

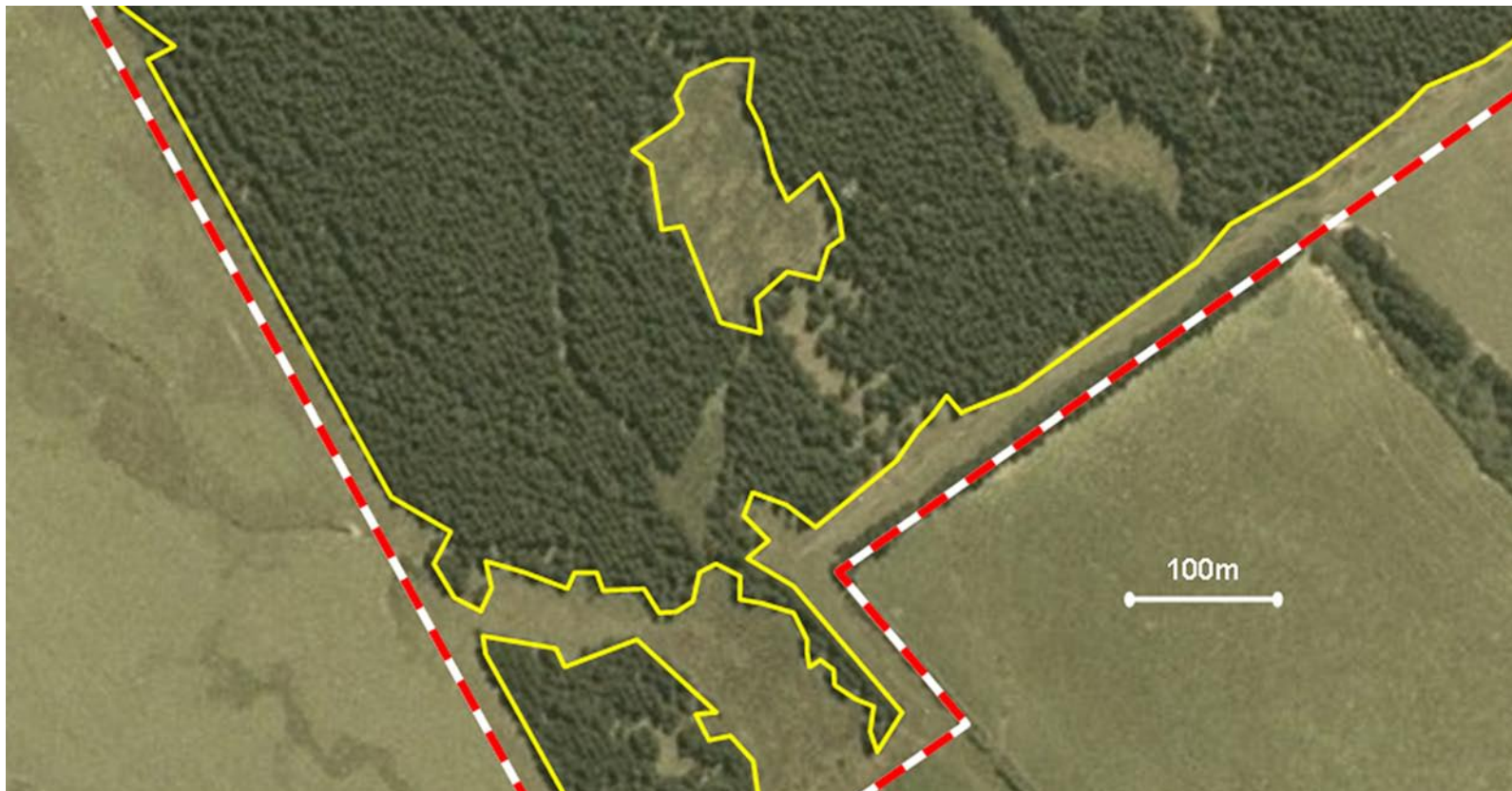


A guide to

# Mapping Forest Land for the Emissions Trading Scheme

January 2018

Ministry for Primary Industries



Further information and downloadable copies of this publication are available at: [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/).

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## About this Guide

*The Guide to Mapping Forest Land* (“the Guide”) provides practical guidance on, and examples of, how to map the area of pre-1990 and post-1989 forest land for the Emissions Trading Scheme (ETS). All mapping must be completed in accordance with the *Geospatial Mapping Information Standard* “the Mapping Standard”, available at [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/) and issued under the authority delegated to the Chief Executive of the Ministry for Primary Industries (MPI) by the Climate Change Response Act 2002 (“the Act”).

The Guide describes the steps that must be taken when applying the two approaches to mapping forest land specified by the Mapping Standard:

- use of the on-line mapping tool within MPI’s Climate Change Information System (CCIS); or
- submission in electronic form to MPI of map information created using a Participant’s own geographic information system (GIS).

For these approaches to mapping, the Guide covers the following key topics:

- When is a map of forest land required?
- How is forest land delineated in accordance with the Mapping Standard?
- What are Carbon Accounting Areas and why are they needed?
- How is mapping completed using the MPI on-line mapping tool?
- How do I prepare and submit mapping information from my own GIS?

The Guide also includes:

- a glossary of key terms relevant to forestry in the ETS, summarised from the Act and the Climate Change (Forestry Sector) Regulations 2008 (“the Regulations”); and
- an abbreviated form of the Mapping Standard, as Appendix 1; (the detailed definition of the New Zealand Transverse Mercator 2000 map projection is only included in the full version of the Mapping Standard, available at [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/)).

The Guide to Mapping Forest Land is one of a series of guides prepared to assist the forestry sector, other landowners and potential investors understand the detailed operation of the ETS for forestry. These guides provide general information only, and do 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.

## Additional guides and standards

The full set of guides that provide detailed information on the function, operation and information requirements of forestry in the ETS can be found on the MPI website, at [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/). Some information for the forestry ETS must be collected, processed or submitted in accordance with prescribed rules and procedures, in order to comply with legislation or regulations. These rules and procedures are set out in documents termed “Standards” and are also available at [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/).

The guides provide not only a general introduction to all aspects of forestry in the ETS, but also give practical advice and examples of how to interpret, and obtain information compliant with, the relevant standards.

## Legislation and Regulations

The legal requirements and definitions relating to forestry in the ETS are set out in:

- Climate Change Response Act 2002; and
- Climate Change (Forestry Sector) Regulations 2008.

These are available at [www.legislation.govt.nz](http://www.legislation.govt.nz). Search for the title of the Act or Regulation.

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# INTRODUCTION

For a Participant in the forestry Emissions Trading Scheme (ETS) to be able to calculate their entitlements or obligations under the Act, they must first estimate the total amount of carbon stored on the forest land registered in the ETS (that is, the forest “carbon stocks”). This requires that two steps be completed:

1. Determining the area of forest land to be registered in the ETS.
2. Calculating the total forest carbon stocks on the registered forest land (in tonnes of carbon dioxide [CO<sub>2</sub>] per hectare).

This Guide provides practical advice on the first of these two steps: determining the area of forest land to be registered in the ETS. Essentially this involves mapping the forest land in accordance with the Mapping Standard, and for post-1989 forests only, by also assigning discrete mapped areas to Carbon Accounting Areas (CAAs). Other guides provide advice on estimating the average forest carbon stocks (tonnes of CO<sub>2</sub> per hectare) on the forest land: the Look-up Table Guide, Field Measurement Guide, and Carbon Calculator Guide. The total forest carbon stocks are obtained by multiplying together the average carbon stocks per hectare and the registered forest land area.

Apart from determining forest land area, mapping forest land also allows:

- verification of the applicant’s legal rights (or obligations) in relation to the forest land area, by allowing the mapped area to be checked against the areas recorded in legal titles, forestry rights or leases, or Crown conservation contracts;
- confirmation of the dates of forest establishment and any other conditions associated with the definition of forest land, by overlaying the mapped area on historical aerial photographs or satellite imagery showing vegetation type.

## 1.1 When is a map of forest land required?

Geospatial mapping information (“mapping information”) about forest land must be prepared and submitted to MPI when:

- initial registration is made to include post-1989 forest land in the ETS;
- adding land to, or removing some land from, the registered area of post-1989 forest land;
- a forestry right or lease, or a Crown conservation contract, either comes into force or ceases to be applicable, for part of a registered area of post-1989 forest land;
- an application is made for an exemption from deforestation liabilities for a total area of pre-1990 forest of less than 50 hectares; or
- an emissions return is submitted in relation to deforestation of pre-1990 forest land.

## 1.2. Other important information

Before reading the remainder of this document, readers should be familiar with information given in *An Overview of Forestry in the Emissions Trading Scheme* (available at <https://mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/>). It provides explanations of key concepts and definitions that have special meaning for forestry under the Act and the Regulations.

The more important definitions are reproduced here in the glossary. Further details are available in the Act and the Regulations, which can be found at [www.legislation.govt.nz](http://www.legislation.govt.nz).

# HOW IS FOREST LAND DELINEATED IN ACCORDANCE WITH THE MAPPING STANDARD?

## 2

The topics covered in this section of the Guide are:

- a summary of the mapping process;
- key mapping concepts and definitions;
- mapping forest land in accordance with the Mapping Standard;
- examples of forest land mapping;
- some common mapping issues and what to do about them.

### 2.1. A summary of the mapping process

The process of mapping forest land – that is, in the context of the ETS, the process of producing mapping information in compliance with the Mapping Standard – is completed by following the steps summarised below. These steps are described using industry-standard mapping terminology and concepts, and also use terms that have special meanings under the Mapping Standard. Such terms are italicised in the steps below, with full descriptions given in Section 3.2 below.

Forest land is mapped by:

1. Obtaining base imagery (orthophotography or orthorectified satellite imagery) of sufficient detail to map the edges of the forest over the area of interest. The base imagery must be in the correct map projection.
2. Using a mapping tool to draw polygons that define the edges of the forest land eligible to be registered in the ETS, over the base imagery.
3. Using the mapping tool to add attributes to the forest land polygons, as required.
4. Assembling the polygon and attribute data that define an applicant's forest land into a shapefile, and providing the shapefile to MPI.

A Participant can prepare shapefiles for registration in the ETS using either MPI's on-line mapping tool or the Participant's (or a consultant's) GIS. The shapefiles must be in the format specified in the Mapping Standard.

The Mapping Standard specifies two ways to submit for registration a shapefile that defines an applicant's eligible forest land:

- using MPI's on-line application process for areas of 2000 hectares or fewer, with the shapefile submitted by electronic upload; or
- a paper-based application for an area of any size, with the shapefile submitted on a CDROM/DVD – in this case, areas greater than 10 000 hectares must be provided in separate shapefiles.

The use of these approaches to define and submit shapefiles is considered in detail in Sections 5 and 6.

### 2.2. Key mapping concepts and definitions

#### Terms used in the mapping process

The terms introduced in the summary of the mapping process (Section 2.1 above) are defined, in the



order they were introduced, as:

### **Base imagery (orthophotography, or orthorectified satellite imagery)**

Mapping tools use specially processed aerial photographs or satellite images as the backdrop over which the polygons that define forest land may be drawn. The processing of aerial photographs or satellite images so they are suitable for use as backdrops involves correcting for distortions due to topography, camera angle and lens imperfections.

