

This is a companion document to the Interim Commercial Thinning Guidance for Interior British Columbia (2021). Information not included in this field guide can be found in that publication.

Note to be a candidate stand for Commercial Thinning (CT) the block is to meet the five key principles outlined in the guidance:

- 1. Vigorous stand growth and site potential is maintained**
- 2. Stand yields are maintained for the full rotation**
- 3. Adaptive management will improve practices**
- 4. Economic benefit to the public is maintained**
- 5. Non-timber values are maintained or enhanced**

The following provides a methodology that will assist in identifying blocks that meet the above principles.

Steps in the field, pre-treatment survey¹:

- Stand survey with multiple plots distributed throughout the stratum.
- Basal area tally plots: Establish at least 6 variable area (BAF 5 prism) plots in the stratum or if less than 4-8 trees per plot then establish 50 m² (3.99m) fixed radius plots. Tally all trees (no diameter limit) by species and diameter classes. Establish 1 tally plot per 4 hectares (e.g. A 20 ha type will require $20\text{ha} \times (1/4\text{ha}) = 5$ plots, so establish the minimum 6 plots). (Field Card 4 is provided to collect tree data)
- Top-height sample trees: At the tally plot, also look out 5.64m and find the top height tree to measure dbh, height, breast height age, and % live crown. Measure at least 6 trees per stratum of the leading species targeted for retention, or 1 top height tree of each 4 hectares, whichever is greater.
- Determine Average Site Index: Use top height and breast height age measurements to determine site index from site index curve or growth intercept (see Field Card 3 for guidance).
- Gather is the stand's history, if available, such as planting date and density and recent fertilization treatments, often available in the RESULTS database.

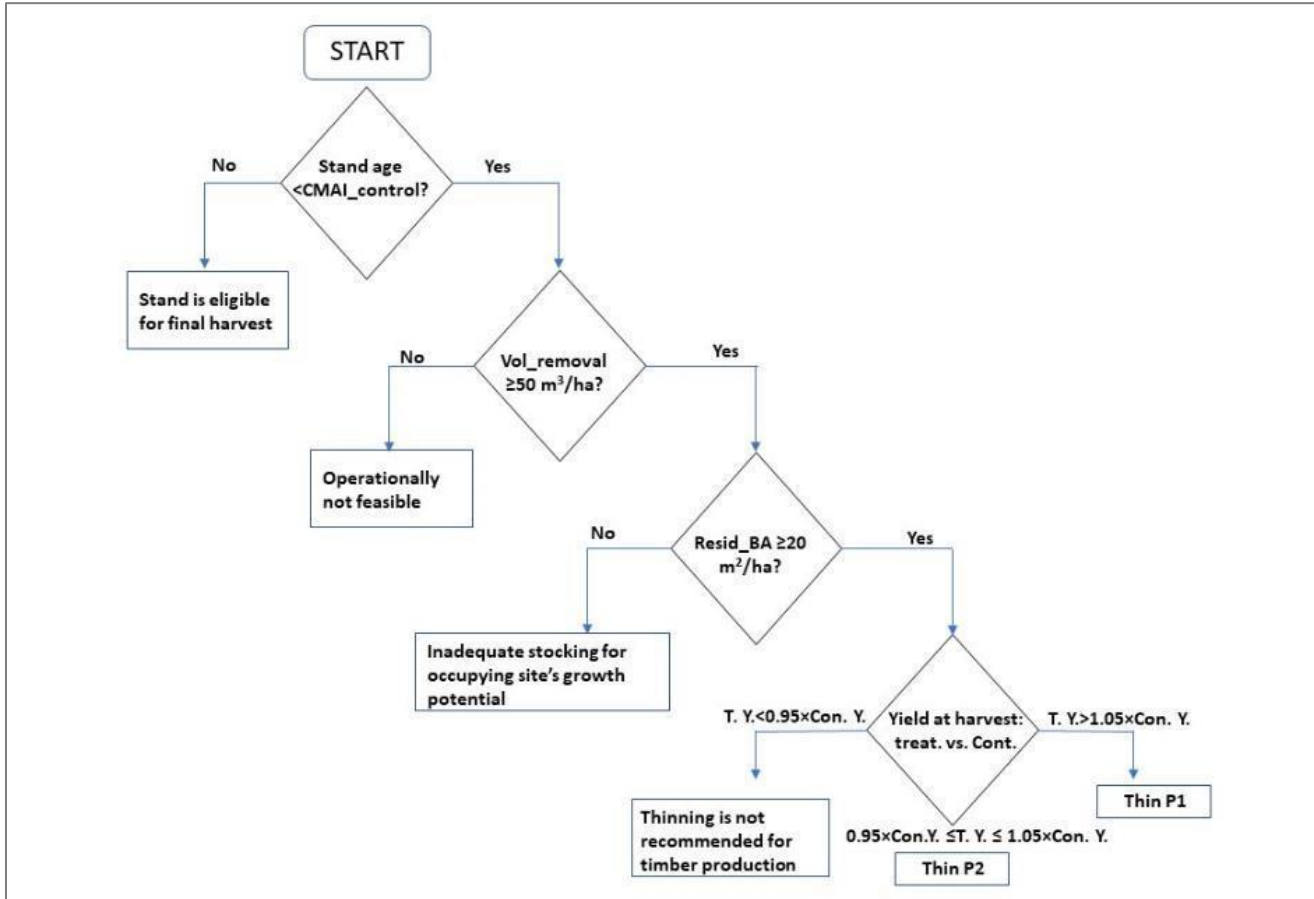
Use of field measurements:

- Tally/count plots are averaged to get the stand basal area, for use on the Field Decision Aid.
- Measured breast height age and inventory-standard top height are used to determine site index to compare the stand to the modelled parameters (record the methodology used).
- Measured stand age (with conversion from breast height age) is used to determine if the stand is below the age of CMAI, the first decision point.
- Measured height and diameter are used to calculate the height to diameter ratio, an indicator of how stable the stand will be against stem damage by wind or snow (see Forest Health section of the Guidelines document for thresholds).
- Measured height to the base of live crown is used to calculate percent live crown, an indicator for multiple reasons, including the amount of windthrow resistance, vigour, and potential growth response the stand may have after CT operations.

¹ Field Card 4 contains sample field cards that may help you collect and organize the data from the field. Field Card 3 contains the Standard data collection methodology for top height and site index.

Commercial Thinning – Pre-treatment survey reference guide, Block Suitability Field Card 1

Use the values collected and calculated from the Graphed Decision Aid (Found on Field Card 2) to determine the stand eligibility for CT treatment.



See Field Card 2 for additional decision aids

Note decision node number two regarding volume removal is considered flexible and up to the operator to determine local economic viability. The final decision node – yield at harvest allows for 90% as a standard.

Field Decision Aid – Field Card 2

Use the values collected and calculated here to determine the initial stand eligibility for Commercial Thinning (CT) using the dichotomous key found on Field Card 1.

The following figures indicate the decision points which create the thresholds for CT treatment. The graphs are valid only when the following assumptions are met:

1. Lodgepole pine, white spruce and Douglas-fir are on site index 16-26.
2. Trees are planted and evenly distributed in the stand, planting density between 1000-2600 sph.
3. Operational implementation is the same as modelling (5 m cut strip and 15 m leave strip).
4. Thinning type (thinning from below in the leave strips) with utilization of 12.5cm dbh, top diameter inside bark is 10cm, removing at least 50m³/ha.
5. Thinning intensity retains a minimum stocking of 20m²/ha of basal area.
6. Residual trees are evenly distributed in the stand.
7. There is no severe mechanical damage in the residual stand.
8. Wind damage and snow breakage are not a significant concern in the area and
9. There are no forest health issues, such as root disease, in the stand.

If these assumptions are not met; consult the CT_spp_Summary_Table with TASS runs for different combinations of thinning utilizations, model the stand in TASS III Graphical User Interface with your harvest pattern and utilization, available for download, or contact the Stand Development Modelling group of the Forest Analysis and Inventory Branch (e.g., Sharad.Baral@gov.bc.ca).

Using the field measured variables of the **current average top height and merch. basal area (>12.5cm)**, locate your stand on the graph. If your basal area is **within or above the values in the green shading, and total stand age is below the culmination of MAI**, you may proceed without contacting the Stand Development Modelling group of the Forest Analysis and Inventory Branch for with site information for custom modelling or to provide interpretation

There is a possibility of observing higher basal area (or a stand lying outside of the Decision Aid graphic) if the stand was initiated with higher planting density (>2600 sph) or located in a better-quality site (SI>26 m) than what was modelled in the TASS simulations. The grey lines indicate the upper bounds of the TASS experimental plot data without OAF's applied.

Conversely, if your stand does not qualify based on the Decision Aid and you believe that a CT operation will provide value to the stand or fit within landscape objectives, use the field data in support of the professional rationale to the decision maker.

