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Forest Connect

Supporting Sustainable Management of Private Woodlands

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Promoting Healthy Tree Growth in a Young Forest

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The patterns of tree growth in brushy areas of young forest mature is called succession. Forest succession, also called forest development, is typically predictable. Predictability allows owners to somewhat influence the trajectory of the future forest with strategically timed actions, or treatments. Forest succession is always happening, and most woodland owners recognize areas of their property that have changed over their years of ownership.

Forest succession typically proceeds through four phases or stages. The stages are defined by the dominant ecological process more than the tree age or size.

The first stage is called "stand initiation." Stand initiation is characterized by a young forest where the crowns of trees have not yet melded (Figure 1), and there remains an abundance of accessible resources. Competition between trees is low. In the beginning of stand initiation there are enough resources that new trees can establish.

Figure 1. The crop tree on the right will grow faster if the poorly formed stem on the left is removed. A variety of individual stem treatments are available to favor the crop tree.

As stand initiation changes to stage two, "stem exclusion", the site is fully occupied by trees and there aren't sufficient resources to allow new trees to establish. Sunlight is lacking for new trees to establish, thus, stems are excluded. Stem exclusion may begin within 10 to 20 years of the initiation of the forest, and often include 5,000 or more stems per acre. A typical feature of stem exclusion is that the crowns of the trees have expanded and coalesced with neighboring trees to create a closed canopy. Tree diameter early in stem exclusion may be 1 or 2 inches, and perhaps 4 to 8 inches at the onset of stage three, understory re-initiation.

In the third stage, understory re-initiation, the heights of trees have differentiated into winners and losers. Many of the early losers have died. Tree death and height growth differentiation allows sunlight to the forest floor and opportunities for a new understory to develop (Figure 2). During this phase, the shorter trees continue to die as they struggle for light, but some stagnate in the understory creating a broad range of tree diameters among trees that are all the same age. As the trees mature, canopy gaps form when a dominant or co-dominant tree (or cluster) dies. This gap can be filled, under good conditions, by seed from the common trees.

The fourth stage, steady state, happens with the formation of gaps and recruitment of even-aged clusters of seedlings. The onset of the steady state stage requires trees large enough to leave an opening that can't be filled by the expansion of tree crowns. On good quality soils in the Northeast, steady state might begin within 60 to 75 years.

Forest development coincides with crown development and the formation of distinct layers of crowns, known as crown classes (Figure 3). The closed canopy of the stem exclusion stage causes competition for sunlight, and some trees die. At the same time, the fastest growing species may gain a height advantage and dominate in the upper canopy. Slower growing species may be relegated to lower strata. The differentiation of heights creates a vertical profile characterized by 4 crown classes. Crown classes include dominant, co-dominant, intermediate, and suppressed or over-topped. Crown class is the height of one tree relative to its neighbors and also defined by whether the tree's crown receives direct or indirect sunlight. The two upper crown classes, dominant and co-dominant, receive direct sunlight. The two lower crown classes do not.

In some woods, an older age class of trees towers above the younger age class (Figure 4). This situation might happen in an old pasture with remnant trees, or after logging that left a few scattered trees. The older trees may form a scattered assemblage of super-dominants that offer opportunities and challenges. These trees provide habitat for birds of prey and a unique aesthetic. The challenge is that trying to cut or fell them will likely result in damage to many of the younger and shorter stems. Damage to some of these younger stems may not be of consequence because a large percentage of trees must die before the stand reaches maturity (see details below). The desire to cut the larger trees ultimately depends on the owner's objectives and whether cutting those trees advances or impedes the objectives.

Figure 2. Although all the same age, some trees grow faster and some trees die. Increased sunlight allows for a new understory during the stand re-initiation stage.

Figure 2. The upper canopy dominant and co-dominant crown classes are evidenced by larger tree crowns and taller heights than the lower crown class intermediate and suppressed trees. All trees are the same age, but grow at different rates. The lower crown classes have lost the race for sun and are the losers.

Figure 4. Some areas have remnant older trees and a dense younger understory. These are technically "two-aged" stands that offer additional opportunities and challenges for managers.

