Assessing Regenerating Totara on the Farm

A preliminary guide for landowners in Northland

By
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Scion

2009

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For

The Northland Regional Council

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This project was funded by the New Zealand Foundation for Research, Science and Technology Envirolink for the Northland Regional Council (516 – NLRC – Guidelines for landowners to assess regenerating totara resources on their farms).

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ABSTRACT

Totara (*Podocarpus totara*) is a prominent feature of rural landscapes in many regions throughout New Zealand. The Northland Totara Working Group is evaluating the extent and quality of these totara-dominant stands to help promote the sustainable management of totara as a specialty timber. The Group has stimulated considerable interest by landowners in potential options for managing totara as a sustainable timber resource that complements existing pastoral farming land use.

This guide provides a preliminary method for landowners, with little or no knowledge of totara, to assess the nature of their regenerating totara forest. It is not a comprehensive survey method, rather, enables a rapid preliminary estimate of the area and the broad characteristics of the resource that can be used to identify options for future management. Where there is interest in developing and utilising this resource, a more comprehensive stand assessment will then be required. Sources of information on forest inventory and a link to the Ministry of Forestry's website that includes information on provisions for sustainable management of native forest are given.

KEYWORDS: *Podocarpus totara*, Northland, survey, methodology, resource, production, farmland, natural regeneration, land use

INTRODUCTION

Totara (*Podocarpus totara*) is regenerating prolifically on pastoral hill country throughout Northland, even in the presence of grazing. The Northland Totara Working Group (NTWG) is evaluating the extent and quality of these totara-dominant stands to help promote the sustainable management of totara as a specialty timber. Landowners are often interested in the characteristics of their own developing totara stands, and in their potential for sustainable management as a long-term timber resource complementary to their existing pastoral land use.

This guide provides a method that allows farmers to rapidly self-assess their totara forest, including its extent, quality and management potential. It is intended only to be a preliminary and largely subjective assessment of broad stand characteristics to give an indication of management prospects. Where landowners are keen to manage and utilise the resource, a more comprehensive stand assessment will be then required. This rapid inventory method is also relevant to many other regions in New Zealand where regenerating totara forest is a feature of the landscape.

BACKGROUND

Totara is regenerating naturally on erosion-prone hillsides or along riparian margins on farmland throughout Northland (Figure 1). These are areas that are often targeted by regional and district councils for improved environmental management to reduce land slipping and sedimentation and improve water quality and flood control. Steep hillsides have poor pasture production and, despite constant intervention to keep them clear of woody vegetation, are often regenerating in totara (Bergin 2003).

The NTWG was established in 2005 to support and promote research and technology transfer in the productive management of totara from both naturally-regenerating stands and plantations. The group is coordinated by the NZ Landcare Trust. Current members include landowners, Northland Regional Council, Far North District Council, NZ Farm Forestry Association, NZ Forest Owners Association, Tane's Tree Trust, sawmillers and wood processors, and Scion.

Many farmers consider totara a weed and have tried for decades to prevent its spread on marginal land. However, through the current work of the NTWG, landowners are becoming aware that there is merit in determining whether it can be managed as a sustainable timber resource complementary to existing pastoral land use.

Current silvicultural trials established in three areas of Northland by the NTWG are evaluating the potential for improving growth and tree form by comparing a range of thinning and pruning options (Bergin 2007; 2008; NTWG 2008). These totara trials are stimulating considerable interest in the management of stands as a sustainable timber resource.

This report provides landowners in Northland with a preliminary method for estimating the extent and broad characteristics of the naturally-regenerating totara on their farms, particularly from a wood production perspective.

Figure 1: Totara regenerates readily on farmland in many regions throughout New Zealand, including Northland. This potential timber resource comprises totara-dominant stands established along riparian areas and steep slopes and isolated large-crown trees scattered across pasture.

CHARACTERISTICS OF TOTARA

Identification and tree form

Totara is a conifer and member of the podocarp family. It is easily recognised by its distinctive tree shape, foliage, bark and fruit (Table 1).

