Lesson 2

Commercial Thinning – Stand Selection Process

How to choose a suitable stand

75 minutes

Objectives:

1. To introduce the concept of appropriate and applicable stands for CT.
2. To outline the use of Reineke's Stand Density Index to help rank stands.
3. To use stock and stand data along with some simple grading rules to identify candidate stands.

Equipment Needs:

- flip chart
- overhead projector and screen

Method:

- lecturette
- short exercises
- slides (if available)

Note: Stands may be selected for a variety of reasons, one of which may be to harvest a stand where adjacency would not permit a clearcut. The assessments we will go over should help determine the suitability of the stand for CT.

CT – Stand selection

- Which stands are suitable?
- What information do I need and how should I collect it?
- Should I use a stand density method to identify my stand?

Overhead: Stand selection

This overhead introduces the subject

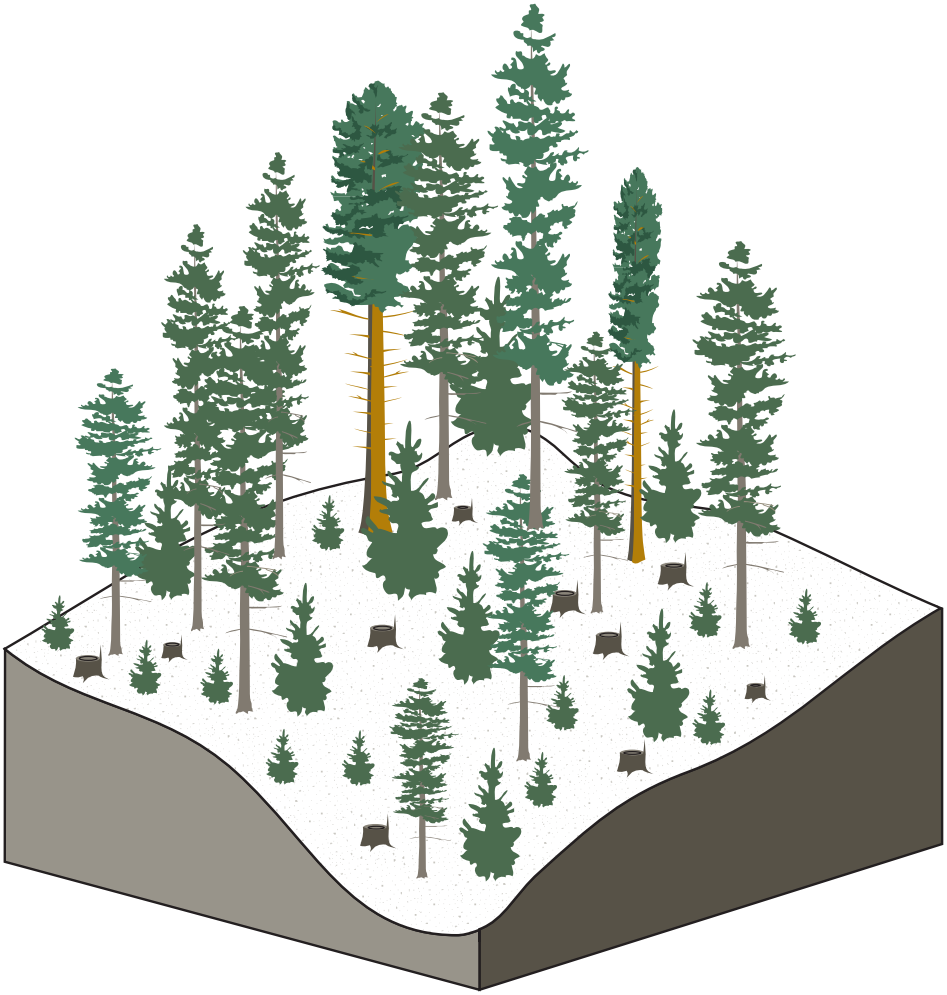
Facilitator:

This lesson is designed to go over the basic process of stand selection. This should be considered an overview. A field exercise could be used to provide greater familiarity with the tools described here.

