



NEW ENGLAND
FORESTRY
FOUNDATION

PRINCIPLES OF FORESTRY AT NEFF

Principles of Forestry at New England Forestry Foundation

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Why Forests

The forests of New England have always supplied their inhabitants with resources for their livelihood. Native Americans thrived on abundant deer, caribou, salmon, beechnuts, chestnuts, and many other animals and plants. European settlers exploited the region's timber and wildlife, sending ship masts and furs to Europe and clearing large swaths of forest for agriculture and livestock.

For more than two centuries until the mid-nineteenth century, European settlers converted the southern New England forest into farms, towns, and cities. They cut the forests for fuel, lumber, and paper. They cleared large swaths of forest for agriculture and pasture. Their plows caused soil erosion, and their industries polluted the waters. For their sawmills, tanneries, and pulp mills in northern New England, they cut the forest repeatedly and intensively. As the forests dwindled, they passed their lands to new owners from away, with no ties to the local economy. Settlers extirpated the cougar, fisher, lynx, beaver and wolf from New England and hunted the passenger pigeon and heath hen to extinction.

Despite all that extraction, the forest's resilience and the remoteness of some areas enabled recovery. Writers and naturalists like Thoreau and Emerson could find solitude and inspiration in New England's more remote forests. The forest reoccupied much of its lost territory as farms were abandoned in the latter half of the nineteenth century, but once again retreated in the late twentieth century, this time losing ground to sprawling suburbs and exurbs in southern New England and fragmentation and unplanned development in the north. Both of these latter southern and northern trends continue to destroy forests that could offer habitat for wildlife and recreation for people while producing wood to support the local New England economy—if only the present invasion could be stanchd and the existing forest managed wisely. (Foster et al. 2010, 9-11; Butler et al. 2011, 1)

New England's forests continue to supply materials for today's society, even after centuries of exploitation and extraction for short-term gain. They retain a great but not fully utilized capacity to supply wood products for building and heating homes; habitat for all manner of bird, mammal, reptile, amphibian and insect; clean water and air; and solitude for relaxation and contemplation.

Why Forestry

New England's forests are too often not managed according to science-based silvicultural principles that would best conserve clean water, clean air, rural economic opportunities, wildlife habitat, and recreational opportunities. New Englanders have an obligation to conserve, protect, and enhance their priceless heritage of forests and other natural resources, for their own current benefit and for the continued benefit to future generations.

Thanks to their inherent resilience, New England forests could—given protection and wise management—assure a dependable local resource that supplies a thriving wood products industry while protecting water and air, and that maintains an extensive connected habitat for plants and wildlife as well as opportunities for recreation and tourism. *Wildlands and Woodlands* (Foster et al. 2010, 4; 2017, 14-20), proposed such a vision for New England, keeping 70 percent of the land area of New England permanently protected as forest, with 90 percent of that (27 million acres) as managed productive woodlands and 10 percent (3 million acres) as wildland reserves. The non-forested 30 percent of the land would be occupied by farms (10-15 percent) while leaving as much as 18 percent as developed land (twice as much as presently developed), and water and wetlands.

Why New England Forestry Foundation

NEFF seeks to help realize the vision of *Wildlands and Woodlands* by actively managing its own lands—more than 27,000 acres in more than 140 forests, all of them green-certified and open to the public—and by monitoring the conservation easements it holds on 1.1 million acres of forestland owned by others.

Promoting Sound Forestry in New England

Observing that New England's private forests were often harvested exploitatively for short-term income, managed poorly, or not managed at all, Harris A. Reynolds, then Secretary of the Massachusetts Forest and Park Association, joined in 1944 with several other New Englanders similarly concerned about the prevailing bad management practices to create the New England Forestry Foundation.

They proposed doing what no other organization was doing—offer active, continuing, and complete forest management services to landowners throughout New England. The founders believed that planned, science-based forest management and controlled, non-extractive harvesting would produce a continuous yield of high-quality timber while protecting wildlife habitat and the productivity of the land. The new organization received its first gift of forestland in 1945 from Lincoln Davis, in Sharon, N.H. Later additions increased the original 657 acres to the present 979-acre Lincoln Davis-Morse-Cabot Memorial Forest.

Since its founding, NEFF has worked with individual forestland owners to help them sustainably manage and conserve their forests. Some have donated land to NEFF to assure that good forest management would be continued. Others have retained ownership but donated conservation easements to assure that their land would permanently remain forested. In 1994, NEFF's field foresters formed their own independent consulting firm to advise forestland owners in New England. They continue to manage most of NEFF's forests as independent consulting foresters. When land is transferred to NEFF the current consulting forester can continue to manage it.

From donations, bargain sales, and occasional purchases, NEFF's land holdings have grown to more than 27,000 acres in more than 140 forests across five New England states. Most of the forests bear the names of the donors who have placed their lands under the permanent care of NEFF. They are NEFF's principal endowment—permanent examples of sound, active forest management.

Only about one tenth of NEFF's expenses for its educational and conservation work is covered by its net income from forestry operations. The remaining 90 percent comes from gifts and bequests from individuals, grants from foundations, investment income, and contributions from individuals. Grants from governments are almost entirely restricted for the purchase of conservation easements.

Concentrating on the Woodland Vision

NEFF's mission is to:

1. Conserve forestland for future generations through purchases, gifts, and bequests of land and easements
2. Manage its forestlands to make them the best forests that the soil and climate are capable of producing

3. Open its forests to the public for recreation, hunting, study, and relaxation
4. Demonstrate sound, science-based silviculture in its forests to exhibit practices that landowners and foresters may observe and adopt
5. Advocate policies and incentives that encourage and sustain private forest ownership, to ensure that landowners have economically viable alternatives to selling their land for development;
6. Educate landowners and the public about the importance of forestry
7. Monitor the conservation easements entrusted to NEFF, ensuring that landowners' wishes to conserve their lands' intents are fulfilled
8. Cooperate with conservation organizations and supporters to help realize *Wildlands and Woodlands* vision to conserve 30 million acres of New England forests

Succinctly, "Our responsibility is to do what we can, learn what we can, improve the solutions, and pass them on," (Feynman 1955, 15)—to leave the future stewards of the forest a growing legacy with wide options for future management.

NEFF concentrates on the woodland part of the *Wildlands and Woodlands* vision and on managing its woodlands for ecological diversity and wildlife habitat as well as long-term sustained yield of timber.

NEFF manages its lands to emulate, favor, and perpetuate natural forest stand dynamics to promote diverse flora and fauna, and structural complexity both vertically and horizontally. The aim is to assure fully functioning natural processes from which good results, including timber, will follow (Frost 2006, 2).

Managing NEFF's forests for public benefit

NEFF manages its forestland to maintain a fully functioning forest ecosystem for future generations while utilizing the forest in an economically optimal manner. It seeks to:

1. Conserve the forest's ecosystems
2. Protect soil, water, and climate
3. Grow timber and other forest products to produce income for NEFF's public programs while supporting the local economy
4. Create opportunities for demonstration of good forestry and experimentation in forest management
5. Offer recreation and hunting, aesthetic amenities, and tranquility

NEFF encourages and promotes these same practices by private forestland owners.