*Table 1: Distinguishing characteristics of totara (*Podocarpus totara*).*

Foliage	Leaves green, flat, linear and sharply pointed. Mature leaves 10-30 mm long and 2-4 mm wide. Shaded leaves on seedlings longer and wider (Figure 2).
Seed	Green nut-like round seeds 3-5 mm long attached to a fleshy receptacle (fruit) which attracts birds to assist dispersal (Figure 2). Separate male and female trees, so only half of the trees will seed.
Bark	Reddish-grey colour, furrowed and stringy on young poles and trees (Figure 3). Becomes more corky and deeply furrowed as trees increase in size and age.
Tree form	With side shade or in forest gaps, seedlings and saplings maintain generally straight stems, with mostly a single leader. Rounded crown forms in semi-mature and mature trees (Figure 3). In open-growing conditions at wide spacing, trees are multi-leadered, and heavily branched with large rounded crowns.

Figure 2: Totara has distinctive long flat needle-like leaves with a sharp point. The green oval seeds are borne on red-orange fleshy receptacles in autumn. Totara has separate male and female trees.

Figure 3: Totara forms a rounded crown as a semi-mature tree (background) sometimes developing clear boles of various lengths with furrowed stringy bark (foreground).

Natural regeneration on Northland farms
Regeneration patterns for totara in pastoral hill country have been intensively studied at several sites in Northland (Bergin 2001). Totara persists on steep hill slopes covered in weedy, open grass rather than on flatter areas with dense pasture swards. Bare ground on steep slopes and continued grazing are considered to be important factors contributing to successful establishment of this relatively unpalatable tree.

Totara is very light-demanding and is sometimes referred to as a pioneer species. It has similar establishment characteristics to manuka (*Leptospermum scoparium*), kanuka (*Kunzea ericoidies*) and gorse (*Ulex europeaus*), whereby it is amongst the first woody species to establish on open sites. Where these other species occur, totara overtops manuka and gorse in 2-3 decades and eventually kanuka. On some sites kahikatea (*Dacrycarpus dacrydioides*) can be present with totara particularly on lower lying sites such as along the base of slopes and riparian areas.

FOREST INVENTORY AND SAMPLING

Forest inventory and sampling is aimed at capturing stand and tree data so that individual tree growth rates and average stand yields can be estimated. This forest inventory data can then be used to determine stand characteristics, including the quality and quantity of various stand attributes such as average tree size, wood quality and volume within a stand. A wealth of publications and field guides describe forest inventory and sampling, many providing detailed methods for determining stand attributes as accurately as possible. These publications include the Forestry Handbook (Colley 2005), Maclaren (2000) and Ellis and Hayes (1997). Rapid forest inventory and sampling methods also exist (e.g. Maclaren and Goulding 1993), but involve decreasing degrees of accuracy.

Undertaking a detailed forest inventory to give reasonable estimates of wood volume and growth rates for Sustainable Forest Management Plans and Permits requires specialised skills. This report therefore only provides landowners with the means to give preliminary estimates of the extent and broad characteristics of naturally-regenerating totara-dominated forest and shrubland on their farms.

DETERMINING THE EXTENT OF TOTARA

The first step for landowners is to determine the *extent* of totara-dominant scrub and forest existing on their property. This is best determined through ground inspection and the use of aerial photography at a scale of 1:5000. Through a combination of ground survey and aerial photography, it should be possible to demarcate the major land use cover types such as tall native forest, shrubland, exotic forest, pastural land use and scattered trees.

The major vegetation cover types likely to be found in most regions of Northland may be distinguished as follows:

- **Mature high native forest** – a heterogeneous pattern and texture resulting from a mixture of species with different tree crown sizes.
- **Pole to semi-mature tree stands** – relatively homogeneous groves dominated by totara at high stocking.
- **Mixed-age woody cover** – highly variable heterogeneous cover of older, large crowned multi-stemmed trees with low coarse branching mixed with younger poles, resulting from different rates of establishment.
- **Low homogeneous shrubland** – vegetation cover that has regenerated in even aged patches or stands grading from mixed species to totara-dominant shrubland.

- **Exotic forest (pines)** – dark green forest cover; young plantations also easily recognised by line planting.
- **Pasture** – light green.
- **Scattered paddock trees** – isolated large-crown trees scattered over grassland; may be difficult to determine species precisely.

Each farm is likely to comprise several of the vegetation cover types described above. Ground-based reconnaissance will be required to confirm vegetation types and to improve the location of boundaries between vegetation cover types, especially where the vegetation pattern is complex. Figures 4 and 5 are aerial photographs of two farms in Northland where totara-dominant vegetation cover types can been identified, although ground reconnaissance will be required to confirm species and boundaries of different vegetation types.