The result is an image that is orthographically correct. That is, it is like a map: it has a defined orientation, and area, shape, direction and distance can be determined according to a single scale across the entire area. Orthographically corrected imagery, including digital photographs, is often simply referred to as orthoimagery. But the terms orthophotography and orthorectified satellite imagery are also used, depending on the source of the image data.

There are a number of national orthoimage datasets based on satellite imagery held by Crown agencies in New Zealand, and acquired within a few years of 1990, 1996, 2000 and 2008. Most of the country is also covered by Crown-owned orthophotography, although the original photographs span a relatively wide range of dates, with limited repeat coverage. A number of local authorities have also produced orthophoto datasets, covering entire regions in some cases.

Persistent cloud in some areas of the country, particularly Northland, means there remain areas of New Zealand without recent orthophoto coverage.

### **Map projection**

Mapping involves representing (“projecting”) the three-dimensional surface of the Earth onto a two-dimensional sheet of paper (or its electronic equivalent), in such a way as to minimise distortions in area, shape, direction and distance. This is done by developing a map projection: a set of mathematical equations that describe the relationship between the same points on the three-dimensional and two-dimensional surfaces. The particular set of equations now used for topographic mapping in New Zealand is known as the New Zealand Transverse Mercator 2000 (NZTM2000) map projection. Details of the NZTM2000 map projection can be found in Appendix 1 of the full version of the Mapping Standard available at <https://mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/>

### **Mapping tool**

A mapping tool is a computer software package designed to allow a user to create, store, edit and display as a map the polygons (and their attributes) that define the boundaries of physical features visible on base imagery – features such as forests, roads and lakes. The process of creating an electronic representation of such features, by drawing directly over base imagery displayed on a computer screen, is termed “on-screen digitising”.

### **Polygon**

For the purposes of mapping, a polygon is defined as a closed shape bounded by sequentially connected polylines that do not cross, such that the map co-ordinates of the end point of one polyline are the same as the map co-ordinates of the start of the next polyline.

### **Attributes**

These are the properties of a polygon. For example, in the case of mapping forest land, attributes might be the area, forest species and the planting date of the forest within the polygon.

### **Shapefile**

A shapefile is the most widely used format for encoding map data as an electronic file. It comprises a set of sub-files listing the types of geometric feature in the data (only polygons in the case of forest land mapping), the data that defines the polygon locations, the attributes of each polygon, and the map projection in which the polygon locations are given. The shapefile specification adopted under the Mapping Standard is set by the Environmental Systems Research Institute (ESRI), the developer of the world's most widely used GIS. Most commercially available GIS known to be used to map forest land in New Zealand are able to export mapped data in shapefile format.

### **On-line mapping tool**

This is a tool provided by MPI to allow Participants who do not have access to a GIS to map their forests. The tool essentially comprises a very simple GIS, and is available as part of MPI's on-line Forestry ETS application process. A description of how to use this tool is given later in this Guide (Section 5).

### **Geographic Information System (GIS)**

A GIS is a computer software package that captures, stores, analyses, manages and presents information that refers to, or is linked to, location – that is, it deals with spatial, or mapped, information. It is typically used to create and store electronic maps; to overlay and analyse different sorts of spatial information; and to display, edit, format and print new maps resulting from such analysis.

### **Terms used in the Mapping Standard**

To complete mapping of forest land successfully, it is also necessary to be familiar with key terms defined in the Mapping Standard. These terms are:

#### **Land parcel boundary**

The spatial boundaries recorded in Land Information New Zealand's (LINZ's) Landonline database.

#### **Non-eligible land**

Land that is not pre-1990 or post-1989 forest land. This comprises non-forest land, and areas of indigenous forest land that existed at 31 December 1990 and remained until at least 1 January 2008.

#### **Line segment**

A straight line bounded by end points with distinct map co-ordinates.

#### **Polyline**

A continuous line composed of one or more line segments.

#### **Polygon**

As defined above.

#### **Tree crown edge**

The estimated spatial location of the outer edge of the foliage of a tree at the time of maturity, for an individual tree that is a forest species.

The tree crown edge definition is one of the most important in terms of locating forest land boundaries. Locating the tree crown edge involves some interpretation (and thus also has some intended flexibility) to

allow for variation in growing conditions and species. Using “at the time of maturity” as the condition for determining the location of the tree crown edge also allows a single canopy edge to be drawn irrespective of tree age. Further, the definition is also able to handle the situation in which an area of deforested land must be mapped after trees have been felled.

For the purposes of mapping the extent of forest land for plantation forest, the age “at the time of maturity” should be taken as meaning the age at which trees will be harvested or are cleared, while in the case of permanent forests it will be when the tree canopy has reached maximum expansion.

## 2.3. Mapping forest land in accordance with the Mapping Standard

The mapping process essentially comprises three steps:

1. Identifying discrete areas of contiguous forest land.
2. Identifying the forest land edges of that forest land.
3. Combining those edges to form polygons within which there is only post-1989 forest land or pre-1990 forest land.

The set of rules that must be followed when performing these steps is given in Section 4 of the Mapping Standard. In this section of the Guide we provide a practical interpretation of these rules, and illustrate their application when digitising forest land using base imagery – in this case by digitising over a series of aerial orthophotos.

Note that once an area of forest land enters the ETS, the area may only be changed if part of the registered forest land area is either removed or transferred to another Participant.

### Identifying forest land edges

The rules used to identify forest land edges are those given in Clauses (5)(a) to (5)(c) of Section 4 of the Mapping Standard. The clauses apply in order of precedence (a) to (c), with (a) highest. Mapping of a given forest edge ceases once completed under a given clause.

Using these rules, forest land edges are determined as follows (italicised text is from the Mapping Standard):

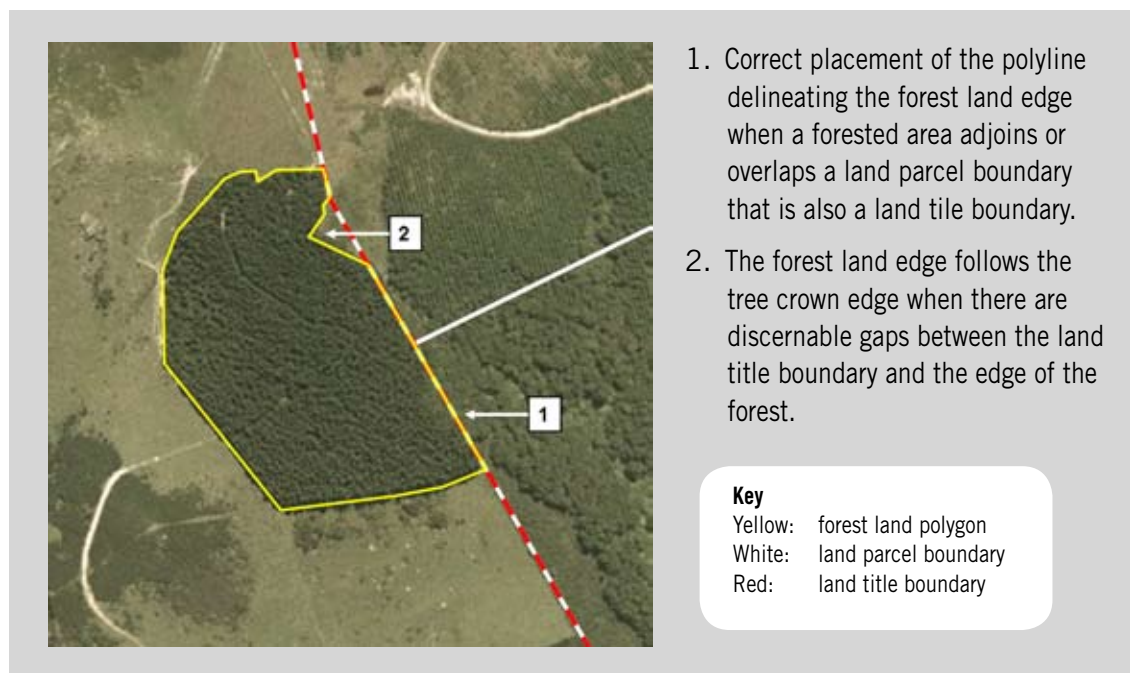
*Clause (5)(a): If the tree crown edges of an area of forest land adjoin or overlap a land parcel boundary, by drawing a polyline coincident with the land parcel boundary; except if the land parcel boundary is common to another land parcel to which the application, notification or emissions return also applies.*

**Interpretation:** only forest land to which the applicant has some form of legal entitlement may be registered in the ETS (whether as the forest landowner, a forest right-holder or lease-holder, or as a Crown conservation contract holder). Thus, if the tree crown edges extend right up to (or overlap) a land parcel boundary that marks the outermost limit of the forest land that the applicant may legally register in the ETS, the forest land edge is a polyline drawn coincident with the land parcel boundary.

This rule is not, of course, mandatory where there is a legal entitlement to register in the ETS forest land that exists on either side of a land parcel boundary (such as when the forest covers two adjoining land parcels both owned by the Participant).

Figure 1 illustrates a common example of applying Clause (5)(a) of the Mapping Standard.

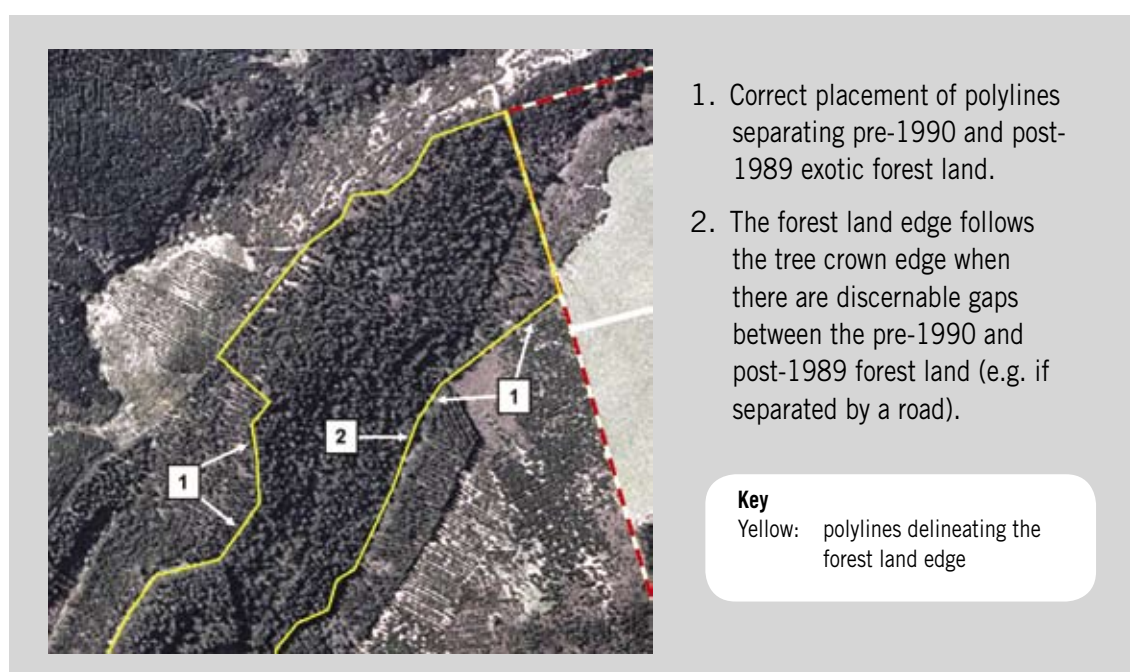
**Figure 1: Identification of forest land edges**



**Clause (5)(b):** if Clause (5)(a) does not apply; for an area of pre-1990 forest land that adjoins an area of post-1989 forest land, by drawing a polyline to separate the pre-1990 forest land and the post-1989 forest land.

