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Science to Stewardship

Silviculture in Planted Conifer Stands at the Quabbin Reservoir

By Roger Monthey and Thom Kyker-Snowman

More than 2.2 million people in Greater Boston depend on the Quabbin Reservoir for drinking water. Ensconced among the rural hills of Western Massachusetts, the Quabbin also provides for wildlife, recreation, and timber resources. Its natural resource managers have long recognized the value that watershed forestry plays in safeguarding all of the Quabbin's gifts. Managed conifer stands play a particularly significant role.

The Quabbin watershed totals 120,000 acres, with 55,000 acres of land and 25,000 acres of open water entrusted to the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. During reservoir construction in the 1930's and 1940's, 6,760 acres of pastures and cultivated fields were planted with conifers, mostly pine as well as some spruce. Native hardwood regeneration overtopped more than half of these plantations over the decades. Several hundred acres were converted back to fields in the 1980's to increase water yield to meet the demands of Boston's growing population.

Red pines make up the vast majority of trees on the 2,750 acres of plantation conifers remaining. In recent years, Quabbin's managers have focused on rapid transition of these wind and root-rot susceptible plantations to a diverse range of native species, including both hardwoods and softwoods. Their approach for red pine follows the plan offered by a recent Forest Service publication[1] asserting that human disturbances have greatly simplified the structure and composition of red pine forests relative to historic conditions.

Management in 60- to 70-year-old plantations at the Quabbin includes an initial prep cut that removes 20 to 30 percent of the basal area to open up the canopy and scarify the litter layer to promote seeding. A regeneration cut 5 to 10 years later removes 60 to 70 percent of the remaining basal area, retaining a portion (10 to 20 square feet of basal area) to provide some structure to the stand as well as a continuing seed

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Silviculture in Planted Conifer Stands at the Quabbin Reservoir *Continued from page 1*

This mixed red and white pine stand, thinned 3 to 5 years following the initial preparatory cut, displays excellent natural regeneration.

source. In the past, regeneration beneath pine plantations was heavily browsed and had to compete with hay-scented fern. Reducing the deer herd and providing adequate scarification has improved its chances (see photo).

Plantations of Norway spruce typically regenerate poorly as a result of the dense shade cast by the overstory foliage and the thick accumulation of slowly decomposing acidic organics on the forest floor. Disturbance events such as windfalls, snow damage, and insect and disease attacks create small-scale canopy gaps to which Norway spruce may respond; however, this response depends largely on advance regeneration (seedling banks) to capture these gaps. Norway spruce seedlings can survive in a stunted condition for many years while retaining the ability to respond to canopy gaps (see http://www.fs.fed.us/database/feis/plants/tree/picabi/botanical_and_ecological_characteristics.html).

Some Norway spruce has regenerated simply in response to opening the canopy with either small (1/3 to ½ acre) group selection cuts or strip cuts of widths that are twice the height of the adjacent trees. Better success results, however, from deliberate scarification or other methods to reduce the litter layer. Norway spruce has been planted beneath natural hemlock stands (where hemlock woolly adelgid is killing the overstory) with some success. Regenerating Norway spruce plantations through direct planting may help reverse declining conifer cover in the wake of the hemlock woolly adelgid.

This small group selection cut regenerated primarily to black birch and vines rather than Norway spruce during the first few years after harvest. Direct planting can increase diversity in these openings.

In addition to protecting the drinking water supply through silviculture on State lands, Quabbin managers work with private landowners to build a larger landscape of working forests. Faced with high development pressure on the State's rural lands, the Division of Water Supply Protection contracted the Massachusetts Forest Stewardship Program to fund the preparation of 10-year forest management plans for private landowners on division watersheds. Participating landowners must enroll in the Stewardship Program and/or the Massachusetts property tax abatement program, both of which involve creation of a multi-resource management plan and require a commitment to its implementation. Since 1995, the division has funded 64 plans on a total of 4,556 acres at an average cost of approximately $12 per acre—a small price to pay for drinking water supply protection.

Contacts at the Quabbin Reservoir include Thom Kyker-Snowman, Natural Resource Specialist (413-784-1249, ext. 551 or thom.kyker-snowman@state.ma.us); and Bruce Spencer, Chief Forester, or Dennis Moran, Forester (978-544-6343).

[1]Palik, Brian; Zasada, John. 2003 An ecological context for regenerating multi-cohort, mixed-species red pine forests. Research Note NC–382. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 8 p. [http://www.ncrs.fs.fed.us/pubs/viewpub.asp?key=1855].