Figure 4: Three totara-dominant vegetation types are evident on the 12 ha property in the centre of this aerial photograph: semi-mature high native forest (uneven heterogeneous texture at centre right); low shrubland (homogeneous texture, lighter colour at centre left); and isolated paddock trees (large rounded crowns). The largest isolated trees on the neighbouring properties are pines, which can only be confirmed by ground inspection.

Figure 5: A uniform young totara-dominant forest cover is evident centre left with a patch of tree ferns and dark green pines to the lower left. Large crown open-grown totara occur along the riparian margin at upper left. An older shrubland cover with a mix of totara and kanuka occurs at the upper right.

DETERMINING TOTARA STAND CLASSES

Once areas of totara on your property have been identified and demarcated, the next step is to determine the broad stand characteristics of the resource. Reconnaissance of totara growing on farms throughout Northland over the last decade (e.g. Bergin 2001; Kennedy 2007; Paul Quinlan, pers. comm.) has consistently shown that the totara resource is highly variable in terms of species composition, stand density, and the size and age of canopy trees. Therefore, without considerable resources and expertise in forest inventory and sampling, only subjective assessments of stand structure and stocking are recommended at this stage.

By undertaking a walk-through inspection of totara-dominant stands, it is likely that several categories of stand type will be encountered. Most totara-dominant stands will have small areas with the following stand types:

1. Mixed age/size stands,
2. Young sapling thickets,
3. Pole stands,
4. Semi-mature stands, and
5. Isolated open-grown trees.

These forest cover classes are defined in detail below.

Stand Class 1 – Mixed age/size stands
Most of the area dominated by totara is likely to be a mixed age/size stand that is highly variable in stocking, tree size and sometimes species composition (Figure 6). They are typical of many stands in Northland comprising a mixture of large old spreading trees, often with poor form, and scattered younger poles with single stems and small or no lower branching.

The scattered larger older trees are likely to be trees that established on open sites 60-100 years ago, while the smaller trees will be younger cohorts that have regenerated subsequently in forest

gaps. Establishing plots to determine average stand diameters, tree heights and stand volumes is very difficult due to the wide variability in tree size and stocking.

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Figure 6: ***Stand Class 1*** *- Totara forest on farms is often a highly variable mixture of different aged/sized trees reflecting different times and rates of establishment.*

Stand Class 2 – Young sapling thickets

Even aged/sized patches of seedling and sapling thickets can regenerate on specific sites in paddocks or as discrete patches within regenerating forest reflecting past management history or disturbance. These relatively similar-aged young stands can comprise up to 50,000 stems/ha of seedlings and saplings that are regenerating in a confined area within 10-20 years of earlier vegetation clearance or other disturbance. Average stem diameters range from 3-10 cm and average tree heights from 3-7 m (Figure 7).

Thinning these stands is likely to be prohibitively expensive and impractical as this would require several operations over an extended period of time to progressively reduce stocking whilst maintaining stand stability and tree form. Such stands should be left to develop naturally into pole stands over the next 20-50 years where natural thinning will reduce densities to 5000 stems/ha or less.

Figure 7: ***Stand Class 2*** *– Young thicket of totara seedlings and saplings that has developed on a hill country farm in the presence of grazing by cattle over the last 2-3 decades since last clearance.*

Stand Class 3 – Pole stands

If regenerating patches of relatively even age cohorts are left to develop, they have the potential to form pole stands in approximately 50-80 years after initial establishment. These stands are dominated by poles with average diameters ranging from 10-20 cm and average tree heights of 5-10 m (Figure 8). Stocking ranges from 3000-10,000 stems/ha.

Pole stands provide a good opportunity to improve growth rates and stem form through thinning and pruning. These are the stand types that have been targeted for the silvicultural trials (predominantly thinning to waste) for which some 40 Permanent Sample Plots have recently been established (Bergin 2007). Plots can be established in these even aged/sized stands to determine average tree size and stand volume.