**Interpretation:** the ETS requires post-1989 and pre-1990 forest land to be separately mapped. Thus, if the tree crown edges of an area of pre-1990 and post-1989 forest land are immediately adjacent to one another, the forest land edge is a polyline drawn to pass equally between the (possibly overlapping) tree crown edges of the trees in the pre-1990 and post-1989 forest land classes. Figure 2 illustrates some common examples of applying Clause (5)(b) of the Mapping Standard.

**Figure 2: Forest land edges where post-1989 and pre-1990 forests adjoin**



**Clause (5)(c):** if Clause (5)(a) or (5)(b) do not apply, by drawing a polyline to separate forest land from non-eligible land, with the polyline constructed so that:

- i) line segments intersect all tree crown edges that are adjacent to the non-eligible land, and are as close as practicable to the adjacent non-eligible land; and
- ii) no point within any line segment shall be more than 15 metres from a point at which that line segment intersects a tree crown edge.

**Interpretation:** the Act permits only eligible forest land (i.e. pre-1990 or post-1989 forest land) to be registered. Non-eligible land (e.g. indigenous forest established on or before 31 December 1989, and non-forest land) must be excluded. However, it is recognised that it is not feasible to exclude during mapping all small areas of non-eligible land, although the inclusion of such areas should be minimised as far as practicable.

The rules in Clause (5)(c) above are therefore a compromise between the effort of mapping out all areas of non-eligible land, the total error in the area of forest land if some minor amounts of non-eligible land are included, and the level of detail generally visible on base imagery used to map forest land (i.e. 15 metres is reasonably discernable).

Clause (5)(c)(i) above is designed simply to ensure the forest land edge is placed inside, rather than outside, the forest – while also being as close to the edge of the forest land as possible.

Clause (5)(c)(ii) above is designed to reduce the mapping effort for forests with complex edges by avoiding having to follow exactly every detail of the edge. It also allows mapping to be performed under a single set of rules irrespective of whether the forest is a closed-canopy or open-canopy forest. Further, it provides some discretion about how areas on either side of forest tracks are mapped, as the “15 metre rule” (Clause (5)(c)(ii) of the Mapping Standard, above) allows a mapped forest edge to cross narrow tracks or roads so as to include within a single polygon the forest land on either side – if desired).

Figures 3, 4 and 5 illustrate some common examples of applying Clause (5)(c) of the Mapping Standard.

**Figure 3: Defining the forest land edge using the “15 metre rule”**



Figure 4: Bridging a gap using the “15 metre rule”

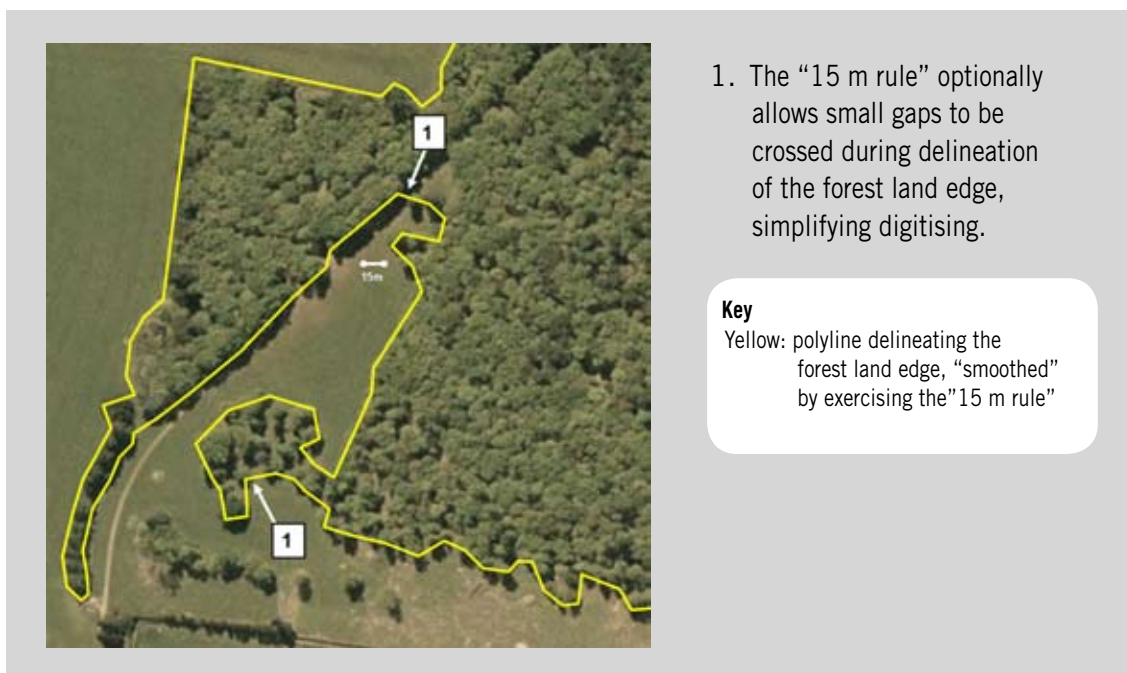
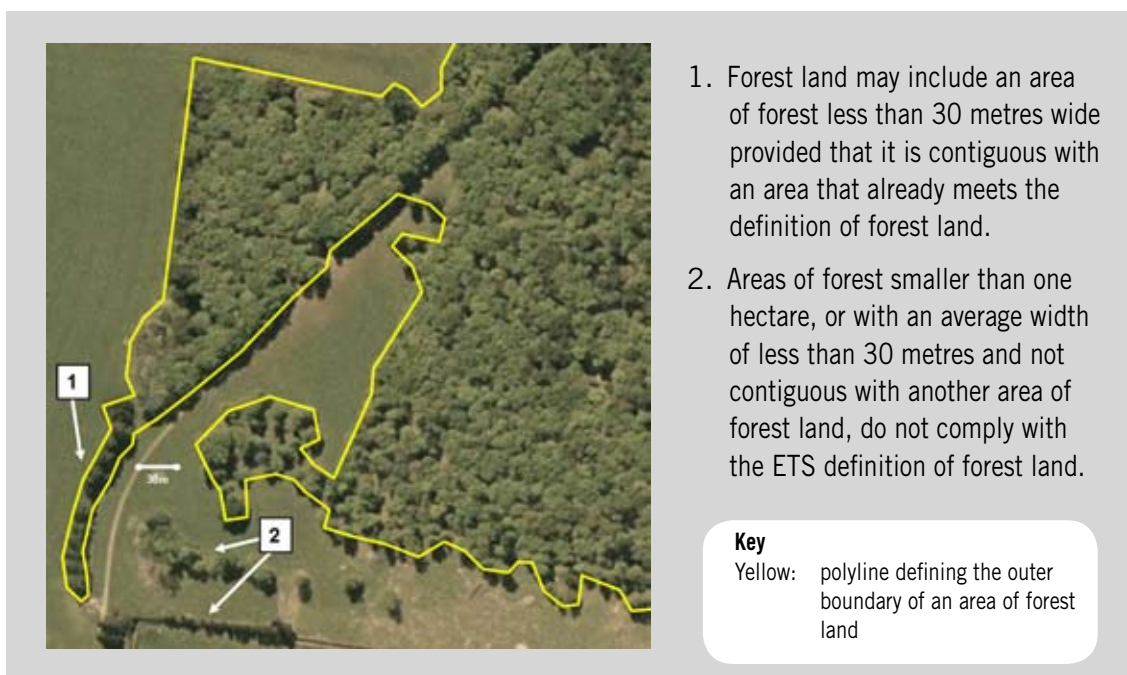


Figure 5: Inclusion and exclusion of areas less than 30 metres wide



### Forming forest land polygons

Having defined forest land edges as a series of polylines, as described above, the next step in mapping forest land is to form the polylines into polygons. To ensure the forest land polygons are formed in an unambiguous way, the Mapping Standard provides a set of rules (Clauses (2)(a) to (2)(e), and Clause (3), in Section 4) that govern how polygons are formed.

Using these rules, polygons are defined by (italicised text is from the Mapping Standard):

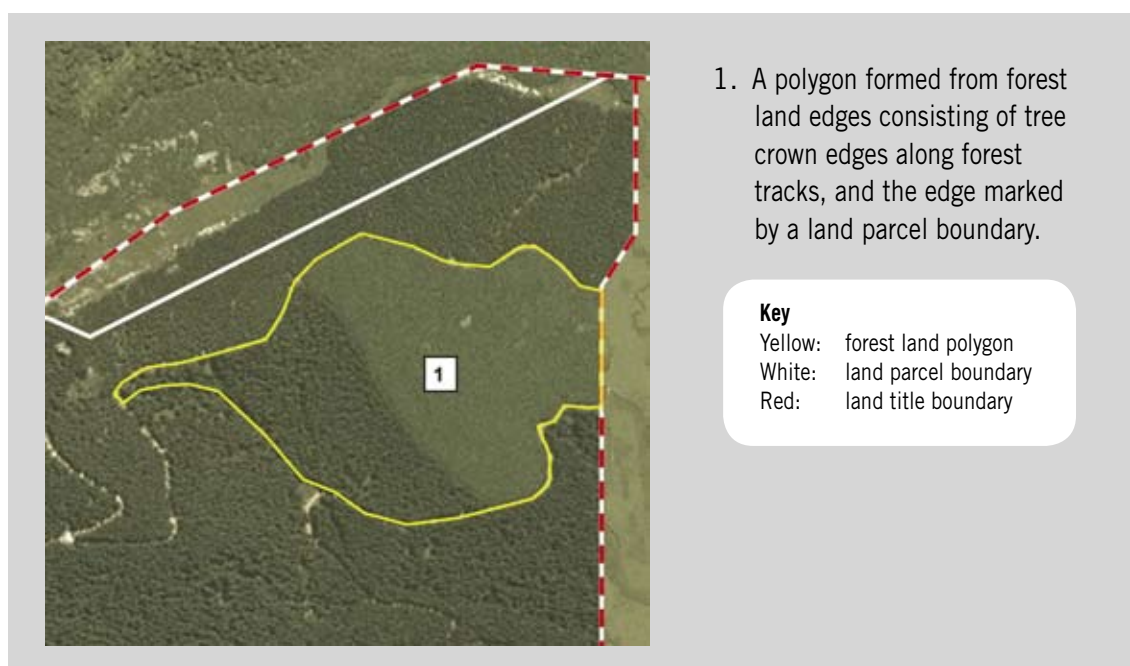
**Clause (2)(a):** *spatially delineating the forest land edges of the outer boundary of each area of contiguous forest land.* (That is, using the rules and examples in the last section above.)

