

Lesson 3

Pruning Principles

60 minutes

Objectives:

1. Participants will discuss and describe key biological pruning principles aimed at maximizing the value return.

Equipment Needs:

- ▲ Ministry of Forests “Pruning for Value” case of pruning samples—Kit #2 (Note: this is the only kit that has numbered samples)
- ▲ flip chart
- ▲ Ministry of Forests video – *Pruning Second Growth Stands* (cued up at the start of Part One)
- ▲ VHS player and monitor
- ▲ overhead projector and screen

Method:

This lesson starts with a small group exercise where the participants examine several wood samples (cross-sections) to identify some key principles for pruning. Next, the instructor shows some overheads with a view of each sample in turn and asks the appropriate group to explain their discovery to the class. The instructor ensures all key principles emerge. A short lecturette follows that reinforces some of the principles raised by expanding on them to provide a greater depth of understanding.

Note: You should hide written clues on sample cross-sections with masking tape.



Wood Samples & Flip Chart: Pruning Principles

Facilitator: Small Group Exercise—Wood Samples (Reference: *Pruning Principles*, page 6–11, *Pruning Guidebook*)

1. Divide the group into 6 small groups.
2. Hand out wood samples as follows to the groups:
Samples 1&2 – Group 1 Samples 3&4 – Group 2
Samples 5&6 – Group 3 Samples 7&8 – Group 4
Sample 9 – Group 5 Sample 10 – Group 6
3. Ask the groups to study the samples and, based on what has already been discussed and what they see in the samples, **what key lessons do they see for pruning to maximize investments** (10–15 minutes).
4. Set the “Stillwater Main” large disk sample somewhere central in the room so that the participants can compare their samples to the Stillwater sample (where the sample asks them to do so).
5. Allow the participants to present their findings using overheads 3 • 1 to 3 • 12. You should put up the overhead in the sequence indicated below and ask the appropriate group to explain.
6. End by asking the group what additional principles emerged from reading the “*Pruning Principles*” section of the guidebook.

Key Points: Ensure the following emerge during the discussions (points that would generally come from the guidebook rather than the samples are in italics):



Pruning Principles

Wood Sample Exercises

Sample #1

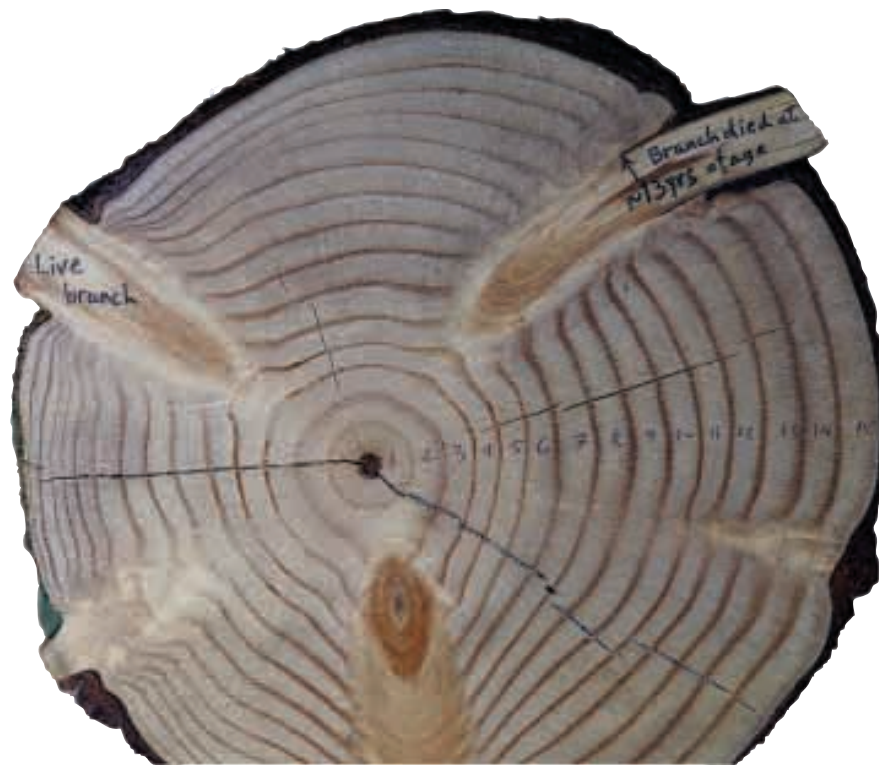




Pruning Examples

Wood Sample Exercise

Sample #2



Sample 1 & 2

Sample 1
OH 3 • 1: Prune early (less than 10 cm diameter), even less than 10 years old. Presumably the trees will be tall enough for the lifts planned (generally 5–7 m tall).