Protecting forestland with conservation easements

To accommodate forest owners who wish to continue managing their land but be assured that the land will never be converted to other uses, NEFF began accepting conservation easements in 1976. By 2017, NEFF's holdings of conservation easements had grown to more than 1.1 million acres in 145 primary-interest easements and more than 5,000 acres in 32 executory interests.

What Are the Silvicultural Options?

A silvicultural system is a long-term plan for managing a stand—a contiguous group of trees sufficiently similar in composition, structure, ages, sizes, soils, and condition to be treated as a distinguishable unit—by tending, harvesting, and regenerating trees to achieve or maintain desired forest conditions or avoid undesired conditions (Nyland 2002, 19; Helms 1998 s.v. silvicultural system).

Diversity of Silvicultural Practices

Age classes

A stand is said to be even-aged if the ages of its trees are within 20 years of each other. Two-aged stands—rare in New England—typically are transitional stands with an immature age class growing under an overstory of mature trees that will soon be removed as the final step in an even-aged management plan. A multiaged stand has three or more age classes differing from each other by at least 20 years.

Even-aged silviculture

Even-aged silviculture regenerates a stand by removing all mature trees within a short period, allocating all the growing space to the new, single age class of young trees (Nyland 2002, 192).

- Shelterwood systems: Shelterwood systems use partial shade to regulate the establishment of regeneration, usually carried out in two or more cuts that successively reduce the overstory. The final cut removes the remainder of the overstory to produce a new even-aged young forest. Several variants exist.
- Dispersed shelterwood: A dispersed shelterwood (also called regular shelterwood) cut reduces the overstory by small patches of less than 0.25 acres throughout the stand. Because almost the entire area is treated, dispersed shelterwood presents operational difficulties if, in subsequent cuts, harvesting machines must pass through regenerated areas to reach overstory trees.
- Patch shelterwood: A patch shelterwood cut (also called a group-selection cut) removes the overstory in noncontiguous patches of 0.25-5 acres. When conducted over several cutting cycles for several decades, patch shelterwood management produces a horizontally diverse mosaic of even-aged groups of different ages. Patch cutting favors regeneration of light-demanding species such as white pines and red oaks. Extraction trails must be laid out to avoid crossing areas where regeneration has been established in earlier patch cuts. NEFF has been creating patch openings in recent harvests and intends to increase the practice in the future.
- Seed tree cut: A shelterwood cut that removes all trees except for a sparse overstory—3 to 8 trees per acre—of mature trees is a seed tree cut. Seed-tree management is appropriate when:
 1. Regeneration of shade-intolerant or mid-tolerant species is needed and the retained trees are windfirm and not susceptible to post-harvest mortality
 2. Early-successional habitat is desired for wildlife
 3. Removal of many low-quality trees is needed to rehabilitate a degraded stand
- Clearcut: A clearcut is the removal of all trees larger than a rather small diameter—frequently 2 inches—from a large area, generally 5 acres or more. The final removal cut in shelterwood

management is usually considered to be a clearcut—but a clearcut with regeneration well established in advance. NEFF does not clearcut except as a final shelterwood cut after the next generation is established or if it is necessary to remove an overstory and midstory to rehabilitate a forest degraded by disease or past exploitive harvesting, or to create habitat for wildlife requiring early-successional forest.

- **Variable-retention harvesting:** A variable-retention cut is the inverse of a patch cut. A seed-tree cut or clearcut is carried out but some diversity is maintained within the resulting predominantly even-aged forest by: retaining individual trees, especially some large trees; leaving uncut patches in which all trees are retained for several cutting cycles in the surrounding forest; and thinning of varying intensity in the retained patches to create or maintain horizontal and vertical heterogeneity in the patches.
- **Smaller forests:** Forests of less than approximately 100 acres may be impractical to manage as multiaged forests because a harvest by single-tree or patch selection might be too small to attract a logger unless many of the trees to be cut are unusually valuable. In such a case even-aged management by a shelterwood or seed-tree cut may be the only practical management alternative.
- **Rehabilitation of poor stands:** Some stands, even large stands, may contain such a large component of low-quality wood that the only way to remove the low-quality trees and restore healthy forest conditions is to remove all trees except those of better quality to initiate a new stand. In such a situation a variable-retention cut, seed-tree cut, or clearcut would be appropriate, depending on the distribution and proportion of better-quality trees to be retained.

Multiaged silviculture

A multiaged system of forest management is a planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes, with each age class typically separated from others by at least 20 years (Helms 1998, s.v. uneven-aged system). There is no final removal cut in a multiaged system, which maintains an established stand structure continuously, with no definite beginning or end.

Multiaged stands offer multiple opportunities to the forest manager to create and maintain stand-level complexity, not only in age, size, and crown height of crop trees, but also in snags and downwood and in species of trees, shrubs, herbaceous plants, fungi, lichens, and animals.

Multiaged management can be carried out by single-tree selection or a patch-selection treating or cutting small groups of trees. A patch-selection cut leaves an opening large enough that an edge effect (transition zone from one forest community to another) exists. Single-tree selection affects a zone so small that no transition zone is created. An opening larger than 10 acres may be large enough to be considered a separately managed stand that has been clearcut and therefore not part of a multiaged stand (O'Hara 2014, 48).

In multiaged stands, each individual tree or small group of trees is evaluated when deciding whether to retain or harvest; groups are selected when managing shade-intolerant species; single trees or small groups are selected when managing for recruitment of shade-tolerant species; rotation age is ignored; no definite schedule of treatments as a function of stand age is imposed; and every opportunity is exploited to manage light for regeneration, improve quality by removing defective or at-risk trees,

improve spacing, harvest mature stems, and assure optimal stocking.

- Small openings—single-tree selection: A multiaged forest can be managed by creating small openings with single-tree selection. Diversity of structure and composition as well as age can be increased by a variable-density thinning that concentrates on removing lower-quality trees, spacing dominants and intermediates, or releasing crop trees while retaining trees of underrepresented species, sizes, and ages. Because the openings created by these operations are small, single-tree selection is best suited to species tolerant of shade.
- Small openings—continuous cover irregular shelterwood: Continuous-cover irregular shelterwood management (also called Baden Femelschlag) is a series of shelterwood cuts that remove parts of the overstory and parts of the lower strata in an irregular pattern. Unlike the regular (dispersed) shelterwood system, removal decisions are based on individual trees or small groups of trees, varying horizontally depending on the trees in place. The sequence of cuts also deviates from regular shelterwood in that the sequence of cuts is more freely applied. The final removal cut of the residual overstory is optional. The result after repeated entries is a stand of multiple strata vertically and irregular groups horizontally. The method is suitable for shade-tolerant species but not for shade-intolerant species. (Raymond et al. 2009, 407)
- Larger openings—expanding gap irregular shelterwood: Larger openings allow shade-intolerant species to be regenerated. Expanding-gap irregular shelterwood management (also called Bavarian Femelschlag) removes small (0.25-1 acre) patches of trees as in a patch shelterwood cut but expands the patches at subsequent entries. The final removal cut of the residual overstory is optional. The result, after repeated entries, is a stand of single-stratum patches vertically and irregular groups horizontally—regular at small scale but irregular at a scale larger than the patch. The method is suitable for shade-intolerant species. Regeneration in earlier cuts is not damaged because forestry machines do not have to drive through the previously cut patches to reach trees to be cut. (Seymour 2005 ,44-45)
- Expanding-gap irregular shelterwood management with reserves (also called Acadian Femelschlag) is expanding gap irregular shelterwood management with selected trees left uncut in the harvested patches. The reserve trees are never (or perhaps only rarely) cut but are left indefinitely to mimic some of the features of old growth, benefit wildlife, and enhance the aesthetic appeal of the forest (Seymour 2005, 45; Seymour 2016a). For a total of up to 10 percent of the basal area of the patch, candidates for reserve trees are: any medium to large tree with a cavity or other evidence of use by wildlife; large trees of poor timber quality, e.g., forked or limby, to become wildlife trees; any long-lived large tree, e.g., white pine, hemlock, oak; and any tree of species rare in the forest.

