

FOREST STEWARDSHIP PLAN

for the



Town Forest Property

184 Groton Road
Hebron, NH
Grafton County



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INTRODUCTION

This forest stewardship plan has been developed to NH Current Use Assessment Documented Stewardship and Tree Farm Program standards. The original plan was developed by FORECO in 2011 and is being updated to capture evolving forest, environmental and regulatory conditions, and landowner objectives. The property comprising approximately 449.4 acres was acquired in 2006 by the Town of Hebron from the Alan E. Esty Revocable Trust and is overseen by the Select Board and Town Conservation Commission. It has a narrow strip of road frontage on the Hebron-Groton Road for access to the property and trail-head parking. There is water frontage on Spectacle Pond and the Cockermouth River. Topography on the property is extremely varied ranging from gentle slopes to areas that are very steep and rocky with large boulders and ledge outcrops.

A Conservation Easement on the property is held by the Society for the Protection of New Hampshire Forests (SPNHF). The easement appears to be a standard SPNHF easement and meshes well with the management goals and objectives of the Town. The Town reserved the right to withdraw from the use limitations of Section 2 of the easement an area of about 8 acres for the purpose of constructing and maintaining a municipal outdoor recreational facility. In 2010 the Town formally withdrew 10.506 acres located at the southern end of the property encompassing most of the field area along with some woodland. Although this withdrawal area is released from the use limitations outlined in Section 2 of the easement, it remains subject to the other terms and restrictions of the easement. The easement is available for review on the Town's website or can be viewed at the Grafton County Registry of Deeds.

PROPERTY INFORMATION

TAX MAP PARCELS: Map 14 Parcels 2, 5 & 6; Map 24 Parcels 1, 2, 9, 14, 15 & 18

DEED: Book 3295 Page 592, 6/20/2006 from Alan E. Esty Revocable Trust

ACREAGE: Approximately 449.4 acres

PLAN: Compilation Plan for Alan E. Esty, Hebron-Groton Road, Spectacle Pond Area, Hebron, N.H., Prepared 1993-1995 by Barnard Survey Assoc. Inc. (not a formal survey, not recorded)

CONSERVATION EASEMENT DEED: Book 3441 Page 529, 8/15/2007 to Society for the Protection of New Hampshire Forests

CONSERVATION EASEMENT WITHDRAWAL: Book 3722 Page 415, 8/12/2010; re-recorded Book 3730 Page 401; 10.506 acres withdrawn

CONSERVATION EASEMENT WITHDRAWAL PLAN: Plan #13768

LANDOWNER GOALS AND OBJECTIVES

The goals and objectives for the property have been established by the Town and are also outlined in the conservation easement:

- Protection of water quality, wetlands and riparian zones, especially that of the Cockermouth River and Spectacle Pond;
- Conservation of natural habitats and native plant and animal species;
- Protection of unique or fragile natural areas;
- Protection of unique historic and cultural features;
- Provide for outdoor recreation by and/or the education of the general public;
- Conservation of scenic quality;
- Maintenance of soil productivity;
- Maintenance or improvement of the overall quality of forest products and wildlife habitat;
- Perform management activities according to generally accepted best management practices for long-term sustainable management;
- Generate some income from timber harvesting to help offset ownership and management costs and to implement recreational and wildlife habitat improvements.

PLANNING PROCESS

In 2005, Forest Resource Consultants (FORECO) performed a timber inventory of the property for property appraisal purposes, measuring 57 sample plots across the property using a 15 basal area factor prism. The plots were located on transect lines that were laid out using a handheld compass and string box. A map of the property including physical features and boundary evidence was developed at that time. A revised version of the original map is included in this plan. Revisions are based on recent field reconnaissance in which changing conditions and new observations were noted. During the 2005 inventory, trees 4 inches and larger in diameter at breast height (DBH or 4.5 feet above ground) were measured at each sample plot to determine stocking (density), species and timber volumes by forest product. The data was processed using the MULTICRUISE timber inventory program to produce the timber data presented in the original plan.

The timber inventory and map were originally created prior to the purchase of the property as part of an appraisal for the Town. FORECO was hired by the Select Board in 2010 after the Town purchased the property to draft a forest stewardship plan and to formulate a schedule of operations for timber harvesting, forestry-based property maintenance, and wildlife habitat improvement.

More recently, FORECO staff met with town officials to discuss updating the existing Forest Stewardship Plan. There were numerous reasons to update the plan, including the incorporation of the findings of the 2011 Rapid Ecological Assessment (REA) conducted by Rick Van de Poll. This, along with other items to be addressed in the update are as follows:

- Detailed review and analysis of two Rapid Ecological Assessments conducted for the Town by Dr. Rick Van de Poll. Incorporate his recommendations into the Forest Stewardship Plan as appropriate.

- Perform a NH Natural Heritage Bureau data check for new occurrences of threatened or endangered species or rare natural communities.
- Obtain updated NH Fish and Game Department Wildlife Action Plan data.
- Utilize the new Dirt to Trees to Wildlife computer analysis tool to analyze the relationships between soils, forest types and wildlife habitat to aid in management recommendations.
- Obtain completed hiking trail location and boundary marking information from the Hebron Conservation Commission. Collect GPS trail locations if not already done by the CC.
- Field evaluation of forest stands to update forest stand conditions and treatment recommendations.
- Update/determine logging road and log landing needs and locations.
- Update/determine main logging skid trail needs and locations to minimize impacts to hiking trails.
- Update the written Forest Stewardship Plan and Forest Type Map based on the above and develop a revised management activity schedule.
- Develop timber harvesting revenue estimates for any anticipated harvest(s).
- If desired, conduct one public session, either to solicit public input for management goals and objectives during the update process, or an informational meeting to present the completed Plan update prior to implementation.

A copy of the REA is available for review on the Town of Hebron's website.

Since no timber harvesting activity occurred after the development of the 2010 plan, it was decided to utilize the 2005 inventory data and not perform a new inventory.

HISTORY

This property is typical of most tracts in this region. A portion of the property was likely cleared for agricultural use by the early settlers. The steeper, rocky areas were probably used as pastureland for livestock such as cattle, horses and sheep, while the more arable and gently sloped soils were likely used to cultivate hay and other crops. Slowly, the fields of New Hampshire were abandoned beginning in the mid 1800's when many changes were occurring in American history. Many inhabitants of New Hampshire left the state to farm the deeper soils of the Midwest and many families lost the labor needed to run their farms during the Civil War. Whole families left to begin new lives in the cities during the industrial revolution. The least productive land that was furthest from the dwellings was abandoned first. Gradually, as agriculture continued to decline, additional acreage was abandoned closer and closer to the farm buildings.

The Town of Hebron acquired the property in 2006 as a Town Forest. Stone walls and barbed wire fence make up portions of the boundary in the southern half of the property indicating that this area was more intensely used for agriculture. There is still a 7-acre field located at the southern end of the property near the Cockermonth River that is actively hayed or mowed and was more than likely utilized for many years as part of a nearby dairy farm. Stone walls indicate that it is very likely that the inhabitants of the nearby farms grew potatoes in the fields as there are many "potato-sized"

rocks in the walls and stone dumps on the edges of the fields. Much of the northern boundary of the property is not made up of stone walls or barbed wire fence indicating it may have been part of a larger property at one time or was too steep and rocky to have organized pastures on it and likely the livestock were allowed to roam free. The property is made up of different parcels that were acquired by the previous owner over a 30-to-40-year period. The previous owner acquired parcels as they became available for sale from different landowners. These lots ranged in size from over 150 acres to as small as 35 acres. Much of the property has received timber harvesting over the years by prior owners. Most recently it appears that there were some scattered light harvests on the property during the 1970s and 1980s, and due to this type of harvesting many portions of the property are now well stocked with mature and overmature timber.

ECOSYSTEM MANAGEMENT/ADJACENT PROPERTIES

The term “ecosystem management” generally includes the following principles: the maintenance of native ecosystem types and ecological processes through natural or human means; the maintenance of viable populations of native flora and fauna and their habitats; to sustain the evolutionary potential of species and ecosystems; to sustain soil productivity and water quality to support the above; and to accommodate human use as part of the ecosystem. From a timber management standpoint, another principle includes the production of forest products in a sustainable manner over the long term. These principles encourage forest managers to look beyond the boundaries of an individual property, to look at the "big picture" of an ecosystem at the landscape level, and to try to coordinate management activities over greater land areas.

Hebron is in an area of the state which is mostly forested. Most of the development, both residential and commercial, is located close to roads leaving large areas of forestland undeveloped. Except for somewhat recent smaller lot development along Groton Road and the small camp lots along the shore of Spectacle Pond, nearby landowners have contiguous holdings ranging from 30 acres to several thousand acres. Of particular importance, especially for wildlife habitat, is the 1,000 + acres of the Flint Memorial and Cockermouth Forests owned by the Society for the Protection of NH Forests, almost 7,000 acres owned by Green Acre Woodlands, Inc., and 272 acres owned by the Hazelton family. The majority of these properties are protected by virtue of their ownership or by conservation easements, and are being managed for sustainable forestry, wildlife habitat and recreation. While there are no cross-boundary management agreements in place, the landowners and forest management professionals involved often communicate with each other on common management goals and activities.

As this property straddles a ridge it provides a very important wildlife corridor that begins at the Cockermouth River and runs up the ridge that leads to Mount Crosby. It is important to keep in mind while conducting any timber harvesting or recreational activities that a buffer in the hemlock area along the main brook is very important for wildlife cover and travel.

In 2010 and 2011, the Town of Hebron engaged Dr. Rick Van de Poll of Ecosystem Management Consultants to perform a Rapid Ecological Assessment (REA) of the property. In his assessment, he identified elements making up the ecological diversity of the forest. These elements include but are not necessarily limited to the following: soil conditions, water resources, natural communities,

wildlife habitats and species presence, significant ecological areas (SEA), and recreation. He noted that about 18% of the property are in SEAs, and most of those are located in the northern portion of the property. He provided conclusions and recommendations that include:

- Zone management to protect significant ecological areas;
- Preserve the highest quality ecological habitats;
- Maintain the most sensitive sites as off limits to trails and active management;
- Maintain adequate timber harvesting buffers along the Cockermouth River, main beaver wetland, and Spectacle Pond;
- Carefully balance the temporary and permanent impacts of access for timber management.

These recommendations have been taken into consideration and incorporated in the updating of this forest stewardship plan.

THREATENED AND ENDANGERED SPECIES

A recent data check with the NH Natural Heritage Bureau (NHB) revealed the presence of Wood Turtles, *Glyptemys insculpta*, as recently as 2015 on the property in the area along the river in Stand 9 and field OP1. As the data check covers an area within one mile of the property, the report appears to include multiple sites in this area, but the map does indicate presence in Stands 9 and OP1. This species is not a federally listed endangered species, however it is a species of special concern in NH with a rating of S3, (S depicting “State) which is rare or uncommon. Globally it has a G3 rating (G depicting “Global”) which is also rare or uncommon. The “3” in these ratings indicates a rating of 1 to 5, the likelihood of the species being imperiled, with 1 being the most likely and 5 being the least. From a forest and wildlife management standpoint, activities should be limited or modified to help protect this species. The habitat opportunities for a species such as this was identified and noted in the REA conducted by Van de Poll in 2011.

Because of low population numbers and the number of years it takes to reach mating age among other things, the loss of adult turtles can have a great impact on their population. The wood turtle is found in slow moving streams and rivers with sandy bottoms, such as the Cockermouth River. Of high importance is the fact they make extensive use of floodplains, meadows, fields, and woodland with dense ground vegetation during the summer and lay their eggs in sandy upland areas. Management measures can be followed to reduce the impact on wood turtles. Extra care should be exercised when mowing the field area in the event a turtle has wandered into it. As with nesting birds, mowing the field area as late as possible in the summer or preferable in late fall will help avoid impacts to turtles. If mowing prior to October when turtles spend more time in the river, raising the mowing deck on the mower is a measure that can be taken to protect nests and individuals by allowing the mower to pass over them as opposed to being lower and potentially destroying them.

A Wood Turtle fact sheet from the NH Wildlife Action Plan can be found in the Appendix detailing its habitats and protection. The NH Wildlife Action Plan’s website can be found on the internet at:

- <https://www.wildlife.state.nh.us/wildlife/wap.html>

In addition to Wood Turtles on the property, the NHB data check also revealed within a one-mile radius of the property other known Wood Turtle sites, as well as the presence of Common Loon, *Gavia immer*, and Thin Leaved Sedge, *Carex cephapoides*. Though these are not on the property, they are in the vicinity and eyes and ears should always be on the lookout for these as well as other rare plant and animal species. Common Loon might be found on Spectacle Pond, but without any islands for protected nesting from predators, successful nesting is likely limited. Other than hiking trails, no management activities are recommended near the Pond.

INVASIVE SPECIES

Invasives can appear at any time and should be eradicated immediately as they can spread rapidly by various means such as mammals, birds, equipment transportation, roadside mowing and even via streams and rivers. For example, seeds from Japanese Knotweed can be stripped from the stem during a period of high water and transported downstream. Once deposited further downstream, they will eventually take root and spread from that location as well.

The property was checked using the NH GRANIT GIS system's Invasive Plant Management Priority Areas layer. A copy of the resulting map can be found in the Appendix of this plan. It identifies areas of high concern regarding the establishment of invasive plant species. These priority designations do not necessarily mean an invasive occurrence has been reported, but flags them as areas of high concern and potential for establishment. In general, the GRANIT layer shows the property classified as low priority for invasives with the exception of areas around wetland/swamps, Spectacle Pond, and along the Cockermouth River and the associated fields.

The 2010 forest stewardship plan and the Van de Poll ecological assessment did not specifically address invasive species. However, it was noted during the reconnaissance visits for this plan update that invasive plant species are present and are isolated so far in the floodplain area near the Cockermouth River and along the access road from the parking area to the bridge on the River. Species observed were Japanese Barberry, Oriental Bittersweet and Virginia Creeper. Although Virginia Creeper is technically not a true invasive, it should be treated as one since it can spread rapidly, overtake an area and choke out other native species. Some of these invasives are known to the Town and its Conservation Commission and they have been working at eradicating them.

Eradicating invasive species can prove to be very difficult. Some management activities should also not be conducted near infested areas to limit their growth and spread. They can be controlled with chemical herbicides, or if organic methods are desired, they may be pulled by hand and disposed of properly. Pulling sometimes leaves roots and other plant material behind which may then resprout. Regular inspections and follow up treatments are recommended. Consultation with the USDA Natural Resource Conservation Service (NRCS) and/or UNH Cooperative Extension can also be helpful. More information and helpful resources regarding the identification, treatment, and eradication of invasive species commonly found in New Hampshire can be found at the following links:

- <https://www.nashuarpc.org/files/7113/9334/6257/invasiveplants.pdf>
- <https://www.nrcs.usda.gov/wps/portal/nrcs/main/nh/technical/ecoscience/invasive>

- <https://www.invasive.org/species/list.cfm?id=53>
- <https://extension.unh.edu/natural-resources/forests-trees/invasive-species>

If a timber harvest, excavation project, mowing or any management activity involving equipment is planned on the property, knowing where that equipment has been and where it has worked is a good first line of defense to combating invasives. Careful inspection of equipment, and sometimes pressure washing to remove seeds and plant material from invasive species potentially residing on it, can be another precaution taken to help control the spread of invasives.

WILDLIFE RESOURCES

A wide variety of wildlife species inhabit the forests of New Hampshire. Each species has its own habitat requirements, which often change from season to season or during different portions of its life cycle. Thus, no area of forest can always support all native wildlife species. Large mammals such as bear, moose and deer require large areas of habitat, each with its own needs for food and shelter. Smaller species usually require smaller habitat areas, but likewise often need a variety of habitats within that area to support its needs. Migratory birds are here for only part of the year, but also have specific needs. One goal of wildlife habitat management is to provide as many varied habitats and food sources as possible for the greatest number of species. Any change in forest habitat or manipulation may be beneficial for some species, while being detrimental to others, at least for some time until the forest or fields change or grow.



Bear clawed beech in stand 7; important for wildlife as mast tree

This property contains many types of wildlife habitats. These include marshy wetlands, wet soils, vernal pools, multiple streams and a river, ledges, rock outcrops, dry ridges, mast areas, softwood and hardwood forests, and open/grassy vegetation (fields and landings). Many different animal signs have been observed across the property including ruffed grouse, whitetail deer, moose, pine marten, snowshoe hare, bear, owls, small rodents and many songbirds. The REA describes wildlife habitats, natural communities, and wildlife species found or likely to be found on the property.

Openings and River Corridor:

The seven-acre field OP1 that is near the river is being maintained as an open, grassy habitat through mowing/brush hogging. As with forest habitat management, vertical diversity is important, and having a diversity of vegetation heights in this field would be beneficial. It is recommended to break up the mowing of this field into thirds. Mow a one third “block” of 2 or so acres each year on a rotating schedule so that each “block” is mowed once every three years. Establishing a rotating/staggered mowing schedule in this fashion creates a diversity of three different vegetation heights important to different species of birds and small mammals. Besides vegetation height, this regime encourages different species of forbs to grow as opposed to just grasses. The Meadow Walk Trail and the path to

the picnic table can be mowed each year to keep the grass short to help minimize the amount of ticks picked up by visitors. It is also important that mowing take place after August 1st so any ground nesting birds are not disturbed before their young fledge from their nests. As mentioned under Threatened and Endangered Species, wood turtles also likely make use of this field. Thus, mowing should be delayed as late as possible, perhaps to October when turtles make more use of the river than upland areas. And raising the mowing deck to mow higher is also a partial safeguard for turtles that may be in the field. There are several spots where the field comes close to the river. It would be beneficial to protect the riverbank, and to provide a wildlife travel corridor and hiding/nesting cover, to refrain from mowing a strip parallel to the river that can grow into shrub vegetation instead of grasses and forbs.

