Mixedwood silviculture wrap-up and discussion

Mixedwood management in the Northeastern United States

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In the Northeast, we recognize mixedwood stands as hardwood–softwood mixtures in which neither component contributes more than 75%–80% of stocking (usually assessed in terms of basal area). Such stands have long been recognized in regional forest type codes used by commercial land managers, i.e., SH for softwood-dominated mixedwoods and HS for hardwood-dominated mixedwoods.

In New England and New York, mixedwood stands occur most frequently in oak–pine, lowland spruce–fir, and mountainous spruce–northern hardwood (*Picea–Acer–Fagus–Betula*) forest types. The mixedwood composition in these forests is largely a function of land use (disturbance) history. For example, in the absence of disturbances that create large canopy gaps and control competing species (i.e., tillage and agricultural abandonment or fire), oak–pine forests, composed of trees of intermediate shade tolerance, tend be followed by more shade-tolerant species such as red maple and eastern hemlock. In contrast, selective logging of spruce from spruce–northern hardwood mixedwoods in mountainous regions of northern New England and New York during the late 1800s and early 1900s largely eliminated this softwood component, with recent inventories now highlighting regional recovery in those stands.

The lowland spruce–fir forest also contains mixedwood stands, with species composition a function of both site and disturbance history. In fact, U.S. Forest Inventory and Analysis data show that the proportion of sprouting hardwoods such as red maple and shade-intolerant hardwoods such as aspen and birch have increased over the long-term in the northeastern spruce–fir forest. Today, monotypic softwood (S) stands are unusual on the managed landscape, except on sites where silvicultural intervention has removed competing hardwoods or where extreme site (very wet or alpine) conditions exclude hardwood species.

The southern part of the Acadian Forest in New England is compositionally different from the spruce–fir or conifer-dominated forests across the border in Canada. The sites we are visiting during this tour, for example, are characterized by spruce, fir and yellow birch. It is a challenge for practitioners in this region to maintain the less-tolerant yellow birch in mixture with shade-tolerant hardwoods.

Yet, spruce–fir–yellow birch is less common to the south, where site conditions (i.e., poor drainage) preclude the growth of quality hardwoods on all but the best sites within the spruce–fir forest. On these "spruce flats" (per M. Westveld, the father of spruce–fir silviculture), a long history of softwood harvesting has resulted in conversion of formerly softwood stands to a SH or even HS composition. Sprouting species in particular proliferate: both red maple as mentioned above and, in recent decades, American beech, which is affected by the beech bark disease. Due to widespread and heavy partial harvesting, this trend will continue. In addition, unlike vertically integrated forest products industries, the timberland investment organizations that own more and more commercial forestland in the Northeast have no long-term or wood production incentive to invest in early stand tending treatments such as hardwood control.

Thus, unlike our neighbors to the north who seek to maintain the hardwood component of many managed northern conifer (spruce–fir) mixedwoods, the challenge in the northeastern U.S. is to maintain or restore softwood composition. While this has been a focus of research in the southern portion of the Acadian Forest since the early 1900s (see work by U.S.D.A. Forest Service researchers M. Westveld and A. Hart, among others), recent declines in the regional softwood pulp market have reduced prices and demand for smaller-than-sawtimber softwoods. Yet, interest in ecological integrity, maintaining flexibility with regard to future markets, and the consistently high value of good-quality sawtimber spruce suggest that we would be well-served to constrain the abundance of hardwoods in low-site spruce–fir stands.

To that end, long-term research at the Penobscot Experimental Forest in Maine and elsewhere in New England and the Adirondacks of New York suggests that establishing and protecting advance softwood regeneration, controlling hardwoods through early stand tending with herbicides or brushsaws, and retaining vigorous softwood trees for seed during or after the regeneration period will increase the proportion of shade-tolerant softwoods. Those interested in maintaining a mixedwood composition, which confers both greater diversity and decreased budworm susceptibility (see work by D. MacLean in New Brunswick), can do this by using larger canopy openings and lower residual basal area during partial harvests.