Intermediate treatments

An intermediate treatment is any entry before harvest to tend the forest. Regeneration is not normally the objective but may be stimulated by the increased light reaching the forest floor.

- Thinning from below: A thinning from below removes suppressed, intermediate, and poorly formed co-dominant trees to reduce competition for moisture and light to allow good-quality dominants and co-dominants to increase in size and value. Feasibility depends on markets for lower-quality wood.

- Crown thinning: A crown thinning (also called thinning from above or crop tree release) removes trees from the canopy surrounding good-quality trees destined for later harvest, to allow them to increase in size and value.
- Pre-commercial treatments: Pre-commercial treatments are pruning crop trees, removing small trees to favor trees with a promising future, felling or girdling trees of poor quality, and thinning that produces no marketable stems.

Diversity of NEFF's Forests

NEFF manages its lands to achieve a diversity of land cover and high-quality timber.

The forests of New England and NEFF

New England's forests have always been subject to what foresters call disturbance—any relatively discrete event that disrupts the ecosystem and alters the physical or biological environment (Helms 1998). Apart from such rare events as the Laurentide glacier that retreated 20,000-10,000 years ago, large-scale disturbances in New England are rare events such as fires and hurricanes, occurring at intervals of 100 to 1,000 years. Small-scale disturbances—floods, ice storms, insect attack, fungal disease, and fire—occur frequently, at an average rate affecting the canopy of roughly 10 percent of the forest area per decade (Fraver, White, and Seymour 2009, 293). Humans—both Native Americans and Europeans—have also disturbed the New England forest constantly since their arrival. Most New England forest stands today, especially in southern and central New England, originated when agricultural and pastoral activity was abandoned and the forest reclaimed the land.

The New England forest's reoccupation of the land cleared by farmers or by extractive harvesting of timber has produced a largely even-aged forest, mostly of three types: oak-pine forests in southern and central New England, spruce-fir forests in northern New England, and northern hardwoods (beech, birch, maple) also in northern New England.

NEFF's forests, past and present

New England's forests are largely even-aged. A few have a low stratum of seedlings that makes them early-stage two-aged forests. Forests acquired by NEFF often had the same characteristics when conveyed to NEFF. A few also have enough midstory trees that minimally qualify them as multiaged but the majority have only trees whose ages are within 20 years of each other. The forests were usually well stocked, perhaps even overstocked in some cases, and have been conservatively managed.

Before approximately 2004, NEFF harvested its forests lightly and partially, expecting that thinning the overstory would recruit a new generation of trees to replace the mature age classes. Forest capital was sometimes drawn upon like a bank account with consequent large annual variances in harvest volume and revenue. Individual consulting foresters made management decisions with no overarching forest management plan. (Balch 2006, 13; 2009a, 1)

Annual forest inventories showed that regeneration in that low-intensity dispersed harvesting regime was inadequate and unfavorably species-biased. Shade-tolerant species such as beech, hemlock, and sugar maple, plus a few mid-tolerant species responded to the increased illumination, but they often failed to thrive and grow rapidly because the retained overstory trees also responded to decreased competition for light and moisture by expanding their crowns and soon cut off the sunlight to the lower strata. Shade-intolerant species that had been suppressed in the shade largely failed to respond to the

increase in light when the overstory was reduced. For regeneration of light-demanding species—such as the valuable oaks and pines of New England—to succeed, the gaps created in the overstory canopy must exceed the space that the surrounding dominant trees will reoccupy after the harvest.

In 2004, NEFF instituted a plan for its entire forest holding, an annually revised forest inventory, and the calculation of an appropriate harvest each year (Balch 2009a, 1). Soil and climate determine the potential productivity of a forest, and in present day, the capability of NEFF’s lands can be divided approximately into three classes:

1. 15-20 percent cannot produce merchantable timber because it is ponds or streams, steep slopes, sensitive wildlife areas, at high altitude, inaccessible because of steep slopes or cliffs, or subject to a conservation easement restricting timber production;
2. 35-40 percent has limited timber productivity because of poorer soil, small area, or is in riparian buffers adjacent to streams, ponds, or vernal pools; and
3. 40-50 percent has good soil and moisture conditions for producing timber. (Balch 2006, 12)

The first category is managed for ecological values or not managed at all. The second category of low-productivity land or partially restricted land is suitable for low-intensity, low-frequency management. NEFF concentrates its management on the third, high-potential category.

Standing volume, and distribution of ages and sizes:

Forest statistics—New England and NEFF

Productivity characteristic	CT, MA, ME, NH, VT 2014-15	NEFF	
		2008	2016
Forestland area, k ac	31,648	22.4	27.8
Timberland, k ac			
Area, k ac	30,349	19.7	22.8
Area, % of total forestland area		88	82
Volume in live trees ≥ 2 1/2" top, M ft ³ ...	56,333	54.1	55.5
Growth, %/yr	2.5	1.8	1.8
Harvest removal, %/yr	1.4	1.7	1.8
k = thousand, M = million, cd = cord (85 ft ³ net wood volume)			
Sources: Balch 2009a; USDA Forest Service 2015, 2016a, 2016b, 2016c, 2016d			

How NEFF Manages Its Forests

Working Toward Diverse Multi-aged Forests

NEFF strives to increase, maintain, or restore its forests to high volumes per acre of high-quality timber with a diversity of ages and structures, managing for abundance and harvesting only from abundance (Frost 2006, 3). It exploits opportunities to convert even-aged stands to multiaged stands of diverse horizontal and vertical structure by regenerating a new age class into single-aged and two-aged stands. NEFF varies stand treatments to introduce or increase spatial complexity in ecosystem type, stand structure, and age.

At larger scales—forests larger than 100 acres—NEFF prefers to avoid even-aged silvicultural systems and conventional multiaged systems that tend to homogenize stand composition and structure, emphasizing expanding-gap irregular shelterwood (Femelschlag) methods. It continues to use the full range of silvicultural practices as appropriate, including even-aged management when needed to favor wildlife, remove large quantities of low-grade timber, on small lots, or in other special, infrequent situations.

At smaller scales—small forests or patches of a few acres—it seeks to create or maintain habitat features for particular species, especially underrepresented species of plants or animals, such as den trees, mast-producing shrubs and trees, and coarse woody material. (Saunders and Arseneault 2013)

Managing for Economic Benefits

Forest management that respects and protects ecosystems as it seeks economic productivity creates a positive feedback loop: a fully functioning resilient forest ecosystem increases the continuing economic value of the forest that in turn funds reinvestment in ecological sustainability.

