip:** if intermingled species are present and the intended predominant species (and actual predominant species, if not the intended species) comprises both planted and regenerated trees, silvicultural and adverse event information are recorded for the planted tree component only – except that if those planted trees comprise trees planted in more than one year, the information recorded must be that for the trees planted in the earliest year only.

## Adding and removing Land

ETS participants can add forest land to their registered land-holding, or remove land from their land-holding. Both actions have additional requirements under the FMA process, which can be summarised as:

(a) **If adding land** – the minimum number of sample plots required by the Regulations for the new total land area must be requested from MPI, and FMA requirements met for all plots once allocated, to get definitive participant-specific tables.
An FMA participant may also request a greater number of sample plots than the minimum.

(b) **If after removing land the remaining forest land is at least 100 hectares** – before the participant needs to complete their emissions return at the end of the mandatory emissions return period, additional sample plots must be requested from MPI if the number of sample plots on the remaining land is less than the minimum number required by the Regulations. An FMA participant may also request a greater number of sample plots than the minimum. If any sample plots are allocated, FMA requirements for those plots must be met (as well as for the plots that remain allocated to the original land) to get definitive participant-specific tables.

(c) **If after removing land the remaining forest land is less than 100 hectares** – if there are two or more plots on the remaining land (or, if both forest classes are assigned to the land, two or more plots on an area of each forest class), all FMA requirements must be met for those remaining sample plots until the end of the current mandatory emissions return period. Otherwise, the FMA participant must use the default tables in the Regulations when preparing emissions returns in respect of all remaining land. The participant ceases to be an FMA participant only at the end of the mandatory emissions return period in which the land was removed. If they increase their registered landholding above 100 hectares later, they will be subject to FMA obligations again.

## Adding land


If an FMA participant adds forest land, either by adding one or more carbon accounting areas (CAAs) or through a transmission of interest (such as a change of land ownership), all six steps of the FMA process summarised above must subsequently be completed to ensure they have a complete plot set and definitive participant-specific tables by the end of the mandatory emissions return period. Some steps are completed for the added forest land only, while others may involve consideration of the total forest land now comprising the FMA participant's land-holding.

### Completing the FMA process after adding land

After adding forest land, the key additional requirements for (or variations to) the FMA process steps described in Section 3 of this guide are:

*Step 1. Assign forest class* – this follows the same procedure as given in Section 3. If a forest class or classes were assigned to the original land, they must also be assigned to the added land. Conversely, if forest class was not assigned to the original land, it cannot be assigned to the added land.

*Step 2. Request sample plots* – when adding land, the same considerations described earlier in Section 3 broadly apply in terms of deciding whether the minimum or a greater number of sample plots should be used. However, because sample plots already exist for part of the FMA participant's total land-holding, there are some restrictions on how sample plots may be allocated to the new land. MPI must allocate new plots in a way that ensures the total plots are allocated as uniformly as possible across the registered land. There are two approaches for allocating new plots:

**a. Allocate plots at the same density – extend plot set grid**

This will result in the plots on the added land being allocated at the same density as the plots allocated on the original land (land area before the recent add land). As the number of minimum required plots does not increased at a linear trajectory with the land area amount, this option typically results in more plots being allocated than the required minimum.

**b. Allocate plots to meet the minimum required – overlay plot set grid**

This will overlay a new plot set grid, to match the minimum required plot number for the total land area that includes the newly added area. As the Climate Change (Forestry) Regulations 2022 require the plots to be allocated as uniformly as possible, some of the existing plots may need to be removed to allow a uniform allocation of the plots to the newly added land.

This also applies to scenarios where the current plots already meet the minimum required number – where land has been added, existing plots may be moved to ensure uniform distribution by having plots allocated to the added land.

These two approaches are shown in Figures 14 and 15.

Figure 14: Extension of the existing sample plot grid to cover the added land

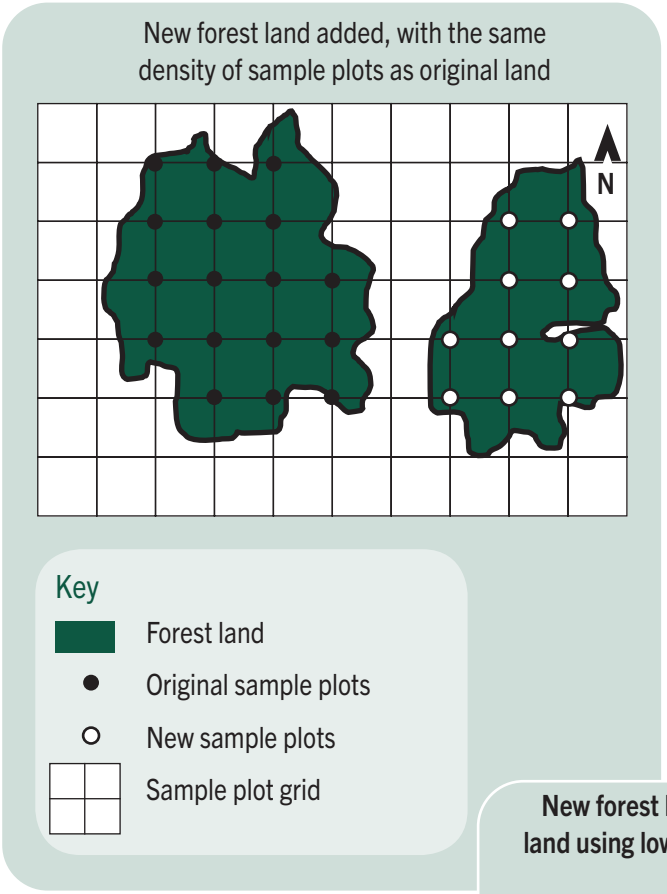
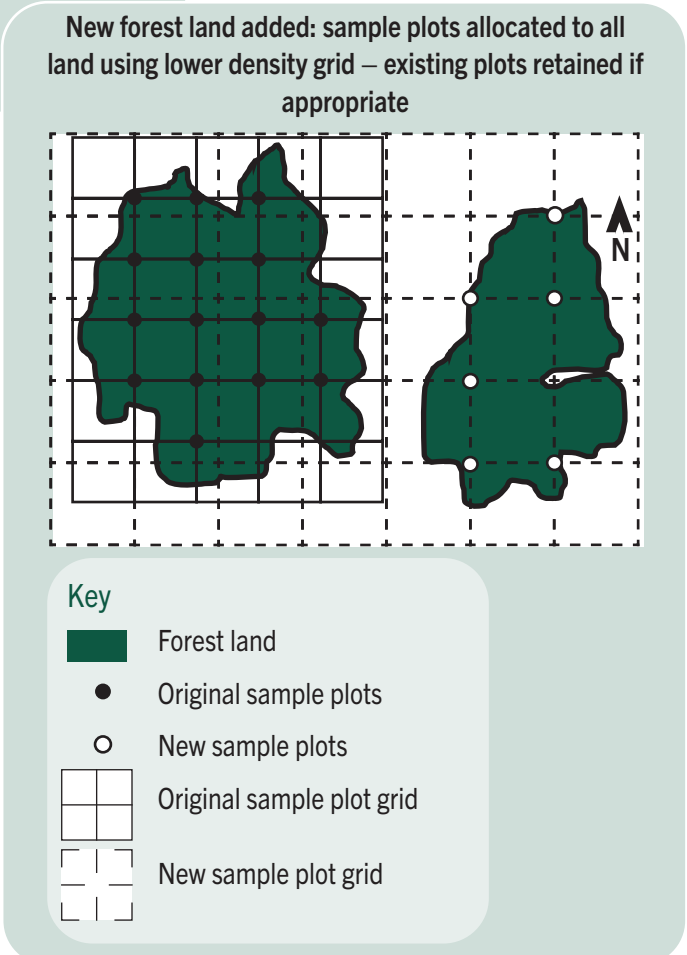



Figure 15: New sample plot grid, with original plots retained



*Step 3. Establish sample plots* – the same procedures as given in Section 3 apply, but for the new sample plots only.

*Step 4. Collect FMA information* – if the FMA participant has already collected the FMA information at the rest of the plots for the current mandatory emissions return period, they only need to collect information at the new sample plots (following the same procedures given in Section 3). However, as an FMA participant only needs to use definitive participant-specific tables for the emissions return at the end of a mandatory emissions return period, they may choose to wait and collect the information for all plots towards the end of the mandatory emissions return period.

*Step 5. Submit FMA information* – although the same procedures as given in Section 3 apply, the FMA information submitted as part of any request for new participant-specific tables must be for the FMA participant's total forest land-holding. That is, the FMA information for the added land must be amalgamated with valid (i.e. updated for silviculture and adverse events, if applicable) information from the sample plots that remain allocated to the original forest land. This may mean a newly collected set of information from all plots, or combining the information from the new plots with information collected at other plots earlier in the mandatory emissions return period.

*MPI provides administrative procedures to assist with submitting complete sets of FMA information, when information for only some sample plots is being supplied – see Section 3.*

**Tip:** an FMA participant with a nominated species list that needs to add additional species to the list as a result of adding land, must add those species before any FMA information for sample plots on the added land is submitted to MPI.

*Step 6. Generate participant-specific tables* – the same procedures as given in Section 3 apply.

## Removing land


If an FMA participant removes forest land, by removing all or part of a CAA, up to five of the six FMA process steps (those highlighted in dark green above) may have to be completed, depending on the amount of land remaining, and the number of sample plots on that land.