**Clause (2)(b):** constructing as a polygon the outer boundary of each area of contiguous forest land from the polylines that comprise the forest land edges, provided that each resultant polygon has an area of at least one hectare.

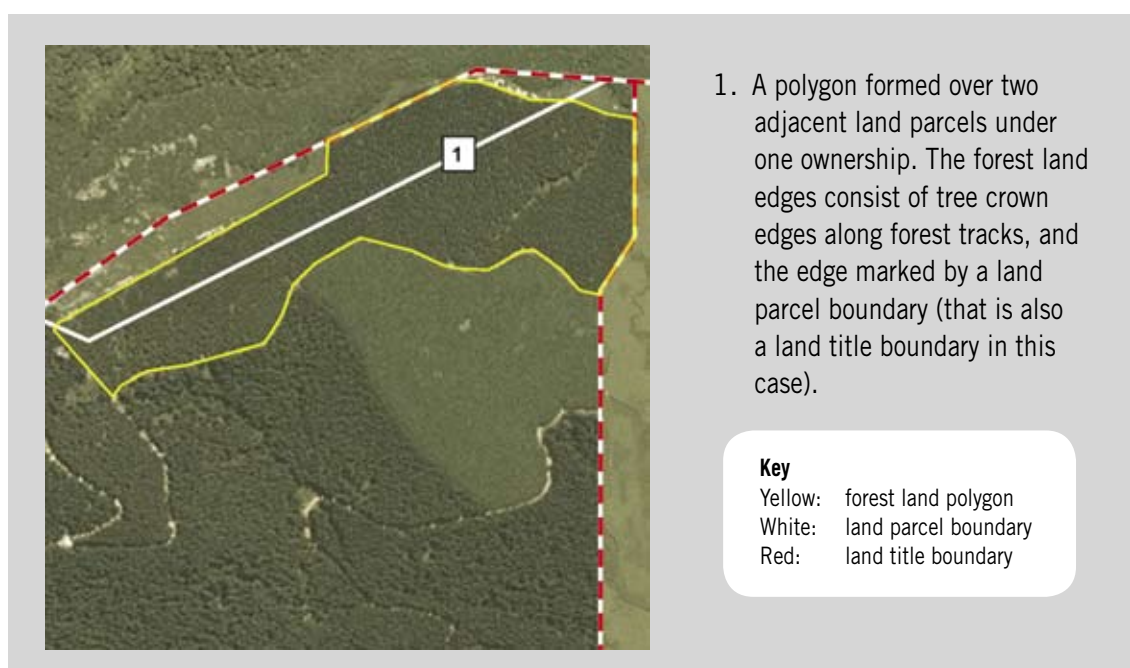
Note that the resultant polygon must be what in mapping terminology is referred to as “topologically correct”: the constituent polylines must each have an end point that is coincident with the start point of the next polyline, and if two polygons have a common boundary, that boundary must be derived from the same polyline(s).

Figures 6 and 7 illustrate examples of the correct formation of a polygon by applying Clauses (2)(a) and (2)(b) of the Mapping Standard.

**Figure 6: Formation of a polygon over two forest species**



**Figure 7: Formation of a polygon over two land parcels**



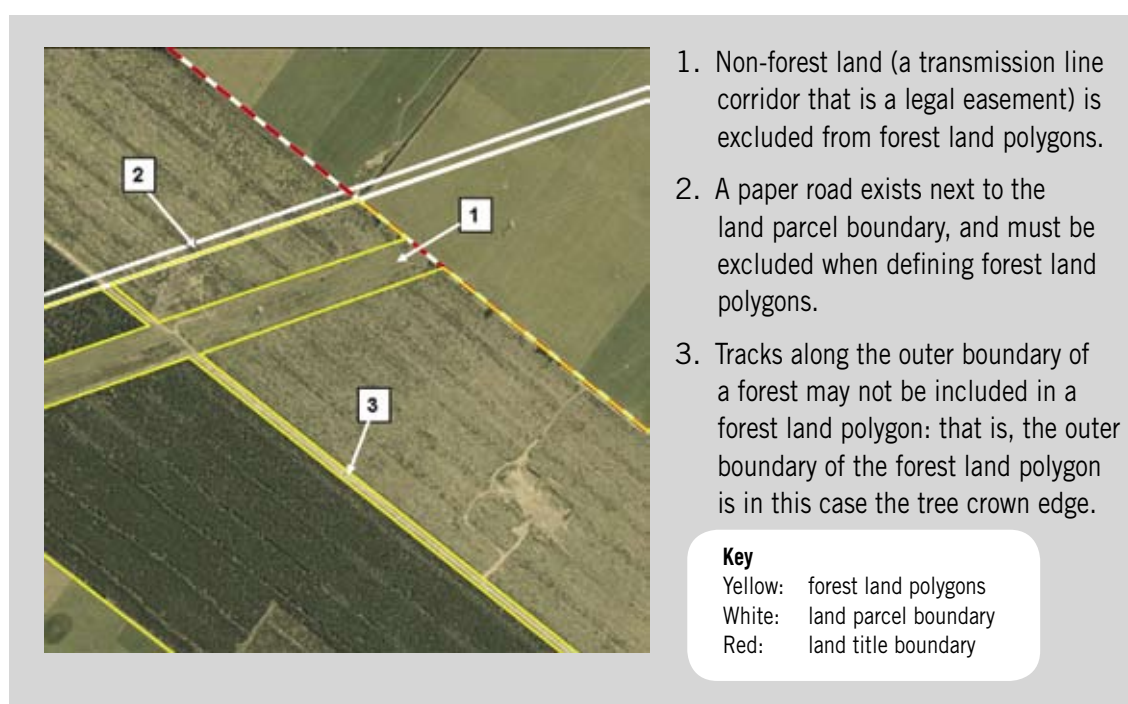
**Clause (2)(c):** for each polygon created by steps (2)(a) and (2)(b), spatially delineating any forest land edges within the polygon adjacent to any area of contiguous non-eligible land that is greater than 1 hectare and has an average width of at least 15 metres measured between tree crown edges.

**Clause (2)(d):** constructing as a polygon the boundary of any non-eligible land from the polylines that comprise the forest land edges adjacent to each area of contiguous non-eligible land.

**Clause (2)(e):** removing the polygons of non-eligible land from the polygons of eligible forest land.

Figure 8 illustrates the correct formation of polygons by applying Clauses (2)(c) to (2)(e) of the Mapping Standard.

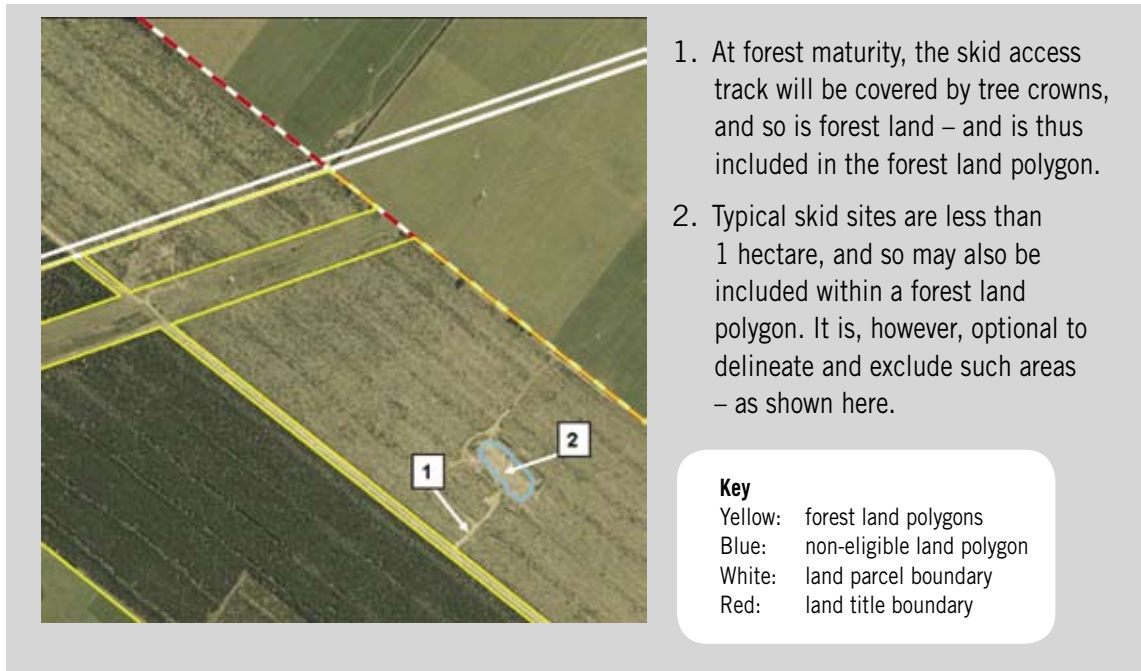
**Figure 8: Excluding non-eligible land**



It is optional to apply Clauses (2)(c) to (2)(e) above to any area of contiguous non-eligible land that is less than one hectare, or that is more than one hectare but has an average width between tree crown edges of less than 15 metres. Figure 9 illustrates the optional exclusion of an area of non-forest land less than one hectare and less than 15 metres wide.



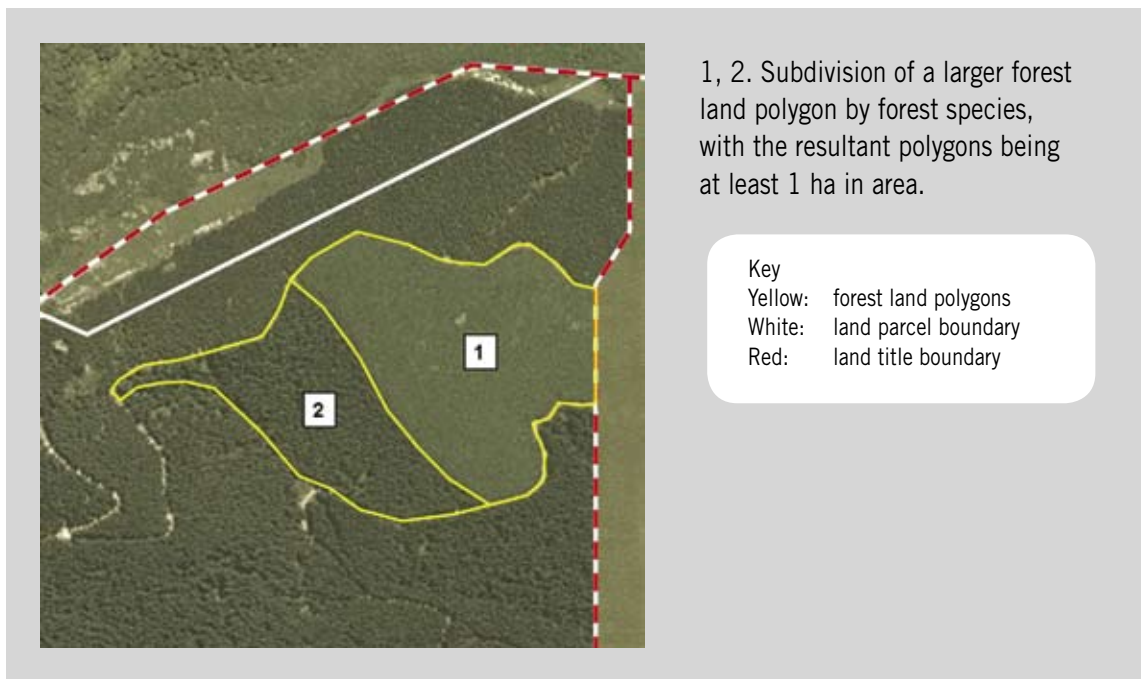
**Figure 9: Formation of polygons including non-forest areas of less than one hectare and areas less than 15 metres wide**



**Clause (3):** each eligible forest land polygon may be further spatially subdivided, provided each resultant polygon has an area of at least one hectare.