Silvicultural practices

To produce timber of good quality at an acceptable rate, NEFF follows and recommends that New England's forest owners and managers also follow practices that:

1. Maintain vegetated cover to protect soil productivity
2. Make full use of natural dynamic forest processes
3. Maximize long-term economic value by preferring irregular shelterwood and selection-system harvesting, and tending at all stages of development
4. Maintain an optimal growing stock of good-quality stems
5. Optimize between harvesting and retaining high-quality growing stock at the smallest feasible management unit (the individual stand)
6. Maintain horizontal and vertical stand structure to maximize resistance to storm damage
7. Attend to the function of every single tree or small group of trees when tending and harvesting
8. Select individual trees (or patches, reserving individual trees) for harvest according to size and growth rather than age or basal area of the stand, basing harvest decisions on the size, growth potential, availability of seed, and merchantability of trees and opportunities to recruit regeneration
9. Avoid clearcutting and other methods that destroy forest conditions, except in special cases such as when regeneration is present but the over story is largely unacceptable growing stock

10. Tend the immature age classes and regenerate the mature age classes at every entry
11. Use natural regeneration rather than planting
12. Use harvesting machines and methods appropriate to the structure and scale of the forest and that minimize disturbance of soil and the residual stand
13. Restrict use of introduced materials (fertilizers, herbicides, etc.) to the minimum required for restoring the productive capacity of the forest
14. Maintain or restore habitat for wildlife displaced by previous management
15. Evaluate periodically the need and opportunity to improve roads, drainage structures, and other infrastructure

Management of light

NEFF manages its forests to increase the regeneration of light-demanding as well as shade-tolerant species, and to promote growth of high-quality trees in intermediate strata as well as dominant overstory trees. It much prefers multiaged management but uses even-aged management in several situations: in smaller forests whose size makes treatments of only part of the forest uneconomic, as part of a mosaic of even-aged patches of different ages, to rehabilitate a degraded stand, or when an early-successional stand is desirable for wildlife habitat.

Tending the immature age classes

NEFF has done some pruning and other limited pre-commercial treatments in the past, especially when subsidies were available from government agencies. Pruning has not been done since 2000 because of doubtful financial returns on the investment. NEFF has recently recommenced some pre-commercial work at a few sites to demonstrate forestry practices. Pruning white pines occupying good sites at low density seems promising—to favor deep crowns to support fast growth of pruned butt logs and red knots (sound knots produced when live branches are pruned off) in the upper logs (Germain et al. 2016, 559).

Regenerating the mature age classes

No fixed plan of cutting based on age, total standing timber volume, or distribution of tree sizes determines NEFF's harvesting policy. The forest itself suggests the timing and design of forestry activity, subject to short-term constraints and opportunities of weather and market conditions. Forestry operations occur as needed to favor the best-quality trees and manage light to assure regeneration. The return interval and intensity of removal may vary greatly depending on forest conditions. An overstocked stand might be cut more intensely, an understocked area might be bypassed entirely. A harvest might be made early in a good seed year or deferred until a good seed year occurs. A severe natural disturbance might prompt entry to salvage damaged trees or perform a sanitation cut, e.g., to harvest susceptible trees before imminent insect or fungal attack. Following a sanitation cut or a heavy cut to remove a dense population of unacceptable growing stock, the forest might not be treated again for decades.

Planting after harvest is unnecessary in NEFF's forests. The land of New England wants to be forested. A field left unmowed for a few years will revert to forest, just as the land reverted to forest when agriculture was abandoned in the 19th and 20th centuries. Seedlings appear in the forest understory under the canopy of mature, seed-producing trees. Given a bit of light, those seedlings will become another generation of mature trees. NEFF's practice of thinning and reducing the canopy by periodic harvests assures that the seedlings will become the next thriving age class in the forest, making replanting unnecessary.

NEFF does not practice intensive plantation silviculture, although it may occasionally interplant depauperate stands to restore absent or underrepresented native species.

Diversity in composition, structure, and age

NEFF manages its lands to maintain a diversity of land cover. It manages its forested areas to promote a multiaged variety of species and sizes of trees and diverse populations of shrubs and herbaceous plants in the understory of the forests and in wetlands and meadows.

Compositional, structural, and age diversity are assessed across the landscape, especially in smaller (less than 100 acre) forests, which may be too small to offer much internal diversity but can contribute to the diversity of the surrounding landscape.

- Landscape-scale diversity: Compositional and structural diversity is assessed across the landscape, not in small areas. Rather than artificially forcing diversity within a stand, NEFF considers the larger landscape of neighboring forests when managing its land (O'Hara 1998, 118).
- Local diversity: NEFF's objectives of promoting high quality and structural diversity require giving priority to the residual stand that will remain after a harvest rather than to the wood that goes to the mill. Diversity of composition—of shrubs, herbaceous species, fungi, lichens, and fauna from soil bacteria to moose and bear, as well as tree species—is usually enriched by promoting structural diversity. NEFF also works to retain uncommon and locally rare species when tending or harvesting a stand.

Management for quality

NEFF practices silviculture that focuses on regenerating desirable species to replace the maturing age classes and tending the immature age classes to favor high-quality individual trees of the native tree species best suited to the soils and climate of the site rather than mere volume of wood:

1. Time is the friend of management for quality; vigorously growing good-quality trees increase the value of the stand. Time is the enemy every year that low-quality trees are allowed to remain in the stand.
2. High-quality wood commands high prices in most markets.
3. The presence of high-quality trees to be harvested may permit the quality of an entire stand to be increased by offering some of the high-quality trees to loggers along with the requirement to remove low-quality trees competing with more promising high-quality trees not harvested.
4. High-quality trees at a site confirm that their habitat is being managed well.

Transition to multiaged forest

NEFF is working to convert much of its single-aged and two-aged forests to multiaged stands. In selecting trees for harvest or retention, primary attention is given to light management to assure regeneration that will replace the mature age classes, and to tending the immature age classes—which are inadequate or wholly lacking in too many stands. In planning for the timing and nature of entry, rotation age is ignored as is any predetermined structure of tree sizes.

Expected forest cover

NEFF expects that its silvicultural practices will produce, on average, stands dominated by larger trees:

Expected forest cover

Tree size	Expected distribution, % of land area
Sawtimber	40-50
Saplings and poles	30-40
Regeneration	5-15

Silvicultural practices will also maintain:

1. stand conditions suited to umbrella animal species (species whose protection indirectly protects other species in its habitat),
2. wildlife trees—3-5 trees/ac, >18" dbh, live but decaying—and
3. 10 percent of forested land area in large-diameter multistoried stands.

Early-successional stands and mosaic forests: In some circumstances, multiaged management may be undesirable or temporarily infeasible. In such cases NEFF uses even-aged management to regenerate short-lived shade-intolerant species such as red pine, larch, aspen, or white birch; rehabilitate a severely degraded forest by removing a population of mostly defective trees; or create attractive conditions for field-nesting birds and other wildlife requiring early-successional habitat.