Figure 8: ***Stand Class 3*** *– Pole stand dominated by totara that has regenerated with manuka and kanuka on this ridge that was previously cleared for pastoral farming. Manuka has long gone but occasional unthrifty kanuka are persisting such as the leaning tree in the centre right.*

Stand Class 4 – Semi-mature stands

Around 80 years to over 100 years since establishment, pole stands develop into semi-mature totara-dominant stands. Average diameters exceed 25 cm and average tree height range from 12 m to over 20 m. Stem densities are in the order of 1000 stems/ha or less (Figure 9).

These stands are suitable for production thinning where larger stems could potentially provide significant volumes of timber. Plots can be established in these stands to determine average tree size and stand volume as a requirement for Sustainable Management Plans or Permits for the extraction of any timber for milling purposes (refer to the MAF website link provided in reference section).

Figure 9: ***Stand Class 4*** *– A semi-mature totara stand at over 100 years old. Note the intense competition is resulting in natural ongoing thinning (stems of trees that have died on the ground) as the dense stands develops over time.*

Stand Class 5 – Isolated open-grown trees

A significant part of the totara resource on farmland in Northland consists of scattered trees on farms or in small open stands. This stand type typically comprises trees in paddocks with large spreading crowns and short, large-diameter boles (Figure 10).

This significant resource on farms is often targeted for firewood and regarded as little use for milling and other uses. Larger trees have significant heartwood development compared with smaller-diameter stems. Tree measurements will allow calculation of individual stem volumes.

Figure 10: ***Stand Class 5*** *– Open-grown totara with large crowns and low heavy branching. These represent a significant component of the totara resource on many farms and can occur as single large crown trees or as small open groves scattered over paddocks.*

STAND ASSESSMENT

Forest sampling and inventory cannot be applied systematically across the resource of regenerating totara, as it is so highly variable. Where there are no readily discernable patches of even aged/sized forest such as pole stands, it is virtually impossible to make meaningful estimates of stand stocking, tree form and volumes without undertaking a full-scale forest inventory that requires a professional forestry consultant. A visual assessment of such stands and a general description may be the only practical option.

Where there are relatively even aged/sized areas of totara-dominated forest, an estimate of stand stocking, average tree sizes and wood volumes is likely to be practical within groves of relatively even aged/sized poles (Stand Class 3) or semi-mature trees (Stand Class 4).

Stand composition
Although stands are dominated by totara, other species may be present. As most stands have been or are still grazed by cattle or sheep, only a limited number of relatively unpalatable species will be present. In Northland, species additional to totara are likely to be:

- Kanuka (*Kunzea ericoidies*) – in older forest forms a canopy tree with small crowns and flaky bark; will gradually be replaced by totara.
- Manuka (*Leptospermum scoparium*) – usually only present in significant numbers in younger shrubland in mixture with saplings and small poles of totara and kanuka.
- Gorse (*Ulex europaeus*) – an exotic shrub found in varying proportions in younger stages of regenerating totara stands.
- Other exotic trees may occasionally be present within shrubland areas – such as scattered wilding pines (*Pinus* spp.) or occasionally planted or wilding eucalypts (*Eucalyptus* spp.), willows (*Salix* spp.) and blackwoods (*Acacia* spp.).

A walk through each stand will give an indication of the species present and the proportion of each. As stands age, the taller-growing and longer-living totara will become more dominant where kanuka, manuka and gorse are present. Tall growing exotic trees such as pines and eucalypts will remain in stands for decades unless felled, ring-barked or poisoned.

Stand density

There are many ways of estimating the number of trees or stocking within a forest stand. Stand density estimates are used to calculate the standing volume of the forest (e.g. Gordon 2005; Maclaren 2000; Goulding and Lawrence 1992).

It is essential that the area used to estimate stand density is homogeneous, i.e. a consistent stand type. Hence, for estimating stand density, choose areas where there is a patch or stand of canopy trees that are of similar size and are relatively evenly spaced.

Avoid areas where there is a wide range of different sized trees such as a mixture of smaller pole totara mixed with larger diameter canopy trees, usually indicating that at least two age classes are present. These stands should be avoided if they cannot be separated into smaller areas comprising trees of relatively even size.

The most common method of sampling stand density is the use of bounded plots that enclose a fixed area of the stand. Plots can be circular, square or rectangular. Transects which are effectively elongated plots can also be used to establish stand density. Circles have the least perimeter-to-area ratios whereas transects have comparatively long edges and therefore less effective in sampling areas. Plots should be large enough to include between 15 and 40 canopy trees on average. A useful summary of the range of plot designs is given in Gordon (2005).