Pruning early is the single most important thing to remember in pruning. Delaying a pruning treatment by just seven years can reduce the Net Present Value of the end product by a factor of 10!

Sample 2
OH 3 • 2: Occlusion of a dead branch takes longer than a live branch. They should be able to see the occlusion on the live branch in sample #1, while sample #2 shows how occlusion may have to start deep within the stem of a tree with a dead branch.

Leaving branches until they die doesn't just mean you will have a larger knotty core and it will take longer for knots to occlude, but knots will be loose, a more severe quality problem.



Pruning Principles Wood Sample Exercises

Sample #3



Pruning Principles Wood Sample Exercises

Sample #4





Sample 3 & 4

Sample 3:
OH 3 • 3

Prune in a stand that has been spaced and is fairly open. Excessive stocking will slow occlusion and clear wood production, wasting the pruning investment.

Prune on richer sites to optimize clear wood production over time (similar to the lower stocking). *Generally pruning is considered economically viable on a SI of 20 or better. A decrease in costs may make lower site indices more viable.*

Sample 4
OH 3 • 4

They will also say to prune early since the sample #4 shows nice clear wood production even just at age 17, when pruned at age 9. The constrained knotty core is clearly evident here.

Pruning Principles
Wood Sample Exercises

Sample #10



Pruning Principles
Wood Sample Exercises

Sample # Stillwater Main



PRUNING WORKSHOP 3 • 5

Pruning Principles
Wood Sample Exercises

Sample # Stillwater Mainline, brush hook pruning



PRUNING WORKSHOP 3 • 6

PRUNING WORKSHOP 3 • 7

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•
• **Sample 10 & 11**

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• Sample 10 Show a slide of sample 10 and a comparison slide of
• OH 3 • 5 the Still water Main sample; check with groups 10 and
• 11 to see if they also found that pruning in a more
• open stand is optimal and that richer sites make for a
• better investment.
• Sample:

• Stillwater
• Main

• OH 3 • 6

• Sample: The Stillwater Mainline disc will also show a fairly
• brush messy occlusion because the pruning was fairly crude.
• hook Pruning with a brush hook resulted in cutting the branch
• pruning collar, giving us about 4–5 cm of messy, distorted grain.
• OH 3 • 7 Luckily the occlusion here was still relatively quick,
• owing to the high site index and/or wide spacing.



Pruning Principles Wood Sample Exercises

Sample #5



Pruning Principles Wood Sample Exercises

Sample #6



Sample 5 & 6

Sample 5 & 6
OH 3 • 8,
3 • 9

Do not prune up too high. Leave 50% of the live crown (unless you need to reduce this for other reasons white pine blister rust pruning). This point is illustrated by the pruning shock exhibited by this tree at breast height when pruned to 41% live crown.

Note: To obtain a constant pruning height throughout the stand, the shorter trees may be pruned to leave a minimum 30% live crown or three whorls remaining on the tree (whichever is greater). An alternative for biodiversity may be to not even prune the smaller trees, perhaps leaving up to 5% of the stand unpruned.

Pruning in multiple lifts allows stands to be pruned earlier to produce a smaller knotty core. There is also less tendency to want to prune too high in any one lift.

Multiple lifts tend to maximize the wood value and the production of mature wood. This would also suggest that you best be serious about pruning or question why you are doing it. Multi-lift pruning is a serious investment!



Pruning Principles Wood Sample Exercises

Sample #7



Pruning Principles Wood Sample Exercises

Sample #8



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•
•
Sample 7 & 8

Sample 7 & 8 Again this group will notice that pruning should occur
OH 3 • 10, in open stands with lower densities, and on richer
3 • 11 sites to maximize the investment by producing more
 clear wood in less time.

ALSO, they should recognize that occlusion of branch
stubs occurs more quickly when the growth increment is
maximized (lower stocking/richer site).