Horizontal diversity can be achieved under even-aged management by performing a succession of patch cuts to create a mosaic of even-aged patches of different ages. A sequence of harvests of the even-aged patches produces a shifting pattern of patches of different ages, with some early-successional patches always present to regenerate light-demanding species or for wildlife requiring young forest habitat.

Late-successional stands and wildland reserves: New England lacks late-successional forests. Only about 53,000 acres of late-successional forest old enough to be categorized as old-growth exist, scattered in about 100 sites, mostly in northern New Hampshire and Maine (Foster 2010, 17-18). Late-successional forests are important as:

4. Reference stands to help us understand what old-growth New England forests are
5. Resilience from large-scale disturbance, e.g., storms and fire
6. Refuges for species of fungi and lichens that need old growth

NEFF has no policy requiring or favoring the establishment of late-successional stands and wildland reserves. Some de facto reserve areas have been established in wet areas, steep slopes, rocky soils, and inaccessible sites but they are small and not the result of policy.

A notable variant on the woodland theme in NEFF's forests is the Hersey Mountain Forest in Sanbornton and New Hampton, N.H. NEFF, the Northeast Wilderness Trust, and Sweetwater Trust collaborated to set aside 2,154 acres as a permanently unmanaged wilderness that will—in a few hundred years—become an old-growth forest. Another 1,093 acres of managed NEFF forest contiguous to the wildland serve as a forested buffer protecting the wildland.

Some areas of NEFF's forests will become unmanaged late-successional simply because they are too steep, wet, or inaccessible for efficient commercial forestry. The expected future condition of those sites is 40-50 percent of standing volume of wood in large (for the site) mature trees that will grow old and die naturally. NEFF has 23 unmanaged late-successional patches in 15 of its forests, with a total area of 238 acres. Together with the unmanaged Hersey Mountain area, these unmanaged wildlands comprise a bit less than 9 percent of the total area of NEFF's forests. Although NEFF concentrates on the woodland

part of the *Wildlands & Woodlands* vision, it expects to continue contributing to the wildlands part of the vision: 5 percent or more of its forestland will remain unmanaged, eventually to become late-successional forests buffered by carefully managed forestland.

Non-woody forest products

NEFF encourages diversification of forest products, including products other than wood:

1. NEFF has leased parts of its forests to producers of maple syrup.
2. NEFF entertains proposals to produce for other products provided they do not compromise other forest values. Promising candidates are ginseng, mushrooms, fir boughs for wreaths (“tipping”), truffles in oak stands (not currently occurring; perhaps a bit too optimistic).
3. Game for hunters.

Biomass harvesting

Although NEFF manages for quality, low-quality wood is ever present. Nature always produces some defective, diseased, and wind-shattered trees. Logging produces tops and limbs of negligible commercial value. The butt log (lowest log on a stem) may be of high quality but logs above the butt log will have branches, hence knots, hence lower quality wood. A forest manager cannot cut only high-quality trees and leave the low-quality trees behind. Such an operation—called high-grading—will degrade the forest and destroy its future value. Whether produced naturally or as a byproduct of harvesting, low-quality wood needs markets to absorb it, to help make responsible forest management financially viable.

Recent markets for biomass (tops, branches, low-quality stems) have offered opportunities to remove low-quality and defective trees that would not otherwise be marketable. NEFF occasionally uses limited biomass harvesting to improve stand quality by removing low-quality trees to increase growing space, light, and moisture available to high-quality trees with a more promising future.

Biomass here means vegetation removed from the forest: small-diameter trees; trees not merchantable as sawlogs, fuelwood, or pulpwood; and slash—limbs and tops of trees felled in a harvest or debris created by storm, fire, or girdling.

NEFF follows Forest Stewards Guild guidelines for retaining biomass (Forest Guild 2010, 5-8):

1. If one third of basal area is removed at a frequency of 15-20 years, then one quarter to one half of the downed woody material (slash, tops, limbs) is retained.
2. At greater harvesting intensity (shorter cutting interval, greater reduction of basal area) more downed woody material is retained.
3. On low-nutrient sites, more downed wood material is retained.

NEFF ordinarily avoids biomass harvesting unless required to rehabilitate a degraded stand of defective or low-quality trees. If necessary, protective measures may be taken during biomass harvesting, such as:

1. Retaining some large logs for wildlife
2. Minimizing removal of leaves by harvesting in winter or retaining more fine woody material (to retain nutrient-rich leaves and buds)
3. Retaining (not chipping) tops and slash from a harvest that is merchantable for the logs alone, i.e., considering the value of retaining the biomass for nutrients and wildlife to be greater than the minimal income from the incremental biomass
4. Avoiding biomass removal from sites with rare species of plants or animals, in riparian areas, on steep slopes, or other ecologically sensitive sites

Exotic invasive plants and herbicides

Exotic invasive plants have compromised forest health in New England by competing with native species that would offer food, shelter, and nesting sites for native wildlife and would produce more and better timber in the absence of the exotic plants. Some NEFF forests have no exotic invasive plants or only minor populations while others suffer from more serious infestation.

Practicing forestry close to nature means managing to favor native species and eliminate nonindigenous species, especially invasive plants. NEFF occasionally uses mechanical removal or herbicides to control nonindigenous invasive plants and, sometimes, native plants such as hay-scented fern when they interfere with regeneration of native tree species, under certain conditions:

1. Invasive plants interfere with native vegetation
2. New infestations of invasive species have appeared
3. Neighboring lands do not harbor populations of invasive plants that could cause re-infestation

Application is highly focused to avoid damage to non-target organisms, always follows applicable laws and regulations, and conforms to the manufacturer's recommendations for use.

Protecting Forest, Soil, Water, and Climate

Protecting the forest ecosystem

NEFF helps to protect the New England forest by carefully managing its more than 27,000 acres of forests throughout New England—the subject of this document—but also, as described in other documents, by acquiring and monitoring conservation easements that prevent conversion of forestland to other uses and that require the practice of competent forestry, and inviting foresters, forestland owners, and interested New England residents to NEFF's forests to learn about and practice responsible forest management.

NEFF's practice of forestry close to nature protects the forest ecosystem, its productivity, and species diversity. NEFF modifies, reduces, or avoids forest management activities, including harvesting, to protect:

1. Imperiled species
2. Unusual and underrepresented species
3. Habitat with unusual features favoring wildlife, such as deer yards
4. Keystone species, such as beavers creating habitat for other species, and bees pollinating many plants
5. Wildlife corridors, e.g., Quabbin to Wachusett, Quabbin to Cardigan, and elements in blocks of contiguous forest
6. Den trees, vernal pools, raptor nests, etc.
7. Patches of plants attractive to pollinators—butterflies, bees, moths, etc.
8. Patches of softwoods within hardwood stands and hardwood patches in softwood stands
9. Vernal and perennial pools (breeding sites for amphibians)
10. Forested riparian buffers around streams and ponds
11. Transitional edges between forest and nonforested areas
12. Shrub and forb meadows
13. Old orchards

When managing for wildlife, multiaged forestry with a diversity of plant species—herbaceous as well as

woody—offers a variety of food sources, nesting sites, and shelter to wildlife.

Even-aged forests (and group-selection harvests of large patches) create early-successional habitat for field-nesting birds, snowshoe hares, and other species requiring shrubs and young-forest conditions.