There is a global concern about decreasing populations of pollinators. Field OP1 provides an opportunity to establish one or more small “pollinator plots” of flowering plants that attract and feed pollinators. There are specific techniques to prepare, seed and maintain these plots, as the goal is to eliminate the existing grasses and forbs that would compete with the desired pollinator plant species. There are a number of suppliers of seed mixes for pollinator plots, and a soil test is sometimes helpful to determine the best species mix. Information and advice can be obtained from USDA-NRCS, UNH Cooperative Extension or the Xerces Society.

Field OP1 also provides an opportunity to plant fruit bearing trees and shrubs for wildlife. Many nurseries supply planting stock, including the NH State Forest Nursery. It’s important to select native, non-invasive species.

Field OP1 is also likely being used as a singing ground for woodcock in the spring. Woodcock is a state species of concern. It is important to maintain this opening to encourage this to continue by keeping the opening the same size and removing some of the larger trees on the edge of the opening to give woodcock enough room to perform their courtship flights. The opening should be twice as wide as the nearest trees are tall - if the nearby white pine trees are 100’ tall, the opening should be a minimum of 200’ wide. This provides the male woodcock enough room to make their spiral flight without fear of hitting nearby trees. Another technique for woodcock habitat is to occasionally “scuff” or scarify the ground with the mower deck or tractor bucket to expose some patches of soil. Woodcock, as well as ruffed grouse and some other species, also benefit from dense thickets of saplings and shrubs, known as early successional habitat, adjacent to openings for hiding, nesting and raising their young. This can be accomplished by creating small (perhaps 1 acre) patch clearcuts staggered over time along portions of the east and north edges of field OP1. These patches could be established initially by a timber harvest. New patches could be created in different locations over time perhaps 20 years apart, starting over again when the trees in the first patch mature or reach a merchantable size. An option to a timber harvest if the vegetation is small or not merchantable would be the use of a forestry mulching machine, sometimes called a “brontosaurus” (excavator style mulcher), ASV (rubber tracked skid-steer mulcher), or similar mulching machine. Patches could be created along the northwest side of the field in hardwood Stand 6, or along the eastern edge of the field in Stand 9. This portion of Stand 9 contains low quality “pasture” or “wolf” white pine and would be an opportune place for such patches. A patch could also extend to Wetland W6, which might encourage the growth of alder which is a preferred species for woodcock.

Van de Poll notes in the REA the importance of the forest-shrub strip along the river in the floodplain area within Stand 9. Except for invasive species control, no management activities are

recommended in that strip. As mentioned above, it would be beneficial to establish more of this vegetated strip in the areas where field OP1 comes closest to the river by discontinuing mowing the field in this strip.

There are some wild apple trees near the field and river primarily in Stand 9 and these trees are extremely valuable for wildlife. Apples are one of the most important sources of food for wildlife from deer and bear to turkey and small rodents. To protect these trees, they should be identified and protected during any timber harvesting or other management activity and should be maintained by keeping them released from overstory trees and ideally pruned on a two-to-four-year rotation.

Field OP2 is small and well uphill from the river floodplain and likely receives no turtle use. The hiking and snowmobile trails also run through it. Thus, it can be mowed annually to keep it in a grassy habitat state.

Log landings can also be maintained in an open state for wildlife habitat diversity, as well as to control woody vegetation for future landing use. Brush hogging the landing every 2 to 3 years would accomplish this goal and can be scheduled with the field mowing.

Dirt to Trees to Wildlife Analysis:

The property was analyzed using the Dirt to Trees to Wildlife (DTW) analysis program. DTW Mapper is an online tool that facilitates exploration of the relationships between soils, forests, and wildlife.

The DTW Mapper analyzes the soils in each project Area of Interest (AOI), such as an entire woodlot or individual forest stand(s), to identify potential forest types expected to occur within each soil type. Forest types are then related to preferred habitat for New England wildlife and lists of those wildlife species are provided. DTW identifies potential forest types based on characteristics of the underlying soils. Over 1,400 distinct soils are grouped based on common characteristics that determine what vegetation grows on them. These soil groups are related to 18 forest types and three non-forest types. For ease of conversation, we refer to all 21 types as “forest types”. Since each forest type provides specific habitat needs, wildlife species that prefer a given forest type for breeding have been determined. Breeding habitats of 330 wildlife species are included.

Through DTW Mapper, reports are generated allowing for a comparison of an existing forest type with potential forest types based on soils. Recommended forest management practices are provided for each forest type along with a list of wildlife species that use each forest type for breeding. Species of Greatest Conservation Need (SGCN) as identified in at least one New England State Wildlife Action Plan are identified by forest type, and recommended practices for each are available.

The Atlantic Coast Joint Venture (ACJV) set common goals for bird conservation in the Atlantic Flyway. ACJV has grouped much of the North American Atlantic Coast into Bird Conservation Regions (BCR). These BCRs are considered by most biologists as a standard foundation for wildlife conservation work. The DTW tool covers Bird Conservation Region 14 (BCR14), which includes lands from northwestern Connecticut to the Gulf of St. Lawrence. The only portion of New Hampshire that does not fall within BCR14 is its coastal area.

The Technical Guide to Forest Wildlife Habitat Management in New England (DeGraaf et.al, 2007)

lists 330 wildlife species applicable to BCR14. This list varies from salamanders to moose and everything in between. Over 90 of these have been identified as Species of Greatest Conservation Need (SGCN) in one or more of the Wildlife Action Plans in the New England states. Each of these species show breeding preference for one or more of 21 forest types that are incorporated in this tool. Each wildlife species is assigned to the forest type(s) it prefers for breeding. It is recognized that some wildlife species may use other types for breeding, but this tool intends to identify the most important ones.

Recommendations are provided for each of the 90 plus SGCNs. In some cases, such as woodcock, golden-winged warbler, bald eagle and New England cottontail, the recommendations were developed by working groups. However, for most of these species, recommendations were developed based on the best available knowledge by individuals working on DTW. These recommended practices are basic, and the expectation is to improve them as knowledge of the special habitat requirements for each SGCN species changes.

The DTW analysis shows 56% of the property is composed of Beckett soil with associations of Tunbridge, Monadnock or Lyman compositions (some with rock outcrops), which translate to Dry Compact Till; and 28% being Tunbridge Lyman Rock Outcrop, which translates to Shallow to Bedrock, Loose Rocks or Ledge Outcrops (see the attached map and stand report). Forest types that have the potential for being on these soil groups is a mix of species ranging from aspen, birch, northern hardwoods, hemlock and pine to spruce and fir in higher elevations. Existing conditions reflect these scenarios almost perfectly.

The main broad cover types the DTW analysis associates on the property based on soils data are as follows: hemlock; pine/oak/maple; spruce-fir; northern red oak; red maple; non-forested upland and non-forest palustrine. Lists of wildlife species that prefer each of these are provided in the attached report found in the Appendix. Each list further identifies any “Species of Greatest Conservation Need” that might occur in the selected type. Suggested management practices can be provided for each of those species and general management strategies are provided for each of the listed forest types. See the attached report in the Appendix for details.

The NH Natural Heritage Bureau data check did not report any bat hibernacula in this vicinity, but bats may be present and forest management activities could impact them. Six out of the nine species of bats in BCR14 are non-migratory and their populations are being severely impacted by a disease known as White Nose Syndrome (WNS). BCR 14 is in the middle of the WNS Zone as delineated by the U.S. Fish and Wildlife Service. Two of these non-migratory species have Federal status under the Endangered Species Act. The Indiana bat and northern long-eared bat (NLB) are listed as endangered. The other four could possibly become listed federally and are listed in several states within BCR 14. The Indiana bat is, at present, confined to the Champlain Valley in Vermont. The northern long-eared bat, however, is present throughout BCR 14. The other species are also present across BCR14, with migratory bats hibernating outside of BCR 14. Bats feed on insects captured over forested canopies, wetlands, water bodies and non-forested openings such as fields. Most roost in hollow trees, under shaggy bark, by hanging on tree branches, or in buildings. They are not fussy about which forest type they hunt over or through, and do not seem to be very selective about where they roost, although some like it warmer than others.

Acoustic surveys can be performed to detect the presence of bats and even which species may be

present, but these surveys can be very expensive. The USFWS has not published formal forest management guidelines for NLB, but general guidelines do exist for other bats, and the former “4d Rule” when NLB was listed as threatened provides some guidance. With no hibernaculum present, the two basic guidelines for bats are 1) to conduct timber harvesting in the winter to avoid the roosting and rearing season, and 2) to retain an adequate amount of roost trees or potential roost trees (trees with holes, cavities, shaggy bark).

NH Wildlife Action Plan:

The 2015 NH Wildlife Action Plan (WAP) is a blueprint for conserving Species of Greatest Conservation Need (SGCN) and their habitats in New Hampshire. New Hampshire's plan identifies 169 SGCN, which represent a broad array of wildlife, and focuses on the 27 habitats that support these species, such as lowland spruce-fir forest, salt marsh, shrublands, warm water lakes and ponds, vernal pools, and many others. Each SGCN and habitat has an individual profile that includes information about the population, threats, and actions needed to conserve these features in New Hampshire¹. The WAP not only identifies these habitat types, but also ranks them in terms of availability at the regional level as well as at the state level.

The WAP data layer revealed that most of the property is made up of the Hemlock-Hardwood-Pine habitat cover type, which is in concert and accurate according to field observations and other data. Other cover types identified by the WAP are the two major wetland features which show as Northern Swamp, Cliff and Talus Slope, Rock Ridge, Grassland and Appalachian Oak Pine.

Regarding wildlife habitat availability ranking, the NH WAP basically identifies most of the property as the Highest Ranked Habitat for NH, with the ledge outcrop and steep rocky areas being the Highest Ranked Habitat for the region.

Smaller scattered areas are classified as being in the “Supporting Landscape or Other” category, meaning there is little or no concern regarding its overall availability in this biological region. The areas classified as Highest Ranked for New Hampshire mean the habitat availability of this type may be somewhat limited at the state-wide level, and the Highest Ranked in region means the habitat is limited at a regional/local level rather than state-wide. Because of the statewide scope of the WAP, it is somewhat general in nature. The REA performed by Van de Poll is specific to this property and is a more intensive assessment. However, the two coincide well in terms of identifying significant habitats, and the WAP provides a comparison of this property to habitat rankings region and statewide.

WAP maps are included in the Appendix along with the DTW information. For more detailed information regarding the Wildlife Action plan, one can visit the website at:

- <https://www.wildlife.nh.gov/wildlife-and-habitat/nh-wildlife-action-plan>

¹ Excerpt taken from the NH Wildlife Action Plan webpage found at <https://www.wildlife.nh.gov/wildlife-and-habitat/nh-wildlife-action-plan>

General Recommendations for Wildlife Habitat Improvement:

Below are some general recommendations to be considered in managing the property for wildlife habitat in concert with forest management activities. These recommendations are based on field observations, timber inventory data and the DTW analysis recommendations for the main cover types on the property:

- 1) Forest cover types – maintain existing types but strive for more northern hardwoods in hardwood areas and regeneration of hemlock and white pine where present. Use even aged management techniques. A three stage shelterwood system would be most desirable.
- 2) If beech regeneration is not of concern, consider group selections and individual tree removals as the harvest method in commercial harvests. Consider keeping groups small, perhaps less than 2 acres in size. Groups of this size may allow more northern hardwoods and aspen to regenerate. Consider 15 years between entries. If beech regeneration is of concern and appears to proliferate, to deter shade tolerant beech establishment consider increasing the size of these groups/patches to 5 acres, or use shelterwood, seed tree or similar harvest methods. Research at the USDA-FS Bartlett NH Experimental Station suggests that larger groups are more likely to attract migratory bird species more successfully than smaller ones.
- 3) Size classes – establish some 0 to 10 year old age class (early successional habitat) on 10% of the property. This can be accomplished by incorporating group selections and patch cuts as described above in a commercial harvest. This creates habitat required by certain species, habitat diversity, and browse for species such as moose and deer.
- 4) If commercial harvests aren't viable, use non-commercial (brontosaurus, brush hog or other methods) to attain the desired 10 percent area in the 0 to 10 year old age class. The focus for these can be in areas of low quality, low value timber.
- 5) Maintain permanent openings on a three-year mowing schedule or rotation. Mow in the fall only.
- 6) Winter harvesting is suggested to avoid possible conflicts with nesting bird species and bat roosting. This is a general recommendation and may conflict with performing regeneration rehabilitation treatments, and some silvicultural practices require some soil scarification for desirable species regeneration. Winter harvesting may also encourage more stump and root sprouting of beech. Beech root sucker and/or stump sprout more vigorously when cut during the winter dormancy months. Stored energy emerges from the root systems and harvested stumps creating numerous new seedlings.
- 7) Using non-whole tree harvest techniques, if available, will provide some winter food for deer and summer cover for ground nesting species by leaving residual tops and limbs in the woods. A whole tree system is feasible provided some tops remain in the woods to accomplish the same habitat objectives.
- 8) Increase overall rotation age (150+ yrs.) with entries around every 20 years as suggested by DTW recommendations. Consider allowing 10% to go beyond this suggested increase.

WATER RESOURCES

Sedimentation from soil erosion can cover and kill small water organisms and eggs, as well as deplete dissolved oxygen needed for aquatic life. Forest management activities should at minimum follow the "NH Best Management Practices for Erosion Control on Timber Harvesting Operations" and the guidelines set forth in "Good Forestry in the Granite State." Good Forestry in the Granite State (GFGS) is a guide that provides landowners and forestry professionals with practical recommendations and information on a wide variety of forest resources. It is important to note these are recommendations only and many meet or in most cases, exceed local laws and Best Management Practices. The publication can be found at this link for details and more information; <https://extension.unh.edu/goodforestry/index.htm>.

Skid trail stream crossings should be kept to a minimum, and proper crossing structures used to ensure water quality is maintained and sedimentation is avoided. Logging on frozen or snow-covered ground also minimizes ground disturbance and possible soil erosion (but sometimes may not meet silvicultural needs for seed germination on disturbed soil). Skid trails should be located to maintain an acceptable buffer or filter zone along streams, wetlands and vernal pools. Skid trails and landings should be water barred or smoothed and critical areas seeded after use to stabilize the surface and prevent erosion.

There are several water resources found within the property with the most noteworthy feature being the Cockermouth River with over 5,000 feet of frontage. Being a 4th order stream, it is an important



View of the Cockermouth River from the bridge at the entrance to the property

area to protect. The legal buffer for forest management activities under the Basal Area law (RSA 227-J:9) on this size of stream is 150 feet when conducting forest management activities. Within this buffer, harvesting is allowed, though restricted to a maximum removal of 50% of the basal area leaving a well distributed stand of healthy, growing trees. GFGS recommends a 300 ft. riparian management zone (RMZ) with a 25 ft. "no harvest" zone along a 4th order stream. Given the nature of the topography and the steep slopes along the river, it is likely the recommended buffer would be accomplished by default.

Spectacle Pond is about 50 acres in size, and the Town Forest has a total of about 725' of frontage in two sections. There is a public access at the northwest end of the Pond off North Groton Road, and there are a number of camps along the shoreline. The slopes above the Pond on the Town Forest in Stand 3F and NC6 are generally quite steep or comprise an SEA, and thus no management is recommended there except for hiking trails. It is important to do proper erosion control on the hiking trails that are upslope from the Pond.

Both the Cockermouth River and Spectacle Pond are subject to the state Shoreland Water Quality Protection Act (RSA 483-B) and associated Rules Env-Wq 1400 and the Basal Area law.

Other important water resources and features on the property of note:

- Wetland W1 is a small remote pond of about 0.1 acre located on the easterly side of the northern tip of the property adjacent to Stand NC 1. The pond is very remote and picturesque and on the property line between the Town Forest and Green Acre Woodlands, Inc.
- Wetland W2 is a 2-acre boreal fen as noted by Van de Poll, at the western side of the northern tip of the property surrounded by Stand NC 1. The outlet to this wetland flows west to the SPNHF Cockermouth Forest.
- Wetland W3 is a forested wetland near the headwaters of the main stream in what Van de Poll refers to as the “central trough” of the property.
- Wetland W4 is a mostly forested wetland adjacent to Stands 2D and 4. Van de Poll shows this on his SEA map as a vernal pool, but it does have a stream flowing through it.
- Wetland W5 is a 2.7 acre beaver wetland that abuts the Spectacle Pond Trail/Esty Logging Road. It is “Designated Wetland” #8 in the Wetlands Protection Overlay District of the Town’s Zoning Ordinance. The main stream in the property’s “central trough” flows through this wetland, the outlet of which crosses the Spectacle Pond Trail/Esty Logging Road and then flows easterly off the property. Beavers have recently moved back into this wetland, building a new dam just upstream of the trail/road crossing, and partially flooding and washing out a portion of the trail/road crossing. Restoration of this crossing is discussed in Access.
- Wetland W6 lies east of field OP1 adjacent to Stand 9 along the property boundary and extends to the Cockermouth River. At least a portion of this wetland is part of the river floodplain, and likely has had beaver activity over the years. It was not checked recently for beaver activity.
- Wetland W7 lies along the southwestern property boundary south of the SPNHF Flint Memorial Forest. The majority of this wetland is on the abutting property and is “Designated Wetland” #9 in the Wetlands Protection Overlay District of the Town’s Zoning Ordinance.
- A perennial stream originates in the north portion of the property in Stand NC1 and flows southerly in the “central trough” to wetland W5, then easterly off the property, returning to the property in wetland W6 and then into the Cockermouth River. Several mostly intermittent streams and seeps flow into this main stream.
- A smaller stream originates in Stand 7 and flows westerly to wetland W7, then southerly along the western property boundary before reaching the river.