1. What stands are suitable? – this is a big question and one that the second overhead covers in more detail.
2. What information do I need and how do I collect it? We will look at a reconnaissance card that was created to gather data relevant to partial cutting prescriptions.
3. In the guidebook (p. 7) numerous references of assessing stand density are provided. We have chosen one method to work through in this workshop— Reineke's Stand Density Index (SDI). The use of it or other methods is at the discretion of the prescriber.

Note: This overhead was designed as a lead-in – do not go into too much detail here. The overheads that follow are designed to provide more information.

CT – Candidate stands



Stands with:

- appropriate age, species and vigour
- adjacency requirements
- sensitive VQOs
- attributes that can improve wildlife habitat or biodiversity.

Overhead: Stand selection – Candidate stands

Facilitator: Use this overhead to spark discussion on which stands are suitable for CT.

The following have been listed on the overhead, but it is not a complete list. Add definition to those on the list and add others that seem appropriate.

- Stands of appropriate age – remember most of our harvests are still in old-growth stands that are past the usual rotation age (unless we are managing for old-growth characteristics). Therefore, most stands are beyond where CT is appropriate – as a regeneration cut should be used. This can vary if not windfirm…

  Appropriate means that they are merchantable but are not yet truly at rotation age, or are an old-growth stand that can survive and thrive to the next cut.

  The most appropriate species are those that can be logged at a profit and will not be unduly harmed by logging. The list of relative susceptibility to decay is found on page 25 of the guidebook. Hemlock and balsam species are most susceptible (after broadleaved species) and require great care if commercially thinned.

- Stands with adjacency requirements – The *Green-up Guidebook* describes maximum cutblock size. It states:

  These maximum block sizes apply to cutblocks that have a clearcut or seed tree silvicultural system where less than 40 per cent of the pre-harvest basal area has been retained on a portion of a block… (p. 5).

  Also – *Green-up requirements do not apply to: single tree selection and other uneven-aged management systems where at least 40 per cent of the pre-harvest basal area has been retained (p. 2).*

  Both of these guidelines would promote CT in areas with limitations on heavier removals.

- Stands within sensitive VQOs – in areas with low visual absorption capacity and in areas with retention or possibly partial retention VQOs, CT may be a temporary solution.

- Stands that can improve wildlife habitat or biodiversity – get input on this – CT could be used to create larger trees sooner, thus creating larger snags or wildlife trees sooner than untreated stands. Forage

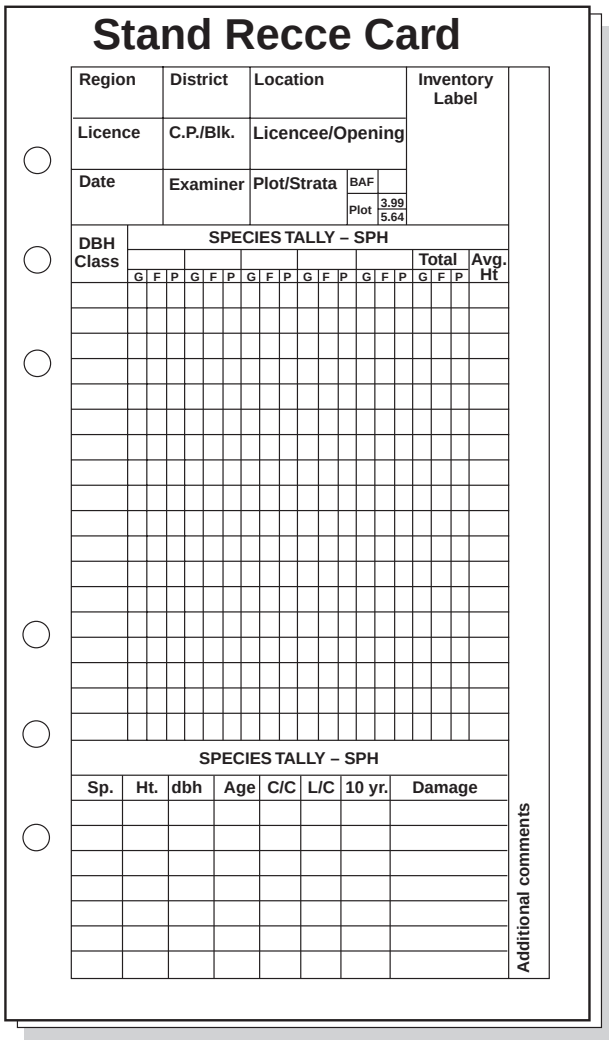
production increases should be minimal with CT, as site occupancy is usually a goal. If increased forage production is an objective, choosing a system that provides less crown cover may be preferable. In most cases, the old-growth attributes cannot be created in normal rotation lengths. Thus, it may be important to keep the trees that are being groomed for specific tasks past the removal cut of the silvicultural system.