NEFF's unmanaged late-successional forest areas benefit other wildlife requiring mature forests. Among NEFF's direct silvicultural actions favoring wildlife are:

1. Retention of both live and dead trees occupied by wildlife or that have cavities or good potential to become den trees, and trees with raptor nests
2. Retaining high-quality or unique mast-producing trees, such as healthy beech and cherry
3. Creating, maintaining, and restoring stand conditions favoring keystone and umbrella species
4. Protecting special habitat features, e.g., deer yards, patchy inclusions, edges, shrub meadows, marshes, etc.

An example of NEFF's protection of wildlife is its policy of peaceful coexistence with beavers. It allows beavers to flood land that would be forested in their absence, and limits its interference with their activities only to the extent of installing culvert protectors and water-level controls on dams to prevent flooding of roads. NEFF has, occasionally and where necessary to prevent damage to forest roads, installed culvert protectors and water-level controls but otherwise leaves the beavers free to fell trees, build dams, and create ponds for muskrats, otters, herons, tree swallows, red-winged blackbirds, fish, frogs, and turtles.

NEFF also manages for imperiled wildlife and to conserve unusual habitat beneficial to wildlife. NEFF has coordinated with the U.S. Fish and Wildlife Service to improve habitat for New England cottontail in the Bennie Eaton Hill forest in Hudson and Pelham, N.H.; clearcut 22 acres in the Lincoln Davis forest in 1997 to reclaim an old blueberry pasture, and is formulating plans maintain the blueberries by periodic mowing or burning; and is working with MassWildlife to restore an inland pitch pine-scrub oak stand in the Mixer-Nields forest in Hardwick, Mass., adjacent to a similar stand on MassWildlife land.

Additional ecosystem-centric management approaches:

- Caves: NEFF follows U.S. laws and regulations for protecting caves.
- Biologically important areas: NEFF follows the requirements of the New England states to protect sensitive habitat, such as that of wood turtles.
- NEFF deters and prevents human-caused damage to its forests:
 1. Boundaries are periodically inspected and blazed and painted as needed to alert NEFF's loggers and neighbors' loggers operating on abutting lands.
 2. NEFF's monitoring deters vandalism and illegal dumping.
 3. Off-highway vehicles are excluded except under special arrangements with snowmobile clubs for designated trails.

Protecting soil

Close-to-nature forestry assures that continuous vegetative cover will prevent soil erosion. To protect soil and water in its forests, NEFF meets or exceeds the best management practices required and recommended by New England's state departments of conservation. In general, NEFF:

1. Maintains a continuous vegetative cover on the soil at all times to prevent erosion.
2. Uses low-impact machines and methods of harvesting whenever possible.
3. Requires loggers to minimize soil disturbance (except when needed to regenerate species requiring exposed mineral soil, in which case the logger is instructed to scarify the ground

surface to prepare a seed bed).

4. Prevents erosion by maintaining roads in good condition with adequate drainage; periodically assessing and maintaining culverts, ditches, cross drains, dams, and spillways; suspending machine operations in wet conditions and preventing disturbance of wet soils by applying slash or installing corduroy logs on extraction trails; limiting machine operation in riparian areas and on vulnerable soils; suspending machine operations in wet weather, limiting machine operation in riparian areas and on vulnerable soils; and excluding off-road vehicles and motor vehicles not involved in forestry work (except for explicitly permitted snowmobiles).

Protecting water

Soil protection also protects water.

1. Minimizing soil disturbance during harvesting prevents soil erosion that would deliver sediment to streams.
2. Controlled drainage of roads prevents road erosion and deposition of sediment in water.
3. Limited forestry activity in riparian buffers reduces disturbance near ponds and streams.
4. NEFF follows recommended as well as required best management practices of each of the New England states for protecting wetlands.

Protecting climate

A continuous vegetative cover reduces ground surface temperatures, which retards oxidation of soil carbon into CO₂. In addition, a management emphasis on growing large, high-quality timber produces—after harvest and manufacturing—like framing, flooring, furniture, and other wood products that sequester carbon for long periods, displacing more energy-intensive (carbon-dioxide producing) metal and concrete construction materials.

Protecting Aesthetic, Cultural and Recreational Values

New Englanders prize forests for their contribution to physical and mental health, both forests near densely populated cities and towns and rural forests for relaxation, contemplation, and recreation.

Aesthetic values

During the infrequent periods of intense forestry activity NEFF requires loggers to preserve aesthetic features in its forest, minimize damage to roads, soil, and retained trees, and to clean up the site when the harvest concludes. NEFF's management for high-quality large timber and protection of wetlands also protects aesthetic qualities of the forest.

- Aesthetics during harvesting: Forestry operations, especially harvesting, often require the use of large, noisy machines that some visitors may find intimidating or objectionable. But harvesting occurs only infrequently for short intervals between long periods of no activity. During the harvest interval a responsible logger using modern equipment can shorten the harvest interval, minimize damage to the forest, and improve its condition by removing low-grade wood that would have to be left behind without the use of machines.
- NEFF protects and restores forest aesthetics by:
 1. Locating landings and log yards away from public roads
 2. Reducing intensity of harvesting close to public roads
 3. Placing a curve, when a new entry from a public road is laid out, to block the view into

the forest interior

4. Minimizing debris on extraction trails that might be used by hikers
5. Requiring loggers to remove trash and hazardous waste (principally lubricants and fuel) from the site at the conclusion of operations
6. Requiring loggers to minimize damage to trees not cut
7. Protecting soil and water quality by preventing erosion and minimizing soil disturbance
8. Retaining selected trees of pleasing appearance such as large trees with good form, fall color, etc., especially near trails
9. Retaining trees of value to wildlife
10. Placing extraction trails preferentially on contour, at harvest boundaries, and along boundaries between cover types
11. Closing extraction trails to vehicle intrusions, and revegetating extraction trails at the conclusion of harvesting

Special measures to remove slash other than from trails and landings or to construct brush piles for wildlife are generally not taken. Slash is only temporarily unsightly and quickly rots, returning nutrients to the soil.

Cultural heritage

NEFF complies with the Forest Stewardship Council's requirements for protecting cultural values. NEFF requires its loggers to avoid damage to stone walls, cellar holes, known graves and cemeteries, monuments, and other cultural artifacts.

- Stone walls, cellar holes, graves, monuments: NEFF avoids damage to cellar holes, monuments, and other cultural artifacts. Stone walls are not disturbed unless making an opening is unavoidable for forestry operations, in which case the stones are stockpiled near the breach.
- Native American sites: NEFF protects Native American sites in its forests, as required by the Forest Stewardship Council.

Recreational opportunities

NEFF does not develop any special facilities for recreation but its forestry activities often create logging trails that offer routes for hikers, birdwatchers, hunters, and other visitors to the forest. Harvesting occasionally creates openings with pleasant vistas and that attract field-nesting birds and other wildlife.