The 2011 Van de Poll REA notes that less than 8 % of the Hebron Town Forest has water at or near the surface for a significant period (i.e., 2 weeks) during the growing season, which seems insignificant in terms of the overall acreage, but these wetlands are important to the biodiversity of the property. It also quantifies there are over 4 miles of streams flowing on the property, with 65% of them being intermittent. Technically, intermittent streams do not need buffering or protection in terms of forest management regulations, but these should be protected to the same level as any perennial stream to protect water quality as they inherently can have an impact on downstream wetlands or perennial streams. The primary concerns are to limit sedimentation reaching the watercourse and maintaining vegetation cover to protect water temperature and wildlife travel corridors. GFGS generally recommends a 100-foot RMZ along perennial streams with a 25 to 50 foot

no harvest zone. The Basal Area law applies to a 50-foot zone along perennial streams. The REA also identifies approximately 19 shallow ephemeral ponded areas which are sometimes referred to as vernal pools. Technically, vernal pools are seasonal (springtime), have no outlet, and dry up. With no fish as predators, vernal pools are important habitats for numerous amphibians and invertebrates. Our observations are that most of the ephemeral ponded area wetlands have inlets and outlets. In any case, wetlands and vernal pools should be protected and buffered from management activities similar to perennial streams. GFGS recommends up to a 200-foot RMZ around vernal pools due to the movement of amphibians around these features.

SOIL RESOURCES

Individual soil specifications and descriptions can be found in the stand descriptions, as well as more detailed information and soils maps in the Appendix. This property has a diverse set of soil types that affect the types of vegetation that grows and when certain management activities can take place. In general, the soils are well drained with some exceptions near wetland complexes. There are many areas that have steep slopes with exposed ledge outcrops. Below is a matrix displaying the breakdown of soil types found on the property, their complex names and acres of each soil type.

SOIL TYPES FOUND ON PROPERTY			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
36B	Adams loamy sand, 3 to 8 percent slopes	8.9	2.0%
36C	Adams loamy sand, 8 to 15 percent slopes	0.0	0.0%
36E	Adams loamy sand, 15 to 60 percent slopes	21.4	4.8%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	60.6	13.6%
102	Sunday loamy sand	8.1	1.8%
104	Podunk fine sandy loam, 0 to 3 percent slopes, frequently flooded	5.2	1.2%
105	Rumney fine sandy loam, 0 to 3 percent slopes, frequently flooded	0.6	0.1%
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	0.2	0.1%
255B	Hermon and Monadnock soils, 0 to 8 percent slopes, very stony	5.9	1.3%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	0.8	0.2%
701B	Becket-Skerry association, 0 to 15 percent slopes, very stony	1.0	0.2%
703D	Becket-Monadnock association, 15 to 35 percent slopes, very stony	23.6	5.3%
709D	Becket-Tunbridge association, 15 to 35 percent slopes, very stony	60.0	13.5%
710D	Becket-Lyman-Rock outcrop complex, 15 to 35 percent slopes	147.3	33.0%
710E	Becket-Lyman-Rock outcrop complex, 35 to 60 percent slopes	20.0	4.5%

SOIL TYPES FOUND ON PROPERTY			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
724B	Skerry-Tunbridge association, 0 to 15 percent slopes, very stony	16.9	3.8%
726D	Rock outcrop-Lyman complex, hilly	49.5	11.1%
726E	Rock outcrop-Lyman complex, steep	16.3	3.6%
W	Water	0.0	0.0%
Totals for Area of Interest		446.3	100%

Soils information can be useful when planning forest management activities. For instance, soil characteristics can help to determine what season might be best to implement a timber harvest, what tree species to manage for or favor for a residual stand, and/or what equipment may be best suited. Often, this step can be overlooked, and unfavorable results experienced by making uninformed decisions and focusing on the wrong details.

Detailed soils information specific to the property from the USDA-NRCS Grafton County Soil Survey can be found in the Appendix. A soils map of the property with supporting information such as unit types and descriptions, soil groups and characteristics, productivity/tree site index and rutting hazards are also included. Soil types are broken down by ground slope class, “A” being flat to gentle slopes, to “E” which are steep slopes. For forest management, the most important piece of soil information is the NH Important Forest Soil Group. A description of these soil groups is also included in the Appendix. These groups tell us in general terms what kinds of trees each soil type is likely to support now and, in the future, as well as some of their limitations.

CULTURAL RESOURCES

This property appears to have been used for agriculture for a short time and more than likely for sheep farming during the wool boom of the 1800s. Stone walls and barbed wire fence comprise some of the boundaries in the southern portion of the property indicating past grazing use. Stone walls should be protected as much as possible during any timber harvesting activities. Trees should not be cut on or next to walls nor should trees be dropped across walls as this will damage them as well. More recently the property has been used for hay production in the fields and on the upper elevations the primary focus has been timber production and recreation. There were no old foundations or cellar holes observed during the 2010 cruise and the recent 2021 reconnaissance that would indicate the property contained a homestead, but such sites should be protected if ever found. One small stone foundation, perhaps a small cabin or a sugar house, was found near the town line north of Spectacle Pond on the western boundary along a hiking trail.

RECREATION

In general, the property is open to the public for recreation including hunting, walking, hiking, watching wildlife, cross country skiing, snow shoeing etc.

As suggested by Van de Poll in his REA, trapping should not be allowed on the property due to the presence of Pine Marten. Allowing trapping would potentially put the species at risk by marten being inadvertently trapped. Combined with forest management, developing and maintaining recreational opportunities is a primary objective of the Town, most particularly, hiking trails. Unauthorized vehicular activity and all-terrain vehicles are not allowed on the property, so hunters, especially those after moose, must be aware of where they are and be prepared for a long drag or backpack if they have a successful hunt. Van de Poll suggests recreational opportunities on the property be primarily restricted to the central and southern portions of the property, with the focus on keeping activities out of the sensitive ecological areas, most of which are located in the northern portion of the property.



Hiking trail along the Cockermonth River

There is a vital Hardy Country Snowmobile Club trail corridor known as the “Hebron to Braley Road” trail which traverses the property at the southern end. Coming in from the west via the adjacent property, it connects to the Town Forest access road just south of the bridge on the Cockermonth River, runs on the access road and crosses the bridge, then traverses easterly through the field and exits onto the neighboring Brittelli property at the northeasterly edge of field OP2. The old “Esty Logging Road” is also sometimes utilized as a snowmobile trail and is identified on the club’s map as the “Spec Pond” trail. The Spec Pond trail appears to be used much less frequently as it is not very wide and may not be groomed.



Trailhead kiosk after crossing over the Cockermonth bridge

There are several established hiking trails on the property and are shown on the forest type map. The original set of trails were located and created around the time of the original forest stewardship plan. Those are shown on a hiking trail map and described on a trails overview and handout, both available on the Town’s web site. The Town has also improved a trailhead parking area on Groton Road and installed a kiosk at the trailhead and the trail junction just north of the Cockermonth River bridge. New trails are also under development and are shown on the forest type map.

Management of any property is often a dynamic process, whereby changes are made because of changing conditions and new information, opportunities, and activities. The REA provides valuable information on sensitive sites to avoid with trails, and the NH Fish and Game Department has developed a tool to assess impacts on wildlife from existing and planned trails. FORECO also has experience with both town and private forest landowners regarding trail locations, especially the coordination of hiking trails and timber harvesting activities.

NH Fish and Game’s “Trails for People and Wildlife” tool (TPW) is partly based on the NH Wildlife Action Plan and displays potential wildlife impacts from recreation trails using ratings from low to

very high. Information can be found at <https://www.wildlife.nh.gov/get-outside/trails-people-and-wildlife>, and the tool can be accessed at UNH's GRANITView mapping service.

Timber harvesting can be disruptive and depending on the equipment and harvesting system used, sometimes logging skid trails are not suitable for hiking trails without considerable effort. We have obtained good results reducing logging impacts to hiking trails by locating trails around the perimeter of harvest areas, minimizing the number of skid trail crossings, and making those crossings as close as possible to being perpendicular.

In this section we outline some considerations for trail changes and new trails. The numbers referred to below correspond to the "Trail Notes" numbers on the Trails & Potential Harvest Areas map.

- In his REA, Van de Poll recommends making the most sensitive ecological sites "off-limits" to trail hikers. The Bald Knob Trail is a long "out and back" trail unless a hiker were to make use of other trails on the SPNHF Cockermouth Forest, perhaps by spotting a second vehicle there. It might be nice to establish a loop trail on the Town Forest that would run through the northern portion of the property in Stand NC1 and follow the main stream southerly in the "central trough" to connect to the new Blue trail. However, Van de Poll recommends against this due to its remote nature and sensitive sites, which coincides with three sites identified by TPW with moderately-high to very high wildlife impacts.
- Note 12: A portion of the Bald Knob Trail that runs along the property boundary with SPNHF next to wetland W2 is very close to an SEA and a TPW high impact site. Impacts could be reduced if this section of trail could be moved further to the west on SPNHF land.
- Note 11: The Blue trail currently ends with two spurs that lead to potential view spots. These spurs infringe on an SEA in Stands 3E and NC5, and could be considered for discontinuance, perhaps in favor of a potential loop trail shown as Note 9.
- Note 9: A potential extension of the Blue trail that would create a loop by connecting with the Bald Knob Trail. From the existing Blue trail it would run up a gully, pass over a flat ridge with a small group of old growth hemlock, cross the main central trough stream, and follow the base of the steep slope along the southern edge of Stand NC3 and connect with the Bald Knob Trail on the ridge line.
- Note 10: A possible spur trail off the Note 9 trail to a view spot at the south end of the Stand 3C ridge. However, the view spot infringes on an SEA at the south tip of Stand NC3.
- Note 8: The Conservation Commission is considering a loop trail that would also connect the Blue trail with the Bald Knob Trail at a lower elevation than the Note 9 trail. This trail would leave the Blue trail, cross the main central trough stream and a smaller stream, then follow an old logging skid trail south to the Bald Knob Trail. If a potential timber harvest in Stand 2C and part of Stand 3F is implemented, the main logging skid trail would need to follow this hiking trail location due to the topography.
- Note 7: If a potential timber harvest in Stand 2C and part of Stand 3F is implemented, the main logging skid trail would need to share this section of a relatively narrow ridge due to topography. The logging skid trail could cross the hiking trail twice, or it may be possible to relocate the hiking trail slightly to the west so that the two trails parallel each other with no trail crossings or shared location.

- Note 6: An old logging skid trail runs up a ridge in the northern finger of Stand 6 where no timber harvesting is proposed. A new trail here could provide a nice loop for the existing Cockermouth Ledge Trail to connect to the Spectacle Pond Trail/Esty Logging Road.
- If a timber harvest is implemented in Stands 7 and 8, TPW indicates that the Stand 8 area has moderately high impact on wildlife from recreation trails. A timber harvest would create browse for wildlife, likely drawing them into this area. In addition, this is an area where locating trails around the perimeter of a harvest area would reduce trail impacts. Here are several options to consider:
 - Note 1: Discontinue this trail in the middle of Stands 7 and 8, and establish a new “perimeter” trail (Note 4) that follows the top of the bank above the western boundary stream, and then follows the property boundary easterly and northerly to the Spectacle Pond Trail just east of the Pond. Discussions with SPNHF forest managers indicate that they may be agreeable to locating some of this trail on their adjacent Flint Memorial Forest.
 - Notes 2: Three sections of the Cockermouth Ledge Trail in the middle of Stand 7 could be discontinued in favor of a new trail (Note 3) that follows the top of the ridge above the steep slopes of Stand NC8, providing views over the Cockermouth River, and continuing on the existing ridge top portion of the Cockermouth Ledge Trail.
 - Note 5: A new trail could connect the Cockermouth Ledge Trail to the new perimeter trail (Note 4), with one logging skid trail crossing.
- If some or all of the timber harvesting proposed in this plan is implemented, the Spectacle Pond Trail/Esty Logging Road will need to be upgraded to accommodate modern logging equipment and to construct a log landing at the east end of Stand 2D. An upgraded road would provide improved access for trail maintenance, emergencies (search and rescue), and forest fire fighting. As mentioned above under Water Resources, recent beaver activity has flooded or washed out a portion of the road just below the outlet of wetland W5. Restoration of this road crossing is discussed under Access.

As the Conservation Commission is well aware, periodic maintenance is needed to prevent or reduce erosion (mainly in the form of water bars), the cutting of vegetation that grows into the trails and trees that fall across the trails, and refreshing trail markers. Vegetation also grows into vistas requiring maintenance to keep them open.

AESTHETICS

Some forest management activities, primarily timber harvesting, can be disruptive and unsightly for a period of time, even when done to the highest quality. However, lopping the tops of trees and limbs low to the ground during harvesting operations softens the visual unsightliness of slash and accelerates the decay process, as the material is closer to ground moisture and fungi. Biomass or whole tree harvesting removes much of the unsightly slash from the forest floor, but usually requires wider skid trails and a larger log landing area due to the equipment size. Different harvesting methods are discussed further under Timber Resource. With any harvesting method, slash heights can be limited by contract to a specified height above the ground. Contract provisions may also require removal of slash accumulations from skid trails to be used for recreational purposes. Post-harvest

erosion control practices could also utilize a bulldozer, excavator or hand methods to reduce slash accumulations, as well as aid in the cleanup and seeding of main skid trails and log landings.

BOUNDARIES

The boundaries on this property are in various states of recognition. Some are easily recognized as they have been brushed, blazed and painted primarily by abutters, while other areas are in poor condition and in need of maintenance. The boundaries in common with the Society for the Protection of NH Forests, Green Acre Woodlands, Inc., the Connor property and some of the Brittelli property are the most recognizable. The boundaries around the camp lots on Spectacle Pond appear to need maintenance, as well as the western boundary along the town line and the southwestern boundary along stand NC8 and wetland W7. The Town has been placing tags or markers along some boundaries, but these should also be blazed and painted so the boundary is obvious between the markers.

It is recommended to perform maintenance on boundary lines that need it in the form of brushing out vegetation along the line, blazing trees and painting the blazes. Once this has been done, maintenance should be performed every 15 years or so to keep brush from growing into the lines, and to repaint so that the lines are readily seen by anyone approaching them. Well maintained boundaries not only aid the landowner, forester and logger in restricting management activities to the intended property, they guard against intentional or unintentional encroachment or trespass by adjacent owners. It is helpful for hiking trails that run along boundary lines that the colors used to delineate trails and boundaries are different.

Research and potential survey work appears to be needed for the western boundary along the town line with Groton. Some maps show the town line running parallel with the western boundary of the Town Forest, whereby the Town Forest may include a strip of land in Groton. There are special laws and rules that apply to municipal boundaries, and research and potential survey work may be needed to determine if existing monuments and blazed lines are in fact on the town line and/or comprise the true boundary line.

ACCESS

The property is accessed over a road that lies within a 66-foot-wide strip of land between the Hebron-Groton Road and the Cockermouth River. A parking area and trail kiosk are located at the entrance to the access road which leads to a bridge over the river and into the open fields. The bridge is constructed of steel girders and concrete deck panels with guard rails and has a gate at the south end of the bridge. The NH Department of Transportation has inspected the bridge and deemed it to be safe for timber harvesting and recreational activities. A dozed trail known as the



Access bridge over the Cockermouth River

“Esty Logging Road” runs from the open fields and through the southern portion of the property ending near Spectacle Pond. This road serves as the Spectacle Pond hiking trail. The southern portion of the road serves as the Hebron to Braley Road/Hardy Country Snowmobile Club trail, and the northern section of the road is used as an intermittent snowmobile trail.

During previous timber harvesting activity, timber was likely trucked across the river at the current bridge location. The open field was likely used as a log landing, and there was probably a log landing in the center of the property in Stand 2D. There is also evidence that timber was skidded across the river at a location about 300 feet upstream (to the west) of the current bridge to harvest timber in Stands 7 and 8. Old skidder trails are found throughout the southern portion of the property, but there is little evidence of recent harvesting activity in the northern portion of the property due to its remote nature and difficult access.

Forest management harvesting activities require a system of "skid" trails, a "log landing" or "yard", and road access to a main road. Trees cut in the woods are normally moved by forwarders, skidders, horses, dozers, etc. on skid trails to a log landing. At the landing, trees are processed and sorted by forest products (typically veneer, sawlogs, pulpwood, firewood, chip wood), and loaded onto trucks for hauling and delivery to mills. The location of main skid trail systems takes careful thought and planning to ensure functionality. A few of the elements to consider are topography, the minimization of stream crossings to help protect water quality, and the most efficient (shortest) skidding distance to the log landing. Typically, a downhill skid to the landing is preferred, but often, to protect other physical features of a wood lot such as hiking trails, stone walls, or wildlife habitat for example, an uphill skid may be necessary. The log landing must be large enough to accommodate the processing and sorting equipment, piled forest products awaiting shipment, the entry and positioning of log trucks, and an area to dispose of waste wood. The most economical access system optimizes the combination of skidding distance, truck road length, and truck road and landing construction costs.

Potential timber harvest areas have been identified and described under Timber Resource and in Stand Descriptions and Prescriptions and are shown on the Trails and Potential Timber Harvest Areas map. If any timber harvesting is implemented in Stands 6 and 9, a log landing can be located along the access road in field OP1. A main log landing is proposed to be located at the east end of Stand 2D, which will serve all the other potential harvest areas. Depending on the type of harvesting equipment used, this landing will likely be around 1 acre in size.

The adjacent SPNHF Flint Memorial Forest is basically “landlocked” with little or no access for forest management purposes. During our discussion with SPNHF staff about the possibility of Hebron Town Forest trails extending onto the Flint Forest, the possibility was identified for SPNHF timber harvesting to make use of the access road, skid trails and log landing on the Hebron property. The topography appears to be conducive to this. If the Town is agreeable, a temporary use agreement is generally entered into between the parties, and some form of payment for use of the Town’s property can be included, or perhaps some form of cost sharing for road improvement expenses.