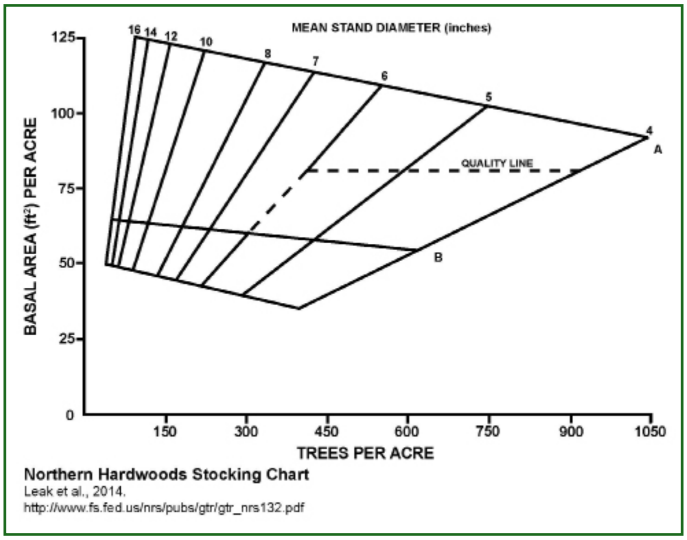

Figure 5. Stocking chart for northern hardwoods illustrates the relationship between trees per acre and basal area.

The pattern of diameter growth during forest development is interesting and predictable. Forester use a chart known as a stocking chart (Figure 5) to describe the changes in the size and abundance of trees through time. The chart shows a comparison of the number of trees per acre on the horizontal or x-axis and the amount of wood, measured as basal area, on the vertical or y-axis. The diagonal lines from lower left to upper right illustrate the mean (i.e., average) diameter of trees. The almost horizontal lines correspond to the A-, B-, and C-levels of stocking.

Measurements in a woodlot can estimate basal area and trees per acre. Graphing the intersection of those values allows a graphical representation of a stand's stocking. The A-level is maximum stocking and thus maximum competition. B-level is stocking that optimizes timber production per acre. C-level is the lowest stocking that will eventually utilize the sunlight available. At the A-level of stocking, there is a 20% average reduction in the number of stems per acre with each 1 inch increase in diameter. Thus for the average diameter to increase by 1 inch, 20% of the trees or 1 in 5 must die.

Owners that thin woodlots that are late in the stem exclusion stage or in the understory re-initiation stage should retain trees that are in the upper canopy, that satisfy their objectives, and that are demonstrating a good acclimation to the site. Upper crown class trees, the dominants and co-dominants, have more leaves and are better able to respond to increases in sunlight following thinning. After thinning and increased sunlight, the upper crown class trees have diameter growth that is 3 to 8 times greater than lower crown class trees. Similarly, the upper crown class trees in a sugarbush may have 50% to 100% more syrup yield per acre than lower crown class trees.

Knowing the correct intensity of cutting or thinning is possible by working with the stocking chart. Most owners will want to have a forester help them inventory the woods and determine the current and desired stocking. The forester could also mark trees that the owner could thin.

Figure 6. Many owners enjoy tall and large trees. Retain trees that align with your ownership objectives.

Owners who thin should select trees based on criteria that favor their objectives and the trees suited to the soils. Retain trees that:

- Are in the upper canopy positions
- Are a species that is suited to the soil type
- Provide outputs/products that support the owner's objectives
- Have good structural characteristics of the stem and crown (Figure 6)

One practical method to thin is by using crop tree management. This method identifies future crop trees that will be released from competition and given more sunlight. Application of crop tree management differs from the use of the stocking chart to make decisions about how many trees to cut. Both methods can improve the growth of residual trees. The owner selects adjacent trees, which compete with the crop tree, for removal. Several online resources are available to describe the details of crop tree management.

Trees competing with crop trees can be removed by either cutting or girdling. Cutting is feasible for owners with a chainsaw and all the appropriate personal protective equipment. Cutting should use the technique of "directional felling" where the owner decides which direction the tree will fall. A course called Game of Logging teaches directional felling techniques. Felling the trees has the added benefit of producing a product such as firewood or maybe fence posts.

Figure 7. A mechanical girdle is organic and severs the vascular tissue known as the phloem. This starves the roots of sugars.

Girdling is a process where the crown is disconnected from the roots by killing the tissue in a band around the stem or injecting an herbicide into the stem that travels to the foliage. Girdling can be via mechanical methods such as an ax, chainsaw or flame torch (Figure 7). Trees can also be killed via chemical methods and injection of a chemical such as glyphosate into a hatchet score or drill hole (Figure 8). Herbicides applied by the basal bark method are a chemical girdle (Figure 9). Be mindful that while girdling is fast and relatively easy, it leaves behind standing dead trees that will eventually fall.

Figure 8. Hatchet marks indicate a tree that has been treated with an herbicide via hack-n-squirt.

Figure 9. Some herbicides can be applied via basal bark. These chemicals result in a chemical girdle of the stem.

For additional information on woodland management go to:
www.ForestConnect.com & www.CornellForestConnect.ning.com

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