Thinning Feasibility Guide

Why does a forest need thinning?

Most forests in the Pacific Northwest are legacies of past management – they've been cut once, twice, or even three times and either left to regenerate naturally or planted with pure Douglas-fir. These relatively young forests are often extremely dense, to the point where trees are competing for resources – mostly sunlight and soil moisture – and the smaller trees are slowly dying off. This is called the stem exclusion phase and it can last decades, during which all of the trees in the forest are stressed by the competition.

During this period of high stress, trees are growing slowly and forests are more susceptible to widespread tree mortality from droughts, disease, or insects. Since the dense canopy blocks direct sunlight, even the more dominant trees will kill off sun-starved lower branches and with them the capacity to take advantage of more abundant sunlight in the future.

S = suppressed. Thinnings typically remove most of the co-dominant and intermediate trees to create space in the canopy. Image from Forest Measurements: An Applied Approach by Joan DeYoung: https://openoregon.pressbooks.pub/forestmeasurements/

Thinning can dramatically shorten the stem exclusion phase by removing the less dominant trees, and can often generate revenue from those smaller trees by selling them to local mills. Thinning also allows us to intervene in order to increase species and structural diversity by varying our density of thinning and favoring keeping underrepresented species. This increase in diversity creates habitat that can support a wider variety and greater abundance of wildlife, and also increases the forest's resilience to disturbance events, such as windstorms, wildfires, or droughts. After thinning, the remaining trees begin to grow more quickly and store more carbon, soon making up for the wood (and carbon) that was removed.

What makes a commercial thinning feasible?

When you have determined that your forest will benefit from thinning, the next step is to figure out whether the thinning will be commercial or pre-commercial. There are several variables that can impact the commercial viability of a thinning, which are summarized below:

Pre-commercial thinning (PCT): PCT means a thinning where the logs are too small to go to the mill, so they're usually left on-site.

Commercial Thinning (CT): CT means a thinning where the logs are big enough to go to the mill. CTs usually generate net revenue, though in low value situations there can be some net cost.

Species

Some tree species have more commercial value than others. While there is fluctuation in log markets, in the Pacific Northwest western redcedar typically has the highest value, followed by

Douglas-fir, red alder/pine/western hemlock/true firs, and then any other hardwoods. Hardwoods other than red alder generally won't have enough value on their own to make a thinning commercially viable, and log volume will have to be higher to make a thinning commercially viable in red alder/pine/western hemlock/true fir stands.

Log Size

The size of trees that will be removed can have a big impact on the commercial viability of a thinning. A tree that is approximately 7" or smaller diameter at breast height (DBH, at 4.5') will most likely have to be sold as pulp, which doesn't generate any revenue to the landowner (in 2024 markets). For a thinning to be commercially viable, you will need to have large enough trees to have a decent proportion of sawlogs. The minimum average DBH needed will also vary by species, from about 9" minimum average DBH for Douglas-fir or western redcedar to about 12" minimum average DBH for other species.

Log Volume

Log volume is simply the amount of logs that will be removed in a thinning. There are some costs in a thinning, such as equipment transportation, which are fixed and don't vary much depending on acreage. For a thinning to generate enough revenue to offset these fixed costs, and make it worthwhile for a logger, it will need to have enough log volume. The minimum amount of log volume will depend on the complexity of the thinning (is it on a steep slope? Is road construction or a stream crossing needed?), and the value (based on species, size, and quality) of the logs being removed.

Stream crossings

New stream crossings, whether for log trucks or logging equipment, can add substantial cost to a thinning. If a stream is considered fish-bearing (generally at least two feet wide, with a stream gradient of less than 16%, though there are some exceptions) then crossing it might make a small thinning not commercially viable, so the minimum log volume to make a thinning viable would go up. The cost of a stream crossing will be highly variable, so you'll need an expert to come evaluate it to determine its impact on the viability of your thinning.

Road Construction

Building new haul roads can be expensive, though on flat ground in summer you can usually keep costs down by using as little rock as possible. Loggers can extract logs about 1,000' without a haul road, but longer distances will require road construction to get trucks closer to the logs. If you will have to build road on a hill, the costs may make a thinning not commercially viable.

Slopes

Ground-based logging equipment can work on slopes with a gradient up to about 40%. If your thinning has slopes over 40% you may need to use tethered equipment or cable yarding, both of which are significantly more expensive than ground-based logging. To make a thinning viable on slopes over 40%, you will need a much higher log volume.

On the following two pages you will find a thinning feasibility decision tree and a stand volume estimator. You can use these tools, along with some basic measurements in your forest, to determine whether a thinning in your forest is needed and whether it is likely to be a financially viable commercial thinning. We also have a digital version of these tools which you can access at: tinyurl.com/VolumeEstimator

