

# 2.2 FOREST STRUCTURE

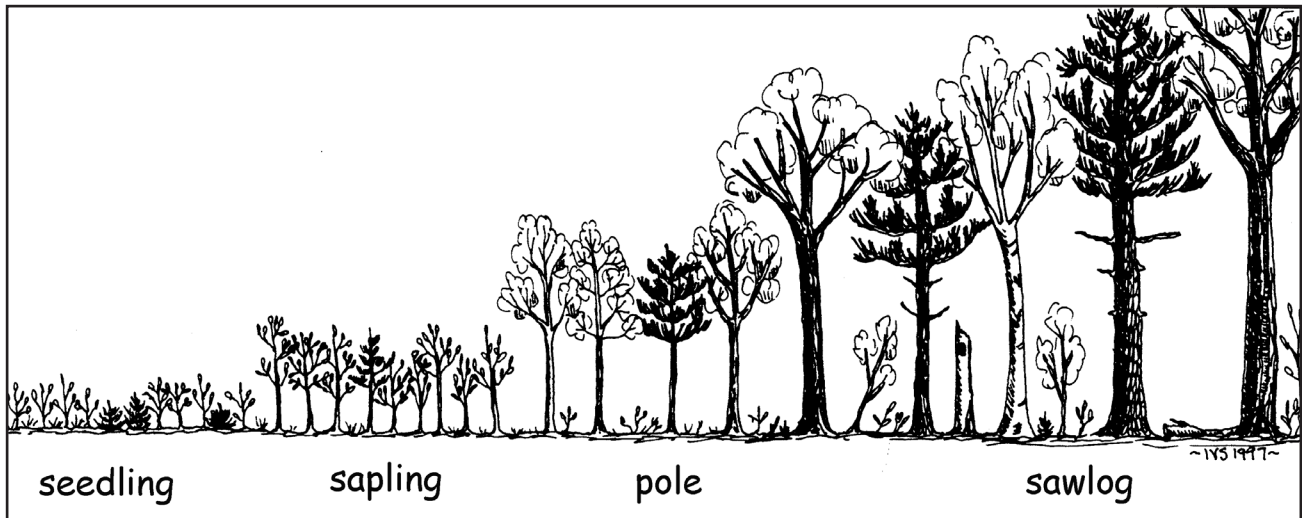
## BACKGROUND

Managing forest structure can meet landowner objectives including a sustainable flow of forest products, wildlife habitat, aesthetics, clean water, and other benefits.

Forest structure is the horizontal and vertical distribution of layers in a forest including the trees, shrubs, and ground cover (which includes vegetation and dead and down woody material). Structure looks at the proportion of small, medium, and large trees and is usually reported as trees per acre by diameter class. These age- or size-class groupings are further defined as seedling, sapling, pole, and sawlog.

### Size Class Groupings

Diameter in Breast Height (DBH) in inches	
Seedling . . . . .	up to 1
Saplings . . . . .	1-4
Pole . . . . .	5-11
Sawlog . . . . .	12 and larger



Forests can have a simple structure or they can be very complex. Based on the range of ages among the different levels of structure, forest stands are defined as even-aged, two-aged or uneven-aged.

Even-aged structure means a stand has one distinct age and size class. (An age class is comprised of trees within 20 years of age). They are often less diverse and composed of fewer species than other structures. Most of the tree diameters come close to the average stand diameter. A plantation provides an extreme example of an even-aged structure.

Two-aged stands are often, but not always, a result of human intervention and may be a temporary condition as management works towards developing an even-aged or uneven-aged stand. Structure within these stands will often have patchy or partial overstory canopies with a well-defined second story, or layer, of either poletimber or seedlings and saplings.

Uneven-aged structure means a stand has three or more age classes. This type of structure is a result of increasing species, age- and size-class diversity within a stand. Different species grow at different rates, and a distinct overstory canopy may no longer be recognizable. Each species or age class exhibits an average stand diameter of its own, and smaller diameter classes may contain more trees per acre than the next larger one. Uneven-aged stands are considered balanced when they have three or more age classes occupying approximately equal areas. When this is achieved, the stand can be considered self-sustaining.

Wildlife biologists and foresters are often interested in structure because of its relationship to timber flow, biological diversity and wildlife habitat. Other chapters in this publication address habitat issues. The focus of this chapter is on the role of structure in maintaining a flow of timber products over time.

