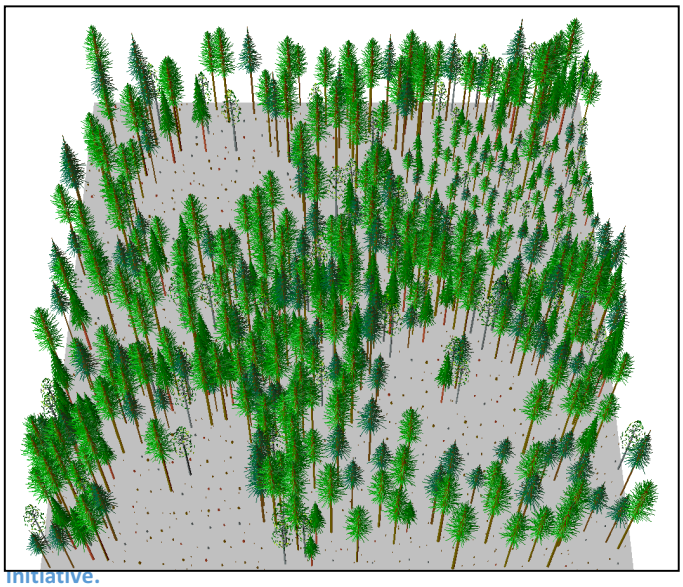
Harvest systems – an introduction

This handout is an introduction to several harvest systems that can be used to achieve the desired future condition of a diverse stand that produces multiple timber products. These systems use a combination of individual tree selection, group selection and variable density thinning. Harvesting should be limited to the dry season to minimize soil disturbance and the risk of exacerbating soil-borne diseases such as root rot.

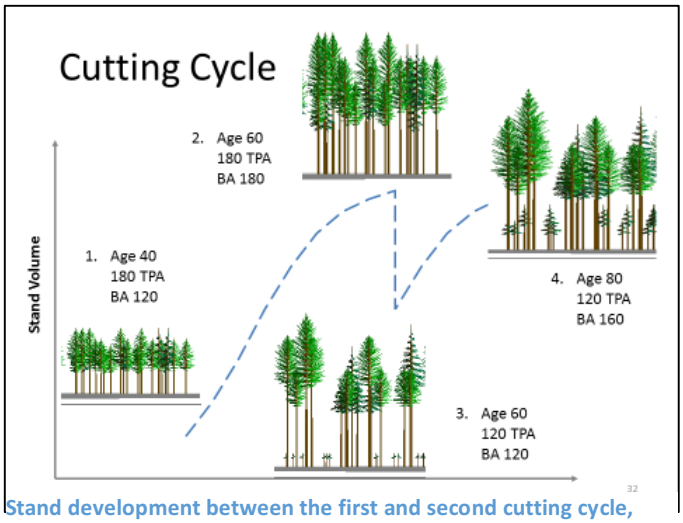


initiative.

Harvest Cycles

Depending on soil productivity, harvest cycles should be scheduled every 10 - 20 years, utilizing the following harvest systems:

- 20 yrs: pre-commercially thin to 180–240 tpa
- 40 yrs: thin from below to 120–160 tpa
- 60 yrs: variable density thin 80–100 tpa
- 80 yrs: variable density thin with gap creation to 50–65 tpa
- 100 years yrs: variable retention harvest to ~



Stand development between the first and second cutting cycle, with understory regeneration.

Natural understory regeneration of shade tolerant conifers and some hardwoods (e.g. cedar, hemlock, bigleaf maple) will likely begin after the first cutting cycle, and gradually increase as the canopy is reduced between the 2nd and 3rd cutting cycles.

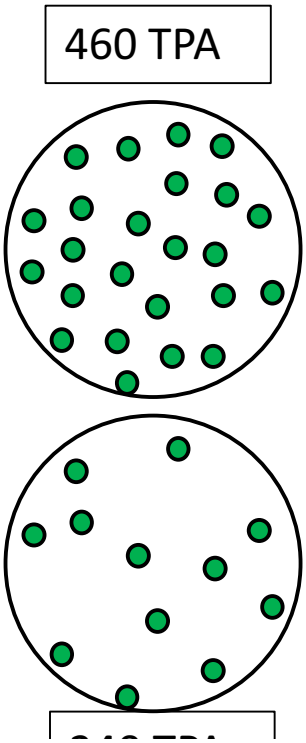
Less shade tolerant species (e.g. Douglas-fir, red alder) are more likely to regenerate along edges, in gaps and under very light canopies. If there is sufficient advanced regeneration in the understory at the time of the variable retention harvest, replanting may not be necessary. Understory regeneration should be monitored, at a minimum, following the second variable retention harvest, to ensure there is an even distribution of the desired crop trees. Manual planting may be necessary to either increase stocking rates, or augment a desired species.