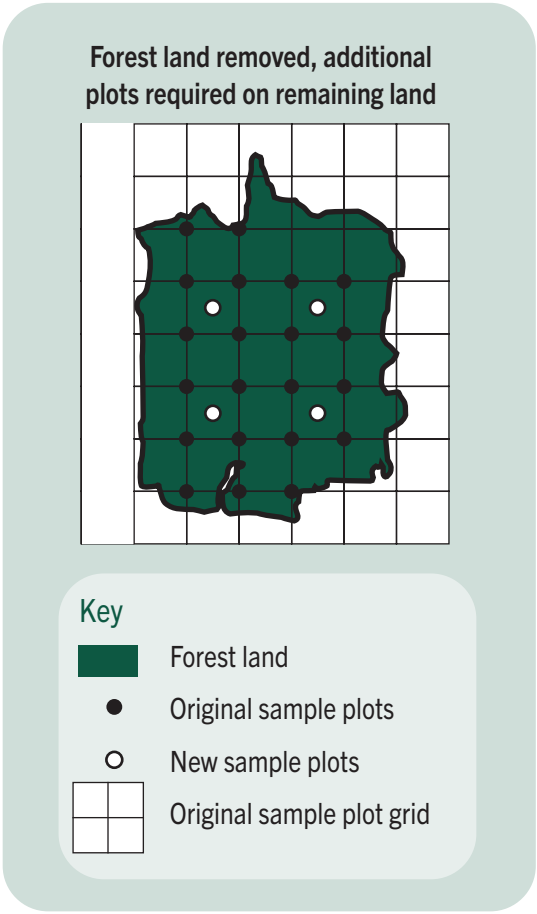
### At least 100 hectares of forest land remains after removing land

If, as a result of removing forest land, the number of sample plots on the remaining land is less than the minimum required by the Regulations, additional sample plots must be allocated to an FMA participant in order to create definitive participant-specific tables for the emissions return at the end of the mandatory emissions return period. The five FMA process steps highlighted above must be completed.

- *Step 2. Request sample plots* – when land has been removed the same considerations described earlier in Section 3 broadly apply, in terms of deciding whether the minimum or a greater number of sample plots should be used. The same process and forms described in Section 3 are also used to request any required sample plots for the remaining land – by forest class, if forest class is assigned. MPI will allocate any additional sample plots as uniformly as practicable over the FMA participant's remaining forest land. An example is shown in Figure 16.

- *Step 3. Establish sample plots* – the same procedures as given in Section 3 apply, but for the added sample plots only.
- *Step 4. Collect FMA information* – if the FMA participant has already collected the FMA information at the rest of the plots for the current mandatory emissions return period, they only need to collect information at the new sample plots (following the same procedures given in Section 3). However, as an FMA participant only needs to use definitive participant-specific tables for the emissions return at the end of a mandatory emissions return period, they may choose to wait and collect the information for all plots towards the end of the mandatory emissions return period.
- *Step 5. Submit FMA information* – although the same procedures as given in Section 3 apply, the FMA information submitted as part of any request for new participant-specific tables must be for the FMA participant's total forest landholding. That is, the FMA information for the additional sample plots must be amalgamated with valid (i.e. updated for silviculture and adverse events, if applicable) information from the sample plots that were originally allocated to the remaining forest land. This may mean a newly collected set of information from all plots, or combining the information from the new plots with information collected at remaining plots earlier in the mandatory emissions return period.
- *Step 6. Generate participant-specific tables* – the same procedures as given in Section 3 for generating tables apply.

Figure 16: Additional sample plots after removing land



### Less than 100 hectares of forest land remains

An FMA participant in this situation must continue to meet all FMA requirements for the sample plots that remain on their remaining land until the end of the current mandatory emissions return period – if two or more active plots remain (for each forest class assigned to the land). If less than two plots remain, the FMA participant must use the default tables in the Regulations for assessment of forest carbon stocks. There is no requirement or provision under the Regulations to allocate additional sample plots for a participant with less than 100 hectares remaining, regardless of how many active plots remain.

Once the mandatory emissions return period is over, a participant with less than 100 hectares of forest remaining must use the default tables in the Regulations for calculating emissions returns related to subsequent periods.

FMA participants with less than 100 hectares of land remaining with two or more active plots after removing land must complete only the last two steps of the FMA process after removing land. The steps are completed in the same way as for the case above, and result in participant-specific tables that are used in the same way.

# GLOSSARY AND APPENDICES 6

## Glossary

| | |
|---|---|
| **Adverse event** | means any fire, or any event of natural cause, that results in the clearing of any trees within a permanent sample plot. Examples other than fire include, but are not limited to, wind, disease, pests and erosion. |
| **Altitude** | means the height above average sea level. |
| **Average maximum slope** | means for permanent sample plots, the average of two angles measured relative to a horizontal plane from the centre of the plot to the perimeter of the plot, where:<br>(a) the first angle is measured in the direction of the steepest slope within the plot, and the second angle in the opposite direction; and<br>(b) the first angle is taken as positive if above a horizontal plane or negative if below it; and<br>(c) the second angle is taken as negative if above a horizontal plane and positive if below it. |
| **Average slope** | means for distances, the angle measured relative to a horizontal plane, taken from the current point to a point of interest. |
| **Breast height** | means a point on a standing tree stem that is:<br>(a) 1.40 metres from ground level when measured parallel to the stem; and<br>(b) if the stem is leaning, is measured from ground level on that side of the stem that makes an angle of less than 90 degrees to ground level; except<br>(c) if the stem is on a slope, is measured from ground level on the uphill side of the stem. |
| **Collar diameter** | means the diameter over bark of a stem, measured at a point on a standing stem that is 0.1 metres from ground level with the point otherwise determined as for breast height. |
| **Crown cover** | means the proportion of an area covered by a projection of all live tree and/or shrub crowns (as applicable) within that area onto a horizontal plane, expressed as the horizontally projected crown area per unit area ($m^2/m^2$). |
| **Crown height** | means the height above ground level of the uppermost green foliage of a live tree or shrub (as applicable). |

| | |
|---|---|
| **Crown volume** | means the product of the average crown height of trees and/or shrubs (as applicable) within an area and the crown cover of trees and/or shrubs (as applicable) in that area. |
| **Diameter at breast height (DBH)** | means the diameter at breast height over bark of a standing stem. |
| **Exotic shrub species** | means a shrub species that is not an indigenous shrub species. |
| **Forest stand** | means:<br>(a) in relation to the location of a permanent sample plot allocated by MPI, an area within an FMA participant's registered post-1989 forest land that has been defined as a single polygon under the *Geospatial Mapping Information Standard* published by MPI, and that has also been assigned to a forest class if forest class has been assigned; or<br>(b) in a general forestry context, an area of trees (usually contiguous but not necessarily so) of the same age, species and silvicultural regime that is also commonly a unit of forest management and record. |
| **Global Positioning System (GPS)** | means the global satellite system that provides information from which the geographic coordinates of a location can be obtained by using a GPS receiver. |
| **Ground level** | means a horizontal plane coincident with the soil surface after woody debris has been removed, and in relation to determining the crown height or stem height of a tree or shrub is taken as being located on the uphill side of a tree or shrub stem if the tree or shrub is on a slope. |
| **Indigenous shrub species** | means a shrub species that occurs naturally in New Zealand or has arrived in New Zealand without human assistance. |
| **Intermingled trees** | In relation to the trees in a permanent sample plot, has the meaning given in the *Field Measurement Approach Standard*. |
| **MPI** | Means the Ministry for Primary Industries. |
| **Permanent sample plot** | means a bounded area, circular or square in shape, centred on a location specified by MPI. |
| **Polygon** | means a closed shape bounded by sequentially connected polylines that do not cross, such that the geographic coordinates of the end point of one polyline are the same as the coordinates of the start of the next polyline. |
| **Polyline** | means a continuous line composed of one or more line segments. |
| **Pruned** | in relation to trees, means that the trees are subject to a pruning regime that is expected to result in at least 50 percent of the stems present at the time of harvest having had branches removed to a height of at least 4.30 metres. |
| **Residual stocking** | means the stocking of live trees after trees have been thinned as part of silviculture or after an adverse event. |
| **Shrub** | means any woody-stemmed perennial species with a crown height of more than 0.3 metres that is not a forest species. |

| | |
|---|---|
| **Silviculture** | means the thinning and pruning regime applied to an area of forest. |
| **Species Group** | Has the meaning given in the *Field Measurement Approach Standard*. |
| **Stem** | means the main woody above-ground body (or bodies, if multi-stemmed) of a tree or shrub. |
| **Stem height** | means the length of a stem from ground level to the uppermost green foliage of a live stem, or of the top of the stem if a dead stem. |
| **Stocking** | in relation to a specified area, means the number of tree stems in that area. |
| **Sub-plot** | means a bounded area that is part of a permanent sample plot, that may be used in relation to collecting FMA information on trees. |
| **Sub-sample** | means a bounded area, circular in shape, within a permanent sample plot or sub-plot, that may be used in relation to collecting FMA information on trees, and has a location taken as the centre point of the sub-sample. |
| **Witness tree** | means a permanently marked tree expected to be remain present until the time of harvest, or until the time of maturity in a non-harvest forest, and located in a known position outside the perimeter of a permanent sample plot. |

# Appendix 1: Collection of FMA Information

The Tables in this Appendix describe the FMA information that must be collected under the Regulations, and the Field Measurement Approach Standards.

The information in Table 1 describes the participant's generic forest-level information that must be collected once for each cycle of FMA field measurement. The information in the remaining tables is that which must be collected at each permanent sample plot or sub-plot (or sub-samples of these).

The Tables that participants must use for their plots or sub-plots depends on whether intermingled trees are present or absent:

(a) use Tables A2-A10 when the tree species in the plot or sub-plot belong to a single forest type, and have the same age[1] (i.e. when the trees are not intermingled);

(b) if intermingled trees are present most of the information collected is the same as when they are absent, with the following exceptions:

- use Tables B4 and B8 instead of Tables A4 and A8; and
- in Tables A5 and A6 collect the information for the intended predominant species only; noting that:
  - if the intended predominant species comprises both planted and regenerated trees, collect information for the planted trees only; and
  - if the trees comprising the intended predominant species include trees planted in different years, collect the required information only for the trees planted in the earliest year.

The FMA information to be collected is presented in a summarised form in the *FMA Information Checklist*, available on our website:
www.mpi.govt.nz/the-field-measurement-approach-fma/

[1] Under the Regulations that describe calculation of age, the following groups of trees in a plot or sub-plot are considered to have the same age (for the purposes of calculation of carbon stocks): exotic species planted in the same year, exotic species regenerated in the same year, indigenous species planted in the same year, and all regenerated indigenous trees that established after a change in land management that initiated the conversion of an area to forest land.