Stewardship News

Crop Tree Release Increases Growth of Mature Red Oak Sawtimber

Jeff Ward's recently published article[1] on the response of mature red oak sawtimber to crop tree release cites previous crop tree research that focused on the release of sapling or pole-sized stems. Few studies have been published on releasing mature oaks, perhaps, as Ward points out, because earlier studies show that mature trees do not respond to thinning. However, more recent studies in Connecticut, Michigan, Kentucky, West Virginia, North Carolina, Georgia, and Arkansas have shown that thinning can increase diameter growth of sawtimber oak.

The objective of Ward's study was "to determine if crop tree management would increase growth of mature oak sawtimber without a loss in bole quality." Landowners may be more receptive to crop tree management over the heavy, even-aged cutting typically required to regenerate oak. Small parcels, which are becoming more and more prevalent, are often managed for nontimber values such as recreation, wildlife management, and seclusion. However, property taxes, insurance, and other costs motivate many landowners to seek alternative income sources. Crop tree management may just fit the bill for many landowners.

Ward studied five mature red oak stands (*Quercus rubra, Q. velutina,* and *Q. coccinea*) ranging from 74 to 94 years old with mean crop tree diameters ranging from 10.9 to 15.4 inches. Crop tree thinning plots were established and growth was monitored for 6 years. Ward's major findings include the following:

- Diameter growth of released and unreleased trees for 2 years after release was not significantly different, but was significantly higher in released trees during each of the subsequent 4 years.
- Crop tree release increased diameter growth of sawtimber red oak by 53 percent.
- Growth of crop trees had not decreased, relative to control trees, 6 years after release.
- Formation of new epicormic branches on the butt log was largely limited to the slowest growing trees.

For more information, contact Jeff Ward, Station Forester, Connecticut Agricultural Experiment Station, New Haven, CT, 203-974-8495, Jeffrey.Ward@po.state.ct.us.

[1]Ward, J.S. 2002. Crop tree release increases growth of mature red oak sawtimber. Northern Journal of Applied Forestry. 19(4): 149–154. [http://www.ingenta.com/journals/browse/saf/njaf].

Forest Stewardship Program's Spatial Analysis Project

by Barbara Tormoehlen

Since its inception in 1990, the Forest Stewardship Program has been offered to landowners on a first-come, first-served basis. While this approach is customer-friendly, it fails to allow assessment of the program's full impact across the landscape.

In search of a way to examine the connectivity of stewardship tracts, target particular forest tracts, and assess the impact that stewardship plans have had on the forest resource as a whole, program managers developed the Spatial Analysis Project (SAP). Forest Service resource and GIS specialists and their counterparts in four pilot States (Connecticut, Maryland, Massachusetts, and Missouri) are utilizing spatial analysis methods and geo-referenced (GIS) data to evaluate the Forest Stewardship Program's effectiveness and position it for the future. Ultimately, the project will indicate what stewardship practices might be more effective in addressing critical needs, assess forest resource threats (insects, diseases, fire, land use change), and provide tools to enable States to focus future program efforts in

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Conserving the Ecology of Urban to Rural Watersheds in New Hampshire

Brook floater mussels; Blanding's, spotted, and wood turtles; eastern hognose snakes; and whippoorwills are but some of the wildlife species found within the Piscataquog River watershed in southern New Hampshire. Backed by funding from the USDA Forest Service, University of New Hampshire Cooperative Extension is teaming up with the Piscataquog Watershed Association to identify and map the watershed's important ecological areas, including critical wildlife habitat, rare plant or animal species, unique geologic features, wildlife corridors, and other features that contribute to the ecological health of the river. Using GIS-based watershed analyses and local expertise, project partners identify priority lands for conservation and stewardship.

Wood turtles are among the many wildlife species found in New Hampshire's Piscataquog River watershed. (photo by Mariko Yamasaki, Northeastern Research Station)

A parallel effort is underway in the Ammonoosuc watershed in northern New Hampshire, home to bald eagles, northern harriers, small-footed bats, and bobcats. The two watersheds, which encompass a continuum of urban to rural landscapes, boast active land trusts (Piscataquog Watershed Association and Ammonoosuc Conservation Trust) that can follow up with landowners and communities on the conservation plans that will be developed. Throughout the two regions, the project has generated enthusiasm among residents to learn more about their watershed's ecology and value.