Harvest Methods

Pre-commercial thinning

Pre-commercial thinning is recommended for stands that exceed 350 trees per acre (tpa). Forest stands that exceed this density will typically enter the stem exclusion phase between the ages of 15–25 years depending largely on soil productivity. This phase is characterized by a dense canopy with sufficient shade to kill lower branches, suppress understory vegetation, and lead to suppression-based mortality of non-dominant trees. Live crowns gradually begin receding, and once they diminish below 35 percent, the growth of the tree shifts from girth production to height production as trees compete for sunlight. In order to keep these stands in optimum growth, and to minimize the risk for natural disturbance, they should be pre-commercially thinned.

The object of pre-commercial thinning is not to maintain an even spacing amongst all trees, but rather to favor healthy trees, both hardwood and conifer, that have dominant crowns and good log quality - a technique referred to as "best tree selection". Stands exceeding 350 tpa should be thinned to a variable stocking of 240–280 tpa. The first thinning of a stand typically occurs "from below", selecting the smaller diameter, suppressed and poorest quality trees first. Thinning in this manner typically results in a variable density spacing amongst retained trees that averages approximately 12–15 feet.

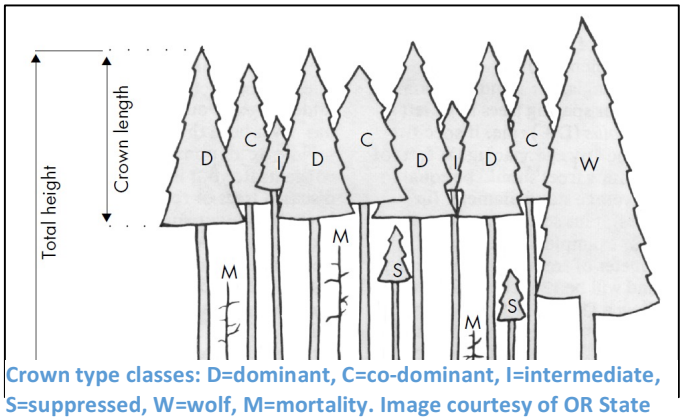


Before and after pre-commercial thinning.

Trees should be cut within six inches of the ground using either a chainsaw or handheld saw. Cut trees should be brought down so they are not leaning on the retained trees. Care should be taken not to damage the trunk of leave trees during thinning. It is crucial that the best trees within a given area be left, rather than rigid adherence to an exact spacing requirement. If high quality leave trees occur in close proximity to each other, they may be left as a clump to help ensure stability against wind disturbances. Leave trees shall be those that have the largest live crown, tallest height, straightest stem, and show no signs of defect (e.g. broken tops, scars, leaning, etc.). The resulting slash can be piled into habitat piles measuring a minimum of 10 ft across and 6 ft high and/or downed logs measuring a minimum of 20 feet long and 12 inches in diameter, cut into firewood and removed, piled and burned, chipped, or any combination thereof. Thinning should be avoided during the prime bird nesting season between March 15th-June 30th.

Thinning from below

Thinning from below is a technique typically used during the first commercial thinning entry in a stand. Approximately 30% - 40% of the overall trees are removed, typically from the suppressed and intermediate crown type classes, in order to promote the growth of the co-dominant and dominant trees. Best Tree Selection methods are used similar to pre-commercial thinning. This means that co-dominant or dominant trees may be removed if they have defect or will release more desirable species in the understory. Thinning is *across the species*, retaining

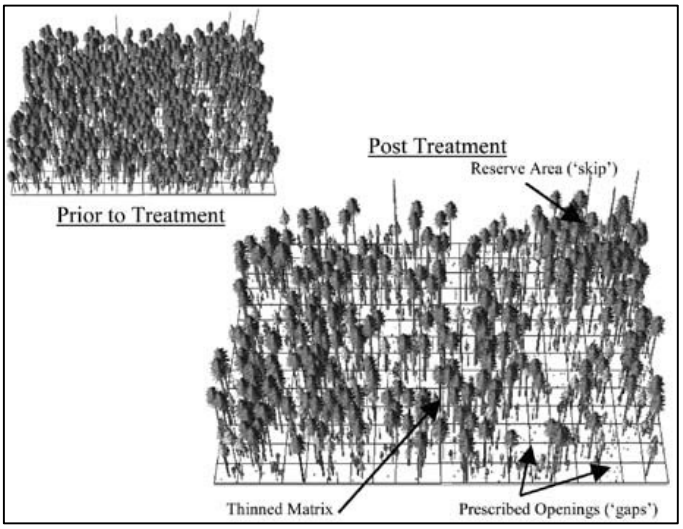


Crown type classes: D=dominant, C=co-dominant, I=intermediate, S=suppressed, W=wolf, M=mortality. Image courtesy of OR State University.

the best quality tree of each species, both hardwood and conifer. If pre-thinning stand density is approximately 300–350 tpa, then stands will be thinned to approximately 200–250 tpa.