Table A1. Forest-level information

| Parameter | Allowable values | Description |
|---|---|---|
| Scheme type | ETS; PFSI | Identifies the scheme to which the FMA participant belongs |
| Participant name | Text – unlimited characters | Participant name as per the Participant Register (or for PFSI covenant holders, the covenant holder's name) |
| Participant holding account number | NZEUR number – 10 characters maximum | NZ Emissions Trading Register holding account number e.g. NZ-1234 |
| Submitter name | Text – 50 characters maximum | Name of the person submitting FMA measurement data (must be the participant or the person MPI has recorded as being delegated by the participant to submit data to MPI) |
| Inventory provider used | Yes, No | Indicates whether or not the participant used an independent inventory provider to collect the FMA information |
| Inventory provider name | Text – 100 characters maximum | If an inventory provider was used, supply the name of the company or organisation |
| Inventory personnel names | Text – 100 characters maximum | The first and last name(s) of those who collected and recorded FMA information |
| Date plots allocated | Date – DD-MM-YYYY (must be a value supplied by the EPA) | The Date of sample plot allocation as provided to participants in the PDF file sent by MPI that lists plot locations |
| FMA information supplied for | All plots, Subset of plots | Indicates whether FMA information is being submitted for all allocated sample plots, or is being supplied for a subset of allocated plots only. The latter option is used when updating information for one or more plots, including if supplying information for the first time for a few plots (e.g. for new plots allocated after adding land) |
| FMA information type | Plot, Silviculture, Adverse events | Indicates the type of FMA information supplied: "Plot" – all information for a sample plot; "Silviculture" – silvicultural information only; "Adverse events" – adverse event information only. Note – if FMA information is supplied for "All plots", the FMA information type must be "Plot", and include information for all sub-plots and sub-samples associated with each plot |
| Information collected for shrubs | Yes, No | Applies to all land if forest class not assigned, or for each defined forest class) – must be "Yes" if information is also being collected for small live trees (those with a diameter at breast height of less than 25 mm, and a height of at least 300 mm |
| Shrub information collected for | All land; Indigenous; Exotic | If FMA information for shrubs is collected, indicates whether it is being collected for all land (whether forest class is assigned or not), or only for land assigned to one of an exotic or indigenous forest class (when forest class has been assigned). |
| Tree information options apply to | All land; each forest class | Indicates how FMA information options for trees – that is, use of nominated species, and collection of information for small stems – apply; as a single choice for all land (irrespective of whether forest class has been assigned), or as separate choices for each forest class (when forest class has been assigned). |
| Information on trees collected for | All trees; nominated species | Indicates which trees FMA information is collected for – all trees, or nominated trees only. This parameter is selected for either all land, or for each forest class depending on the selections made for the "Tree information options apply to" parameter above. |
| Tree stem diameters collected for | DBH stems; all stems | Indicates the tree diameter thresholds that apply to collection of FMA information – collected for stems with DBH of at least 25 mm only, or also includes smaller trees of at least 300 mm height for which collar diameter is determined. This parameter is selected for either all land, or for the land in each forest class, depending on the selections made for the "Tree information options apply to" parameter above. |

## Table A2. Sample plot information

Plot information describes the sample plot location and dimensions. Some fields also indicate the type of records that are expected – used for checking the actual records provided.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1, 2, 3 … n – positive integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Plot area | Selected from specified list | List specified in the Field Measurement Approach Standard: 0.030, 0.040, 0.060, 0.080, 0.100; or 0.200 |
| Plot shape | Circular, Square | Selected according to the criteria in the Field Measurement Approach Standard, Part 4 |
| Plot average maximum slope | Value (degrees) -- integer | Average maximum slope of a plot is defined in the Field Measurement Approach Standard, Part 1 |
| Plot dimensions (horizontal plane) | | If a sample plot is laid out in a horizontal plane, and the plot shape is: |
| – radius ($r_p$) | Value (m) –2 decimal places | – circular |
| – length ($l_p$) | Value (m) –2 decimal places | – square |
| Plot dimensions (sloping plane) | | If a sample plot is laid out in the plane of the maximum average slope, and the plot shape is: |
| – Slope-adjusted radius (rP-S) | Value (m) –2 decimal places | – circular |
| – Slope-adjusted length (lP-S) | Value (m) –2 decimal places | – square |
| Position navigated to coordinates | Values (m) – integer | Averaged Easting and Northing from the GPS receiver, at the position "navigated to" when determining a plot location |
| Plot centre point coordinates | Values (m) – integer | Averaged Easting, Northing, and altitude from the GPS receiver, at the marked sample plot centre point |
| Plot extends beyond forest land boundary | Yes, No | Indicates whether or not a sample plot extends partially beyond the FMA participant's forest land boundary |
| Plot percentage area within boundary | Values (m) – integer | Recorded only where a sample plot extends partially beyond the forest land boundary, and is not relocated |
| Plot centre point relocated | Yes, No | Indicates whether the sample plot centre point has been relocated (and if so, a reason must be given – next entry below in table |
| Plot relocated reason | Forest land edge; Forest class edge; Silvicultural trial, Old trees present | Plot relocated because: it extended beyond the forest land boundary; or it extended into another stand with a different forest class; or it extended into an area subject to a silvicultural (or other) trial; or old regenerated trees are present from 2 or more years before the change in land management that initiated the conversion of an area to forest land |
| Plot centre point re-established | Yes, No | Indicates whether or not, when revisiting a sample plot, that the plot centre point has had to be re-established under the Field Measurement Approach Part 3 because the plot centre point markers could not be found (including if using witness trees to relocate the centre point). |
| Plot data collection start date | Date (DD-MM-YYYY) | Date on which collection of FMA information first began for this sample plot |

## Table A3. Shrub information for a sample plot

Collection of FMA information for shrubs is optional – and different options may apply to the land in each forest class, if forest class is assigned.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Shrubs present | Yes, No | If FMA collection is being collected for shrubs, indicates whether shrubs are present within the perimeter of the current sample plot |
| **If trees are recorded as being absent in the plot or sub-plot; or if it is likely the shrubs first established more than two years before or after those trees recorded as being present, then record an estimate of the year the first of the shrubs regenerated:** | | |
| Year first regenerated | YYYY - Year | The year estimated as that in which the shrubs first regenerated |
| **If shrubs are present, the following must be included for each shrub type present:** | | |
| Shrub type | Mānuka/Kānuka Tauhinu, Other indigenous shrubs, Gorse, Broom, Other exotic shrubs | One of (as specified in the Field measurement Approach Standard, Part 7): Mānuka (if not a forest species in that location), Tauhinu, Other indigenous shrubs, Gorse, Broom, Other exotic shrubs – selected for each shrub type present |
| Crown cover for that shrub type | Estimated average value (%) – positive integer (1–100) | Estimated crown cover of all live shrubs with the selected shrub type (expressed as a percentage of the sample plot area) – repeated for each shrub type present |
| Average height for that shrub type | Estimated average value (m) – positive real type number rounded to 2 decimal places | Estimated average crown height of all live shrubs with the selected shrub type – repeated for each shrub type present |

## Table A4: Tree information for a sample plot

The information in this Table describes the overall status of trees (live or standing dead) for a sample plot **when intermingled trees are absent**. If intermingled trees are present, use Table B4. If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot identifier) relate to those species **only** – all other tree species are ignored.

**Notes:** If trees for which FMA information must be collected are absent, record information listed in the grey-shaded sections of the Table only. However, if trees are absent due to a thinning or an adverse event, also record information for all remaining parameters listed in the table **as if the trees are still present**.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Trees present | Yes, No | Indicates whether any trees (live or standing dead) are present in the sample plot. If not present, the reason is recorded (next entry below in the Table) |
| Reason for absence | Selected from specified list | If trees are not present, this specifies the reason for their absence. The list of allowable values is given in the FMA Information Standard, and includes such reasons as: , Nominated tree species not present; Unstocked due to harvesting or thinning; Unstocked due to an adverse event; Permanently unstocked area; Trees below stem diameter or height thresholds, or Other. (Note : for PFSI participants, there is an additional allowable value – PFSI non-eligible forest |
| Species group assigned if trees absent | Tree Species Group Code | If there are no trees present in a plot or sub-plot, record (in order of preference, as applicable): the species group of the intended predominant species expected to be present in the future, the predominant species adjacent to the plot/sub-plot and in the same stand, or the intended predominant species adjacent to the plot/sub-plot and in the same stand. |
| Low count of live DBH-measured stems | Yes; No | If trees are present, indicates whether DBH was determined for at least 20 live tree stems (if not, see next entry in the Table) |
| Reason for low count of live DBH-measured stems | Selected from specified list | If the number of live tree stems for which DBH is determined is less than 20, this specifies the reason for the low stem count. A list is given in the FMA Information Standard, and includes such reasons as: Stems below DBH threshold; low final stocking; Maximum plot area used; Unstocked area present; or Other. A low final stocking may exist because variation in stocking due to uneven thinning or mortality has resulted in fewer stems in a sample plot than originally anticipated. The "Maximum plot area used" reason is for cases when even though a plot area of 0.2 ha was used the stocking was so low that 20 live tree stems were never going to be present at final stocking. A low stem count may also occur if the plot includes a permanent or temporarily unstocked area |
| Intermingled trees present | No | Confirms that intermingled trees are absent |
| Planted trees present | Yes, No | Indicates whether or not planted trees (live or standing dead) are present |
| Planted stocking | Value (stems/ha) – integer | If planted trees are present, an estimate of the planted stocking in stems per hectare (adjusted for any unstocked gaps) |
| Planting year | Year (YYYY) | If planted trees are present, the year the trees were planted |
| Planting month | Month (MM); Null | If planted trees are present, the month the trees were planted if known |
| Regenerated trees present | Yes, No | Indicates whether or not regenerated trees (live or standing dead) are present |
| Year first regenerated | Year (YYYY) | If regenerated trees are present, the year the trees first regenerated |
| Month first regenerated | Month (MM); Null | If regenerated trees are present, the month the trees first regenerated if known |

## Table B4. Tree information for a sample plot when intermingled trees are present

The information in this Table describes the overall status of trees (live or standing dead) for a sample plot **when intermingled trees are present**. If intermingled trees are absent, use Table A4. If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot identifier) relate to those species only – all other tree species are ignored.

**Notes:** The information recorded in the grey-shaded sections of the Table relates to all the trees in the plot or sub-plot for which FMA information must be collected. Information in the green-shaded sections is recorded for the single intended predominant species only. If the intended predominant species includes trees planted in different years, the information for the planted trees in the green-shaded sections is recorded for the trees planted in the earliest year only.