To accommodate logging equipment, the access road needs improvement north of field OP1. The road needs to be widened, ditch lines installed for drainage in several sections, and several culverts installed (generally in locations at existing water bars). There is a short but steep (23% grade) section of road north of field OP2 that goes over a small hill. If there is no ledge on this hill, some excavation of the top of the hill would be helpful to reduce the steepness of this grade.

The most significant undertaking will be crossing the main brook below the outlet of wetland W5 next to the eastern property boundary, where a foot bridge has been installed for the Spectacle Pond hiking trail. As noted elsewhere, beavers have recently moved back to this wetland and have constructed a new dam about 20' west of the road, the top of which is at a higher elevation than the road. Water has partially flooded and washed out a section of road just north of the crossing. The Conservation Commission has attempted to place some logs on the uphill side of the road in hopes that the beaver would continue building their dam against the logs so that water would not flow onto the road. RSA 210:9 allows a landowner to destroy beavers, remove beaver dams (with a gradual release of water) or install water flow devices to protect their property, and work may be done without a wetlands permit if machinery does not enter the water and no dredging or filling takes place. Trapping of beaver is an option, but no trapping is recommended by Van de Poll to prevent accidental trapping of pine marten, and regular trapping may be needed if beaver return. Installation of a flow control device could be considered – there are several different types of devices available. But there is no guarantee that the device will work as intended and may need regular maintenance. A first option to try could be to leave the existing beaver dam in place and build up the road surface with fill using cubic yard concrete waste blocks as a retaining wall along the wetland side of the road. Logs for a retaining wall would not be a long-term solution as the logs would rot and decay over time. Fill could likely be obtained from the hillside above the road north of field OP2 and from the top of the small hill that needs excavation mentioned above.

With any option, a truck bridge would need to be installed over the outlet stream. A culvert (or culverts) would need to be quite large to handle the anticipated flow of this stream, are subject to blockage by debris and beavers, and is thus not a good option. Prior to the recent beaver impacts, a truck bridge span was estimated to be 25' to 30'. This length is probably longer than can be spanned with wood stringers, so metal I-beam stringers will likely be needed. They can be purchased at a custom length for this span and a pressure treated wood deck installed, or premade permanent and portable truck bridges are available. Cubic yard concrete waste blocks could be used for the bridge abutments. Because of the recent beaver activity, it may be beneficial to move the road crossing and bridge location slightly downstream where the brook channel is narrower and more defined. However, this would place the crossing on the property boundary or slightly onto the abutting Brittelli property. If Brittelli is agreeable, this could be accomplished with an access easement or a boundary line adjustment. A site visit with personnel from NH DES Wetlands Bureau may be beneficial to determine the best crossing location and the type of wetlands permit required. A “bank to bank” crossing where no disturbance is done to jurisdictional wetlands requires no permit but may require a longer (and more costly) bridge span.

Stands 7 and 8 in the southern portion of the property were once accessed for timber harvesting via a narrow, steep dozed skid trail (now part of the Cockermouth Ledge Trail) in Stand NC8 that crossed the Cockermouth River to the west of the existing access road bridge. That river crossing is no longer feasible due to the width of the river and water quality issues, not to mention skidding and access on another property on the south side of the river. We considered the option of an excavated sidehill skid trail from the trail kiosk at the north side of the access road bridge, traversing westerly across the steep slope above the river. This would require extensive cut and fill excavation work and create some potential erosion issues within the sensitive river buffer. Kiosk relocation and skidding across the access road to field OP1 would also be needed.

A better option for access to Stands 7 and 8 is a new skid trail from the planned log landing in Stand 2D that runs parallel with the eastern boundary of the SPNHF Flint Memorial Forest above proposed hiking trail Note 4. Because of the topography, this skid trail will require a few short sections of sidehill excavation.

Just west of the proposed log landing in Stand 2D both the Esty Log Road and the Spectacle Pond Trail cross the main central trough stream. A hiking trail foot bridge crosses the stream just downstream from the old log road crossing. A skidder bridge will be needed to cross this stream. The best location may be at the foot bridge, in which case the foot bridge could be temporarily removed and then replaced after the harvesting is completed.

CLIMATE RESILIENCY & CARBON SEQUESTRATION/STORAGE

Climate models project that temperatures will increase across all seasons in the Northeast region over the next century. The projected increase in annual temperature ranges from 3 to 10°F by the end of the century. While it is difficult to predict how future precipitation will change, total annual precipitation is generally expected to increase over the next 100 years. The greatest precipitation increases are expected to occur during the winter, where warmer temperatures will result in more winter precipitation falling as rain instead of snow. There is more uncertainty as to whether precipitation will increase or decrease during the growing season. Even with moderate increases in rainfall, there may be more frequent droughts in the summer and/ or fall because higher temperatures will lead to greater water loss from evaporation and transpiration. These factors indicate that over the long term, our forests may shift in composition towards tree species more common to warmer climates in areas to our south.

Forests of the northeast are an important part of climate mitigation through the sequestering and storing of carbon. Those managed for climate resiliency are even more capable of sequestration and carbon storage. Sequestration is the rate of atmospheric carbon uptake or storage. That rate is greater in young, vigorous stands of trees, and lower in stands of old age. Carbon storage relates to the quantity of carbon being stored in trees, other vegetation, and soil. Older aged stands of trees that are fully stocked contain the highest quantity of carbon, whereas young stands of small trees contain the lowest quantity.

Forests managed for climate resiliency and carbon sequestration and storage need to contain a diversity of species, age classes and forest structure over time to maintain and strive to increase both carbon sequestration and storage. A forest of all old trees or all young trees does not achieve this goal. A mix of young, middle age and older trees are needed, which also satisfies the diversity goals of wildlife habitat management. This mix can be achieved through several actions:

- Keeping forests as forest – which has been achieved on this property by the conservation easement.
- Thinning of forest stands to increase growth rates, especially on species expected to thrive in a warmer climate.
- Regeneration of older stands to provide age class, structural and species diversity.
- Improving forest health through harvests focused on removing unhealthy or insect infested trees, while assuring that a dead wood component is retained.

- Striving to produce as much solid wood products as possible for long term carbon storage in those products.
- Grow appropriate species to a longer rotation age.
- Identify set-aside areas appropriate for no harvest options, such as non-operable areas, stream/river buffers, old or older growth areas, and significant ecological areas.

These objectives can be achieved with the recommendations in this stewardship plan. Excellent sources of information on climate resiliency and forest carbon can be found at <https://www.northeastforestcarbon.org>.

FOREST ECONOMICS & TIMBER TAXATION

Timber Yield Tax - The town assesses a timber yield tax of 10 percent of the stumpage value of timber harvested during a tax year (April 1 to March 31). An Intent to Cut must be filed prior to harvesting, and a Report of Cut is filed after harvesting is completed. The town Selectmen or Assessors establish an assessment rate for each species/product, and a tax bill is issued by the town Tax Collector. The purchaser of stumpage, typically the logger or sawmill, is responsible for the payment of timber tax on publicly owned land. Thus, that expense can be expected to reduce the timber prices offered by the timber purchaser on public land but is offset when the tax is paid to the town. Because of this offset, the timber yield tax law allows municipalities to waive the tax on timber harvested on their land.

Forest Carbon - Aside from generating income from the sale of timber, a forest owner may also generate income by means of selling carbon credits. This is a relatively new concept and has been rapidly developing and changing. Atmospheric carbon is stored in forests and the quantity of carbon stored over a certain period can be calculated (usually in tons). A carbon sequestration project could be developed by one or a group of landowners, and the carbon “credits” are sold or transferred to carbon “buyers” or “brokers.” The credits are purchased by companies exceeding emission standards as environmental mitigation, or to those who wish to reduce or cancel out their carbon footprint for the sake of being “green” and helping to combat climate change from greenhouse gas emissions.

In the early stages, carbon offset programs were only viable for large landowners with a minimum of tens of thousands of acres, such as Timber Investment Management Organizations. This was primarily due to the high cost of establishing the carbon volumes through a very detailed forest inventory of a given property or properties. The agreements were for a long period of time, often up to 100 years, and imposed restrictions on timber harvesting to assure the carbon volume on the property was maintained. Additionally, carbon offsets were only available to companies mandated to purchase credits in the regulatory or compliance market to comply with emission standards and regulations as means to stay viable without investing capital to upgrade processes to meet emission standards.

A new non-regulatory voluntary carbon offset market has developed, and project developers now don't require up-front payment of costs from the landowner, making them feasible for smaller landowners. These projects can also be less restrictive from a timber harvesting standpoint based on how much the landowner desires to harvest of their forest's annual timber growth. Typically, these programs sell carbon credits to companies who volunteer to purchase credits to minimize

their carbon footprint and are generally for a shorter time, such as 10, 20 or 40 years. The carbon credits of these projects are of lesser value than the regulatory market due to the shorter time periods, smaller acreages, and the credits being sold into a voluntary market rather than a compliance (mandatory) one.

Recent technological advancements are making it easier to assess forest conditions and perform timber/carbon inventories with less field work, reducing development time and costs even further. Pilot programs are now being developed making it viable for a landowner with as little as 100 acres or less to enter into some form of carbon credit sale. Two of these programs worthy of note are the Family Forest Carbon Program (American Forest Foundation & Nature Conservancy) and the Core Carbon Program (Finite Carbon). These programs are making it possible for a landowner of almost any size who wishes to responsibly manage their forests to enter a carbon credit program. These programs are much less restrictive, and some are annualized so an owner can opt out at any given year. It is a very complicated topic and project developers offer different programs. A landowner interested in pursuing such a project should become well informed on the subject. A good source of information on forest carbon and the carbon credit markets can be found at <https://www.northeastforestcarbon.org>.

TIMBER RESOURCE

The Town Forest was delineated into forest “stands” of similar tree species and composition, called forest types. There are two main types in this forest – 1) northern hardwoods or mixed hardwoods, dominated by either American beech or red oak, and 2) mixed softwood-hardwood, usually dominated by hemlock with white pine, red spruce and balsam fir mixed in, along with an occasional red pine. Stands labeled as “NC” are non-commercial or non-operable for timber harvesting. They generally are comprised of steep slopes, rock outcrops, ledges and shallow to bedrock soils, or are inaccessible to harvesting equipment. In many places these coincide with or include significant ecological areas (SEA) identified by Van de Poll.

The proposed areas for timber harvesting in this plan generally follows Van de Poll’s recommendations and avoids established hiking trails as much as possible. Van de Poll recommends no management in the remote northern portions of the property, concentrating active management in the southern areas. This leaves the northern areas to continue their old or older growth, natural area style succession. This combination of active management and non-management also helps to meet the objectives for wildlife habitat, climate resiliency and carbon sequestration and storage. About 136 acres or 30% of the property is proposed for harvesting.

As mentioned in History, it appears that past timber harvesting may have been light thinnings that occurred as much as 40 to 50 years ago. Thus, there is a significant quantity of mature and sometimes diseased and low quality timber found on the property. In the past the area has experienced major and minor defoliations primarily of red oak from the spongy (gypsy) moth, and at least the upper elevations of this property received crown damage from the 1998 ice storm. The light thinnings and partial sunlight reaching the forest floor from dying trees and degrading crowns have encouraged the regeneration of beech, primarily in the hardwood stands. This presents a challenge in forest management to encourage the growth of more valuable species because beech sprouts

abundantly from stumps and roots. Several of the stand treatment recommendations include some form of regeneration harvest to accomplish this goal. If any timber harvesting is implemented, decisions will need to be made concerning the type of harvesting equipment to be used to best satisfy all of the Town's objectives:

- With an objective of scenic quality and recreational use, whole tree harvesting with chipping that removes most of the tops and limbs of harvested trees would be a logical choice. The tradeoff is that this equipment is large (needing a larger log landing, wider skid trails and more room to operate in the woods) and heavy (sometimes resulting in higher soil impacts on wet or unfrozen ground). It is an efficient harvesting system usually requiring less operating time due to its high production rates. A “feller-buncher” is the normal tree cutting machine, which usually has a cutting head that can easily cut understory beech saplings if that is a management goal (as in the some of the hardwood stands). Grapple skidders haul bunches of whole trees to the log landing where some limbs are stripped and the tops chipped. A considerable amount of debris can be generated on the log landing that needs to be grappled back to the woods, or pushed off to the side at the completion of the operation.
- Another option is a “cut to length” or CTL harvesting system. A processing machine cuts the trees, strips the top and limbs and leaves them where cut or in a skid trail, and cuts the tree bole into products, all in the woods. A “forwarder” then picks up the products and hauls them to the log landing. Tops and limbs are left in the woods, which may not meet aesthetic goals, but may be better for soil nutrient recycling, wildlife habitat and protection of regeneration from browsing. Many tops and limbs are left in skid trails to protect soils from the weight of the forwarder, so they aren't conducive for use as recreation trails. The equipment is generally smaller, the log landing can also be smaller, and little debris is generated on the log landing. The processor is not able to cut understory beech saplings, although some operators make use of a feller-buncher to fell the trees for the processor. Skidding distance is limited and shorter due to the economics of the slow forwarder speed.
- “Conventional” hand cutting (chain saw) operations generally utilize cable skidders. Tops and limbs are left in the woods, some of which are left in skid trails. The equipment is smaller and lighter, and log landings can be smaller. Production rates are lower. Cutting significant amounts of understory beech saplings is generally not feasible, unless the operator is willing to cut them by hand methods and is paid for that work. Fewer operators are available with this equipment.
- There are a few logging contractors with “hybrid” equipment operations. Some may have a smaller, lighter feller-buncher to cut trees, leave the tops and limbs and the woods, and utilize smaller, lighter skidders. The feller-buncher may be able to cut understory beech saplings if needed. There are operators with combinations of all of the above. At the time of harvest implementation, all options could be explored to select an operator that best meets the objectives of the Town.

FOREST STAND TYPE DESCRIPTIONS AND PRESCRIPTIONS

The following section describes in detail the current status and recommended management activities for each forest stand. Explanations for common forestry terminology can be found in the Glossary. The following page presents a graphic depiction of the general silvicultural prescriptions described below.

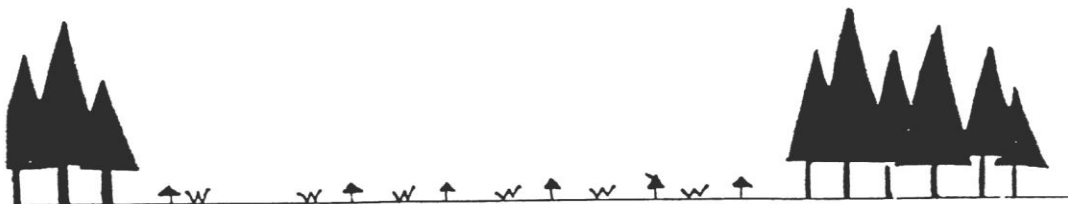
Stand prescriptions may contain the following silvicultural prescriptions:

The first three prescriptions allow regeneration to develop without being damaged by subsequent harvesting operations:

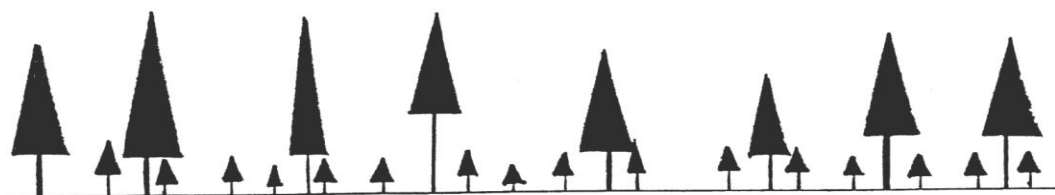
- * **Group Selection** - The removal of groups of trees, in groups ranging from (small) 30' to 50' in diameter to (large) about 2 acres. This is used in stands with groups or a high percentage of mature or low quality trees where clearcutting is not an option. The objective is to regenerate the stand, usually for shade tolerant species such as sugar maple, yellow birch and white ash. It may also be used as a technique in fostering unevenaged stands.
- * **Patch Clearcutting** - The removal of all trees on areas larger than group selections, but smaller than the whole stand. Size generally ranges from 2 acres up to 5 acres and is usually spread evenly through the stand. This is also used in stands that are basically mature or contain a very high percentage of low-quality trees. The objective is regeneration, usually for shade intolerant species, under a modified form of evenaged management. It is sometimes used as an alternative to stand clearcutting for wildlife or aesthetic reasons.
- * **Stand Clearcutting** - The removal of all or the majority of trees of an entire forest stand. As above, the objective is regeneration of a mature or low quality stand under even aged management.
- * **Shelterwood & Seed Tree** - The removal of all trees except a scattering of seed and shade trees of desirable species. Shelterwood leaves a higher number of overstory trees, sometimes favoring more shade tolerant species. Seed Tree leaves less overstory trees, favoring shade intolerant species. The objective is regeneration under evenaged management. After successful regeneration, the overstory trees are removed. Protection of regeneration during overstory removal can be difficult.
- * **Single Tree Selection** - The removal of individual trees in a stand with a goal of unevenaged management. The improvement of stand quality and growth is a goal by removing low quality and mature trees and reducing competition to result in a relatively even-spaced stand. A goal is also to create or leave a certain distribution of trees in each diameter class. To achieve the latter, some low quality or mature trees may need to be left.
- * **Thinning** - The removal of a certain percentage of the total number of trees in a stand, to leave a relatively even-spaced stocking of trees. Removals average around 30% of the stocking. Used in immature, evenaged stands, the goal is to increase growth by reducing competition, and increase quality by removing the lowest quality and mature trees.

