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Silvicultural Decisions V - Why and How to Thin

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Thinning is generally applied to even-aged forest stands, and most of the forestry literature on the subject limits the concept to same-age trees. One reason for this is that it is easier to judge which trees are the most vigorous. However, in uneven-aged stands of pure or mixed species, or in middle-aged, multi-structured stands that have never been managed, thinning also has many benefits, although the practice is more complex. Here are some of the basics of why you should thin, and where it is applicable.

Thinning is a management practice based on the well-established concept of *carrying capacity*: a given forest site can support a specific level of forest biomass. Foresters use basal area per acre (ba/ac) as a common measure of carrying capacity. Basal area is defined as the sum of the cross-sectional areas (in square feet or meters) of each tree measured at dbh (diameter breast height, a point 4 feet above the ground). Usually, samples are taken to get the average ba/ac for a stand.

Stands naturally lose trees to mortality once carrying capacity is achieved. Physiological (suppression), pathological (insects, disease), and environmental factors (snow, ice, wind, sunscald) usually cause mortality, and are generally most pronounced on trees under the most competitive stress. Thinning reduces competitive stress by lowering ba/ac below carrying capacity. Thinning can also change species composition, by favoring vigorous species. After thinning, more of the carrying capacity is available for fewer trees, generally improving growth and reducing mortality. Thinning rarely increases, and usually decreases, the maximum biomass a site produces. Symbiotic relationships can increase carrying capacity. For example, mixed stands of paper birch and Douglas-fir can contain more basal area than pure stands of either.

Thinning that extracts the most valuable trees seriously reduces short and long-term forest health and productivity. Finally, slash (residue) from thinning can increase fire and insect hazards, and logging damage can have a diverse negative effects on residual trees and the forest site. *(Note: there is a lot of current emphasis on letting trees decay for nutrition and habitat. Most forests that have been unmanaged in the past have excess material already on the ground due to high mortality rates and very slow decomposition in our region. Additional down material can increase fire risks and inhibits some wildlife (while favoring others), with little ecosystem benefit. The exception would be stands with recent wildfire or little natural mortality)*. As with any other silvicultural practice a lot of knowledge and care is required to successfully meet objectives.

Many environmental and economic objectives can be achieved through thinning with the right design and implementation. Some of the more commonly listed goals of thinning are:

- To reduce insect and disease vulnerability by increasing individual tree vigor and species diversity.
- To redistribute total stand fiber growth to fewer trees of higher quality, increasing value while decreasing time to reach merchantable size.
- To select and leave the trees that are the most favorable species for ecosystem health and product value.
- To use or sell trees that would otherwise die and decay, when doing a *commercial* thinning (thinning

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of small, defective or otherwise unmerchantable trees is referred to as *precommercial thinning*).

- To enhance non-timber forest amenities including grazing, wildlife and recreation.
- To improve return on forest investment by selling trees that otherwise would be lost, paying up-front for stand improvement, decreasing risk of fire or pathogens, and improving future opportunities for natural regeneration versus expensive planting.

The type of thinning and spacing of residual trees is a complex decision that is beyond the scope of this article to cover completely. Knowledge, experience, and even intuition must modify the guidelines that I provide. This is particularly true in the Inland Northwest, where thinning has not been widely applied and experienced. It would take a textbook to cover the subject, and one that does this well is "*The Practice of Silviculture – Applied Forest Ecology*", 9th edition, published by John Wiley and Sons, 1997, available in some libraries and most bookstores (Library of Congress #ISBN 0-471-10941-X).

There are five distinct methods of thinning that describe which trees to cut and leave:

1) Low – Low thinning removes the shortest, most suppressed trees, and has the least effect on growth release.
2) Crown – Crown thinning works in the mid and upper crown levels and has a more dramatic effect on growth, composition and form.
3) Selection – Selection thinning is most effectively applied where rough, large-branched trees in a dominant crown position are removed to favor better-formed trees of favorable species. Selection methods also pose a risk of highgrading.
4) Mechanical (row) – Mechanical or row thinning removes trees in a geometric pattern, generally every other row, or every other tree in forest plantations.
5) Free – Free thinning is best thought of as a combination of the other methods, applied to highly variable stands, usually in a first entry into previously unmanaged forests.

There are many factors involved in making the choice of thinning method, usually requiring the skills of an educated forest manager. *One key factor* that many professionals and landowners often neglect *is to focus on the trees that will be left, not on the trees that will be cut*. The opposite is unfortunately the more common.

Three approaches to spacing when thinning cover most situations and needs. The most simple is called the Diameter-Plus or "D+" method. It is based on the concept that larger diameter trees need more space than smaller trees. On the best sites in our regions, where carrying capacity is highest, a D+5 rule is common, but on an average site (and a good rule of thumb) use D+7. To apply to an even-aged, mostly uniform stand, simply add 7 (feet) to the average stand diameter (in inches, each inch = 1 foot spacing) to get a general spacing. For example, a stand with an average dbh of 8" would have a 15 foot spacing. Using the D+ rule in diverse stands is more difficult, because companion trees may have larger size differences, but averages will work. For example, if a leave tree is 12" (D+ is 19') and the next one of good quality is only 7" (D+ is 14'), a 16'-17' spacing is fine.

The next approach is to use basal area as a guide, and make a decision of a basal area target (often 30-40% less than full stocking), then use average diameter and the target ba/ac to obtain an average tree spacing. Figure 1 gives a chart showing this relationship, drawn from a publication that more fully explains the process (PNW-298 by James W. Barrett, available from USDA Forest Service offices).

A third approach available to most everyone with the advent of personal computers and the Internet is to put stand data into a computer simulation model, and get current and predicted stand conditions as an output. Various thinning methods and intensities can be simulated, and the predicted results examined before actually applying on the ground. This approach is of course limited by the accuracy of the model, but many are becoming quite sophisticated. One of the newest

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has been produced at the University of Washington and provides a graphic interface to a stand growth simulator. Output is visually depicted by realistic tree symbols that represent current and future stands, based on original data and thinning or other practices. Natural mortality and regeneration of new trees can be included. A free version of this model that you can download and use is available on the Internet at http://lms.cfr.washington.edu/lms/html.

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