Figure 10 illustrates polygon formation by applying Clause (3) of the Mapping Standard, in this case subdivision of the polygon by forest age.

**Figure 10: Forest land subdivided by species**



## 2.4. Some common mapping issues and what to do about them

### Mapping temporarily unstocked areas

Areas of forest land that are cleared because of human actions or natural causes, and so temporarily do not meet the definition of forest land – but are being managed in such a way that it is likely the areas will again become forest land in the near future – are still regarded as being forest land. Such areas are referred to as being “temporarily unstocked”. These areas may, for example, occur because of localised windthrow or fire.

Temporarily unstocked areas should be mapped as forest land if there is an intention to shortly return the areas to forest by replanting or natural regeneration. If temporarily unstocked areas of pre-1990 or post-1989 forest land are left unplanted, or if natural regeneration in such areas is insufficient, the areas will become subject to Section 179 of the Act and regarded as deforested if:

- four years after clearing, there are fewer than 500 stems per hectare of forest species (either planted or naturally regenerated); or
- 10 years after clearing, predominantly exotic forest species are growing, but a given hectare does not have a tree crown cover of at least 30 percent from trees that have reached five metres in height; or
- 20 years after clearing, predominantly indigenous forest species are growing, but a given hectare does not have tree crown cover of at least 30 percent from trees that have reached five metres in height.

### Differences between Landonline and surveyed land parcel boundaries

As noted in the introduction to this Guide, a key reason for mapping forest land is to verify that the applicant has legal entitlement to, or legal responsibility for, the emission units that are associated with a change in carbon stocks on a given area of forest land. Verification comprises ensuring all forest land polygons submitted by an applicant fall within the land parcel boundaries associated with land titles listed as part of the application.

The land parcel boundaries used by MPI to perform the verification are taken from Landonline, the Core Record System maintained by Land Information New Zealand (LINZ). These boundaries are considered by MPI to be the definitive legal property boundaries, and any forest land polygons (or part polygons) that fall outside the Landonline boundaries will normally be excluded from registration.

However, the Landonline land parcel boundaries have variable accuracy depending on the data source. If the applicant has credible information that clearly demonstrates the Landonline data is spatially incorrect, and professionally surveyed data establishing the true land parcel boundary also exists, MPI will consider allowing the surveyed boundary data to be used. An application for acceptance of such land parcel boundaries should be made by writing to the Chief Executive of MPI, and should provide all available supporting information. It is expected that in such circumstances the applicant would also pursue amendment by LINZ of the Landonline data.

### Give-and-take boundary issues

Forest owners can knowingly have forests planted across their legal boundaries as a result of local “give-and-take” or “over-boundary” agreements with neighbouring land title holders. Such agreements, even if legally formalised, are not recognised under the Act: only forest land to which the applicant has legal entitlement through ownership, a forestry right, a forestry lease or a Crown conservation contract may be registered under the ETS.

Forest owners should be aware that the Act may provide entitlements or impose obligations not originally envisaged when give-and-take agreements were put in place. For example, if an area of pre-1990 forest were established across a land title boundary under a give-and-take boundary arrangement, and was later deforested, emissions liabilities could accrue to both landowners – notwithstanding the fact that one neighbour may legally (or otherwise) recognise that the trees actually belong to the other neighbour.

It is up to neighbouring landowners with give-and-take agreements to put in place arrangements to manage any issues that may arise under the Act. MPI will not be a party to these arrangements. If there is already a give-and-take agreement in place, it is suggested that it be amended to reflect the entitlements and obligations that will arise should the forest land in question become subject to the terms of the Act.

### Issues with base imagery

The base imagery used as the backdrop for on-screen digitising of forest land polygons should ideally be sufficiently detailed to resolve individual tree crowns, while also being available at a date relevant to the application. However, the usability of base imagery can be affected by low sun angles (which cause shadows), haze and cloud cover. Shadows can sometimes be difficult to separate from the actual edges of forest stands, and care must be taken to avoid misinterpretation. Shadow length will also vary depending on the sun angle at various times of the day and year, and on topography, which can further complicate the accurate location of forest land edges.

Aerial photography (orthophotos) will almost always be the best choice for use as base imagery when digitising forest land polygons. However, in some cases, photography relevant to the date of application may not exist. In this situation, applicants who are using their own GIS to generate forest maps will need to decide if older but more detailed aerial photography, or more up-to-date satellite imagery that shows lesser detail, is the most suitable for use as base imagery. If applicants are using the MPI on-line mapping tool to define forest land polygons, the base imagery will usually comprise the most up-to-date aerial orthophotos, since these generally show the most detail and thus simplify mapping.

Whether an applicant's particular forests are visible on a given set of base imagery will depend on the date at which the forest was established in relation to the date of the aerial photography or satellite imagery forming the base imagery. Interpretation of the location of the edges of forest land by reference to other physical features visible in the base imagery (such as fence-lines, ridge-lines, tracks and streams) may be required if trees are not visible. Similar interpretation may be required in areas where orthophotos are not available and orthorectified satellite imagery has to be used as the base imagery. Even if the satellite imagery is at the correct date for the forest extent to be visible, satellite imagery may often not have sufficient detail for individual trees to be discernable.

When MPI is assessing the accuracy of submitted forest land polygon data, account will be taken of the quality of the base imagery available to applicants. However, applicants who have prepared mapping information using their own GIS may be asked to explain their particular choice of base imagery if better alternatives are considered by MPI to exist.

# WHAT ARE CARBON ACCOUNTING AREAS AND WHY ARE THEY NEEDED?

# 3

## 3.1. What is a Carbon Accounting Area (CAA)?

A CAA is the area of forest land for which a post-1989 Participant is required to report the change in forest carbon stocks over time. CAAs are created by assigning a CAA number as an attribute to each forest land polygon that belongs to a given CAA. A CAA thus comprises a set of one or more forest land polygons and each forest land polygon can belong to only one CAA. The total carbon stocks in a CAA at a given time are thus the sum of the carbon stocks in the forest land polygons that make up a particular CAA.

CAAs are created either during the on-line registration process (using the MPI on-line mapping tool), or by assigning a CAA number attribute to each forest land polygon using a Participant's GIS followed by electronic or paper-based submission of shapefile data to MPI. CAAs may comprise forest land polygons of any total area, and there are no limits on the number of CAAs a Participant may specify. CAAs also need not comprise forest land polygons that are contiguous. However, once forest land is registered in a CAA, no further changes to the CAA can be made unless part of the forest land comprising a CAA is withdrawn from the ETS, is sold, or is covered by a forestry right or Crown conservation contract that expires.

## 3.2. Why are CAAs needed?

CAAs, and their associated carbon accounting records (CARs), provide the fundamental mechanism by which the total NZUs issued and surrendered for a given area of forest land are tracked through time. Because CAAs are the basic accounting unit, it is also at the CAA level that an important principle of Kyoto Protocol-compliant accounting is applied: that a Participant's maximum emissions liabilities are capped at the maximum number of NZUs previously issued for that CAA since 2008.

For example, for a CAA comprising forest planted in 1992, which is harvested in 2020, the total loss in carbon stocks at harvest would be much greater than the carbon stored since 2008. In this case the cap would apply, and the Participant would only have to surrender NZUs equivalent to the NZUs received for the gain in carbon stocks since 2008.

## 3.3. Choosing the forest land that comprises a CAA

It is up to the Participant to decide how many CAAs they would like to specify for the post-1989 forest land they bring into the ETS. For some Participants, the simplicity of having a single CAA may outweigh other considerations. Other Participants may wish to specify multiple CAAs that relate to forest stand characteristics (such as trees of a particular age, or a particular management regime). Once forest land is assigned to a CAA and registered, the assignment cannot usually be changed.

Because the CAA is the basic accounting unit at which the liabilities cap is applied, forest land polygons can also often be assigned to CAAs in a manner that is likely to maximise the benefit of the liability cap. In general, this will be when all forest land within a given CAA is harvested/cleared during the period covered by a single mandatory emissions return. This is because with such an arrangement emissions from one part of the CAA are not subtracted from gains in carbon stocks elsewhere within the

CAA, prior to the cap being applied.

Participants should always carefully consider their individual circumstances in relation to forest area, age, and harvesting/clearing intentions when assigning forest land to CAAs – in relation to the rules that govern application of the liability cap. If harvesting intentions are uncertain at the time of registration, smaller rather than larger CAAs may provide participants with more flexibility in application of the liability cap at the time of harvesting/clearing. However, larger numbers of CAAs may increase administration effort during filing of emissions returns.

# HOW IS MAPPING COMPLETED USING THE MAF ON-LINE MAPPING TOOL?

## 4

### 4.1. A summary of the on-line mapping process

The MPI on-line mapping tool is one of the components of the Climate Change Information System (CCIS), which is available at <https://mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/>. The tool has the basic GIS functionality required to allow Participants to digitise and edit forest land polygons over a base imagery backdrop, and to assign the polygon attributes specified in the Mapping Standard.

The on-line mapping tool uses a simple web-based interface which allows a Participant to:

- Quickly display a map of the local area to which the application relates by:
  - entering the land parcel description; or
  - entering the name of a nearby road; or
  - zooming in on a map of New Zealand;
- Once in the general area, to zoom in further until the base imagery backdrop appears (usually a colour orthophoto, although sometimes a black-and-white orthophoto, or an orthorectified colour satellite image if no aerial photographs are available);
- Further zoom in until forest and individual trees relating to the application are visible (or if the date or resolution of the base imagery is such that the forest is not visible, to zoom in until sufficient land features are visible to determine which areas are now forest land).
- Digitise the outer boundary of an area of pre-1990 or post-1989 forest land, using the *Add forest area* tool provided. This step must be completed in accordance with the rules provided in Section 2.3 of this Guide.
- Assign attributes to the forest land polygon, by entering text in the dialogue box that appears when digitising of a forest land polygon is complete. Mandatory attributes include the CAA number, the forest species, and the year of forest establishment for post-1989 forests. However, the following attributes may also optionally be entered: a forest number and a compartment number.
- Digitise the boundary(s) of any non-eligible land included within the outer boundary of an area of pre-1990 or post-1989 forest land, and remove the non-eligible land, using the *Subtract forest area* tool provided. This step must be completed in accordance with the rules provided in Section 2.3 of this Guide.

The on-line mapping tool automatically creates and saves the necessary shapefile within which the information relating to digitised forest land polygons and attributes is stored. The on-line mapping tool also provides the ability to edit or delete previously digitised forest land polygons, and to revise the associated attributes at any time until the application is submitted. Mapping need not be completed in one session.