Pruning Principles

Wood Sample Exercises

Sample #9



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•
Sample 9

Sample 9
OH 3 • 12

Again the group will notice here the wasted investment when pruning in a dense stand (here it is 1400/ha). But also, pruning here was conducted late, giving a large knotty core. Notice that the occlusion of the branch stubs and resumption of normal growth rings was slow. This was due to the large branches on this old tree and the fact that older branches have considerable bark, which also slows occlusion and resumption of normal wood grain patterns.



Summary of Some Key Pruning Principles

- ▲ Prune early to minimize knotty core
- ▲ Prune your best sites ($SI_{50}=20+$)
- ▲ Prune your healthiest sites
- ▲ Prune in widely spaced stands
- ▲ Prune the best, space the rest
- ▲ Leave enough crown to respond with adequate growth
- ▲ Use proper tools
- ▲ Prune close to the tree, without damage to branch collar

Overhead: Summary of Some Key Pruning Principles

Facilitator: Summarize discussions

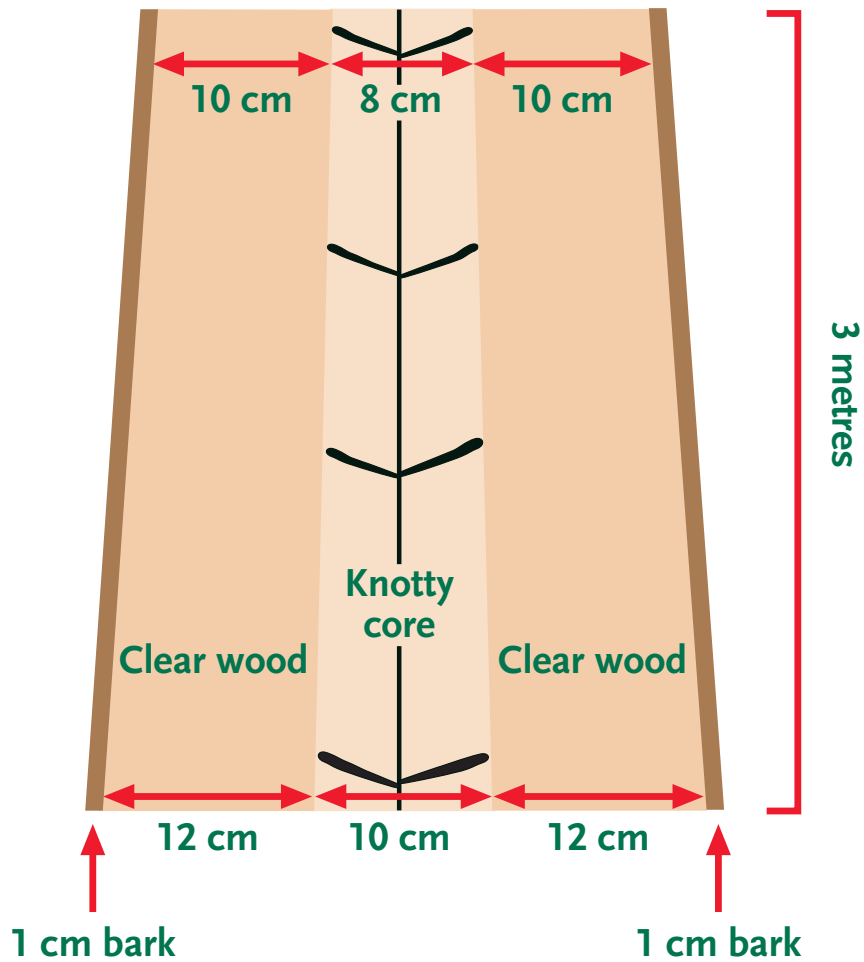
Mention that all of these points are in the *Pruning Guidebook* (pages 6–12).