The top height tree is the largest DBH tree of a given species that is healthy and with an intact top in a 5.64 m fixed radius (0.01 ha) plot. The top height is the average of all the measured trees distributed in the stand (see Field Card 3 for methodology).

Commercial Thinning – Pre-treatment survey reference guide, Block Suitability Field Card 2

Lodgepole pine:

Step one – identify whether the stand is below CMAI – use the table below (Field Card 3 identifies how to calculate SI and Stand Age)

Table 1: Mean annual increment culmination age for lodgepole pine stands of various initial planting density and site index. CMAI is based on merchantable volume (DBH=12.5 cm+ and dib=10).

Initial density (stems/ha)	Site index (m)					
	16	18	20	22	24	26
1000	100	85	80	65	60	55
1200	100	85	75	65	60	55
1400	95	85	75	65	55	50
1600	95	80	70	60	55	50
1800	90	75	70	60	55	50
2000	90	75	70	60	50	45
2200	85	75	65	55	50	45
2400	85	75	65	55	50	45
2600	85	75	65	55	45	45

Step two – locate the block on the graph below to assess suitability based on model outputs

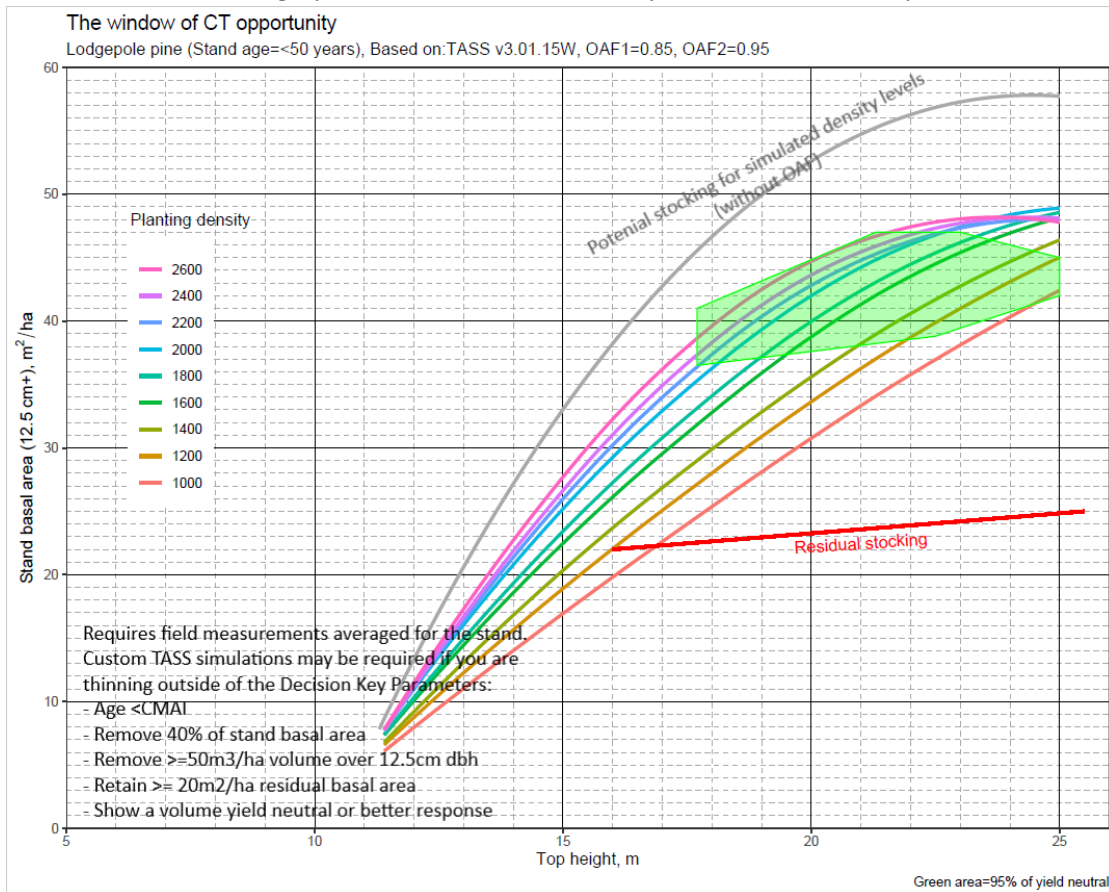


Figure 1: Graphed Decision Aid for lodgepole pine

White spruce

Step one – identify whether the stand age is below CMAI – use the table below (Field Card 3 identifies how to calculate SI and Stand Age)

Table 2: Mean annual increment culmination age for white spruce stands of various initial planting density and site index. MAI is based on merchantable volume (DBH=12.5 cm+ and dib=10).