A description of the functionality and features provided by the on-line mapping tool is available at <https://mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/registering-post-1989-forest-land/>.

Once the map of forest land has been finalised, and the associated ETS application submitted, the shapefile will be checked by MPI for accuracy and consistency with the definition of forest land. MPI has access to a wide range of satellite imagery, but most of this imagery requires specialised analysis

by trained image interpreters, and so is not available as part of the on-line mapping tool. Applicants will be advised if any issues are found with the submitted shapefile.

## 4.2. Maps and base imagery used in the on-line mapping tool

The default map used by the on-line mapping tool is a simplified version of the New Zealand topographical map series. This map will show on the screen at start-up, and whenever the distance scale displayed under the scale bar (located on the bottom right-hand corner of the screen) is two kilometres or more.

When, after zooming in, the scale bar shows a value smaller than two kilometres, the best orthophoto that covers the entire area will be displayed as the base image. If orthophoto coverage is not available, the best satellite imagery of the area will be displayed.

There are numerous orthophoto series available in New Zealand, although no national coverage at a single date. Also, to reduce the amount of information that has to be transmitted over the internet, the on-line mapping tool will select for display an orthophoto from those available that has no more resolution than is needed at a particular scale. Users may therefore sometimes encounter black-and-white images when only partially zoomed in, or when colour aerial photography is not available for a particular area.

To digitise forest land, the user must zoom in on the area of interest until the scale bar indicates 100 metres or less. At this scale, the base image displayed will usually be a colour orthophoto – although as noted earlier, the date of the orthophoto may not necessarily be such that an applicant's forest is displayed. On-screen digitising of forest land polygons is not available if the scale bar displays a figure greater than 100 metres.

## 4.3. Limitations on the size of shapefiles

Because the on-line mapping tool works over the internet, the amount of information that can be transmitted to or from a user's computer system can sometimes be limited. On-screen digitising requires a responsive computer system, which displays and updates polygons in real time as they are digitised. Digitising becomes difficult if points are added faster than they can be transmitted back to the remote computer system running the mapping tool, stored on that system, and the updated display information sent back to the user.

Practical experience shows that it is not feasible to digitise areas of forest land of more than 2000 hectares using the on-line mapping tool, even on a good-quality broadband internet connection. Applicants with larger areas of forest land must therefore prepare shapefiles of their forest land using their own (or their consultants') GIS, and submit those shapefiles to MPI on CDROMs or DVDs – as described in the next section below.

# HOW DO I PREPARE AND SUBMIT MAPPING INFORMATION FROM MY OWN GIS?

# 5

## 5.1. Summary of the map preparation and submission process

Existing digital forest maps may not necessarily meet the requirements for registration of forest land under the ETS. The steps below outline the process that applicants should complete to ensure that their mapping information is compliant with the requirements of the Act and the Regulations – as specified in the Mapping Standard:

1. Review the approach taken to forest mapping, to ensure compliance with the principles laid out in the Mapping Standard, and with the practice and interpretations provided in this Guide. Re-process any areas that do not comply.
2. If the application relates to post-1989 forest land, assign each mapped forest land polygon to a CAA.
3. Assign, as required, any other optional attributes specified in the Mapping Standard to each forest land polygon.
4. Convert, if necessary, the existing forest land mapping information from the format used by the applicant's GIS to the ESRI shapefile format defined in the Mapping Standard. Most commercial GIS will have a conversion utility to do this automatically.
5. Re-project, if necessary, the shapefile to the NZTM2000 map projection, as required by the Mapping Standard. Most commercial GISs will have a conversion utility to do this automatically.
6. Submit the resulting shapefile to MPI, either by electronic upload as part of the on-line registration process or by sending the shapefile to MPI on a CDROM or DVD.

Section 5.2 below provides details on how to make the commonly used net-stocked and gross-stocked approaches to forest mapping compliant with the Mapping Standard. Issues related to the assignment of polygon attributes, to map projections and to shapefile submission are covered in Section 5.3.

Note that steps 2 and 3 above can also be performed within the CCIS on-line registration environment, although it is likely to be most convenient to complete these steps using an applicant's own GIS. There are also some restrictions on the sizes of shapefile that can be uploaded electronically, as detailed below in Section 5.3.

## 5.2. Using existing digital forest mapping information

Geospatial datasets derived from mapping of forest on the basis of net-stocked area can usually be made compliant with the Mapping Standard with limited effort. Commercial GIS provide many features to automate much of the data re-processing likely required. However, if existing forest geospatial datasets have been derived on the basis of gross-stocked area, ensuring compliance with the Mapping Standard is likely to involve considerably more work.

If an applicant has mapped forest land in a manner different to that described in the remainder of this section, they should propose their own procedure for converting existing forest geospatial data to be compliant with the Act, the Regulations and the Mapping Standard. That procedure must be discussed with MPI before attempting to register forest land under the ETS. Any procedure should be based as far as possible on the approaches outlined in the remainder of this section.



### Using existing datasets of net-stocked forest area

Existing geospatial datasets of net-stocked forest area are expected to be able to meet the requirements of the Mapping Standard provided these datasets either already conform with, or are re-processed to satisfy, the following requirements:

- i) The original map has been generated by digitising over accurately orthorectified aerial photography, and the orthophotography has sufficient spatial resolution to readily discern:

- the individual trees (even if very young) on the forest land;
- distances of 15 metres or less.

Alternatively, the digitising process can have been completed in the field using either a differentially corrected Global Positioning Satellite (GPS) receiver or a high-quality (at least 10-channel) GPS receiver operated when selective availability was turned off by the satellite operators.

- ii) The digitising process has accurately mapped as a polygon the edge of the forest as the canopy drip-line of the outermost trees in each forest stand that are forest species. In respect of crossing any gaps between trees, the resulting polyline must be compliant with Section 4, Clause (5)(c)(ii), of the Mapping Standard that specifies the maximum distance a polyline may extend between intersections with successive tree crown edges (the “15 metre rule”).
- iii) The position of the canopy drip-line at maturity must next be estimated, if the trees in the forest are not already at maturity. This can be done by buffering the polyline delineating the canopy drip-line, according to a distance that represents the likely expansion in tree crown radius between the date of mapping and the expected date at forest maturity.

The following buffer widths are suggested for *Pinus radiata* forest:

- age zero to five, buffer four metres;
- age six to 10, buffer three metres;
- age 11 to 15, buffer two metres;
- age 16 to 20, buffer one metre;
- age 21 plus, no buffer.

The applicant may use alternative widths for alternative species, although these must be credibly justified in a letter accompanying any application.

- iv) The resultant polylines formed by buffering (if necessary) the canopy drip-line are replaced, where applicable, by polylines coincident with land parcel boundaries or by more appropriate polylines separating pre-1990 from post-1989 forest land – in accordance with Clauses (5)(a) and (5)(b) of Section 4 of the Mapping Standard. These replaced polylines may then be taken as “forest land edges” as defined under Section 4, Clauses (5)(a) and (5)(b) of the Mapping Standard. This procedure is further described, and illustrated using examples, in Section 2.3 of this Guide.
- v) The remaining polylines formed by buffering (if necessary) the canopy drip-line, and not replaced in step (iv) immediately above, may be taken as representing “forest land edges” as specified in Section 4, Clause (4)(c) of the Mapping Standard. However, all polylines resulting from the buffering process must be visually examined to ensure that:
  - The buffering operation has not caused segments of polylines to merge or cross – within or between forest land polygons. If this has occurred, the polylines must be corrected by manual editing.
  - The polylines resulting from the buffering operation are compliant with Section 4, Clause (5)(c)(ii) of the Mapping Standard (the “15 metre rule”).

- The correct placement of polylines to locate forest land edges is further described, and illustrated using examples, in Section 2.3 of this Guide.
- vi) Once all forest land edges are identified, polygons that define the area of forest land may be formed by following the stepwise process given in Section (4), Clause (2) of the Mapping Standard. These steps are illustrated in Section 2.3 of this Guide.

### Using existing datasets of gross-stocked forest area

Mapping of gross-stocked area may have been performed in a variety of ways. Two common procedures are considered here, and approaches are given for making the resultant geospatial datasets compliant with the Mapping Standard. The use of data generated by any other procedure would need to be first discussed with MPI before being submitted.

**Case 1:** existing geospatial datasets of gross-stocked forest area are expected to meet the requirements of the Mapping Standard provided these datasets either already conform with, or are re-processed to satisfy, the following requirements:

- i) The original map has been generated by digitising over accurately orthorectified aerial photography, and the orthophotography has sufficient spatial resolution to readily discern:
- the individual trees (even if very young) on the forest land; and
  - distances of 15 metres or less.

Alternatively, the digitising process can have been completed in the field using either a differentially corrected GPS receiver or a high-quality (at least 10-channel) GPS receiver operated when selective availability was turned off by the satellite operators.

- ii) The digitising process has accurately mapped as a polygon the edge of the forest as the canopy drip-line of the outermost trees in each forest stand that are forest species. In respect of crossing any gaps between trees, the resulting polyline must be compliant with Section 4, Clause (5)(c)(ii) of the Mapping Standard (the “15 metre rule”).
- iii) The geospatial data must now be prepared to allow, in a subsequent processing step, non-eligible land to be removed from within each gross-stocked forest polygon. This is achieved by identifying internal boundaries that separate forest land from non-eligible land: the position of the canopy drip-line, of trees that are forest species, immediately adjacent to areas of non-eligible land. Sufficient internal boundaries need to be defined such that the larger areas of non-eligible land within the forest polygon can be removed in accordance with Section 4, Clauses (2)(d) and (2)(e) of the Mapping Standard (as illustrated in Section 2.3 of this Guide).
- iv) Complete dataset preparation by following the procedure given above for using existing datasets of net-stocked forest area, from step (iii) onwards.

**Case 2:** if existing geospatial datasets of gross-stocked forest area have not been created by delineating all areas of forest according to the position of the canopy drip-line present at the time of mapping, adopt one of the two approaches given below:

- **Editing:** ensure that the geospatial data satisfies step (i) in Case 1 above, then edit all existing forest polygons such that all existing polygon boundaries are coincident with the canopy drip-line. In respect of crossing any gaps between trees, the resulting polyline must be compliant with Section 4, Clause (5)(c)(ii) of the Mapping Standard (the “15 metre rule”). Complete data re-processing by following the steps in Case 1 above, from step (iii) onwards.

- **Re-mapping:** remap the forest area completely according to the procedures given in the Mapping Standard. The information given in Section 2.3 of this Guide will assist with this.