These efforts are part of New Hampshire's Living Legacy Project, a public-private partnership to establish and support a well-coordinated, comprehensive system of public and private lands, with stewards dedicated to protecting the full spectrum of biological diversity in the State. The ability to achieve this goal relies in large part on the interests of landowners, communities, and land trusts working together on land conservation and stewardship. For more information, contact Karen Bennett, UNH Cooperative Extension, 603-862-4861, karen.bennett@unh.edu.

Forest Stewardship Program's Spatial Analysis Project

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addressing critical issues. While offering a standard methodology for evaluating program effectiveness, the SAP allows States to customize it according to State needs and conditions.

Current plans call for expanding the project to each of the 20 Northeastern and Midwestern States over the next 3 years, based on available funding and State interest. For more information, contact Barbara Tormoehlen, Project Coordinator, 812-277-3567, btormoehlen@fs.fed.us.

New York's Automated Data Entry System for Forest Stewardship Planning

by Eddie Bevilacqua and Christine Hopkins

To improve forest stewardship planning, the New York State Department of Environmental Conservation (DEC) is putting the final touches on a user-friendly interface that will incorporate geo-referenced spatial information on stewardship properties. The DEC currently has no standard reporting procedure, nor a standardized digital format for forest stewardship plans. This project brings the consistency needed by field foresters for developing forest stewardship plans and managing the associated data for statewide reporting.

The DEC selected the Environmental Systems Research Institute's (ESRI) ArcView™ software (version 3.2 or later) for this project since it is used in all of its regional offices. The finished product, known as the Forest Stewardship Automated Data Entry System (FSADES), was created as an ArcView 3 extension.

The FSADES offers a number of unique features:

- A customizable graphical user interface that facilitates data entry and standardizes the creation of forest stewardship plans and maps for landowners.
- A temporal dimension that enables DEC foresters to easily retrieve and query recommended stewardship activities by year and proposed activity.
- The creation of both tabular and geo-referenced (GIS) property data to streamline the process of reporting stewardship accomplishments from regional to State offices and to meet Federal requirements, as well as to conduct spatial analysis, which can display areas with stewardship plans and relates stewardship activities to specific sites or regions.

The FSADES's data entry component is based on the StewPlan software developed by Knopp and Twery[1], except that all data are stored in ArcView 3 tables for easy retrieval and analysis. Modules were also developed to facilitate the data entry and storage of the geo-referenced property and stand boundaries, either through digitizing over any digital source (e.g., digital ortho quarter-quads [DOQQ's], which are available to all DEC foresters) or by using global positioning system (GPS) coordinates obtained from the field.

The FSADES is undergoing beta testing by DEC foresters, with full implementation anticipated by summer 2004. The plan template is currently tailored to incorporate the required elements for stewardship plans as defined by the DEC (see http://www.dnr.cornell.edu/ext/stewardship/stewardship_plan_tools/plan_standards_web.htm) but can be modified to meet the required elements defined by other State agencies.

For further information, please contact Eddie Bevilacqua, SUNY College of Environmental Sciences and Forestry, 320 Bray Hall, Syracuse, NY, 13210, 315-470-6697, ebevilacqua@esf.edu.

[1]Knopp, Peter D.; Twery, Mark J. 2003. Stewplan: software for creating forest stewardship plans (Version 1.3) [Computer program]. Gen. Tech. Rep. NE–301. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 12 p. [User's manual; CD-ROM]. [http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/2003/gtrne301.pdf].

Landowner Spotlight

The Walizer's (Pennsylvania)

by Karen Sykes

Jim and Libby Walizer's forestry objectives mirror those of many private woodland owners: balance short- and long-term timber outcome with valuable wildlife habitat improvements. The Walizer's, who own multiple farm sites where they live in north-central Pennsylvania's Nittany Valley, are committed to forest stewardship plans in many of their stands.

The Walizer's took the first important step toward becoming land stewards in 1984 when they first sought the advice of a professional forester. Together, they worked to develop a forest stewardship plan that would help them reach their goals and also help their land recover from previous poor harvesting practices. A key component to their success was USDA Forest Service funding that offsets planning costs for private landowners.

On a 4-acre lot known as the "Home Lot," black cherry, one the most valuable species in Pennsylvania, flourishes after a diameter limit cut about 20 years ago. Other species, such as white oak, white pine, red maple, scarlet oak, and sassafras, also responded well to the previous harvest. In the future, the Walizer's will continue to monitor the stand for grapevine and remove vines if they threaten valuable trees. A crop tree release may also be considered later. The resident birdlife is another focus in this woodlot; a red-tailed hawk currently nests within.