Optional on the flip chart

Ask the group what stand characteristics and age are preferred – some examples (record on flip chart)

- Previously spaced
- Healthy trees with good crowns
- 40–60 years old – to provide merchantable volume now and provide enough time to rotation to add increment
- Douglas-fir on the coast, Pl in the interior.

CT – Stand selection



Stand Recce Card

Region	District	Location	Inventory Label
Licence	C.P./Blk.	Licencee/Opening	
Date	Examiner	Plot/Strata	BAF / Plot 3.99 5.64

DBH Class	SPECIES TALLY – SPH																Total		Avg. Ht
	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	

SPECIES TALLY – SPH							
Sp.	Ht.	dbh	Age	C/C	L/C	10 yr.	Damage

Additional comments

Recce to assess and provide:

- species and density
- release potential
- windthrow potential
- forest health
- harvesting feasibility
- approximate boundaries
- site index
- potential products.

Overhead: **Stand selection – Recce card**

Facilitator: Go over the need for good pre-harvest data

Question group: What different information would you want to collect for a partial cut vs. a clearcut?

The key is information on potential leave stems and on those you wish to harvest – you need to know how many and where the stems are to create a meaningful prescription.

Merchantability and logging costs are going to dictate whether you can commercially thin the block at a profit. Thus a breakdown by log size will be critical in estimating merchantability and the total number of stems can help to estimate whether there is an adequate number to break even.

Cruise information can be used – with additional information on vigour and windfirmness added in. Another method that is useful for prescription making is the Recce card.

Be sure the following points are covered:

- The form was created to help collect data relevant for partial cutting prescriptions.

Hold up the form and go over the important sections.

- The information required is the BAF of the prism used, the subplot size for tallying submerchantable stems. A description of the vigour criteria (back of the page).
- You can use the form for one plot or a number of plots. If you use it for numerous plots, be sure to record the number of plots in the plots/strata box.
- DBH classes can be the traditional 5 cm classes (e.g., 20 cm class is 17.5 – 22.5 cm). You may wish to choose larger classes – it is up to you. You may wish to organize it by log grade – such as breaking up the J grade into large gang (20–36 top diameter inside bark (dib), and small gang 20 cm top dib or under). To translate this into dbh, take into account taper and bark thickness. This will vary considerably by species and stand density.

These data are important as they can be used to place value on the stand and help choose cut/leave ratios. Learn as much about this as possible if you plan on using CT.