HARVESTING METHODS

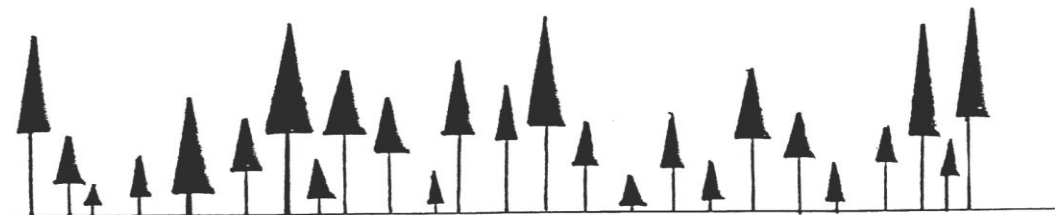
Clearcut



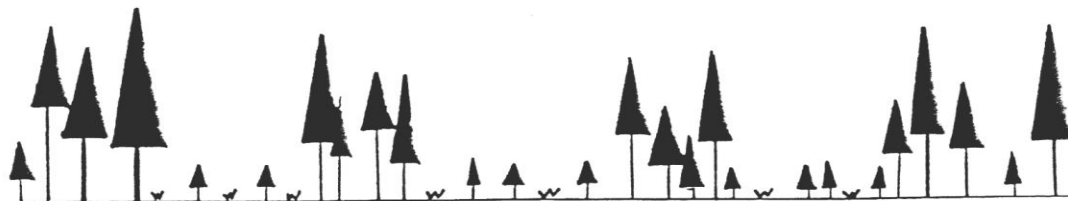
Shelterwood



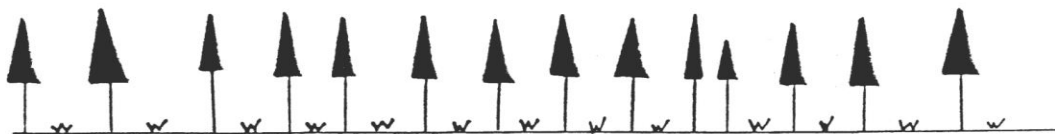
Single-Tree Selection



Group Selection

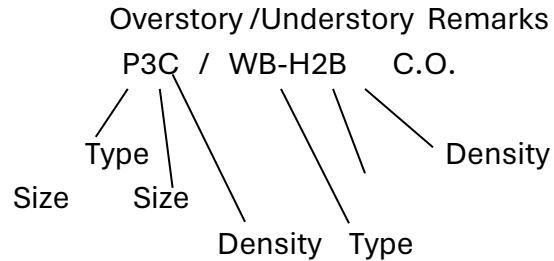


Thinning



TIMBER STAND DESIGNATIONS

Stand designations are made up of several parts depending on the situation. All parts are shown in the example below. The understory and remarks sections are sometimes omitted.



The first part before a slash is the overstory designation; the second part is the understory designation.

TYPE DESIGNATIONS:

- Wp, P Pine
- H Mixed Hardwood species
- M Mixed Hardwood and Softwood species
- S Softwood species

Particular species may also be listed. See Species Abbreviations and map legend.

SIZE DESIGNATIONS (based on average stand diameter):

- 1 Sapling size ≤ 4 " DBH
- 2 Pole size $> 4" \leq 10$ " DBH
- 3 Sawlog size > 10 " DBH

DENSITY DESIGNATIONS:

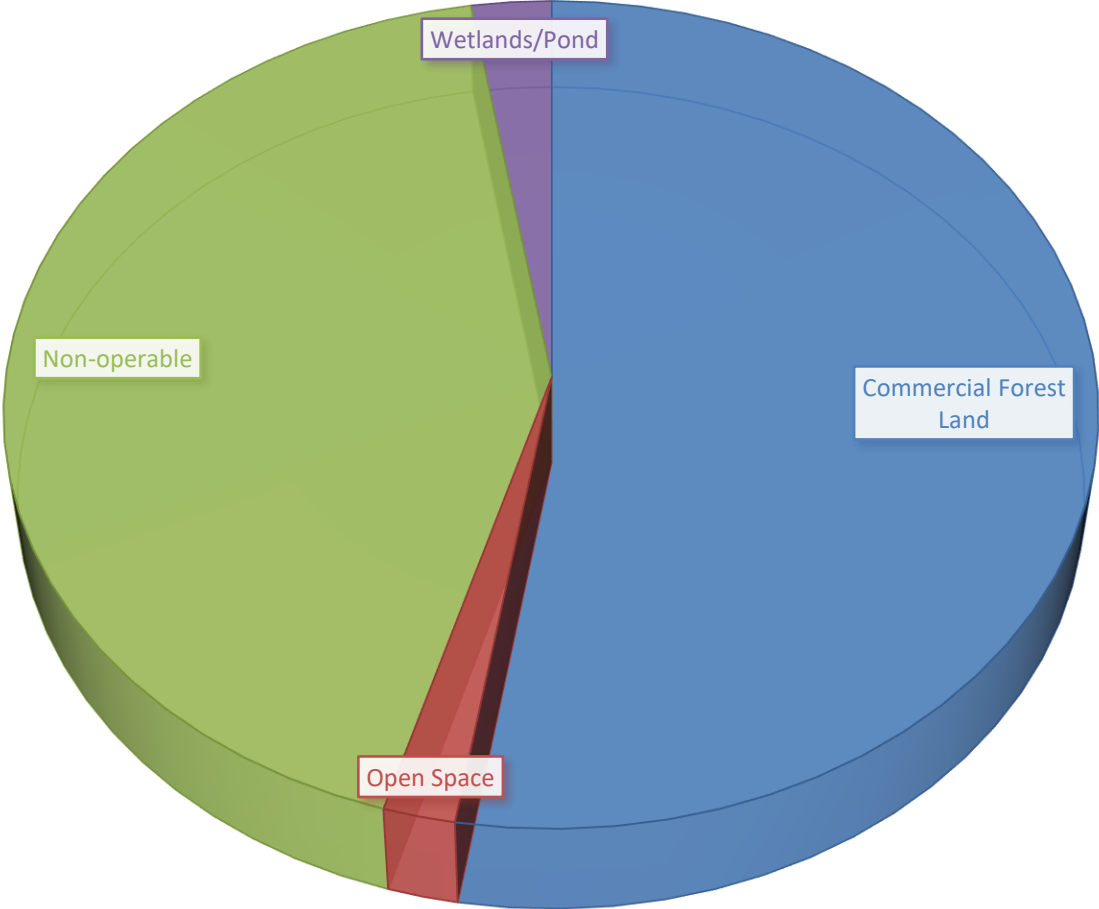
- A Overstocked
- B Adequately stocked
- C Understocked

Remarks usually refer to past harvesting done, if any. In the above example, C.O. stands for Cutover.

ACREAGE SUMMARY

COMMERCIAL FOREST LAND		
STAND NUMBER	FOREST TYPE	ACRES
1	Ro,Be,H2-3A	19.50
2	Be,H2-3A	84.20
3	Hm,H,Sp3-2A	47.70
4	Hm,H,Wp2-3A	10.30
5	Hm,H2-3A Buffer	6.80
6	Ro,H2-3A	7.20
7	Hm,H,Ro,Wp2-3A	27.00
8	Ro,H,Wp2-3A	21.40
9	Wp,H3-2B	12.20
TOTAL COMMERCIAL FOREST LAND		236.30
OTHER LAND		
STAND NUMBER	DESCRIPTION	ACRES
OP1	Field	7.50
OP2	Field	.40
OP3	Road and Parking	.90
NC1	Non-operable	48.00
NC2	Non-operable	4.20
NC3	Non-operable	35.40
NC4	Non-operable	3.90
NC5	Non-operable	3.50
NC6	Non-operable	40.50
NC7	Non-operable	8.90
NC8	Non-operable	48.30
W1	Pond	.10
W2	Wetland	1.90
W3	Wetland	.70
W4	Wetland	.40
W5	Wetland	2.70
W6	Wetland	4.90
W7	Wetland	.90
TOTAL OTHER LAND		213.10
TOTAL PROPERTY		449.40

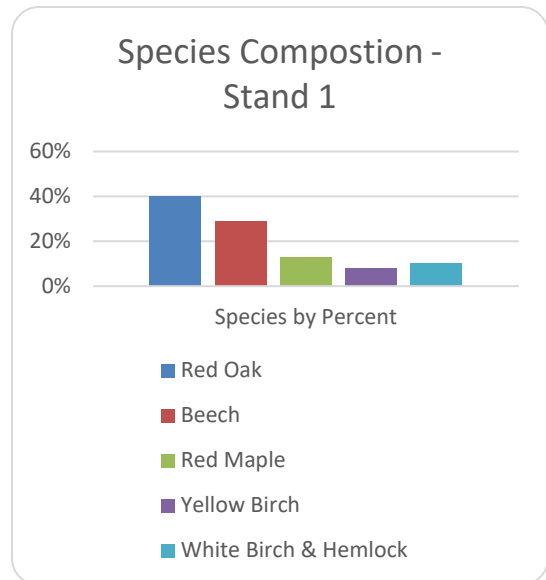
TOWN FOREST - ACREAGE BY TYPE



STAND DESCRIPTIONS AND PRESCRIPTIONS

STAND 1 – RO, BE, H2-3A/H1B

This 19.5 acre red oak, beech and hardwood stand is located along the western boundary and town line south of the SPNHF Cockermouth Forest. Topography ranges from moderate to steep west facing slopes with areas of many surface rocks. The stand does not appear to have been logged during the most recent harvest. Subsequently it is comprised of sawlog sized red maple in areas that are more poorly drained and in the areas that are better drained the stand is heavier to red oak, beech and yellow birch. It is overstocked at 95 ft² of basal area per acre with red oak comprising 40% of the basal area followed by beech at 29%, red maple 13%, yellow birch 8% and white birch and hemlock making up the remainder. There are scattered stems of mature red oak, and some of the beech appear to not have beech bark disease. Timber volumes average 5,000 board feet of sawlogs and 8 cords of pulpwood per acre. In much of the stand the regeneration is dominated by beech and striped maple due to the crown damage during the 1998 ice storm. There are several small drainages running through the stand.



The predominant soil found is Becket/Monadnock 703D that is moderately steep and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IB. It tends to be a moderate to well-drained soil favoring successional hardwoods such as red oak, beech, white ash, yellow birch and sugar maple. However, it is also suited to growing hemlock, balsam fir and red spruce. This soil is moderately prone to windthrow and this should be taken into account when prescribing future treatments. The prolific rocks in this stand and damp soils in portions of adjacent stands could limit harvesting activities to dry summer or to winter/frozen conditions.

This stand has not been treated in many years and would benefit from a shelterwood harvest to regenerate red oak and yellow birch. It should be a treatment similar to a deferred or irregular shelterwood outlined in the 2014 Silvicultural Guide for Northern Hardwoods. The basal area should be reduced to between 30 and 50 ft² per acre with a focus on removing the diseased beech and the mature and poorest quality red oak, red maple and yellow birch. Non-diseased beech should be left singly or in groups to hopefully continue their genetics in the stand and to provide mast (beech nuts) especially for bears. The existing beech and striped maple understory should be cut as part of the timber harvest to encourage red oak and other desired species to regenerate. With the combination of wet soils in the depressions and dry soils that are found on the ridges, if possible harvesting work should be performed during a dry summer to prepare a seed bed which encourages red oak regeneration. This stand should be reassessed about 15-20 years after this harvest for a second cut shelterwood or a seed tree treatment.

Access to this stand is difficult as it slopes west towards two abutting tax map parcels in Groton that are accessed from Blanchette Lane. It would be ideal if this stand could be harvested at the same time as one or both of those abutting properties are harvested, with a temporary use agreement to utilize their access road, log landing and skid trails. The maximum skidding distance appears to be about 0.7 mi. Otherwise, an uphill skid across the ridge and the Bald Knob Trail would be needed to then skid downhill through Stands 2C and 2D to the main log landing on the Town Forest. The maximum skidding distance for this option would be about 1.1 mi.

STAND 2 – BE, H2-3A/BE,H1-2A-B

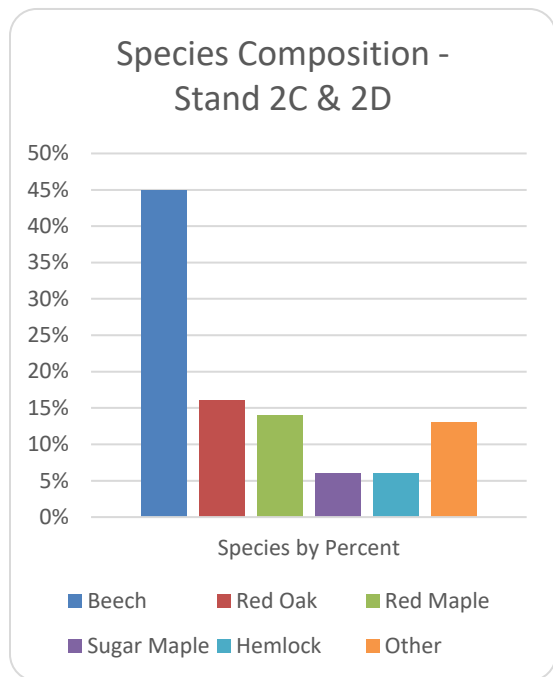
This 84.2 acre overstocked northern hardwood stand is found in four different locations in the middle of the property labeled 2A, 2B, 2C and 2D on the Forest Type Map. Collectively the stand is dominated by beech with a mix of other hardwood species and a small component of hemlock and spruce.

Stands 2A and 2B comprise 16.4 acres and are located in the northern portion of the property, are remote, and likely weren't logged during the last harvest due to difficult access and long skidding distances. Because of the advanced age, there are single trees and groups of trees that are overmature and of large size, likely with considerable rot and decay within them. Van de Poll indicates that these areas are exhibiting signs of old or older growth forest. Based on these conditions, it is recommended that no harvesting be done in these

two areas and that they continue to develop as old growth forest for forest diversity, wildlife habitat and forest carbon storage.

Stands 2C and 2D comprise 68 acres and are overstocked at 130 ft² of basal area per acre with beech comprising 45% of the basal area followed by red oak at 16%, red maple 14%, sugar maple and hemlock each at 6%, and lesser amounts of yellow birch, white birch, white ash and spruce. White ash is dying at the upper elevations due to old age and ash dieback/yellows disease, and most of the beech is affected by nectria/beechn bark disease. About 50% of the stocking is considered unacceptable growing stock due to its age, defect, disease or low quality. Although many trees are mature or overmature, there is a complement of middle age red oak stems and poletimber/small sawtimber of other species. The understory is overstocked and dominated by beech which regenerated under partial shade after the last light harvest and the 1998 ice storm that damaged tree crowns. Timber volumes average 5,000 board feet of sawlogs and 16 cords of pulpwood per acre. There are a few small drainages, seeps and wetlands in the stand, and the main central trough stream runs through the eastern portion of Stand 2D.

The predominant soil found in this stand is Becket/Lyman 710D that is hilly and very stoney. It makes up the northern two thirds of the stand. In the important forest soil groups guide (see Appendix) this soil is classified as IIA. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. However, it is also suited to



growing pine, balsam fir and red spruce. This sometimes moderately drained soil is prone to windthrow and this should be taken into account when prescribing future treatments. The prolific rocks and steep slopes limit harvesting activities to dry summer or to winter/frozen conditions. Erosion control is necessary to minimize erosion at the completion of any timber harvest. The other predominant soil found in this stand is Becket/Tunbridge 709D that is moderately steep and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IB. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. This soil is moderately prone to windthrow. The prolific rocks in this stand and damp soils in portions of adjacent stands conditions limit harvesting activities to dry summer or to winter/frozen conditions.

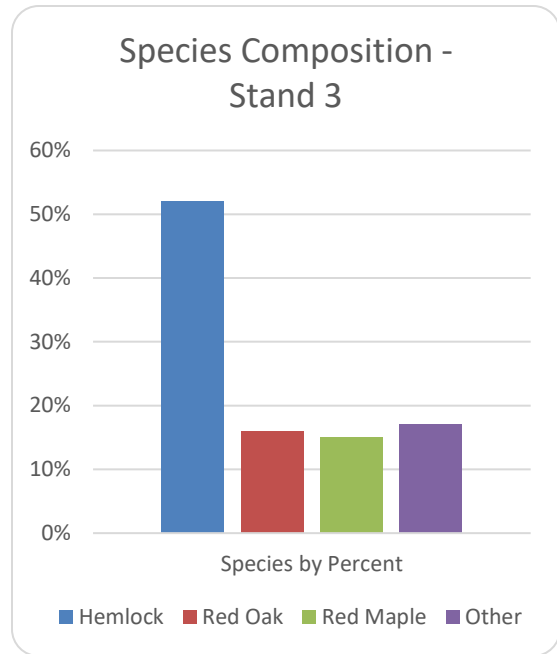
Because of the age, composition, and a high percent of unacceptable growing stock, a regeneration treatment needs to be considered. A form of shelterwood would be the main treatment, but in some areas with little acceptable growing stock to leave, it will tend towards a seed tree treatment. The primary stems to leave in the shelterwood or seed tree will be the middle-aged red oak, which can be complemented by other species such as red and sugar maple, yellow birch, non-diseased beech and almost all of the hemlock. Almost all of the ash should be harvested due to dieback and the expected arrival of the emerald ash borer. Some ash can be left for genetic stock where there are groups of poletimber that would be left as an irregular shelterwood. Non-diseased beech should be left singly or in groups to hopefully continue their genetics in the stand and to provide mast (beech nuts) especially for bears. Otherwise, a deferred shelterwood would leave about 20 to 40 ft² of basal area per acre. A shelterwood or seed tree treatment with scattered residual trees and groups of trees may be more aesthetically appealing than a stand or patch clearcut, and will leave mast, roosting and den/cavity trees for wildlife. This treatment could also create some views from the Bald Knob Trail in Stand 2C. No harvest will occur in the northeast portion of Stand 2C between Stands NC3 and NC5 on the east side of the central trough stream. Buffers should be left along the central trough stream and several smaller streams and wetlands, as well as wetland W4 and any hiking trail. The potential harvest areas in Stands 2C and 2D are estimated to be about 50 acres. Almost all of the beech understory should be cut to encourage regeneration of more desirable species, which may require a high speed feller-buncher cutting head. Skidding will be to the main landing in Stand 2D, and two skidder bridges will be needed to cross the central trough stream as well as a smaller stream which is the outlet of wetland W4. The stand should be re-assessed in 20 years after this harvest to investigate a possible full or partial overstory removal.