Some examples of effective silvicultural treatments for varying compositions are as follows for the lowland spruce–fir type in northern New England:

Softwood:

- clearcutting, planting softwoods, conducting precommercial chemical or mechanical weeding;
- uniform shelterwood with removal of hardwoods during the preparatory cut, weeding, thinning (Figure 33);
- single-tree selection cutting on a short (5- to 10-year) cutting cycle with high residual basal area (approx. >100 ft²/ac [23 m²/ha] in trees >1 inch [2.54 cm] dbh) (Figure 34);

Mixedwood:

- clearcutting, planting softwoods and hardwoods;
- irregular shelterwood (Figure 35);
- group selection (gaps 2 tree-heights wide) or single-tree selection with a long (15- to 25-year) cutting cycle and low residual basal area (approx. <80 ft²/ac [18 m²/ha] in trees >1 inch [2.54 cm] dbh) (Figure 36);

Hardwood:

- clearcutting.

In addition, commonly applied exploitative cuttings such as fixed diameter-limit and commercial clearcutting (forms of high grading) result in stands with a greater proportion of hardwoods, with the amount of hardwood growing stock generally increasing with intensity and number of harvests (Figure 37).

Illustrations

When research by the U.S.D.A. Forest Service began in 1950 at the Penobscot Experimental Forest in Maine, all study stands had >80% softwood (S) composition. Results after 60 years for a range of treatments are shown in figures 33–37.

Figure 33. Uniform shelterwood spruce–fir (S) stand with precommercial (6 feet × 6 feet or 1.8 m × 1.8 m) and commercial (40% relative density removal) thinning. U.S.D.A. Forest Service photograph.

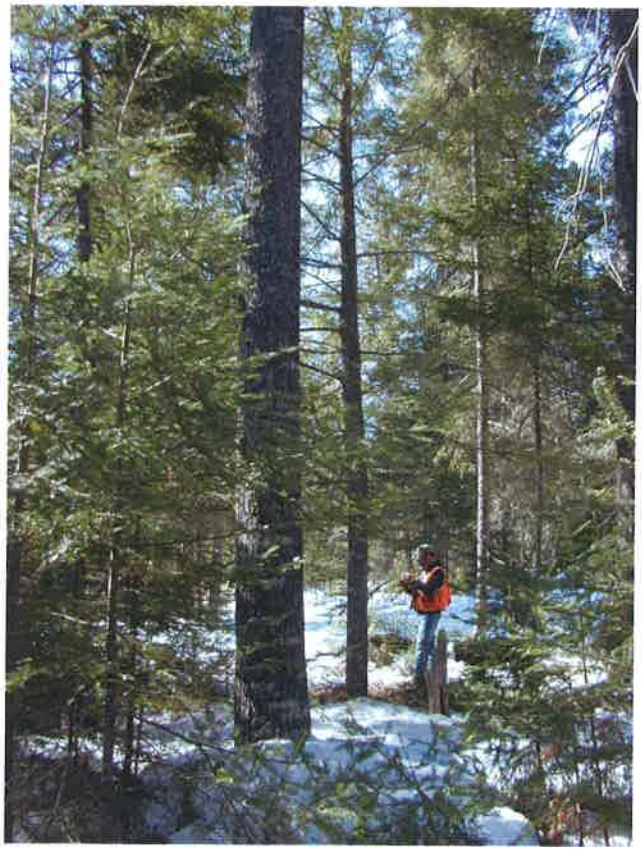

Figure 34. Softwood-dominated (S) spruce–fir single-tree selection stand in Maine (BA approx. 120 ft²/ac [28 m²/ha] in trees >1 inch [2.54 cm] dbh). U.S.D.A. Forest Service photograph.

Figure 35. Irregular shelterwood in a mixedwood spruce–fir–hardwood (SH) stand in Maine (Bob Seymour's "Acadian Femelschlag": irregular expanding gap shelterwood with reserves). U.S.D.A. Forest Service photograph.

Figure 36. Mixedwood spruce–fir–hardwood (SH) selection stand in Maine (BA approx. 80 ft²/ac [18 m²/ha]). U.S.D.A. Forest Service photograph.

Figure 37. Commercial clearcut (high-graded) mixedwood spruce–fir–hardwood (HS) stand in Maine. U.S.D.A. Forest Service photograph.

Some good references include:

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