- Trails: NEFF has developed a few foot trails in forests but most hiking trails are inactive logging trails that offer routes for hikers, birdwatchers, and hunters.
- Time: Visitors are welcome in NEFF's forests from dawn to dusk. NEFF requests that visitors take only photographs and leave only footprints in its forests. All trash must be carried out and disposed of responsibly.
- Access and Parking: NEFF's forests have no special facilities for parking; parking availability varies with each forest.
 1. Gates and entrances must not be blocked by parked cars.
 2. During peak times, visits may be limited by availability of parking space. Parking outside on public roads is under the jurisdiction of local towns.
 3. Most parking areas are log landings. They usually accommodate only a few vehicles, may be thickly vegetated if not recently or frequently used, and aren't plowed in winter.

- Hiking, snowshoeing, cross-country skiing, trail running: The low-impact activities of hiking, snowshoeing, cross-country skiing, and trail running are encouraged.
- Dog-walking: Dogs are permitted on marked forest roads and trails and must be controlled at all times to prevent damage to property or harassment of wildlife. Owners must remove any dog waste from the forest.
- Equestrians: Horseback-riding permitted; equestrians must control horses, remain on trails.
- Bicycling: Bicycling is permitted in most NEFF forests subject to these conditions: Bicycling is permitted only on marked trails; cyclists must not exceed a safe and reasonable speed; cyclists must yield to hikers and equestrians, and announce their presence when approaching others from behind.
- Motorized vehicles: Off-highway vehicles are, with one exception, not allowed in NEFF forests. NEFF has occasionally cooperated with local snowmobile clubs to allow operation of snowmobiles on designated NEFF land in return for the clubs' maintaining and monitoring the snowmobile trails. Off-trail operation of snowmobiles is not allowed. Similar permission is not granted to individuals. No motorized wheeled vehicles are allowed on NEFF lands in any season.
- Camping and Fires: Camping is not permitted on our properties, except at Chamberlain Reynolds Memorial Forest in Center Harbor, NH. Reservations are required at that forest. However, scout and other community groups occasionally request and may be granted permission to camp in certain locations. Fires are prohibited in all NEFF forests.
- Alcohol: Alcohol is prohibited in all NEFF forests.
- Hunting and Fishing: Hunting and fishing are permitted at most NEFF forests subject to these conditions:
 1. Hunting: Deer hunting is encouraged, for our benefit to reduce browsing of regeneration and as benefit to the community; no metal—spikes, lag bolts, etc.—may be placed in trees to secure a hunting stand; the stand must be labeled with name and contact information of the hunter; the stand may not be placed earlier than one month prior to the opening of the hunting season; the stand must be removed within one month of the end of the season; no brush or trees may be cut to clear sight lines; all cartridges and spent shells must be removed by hunter; NEFF may remove, dismantle, or scrap any stand on its lands that does not conform to these conditions, and any stand that remains after the end of hunting season.
 2. Target shooting is not permitted.
 3. Trapping is not permitted.
 4. Lead sinkers may not be used in fishing.
 5. Hunters and fishers are encouraged to join NEFF to support its work and maintenance of forests favorable for hunting.

Engaging the Community

NEFF works to arouse public interest in sound forestry practice; contribute to the community welfare

through its economic activity; help supply New England with locally grown renewable forest products; inform the forest owners and others about its efforts to practice sound forestry while protecting forest resources; engage in and support scientific understanding of environmental issues related to forestry; consider its neighbors and their community when planning and carrying out forestry activity; and collaborate with other conservation organizations to advance the conservation of forests in New England.

NEFF forests for education

NEFF's forestry activities are designed to benefit its neighbors in three main ways. First, NEFF considers the effects of its activities on both neighboring forests and the surrounding community. In planning for its forests, NEFF considers the effects of its actions on the surrounding lands both locally and as part of the larger forested landscape.

Second, NEFF's active forest management contributes to the New England economy by creating local jobs for foresters, loggers, truckers, mill workers, and associated businesses.

Finally, NEFF's forests are demonstration sites for forestry practices. NEFF works to educate other forest owners, professional foresters, and the general public about how and why NEFF manages its forests. NEFF makes the results available to local forest owners and others working in or interested in forests, and to the general public:

1. Pre-harvest walks inform the community about NEFF's plans for harvesting and regenerating.
2. Articles in NEFF brochures and newsletters and videos inform the public about NEFF's activities and forest practices.
3. Marteloscope workshops help foresters and other interested persons improve or become acquainted with forest management skills.
4. NEFF conducts research in its forests and publishes the results to help others manage their forests better, as in a study of a plan for adapting to climate change at its Allen-Whitney forest in Maine (Wilkerson and Sartoris 2014, 3).
5. NEFF collects and compiles data on its forest activities and makes the results available to the public. Many past records of notable landscape were not accompanied by reliable locational data. With the advent of GPS data, NEFF has begun to gather and compile accurate spatial data as landscape features of interest are encountered in the field.
6. NEFF places informative signs in its forests. At the entrance to every NEFF forest is a sign identifying the forest and NEFF, giving contact information and the donor's name, and informing the public of the activities and objectives for the forest. Some forests have didactic signs describing the silvicultural history of the forest. NEFF is currently redesigning its signage and plans to increase the number of the signs, improve uniformity in their appearance, and increase the information offered to visitors about the nature of the forest, past management activity, and plans for the future.

Ventures with conservation organizations

NEFF cooperates with other conservation organizations and government agencies to promote good forestry, including:

1. The American Chestnut Foundation, working toward the development of a blight-resistant American chestnut
2. The MassConn Sustainable Forest Partnership, a cooperative effort among NEFF, American

Forest Foundation, and several regional land trusts in Massachusetts and Connecticut. The Nature Conservancy

3. U.S. Fish and Wildlife Service, for the New England cottontail
4. State wildlife agencies, e.g., for protecting New England cottontail
5. State Audubon societies, for bird habitat
6. Ruffed Grouse society
7. The Trust for Public Land
8. Other land trusts, on conservation projects promoting good forestry

Ethics, Planning, Assessment and New Lands

Ethical principles

NEFF follows ethical principles in the stewardship of the forests entrusted to its care.

- Forestry close to nature: Responsible forestry requires that the forest be protected as a fully functioning ecosystem and, if necessary, rehabilitated from previous negligent or exploitive management. In its forest management, NEFF relies on natural processes to direct forest stand dynamics toward:
 1. Diversity of flora and fauna typical of the stand, forest, and region
 2. Diversity within the local population of each species, preserving the potential for evolutionary development and adaptive response to climate change
 3. Variation of horizontal and vertical structures of vegetation, and ecosystem type in the stand and forest, considered as components of the surrounding larger landscape
 4. Full functioning of ecological processes, that is, forest stand dynamics close to natural processes
- NEFF practices and recommends that other forestland owners practice the following principles:
 1. Treating the entire ecosystem, not only trees but also soil, carbon, water, fungi, plants, and animals as the productive capital of the forest
 2. Observing, following, maintaining, and, where necessary, restoring the natural forest vegetation pattern while making use of the forest
 3. Managing adaptively, working with the site and respecting inherent variations without imposing artificial uniformity or forcing any predetermined unnatural structure or composition on the forest
 4. Responding to environmental and market conditions without compromising sustainability
 5. Managing with humility and continual learning, drawing on field observations and science
 6. Maintaining soil productivity by keeping a continuous vegetated soil cover and retaining biomass, including down woody material, in the forest
 7. Growing native species well suited to the site
 8. Using natural regeneration rather than clearcutting and replanting
 9. Encouraging a mixed-species forest with special attention to rare, underrepresented, and imperiled species
 10. Forgoing short-term financial gain to favor long-term financial value and ecological integrity of the forest
 11. Maintaining nonforested areas for diversity and to accommodate wildlife and plants that require wetland or upland field habitat
 12. In special cases, forgoing harvesting