If the intended predominant species is not the actual predominant species at the time of measurement, also record the name of the single species that is the predominant species at that time. In addition, collect the information in the green-shaded sections for the predominant species at the time of measurement only. If the intended predominant species includes trees planted in different years, the information for the planted trees in the green-shaded sections is recorded for the trees planted in the earliest year only.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Trees present | Yes, No | Indicates whether any trees (live or standing dead) are present in the sample plot. If not present, the reason is recorded (next entry below in the Table) |
| Reason for absence | Selected from specified list | If trees are not present, this specifies the reason for their absence. The list of allowable values is given in the FMA Information Standard, and includes such reasons as: , Nominated tree species not present; Unstocked due to harvesting or thinning; Unstocked due to an adverse event; Permanently unstocked area; Trees below stem diameter or height thresholds, or Other. (Note : for PFSI participants, there is an additional allowable value – PFSI non-eligible forest) |
| Low count of live DBH-measured stems | Yes | If trees are present, indicates whether DBH was collected for at least 20 live tree stems |
| Reason for low stem count of live DBH-measured trees | Selected from specified list | If the number of live tree stems for which DBH is determined is less than 20, this specifies the reason for the low stem count. A list is given in the FMA Information Standard, and includes such reasons as: Stems below DBH threshold; low final stocking; Maximum plot area used; Unstocked area present; or Other. A low final stocking may exist because variation in stocking due to uneven thinning or mortality has resulted in fewer stems in a sample plot than originally anticipated. The "Maximum plot area used" reason is for cases when even though a plot area of 0.2 ha was used the stocking was so low that 20 live tree stems were never going to be present at final stocking. A low stem count may also occur if the plot includes a permanent or temporarily unstocked area |
| Intermingled trees present | Yes | Confirms that intermingled trees are present |
| Intended Predominant Species | Selected from specified list | The single Intended Predominant Species (selected from a list in the FMA Information Standard). For participants who have a list of nominated tree species, the intended predominant species must be one of those on that list |
| Predominant Species at time of measurement | Selected from specified list | **Only recorded** if the Intended Predominant Species is not the predominant species at the time of measurement (selected from a list in the FMA Information Standard). For participants who have a list of nominated tree species, the predominant species must be one of those on that list |
| Planted trees present | Yes, No | Indicates whether or not planted trees (live or standing dead) are present |
| Planted stocking | Value (stems/ha) – integer | If planted trees are present, an estimate of the planted stocking in stems per hectare (adjusted for any unstocked gaps) |
| Planting year | Year (YYYY) | If planted trees are present, the year the trees were planted |
| Planting month | Month (MM); Null | If planted trees are present, the month the trees were planted if known |
| Planted tree info for oldest trees only | Yes, No | Indicates whether information is collected for trees planted in the first year only (if intended predominant species includes trees planted in more than one year) |
| Regenerated trees present | Yes, No | Indicates whether or not regenerated trees (live or standing dead) are present |
| Year first regenerated | Year (YYYY) | If regenerated trees are present, the year the trees first regenerated |
| Month first regenerated | Month (MM); Null | If regenerated trees are present, the month the trees first regenerated if known |

## Table A5: Silvicultural information for a sample plot

If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot Identifier) relate to those species on the list only – all other tree species are ignored. .

**Notes:**

If trees for which FMA information must be collected are absent in a sample plot, no silvicultural information is recorded **unless** the absence is due to the most recent thinning event – in which case information is recorded for all parameters listed for all thinnings up to and including the last thinning.

If both planted and regenerated trees are/were present with the same year of establishment, information is collected for the planted trees only.

If intermingled trees are present, information is recorded for the single intended predominant species only. If the intended predominant species comprises both planted and regenerated trees, information is collected for the planted trees only. If the intended predominant species includes trees planted in different years, the information for planted trees is recorded for the trees planted in the earliest year only.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Trees subject to pruning (at any time since planting/regeneration | Yes, No | Indicates whether or not trees are pruned (see definition of "pruned" in the Field Measurement Approach Standard, Part 1) |
| Trees subject to thinning (at any time since planting/regeneration) | Yes, No | Indicates whether or not thinning has occurred, or is intended to take place, for the trees in the sample plot. If "No" the information below in this Table is not recorded |
| **For each thinning, record the:** | | |
| Thinning identifier | 1,2,3 … n – positive integer | A unique sequential integer, starting at 1, identifying each previous, and expected future, thinning that trees in the sample plot have been or will be subject to |
| Thinning year | Year (YYYY) | For a previous thinning, the year of that thinning; for a future thinning, the expected year of thinning |
| Thinning month | Month (MMM) | For a previous thinning, the month of that thinning; for a future thinning, the expected month of thinning if known |
| Post-thinning residual stocking (of live stems) | Value (st/ha) – integer | For a previous thinning, the stocking of live trees within the sample plot after thinning ( stems per hectare equivalent); for a future thinning the expected target residual stocking |
| Residual stocking determined by | Counting, Estimation | Recorded for a previous thinning only, and specifies whether the residual stocking has been determined by counting remaining live trees and stumps of earlier cleared trees, or estimated because the stumps are not visible or are too decayed |
| Stocking estimation method | Selected from a specified list | Recorded only for previous thinnings where the residual stocking has been estimated, and specifies the approach used for estimation (one of, in order of preference) – stand records, quality control data (for the thinning operation), contractor payment records, or personal knowledge of the owner or consultant |
| Majority of thinnings remain on site | Yes, No | For a previous thinning, indicates whether the majority of tree stems thinned remained on site (i.e. thinning to waste) or were removed (i.e. production thinning); for a future thinning, indicates whether the majority of tree stems thinned are expected to remain on site (i.e. thinning to waste) or are to be removed (i.e. production thinning) |

## Table A6: Adverse event information for a sample plot

If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot Identifier) relate to those species on the list only – all other tree species are ignored.

**Notes:**

If trees for which FMA information must be collected are absent in a sample plot, no adverse event information is recorded **unless** the absence is due to the most recent adverse event – in which case information is recorded for all parameters listed for all adverse events up to and including the last adverse event.

If both planted and regenerated trees are/were present with the same year of establishment, information is collected for the planted trees only.

If intermingled trees are present, information is recorded for the single intended predominant species only. If the intended predominant species comprises both planted and regenerated trees, information is collected for the planted trees only. If the intended predominant species includes trees planted in different years, the information for planted trees is recorded for the trees planted in the earliest year only.

| Parameter | Allowable values | Description |
|---|---|---|
| Plot identifier | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| **For each adverse event, record the:** | | |
| Adverse event identifier | 1,2,3 … n - integer | A unique sequential integer, starting at 1, identifying each adverse event that trees in the sample plot have been subject to |
| Adverse event year | Year (YYYY) | The year that the adverse event occurred |
| Adverse event month | Month (MMM); Null | The month (if known) that the adverse event occurred |
| Adverse event type | Fire, Wind, Erosion, Other | The type of adverse event |
| Residual stocking (of live stems) after event | Value (st/ha) - integer | The stocking of live trees within the sample plot after the adverse event, converted to a stems per hectare equivalent |
| Residual stocking determined by | Counting, Estimation | Specifies whether the residual stocking has been determined by counting remaining live trees and stumps of earlier cleared trees, or estimated (irrespective of the reason) |
| Residual stocking estimation method | Selected from a specified list | If residual stocking has been estimated, specifies the approach used for estimation (one of, in order of preference): stand records, information from damage surveys, or personal knowledge of the owner or consultant. |
| Majority of cleared wood remains on site | Yes, No | Indicates whether the majority of the tree stems affected by the adverse event remained on site (as waste) or were removed (i.e. were recovered for productive use) |

## Table A7. Tree stem information for stems with measured diameters in a sample plot

If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot Identifier) relate to those species on the list only – all other tree species are ignored.

| Parameter | Allowable values | Description |
|---|---|---|
| **Plot Identifier** | 1,2,3 … n – integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| **For each stem with a measured DBH or collar diameter, record the:** | | |
| Stem identifier | 1,2,3 … n – positive integer; new set for each plot, sub-plot or sub-sample | A unique sequential integer, starting at 1, identifying each tree stem measured in the plot |
| Stem establishment type | Planted, Regenerated | Specifies whether a planted or regenerated tree stem is being measured |
| Stem state | Null; X | Default ("Null") indicates a live tree stem – recorded (X) only when the stem is dead |
| Stem species | Selected from a specified list | List provided in the FMA Information Standard. The species recorded must be on the FMA participant's nominated species list if nominated tree species are being used |
| Stem diameter | Value (mm) – integer | The stem diameter (DBH or collar diameter, as applicable) in millimeters |
| Stem diameter type | DBH, CD | The value "CD" indicates a collar diameter (only used if FMA information is collected for small trees with a DBH of less than 25 mm and a height of at least 300 mm) |
| Stem diameter estimated because | Null, No | Default ("Null") indicates the stem diameter was measured at the standard height (1.40 m for DBH, or 0.1 m for collar diameters). |
| Stem diameter at standard height estimated due to presence of | Fork, Branches, Nodal swelling, Other malformation | If the stem diameter is not measured at the standard height, record the reason why as one of: the stem forks at that height; branches in the way; the stem is enlarged due to post-pruning nodal swelling; or some other type of stem malformation |
| Stem height | Value (m) –1 decimal place; Null | Record the heights of at least 8 non-malformed stems for each species group represented in a sample plot – with one set of heights for trees with DBHs and another for trees with collar diameters (if collar diameters are being measured). Heights of all broken-topped stems must also be recorded if the stem is less than two- thirds its expected height in an unbroken state. Heights of all tree ferns, cabbage trees, and nikau palms are also required |
| Stem broken-top indicator | Yes, No | Default ("Null") indicates a stem without a broken top – recorded ("Yes") only when a broken-top stem has a height less than two-thirds its expected height in an unbroken state |

## Table A8. Tree stem information for stems with estimated average collar diameters in a sample plot

This Table is used **when intermingled trees are absent**. If intermingled trees are present, use Table B8. If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot Identifier) relate to those species on the list only – all other tree species are ignored.

| Parameter | Allowable values | Description |
|---|---|---|
| **Plot Identifier** | 1, 2, 3 … n – positive integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| **For the tree stems with estimated average collar diameters in each species group, record the:** | | |
| Species group collar diameters estimated for | Selected from a specified list | One of: *Pinus radiata*, Douglas fir, exotic hardwoods, exotic softwoods, or indigenous species. |
| Establishment type of the majority of the collar diameter stems | Planted; Regenerated | Specifies whether the majority of stems for which collar diameters are estimated, are planted or regenerated |
| Average collar diameter of stems | Value (mm) – integer | Visually identify stems with approximately the average collar diameter, and take a sample of collar diameter measurements to determine a final value |
| Average height of collar diameter stems | Value (m) –1 decimal place | Visually identify stems with approximately the average collar diameter, and take a sample of height measurements to determine a final value |
| Stocking of collar diameter stems | Value (st/ha) – integer | Estimate the stocking of all collar diameter stems that FMA information is being collected for, and convert to stems per hectare |

## Table B8. Tree stem information for stems with estimated average collar diameters in a sample plot when intermingled trees are present

This Table is used when intermingled trees are present. If intermingled trees are absent, use Table A8. If an FMA participant has a list of nominated tree species, all parameters in this Table (other than the Plot Identifier) relate to those species on the list only – all other tree species are ignored.