STAND 3 – HM, H2-3A/H,S1C

This overstocked 47.7 acre hemlock-hardwood stand is made up of six areas located in the northern half of the property, ranging from 3 to 20 acres in size. On average, the basal area is 167 ft² per acre and is comprised of hemlock 52%, red oak 16%, red maple 15%, and spruce, white pine, beech, yellow birch and white birch comprising the remainder. The northeastern areas contain the most

spruce and white pine, and several groups of hemlock observed there appeared to be quite old. The understory is very sparse and is a mix of hardwoods and softwoods, mostly beech, hemlock and striped maple. Slopes are moderate to somewhat steep. Deer, moose and snowshoe hare sign were observed in several areas.

The predominant soil type found in this stand is Becket/Lyman 710D that is hilly and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IIA. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. However, it is also suited to growing white pine, hemlock, balsam fir and red spruce. This sometimes moderately drained soil is prone to windthrow. The prolific rocks and steep slopes limit harvesting activities to dry summer or to winter/frozen conditions. Erosion control is necessary to minimize erosion at the completion of any timber harvest.



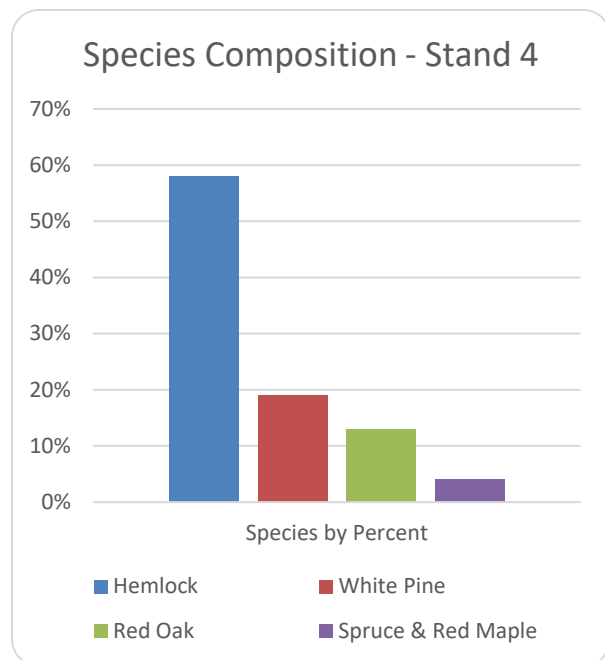
This stand is important for wildlife habitat primarily due to its softwood component. Softwoods, especially hemlock, provide important wildlife cover and roosting and nesting habitat. These areas may not be large enough to be considered deer wintering yards, but deer and other wildlife will certainly make use of these areas because they are sheltered and provide reduced snow depth for easier travel and bedding under the thick softwood canopy. Several of the northeastern areas are in or adjacent to SEAs identified by Van de Poll. Due to their remoteness and ecological and wildlife habitat importance, no harvesting activity is recommended in areas 3A, 3B, 3C, 3E and the portions of 3F east of the central trough stream or west of the Bald Knob Trail down to Spectacle Pond. This will also minimize any harvesting impacts on the Blue Trail that runs along the east side of the central trough stream.

About 9 acres comprising Stand 3D west of the Bald Knob Trail and a small portion of Stand 3F adjacent to Stand 2C west of the central trough stream are recommended for single tree selection or small group selection treatment. These areas average 170 ft² of basal area per acre, 8,000 board feet of sawlogs and 21 cords of pulpwood per acre. Treatment should focus on maintaining the hemlock/softwood overstory while encouraging some hemlock regeneration for the future stand. Harvesting would concentrate on removing mature and low quality hardwoods that are competing with hemlock. A goal would be to maintain 70% crown closure. Ground/soil scarification would be helpful to prepare a seedbed for hemlock regeneration, but harvesting season will be dictated by harvests in other stands. The stand should be re-assessed in 20 years after this harvest to determine the need for a similar or different treatment.

STAND 4 – HM, H,WP2-3A/HM,H1-2B

This 10.3 acre over-stocked hemlock-hardwood-white pine stand is located along the eastern boundary line adjacent to wetland W4. It is similar to Stand 3 but is lower in elevation and has a higher

composition of white pine, including some large “legacy”/older growth pine and hemlock. The basal area is 230 ft² per acre and is comprised of hemlock 58%, white pine 19%, red oak 13%, and spruce and red maple comprising the remainder. Timber volumes average 15,000 board feet of sawlogs and 20 cords of pulpwood per acre. The understory is generally sparse, although there are a few thick pockets of seedlings and saplings, and is a mix of hardwoods and softwoods, mostly beech, hemlock and balsam fir. Slopes are moderate to somewhat steep. Deer and moose sign were observed in this softwood dominated stand.



The predominant soil found in this stand is Becket/Tunbridge 709D that is moderately steep and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IB. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. However, it is also suited to growing white pine, hemlock, balsam fir and red spruce. This soil is moderately prone to windthrow.

Similar to Stand 3, this stand is important for wildlife habitat primarily due to its softwood component. Softwoods, especially hemlock, provide important wildlife cover and roosting and nesting habitat. This stand may not be large enough to be considered a deer wintering yard, but deer and other wildlife will certainly make use of this area because it is sheltered and provides reduced snow depth for easier travel and bedding under the thick softwood canopy. A single tree selection or small group selection treatment on about 8 acres should focus on maintaining the hemlock/softwood overstory while encouraging some hemlock regeneration for the future stand. Harvesting would concentrate on removing some of the mature pine and the mature and low quality hardwoods that are competing with hemlock. A goal would be to maintain 70% crown closure. Ground/soil scarification would be helpful to prepare a seedbed for hemlock regeneration, but harvesting season will be dictated by harvests in other stands. Buffers should be left along hiking trails, streams and wetland W4. The stand should be re-assessed in 20 years after this harvest to determine the need for a similar or different treatment.

STAND 5 – HM, H2-3A BUFFER

This 6.3 acre hemlock-hardwood stand is located in the southern portion of the property surrounding the SEA beaver swamp wetland W5. It is also adjacent to the steep slopes and rock outcrops of Stand NC8 which contains some SEA areas. Areas that are poorly drained around wetland W5 have a heavier stocking of red maple, while areas that are better drained are mostly hemlock, yellow birch,

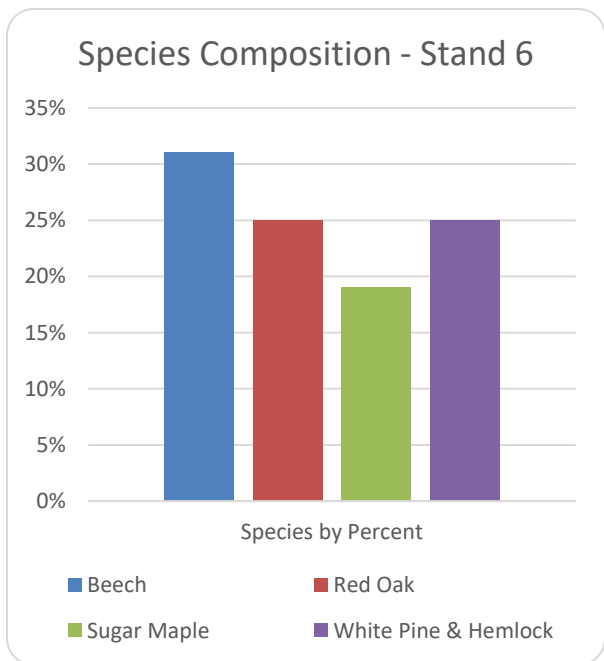
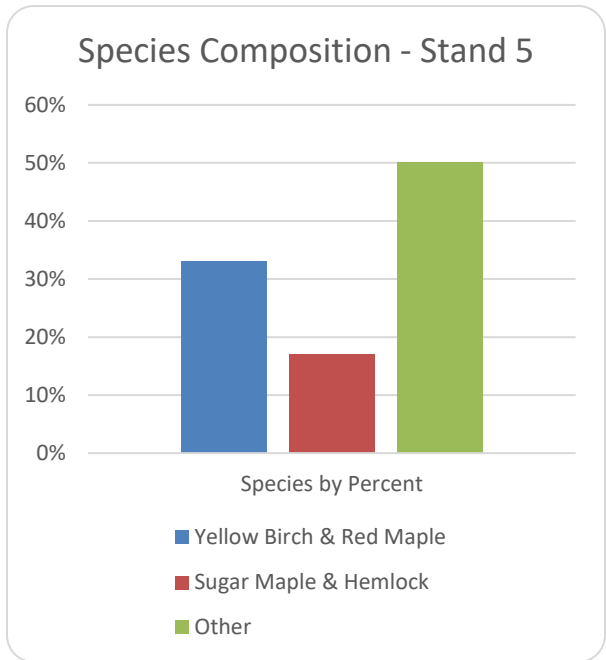
sugar maple, and red maple. It is overstocked at 135 ft² of basal area per acre with yellow birch and red maple comprising 33% of the basal area followed by sugar maple and hemlock at 17%. Timber volumes average 4,500 board feet of sawlogs and 17 cords of pulpwood per acre. Understory regeneration is comprised predominantly of hemlock with some scattered beech. The Esty logging/access road/Spectacle Pond Trail runs along the eastern edge of this stand.

The better drained soils in this stand are Skerry/Tunbridge 724B that is undulating and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IB. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. This sometimes moderately drained soil is susceptible to windthrow. The soils map doesn't show it separately, but the poorly drained area around wetland W5 is likely a Rumney soil type, important forest soil group IIB.

As this stand surrounds SEA beaver swamp wetland W5 and is adjacent to SEA areas in Stand NC8, it is recommended to consider this stand as a buffer area and that no treatments are performed here. An old winter skid trail is located in this stand along the southern edge of wetland W5, and it is recommended to not use this trail as a hiking trail due to the wet soils and to protect the SEAs and wildlife habitat from human activity.

STAND 6 – Ro, H2-3A/H1B

This 7.2 acre red oak, beech and scattered softwood stand is located at the southern end of the property between fields OP1 and OP2 and the non-commercial ledge Stand NC8 uphill from the access road/Spectacle Pond Trail. There is a narrow finger at the north end of the stand that juts into Stand NC8. Topography is moderate to steep with many surface rocks. Most of the stand does not appear to have been treated during the most recent harvest. Subsequently it is comprised of sawlog sized red oak, beech, sugar maple and white pine. It is overstocked at 120 ft² of basal area per acre with beech comprising 31% of the basal area followed by red oak at 25%, sugar maple at 19% and white pine and hemlock making up the remainder. Timber volumes average 8,000



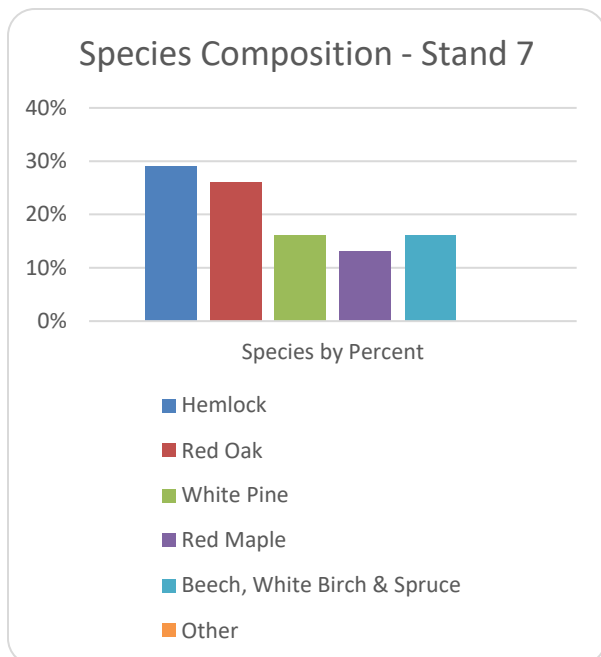
board feet of sawlogs and 9 cords of pulpwood per acre. In much of the stand the regeneration is dominated by hemlock and beech.

The predominant soil found in this stand is Becket/Tunbridge 709D that is hilly and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IB. It tends to be a moderate to well drained soil favoring successional hardwoods such as red oak, beech, white ash, yellow birch and sugar maple. However, it is also suited to growing pine, balsam fir and red spruce. This sometimes moderately drained soil is prone to windthrow. The prolific rocks limit harvesting activities to very dry summer or to winter/frozen conditions.

No treatment is recommended in the northern finger of this stand as it is close to some SEA areas in Stand NC8, and a potential new hiking trail is possible (Note 6 on the Forest Type Map) to connect the Spectacle Pond Trail to the Cockermouth Ledge Trail that would provide a new loop for the latter trail. Otherwise there are several options for treatment in the remaining 2.5 acres of this stand. As mentioned under Wildlife Resources and in Stand 9 below, some small patch clearcuts around field OP1 would benefit primarily woodcock and ruffed grouse habitat. If these patches are not done in Stand 9, they could be done in Stand 6 now or later as part of a series of progressive patch cuts over time for habitat diversity. If the patches are done in Stand 9 during this first harvest entry, then this portion of Stand 6 could receive a single tree or group selection treatment, with patch cuts to be considered in future entries. Basal area would be reduced by between 15 and 30 ft² per acre focusing on removing the poor quality beech and red maple and the overmature red oak and yellow birch. Aesthetics are important in this stand as it is adjacent to the fields and the main access road/hiking trail, perhaps taking precedence over silviculture. Soil scarification during harvesting would be beneficial to scarify a seed bed to encourage red oak regeneration. This stand should be reassessed in 20 years after the completion of this harvest to determine the next treatment in relation to that in Stand 9.

STAND 7 – HM,H,RO,WP2-3A

This 27 acre softwood-hardwood stand is located at the southwestern end of the property adjacent to Stand NC8. Sections of the Cockermouth Ledge Trail run through and along the edges of this stand. Topography is moderate and most of the stand does not appear to have been treated during the most recent harvest. The stand is overstocked at 116 ft² of basal area per acre with hemlock comprising 29% of the basal area followed by red oak at 26%, white pine at 16%, red maple 13% and beech, white birch and spruce making up the remainder. The white pine tends to be scattered large mature stems. Timber volumes average 6,500 board feet of sawlogs and 11 cords of pulpwood per acre. In much of the stand the regeneration is dominated by beech and hemlock, with some pockets of thick seedlings and saplings.

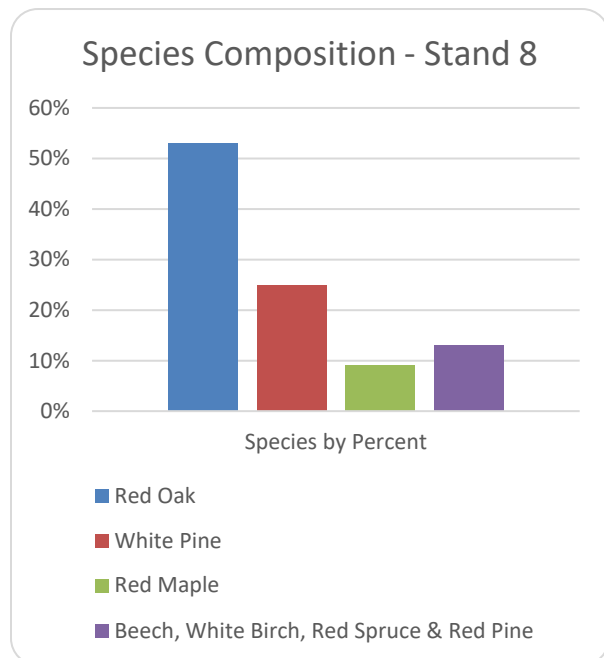


The predominant soil found in this stand is Tunbridge/Lyman/Rock Outcrop 61E that is hilly and very stoney. In the important forest soil groups guide (see Appendix) this soil is classified as IIA. It tends to be a moderate to well drained soil favoring successional hardwoods such as beech, white ash, yellow birch and sugar maple. However, it is also suited to growing white pine, hemlock, balsam fir and red spruce. This sometimes moderately drained soil is prone to windthrow. The prolific rocks and slopes limit harvesting activities to dry summer or to winter/frozen conditions. Erosion control is necessary to minimize erosion at the completion of any timber harvest.

A single tree selection and group selection treatment is recommended on about 24 acres of this stand. As in the other stands on the property dominated by hemlock, the focus of the treatment would be to release the hemlock from hardwood competition to encourage softwood cover. The pockets of saplings could also be released by cutting adjacent overstory trees. Some of the mature pine and oak could be harvested where it is convenient, leaving a complement of oak for mast (acorn) production. A few pockets of thick hemlock could be left untreated to provide dense softwood cover. It may be possible to cut a view at the base of the steep slopes at the western tip of Stand NC8 for the end of the Cockermouth Ledge Trail. As mentioned in Recreation, relocating portions of the Cockermouth Ledge Trail (Notes 1 and 2) would reduce or eliminate harvesting impacts on the trail and keep the trails out of a block of forest identified as important for wildlife habitat in TPW. These trails could be relocated to the locations shown as Notes 3, 4 and 5 on the Forest Type Map. Any trails within the harvest area should have a harvest buffer along them, and skid trails should cross hiking trails as close to perpendicular as possible. Skidding access would be from a landing in Stand 2D to the north, requiring a few sections of excavated skid trail along the western boundary line as described in Access. The stand should be re-assessed in 20 years after this harvest to determine the need for a similar or different treatment.