Variable density thinning

Variable density thinning techniques are typically employed during the second and subsequent thinning entries of a stand. Variable density thinning involves varying the thinning intensity to produce a mosaic of unthinned, moderately thinned, and heavily thinned patches. Thinning with skips and gaps can also create this mosaic. Variable density thinning helps generate a more complex forest structure, and produces a variety of timber products, by promoting tree growth at different rates. It also encourages a more diverse understory, including natural regeneration of a variety of hardwoods and conifers.



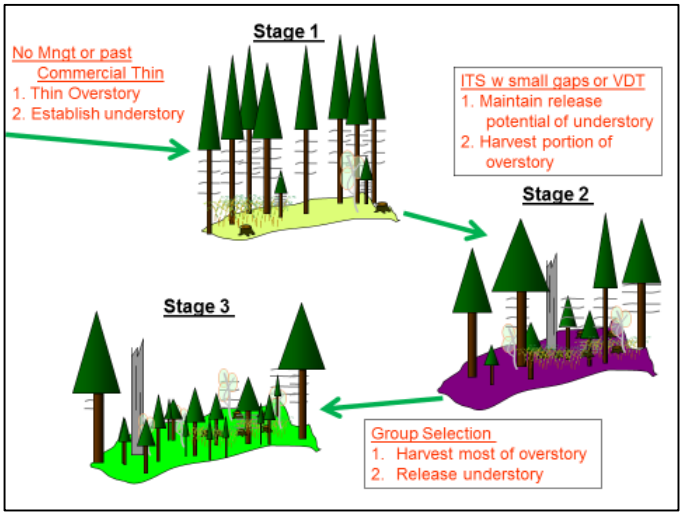
Before and after variable density thinning. Image courtesy of Forestnet.com.

Variable-density thinning can improve forest health by increasing: (a) resistance to disturbance, such as wind, disease, pests, etc., (b) ability to recover after disturbance, and (c) biological diversity that allows ecosystems the forest to adapt to changing climatic conditions.

Variable density thinning typically occurs across both species and diameters, reducing stand density by no more than one-third of the standing trees per entry (20% - 25% of basal area). Areas of higher productivity may be thinned more heavily. Sensitive areas (wet soils, around snags, steep slopes) may be skipped, or thinned lighter. If stand density is approximately 200 – 250 tpa, then the 2nd entry will reduce the density to 120– 60 tpa. During the third entry thinning, stand density will be reduced further to approximately 90–105 tpa, and gaps can be created using group tree selection, then replanted if sufficient natural regeneration doesn't exist. The following thinning entry will likely follow variable retention harvesting methods as per below. When selecting trees for harvest, most thinning is still conducted from below. However, dominant overstory trees may be selected for harvest if they will release a vigorous understory tree that has ample live crown. Thinning in this manner produces a more complex forest canopy and stimulates natural regeneration in the understory, thereby minimizing the need for manual planting.

Variable retention harvesting

Variable retention harvesting is typically applied to older stands during the third or fourth thinning entry. During a variable retention harvest (VRH), most of the dominant and co-dominant trees are removed, with the exception of up to 15 trees per acre. These leave trees are retained as permanent biological legacies, whether standing or as future blowdown. The leave trees can also provide important shade and climate mitigation values for seedlings and advanced regeneration throughout a recently harvested unit.



Transitioning from variable density thinning to variable retention harvest to release understory trees. Image courtesy of Rolph Gersonde.

VRH objectives include providing habitat for wildlife and retaining some of the original forest floor, including shrubs, plants, and populations of beneficial mycorrhizal fungi. Retaining these "biological legacies" enhances the diversity of plant and animal life in the regenerating forest stand over a long time. Operationally, VRH must plan for future access to avoid injuring trees that are left on the site forever. Because the economic value of retained trees will not be realized, poor quality (from a market perspective) trees are typically chosen for retention.

If, during previous harvests, the stand was thinned using variable density thinning techniques, then there may be sufficient natural regeneration in the understory to avoid manually replanting the site. A post-harvest inventory must be made to quantify the species and stocking density to determine if the stand has a desirable composition. If planting will be used to regenerate the stand, retaining large, limby trees with thick, tapered boles reduces the likelihood of blow down. Trees with forked or dead tops are also good candidates for retention. These "defective" trees provide perching or nesting habitat for a variety of birds and small mammals.