The information in the green shaded sections of the Table is collected separately for different subsets of small trees – those comprising:

- the intended predominant species
- the predominant species at the time of measurement (if not the intended predominant species)
- trees other than those above, in each species group present.

| Parameter | Allowable values | Description |
|---|---|---|
| **Plot Identifier** | 1, 2, 3 … n – positive integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| **For the tree stems with estimated average collar diameters in each identified subset, record the:** | | |
| Species collar diameters estimated for | Selected from a specified list | **Only recorded** if the information below is for collar diameter stems belonging to the intended predominant species, or to the predominant species at the time of measurement (if not the intended predominant species).<br>List provided in the *FMA Information Standard*; Appendix 1, Table A3. The species recorded must be on the FMA participant's nominated species list if nominated tree species are being used |
| Species group collar diameters estimated for | Selected from a specified list | One of: *Pinus radiata*, Douglas fir, exotic hardwoods, exotic softwoods, or indigenous species. |
| Establishment type of the majority of the collar diameter stems | Planted; Regenerated | Specifies whether the majority of stems for which collar diameters are estimated, are planted or regenerated |
| Average collar diameter of stems | Value (mm) – integer | Visually identify stems with approximately the average collar diameter, and take a sample of collar diameter measurements to determine a final value |
| Average height of collar diameter stems | Value (m) –1 decimal place | Visually identify stems with approximately the average collar diameter, and take a sample of height measurements to determine a final value |
| Stocking of collar diameter stems | Value (st/ha) – integer | Estimate the stocking of all collar diameter stems that FMA information is being collected for, and convert to stems per hectare |

## Table A9. Additional information collected for a sub-plot in a sample plot

For each sub-plot in a sample plot, record the information in the Table below. Information for the sample plot that the sub-plot is located within is recorded as usual. Otherwise, the same FMA information is recorded as for the shrubs (if applicable) and trees in a sample plot, except for the shrubs and trees in the sub-plot only (i.e. that in Tables A3–A10, or for Tables B4 and B8 instead of Tables A4 and A8 if intermingled trees are present in the sub-plot).

| Parameter | Allowable values | Description |
|---|---|---|
| Plot Identifier | 1, 2, 3 ... n – positive integer | The Plot ID number allocated by MPI that the FMA information is being collected for |
| Sub-plot identifier | 1, 2, 3 ... n – integer | A unique sequential integer, starting at 1, identifying each sub-plot that is part of the sample plot |
| Sub-plot percentage area | Value (%) – integer | The area of the sub-plot expressed as a percentage of the area of the sample plot it is part of |

Table A.10 Additional information collected for a sub-sample in a sample plot or sub-plot

| Parameter | Allowable values | Description |
|---|---|---|
| **If a sample plot is being sub-sampled, record for each sub-sample the:** | | |
| Plot Identifier | 1, 2, 3 ... n – positive integer | If a sample plot is being sub-sampled, record the Plot ID number allocated by MPI that the plot is part of |
| **If a sub-plot is being sub-sampled, record for each sub-sample the:** | | |
| Sub-sample identifier | 1, 2, 3 ... n – positive integer | A unique sequential integer, starting at 1, identifying each sub-sample that is part of a sample plot or sub-plot |
| Sub-plot identifier | 1, 2, 3 ... n – positive integer | The unique integer identifying the sub-plot that is being sub-sampled, and allocated earlier when collecting Tree, Silviculture, and/or Adverse Event information |
| Sub-sample radius | Selected from a specified list | One of the following specified in the Field Measurement Approach Standard (m): 0.50, 1.00, 1.50, 2.00, 2.50, 3.00, 3.50, 4.00, 4.50, 5.00, 6.00, 7.00, 8.00, 9.00, or 10.0. Larger values in increments of 2 m may also be used. |
| Sub-sample average maximum slope | Value (degrees) – integer | Determined using the same procedure as for average maximum slope (in degrees) of a circular sample plot, except using the sub-sample radius |
| Sub-sample slope-adjusted radius | Value (m) – 2 decimal places | If maximum average slope > 10 degrees |
| Sub-sample transect width ($D_{Line\text{-}transect}$) | Null; Value (m) – 2 decimal places | Default ("Null") indicates line transect sub-sampling is not used; or if used record the value of $D_{Line\text{-}transect}$. |
| Trees present | Yes, No | Indicates whether any trees are present in the sub-sample. If nor present, the reason is recorded (next entry below) |
| Reason for absence | Selected from a specified list | If trees are not present, this specifies the reason for the absence of trees – and Tree Stem information is not recorded. The list of allowable values is given in the FMA Information Standard, and includes such reasons as: Nominated tree species not present; Unstocked due to harvesting or thinning; Unstocked due to an adverse event; Permanently unstocked area; Trees below stem diameter or height thresholds, or Other. (Note : for PFSI participants, there is an additional allowable value – PFSI non-eligible forest |
| Sub-sample transect width ($D_{Line\text{-}transect}$) | Null; Value (m) – 2 decimal places | Default ("Null") indicates line transect sub-sampling is not used; or if used record the value of DLine-transect. |
| Trees present | Yes, No | Indicates whether any trees are present in the sub-sample. If nor present, the reason is recorded (next entry below) |
| Reason for absence | Selected from a specified list | If trees are not present, this specifies the reason for the absence of trees – and Tree Stem information is not recorded. The list of allowable values is given in the FMA Information Standard, and includes such reasons as: Nominated tree species not present; Unstocked due to harvesting or thinning; Unstocked due to an adverse event; Permanently unstocked area; Trees below stem diameter or height thresholds, or Other. (Note : for PFSI participants, there is an additional allowable value – PFSI non-eligible forest |

# Appendix 2: Equations and reference tables

## Equation for slope adjustment of length or distance

Any lengths or distances required to be determined by an FMA participant in a horizontal plane, if not measured in such a plane, must be corrected to an equivalent horizontal length or distance using the formula:

$$D_H = D_S \cos(\theta)$$

where:

- $D_H$ is the equivalent horizontal length or distance
- $D_S$ is the length or distance measured in a plane that is at an angle $\theta$ relative to a horizontal plane
- $cos$ is the cosine trigonometric function
- $\theta$ is the angle between the plane in which measurements are made and a horizontal plane, expressed in degrees or radians (as applicable)

## Equation for slope adjustment of circular sample plot or sub-sample radius

If a circular sample plot or sub-sample with a radius rP in a horizontal plane is to be laid out on a slope in the plane of the average maximum slope, so that the horizontally-projected area remains constant, the radius of the sample plot or sub-sample must be adjusted to a value $r_{P\text{-}S}$ given by:

$$r_{P\text{-}S} = r_P \Big/ \sqrt{\cos \theta_S}$$

where:

- $r_P$ is the radius of a sample plot or sub-sample in a horizontal plane, in metres
- $cos$ is the cosine trigonometric function
- $\theta_S$ is the average maximum slope angle for the sample plot or sub-sample expressed in degrees or radians (as applicable)

## Equation for slope adjustment of square sample plot side length

If a square sample plot with side length $l_P$ in a horizontal plane is to be laid out on a slope in the plane of the average maximum slope, so that the horizontally-projected area remains constant, the side length of the sample plot must be adjusted to a value $l_{P\text{-}S}$ given by:

$$l_{P\text{-}S} = l_P \Big/ \sqrt{\cos \theta_S}$$

where:

- $l_P$ is the side length of a square plot in a horizontal plane, in metres
- $cos$ is the cosine trigonometric function
- $\theta_S$ is the average maximum slope angle for the plot expressed in degrees or radians (as applicable)