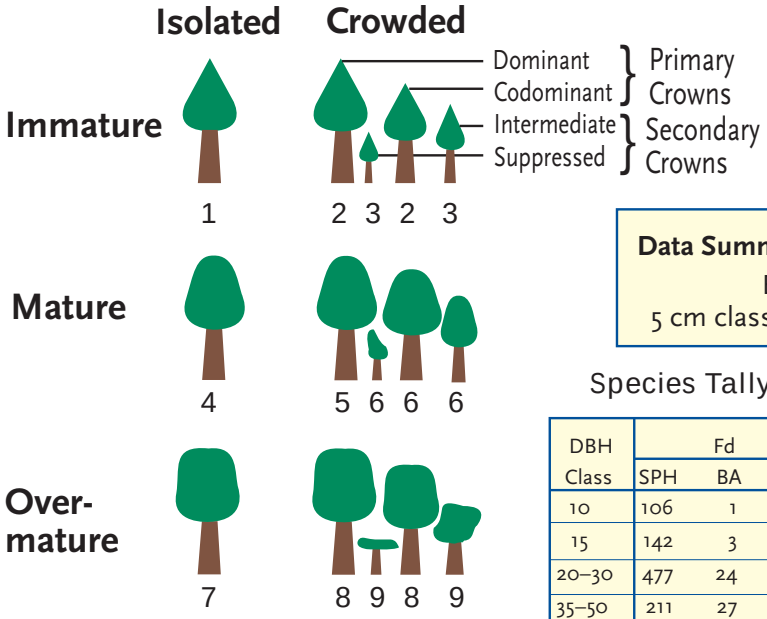
- Each species has three columns: G,F, and P. You must put the species name at the top and identify what constitutes G,F, and P on the back of the form. You may wish to use two codes – leave and take – but this may be difficult prior to seeing the whole stand.
- Sample tree information is presented at the bottom of the form. Obviously age and vigour are important considerations.
- On the back are spaces to assess windthrow hazard. This information is very important for the success of your prescription – be aware of windthrow hazards.
- Make notes on harvesting options – are there old trails that can be reused? Is it possible to use ground based systems?
- Figure out logical boundaries based on topography and windfirmness.
- Use the most accurate SI method – the height over age curves should work best in the age group you are in.
- Think about potential products while on site – how much will be pulp vs sawlog? Think about it.

Point out the other points on the OH.

- Block design may be significantly influenced by windthrow hazard.

CT – Stand selection

Almanor Tree Classification System



Data Summary Sheets by DBH Class Group
By SPH, BA and Volume
5 cm classes, 10 cm classes, other classes?

Species Tally by Diameter Class Group

DBH Class	Fd			Cw			Total		
	SPH	BA	VOL	SPH	BA	VOL	SPH	BA	VOL
10	106	1					106	1	
15	142	3		47	1		189	3	
20–30	477	24	151	134	7	42	611	31	193
35–50	211	27	235	39	6	55	249	33	290
55–70	36	11	119	7	2	18	43	12	137
75–100									
TOTAL	970	65	506	227	15	114	1197	80	620

Important Recce components are:

- an assessment strategy (e.g., 30 plots or 1 plot per ha or × per strata...)
- clearly defined criteria for leave trees (see above)
- summary output tables, graphs (or both)
- data that can be used to create and justify your prescription.

Overhead: **Stand selection – Recce – important components**

Facilitator: Important components of a recce[2]

- An assessment strategy – the block should be pre-stratified and a plan for assessment worked out. In some cases the block may be so heterogeneous that stratification is not practical – if so, sample the entire block as a mosaic.
- To get significant results in heterogeneous blocks, 30 plots are recommended. If the block is very homogeneous fewer plots may be needed to describe the stand adequately. There is no standard provided.
- Leave tree or vigour criteria are necessary to determine the feasibility of the harvest. This information can be summarized and an estimate of products created.
- A prism sweep is done for each plot – trees are put into diameter classes. You can measure each tree or estimate the diameter using a marked stick (metre stick or homemade version). You may have a specific cutoff point below which the trees are unmerchantable. Select the BAF (basal area factor of your prism) to get between 6–12 trees per plot.
- You may also wish to put in a fixed area plot and pick the leave and take trees from that plot. A 0.01 ha plot is 10×10 m and allows easy conversion to sph (stems times 100). For a circular plot of the same size the radius is 5.64 m.
- Remember the data you collect will be used to formulate and help you justify your prescription. Collect the important data while you are there – return a second time to corroborate your initial findings.