STAND 8 – Ro,H,WP2-3A/H1B

This 21.4 acre red oak-hardwood-white pine stand is located at the southwestern end of the property. Topography is moderate to moderately steep and is located above Stand NC8 which comprises the steep slopes along the Cockermouth River and the wetland along the southwestern boundary line. The stand does not appear to have been treated during the most recent harvest. It is overstocked at 133 ft² of basal area per acre with red oak comprising 53% of the basal area followed by white pine at 25%, red maple 9% with beech, white birch, red spruce and red pine making up the remainder. The pine component tends to be large, dominant, scattered trees. There is evidence of past gypsy moth defoliation on the oak, as well as caliciopsis (pine canker) on the white pine. Timber volumes average 8,500 board feet of sawlogs and 11 cords of pulpwood per acre. The understory is dominated by beech, hemlock, pine and spruce.



The predominant soil found in this stand is Adams Loamy Sand 36E that is moderately steep. In the important forest soil groups guide (see Appendix) this soil is classified as IIA. It tends to be an excessively drained soil favoring softwoods such as white pine, red pine and hemlock. However, it is also suited to growing red oak, sugar maple, white ash, yellow birch and beech. This excessively drained soil can be prone to windthrow. The dry soil conditions do not limit harvesting activities to any time of the year but care should be taken to do erosion control after the completion of any harvest.

A thinning or first cut shelterwood is recommended on about 17 acres of this stand. Most of the white pine overstory should be harvested, leaving some large “legacy” trees for wildlife and diversity. The red oak should be thinned to reduce crown competition to increase the growth rate and health of the residual trees, and mature or low quality stems of other hardwood species could be harvested to release the best quality trees. The harvest could also release pockets of primarily softwood understory (pine, hemlock and spruce). There is a component of beech in the understory that may dominate with increased sunlight after the harvest. Thus it may be beneficial to cut this component with a high speed feller-buncher head during the harvest, or by hand methods during or after the harvest. Soil scarification would be beneficial to regenerate pine and oak, but harvest season will be dictated by other stands and priorities. As mentioned in Recreation, relocating portions of the Cockermouth Ledge Trail (Note 1) would reduce or eliminate harvesting impacts on the trail and keep the trails out of a block of forest identified as important for wildlife habitat in TPW. This trail could be relocated to the sections shown as Notes 3 and 4 on the Forest Type Map. Any trails remaining within the harvest area should have a harvest buffer along them. Skidding access would be from a landing in Stand 2D to the north, requiring a few sections of excavated skid trail in Stand 7 along the western boundary line as described in Access. The stand should be re-assessed in 20 years after this harvest to determine the need for a similar or different treatment.

STAND 9 – WP,H3-2B

This 12.2 acre stand is located along the Cockermouth River east of the bridge and adjacent to field OP1. The western portion of the stand is dominated by hardwoods with a few stems and groups of “pasture” or “wolf” white pines. An SEA is located between the river and the field just south of the picnic table off the Meadow Walk Trail. The eastern portion of the stand includes an abandoned field that has grown into an area of low-quality white pine repeatedly damaged by the white pine weevil. There is a strip of floodplain hardwoods between the pine and the river that contains a few old apple trees and some black cherry, as well as some invasive barberry, bittersweet and possibly Virginia creeper. Most of this eastern portion is identified as an SEA.

Most of the stand is river corridor or floodplain and should be left unmanaged. Besides protection of the river for water quality, the stand also provides an important wildlife travel corridor and hiding cover adjacent to the large field. As mentioned under Wildlife Resources, a strip of vegetation should be left un-mowed between the river and the field. Control of the invasive species should be considered. Herbicides would be the most effective, but they are close to the river and hand methods may be more appropriate. The apple trees could be released from competition and pruned to improve their health and apple production for wildlife food. The only other management activity to consider is patch cuts in the low-quality pine area on the east side of field OP1 to create early successional habitat primarily for woodcock and ruffed grouse. This is detailed under Wildlife

Resources and can be considered in conjunction with hardwood Stand 6 on the northwest side of field OP1. Perhaps two patches of 1-2 acres each could be considered to be created over time in different harvest entries. One patch could extend to wetland W6 to help regenerate alder, which is a beneficial species especially for woodcock. As this is also habitat for wood turtles, any harvest activity here should take place late fall or winter.

MANAGEMENT ACTIVITY TIME SCHEDULE

PERIODIC/ONGOING/POTENTIAL:
<ul style="list-style-type: none"> • Field OP1 mowing – One third each year, after August 1st or preferably later
<ul style="list-style-type: none"> • Field OP2 mowing – Annually after August 1st
<ul style="list-style-type: none"> • Access road maintenance as needed (crown, waterbar, clean culverts)
<ul style="list-style-type: none"> • Brush hog log landing – at least every three years
<ul style="list-style-type: none"> • Trail maintenance (clear downed trees, erosion control waterbars, remark)
<ul style="list-style-type: none"> • Boundary maintenance – brush, blaze and paint as needed
<ul style="list-style-type: none"> • Research/resolve town line and boundary location
<ul style="list-style-type: none"> • Prior to harvests – 30 day prior certification to conservation easement holder
<ul style="list-style-type: none"> • Stand 9 – Apple tree release and pruning; invasive species control
<ul style="list-style-type: none"> • Field OP1- Potential pollinator plot(s); Potential fruit bearing tree and shrub plantings
Years 2024-2030
<ul style="list-style-type: none"> • Investigate options for access road and bridge at beaver flooding
<ul style="list-style-type: none"> • Improve access road, install bridge and culverts
<ul style="list-style-type: none"> • Construct log landing in Stand 2D
<ul style="list-style-type: none"> • Stand 1 – Shelterwood harvest – 19 acres
<ul style="list-style-type: none"> • Stands 2C & 2D – Shelterwood & Seed Tree harvest – 50 acres
<ul style="list-style-type: none"> • Stands 3D & 3F – Single Tree & Group Selection harvest– 9 acres
<ul style="list-style-type: none"> • Stand 4 - Single Tree & Group Selection harvest – 8 acres
<ul style="list-style-type: none"> • Stand 6 - Single Tree & Group Selection harvest – 2.5 acres Or Patch Cut for early successional habitat 1 to 2 acres (if not in Stand 9)
<ul style="list-style-type: none"> • Stand 7 - Single Tree & Group Selection harvest – 24 acres
<ul style="list-style-type: none"> • Stand 8 - Thin or First Cut Shelterwood harvest – 17 acres
<ul style="list-style-type: none"> • Stand 9 - Patch Cut for early successional habitat 1 to 2 acres (if not in Stand 6)
<ul style="list-style-type: none"> • Hiking trail relocations as desired
<ul style="list-style-type: none"> • Post harvest erosion control water bars & seeding
+20 years
<ul style="list-style-type: none"> • Assess harvested stands for next treatment needs
<ul style="list-style-type: none"> • Update Forest Stewardship Plan

APPENDIX

PHOTOGRAPHS



PHOTO 1 CENTRAL TROUGH STREAM RUNNING THROUGH PROPERTY



PHOTO 2 LEDGE OUTCROP - CHARACTERISTIC OF OTHER AREAS OF THE PROPERTY



PHOTO 3 VISTA AREA OF MOUNT CARDIGAN FROM THE SOUTHERN END OF THE PROPERTY



PHOTO 4 VIEW OF MOUNT CARDIGAN FROM THE NORTHWESTERN PORTION OF THE PROPERTY



PHOTO 5 VIEW OF TENNEY MOUNTAIN FROM REMOTE POND



PHOTO 6 VIEW OF TENNEY RIDGE WITH PLYMOUTH MOUNTAIN IN BACKGROUND



PHOTO 7 ICE DAMAGE IN STAND 2



PHOTO 8 NEWFOUND LAKE FROM CENTER OF STAND 2; POTENTIAL VISTA; NOTE ICE DAMAGE



PHOTO 9 NON-COMMERCIAL SPRUCE STAND AT HEIGHT OF PROPERTY (NORTH END)



PHOTO 10 VIEW OF NEWFOUND LAKE FROM EASTERN CORNER OF PROPERTY ON CONNOR/BRITTELLI/HEBRON TOWN FOREST PROPERTY LINE



PHOTO 11 BEAR CLAWED BEECH IN STAND 7; IMPORTANT FOR WILDLIFE AS MAST TREE

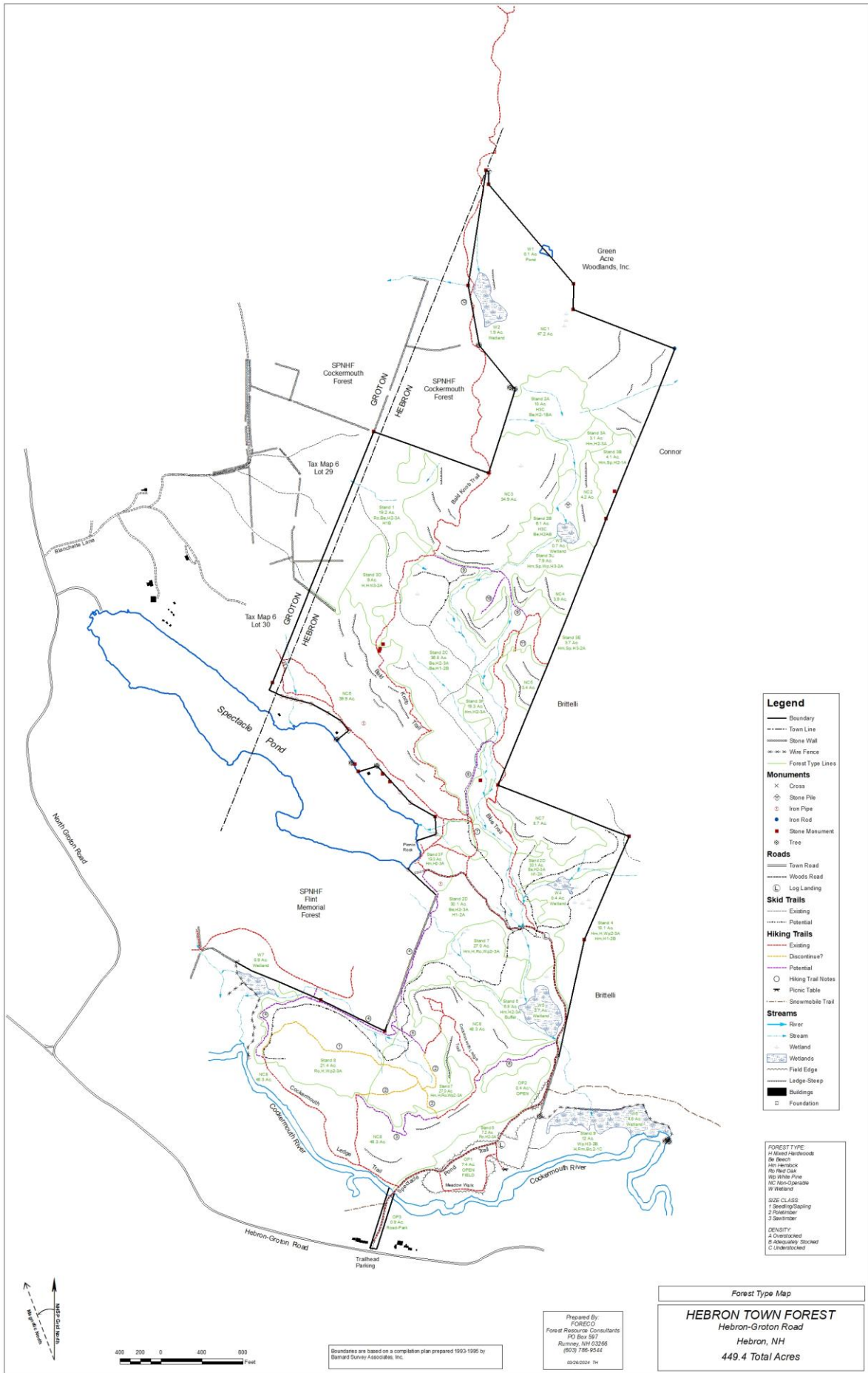


PHOTO 22 BEAR TEETH MARKS ON A BALSAM FIR



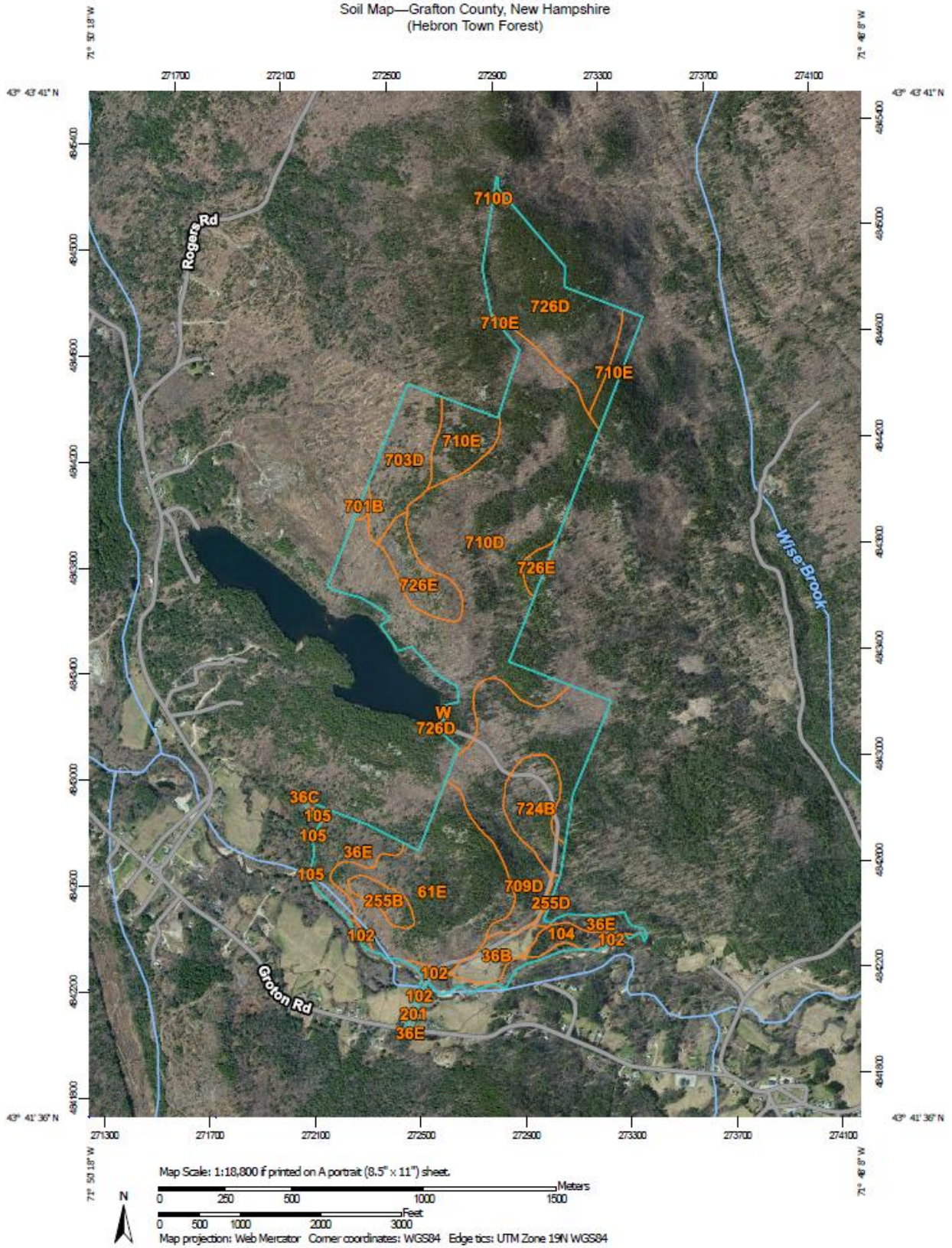
PHOTO 33 SMALL REMOTE POND ADJACENT TO GREEN ACRE WOODLANDS' BOUNDARY
AT NORTHERN END OF PROPERTY

FOREST TYPE MAP



SOIL TYPE & GROUP DESCRIPTIONS

Soil Map—Grafton County, New Hampshire
(Hebron Town Forest)



Natural Resources
Conservation Service


Web Soil Survey
National Cooperative Soil Survey

3/21/2022
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Soil Map—Grafton County, New Hampshire
(Hebron Town Forest)


MAP LEGEND


Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grafton County, New Hampshire

Survey Area Data: Version 25, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 8, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