### 5.3. Submission of mapping information as a shapefile

If mapping information describing forest land to be registered under the ETS is prepared using an applicant's own GIS, the data must be submitted to MPI with the content, and in the format, prescribed in Section 7 of the Mapping Standard. The steps required to do this are:

1. Assign attributes, as applicable, to each forest land polygon using the attribute names and field definitions given in Table 1 below. The CAA number, forest species, and the year of forest establishment are mandatory attributes for post-1989 forests. The CAA number must comprise a continuous series of whole numbers starting at 1. All other attributes are optional. This step may also be completed using the on-line mapping tool, after the polygon spatial data has been uploaded into the CCIS.
2. Convert, if necessary, the existing forest land mapping information from the native format used by the applicant's GIS to an ESRI shapefile format, as defined below. Most commercial GISs will have a conversion utility to do this automatically.
3. Re-project, if necessary, the shapefile to the NZTM2000 map projection. Most commercial GIS will have a conversion utility to do this automatically.
4. Submit the shapefile to MPI. There are some restrictions on how this can be done, which depend on the size of the digitised forest land area:
  - i) For forests of any size, the shapefile may be submitted on CDROM or DVD. However, if the area of forest land is greater than 10 000 hectares, the area must be divided among several shapefiles such that each shapefile comprises data for at most 10 000 hectares.
  - ii) For an area of 2000 hectares or less, the shapefile may be uploaded electronically as part of the on-line application process.

For the purposes of submitting geospatial data on forest land for registration in the ETS, a shapefile must comprise the following four digital files:

- .shp file – shape format file: the feature geometry in the shapefile (i.e. the map co-ordinates of the line segments that make up the forest land polygons);
- .shx file – shape index format file: a positional index of the feature geometry in the shapefile (i.e. the location within the .shp file of the start of the data for each forest land polygon);
- .dbf file – attribute format file: the attributes for each forest land polygon in the shapefile; and
- .prj file – projection format file: the co-ordinate system and map projection information for the shapefile.

The shapefile must otherwise conform to the specification given in the ESRI Shapefile Technical Description White Paper dated June 2004. The Paper can be found at: <https://www.esri.com/library/whitepapers/pdfs/shapefile.pdf>.

#### Polygon attributes

The .dbf file is not necessarily required if attributes are to be added to the forest land polygons after the shapefile has been uploaded into the CCIS. However, this is not recommended for larger forests, as editing large datasets within the CCIS environment (i.e. over the internet) can be a time-consuming process whenever a large number of polygons are involved.

If a .dbf file is supplied that includes attribute names other than those in Table 1, the data associated with those attribute names will be ignored.

Forest number and compartment number are optional attributes, and are provided for the convenience of forest owners to allow data to be added that cross-references those held for the same forests in their own GIS. If these attributes are used, it is strongly recommended they be added using the applicant's own GIS, prior to the submission of the shapefile.

**Table 1: Specification for the attributes in the attribute format file (.dbf) to be submitted as part of the mapping information**

Attribute	Attribute Name	Mandatory or Optional	Description	Format
Carbon Accounting Area number	CAA_NUM	Mandatory for areas of post- 1989 forest land, otherwise not included	Integer	Long integer, 9 characters
Forest number	FOREST_NUM	Optional	Integer	Long integer, 9 characters
Compartment number	COMP_NUM	Optional	Integer	Long integer, 9 characters
Species	SPECIES	Mandatory	String	Text, 50 characters
Year established	YEAR_PLANT	Mandatory for areas of post-1989 forest land	Integer	Long integer, 9 characters

### Map projection

The map projection for the shapefile must be the NZTM2000 projection. This projection is the current national standard projection for topographic mapping in New Zealand. It utilises the New Zealand Geodetic Datum 2000 and supersedes the New Zealand Map Grid (NZMG) projection, which was defined in terms of the New Zealand Geodetic Datum 1949.

The definition of NZTM2000 is given in the LINZ Standard LINZS25002, which is provided as an Appendix in the Mapping Standard available at [www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/](http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/). The LINZS25002 Standard can also be found on the LINZ website, together with advice about transforming geospatial data between the older NZMG and current NZTM2000 projections, at <https://www.linz.govt.nz/regulatory/25002>.

## Glossary

### **Carbon Accounting Area (CAA)**

An area of forest land determined by the Participant during the ETS registration process that is the basic unit for which accounting of carbon gains and losses is performed. A CAA can be any size; there are no limits on the number of CAAs a Participant may specify; and they do not need to comprise contiguous forest areas.

### **Carbon Accounting Record (CAR)**

A permanent record kept by MPI of the carbon stocks for a CAA, and of the NZUs received or emission units surrendered for that CAA.

### **Carbon dioxide (CO<sub>2</sub>)**

A naturally occurring gas, which is also a by-product of the burning and breakdown of fossil fuels and biomass, land use changes and other industrial processes. It is the principal human-induced greenhouse gas that contributes to global warming.

### **Carbon stocks**

The total carbon in a forest, including that in stemwood, bark, branches, leaves, litter, woody debris, stumps and roots.

### **Chief Executive**

The chief executive of the department that is, with the authority of the Prime Minister, responsible for administering a particular part of the Climate Change Response Act 2002.

In the case of the ETS (Forestry), the responsibilities regarding administering forestry and the ETS have been delegated to MPI, so references to the “Chief Executive” in this Guide are simply referred to as “MPI”.

### **Clearing**

In relation to a tree, includes:

- the felling, harvesting, burning, removing by mechanical means, spraying with herbicide intended to kill the tree, or undertaking any other form of human activity that kills the tree; and
- the felling, burning, killing, uprooting or destroying by a natural cause or event; but
- does not include pruning or thinning.

### **Crown conservation contract**

A written agreement with the Crown (including a concession granted in accordance with Part 3B of the Conservation Act 1987) for the removal and storage of greenhouse gases on post-1989 forest land that is Crown land managed or administered under the Conservation Act 1987 or any of the Acts listed in Schedule 1 of that Act.

## Deforestation

Deforest, in relation to forest land, means:

- to convert forest land to land that is not forest land; and
- includes clearing land, where the following applies:
  - four years after clearing, a given hectare has not been replanted with at least 500 stems of forest species or has not naturally established a covering of at least 500 stems of forest species; or
  - 10 years after clearing, predominantly exotic forest species are growing, but a given hectare does not have tree crown cover of at least 30 percent from trees that have reached five metres in height; or
  - 20 years after clearing, predominantly indigenous forest species are growing, but a given hectare does not have tree crown cover of at least 30 percent from trees that have reached five metres in height.

Deforestation is generally treated as occurring on the date the hectare is cleared as part of the deforestation process. The only exceptions are where deforestation is deemed to have occurred four, 10 or 20 years after clearance in the circumstances outlined above; however, in these circumstances any liabilities associated with deforestation are calculated as at four, 10 or 20 years earlier, respectively.

## Emission

The release of greenhouse gases into the atmosphere.

## Exotic forest

A forest in which the predominant species does not occur naturally in New Zealand – that is, is not an indigenous species.

## Forest land

- (a) means an area of land of at least 1 hectare that has, or is likely when the forest species reach maturity to have, tree crown cover from forest species of more than 30 percent in each hectare; and
- (b) includes an area of land that temporarily does not meet the requirements specified in paragraph (a) because of human intervention or natural causes but that is likely to revert to land that meets the requirements specified in paragraph (a);
- (c) does not include –
  - i) a shelter belt of forest species, where the tree crown cover at maturity has, or is likely to have, an average width of less than 30 metres; or
  - ii) an area of land where the forest species have, or are likely to have, a tree crown cover at maturity of an average width of less than 30 metres, unless the area is contiguous with land that meets the requirements specified in paragraph (a) or (b).

If an area of land temporarily does not meet the forest species and crown cover requirements because of human action or natural events (it may have just been harvested, or trees may have been blown over by strong winds), but is likely to meet these requirements again in the future, it is still considered to be forest land as per paragraph (b) above. Such areas are termed “temporarily unstocked”.

### Forest species

A tree species capable of reaching at least five metres in height at maturity in the place that it is located.

For the purposes of the Forestry ETS, any woody vegetation (and including tree ferns) capable of reaching 5 metres in the place it is growing is considered to be a “tree”.

### Forest type

The forest type of a hectare of forest land is, based on the predominant forest species on the land, one of:

- *Pinus radiata*;
- Douglas-fir;
- exotic softwoods;
- exotic hardwoods; or
- indigenous forest.

### Harvesting

When forest species are cleared from the land, and new forest species' seedlings either are planted or naturally regenerate. In this case, there is no land use change involved when the trees are harvested. The harvested area remains forest land, and in the period between harvesting and replanting is considered temporarily unstocked.

### Indigenous forest

A forest that comprises tree species that occur naturally in New Zealand or have arrived in New Zealand without human assistance. Strict definitions may relate to the original method of forest establishment (and the direct involvement of people in the process), the mixture of flora and fauna, and the conditions believed to have been present prior to human intervention.

### Kyoto Protocol

A protocol to the United Nations Framework Convention on Climate Change that includes emissions limitation or reduction commitments for ratifying countries listed in its Annex B (developed countries and Economies in Transition) (see <http://unfccc.int/resource/docs/convkp/kpeng.html> for further information).

### Land parcel boundary

The spatial boundaries recorded in Landonline ([www.landonline.govt.nz](http://www.landonline.govt.nz)).

### Land title

A legal document summarising the ownership of one or more land parcels, and any restrictions on the free use of the described lands. A land title can relate to one or many legal land parcels. A land title is also referred to as a “certificate of title” (also “CT” or “title”) or “computer register”.

### New Zealand Unit (NZU)

A greenhouse gas emissions unit specific to the New Zealand ETS, and equal to one tonne of CO<sub>2</sub>.

### Non-eligible land

Land that is not pre-1990 or post-1989 forest land, as applicable.

### Participant

A person becomes a mandatory Participant if they undertake certain activities covered by Schedule 3 of the ETS (for example, deforesting pre-1990 forest land). Other people may become Participants by voluntarily registering in respect of activities listed in Schedule 4 (for example, owning post-1989 forest land).

### Post-1989 forest land

Forest land that:

- was not forest land on 31 December 1989; or
- was forest land on 31 December 1989 but was deforested (that is, converted to another land use) between 1 January 1990 and 31 December 2007; or
- was pre-1990 forest land, other than exempt land:
  - that was deforested on or after 1 January 2008, and
  - in respect of which any liability to surrender units arising in relation to deforestation has been satisfied; or
- was exempt land:
  - that has been deforested; and
  - in respect of which the number of units that would have been required to be surrendered in relation to deforestation, had the land not been exempt land, have been surrendered.

Both exotic and indigenous forest species are eligible to participate in the ETS as post-1989 forest land.

### Pre-1990 forest land

Forest land that:

- was forest land on 31 December 1989; and
- remained as forest land on 31 December 2007; and
- where the forest species on the forest land on 31 December 2007 consisted predominantly of exotic forest species.

But does not include any forest land that meets the definition above but also:

- has been deforested and any liability arising from that deforestation has been satisfied; or
- was declared to be exempt land, has been deforested, and the NZUs that would have been required to be surrendered had the land not been exempt, have been surrendered.

Only forests comprising predominantly exotic forest species are subject to the ETS as pre-1990 forest land.

### Registered forestry right

A forestry right registered under the Forestry Rights Registration Act 1983.



### Registered lease

Registered lease:

- a) in relation to a lease in respect of land registered under the Land Transfer Act 1952,—
  - i) means a lease registered under that Act; and
  - ii) includes a lease registered under the Land Transfer (Computer Registers and Electronic Lodgement) Amendment Act 2002:
- b) in relation to a lease in respect of land that is not registered under the Land Transfer Act 1952, means a lease registered under the Deeds Registration Act 1908.