### OBJECTIVE

**Maintain a sustainable flow of quality timber through control of stand and forest structure.**

### CONSIDERATIONS

- A forest inventory is useful for analyzing and understanding structure.
- Controlling stand structure requires appreciable effort, especially in uneven-aged stands, and will require professional assistance with stand inventory and timber marking practices.
- Maintaining a balanced stand structure is more practical on larger ownerships.
- Attempts to sustain production of quality timber by simple rules such as keeping harvest equal to growth is only possible after the stand structure becomes balanced at an optimum level. Keeping harvest equal to growth may not allow for other practices in this publication.
- A true uneven-aged condition takes time to establish and can be difficult to implement when harvesting.
- While in theory uneven-aged management requires maintaining size-class balance at the stand level, in practice it may be more feasible to maintain this balance across larger management units, with individual stands managed for a multi-aged (though not perfectly balanced) structure.
- Stand and forest structure and density guidelines vary by species. See the Recommended Practices for general guidelines to cover the likely range in conditions.
- Uneven-aged stands often provide a variety of vertical structure (i.e. multiple canopy layers, for example; overstory, midstory and shrub layers). Even-aged stands can provide some vertical structure, particularly when routinely thinned.
- Even-aged stands can provide horizontal diversity (i.e. a variety of forest types and age classes across the landscape). Uneven-aged stands can provide some horizontal structure, especially when group selection is used.
- Site factors such as soil type can influence stand structure.
- Stand growth and harvest yields will differ depending on any stand's existing structure and the intention of management.
- Rotation age will be fixed or nearly so for even-aged stands, whereas uneven-aged stands have a continuum of harvests and regeneration and theoretically have no end of rotation date.
- Shade tolerance, a species' ability to thrive and prosper depending on the amount of available light and competition from others, will often dictate what species will regenerate (2.3 Regeneration Methods).

## 2.2: Forest Structure

- Advance regeneration are those young trees established naturally without the influence of harvesting. When present, they can simplify the silviculture needed to sustain the future forest.
- Forest structure within the understory also includes down woody material, shrubs, forbs, grasses, and other herbaceous plants. These dead and living plant materials comprise an important part of the forest ecosystem, vital to habitat, forest soils and biodiversity.
- The prevalence of mechanized harvesting systems and the growing demand for biomass fuel make it efficient and profitable to manage even-aged stands.
- The selection system, both group and individual, establishes an uneven-aged structure. Small group cuts are most often used and preferred over individual tree selection, which can lead to high grading.

## RECOMMENDED PRACTICES

- ✓ Have a clear understanding of the goals and objectives for a stand and how the existing structure can or can't be manipulated to achieve the stated goals.
- ✓ Inventory the stand to gather data on the species composition, trees per acre, average diameter, basal area, and stem quality.

### Even-aged Management

- ✓ Provide an array of even-aged stands over time using clearcut or shelterwood harvest practices (2.3 Regeneration Methods).
- ✓ Use even-aged harvest techniques to regenerate shade-intolerant or moderately tolerant species.
- ✓ Strive for the following percentages of acres in seedling/sapling, pole, and sawlog stands:

<b>Tree Size</b>	<b>Percent of Acres</b>
Seedling/Sapling . . . . .	20-30
Pole. . . . .	25-35
Sawlog . . . . .	35-55

These targets are based on rotation ages of about 80 to 120 years (shorter if there is a predominance of short-lived species such as aspen, white birch or balsam fir). They are most applicable at the landscape scale or on large properties (several thousand acres or larger).

- ✓ Change the percentages suggested in the above table in seedling/sapling stands and the percentages in sawlog and mature stands when biodiversity, wildlife or aesthetic goals extend or shorten rotation ages. For example, lower the percentage of seedling/saplings and increase the percentage of sawlogs when rotation age is extended.
- ✓ Identify, maintain, and regenerate wildlife habitat inclusions (e.g. aspen, soft mast, hemlock, or oak raptor-nesting trees).

### Uneven-aged Management

- ✓ Develop stands with a range in tree sizes using some form of partial cutting such as individual tree selection or group selection.
- ✓ Use uneven-aged management to favor shade-tolerant species (e.g., northern hardwoods).

## 2.2: Forest Structure

- ✓ Harvest trees to adjust stand conditions to within the recommended ranges below. Sustained yield is ensured by the ever-increasing number of younger trees available in the stand.

<b>Tree Diameter</b>	<b>Percent Basal Area (of Sq. Ft./ Acre)</b>	<b>Percent Nos. (of Trees/ Acre)</b>
6-10 .....	30-50 .....	60-80
12-14 .....	20-30 .....	15-20
16-22+ .....	25-50 .....	5-20

Examples (using the mid-range in above categories):

- (1) If a stand contained a basal area of 100 square feet per acre, 40 square feet per acre may represent trees 6-10 inches in diameter at breast height (DBH), 25 square feet may represent trees 12 to 14 inches DBH and 35 square feet may represent trees 16 inches DBH or greater.
  - (2) If the stand contained 100 trees per acre, those same classes may contain 70, 17.5 and 12.5 trees per acre respectively.
- ✓ Identify, maintain, and regenerate wildlife habitat inclusions (aspen, soft mast, hemlock, oak raptor nesting trees).

## CROSS REFERENCES

2.1 New Hampshire Forest Types; 2.3 Regeneration Methods; 2.4 Managing for High-Value Trees; 6.2 Cavity Trees, Dens and Snags; 6.3 Dead and Down Woody Material; 6.4 Overstory Inclusions; 6.6 Temporary Openings Created by Forest Management; 6.7 Aspen Management; 7.5 Old-Growth Forests.

## ADDITIONAL INFORMATION

DeGraaf, R.M., M. Yamasaki, W.B. Leak, and J.W. Lanier. 1992. *New England Wildlife: Management of Forested Habitats*. USDA For. Serv. Gen. Tech. Rep. NE-144. 271 p.

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