Key Points

- ▲ **Prune early to minimize the knotty core** and maximize clear wood. This will be the most important factor to maximize return on investment. A difference of 7 cm diameter can increase return on investment by a factor of 10.
 - Use **overhead 3 • 2 and 3 • 4** to illustrate why this is the case
 - Branches on younger trees will be live, not dead, and bark will be thin, and therefore branch stubs will heal over much more quickly and will not form loose knots.
- ▲ **Prune your best sites.** Rapidly growing trees on SI₅₀ sites of 20+ will give you the best return on investment (ROI).
- ▲ **Prune your healthiest sites.** To minimize the risk of losing your pruning investment, prune only those stands with minimal or no expression of forest pest agents.
- ▲ **Prune in widely spaced stands.** ROI is again limited, even on good sites, if the diameter growth of the pruned trees slows due to inter-tree competition. Ideal stand densities for pruning will usually be below that which is generally used to maximize volume production. Therefore, volume is sacrificed for value—this better fit with your objectives.
 - Use **overhead 3 • 7 and 3 • 8** to illustrate just how low you may have to go to maintain open conditions for lodgepole pine.
- ▲ **Prune your best crop trees and space out the rest.** Pruned trees will be at a height growth disadvantage to neighboring unpruned trees. This will lead to overtopping and eventual death of pruned trees.
- ▲ **Leave enough crown to respond** (50% live crown is suggested). You need enough photosynthetic capacity to respond to treatment. On occasion this can be dropped as low as 30% live crown or three whorls remaining on the tree – whichever is the greater length – to maintain a fixed pruning height throughout the stand, while accommodating variation in tree height.
 - Use **overhead 3 • 8 and 3 • 9** to illustrate how to determine optimum height in stands with high variation. Prune young and prune high.
- ▲ **Use proper tools and prune close to the tree, without damaging the branch collar.** This will allow for rapid occlusion of branch stubs and regular clear wood production over these stubs.

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The End Product Target for Pruning One Lift



Overhead: The End Product Target for Pruning (one lift)

Facilitator: Summarize discussions by pointing out what we are aiming for

Key Points

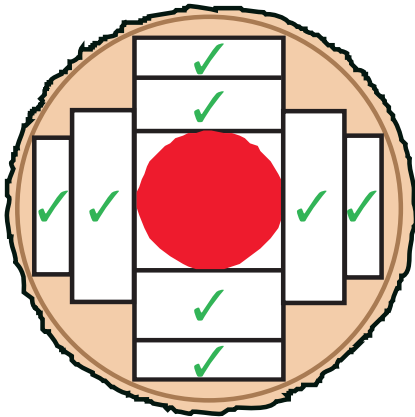
- ▲ We will need to prune up to at least 3 m to give us one high value butt log.
- ▲ We must minimize the knotty core to maximize clear wood production. An 8–10 cm knotty core is the maximum size desirable.
- ▲ We need an end product with a large enough dbh to achieve a clear shell that is AT LEAST 10 cm wide at the top end and a minimum of 3 m long.
 - to produce 1 × 6, 1 × 8, 1 × 10 inch boards which command the best values
 - to produce high value veneers (e.g., clear lodgepole pine veneer)
- ▲ We must ensure that we time the treatment properly and conduct the pruning on our better sites.

Note: On the higher sites, the window of opportunity for best pruning becomes even more critical. Since trees grow more rapidly on highly productive sites, they grow through this “ideal” window of opportunity more rapidly than on poor sites.