The 20-acre "Dad's Lot" received a seed tree cut in 1988. The new stand approaches 30 feet tall and includes tulip poplar, black cherry, aspen, white oak, black oak, and red oak. An old honeysuckle-covered railroad bed offers the Walizer's a beautiful view of this stand.

The largest stand on the property, 42-acres known as "Den's Lot," was originally comprised of black oak, white oak, chestnut oak, white pine, tulip poplar, white ash, and others. Grapevine, fern, and deer threatened the future of the stand, so the Walizer's again sought the advice of a professional forester. Jim and his family cut all the grapevines in the winter of 1994, and sprayed the ferns with herbicides before a timber sale in 1998. Fencing the circumference of the most valuable forest stands offers the only hope against deer damage, but it is far from foolproof. As Jim described the problem during a recent property tour, a doe walked out of an adjacent cornfield, no doubt waiting for the tour to leave so she could feast on the succulent seedlings in Den's Lot.

The Walizer's are doing their small part to help restore the American chestnut. They gather seed from the few mature chestnut trees on their property and grow seedlings to give to friends for planting. They've sought advice on how to protect the seedlings from deer damage, and Jim has been experimenting with tree shelters of his own design.

Jim Walizer designed this tree shelter to protect seedlings from deer browsing.

The Walizer's also recognize their working farm's potential impact on water quality. They took the critical step to establish riparian buffers along a tributary of Little Fish Creek, which runs through the property, and provided cattle crossings for their livestock. Jim assisted with the

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The Perry's (Maryland)

by Karen Sykes

Dr. Peter and Mrs. Helen Perry of Harwood, Maryland, do all the right things as private woodland owners. After more than 25 years under their stewardship, the Perry's woodlot shines as a beautiful example of how timber harvesting can provide sustainable benefits while improving the health and quality of the residual stand.

The Perry's live on their 31-acre woodlot and put their own labor into the diverse management activities on the property. Their harvesting operation includes a modern track bulldozer with a log skidder attachment, and a heavy-duty, four-wheel drive tractor with a front-end loader. Their mill operation includes a bandsaw and planer/molder. The Perry's do some custom sawing, but the majority of milling is for family use, such as the white oak flooring that graces their home.

The large, sawtimber-size trees visible at most locations on the Perry woodlot result from silvicultural activities including salvage and improvement cutting. The Perry's also own riverfront property along the Patuxent River, where public river access is encouraged and visitors are welcome.

Mrs. Perry blends a working knowledge of the sawmill and harvesting equipment with expertise in the uses of the plants growing on their forest's floor. She picks, dries, and grounds spicebush berries for use as a seasoning. "It can be used in place of allspice," she explained. Fruits, plant parts, and a variety of berries become jams, preserves, and other seasonings. She even "tames" stinging nettle by boiling the leaves to neutralize their sting so they can be enjoyed in salads or soups.

"Everything has a use," Mrs. Perry declared during a recent tour. This seems the sentiment of the entire family in relation to their forest. It's an ethic common to all great forest stewards.

Peter Perry (left) shows his track bulldozer to State and Federal Forest Stewardship Program representatives during a recent site visit.

The Walizer's *Continued from page 6*

layout and design of the riparian buffers and secured additional Federal cost-share funds through the Conservation Reserve Enhancement Program to establish them. First, they stabilized the streambanks with live stakes composed of silky willow and silky dogwood. Then, they planted gray dogwood, red chokeberry, winterberry, green ash, sugar maple, red oak, and black locust on both sides of the stream. The riparian area was fenced to protect it from the livestock. Jim was delighted to discover that black walnut began establishing itself within the buffer.

Jim summed up the Walizer's focus on long-term goals as well as short-term benefits when he said, "My shelterwood cut is harvest for three generations. The first cut is for me, the second cut is for my sons, and 50 years from now, the third cut will be for my grandsons."

Research

Forests and Streams

by Michael Majeski

The foundation for the proper management of watersheds, riparian areas, and streams rests in knowing the dynamics of stable and unstable streams. If we understand how streams handle the energy of flowing water and sediment, we will understand how to place infrastructure, evaluate watershed condition through stream channel condition, and improve watershed function through good forest management.

Channel Function

Running water forms channels sized and shaped by flow volume, speed, and the amount of sediment carried. Like the constant movement of water, the channel itself also moves over time. It may gradually migrate across a valley floor, or make rapid, drastic changes to its course during a flood.