To obtain an estimate of the density of totara within a semi-mature stand, lay out a square plot up to 20 m x 20 m in size or a circular plot with a radius of 11.3 m. This will give a 400 m^2 or 0.04 ha plot. A smaller plot can be used in denser stands with smaller canopy trees. Care is required in siting plots within a representative area of the stand and to avoid major change in slope and forest type. Long transect-type plots have the potential to traverse beyond relatively homogeneous stand and site characteristics. Only those trees that have crowns within the canopy should be included. Smaller sub-canopy trees, shrubs and ground cover plants do not need to be assessed.

Where density is relatively uniform, a rough estimate of density can be determined by measuring the distances between immediately adjacent stems. This will require a random selection of at least 20 tree spacings located throughout the stand for measurement. Average tree spacing can be converted into stems per ha using Table 2 as a guide.

Table 2: Approximate stand density based on average tree spacing calculated from a minimum of 20 between tree measurements within a relatively uniform stocking stand.

Average spacing between trees (m)	Approximate stand density (stems per ha)
0.5	40,000
1	10,000
1.5	4444
2	2500
2.5	1600
3	1100
3.5	820
4	625
4.5	500
5	400
5.5	330
6	280

Measuring trees
A number of field guides and books (e.g. Ellis and Hayes 1997; Goulding 2005) provide comprehensive descriptions of the measurement of trees. The main parameters to measure for trees are diameter and tree height.

Diameter
Diameter at breast height (DBH) refers to the diameter measured over bark at breast height, taken in New Zealand at a standard 1.4 m above ground level (Figure 11). On sloping ground, the measurement is taken from the uphill side of the tree. Where the point of measurement falls on a low branch or a defect that has influenced the diameter of the bole at that point compared to most of the trunk, then the measurement should be taken at a 'representative point' close to breast height (Goulding 2005).

A diameter tape is graduated to show the diameter of a circle when wrapped around the stem. Loose bark should be removed prior to measurement and vines should not be included. Alternatively, callipers may be used to estimate stem diameter or circumference can be measured using a standard tape and the value divided by 3.14 to give diameter. Diameters of trees are recorded in centimetres, often to the nearest tenth.

If a bounded plot is being established, then all canopy trees could be measured to give average stem diameter for that plot. If not all trees are to be measured, a minimum sample of 15 trees that are representative of the stand should be assessed to calculate average diameter. Where practical, diameter measurements of 20-30 trees will give a more representative estimate, especially if stem sizes are variable.

Figure 11: Taking diameter at breast height (DBH), 1.4 m above ground. If the tree is on a slope, DBH is measured 1.4 m above ground on the uphill side of the tree.

Tree height

Tree height may be total tree height or height of the merchantable stem. These are defined as:

- Total tree height – the distance from the top of the tree to a point level with its base vertically below the top.

- Merchantable bole height – the distance measured to the top of the merchantable bole from the ground. The uppermost point of the merchantable bole is defined as either the point where the bole branches into the crown of the tree or the point where the bole reaches a minimum diameter of 15 centimetres, whichever occurs first.

Heights of trees and merchantable boles are recorded in metres. Those not familiar with measurement of height and diameter of standing trees should refer to a forestry consultant or publications such as Maclaren (2000).

Obtaining tree heights is more time-consuming than obtaining diameters. However, the height of canopy trees within stands is often less variable than diameters, so a smaller number of trees, perhaps as low as five, can be measured to estimate stand canopy height. If merchantable volume is to be calculated, and trees vary in merchantable bole height, then a minimum of 12 trees will require height measurements.

There are several methods for measuring tree height, all of which require specialised instruments for measuring angles and distances such as the Haglof Vertex and the Suunto hypsometer. For trees less than 10 m high, telescopic height poles can be used but these are not commonly available and are expensive. A description of this equipment is given in Maclaren (2000) and methods for using it in Goulding (2005) and Ellis and Hayes (1997).

For the purposes of a quick estimate of tree heights or merchantable bole heights in totara stands, one suggestion is to stand about 10 m away from the tree and use increments of 2 m based on a person standing next to the tree to determine tree height. This will only give a rough estimate of height but is likely to be sufficient for an indication of average stand height.