Thinning Feasibility Decision Tree

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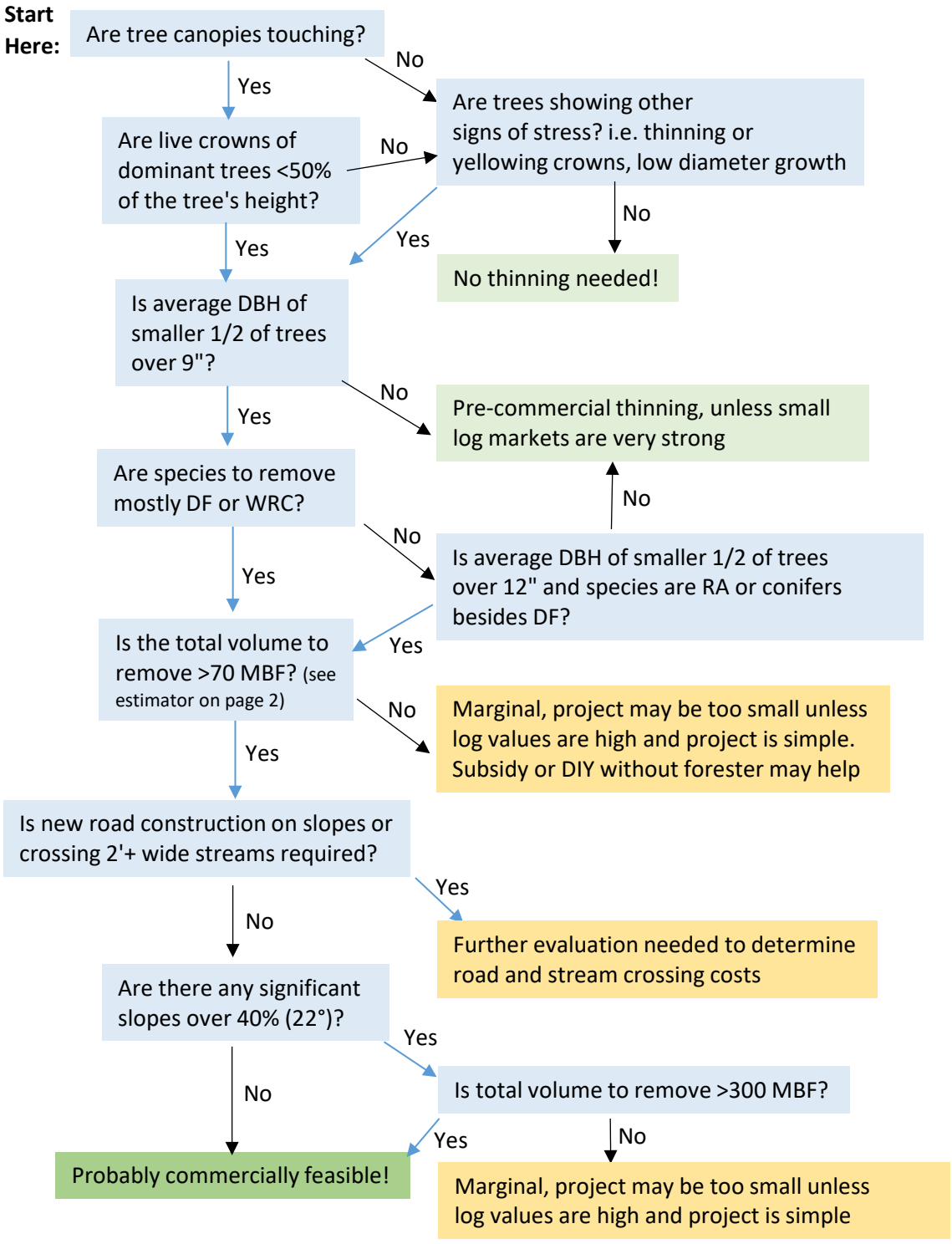
This decision tree will walk you through the steps to determine whether it is feasible and beneficial to commercially thin your forest.
Tools required: Diameter tape (or any flexible tape measure, dividing circumference by 3.14 to get diameter), 30' tape measure, clinometer (or phone app).
For volume calculation, see the Stand Volume Estimator on page 2. There is also a glossary on page 2.



Stand Volume Estimator

a) Choose a few plot locations (1-3 are usually sufficient for this rough estimation purpose). Pick plot locations randomly, or if doing few plots pick areas that you feel are representative of the overall stand.

b) **Measure a 26.3' radius** from plot center (1/20th acre plot). **Count the number of live trees** over 5" DBH (Diameter at Breast Height, 4.5') within the plot, and **record their diameters**.

c) While measuring your plots, make note of the main species of tree being removed, any steep slopes over 40%, and any streams over 2' wide that will have to be crossed for logging access.

d) Multiply the number of trees you counted in your plot by 20 to get trees per acre (TPA). Calculate the average DBH of the smaller half of the trees you measured.

e) Use the formula and table below to calculate MBF volume removal for your thinning.

Notes and assumptions:

The formula assumes you're removing about half of the trees, which is fairly standard for many commercial thinnings. It also assumes heights are 80x diameter. Dense stands that are in need of thinning usually have heights above 80x diameter, so this estimate is likely conservative.

You should just be running this calculation once, if you measure multiple plots you should average your TPA and DBH across all plots before calculating.

TPA	x	0.50	x	BF/tree (from table below)	x	Acres	÷	1,000	=	MBF volume removal

Avg. DBH	BF/tree
9	19
10	33
11	53
12	78
13	110
14	149
15	196
16	251
17	316
18	392

Glossary	
DF	Douglas-fir
WRC	Western redcedar
RA	Red alder
DBH	Diameter at breast height, or 4.5'
Live crown	The part of a tree with live branches. Small sprouts lower on the trunk should not be included. Live crown should only be estimated for overstory trees.
TPA	Trees per acre
BF	Board feet, the most common measure of timber volume in the United States.
MBF	One thousand board feet, how timber volume is usually reported/sold in the US.