Table A1. Slope-adjusted radii and side lengths for sample plots

| Slope (°) | Radius of circular plots for given slope angle, for sample plot areas of: | | | | | | Side length of square plots for given slope angle, for sample plot areas of: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.03 ha | 0.04 ha | 0.06 ha | 0.08 ha | 0.10 ha | 0.20 ha | 0.03 ha | 0.04 ha | 0.06 ha | 0.08 ha | 0.10 ha | 0.20 ha |
| 0 | 9.77 | 11.28 | 13.82 | 15.96 | 17.84 | 25.23 | 17.32 | 20.00 | 24.49 | 28.28 | 31.62 | 44.72 |
| 10 | 9.85 | 11.37 | 13.93 | 16.08 | 17.98 | 25.43 | 17.45 | 20.15 | 24.68 | 28.50 | 31.87 | 45.06 |
| 11 | 9.86 | 11.39 | 13.95 | 16.11 | 18.01 | 25.47 | 17.48 | 20.19 | 24.72 | 28.55 | 31.92 | 45.14 |
| 12 | 9.88 | 11.41 | 13.97 | 16.13 | 18.04 | 25.51 | 17.51 | 20.22 | 24.77 | 28.60 | 31.97 | 45.22 |
| 13 | 9.90 | 11.43 | 14.00 | 16.17 | 18.07 | 25.56 | 17.55 | 20.26 | 24.81 | 28.65 | 32.04 | 45.31 |
| 14 | 9.92 | 11.46 | 14.03 | 16.20 | 18.11 | 25.61 | 17.58 | 20.30 | 24.87 | 28.71 | 32.10 | 45.40 |
| 15 | 9.94 | 11.48 | 14.06 | 16.24 | 18.15 | 25.67 | 17.62 | 20.35 | 24.92 | 28.78 | 32.18 | 45.50 |
| 16 | 9.97 | 11.51 | 14.10 | 16.28 | 18.20 | 25.73 | 17.67 | 20.40 | 24.98 | 28.85 | 32.25 | 45.61 |
| 17 | 9.99 | 11.54 | 14.13 | 16.32 | 18.24 | 25.80 | 17.71 | 20.45 | 25.05 | 28.92 | 32.34 | 45.73 |
| 18 | 10.02 | 11.57 | 14.17 | 16.36 | 18.29 | 25.87 | 17.76 | 20.51 | 25.12 | 29.00 | 32.43 | 45.86 |
| 19 | 10.05 | 11.60 | 14.21 | 16.41 | 18.35 | 25.95 | 17.81 | 20.57 | 25.19 | 29.09 | 32.52 | 45.99 |
| 20 | 10.08 | 11.64 | 14.26 | 16.46 | 18.40 | 26.03 | 17.87 | 20.63 | 25.27 | 29.18 | 32.62 | 46.13 |
| 21 | 10.11 | 11.68 | 14.30 | 16.52 | 18.46 | 26.11 | 17.93 | 20.70 | 25.35 | 29.27 | 32.73 | 46.28 |
| 22 | 10.15 | 11.72 | 14.35 | 16.57 | 18.53 | 26.20 | 17.99 | 20.77 | 25.44 | 29.37 | 32.84 | 46.44 |
| 23 | 10.19 | 11.76 | 14.40 | 16.63 | 18.60 | 26.30 | 18.05 | 20.85 | 25.53 | 29.48 | 32.96 | 46.61 |
| 24 | 10.22 | 11.81 | 14.46 | 16.70 | 18.67 | 26.40 | 18.12 | 20.92 | 25.63 | 29.59 | 33.09 | 46.79 |
| 25 | 10.26 | 11.85 | 14.52 | 16.76 | 18.74 | 26.50 | 18.19 | 21.01 | 25.73 | 29.71 | 33.22 | 46.98 |
| 26 | 10.31 | 11.90 | 14.58 | 16.83 | 18.82 | 26.61 | 18.27 | 21.10 | 25.84 | 29.83 | 33.36 | 47.17 |
| 27 | 10.35 | 11.95 | 14.64 | 16.91 | 18.90 | 26.73 | 18.35 | 21.19 | 25.95 | 29.96 | 33.50 | 47.38 |
| 28 | 10.40 | 12.01 | 14.71 | 16.98 | 18.99 | 26.85 | 18.43 | 21.28 | 26.07 | 30.10 | 33.65 | 47.59 |
| 29 | 10.45 | 12.07 | 14.78 | 17.06 | 19.08 | 26.98 | 18.52 | 21.39 | 26.19 | 30.24 | 33.81 | 47.82 |
| 30 | 10.50 | 12.13 | 14.85 | 17.15 | 19.17 | 27.11 | 18.61 | 21.49 | 26.32 | 30.39 | 33.98 | 48.06 |
| 31 | 10.55 | 12.19 | 14.93 | 17.24 | 19.27 | 27.25 | 18.71 | 21.60 | 26.46 | 30.55 | 34.16 | 48.30 |
| 32 | 10.61 | 12.25 | 15.01 | 17.33 | 19.37 | 27.40 | 18.81 | 21.72 | 26.60 | 30.71 | 34.34 | 48.56 |
| 33 | 10.67 | 12.32 | 15.09 | 17.43 | 19.48 | 27.55 | 18.91 | 21.84 | 26.75 | 30.89 | 34.53 | 48.83 |
| 34 | 10.73 | 12.39 | 15.18 | 17.53 | 19.59 | 27.71 | 19.02 | 21.97 | 26.90 | 31.06 | 34.73 | 49.12 |
| 35 | 10.80 | 12.47 | 15.27 | 17.63 | 19.71 | 27.88 | 19.14 | 22.10 | 27.06 | 31.25 | 34.94 | 49.41 |
| 36 | 10.86 | 12.55 | 15.36 | 17.74 | 19.84 | 28.05 | 19.26 | 22.24 | 27.23 | 31.45 | 35.16 | 49.72 |
| 37 | 10.93 | 12.63 | 15.46 | 17.86 | 19.96 | 28.23 | 19.38 | 22.38 | 27.41 | 31.65 | 35.39 | 50.04 |
| 38 | 11.01 | 12.71 | 15.57 | 17.98 | 20.10 | 28.42 | 19.51 | 22.53 | 27.59 | 31.86 | 35.62 | 50.38 |
| 39 | 11.08 | 12.80 | 15.68 | 18.10 | 20.24 | 28.62 | 19.65 | 22.69 | 27.79 | 32.08 | 35.87 | 50.73 |
| 40 | 11.16 | 12.89 | 15.79 | 18.23 | 20.38 | 28.83 | 19.79 | 22.85 | 27.99 | 32.32 | 36.13 | 51.10 |
| 41 | 11.25 | 12.99 | 15.91 | 18.37 | 20.54 | 29.04 | 19.94 | 23.02 | 28.20 | 32.56 | 36.40 | 51.48 |
| 42 | 11.34 | 13.09 | 16.03 | 18.51 | 20.70 | 29.27 | 20.09 | 23.20 | 28.41 | 32.81 | 36.68 | 51.88 |
| 43 | 11.43 | 13.19 | 16.16 | 18.66 | 20.86 | 29.50 | 20.25 | 23.39 | 28.64 | 33.07 | 36.98 | 52.29 |
| 44 | 11.52 | 13.30 | 16.29 | 18.81 | 21.04 | 29.75 | 20.42 | 23.58 | 28.88 | 33.35 | 37.28 | 52.73 |
| 45 | 11.62 | 13.42 | 16.43 | 18.98 | 21.22 | 30.01 | 20.60 | 23.78 | 29.13 | 33.64 | 37.61 | 53.18 |

Table A2a. Sub-sample areas for specified sub-sample radii

| Radius (m) | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| Area ($m^2$) | 3.14 | 7.07 | 12.57 | 19.63 | 28.27 | 38.48 | 50.27 | 63.62 | 78.54 | 113.10 |

Table A2b. Slope-adjusted radii for sub-samples

| Slope (°) | Slope-adjusted radii of sub-samples with radius in a horizontal plane of (m): | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 |
| 0 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 |
| 10 | 1.01 | 1.51 | 2.02 | 2.52 | 3.02 | 3.53 | 4.03 | 4.53 | 5.04 | 6.05 |
| 11 | 1.01 | 1.51 | 2.02 | 2.52 | 3.03 | 3.53 | 4.04 | 4.54 | 5.05 | 6.06 |
| 12 | 1.01 | 1.52 | 2.02 | 2.53 | 3.03 | 3.54 | 4.04 | 4.55 | 5.06 | 6.07 |
| 13 | 1.01 | 1.52 | 2.03 | 2.53 | 3.04 | 3.55 | 4.05 | 4.56 | 5.07 | 6.08 |
| 14 | 1.02 | 1.52 | 2.03 | 2.54 | 3.05 | 3.55 | 4.06 | 4.57 | 5.08 | 6.09 |
| 15 | 1.02 | 1.53 | 2.03 | 2.54 | 3.05 | 3.56 | 4.07 | 4.58 | 5.09 | 6.10 |
| 16 | 1.02 | 1.53 | 2.04 | 2.55 | 3.06 | 3.57 | 4.08 | 4.59 | 5.10 | 6.12 |
| 17 | 1.02 | 1.53 | 2.05 | 2.56 | 3.07 | 3.58 | 4.09 | 4.60 | 5.11 | 6.14 |
| 18 | 1.03 | 1.54 | 2.05 | 2.56 | 3.08 | 3.59 | 4.10 | 4.61 | 5.13 | 6.15 |
| 19 | 1.03 | 1.54 | 2.06 | 2.57 | 3.09 | 3.60 | 4.11 | 4.63 | 5.14 | 6.17 |
| 20 | 1.03 | 1.55 | 2.06 | 2.58 | 3.09 | 3.61 | 4.13 | 4.64 | 5.16 | 6.19 |
| 21 | 1.03 | 1.55 | 2.07 | 2.59 | 3.10 | 3.62 | 4.14 | 4.66 | 5.17 | 6.21 |
| 22 | 1.04 | 1.56 | 2.08 | 2.60 | 3.12 | 3.63 | 4.15 | 4.67 | 5.19 | 6.23 |
| 23 | 1.04 | 1.56 | 2.08 | 2.61 | 3.13 | 3.65 | 4.17 | 4.69 | 5.21 | 6.25 |
| 24 | 1.05 | 1.57 | 2.09 | 2.62 | 3.14 | 3.66 | 4.18 | 4.71 | 5.23 | 6.28 |
| 25 | 1.05 | 1.58 | 2.10 | 2.63 | 3.15 | 3.68 | 4.20 | 4.73 | 5.25 | 6.30 |
| 26 | 1.05 | 1.58 | 2.11 | 2.64 | 3.16 | 3.69 | 4.22 | 4.75 | 5.27 | 6.33 |
| 27 | 1.06 | 1.59 | 2.12 | 2.65 | 3.18 | 3.71 | 4.24 | 4.77 | 5.30 | 6.36 |
| 28 | 1.06 | 1.60 | 2.13 | 2.66 | 3.19 | 3.72 | 4.26 | 4.79 | 5.32 | 6.39 |
| 29 | 1.07 | 1.60 | 2.14 | 2.67 | 3.21 | 3.74 | 4.28 | 4.81 | 5.35 | 6.42 |
| 30 | 1.07 | 1.61 | 2.15 | 2.69 | 3.22 | 3.76 | 4.30 | 4.84 | 5.37 | 6.45 |
| 31 | 1.08 | 1.62 | 2.16 | 2.70 | 3.24 | 3.78 | 4.32 | 4.86 | 5.40 | 6.48 |
| 32 | 1.09 | 1.63 | 2.17 | 2.71 | 3.26 | 3.80 | 4.34 | 4.89 | 5.43 | 6.52 |
| 33 | 1.09 | 1.64 | 2.18 | 2.73 | 3.28 | 3.82 | 4.37 | 4.91 | 5.46 | 6.55 |
| 34 | 1.10 | 1.65 | 2.20 | 2.75 | 3.29 | 3.84 | 4.39 | 4.94 | 5.49 | 6.59 |
| 35 | 1.10 | 1.66 | 2.21 | 2.76 | 3.31 | 3.87 | 4.42 | 4.97 | 5.52 | 6.63 |
| 36 | 1.11 | 1.67 | 2.22 | 2.78 | 3.34 | 3.89 | 4.45 | 5.00 | 5.56 | 6.67 |
| 37 | 1.12 | 1.68 | 2.24 | 2.80 | 3.36 | 3.92 | 4.48 | 5.04 | 5.59 | 6.71 |
| 38 | 1.13 | 1.69 | 2.25 | 2.82 | 3.38 | 3.94 | 4.51 | 5.07 | 5.63 | 6.76 |
| 39 | 1.13 | 1.70 | 2.27 | 2.84 | 3.40 | 3.97 | 4.54 | 5.10 | 5.67 | 6.81 |
| 40 | 1.14 | 1.71 | 2.29 | 2.86 | 3.43 | 4.00 | 4.57 | 5.14 | 5.71 | 6.86 |
| 41 | 1.15 | 1.73 | 2.30 | 2.88 | 3.45 | 4.03 | 4.60 | 5.18 | 5.76 | 6.91 |
| 42 | 1.16 | 1.74 | 2.32 | 2.90 | 3.48 | 4.06 | 4.64 | 5.22 | 5.80 | 6.96 |
| 43 | 1.17 | 1.75 | 2.34 | 2.92 | 3.51 | 4.09 | 4.68 | 5.26 | 5.85 | 7.02 |
| 44 | 1.18 | 1.77 | 2.36 | 2.95 | 3.54 | 4.13 | 4.72 | 5.31 | 5.90 | 7.07 |
| 45 | 1.19 | 1.78 | 2.38 | 2.97 | 3.57 | 4.16 | 4.76 | 5.35 | 5.95 | 7.14 |