When stream flow enters a curve in the channel, the buildup of sediment on the slower moving inside of the bend gradually advances the bank into the channel. At the same time, the faster moving water on the outside of a bend tends to erode its bank. The channel width remains the same as it migrates across the valley bottom (floodplain).

Flat valleys or floodplains, no matter how wide, are the result of a river's migration over time. (photo by U.S. Fish and Wildlife Service)

Stream channel stability is a function of the sediment load it moves, the stream slope (manifested in velocity), and the volume of flowing water. A change in any one of these variables triggers equal adjustments in the companion variables, which then trigger changes to stream channel characteristics.

Water Yield

Watershed forestry research reveals increases in stream flow peaks after harvesting. Tree cover removal reduces leaf area and the amount of water transpired and evaporated to the atmosphere. More water reaches the ground and finds its way into streams as runoff. Increased water yield can benefit low flows, but it also can increase bankfull flows, which are the stream flow depth most responsible for channel movement across the valley bottom.

Disturbances of any kind will increase water yield, but canopy coverage must be reduced by at least 25 percent to produce detectable increases. Complete canopy removal can increase annual water yield by 40 percent and peak flows by about 20 percent. In general, snowmelt peaks increase 2 to 3 times with clear cutting, and the change may last up to 15 years. Rainfall peaks increase up to 2 times in magnitude but last only 5 to 10 years.

Converting two-thirds of a watershed to open areas (agriculture or development) and young forests (< 16 years) will double or triple bankfull flows. The impacts on bankfull flow begin in watersheds 1 square mile and larger in moraine or steep areas with slopes from 3 to 45 percent, and in watersheds 10 square miles and larger in

flat outwash or lakebed watersheds with slopes less than 3 percent.

Road systems whose total right-of-way covers 15 percent of a watershed area will also double bankfull flows. Road ditches extend the watershed stream network, allowing more water to reach the channel faster. Just as road ditches increase bankfull flows, drained land (tiled and ditched agriculture or wetland) exceeding one-third of the watershed area will double bankfull flows.

Sediment Yield

Careless logging practices, particularly poorly designed haul roads and skid trails at stream crossings, cause sediment to reach streams. Fine sand from eroding road surfaces degrades channel habitat. This occurs where the road slope approaching the channel is steep (usually more than 3 percent). Eroding sand can fill pools for ½ to 1 mile below the crossing. The critical factor in the amount of sediment reaching a stream during a harvest is not the intensity of harvest, but the care taken during logging.

Forest Management Recommendations

The key to good harvesting and forest management is to dissipate the energy of flowing water and try to move it into the ground rather than allowing it to flow over the surface to the stream channel. In mixed forested and open area landscapes, keep young forest and open areas at less than 60 percent of the watershed area to maintain current bankfull flows.

Other recommendations include:

- Keep drainage networks at less than one-third of the watershed area and ditched roads at less than 15 percent of the basin.
- Where road approaches to the crossing are long, use ditch turnouts that channel water to the forest floor.
- Design road or skid trail approaches with an up-slope as they reach a stream. If you must downslope, add ½ to 1½ inches crushed rock (limestone or igneous) on the approach.
- Match culvert width to bankfull stream width. The culvert should be able to pass anything the stream can carry. Use multiple culverts if needed. Provide fish passage by digging in a 2–3 foot culvert about 1 foot below the stream riffle. Dig in larger culverts 1½ feet below the stream riffle.
- Consider bottomless culverts—arches that keep the stream bottom natural for aquatic organism and fish passage.

For more information, see the following references.

Palone, Roxane S.; Todd, Albert H. 1997. Chesapeake Bay riparian handbook: a guide for establishing and maintaining riparian forest buffers. NA–TP–02–97. Radnor, PA: U.S. Department of Agriculture, Northeastern Area State and Private Forestry. [pagination not continuous]. [http://www.chesapeakebay.net/pubs/subcommittee/nsc/forest/handbook.htm]

University of Wisconsin-Extension. 2003. Fish friendly culverts: proper design, installation, and maintenance can protect both roadways and fish. Factsheet. Madison, WI. 8 p. [http://clean-water.uwex.edu/pubs/culverts/fishfriendlyculverts.pdf].

Verry, Elon S.; Hornbeck, James W.; Dolloff, C. Andrew, eds. 2000. Riparian management in forests of the continental Eastern United States. Boca Raton, FL: Lewis Publishers. 402 p.

How Are We Doing?