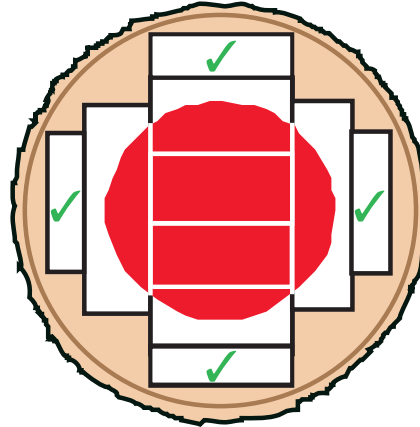


Distribution of Clear Wood Relative to Timing of Treatment

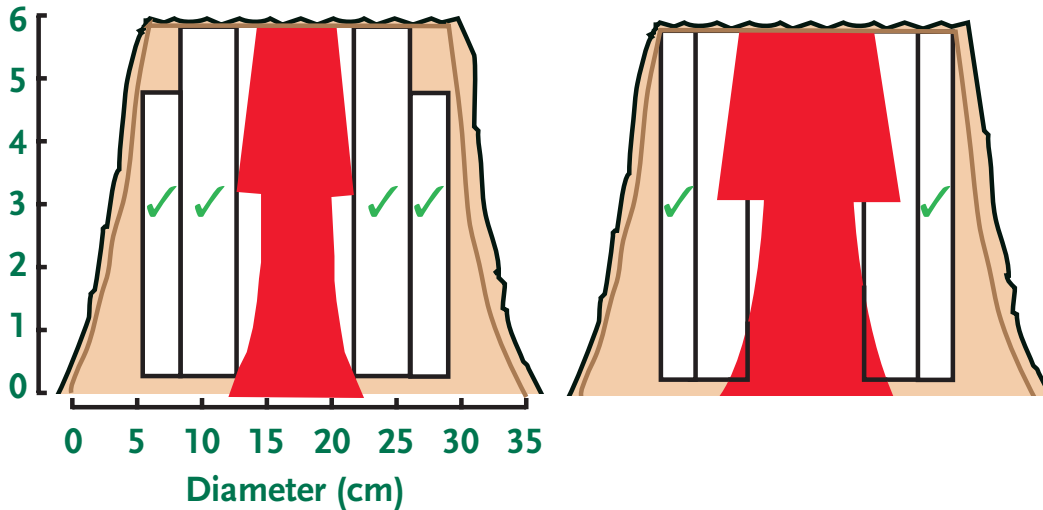
Pruned on time



Pruned late



Lift height (m)



Knotty
 Residue

✓
 Clear boards
 Clear

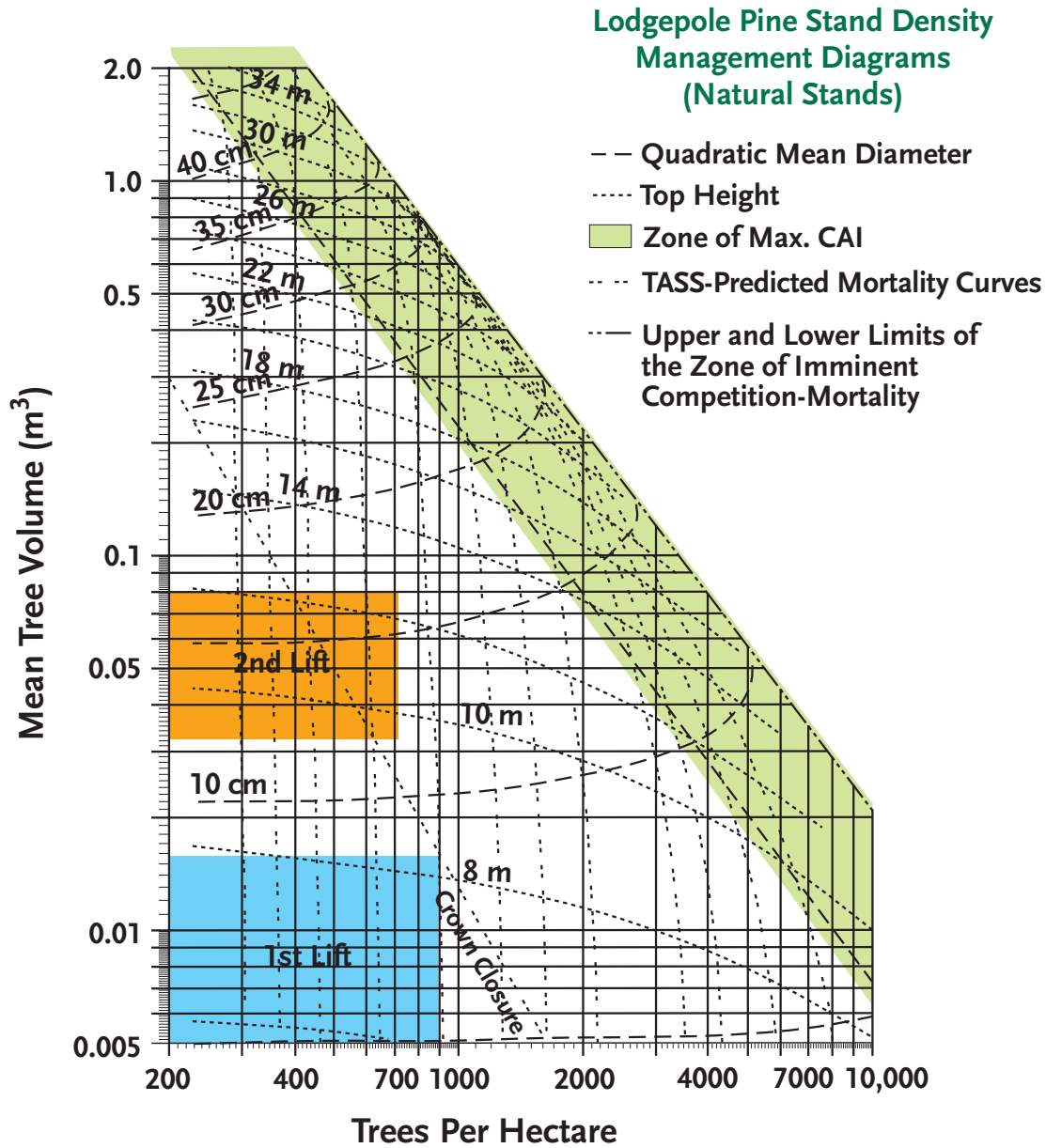
Overhead: Distribution of Clear Wood Relative to Timing of Treatment