Table A3a. Sub-sample areas for specified sub-sample radii 7 to 20 metres

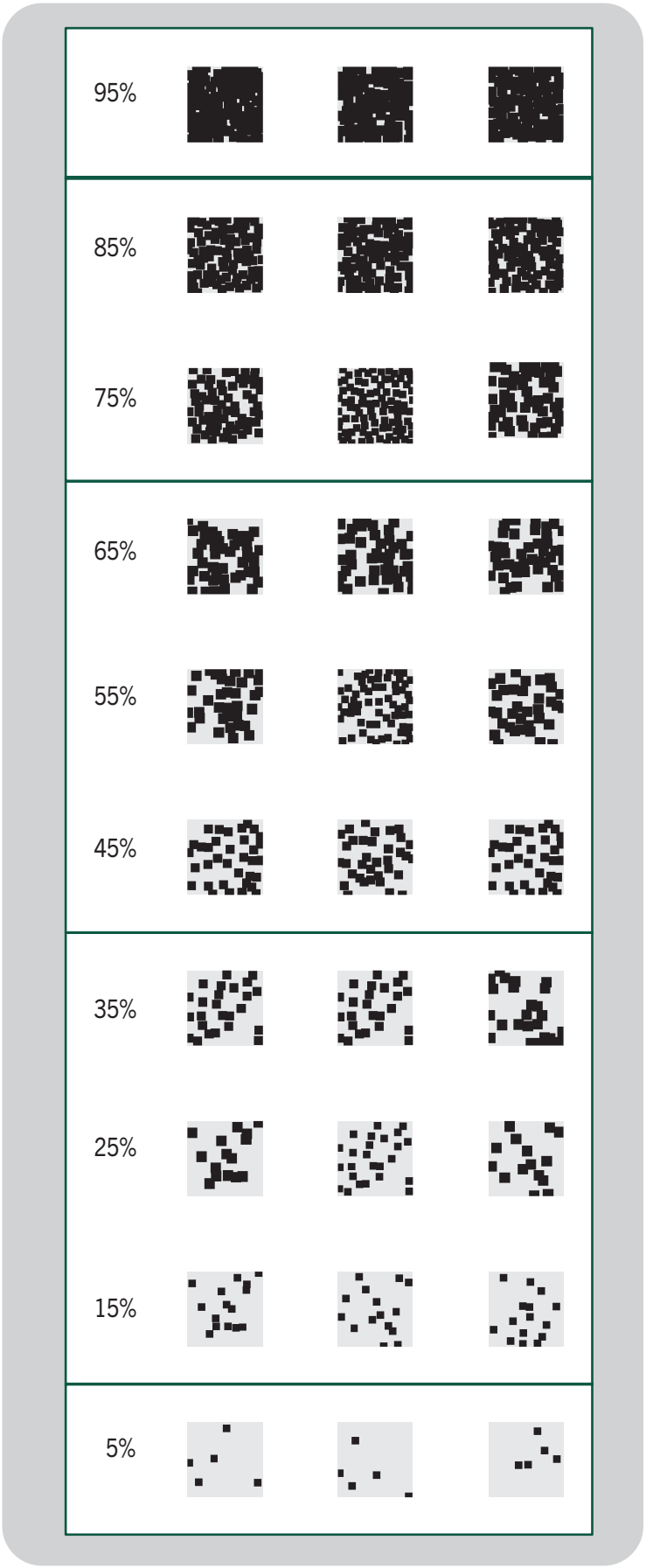
| Radius (m) | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 |
|---|---|---|---|---|---|---|---|---|---|
| Area ($m^2$) | 153.94 | 201.06 | 254.47 | 314.16 | 452.39 | 615.75 | 804.25 | 1017.88 | 1256.64 |

Table A3b. Slope-adjusted radii for sub-samples

| Slope (°) | Slope-adjusted radii of sub-samples with radius in a horizontal plane of (m): | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 |
| 0 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 |
| 10 | 7.05 | 8.06 | 9.07 | 10.08 | 12.09 | 14.11 | 16.12 | 18.14 | 20.15 |
| 11 | 7.07 | 8.07 | 9.08 | 10.09 | 12.11 | 14.13 | 16.15 | 18.17 | 20.19 |
| 12 | 7.08 | 8.09 | 9.10 | 10.11 | 12.13 | 14.16 | 16.18 | 18.20 | 20.22 |
| 13 | 7.09 | 8.10 | 9.12 | 10.13 | 12.16 | 14.18 | 16.21 | 18.24 | 20.26 |
| 14 | 7.11 | 8.12 | 9.14 | 10.15 | 12.18 | 14.21 | 16.24 | 18.27 | 20.30 |
| 15 | 7.12 | 8.14 | 9.16 | 10.17 | 12.21 | 14.24 | 16.28 | 18.31 | 20.35 |
| 16 | 7.14 | 8.16 | 9.18 | 10.20 | 12.24 | 14.28 | 16.32 | 18.36 | 20.40 |
| 17 | 7.16 | 8.18 | 9.20 | 10.23 | 12.27 | 14.32 | 16.36 | 18.41 | 20.45 |
| 18 | 7.18 | 8.20 | 9.23 | 10.25 | 12.30 | 14.36 | 16.41 | 18.46 | 20.51 |
| 19 | 7.20 | 8.23 | 9.26 | 10.28 | 12.34 | 14.40 | 16.45 | 18.51 | 20.57 |
| 20 | 7.22 | 8.25 | 9.28 | 10.32 | 12.38 | 14.44 | 16.51 | 18.57 | 20.63 |
| 21 | 7.24 | 8.28 | 9.31 | 10.35 | 12.42 | 14.49 | 16.56 | 18.63 | 20.70 |
| 22 | 7.27 | 8.31 | 9.35 | 10.39 | 12.46 | 14.54 | 16.62 | 18.69 | 20.77 |
| 23 | 7.30 | 8.34 | 9.38 | 10.42 | 12.51 | 14.59 | 16.68 | 18.76 | 20.85 |
| 24 | 7.32 | 8.37 | 9.42 | 10.46 | 12.55 | 14.65 | 16.74 | 18.83 | 20.92 |
| 25 | 7.35 | 8.40 | 9.45 | 10.50 | 12.61 | 14.71 | 16.81 | 18.91 | 21.01 |
| 26 | 7.38 | 8.44 | 9.49 | 10.55 | 12.66 | 14.77 | 16.88 | 18.99 | 21.10 |
| 27 | 7.42 | 8.48 | 9.53 | 10.59 | 12.71 | 14.83 | 16.95 | 19.07 | 21.19 |
| 28 | 7.45 | 8.51 | 9.58 | 10.64 | 12.77 | 14.90 | 17.03 | 19.16 | 21.28 |
| 29 | 7.48 | 8.55 | 9.62 | 10.69 | 12.83 | 14.97 | 17.11 | 19.25 | 21.39 |
| 30 | 7.52 | 8.60 | 9.67 | 10.75 | 12.89 | 15.04 | 17.19 | 19.34 | 21.49 |
| 31 | 7.56 | 8.64 | 9.72 | 10.80 | 12.96 | 15.12 | 17.28 | 19.44 | 21.60 |
| 32 | 7.60 | 8.69 | 9.77 | 10.86 | 13.03 | 15.20 | 17.37 | 19.55 | 21.72 |
| 33 | 7.64 | 8.74 | 9.83 | 10.92 | 13.10 | 15.29 | 17.47 | 19.66 | 21.84 |
| 34 | 7.69 | 8.79 | 9.88 | 10.98 | 13.18 | 15.38 | 17.57 | 19.77 | 21.97 |
| 35 | 7.73 | 8.84 | 9.94 | 11.05 | 13.26 | 15.47 | 17.68 | 19.89 | 22.10 |
| 36 | 7.78 | 8.89 | 10.01 | 11.12 | 13.34 | 15.57 | 17.79 | 20.01 | 22.24 |
| 37 | 7.83 | 8.95 | 10.07 | 11.19 | 13.43 | 15.67 | 17.90 | 20.14 | 22.38 |
| 38 | 7.89 | 9.01 | 10.14 | 11.27 | 13.52 | 15.77 | 18.02 | 20.28 | 22.53 |
| 39 | 7.94 | 9.07 | 10.21 | 11.34 | 13.61 | 15.88 | 18.15 | 20.42 | 22.69 |
| 40 | 8.00 | 9.14 | 10.28 | 11.43 | 13.71 | 16.00 | 18.28 | 20.57 | 22.85 |
| 41 | 8.06 | 9.21 | 10.36 | 11.51 | 13.81 | 16.12 | 18.42 | 20.72 | 23.02 |
| 42 | 8.12 | 9.28 | 10.44 | 11.60 | 13.92 | 16.24 | 18.56 | 20.88 | 23.20 |
| 43 | 8.19 | 9.35 | 10.52 | 11.69 | 14.03 | 16.37 | 18.71 | 21.05 | 23.39 |
| 44 | 8.25 | 9.43 | 10.61 | 11.79 | 14.15 | 16.51 | 18.86 | 21.22 | 23.58 |
| 45 | 8.32 | 9.51 | 10.70 | 11.89 | 14.27 | 16.65 | 19.03 | 21.41 | 23.78 |

## Figure A4. Crown cover estimation guide

When using the scale first determine which of 5 broad classes (denoted by horizontal lines) best fits the foliage cover of the whole canopy. Within that class select the square which most closely resembles the foliage cover of the canopy. From left to right, the columns on the scale represent a more to less uniform distribution of foliage.