We designed this newsletter to offer natural resource professionals, consultant foresters, and landowners insight into the concept of stewardship through articles on topics such as silviculture, biodiversity, wildlife, recreation, and related research. Let us know how we can serve you better! We invite your input on changes, improvements, and additions, as well as suggestions for article topics or details on upcoming meetings or conferences. Please send you comments to:

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Naturalist's Corner

King Bolete

By Roger Monthey

One of the most delectable mushrooms I have ever tasted is the king bolete (*Boletus edulis*). The "king" grows especially well in conifers but is also found in hardwoods, woodland edges, and even on tree-studded lawns (it is mycorrhizal and lives symbiotically in association with tree roots). Last summer's muggy, rainy weather contributed to an apparently large fruiting in the Northeast. Finding edible specimens can be a challenge as they tend to become maggot-infested (unless you want to sample some exotic protein!), but I was fortunate enough to collect the pictured specimen in mid-August.

King Bolete (*Boletus edulis*) (photo by Kenneth Dudzik, Northeastern Research Station)

According to David Arora, author of *Mushrooms Demystified*[1], "If any mushroom deserves the dubious title of 'king,' this is the one. It is a consummate creation, the peerless epitome of earthbound substance, a bald bulbous pillar of thick white flesh—the one aristocrat the peasant can eat!" (p. 530). To prepare the king, cut the stalk and cap into small slices and sauté in olive oil, butter, or margarine. Arora further states that the boletes, which include many other species in addition to the king, are one of the safest groups to eat. These substantial mushrooms attain their greatest diversity in eastern forests, including coniferous and hardwood stands.

The king bolete has pores rather than gills, with a cap 8–30 cm broad or more. The cap color is variable—biscuit-brown or warm brown to yellow-brown, cinnamon-brown, reddish-brown, or dark red. The flesh is thick, firm, and white, or sometimes tinged with yellow or red as it ages. The pores are white initially, then become yellow, olive-yellow, or brown.

[1]Arora, David. 1986. Mushrooms demystified: a comprehensive guide to the fleshy fungi. 2nd ed. Berkeley, CA: Ten Speed Press. 959 p. [Check with your local library or bookstore].

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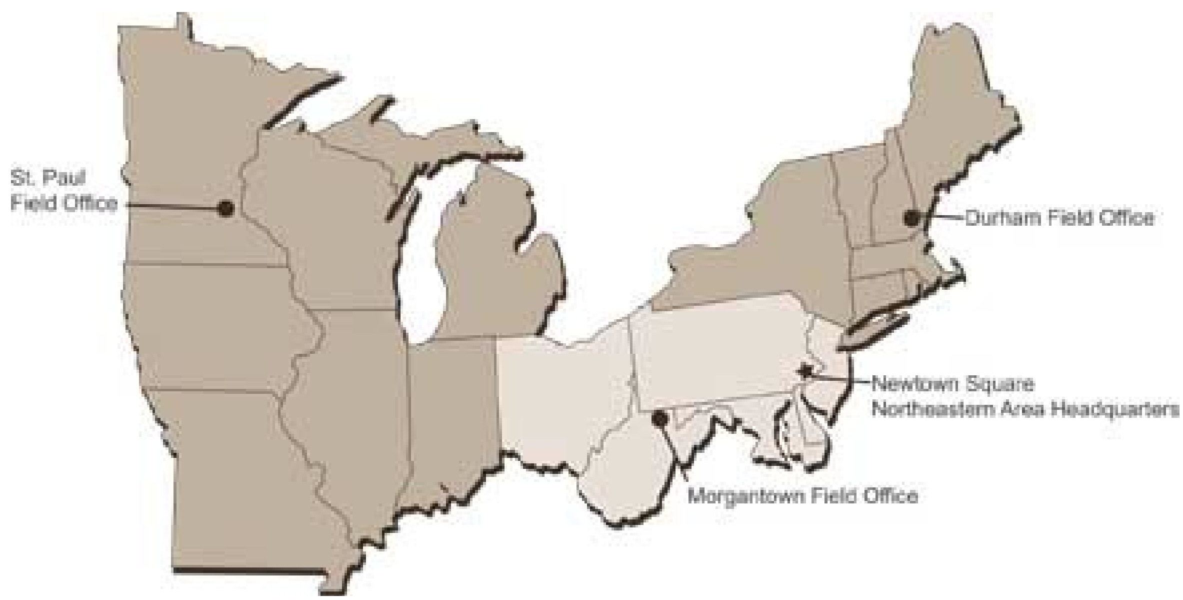

Northeastern Area State and Private Forestry