[2] Note that this information is not for valuation purposes. Instead it is meant to provide adequate data from which to formulate a silviculture prescription.

CT – Stand selection

Reineke's stand density index

Reineke's is one of a number of methods.

- It assumes that site productivity is relatively constant over a range of densities.

$$SDI = N_O \times (D_q/25)^{1.605}$$

Dq = Quadratic mean diameter

$$Dq = \sqrt{\frac{\sum_{i=1}^{N} d_i^2}{N}}$$

Overhead: Stand Selection – Reineke's Stand Density Index

Facilitator: Go over the following:

Reineke's stand density index is one method to rank a stand for site occupancy.

- It is based on the concept that the number of stems for full site occupancy decreases as the stems grow. In other words, there is natural mortality of smaller stems leaving fewer larger stems over time.
- The equation uses the quadratic mean diameter from your stand and relates the number of trees in your stand to a density index of 25 cm stems.
- The outcome is then judged against a table of key values to determine where you are in terms of site occupancy.
- We have provided numbers for Fd and Hw. Alternative methods should be used for other species.

Key points:

- Explain how to calculate the quadratic mean diameter (Dq)

$$Dq = \sqrt{\frac{\sum_{i=1}^{N} d_i^2}{N}}$$

- Dq is the quadratic mean diameter (qmd)
- $\sum_{i=1}^{N} d_i^2$ is the sum of all the measured diameters (dbh)
  – **squared** (from a range of sample plots in the stratum)
- N = number of trees sampled to get the diameters – divide the sum of the squared diameters by N, then take the square root of the whole thing to get the Dq.
- Introduce the key value table for using the stand density index using the next overhead.

SDI = $N_0 \times (Dq/25)^{1.605}$

N_o = the number of stems per ha

Dq = qmd as calculated above.

The EXCEL formula is N_0*Power ((Dq/25), 1.605)

Note: We will have a short exercise using the table to promote greater comfort with the methodology.

CT – Stand selection

Levels of competition	% max. SDI	Species	
		Fd	Hw
Maximum	100	1450	1950
Lower limit of self thinning	60	870	1170
Lower limit of full site occupancy	35	510	680
Onset of competition	25	360	490

Key values for Reineke's stand density index

Overhead: Reineke's SDI – Table of key values

Facilitator:

This table provides values that were compiled by Long (1985) that relate to levels of site occupancy. The table is divided by species – go over one example, then have the participants turn to their neighbour for a ranking exercise based on 5 stands where they have been provided the qmd, stems per ha and SDI value for a local species.

The main points to emphasize from the table are:

The maximum level of competition (100% SDI) – After this point the stand is experiencing high levels of density-dependent mortality. At this point the stand is beyond traditional CT logic (timely harvest to capture mortality and provide added growth prior to final harvest). It may benefit from CT. However mortality has already claimed some volume and the remaining trees may have a prolonged adjustment period to provide additional growth due to reduced crown length.

The lower limit of self thinning (60% SDI) – After this point the stand begins to self thin itself through density-dependent mortality. You may find CT is effective at capturing mortality at this stage. However, if the stand is much beyond this point crown size will have been affected and response may be limited. The rule of thumb is to keep the stand below this point to maximize site potential.

Lower limit of full site occupancy (35% SDI) – This is the lower limit for which the site is fully occupied. An objective is to manage the stand to keep the density between this and 60% SDI, to maximize use of the resources on-site.

Onset of competition (25% SDI) – This often relates to crown closure. This is too soon to CT as growing space will be opened up prematurely for maximum volume production.

Workbook: Commercial thinning – SDI exercise

Facilitator:

Have the groups turn to their neighbour and go through the exercise of ranking these three stands as to their preference for commercial thinning. All blocks offer the same logistics (e.g., slope, aspect, roading). Have the groups provide justification for their ranking.