# Appendix 3: Change log

| Date | Change |
|---|---|
| 12 January 2023 | **Changes to 'Standards for the FMA' – page 3**<br>• The Geospatial Mapping Information Standard has been removed from this list. This standard no longer prescribes how to assign forest classes to post-1989 forest land.<br>• The FMA Standard and the FMA Information Standard have both been updated for the legislative and regulatory changes. |
| | **Changes to 'MPI contact details' – page 4**<br>These details were updated:<br>• the address for the Ministry for Primary Industries - Manatū Ahu Matua<br>• the contact email address for Te Uru Rākau – New Zealand Forest Service (ForestryETS@mpi.govt.nz). |
| | **Changes to 'Who is Required to Use the FMA?' – page 6**<br>The 100-hectare threshold applies to all of the post-1989 forest land you have registered, across both standard and permanent forestry. |
| | **Changes to 'What's Involved in the FMA Process' – pages 7-9**<br>• From 1 January 2023, "definitive" participant-specific tables are only required for the emissions return at the end of a mandatory emissions return period. Participant-specific tables are definitive if they are created with information collected in the relevant mandatory emissions return period, from a plot set that covers all of your post-1989 forest land in the ETS at the end of the mandatory emissions return period.<br>• You are no longer required to complete the process to get updated plot locations after every time you add or remove land, as long as you have definitive participant-specific tables by the end of the mandatory emissions return period. |
| | **Changes to 'Key FMA Options and Decisions'**<br>*Assigning Forest Class: an important choice – pages 11-12*<br>From 1 January 2023, you may assign or remove a forest class at any time. Previously, forest classes could only be changed with a request for a new set of sample plot locations. |
| | **Changes to 'When must FMA information be collected?' – pages 13-14**<br>• With the new provisions introduced by the Climate Change Response (Emissions Trading Reform) Amendment Act 2020, there are a number of circumstances when a sample plot may be inactive. Forest measurements only need to be collected from plots that are active at the end of the mandatory emissions return period. The circumstances in which a plot may be inactive are explained in Section 3, Step 4: "Collect FMA Information at Sample Plots".<br>• A box has been inserted with the following:<br>Important note: Participants may not be required to collect FMA information in the 2023-2025 mandatory emissions return period If your area of registered land in the ETS has or will increase or decrease during the 2023-2025 period, use your existing participant-specific tables (or if you do not have them for the forest type, the default tables). There are 2 cases where you must measure your forest and get new participant-specific tables. If your registered land in the ETS does not change between when you |

| Date | Change |
|---|---|
| | were last issued sample plots and 31 December 2025, you must measure as below:<br>• If you had a temporary waiver for the emissions return at the end of the 2018 to 2022 mandatory emissions return period, you will need to measure your forest during the 2023 to 2025 mandatory emissions return period and submit the data to us to get carbon tables for the return due in 2026. If you collected data from some or all of your sample plots between 2018 and 2022, you can submit that data instead of measuring those plots in your forest.<br>• If you had new participant-specific tables issued from information collected between 1 January 2018 and 31 December 2022 and you don't change your ETS landholding in the current period, you may resubmit the same data to get tables issued for the current period.<br>If either of these apply to you, contact us at forestryETS@mpi.govt.nz<br>Note: The current period runs from 1 January 2023 to 31 December 2025, and is 3 years instead of the usual 5 years. It is shorter to realign New Zealand's ETS with global reporting periods<br>• The guidance on which tables to use for submitting different kinds of emissions returns has been updated. For all emissions returns other than the one following the end of a mandatory emissions return period, you must use your latest set of participant-specific tables. If you do not yet have participant-specific tables, you must use the default tables from the regulations. |
| | **Changes to 'The FMA Process: a Step-by-Step Guide' – pages 15-46**<br>The forms required for assigning forest class and requesting sample plots must be requested through the online system Tupu-ake, available in January 2023, or by email from ForestryETS@mpi.govt.nz<br>More detail about this process is given at each step.<br><br>*Assign Forest Class – pages 16-17*<br>• You may class areas of forest land as exotic or indigenous at any time, by giving us written notice. Completing a form to assign forest class is no longer required if you do not want to class your forest. You may instead go straight to requesting your sample plots. You must indicate on the request sample plot locations form that you do not wish to class areas of your forest as exotic or indigenous.<br>• The form that was previously called 'Assign Forest Class' has been renamed 'Class areas of your forest as exotic or indigenous'.<br>*Request Sample Plots – pages 17-22*<br>• The form that was previously called 'Request to Allocate Permanent Sample Plot Locations' has been renamed 'Request sample plot locations'.<br>*Establish Sample Plots – pages 22-32*<br>• A fibreglass peg may be used instead of a wooden peg when permanently marking the sample plot centre point.<br>*Collect FMA Information at Sample Plots – pages 32-42*<br>• Sample plots may be considered "inactive" under certain circumstances. These circumstances are explained in this section. |

| Date | Change |
|---|---|
| | • Mānuka and kānuka are considered forest species in most areas of New Zealand. In particular environments, they are considered shrub species. You must decide whether your mānuka and kānuka stands meet the definition of forest species or shrub species.<br>• The requirement to determine the age of regenerated trees by ring counting a core sample has been removed. For many regenerating indigenous species, determining age in this way is not possible.<br>• When measuring stem heights, you must make a note that all eligible stems have been selected if a plot has less than 8 stems eligible. We may ask for more information as to why you did not meet the minimum number for sampling.<br>*Submit FMA Information – pages 42-45*<br>• From late January 2023, the online system Tupu-ake will be available. You can complete most of your transactions for forestry in the ETS in this system. However, it does not have functionality for submitting your forest measurement information. You must request access to the old online system through Tupu-ake, to submit your information.<br>• Updated silvicultural and adverse event information only needs to be submitted if you've already submitted your forest measurement information for the mandatory emissions return period and the information has changed. You may submit emissions returns other than the emissions return at the end of the mandatory emissions return period using participant-specific tables with silvicultural or adverse event information that's out of date.<br>*Generate Participant-specific Tables – pages 45-46*<br>• Once we have created your participant-specific tables we will upload them to Tupu-ake. You can access them in the system, and if you prepare your emissions return using the system to generate the values, it will use your participant-specific tables.<br>• If you have less than two active plots (or, if you have assigned both forest classes to your land, less than two active plots on each forest class) at the end of the mandatory emissions return period, you must use the default tables for the emissions return at the end of the period. |
| | **Changes to 'Purpose of this section' – page 47**<br>An additional point has been added about requesting an extension for collecting and submitting FMA information. |
| | **Changes to 'Waivers and extensions' – pages 48-50**<br>• Temporary waivers are only applicable to emissions returns following a mandatory emissions return period. This is because this is now the only emissions return that requires you to have up-to-date participant-specific tables. The information in the guide has been updated to reflect the tables you're required to use if you have a temporary waiver, based on the regulations.<br>• You may ask for more time to establish sample plots and/or collect and submit your forest measurement information. Information about this has been provided, with a link to further guidance and how to apply. |

<table>
<tr><th>Date</th><th>Change</th></tr>
<tr><td></td><td>
Changes to ‘Requesting a New Set of Sample Plots’ – pages 50-51<br>
If you request a new set of sample plot locations, you must collect information at the new plot locations and request a new set of participant-specific tables with enough time to use them for your emissions return at the end of the mandatory emissions return period. Once you have the new tables, you must use them for any emissions returns you submit.<br><br>
Changes to ‘Compliance and Compliance Audits’ – pages 53-54<br>
If you commit an offence or fail to meet your obligations in the ETS, you may be subject to an infringement notice or penalty. More information about infringements is available on our website:<br>
Infringement offences in the ETS:<br>
www.mpi.govt.nz/infringement-offences-in-the-ets/<br>
Penalties in the ETS:<br>
www.mpi.govt.nz/penalties-and-the-emissions-trading-scheme/<br><br>
Changes to ‘Adding and Removing Land’ – pages 66-71<br>
• After adding and/or removing land, you only need to complete the process to get new participant-specific tables for the emissions return at the end of the mandatory emissions return period. Previously, you needed new tables for any emissions return if the existing plot set was affected by land changes, except a provisional emissions return (formerly known as a voluntary emissions return).<br>
• If you request new sample plots, we must allocate them so that the total plot set is allocated as uniformly as possible across your registered land.<br>
• The information about the two approaches for allocating new plots has been updated. These approaches have not changed. We have changed the explanations to make them clearer.<br>
• If, after removing land, you have less than 100 hectares of forest land but two or more active plots left, you must use definitive participant-specific tables for the emissions return at the end of the mandatory emissions return period. However, if you have less than two active plots left (or less than two active plots in each forest class, if you have assigned classes to your forest land), you must use the default tables for this emissions return. If you have less than 100 hectares of forest land at the end of a mandatory emissions return period, you are no longer subject to the field measurement approach (unless your registered landholding reaches 100 hectares again).<br><br>
Changes to Table B4: Tree Information for a Sample Plot When Intermingled Trees are Present – page 80<br>
An additional data field has been added to the table:
<table>
<tr><th>Parameter</th><th>Allowable values</th><th>Description</th></tr>
<tr><td>Planted tree info for oldest trees only</td><td>Yes, No</td><td>Indicates whether information is collected for trees planted in the first year only (if intended predominant species includes trees planted in more than one year)</td></tr>
</table>
</td></tr>
</table>

| Date | Change |
|---|---|
| 3 July 2023 | **Change to 'When must FMA information be collected?' – page 14**<br>In the box titled 'Important note: Participants may not be required to collect FMA information in the 2023-2025 mandatory emissions return period', the second bullet point has been edited from 'If you had new participant-specific tables issued between 1 January 2018 and 31 December 2022...' to say 'If you had new participant-specific tables issued from information collected between 1 January 2018 and 31 December 2022...' |
| 8 August 2023 | **Change to 'When must FMA information be collected?' – page 14**<br>Text amended in the box titled 'Important note: Participants who were subject to the FMA in the 2018 to 2022 period may not be required to collect FMA information in the 2023 to 2025 mandatory emissions return period' to clarify rules. |