Facilitator:

Key Points

- ▲ It becomes easy to see on this overhead why the ROI can be so much better when stems are pruned young, at a small diameter.
- ▲ The stem pruned on time has close to 4 times the volume of clear wood than the stem pruned late. At the same time, the branches on the stem pruned late may have been bigger and more expensive to cut. Where would you rather spend your money?

Optimum Pruning Density To Minimize Inter-crown Competition



Overhead: Optimum Density for Pruning in Lodgepole Pine

Facilitator: Very quickly explain how this graph works

Key Points

- ▲ This is a stand density management diagram developed for lodgepole pine based on numerous TIPSYS runs of pine TASS data. The diagram is based on the mortality curves formed through natural mortality of pine started at different densities.
- ▲ The relationships you see are independent of height, although they only hold true for single species, even-aged stands.
- ▲ The quadratic mean diameter is graphed in the dark dashed lines and the top height is the dark dotted lines.
- ▲ The crown closure zone is not exactly crown closure as we generally know it, but the time when the crowns are starting to interact such that they are affecting the growth of one another.
- ▲ The zone of imminent mortality is the zone where competition is so high that mortality is going to occur.
- ▲ The diagram shows first lift pruning at densities up to 900 sph and 5–7 m in height to minimize inter-crown competition (the crown closure line). The optimum range for lodgepole pine is generally between 700 sph and 900 sph to maintain decent site occupancy. At 10–12 m the 2nd lift should occur (if there is to be one). This will maximize clear wood production as the stem grows from 5–8 cm diameter up to 12–17 cm diameter.



Note: Using this diagram for lodgepole pine, we see that the TASS data suggests a stand at 1000 stems per ha would be getting competitive crown interactions at 8 m in height. Likely significant interactions would occur at 12–14 m in height with a noticeable decline in diameter growth. This has been documented on a real site in the Prince George District.

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Timing

Determining Optimum Pruning Height



How do I time my lift in a stand with variable heights?



Consider:

- ▲ Height of pruning lift
- ▲ 50% residual crown is best

Example:

- ▲ 3 m single lift pruning
- ▲ average diameter trees should be:
 - 6–7 m tall (50% LC)
 - 5–10 cm dbh
- ▲ taller trees? should mostly be <12 cm dbh
- ▲ many smaller trees?
 - delay treatment until average diameter trees are closer to 7 m and 10 cm dbh
 - smaller trees can be 4.5 m

Overhead: **Determining Optimum Pruning Height in Stands with Variable Height**

Facilitator: Summarize discussions by pointing out what we are aiming for

Key Points

- ▲ Remember that timing is everything in pruning.
- ▲ First determine the height of the pruning lift.
 - One lift only—generally 3 m to allow for a decent butt log.
 - If 2 or 3 lifts, you can get away with a lower initial height.
 - In our example we want a one lift height of 3 m.
- ▲ To ensure 50% live crown, we need at least a 6 m height and probably somewhere between 6–7 m to be safe.
- ▲ You will then want the trees in your stand to have an average stand diameter between 5–10 cm.
- ▲ If you have many trees taller than 6 m, you should ensure that they are not more than 12–15 cm dbh.
- ▲ If you have many trees smaller than your average diameter or 5–10 cm and height less than 6 m, you should delay pruning until your stand is in the “ideal window of opportunity.”