Initial density (stems/ha)	Site index (m)					
	16	18	20	22	24	26
1000	120	105	95	85	80	70
1200	115	105	95	85	75	70
1400	115	105	90	85	75	70
1600	115	100	90	85	75	70
1800	115	105	95	85	75	70
2000	110	100	85	80	75	65
2200	115	100	90	80	75	70
2400	110	100	85	80	70	65
2600	115	100	90	80	70	65

Step two – locate the block on the graph below to assess suitability based on model outputs

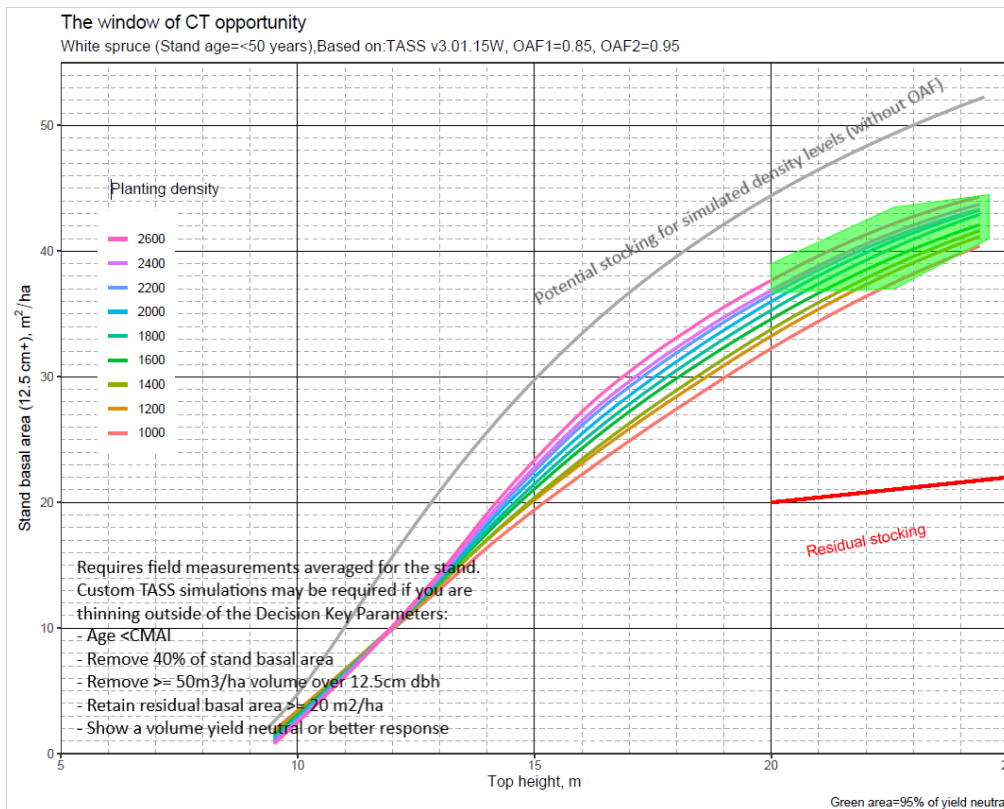


Figure 2: Graphed Decision Aid for white spruce

Douglas-fir:

Due to lack of data there is only one TASS scenario for eligibly for CT for Fd – note there is no associated graph.

Table 1: Field Decision Aid for Douglas-fir

Thinning Age	MAI Culmination Age	Planting Density (sph)	Site Index	Basal Area removal	Basal Area before Thinning
65	121	2000	26	25 %	42

Steps

- Assess block suitability using the above matrices for CMAI for PI and Sw,
 - Note - Fd has insufficient information to provide similar tables.
- Access stand for vigour and sufficient volume for removal and retention – Y / N – Use Data Field Cards
- Assess suitability using the above graphs based on current stand basal area and top height.
- Locate your block on the graph intersect, if found within the yellow or green highlighted areas it is within the 95% volume projection and is considered a suitable candidate stand.
- Where outside of the green and it is expected the stand will benefit from CT, a custom simulation could be used to assess suitability.

Commercial Thinning – Pre-treatment survey reference guide, Field Card 3

Site Index is used in the Initial Density over Site Index Matrix (Field Card 2) to determine Culmination of Mean Annual Increment CMAI – which is used to determine if the block is suitable for CT or final harvest (CMAI table found on Field Card 2 for PI and Sw).