The data are as follows:

Douglas-fir SI = 30

Block 1 – SDI = 1277, N = 600 sph, QMD = 40 cm

Block 2 – SDI = 851, N = 400 sph, QMD = 40 cm

Block 3 – SDI = 848, N = 600 sph, QMD = 31 cm

Flip chart:

Go around the room and ask how the blocks were ranked – put the ranks on the flip chart. The fall-out based on the logic provided. Obviously if the sites offered different logistics or green-up considerations the ranking could differ.

Ranking – Block 2, (3, 1?)

1. Why block 2? It is near the 60% point and has a larger qmd than block 3 that has a similar SDI. It would therefore have fewer and larger stems to harvest (greater profit).
2. To be sure we would need more information at this point on the size of potential leave trees for block 3. Block 1 would cost more to harvest but would have more volume. It may have spindly (poor ht/diam ratio stems) and small crowns. Thus both 1 and 3 are questionable for CT without more info.

After ranking the stands, ask the group what further information they need to make a more accurate assessment. They should provide the following (as discussed for the Recce):

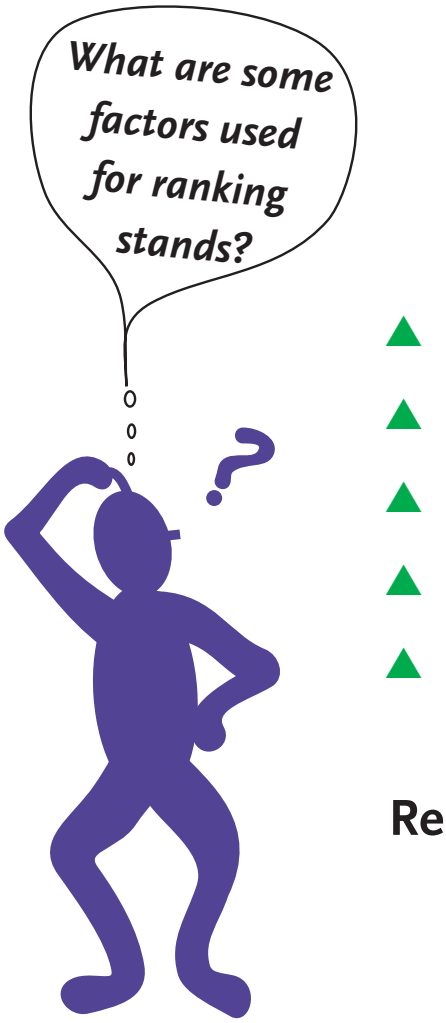
- diameter distribution
- species distribution – is it really all Fd
- crown lengths
- vigour
- basal area of the stand
- list others here as provided from your group

Important points to stress:

Remember density management tools must be used with a knowledge of the biology of the stand. Do not use the numbers without understanding possible limitations and assumptions.

Don’t settle on one measure for picking your stand – use your head.

CT – Stand selection



Remember: Don't rely on only one measure. Use your head!

Overhead: **Commercial thinning – Other factors for ranking stands?**

Facilitator: Have the group read page 19 of the guidebook regarding other factors that can be used in selecting a stand for commercial thinning.

There is space on the overhead to add the additional factors:

- Size; age; level of competition; site quality; species (susceptibility to windthrow and decay); site sensitivity; access; piece size; volume per ha; need for fibre.

Question:

Are there any questions regarding the factors mentioned? Go over them if there are.

Is spacing a necessary condition for CT?

If so on what sites?

- medium sites, especially lodgepole pine

What are good candidate species?

- Coast – Douglas-fir, Cw, Bg, Hw?
- Interior – lodgepole pine, Fd, Lw, possibly spruce depends on windfirmness, Bl? Cw, Hw?

What makes for a good leave tree?

- lots of crown
- low height to diameter ratio (below 80 or 90)

How many trees are too many?

- depends upon the merchantability and logging costs. If the stems are merchantable production rates usually increase with more stems being taken (up to a point).