Assessing tree form

The form of totara trees is highly variable throughout Northland, largely in response to the degree of competition, particularly during the establishment phase, and the nature of neighbouring vegetation cover. Where totara has regenerated in dense stands, trees within the stand can form straight, single-stemmed boles with small branching. In contrast, trees establishing in paddocks in the absence of side shade form large rounded crowns with short boles and coarse branching to near ground level.

Kennedy (2007) has developed a subjective assessment of tree form whereby trees are placed into one of five tree form classes. The description and an example photograph for each class is shown in Table 3.

Table 3: Tree form class description for assessing individual tree form based largely on a subjective visual assessment into one of five classes (reproduced from Kennedy 2007)

Form Class Description and Characteristics/Defects	**Example**
Class: 1 **Rating:** Excellent **Log lengths:** 6+ m **Description:** Single straight trunk, clear bole or only a few small branches or knots; no other apparent defects.	
Class: 2 **Rating:** Good **Log lengths:** 5-6+ m **Description:** Single straight lower trunk, but may have some small-medium branches or knots, and may have heavy branches or fork above lower log length.	
Class: 3 **Rating:** Fair **Log lengths:** 2.7-5+ m **Description:** Short logs, or multiple logs, down-graded by defects such as moderate-heavy branching or knots, slight sweep, twist or wobble.	

Class: 4 **Rating:** Poor **Log lengths:** 1.5-2.7 m **Description:** Short recoverable butt log length, may have variable grain patterns and some knots.	
Class: 5 **Rating:** Non-merchantable **Log lengths:** <1.5 m **Description:** No merchantable trunk length. May have multiple stems/ heavy branches and or forks; some branches may have considerable size.	

If plots are being established, then only the canopy trees within that plot are to be assessed for tree form. As trees are being measured for diameter and height a tree form class code can be quickly determined using Table 3 as a guide. Where plots are not being established and a quick overview of the stand is being undertaken, then a visual assessment of tree form for a random selection of trees may be sufficient.

Estimating Standing Volume

The volume of standing trees for most indigenous tree species can be estimated using tables developed by Ellis (1979) and available on the MAF website (link listed in reference section). These tables estimate the volume of standing trees from the measurement of diameter at breast height (DBH) and merchantable height.

Appendix 1 provides estimated roundwood volume for trees from 20-100 cm DBH and for merchantable height of trees from 2-10 m. There are no deductions for defect in these tables. The estimated volume excludes the stump (typically about 30cm), and is an 'under bark' volume. Diameters in these tables are diameters at breast height (DBH) measured over bark, in centimetres.

If the volumes of individual trees are known, they can be added together to provide an estimate of stand volume (Maclaren 2000). The sum of the individual tree volumes, divided by the area of the plot in hectares, will provide the total stand volume per hectare. Further details on this and other methods for calculating standing volume are provided in Maclaren (2000).

RECORDING FIELD DATA

To assist landowners to assess their totara stands in the field, a record sheet is provided in Appendix 2 to be used where plots are established only within areas where there is a relatively consistent stocking and size of canopy trees (i.e. Stand Class 3 – poles and Stand Class 4 – semi-mature trees).

Information required includes:

- Farm, stand and plot identification
- Totara stand class:
    1. Mixed age/size stands
    2. Young sapling thickets
    3. Pole stands
    4. Semi-mature stands
    5. Isolated open-grown trees.
- Measured DBH (require a minimum of 15 trees)
- Estimated stand canopy height (minimum of 5 representative trees)
- Estimated length of merchantable bole (required for all trees where DBH is measured)
- Tree form class (for all trees where DBH assessed):
    1. Excellent
    2. Good
    3. Fair
    4. Poor
    5. Non-merchantable.

Once data is collected, average diameter, tree height, merchantable stem length and tree form class can be estimated. Each plot will require a separate record sheet.

Volumes for each tree can then be calculated from the DBH and merchantable bole length using the volume table in Appendix 1 (stand volume).

Appendix 3 provides a template for summarising stand information for plots established in relatively even age/size poles or semi-mature trees including average DBH, height, merchantable bole length, standing tree volume, stand density and stand volume. The service of a forestry consultant will be required for those not proficient with calculating sampling data.