### Removals

The amount of greenhouse gases removed from, or not released into, the atmosphere due to a particular activity (expressed in carbon dioxide equivalents, CO<sub>2</sub>-e).



## Appendix 1: The Geospatial Mapping Information Standard

This Geospatial Mapping Information Standard ("the Standard") is prescribed pursuant to Section 90 of the Climate Change Response Act 2002 ("the Act").

### Scope

Regulation 6 of the Climate Change (Forestry Sector) Regulations 2008 ("the Regulations") states that if the Regulations require an application, notice or emissions return to be submitted with geospatial mapping information about an area of forest land referred to in that application, notice or emissions return, the information must be provided in the format prescribed by the Chief Executive under Section 90 of the Act.

Clause 9(1)(i) of the Climate Change (Pre-1990 Forest Land Allocation Plan) Order 2010 ("Allocation Plan") states that an eligible person must provide geospatial mapping information that complies with any format requirements prescribed under Section 90 of the Act.

A reference to a Section means (unless specifically defined as a Section in this Standard) that Section in the Climate Change Response Act 2002, a reference to a Regulation means that Regulation in the Climate Change (Forestry Sector) Regulations 2008 and a reference to a Clause means that clause in the Climate Change (Pre-1990 Forest Land Allocation Plan) Order 2010.

### Purpose

This document contains the Standard that prescribes the format and content of the geospatial mapping information that a person must provide to comply with the requirements of the Act, the Regulations, and the Allocation Plan. The document includes the following sections:

1. Interpretation: definition of special terms used in this Standard.
2. A summary of the circumstances in which geospatial mapping information must be supplied with an application, notice or emissions return.
3. A description of the geospatial mapping information that must be supplied with an application, notice or emissions return.
4. Specification of the procedure for mapping an area of forest land in relation to: registration of post-1989 forest land, deforestation of pre-1990 forest land, exemptions from liabilities for deforestation of pre-1990 forest land (including for deforestation of tree weeds), or application for an allocation of New Zealand Units (NZUs) under the Allocation Plan...
5. Requirements for mapping within land title legal boundaries.
6. Specification of the options available for creation and submission of digital geospatial mapping information to the Chief Executive.
7. Specification of the format for digital geospatial mapping information.

Guidance on practical implementation of this Standard can be obtained from *A Guide to Mapping Forest Land for the Emissions Trading Scheme*, available at: <http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/mapping-forest-land-in-the-ets/>.

## 1 Interpretation

(1) In this Standard, unless the context requires otherwise:

**Land parcel boundary** means the spatial boundaries recorded in Landonline.

**Line segment** means a straight line bounded by end points with distinct map coordinates.

**Non-eligible land** means land that is not pre-1990 forest land, or not post-1989 forest land, as applicable.

**Polyline** means a continuous line composed of one or more line segments.

**Polygon** means a closed shape bounded by sequentially-connected polylines that do not cross, such that the map co-ordinates of the end point of one polyline are the same as the map coordinates of the start of the next polyline.

**Tree crown edge** means the estimated spatial location of the outer edge of the foliage of a tree at the time of maturity, for an individual tree that is a forest species.

- (2) Any word or expression defined in the Act or Regulations and used in this Standard has the same meaning as it has in the Act or Regulations.

## 2 Circumstances Requiring Submission of Geospatial Mapping Information

- (1) For pre-1990 forest land, geospatial mapping information must be provided when:
- (a) An application is submitted in relation to an exemption from deforestation liabilities for areas less than 50 hectares (under Section 183, Regulation 13).
  - (b) An application is submitted in relation to an exemption from liabilities for deforestation of tree weeds (under Section 184, Regulation 25(1)(d)).
  - (c) An emissions return is submitted in relation to deforestation (under Section 65, Regulation 17(c)).
  - (d) An application is submitted in relation to an allocation of NZUs under the Allocation Plan (Clause 9(1)(i)).
- (2) For post-1989 forest land, geospatial mapping information must be provided in accordance with Regulation 18, for the range of circumstances described in Schedule 5 of the Regulations. These circumstances are set out below:
- (a) An application to be registered as a Participant in the ETS (under Section 57).
  - (b) An application by an existing Participant to add a carbon accounting area, or to remove land from a carbon accounting area (under Section 188).
  - (c) Notice is given by an existing Participant that they have ceased to carry out an activity listed in Part 1 of Schedule 4 of the Act in relation to part of a carbon accounting area (under Section 188).
  - (d) Notice is given of a transfer of forest land, or of the transfer of a registered forestry right or registered lease or Crown conservation contract in relation to forest land, for part of a carbon accounting area (under Section 192).
  - (e) Notice is given of the registration of a forestry right or lease over forest land, or entry of forest land into a Crown conservation contract, where these relate to part of a carbon accounting area (under Section 192).
  - (f) Notice is given of expiry or termination of a registered forestry right, a registered lease or a Crown conservation contract that relates to part of a carbon accounting area (under Section 193).

## 3 Description of the Required Geospatial Mapping Information

- (1) Where geospatial mapping information is required to be submitted with an application, notice or emissions return, that information shall comprise:
- (a) One or more polygons that spatially delineate each area of forest land required to be identified under the Act or Regulations; and
  - (b) For post-1989 forest land, a number to identify the carbon accounting area that each polygon is to be associated with.
- (2) The geospatial mapping information for each polygon that delineates an area of post-1989 forest land may include:
- (a) A number used to identify a particular forest.

- (b) A number used to identify a particular compartment in a forest.
- (c) Text which defines the forest type within a forest compartment.
- (d) A number which is the year the forest was established (i.e. the year the forest was planted, or was naturally regenerated).

#### **4** Specification of the Procedure for Mapping Forest Land

- (1) The geospatial mapping information must include one or more polygons that define the area of forest land in respect to an application, notification or filing of an emissions return.
- (2) The polygons must be defined by:
  - (a) Spatially delineating as polylines the forest land edges of the outer boundary of each area of contiguous forest land; and
  - (b) Constructing as a polygon the outer boundary of each area of contiguous forest land from the polylines that comprise the forest land edges, provided that each resultant polygon has an area of at least one hectare; and
  - (c) For each polygon constructed in step (2)(b), spatially delineating as polylines any forest land edges within the polygon and adjacent to any contiguous area of non-eligible land that has both an area of more than one hectare and an average width of at least 15 metres measured between tree crown edges; and
  - (d) Constructing as a polygon the boundary of any non-eligible land from the polylines identified in step (2)(c) that comprise the forest land edges adjacent to each identified area of contiguous non-eligible land; and
  - (e) Removing the polygons of non-eligible land.
- (3) Each forest land polygon may be further spatially subdivided, provided each resultant polygon has an area of at least one hectare.
- (4) If the forest land delineated by a polygon is post-1989 forest land, the polygon must be assigned a number to identify the carbon accounting area that the polygon is to be associated with.
- (5) Forest land edges are determined as follows:
  - (a) If the tree crown edge of an area of forest land adjoins or overlaps a land parcel boundary; by drawing a polyline coincident with the land parcel boundary, except if the land parcel boundary is common to another land parcel to which the application, notification or emissions return also applies; or
  - (b) If (a) does not apply; for an area of pre-1990 forest land that adjoins an area of post-1989 forest land, by drawing a polyline to separate the pre-1990 forest land and the post-1989 forest land; or
  - (c) If (a) or (b) do not apply; by drawing a polyline to separate forest land from non-eligible land, with the polyline constructed so that:
    - (i) Line segments intersect tree crown edges that are adjacent to the non-eligible land, and are drawn as close as practicable to the adjacent non-eligible land; and
    - (ii) No point within any line segment shall be more than 15 metres from a point at which that line segment intersects a tree crown edge.

#### **5** Mapping within Legal Boundaries

- (1) A person must not submit geospatial mapping information for any area of forest land that falls outside the area of forest land for which an application, notice or emissions return is being made under the Act.
- (2) Despite (1), geospatial mapping information may with the approval of the Chief Executive include an area of forest land that falls outside of the land parcel boundaries recorded in Landonline.

## 6 Specification of Options for Creating and Submitting Digital Geospatial Mapping Information

- (1) The geospatial mapping information that must be submitted in accordance with this standard:
  - (a) In the case of a paper-based application, notice or emissions return; must be one or more shapefiles where each shapefile:
    - (i) Includes data for an area of forest land not greater than 10,000 hectares; and
    - (ii) Is created by using the applicant's own Geographic Information System (GIS), and submitted on a CD-ROM or DVD.
  - (b) In the case of an on-line application, notice or emissions return; must be a single shapefile that:
    - (i) Includes data for an area of forest land not greater than 2000 hectares; and
    - (ii) Is created by the mapping tool within the on-line application process, accessible at <http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/>; or
    - (ii) Is created using the applicants own GIS, and is uploaded electronically as part of the on-line application process available at <http://www.mpi.govt.nz/growing-and-harvesting/forestry/forestry-in-the-emissions-trading-scheme/>.

## 7 Specification of the Format for Digital Geospatial Mapping Information

- (1) For the purposes of submitting geospatial mapping information on forest land for the ETS, a shapefile:
  - (a) Must comprise the following three digital files:
    - (i) A .shp file – shape format file; the feature geometry in the shapefile (i.e. the map coordinates of the polyline segments that make up the forest land polygons).
    - (ii) A .shx file – shape index format file; a positional index of the feature geometry in the shapefile (i.e. the location within the .shp file of the start of the data for each forest land polygon).
    - (iii) A .prj file – projection format file; the coordinate system and map projection information for the shapefile.
  - (b) May include a .dbf file – attribute format file; the attributes for each forest land polygon in the shapefile.
  - (c) Must not include multi-part polygons.
- (2) The projection format file must contain information compliant with the New Zealand Transverse Mercator 2000 Projection. This projection is specified in the document attached as Appendix A.
- (3) When submitted as part of a shapefile, the attribute format file (i.e. the .dbf file) must include as attributes the information specified in Table 1 below, except that the attribute that records the number of a carbon accounting area
  - (i) Is only included when registering post-1989 forest land; and
  - (ii) Must be a whole number selected sequentially from the set of positive whole numbers beginning at 1; and
  - (iii) Must be a number that is unique for each set of forest land polygons assigned to a given carbon accounting area; and
  - (iv) Must not be a number used as the carbon accounting area number of a set of forest land polygons that were previously registered by the Participant, but are no longer in the ETS.
- (4) The shapefile must otherwise conform to the specification given in the Environmental Systems Research Institute (ESRI) Shapefile Technical Description White Paper dated June 2004. The Paper can be found at: <http://support.esri.com/index.cfm?fa=knowledgebase.whitepapers.listPapers&PID=21>

Table 1. Specification for polygon attributes in the attribute format file.

Attribute	Attribute Name	Mandatory or Optional	Description	Format
Carbon accounting area number	CAA_NUM	Mandatory for areas of post-1989 forest land, otherwise not included	Integer	Long integer, 9 characters
Species	SPECIES	Mandatory	String	Text, 50 characters
Year established	YEAR_PLANT	Mandatory for areas of post-1989 forest land	Integer	Long integer, 9 characters
Forest number	FOREST_NUM	Optional	Integer	Long integer, 9 characters
Compartment number	COMP_NUM	Optional	Integer	Long integer, 9 characters