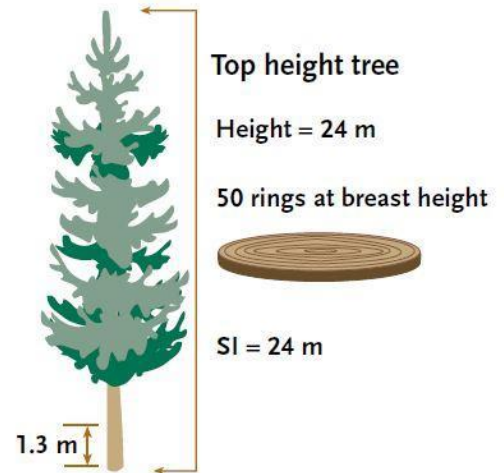
Site index is the site's potential to grow trees and is one of the key variables to be considered for effective forest management. Therefore, it is essential to determine the site index accurately based on site data, i.e., not from SIBEC or VRI.

Top Height Sample Trees:

The top height tree is the largest DBH tree of a given species that is healthy and with an intact top in a 5.64 m fixed radius (0.01 ha) plot.

The measured top height trees must be gathered from throughout the stand and not located in a cluster from within one plot.

- Measure the height and breast height age of the tree to determine the site index, using one of the methods below.
- Calculate the average of the measurements to determine the site index of the stand.



Site Index Methodology:

1. Stands with greater than 30 years growth above breast height: use site index curve methodology. (preferred method)

Using “Site Index Curves and Tables for British Columbia Interior Species, Land Management Handbook Field Guide Insert 6 Second edition 1994. <https://www.for.gov.bc.ca/hfd/pubs/docs/Fgi/Fgi06.pdf>

2. Stands with fewer than 30 years growth above breast height: use the growth intercept methodology. (alternate method)

Using “Growth Intercept Models and Table for British Columbia – Interior Species, Land Management Handbook Field Guide Insert 10 Third edition 1999”. <https://www.for.gov.bc.ca/hfd/pubs/Docs/Fgi/Fgi10-files/fgi10-r3.pdf>

3. If you require a more refined estimation, use the most recent version of the Site Tools for BC (currently it is Site Tools 4.1) a free application from FLNRORD Forest Analysis and Inventory Branch.

Determining stand age - used to assess suitability for CT based on CMAI – see tables on Field Card 2.

The preferred method of determining the age of the stand is via tree planting records indicating the year of planting and the age of the seedlings. If planting date is known, but stock age is not, then a reasonable age to use is one year at planting.

Total age, breast height age, and years to breast height

The concept of site index is based on breast height age – not total age. The figure to the right illustrates the differences between total age, breast height age, and years to breast height. Total age is the number of years since seed germination.

The number of years it took a tree to grow from seed to breast height is termed “years to breast height.” The number of years growth above breast height is termed “breast height age.” Breast height age is the number of annual growth rings at breast height. Total age is the number of rings at the point of germination. Breast height is 1.3 m above ground measured from the high side.

If planting records are unreliable, determine the stand total age by using the breast height age counted in the field. For the site index estimation and the years to breast height age use the factor from Site Tools 4.1, summarized in the table below.

Total Age, Breast Height Age, Years to Breast Height Age

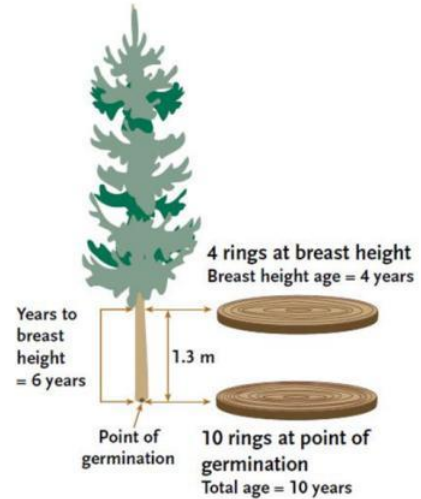


Table 2: Determining stand total age from years to reach breast height (bh) (1.3m)

Species	Regen method	Site Index (m) (measured in field)	Add yrs to reach bh to achieve stand total age
Fdi	All	16-18	10
		20-22	9
		24-26	8
Pli	All	16	7
		18-20	6
		22-26	5
Sw	Natural	16	15
		18-20	14
		22-24	13
	Planted	26	12
		16	11
		18-20	10
		22-24	9
		26	8