- NEFF endorses the principles of the Forest Stewards Guild:
 1. The well-being of human society is dependent on responsible forest management that places the highest priority on the maintenance and enhancement of the entire forest ecosystem.
 2. The natural forest provides a model for sustainable resource management; therefore, responsible forest management imitates nature's dynamic processes and minimizes impacts when harvesting trees and other products.
 3. The forest has value in its own right, independent of human intentions and needs.
 4. Human knowledge of forest ecosystems is limited. Responsible management that sustains the forest requires a humble approach and continuous learning.
 5. The practice of forestry must be grounded in field observation and experience as well as in the biological sciences. This practical knowledge should be developed and shared with both traditional and non-traditional educational institutions and programs.
 6. Our first duty is to forests and their future. When confronted with circumstances that threaten the integrity of the forest and conflict with the Mission and Principles of the Forest Stewards Guild, members must respond through education, advocacy, or where necessary, disassociation. Guild membership signifies a commitment to the highest forest stewardship ethic. (Forest Stewards Guild 2017)

- NEFF follows the Grey Towers Protocol, four principles of land stewardship resulting from a conference at the Pinchot Institute for Conservation in 1990:
 1. Management activities must be within the physical and biological capabilities of the land, based upon comprehensive, up-to-date resource information and a thorough scientific understanding of the ecosystem's functioning and response.
 2. The intent of management, as well as monitoring and reporting, should be making progress toward desired future resource conditions, not on achieving specific near-term resource output targets.
 3. Stewardship means passing the land and resources—including intact, functioning forest ecosystems—to the next generation in better condition than they were found.
 4. Land stewardship must be more than good "scientific management;" it must be a moral imperative. (Sample 1995, 10-20)

Certification

Third-party auditors have certified NEFF's forest management, and NEFF will to continue certification of its forests.

- NEFF's forests have been certified by the Forest Stewardship Council since 2000. Conformity with NEFF's Regional Management Plan and *FSC-US forest management standard* (Forest Stewardship Council 2010) is audited annually and recertified at five-year intervals by an independent auditor unaffiliated with NEFF or any of NEFF's consulting foresters. Current certification is via a group certificate through New England Forestry Consultants.

- NEFF's forests in Maine, New Hampshire, Vermont, and Massachusetts have been certified as Tree Farms by the American Tree Farm System as complying with *Standards & guidance 2015-2020* (American Tree Farm System 2015).

- NEFF's management of its forests and conservation easements complies with the standards of

the Land Trust Alliance, in particular with standard 12, but NEFF has not applied for accreditation by LTA (Land Trust Alliance 2017).

Planning and assessing progress

NEFF manages its forest according to a regional management plan for its entire assembly of forests and an individual management for each individual forest. The management plans are usually prepared by an independent licensed consulting forester with guidance by NEFF. Each management plan is reviewed and normally revised periodically as appropriate, typically decennially. The revision interval is extended beyond 10 years if a longer growth period is expected, for example, when cut-over land is acquired that will require a long recovery period after initial assessment and rehabilitation.

Each year NEFF determines which forests require treatment, what treatments are appropriate, and prepares an operating plan for the year. Over periods of 10 or more years, harvesting approximates growth so that stocking and productivity of the forest are not compromised. Harvesting intensity may vary greatly from year to year because of weather and ground conditions, timber markets, foresters' recommendations, scheduling constraints and opportunities, and the need to increase light for regeneration or to rehabilitate degraded stands.

A project plan is prepared for every harvest and all other important silviculture tending operations actions in NEFF's forests. The results of each operation are reviewed at the completion of the project.

Each entry into NEFF's forests for tending, harvesting, or regeneration is supervised by a consulting forester with periodic inspection by NEFF staff. When appropriate, NEFF invites the public to a guided tour of a harvest area before, during or after a harvest. Each significant operation is inspected at completion.

- Annual estimation of timber: NEFF annually contracts with consulting foresters to prepare an inventory and assessment of growth for its forests. Samples are taken at 200 randomly selected plots divided proportionally across the five different forest types on NEFF lands—pine-hemlock, oak-pine, oak-hickory, maple-beech-birch, and spruce-fir. Every year the 40 oldest inventory points are removed and 40 new random points are measured. Inventory and growth are then recalculated with the most recent set of 200 plot samples.
- Inventory of individual forests: A comprehensive inventory of tree volumes, products, and values on each individual forest is conducted by a consulting forester at each decennial revision of the forest's management plan.

Land acquisition

NEFF welcomes opportunities to conserve land, both through fee interest and conservation easements, and has participated in many such projects. Desirable characteristics for potential forest acquisitions are:

1. Acquisition should be favorably financed. Donation of an entire fee interest is especially generous but bargain sales or other purchase arrangements including recovery from near-future timber sales area also welcome.
2. Adequate land area and boundary configuration that allow forestry activity. Parcels greater than 100 acres are preferred.
3. Legal access.

4. Productive soils on ground accessible to forest machines.
5. Open to the public in some way, preferably open to hunting.
6. Connectivity enhancement: Land abutting land already owned by NEFF, corridor lots connecting other conserved lands.
7. Adequate timber present.
8. Associated with or adjacent to an educational institution.
9. Attractive ecological characteristics, if they do not interfere with responsible silvicultural activity.

Interested persons should visit the NEFF website to find examples of completed land conservation projects.

What Hinders Good Forestry Practices

Apart from the obvious adverse factors—1938-scale hurricanes, Asian long-horned beetles, emerald ash borers, lack of funds, lack of public awareness, etc.—one large impediment to practicing good forestry is the lack of markets for low-quality wood. High-quality wood can almost always find good markets but forest improvements to increase the growth of high-quality wood of desirable species often depend on removing lower quality trees for which there is no market or only markets offering low prices that do not repay the expense of logging to remove them. Markets for pulpwood have collapsed in New England since 2014 by around 275 truckloads a day for pulp wood and wood chips. Procurement radii have shrunk, even with low fuel prices favoring trucking, eliminating markets for low-quality wood distant from mills. And the market for biomass that could be removed to improve stand quality is vulnerable to the low price of natural gas and to political decisions. (Kingsley 2017, 10-13) These and other adverse market conditions and natural events could force changes or compromises in NEFF's forest management.

What Needs to Be Done

The New England Forestry Foundation has the ability and experience—70 years of forest management, more than 27,000 acres of managed forest, 1.1 million acres of forestland under conservation easements—to make a large contribution to the fulfillment of the W&W vision. It needs resources to accomplish the mission of managing and conserving forests, and of continuing its program of teaching forestland owners and foresters and demonstrating practical forestry close to nature.

NEFF is steadfast in its practice and promotion of sound forestry but flexible in cooperating with landowners who wish to conserve their land. We know well that each forest and forest owner is unique. If you know a forest owner who wishes to protect his or her land permanently, please call us. We would be delighted to help any forester or forest owner who wishes to create a permanent legacy of stewardship.

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