MANAGEMENT OPTIONS

From this basic inventory data, landowners, with the assistance of the NTWG, should be in a position to determine options for potentially managing and utilising their totara resource. The range of management options will include encouraging landowners to:

- leave young sapling thickets to develop naturally until they have thinned down to densities of 10,000 stems per ha or less,
- thin and prune pole stands to improve growth and tree form,
- production thin semi-mature stands, and
- manage totara-dominant stands for conservation and environmental purposes.

Landowners have the option of providing their forest inventory data to the NTWG to allow region-wide collation of the extent of regenerating farm-grown totara resource and to gauge landowner interest in management. For more information on the work of the NTWG contact:

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HARVESTING AND MILLING INDIGENOUS TIMBER

For landowners wishing to harvest and mill timber from their totara stands, the Ministry of Agriculture and Forestry (MAF) has prepared a guide that is available on their website (see links in reference section).

This guide will help owners of indigenous forest landholdings understand the sustainable forest management (SFM) provisions of the Forest Ammendment Act. It outlines what is involved in preparing:

- a draft SFM Plan;
- a SFM Permit application;
- an Annual Logging Plan.

Download this guide as a PDF (379 KB)

Alternatively you can request copies of this guide from:

Policy Publications
MAF Policy
PO Box 2526
Wellington
New Zealand
Tel: 04 894 0252
Email: policy.publications@maf.govt.nz

ACKNOWLEDGEMENTS

The assistance of members of the Northland Totara Working Group in reviewing and providing information and photographs are gratefully acknowledged. Paul Quinlan provided detailed feedback and perspective on assessment of the diverse totara resource in Northland. Chris Kennedy provided the aerial photography and allowed the reproduction of his Tree Form Classes in Table 3. Helen Moodie (NZ Landcare Trust), Convenor of the NTWG, provided guidance and support. Heidi Dungey, Greg Steward and Thomas Paul (Scion), Peter Berg and Ian Barton (Tane's Tree Trust), Mark Smale (Landcare Research), Don McKenzie (Northland Regional Council) and Alan Griffith (MAF) provided valuable comments on earlier drafts. Many thanks also to others at Scion including Margaret Richardson for editing, Carolyn Hodgson for proof-reading and Vicky Hodder for formatting.

This project was funded by FRST Envirolink for the Northland Regional Council (516-NLRC75 – Guidelines for landowners to assess regenerating totara resource on their farms).

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http://www.maf.govt.nz/forestry/indigenous-forestry/guide/ A Guide to Preparing Draft Sustainable Forest Management Plans, Sustainable Forest Management Permit Applications and Annual Logging Plans

http://www.maf.govt.nz/forestry/indigenous-forestry/intro-page-for-standards.htm Standards and Guidelines for the Sustainable Management of Indigenous Forests

http://www.maf.govt.nz/forestry/indigenous-forestry/ellis-tables/ Estimation of Standing Volume for Indigenous Tree Species

APPENDICES

Appendix 1: Volume table used to estimate the standing roundwood volume for indigenous timber species including totara for trees with a DBH from 20-100 cm. Volumes are cubic metres of roundwood inside bark (New Zealand rimu volume table applicable to all NZ podocarps, Ellis 1979).
(refer to: http://www.maf.govt.nz/forestry/indigenous-forestry/ellis-tables/)

