Stand Density Relationships

John C. Tappeiner, II

Presentation Abstract

Thinning stands (managing their densities) affects the development of trees and understory plants as individuals, as well as stand-level characteristics like structure, microclimate, and stand growth, habitat for various species, and fuel and potential fire severity. These characteristics and the rate of changes are affected by thinning severity—the reduction in numbers of trees, the stand density, and also by the number, sizes, species, and growth rates of the trees retained. In addition, site variables like potential for severe wind and ice/snow storms, soil depth/rooting, root diseases, and others, have an effect.

Changing stand density simultaneously affects a variety of stand characteristics. For example, thinning to low stand density favors the growth of trees with large stems, crowns, and branches, and may produce considerable volumes of commercial wood in the short term. Thinning stands to low density favors growth of large trees; it may reduce long-term commercial wood production if densities are quite low, and production of snags and dead wood by competition will probably be delayed. Thinning favors development of an understory and a multi-story stand, and generally improves wildlife habitat. However, it can lead to a dense understory that may increase risk of severe fire.

Forest stands are often variable in tree spacing, size, and species composition, even in rather uniform plantations, and the application of thinning prescriptions may need to be flexible to take advantage of this. Thinning density may vary to release understory trees, avoid damage to wet areas, or leave trees at higher density where wind throw is likely, to protect areas of snags. Presence of root disease "pockets" may require variance from the general prescription. Resistant tree species may be favored, openings may be left that will fill in with shrubs, or immune tree species may regenerate.

Large dominant and codominant trees are usually left in thinning, because they grow faster. Where the purpose of thinning is growing late-successional stands, these are the trees that are most likely to become the large trees characteristic of old-growth forests. In certain stands, some of these trees may be removed to favor minor tree species and help develop a mixed-species stand, or to produce valuable products like poles and pilings that will help pay for the costs of thinning. Several treatments may be needed to meet stand management objectives. Examples: thinning dense stands to low density may require several treatments to avoid damage from wind or ice storms that could result from a single, drastic reduction in stand density; or additional treatments may be necessary to manage the dense tree understory that can develop after thinning.

When conducting research on thinning, it is important to specify thinning objectives, and the treatments thinning methods, densities, and other characteristics used to achieve them. Often the

John C. Tappeiner, II is emeritus faculty, College of Forestry, Oregon State University; john.tappeiner@oregonstate.edu.

literature on the effects of thinning on variables other than wood production does not provide enough detail. To interpret the results or repeat the study, stand density immediately before and after thinning and for a period (5 to 10 yr) after thinning, and effects of variables like root disease, wind/ice damage, and others, are needed.

Keywords: density management, thinning severity, stand structure and composition, wood production, late-successional stands.

Editors' suggestions:

Bailey, J.D.; Tappeiner, J.C. 1998. Effects of thinning on structural development in 40- to 100-year-old Douglas-fir stands in western Oregon. Forest Ecology and Management. 108: 99–113.

Poage, N.J.; Tappeiner, J.C. II. 2002. Long-term patterns of diameter and basal area growth of old-growth Douglas-fir trees in western Oregon. Canadian Journal of Forest Research. 32: 1232–1243.

Tappeiner, J.C.; Huffman, D.; Marshall, D.; Spies, T.A.; Bailey, J.D. 1997. Density, ages, and growth rates in old-growth and young-growth forests in coastal Oregon. Canadian Journal of Forest Research. 27: 638–648.