D.B.H. (cm)	Merchantable Height (m)								
	2	3	4	5	6	7	8	9	10
20	0.088	0.113	0.136	0.157	0.177	0.195	0.212	0.229	0.245
22	0.106	0.137	0.165	0.190	0.213	0.236	0.257	0.277	0.296
24	0.126	0.163	0.196	0.226	0.254	0.280	0.305	0.329	0.352
26	0.147	0.191	0.229	0.265	0.297	0.328	0.357	0.385	0.412
28	0.171	0.221	0.266	0.307	0.344	0.380	0.414	0.446	0.477
30	0.196	0.254	0.305	0.352	0.395	0.436	0.475	0.512	0.548
32	0.223	0.288	0.347	0.400	0.449	0.496	0.540	0.582	0.622
34	0.251	0.325	0.391	0.451	0.506	0.559	0.609	0.656	0.702
36	0.281	0.364	0.438	0.505	0.567	0.626	0.682	0.735	0.786
38	0.313	0.406	0.487	0.562	0.632	0.697	0.759	0.818	0.875
40	0.347	0.449	0.540	0.622	0.699	0.772	0.840	0.906	0.969
42	0.382	0.495	0.595	0.686	0.770	0.850	0.926	0.998	1.068
44	0.419	0.543	0.652	0.752	0.845	0.932	1.015	1.095	1.171
46	0.457	0.593	0.712	0.821	0.923	1.018	1.109	1.196	1.279
48	0.498	0.645	0.775	0.894	1.004	1.108	1.207	1.301	1.392
50	0.540	0.699	0.840	0.969	1.089	1.202	1.309	1.411	1.509
52	0.583	0.756	0.908	1.048	1.177	1.299	1.415	1.525	1.631
54	0.629	0.815	0.979	1.129	1.269	1.400	1.525	1.644	1.758
56	0.676	0.876	1.052	1.214	1.364	1.505	1.639	1.767	1.890
58	0.725	0.939	1.128	1.301	1.462	1.613	1.757	1.894	2.026
60	0.775	1.004	1.207	1.392	1.564	1.726	1.879	2.026	2.167
62	0.827	1.072	1.288	1.485	1.669	1.842	2.006	2.163	2.313
64	0.881	1.141	1.372	1.582	1.778	1.962	2.136	2.303	2.464
66	0.936	1.213	1.458	1.682	1.890	2.085	2.271	2.448	2.619
68	0.994	1.287	1.547	1.784	2.005	2.212	2.409	2.598	2.779
70	1.052	1.364	1.639	1.890	2.124	2.343	2.552	2.752	2.943
72	1.113	1.442	1.733	1.999	2.246	2.478	2.699	2.910	3.113
74	1.175	1.523	1.830	2.110	2.371	2.617	2.850	3.073	3.287
76	1.239	1.606	1.930	2.225	2.500	2.759	3.005	3.240	3.465
78	1.305	1.690	2.032	2.343	2.632	2.905	3.164	3.411	3.649
80	1.372	1.778	2.136	2.464	2.768	3.055	3.327	3.587	3.837
82	1.441	1.867	2.244	2.587	2.907	3.208	3.494	3.767	4.029
84	1.511	1.958	2.354	2.714	3.050	3.365	3.665	3.952	4.227
86	1.584	2.052	2.466	2.844	3.195	3.526	3.840	4.141	4.429
88	1.658	2.148	2.581	2.977	3.345	3.691	4.020	4.334	4.636
90	1.733	2.246	2.699	3.113	3.497	3.859	4.203	4.532	4.847
92	1.810	2.346	2.819	3.251	3.653	4.031	4.390	4.734	5.063
94	1.889	2.448	2.942	3.393	3.813	4.207	4.582	4.940	5.284
96	1.970	2.553	3.068	3.538	3.975	4.387	4.777	5.151	5.510
98	2.052	2.659	3.196	3.686	4.141	4.570	4.977	5.366	5.740
100	2.136	2.768	3.327	3.837	4.311	4.757	5.181	5.586	5.975

Appendix 2: Record sheet for entering field data from naturally-regenerating totara stands.

Landowner/farm location: …….

Stand Identification: …….. Plot No.: ……

Totara stand class (1-5)*: ……..…

Tree No.	DBH (cm)	Estimated tree height (m)	Estimated Merchantable bole length (m)	Tree form class (1-5)†	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

*** Totara stand class:**

1. Mixed age/size stands.
2. Young sapling thickets
3. Pole stands
4. Semi-mature stands.
5. Isolated open-grown trees.

† **Tree form class:**

1. Excellent
2. Good
3. Fair
4. Poor
5. Non-merchantable.

Comments:

Appendix 3: Record sheet for summarising stand information from plots established in even age/size pole and semi-mature tree stands (Totara Stand Class 3 and 4). Due to the high degree of variability, it is difficult to assess tree and stand characteristics for Stand Class 1 (mixed age/size forest types) and Stand Class 5 (open grown totara).

Landowner/farm location: …….

Stand No.	Plot No.	Plot size (ha)	Totara stand class (3 or 4)*	Av. DBH (cm)	Av. height (m)	Av. merch. bole length (m)	Av. tree form class (1-5)†	Av. standing tree volume (m^3)	Stand density (stems /ha)	Stand volume (m^3/ha)

*** Totara stand class:**

3 Pole stands
4 Semi-mature stands.

† Tree form class:

1. Excellent
2. Good
3. Fair
4. Poor
5. Non-merchantable.

Comments