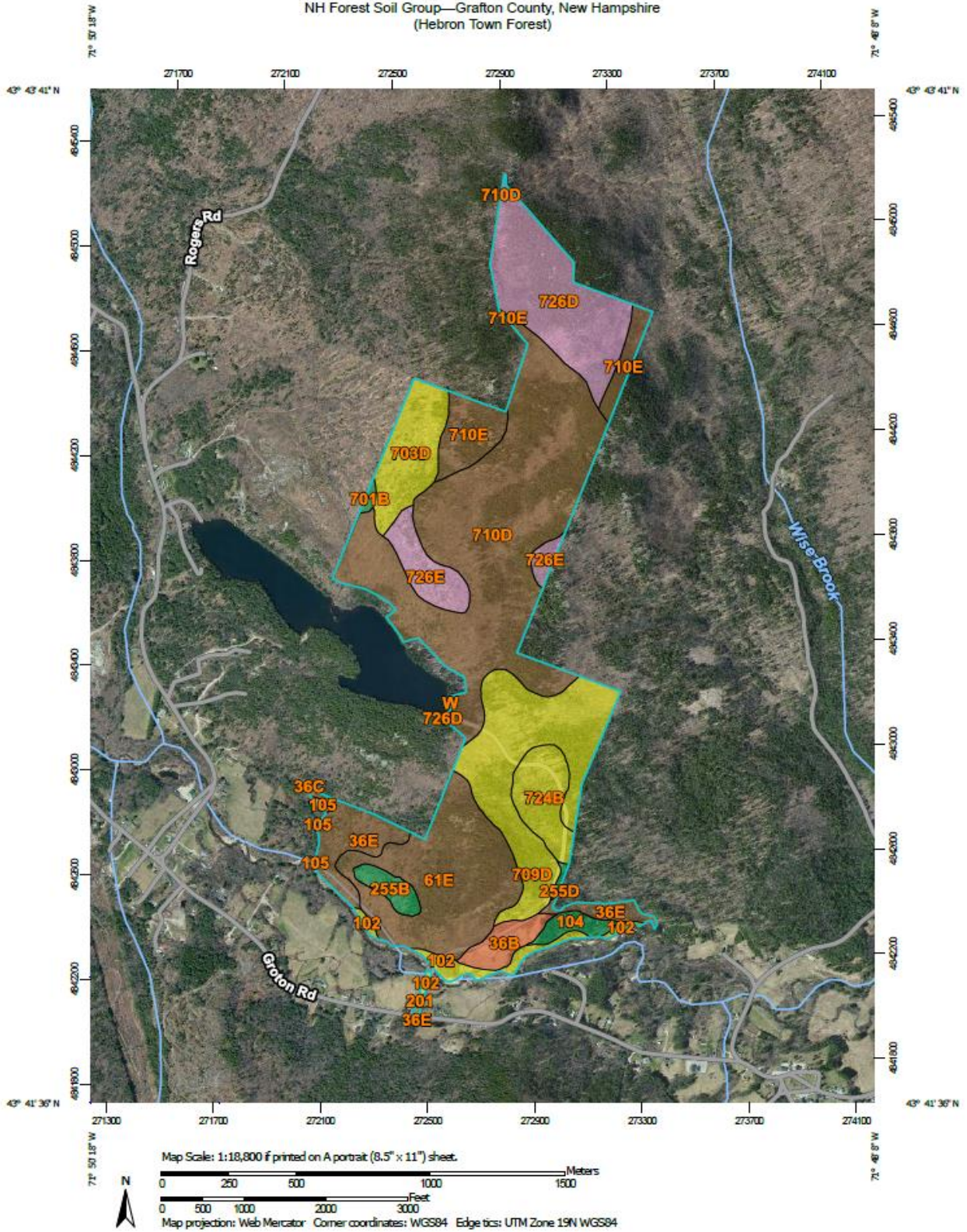
3/21/2022
Page 2 of 4

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
36B	Adams loamy sand, 3 to 8 percent slopes	8.9	2.0%
36C	Adams loamy sand, 8 to 15 percent slopes	0.0	0.0%
36E	Adams loamy sand, 15 to 60 percent slopes	21.4	4.8%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	60.6	13.6%
102	Sunday loamy sand	8.1	1.8%
104	Podunk fine sandy loam, 0 to 3 percent slopes, frequently flooded	5.2	1.2%
105	Rumney fine sandy loam, 0 to 3 percent slopes, frequently flooded	0.6	0.1%
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	0.2	0.1%
255B	Hermon and Monadnock soils, 0 to 8 percent slopes, very stony	5.9	1.3%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	0.8	0.2%
701B	Becket-Skerry association, 0 to 15 percent slopes, very stony	1.0	0.2%
703D	Becket-Monadnock association, 15 to 35 percent slopes, very stony	23.6	5.3%
709D	Becket-Tunbridge association, 15 to 35 percent slopes, very stony	60.0	13.5%
710D	Becket-Lyman-Rock outcrop complex, 15 to 35 percent slopes	147.3	33.0%
710E	Becket-Lyman-Rock outcrop complex, 35 to 60 percent slopes	20.0	4.5%
724B	Skerry-Tunbridge association, 0 to 15 percent slopes, very stony	16.9	3.8%
726D	Rock outcrop-Lyman complex, hilly	49.5	11.1%
726E	Rock outcrop-Lyman complex, steep	16.3	3.6%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
W	Water	0.0	0.0%
Totals for Area of Interest		446.3	100.0%

NH Forest Soil Group—Grafton County, New Hampshire
(Hebron Town Forest)



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

3/21/2022
Page 1 of 6

MAP LEGEND		MAP INFORMATION
<p>Area of Interest (AOI)</p> <p> Area of Interest (AOI)</p>	<p> Not rated or not available</p>	<p>The soil surveys that comprise your AOI were mapped at 1:24,000.</p> <p>Please rely on the bar scale on each map sheet for map measurements.</p> <p>Source of Map: Natural Resources Conservation Service Web Soil Survey URL: Coordinate System: Web Mercator (EPSG:3857)</p> <p>Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.</p> <p>This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.</p> <p>Soil Survey Area: Grafton County, New Hampshire Survey Area Data: Version 25, Aug 31, 2021</p> <p>Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.</p> <p>Date(s) aerial images were photographed: Apr 8, 2011—May 1, 2011</p> <p>The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.</p>
<p>Soils</p> <p>Soil Rating Polygons</p> <p> Group IA</p> <p> Group IB</p> <p> Group IC</p> <p> Group IIA</p> <p> Group IIB</p> <p> NC</p> <p> Not rated or not available</p> <p>Soil Rating Lines</p> <p> Group IA</p> <p> Group IB</p> <p> Group IC</p> <p> Group IIA</p> <p> Group IIB</p> <p> NC</p> <p> Not rated or not available</p> <p>Soil Rating Points</p> <p> Group IA</p> <p> Group IB</p> <p> Group IC</p> <p> Group IIA</p> <p> Group IIB</p> <p> NC</p>	<p>Water Features</p> <p> Streams and Canals</p> <p>Transportation</p> <p> Rails</p> <p> Interstate Highways</p> <p> US Routes</p> <p> Major Roads</p> <p> Local Roads</p> <p>Background</p> <p> Aerial Photography</p>	

NH Forest Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
36B	Adams loamy sand, 3 to 8 percent slopes	Group IC	8.9	2.0%
36C	Adams loamy sand, 8 to 15 percent slopes	Group IC	0.0	0.0%
36E	Adams loamy sand, 15 to 60 percent slopes	Group IIA	21.4	4.8%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	Group IIA	60.6	13.6%
102	Sunday loamy sand	Group IB	8.1	1.8%
104	Podunk fine sandy loam, 0 to 3 percent slopes, frequently flooded	Group IA	5.2	1.2%
105	Rumney fine sandy loam, 0 to 3 percent slopes, frequently flooded	Group IIB	0.6	0.1%
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	Group IA	0.2	0.1%
255B	Hermon and Monadnock soils, 0 to 8 percent slopes, very stony	Group IA	5.9	1.3%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	Group IA	0.8	0.2%
701B	Becket-Skerry association, 0 to 15 percent slopes, very stony	Group IA	1.0	0.2%
703D	Becket-Monadnock association, 15 to 35 percent slopes, very stony	Group IB	23.6	5.3%
709D	Becket-Tunbridge association, 15 to 35 percent slopes, very stony	Group IB	60.0	13.5%
710D	Becket-Lyman-Rock outcrop complex, 15 to 35 percent slopes	Group IIA	147.3	33.0%
710E	Becket-Lyman-Rock outcrop complex, 35 to 60 percent slopes	Group IIA	20.0	4.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
724B	Skerry-Tunbridge association, 0 to 15 percent slopes, very stony	Group IB	16.9	3.8%
726D	Rock outcrop-Lyman complex, hilly	NC	49.5	11.1%
726E	Rock outcrop-Lyman complex, steep	NC	16.3	3.6%
W	Water	NC	0.0	0.0%
Totals for Area of Interest			446.3	100.0%

Description

NH Forest Soil Groups (NHFGs) consist of map units that are similar in their potential for commercial forest products, their suitability for native tree growth, and their use and management. Considered in grouping the map units are depth to bedrock, texture, saturated hydraulic conductivity, available water capacity, drainage class, and slope. The grouping applies only to soils in the State of New Hampshire.

The NHFGs have been developed to help land users and managers in New Hampshire evaluate the relative productivity of soils and to better understand patterns of plant succession and how soil and site interactions influence management decisions. The soils are assigned to one of five groups (IA, IB, IC, IIA, and IIB). Several map units in New Hampshire either vary so greatly or have such a limited potential for commercial forest products that they have not been assigned to an NHFG (NC). Examples of NC map units are very poorly drained soils and soils at high elevations. The kinds of tree species generally growing in climax stands in each of the five NHFGs vary from county to county. This information is available through local NRCS field offices.

IA—This group consists of very deep, loamy, moderately well drained or well drained soils. Generally, these soils are more fertile than other soils and have the most favorable soil moisture relationships.

IB—The soils in this group are generally sandy or loamy over sandy material and are slightly less fertile than group IA soils. Group IB soils are moderately well drained or well drained. Their soil moisture is adequate for good tree growth, but it may not be quite as abundant as that in group IA soils.

IC—The soils in this group are in areas of outwash sand and gravel. They are moderately well to excessively drained. Their soil moisture is adequate for good softwood growth but is limited for hardwoods.

IIA—This diverse group includes many of the same soils as those in groups IA and IB. The soils are separated into a unique group, however, because they have physical limitations that make forest management more difficult and costly, i.e., steep slopes, bedrock outcrops, erosive textures, surface boulders, and extreme rockiness.

IIB—The soils in this group are poorly drained. The seasonal high water table is generally within 12 inches of the surface. Productivity is generally less than that of soils in the other groups.

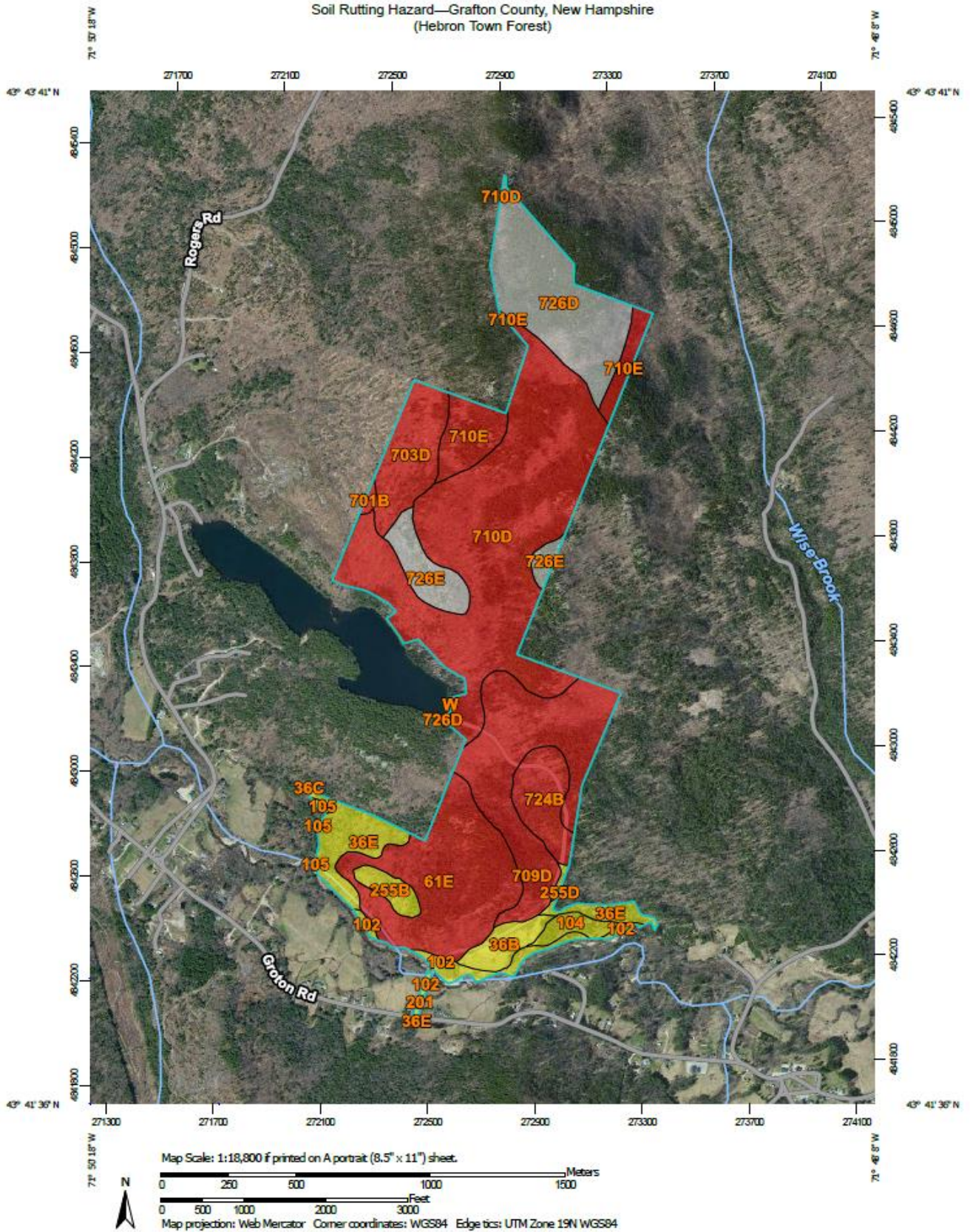
NC—The map units in this category either vary so greatly or have such a limited potential for commercial forest products that they have not been assigned to an NHFG. Commonly, onsite visit would be required to evaluate the situation.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower





















Soil Rutting Hazard—Grafton County, New Hampshire
(Hebron Town Forest)



USDA
Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

3/21/2022
Page 1 of 6

MAP LEGEND		MAP INFORMATION
<p>Area of Interest (AOI)</p> <p> Area of Interest (AOI)</p>	<p>Background</p> <p> Aerial Photography</p>	<p>The soil surveys that comprise your AOI were mapped at 1:24,000.</p> <p>Please rely on the bar scale on each map sheet for map measurements.</p> <p>Source of Map: Natural Resources Conservation Service Web Soil Survey URL: Coordinate System: Web Mercator (EPSG:3857)</p> <p>Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.</p> <p>This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.</p> <p>Soil Survey Area: Grafton County, New Hampshire Survey Area Data: Version 25, Aug 31, 2021</p> <p>Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.</p> <p>Date(s) aerial images were photographed: Apr 8, 2011—May 1, 2011</p> <p>The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.</p>
<p>Soils</p> <p>Soil Rating Polygons</p> <p> Severe</p> <p> Moderate</p> <p> Slight</p> <p> Not rated or not available</p>		
<p>Soil Rating Lines</p> <p> Severe</p> <p> Moderate</p> <p> Slight</p> <p> Not rated or not available</p>		
<p>Soil Rating Points</p> <p> Severe</p> <p> Moderate</p> <p> Slight</p> <p> Not rated or not available</p>		
<p>Water Features</p> <p> Streams and Canals</p>		
<p>Transportation</p> <p> Rails</p> <p> Interstate Highways</p> <p> US Routes</p> <p> Major Roads</p> <p> Local Roads</p>		

Rating	Acres in AOI	Percent of AOI
Severe	329.4	73.8%
Moderate	51.2	11.5%
Null or Not Rated	65.8	14.7%
Totals for Area of Interest	446.3	100.0%

Description

The ratings in this interpretation indicate the hazard of surface rut formation through the operation of forestland equipment. Soil displacement and puddling (soil deformation and compaction) may occur simultaneously with rutting.

Ratings are based on depth to a water table, rock fragments on or below the surface, the Unified classification of the soil, depth to a restrictive layer, and slope. The hazard is described as slight, moderate, or severe. A rating of "slight" indicates that the soil is subject to little or no rutting. "Moderate" indicates that rutting is likely. "Severe" indicates that ruts form readily.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified aspect of forestland management (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

**NEW HAMPSHIRE NATURAL HERITAGE BUREAU
INFORMATION**



New Hampshire Natural Heritage Bureau

DNCR - Division of Forests & Lands
 172 Pembroke Road, Concord, NH 03301
 Phone: (603) 271-2214 Fax: (603) 271-6488

To: Kevin D. Lemire
 Forest Resources Consultants, LLC
 PO Box 597
 Rumney, NH 03266

From: NH Natural Heritage Bureau
Date: 2022-03-16

Re: Review by NH Natural Heritage Bureau of request dated 2022-03-15

NHB File ID: 3859 **Town:** Hebron, NH
Project type: Landowner Request **Location:** Map 14 Lots 2, 5 & 6 - Map 24 Lots 1, 2, & 18; Town of Hebron

We have searched our database for records of rare species and exemplary natural communities on the property(s) identified in your request. Our database includes known records for species officially listed as Threatened or Endangered by either the state of New Hampshire or the federal government, as well as species and natural communities judged by experts to be at risk in New Hampshire but not yet formally listed.

NHB records on the property(s):

Vertebrate Species	Mapping Precision	% within tract	Last Reported	Listing Status	Conservation Rank
Wood Turtle - <i>Glyptemys insculpta</i>	High	1.3	2015	Federal - NH -- SC	Global - S3 G3 S3

NHB records within one mile of the property(s):

Plant Species	Last Reported	Listing Status	Conservation Rank
thin-leaved sedge - <i>Carex cephaloides</i>	2012	Federal - NH -- T	Global - S2 G5 S2
Vertebrate Species	Last Reported	Listing Status	Conservation Rank
Common Loon - <i>Colinus virginianus</i>	2021	Federal - NH -- T	Global - S2B G5 S2B
Wood Turtle - <i>Glyptemys insculpta</i>	2015	-- SC	G3 S3

Listing codes: T = Threatened, E = Endangered, SC = Special Concern
 Rank prefix: G = Global, S = State, T = Global or state rank for a sub-species or variety (taxon)

NOTE: This review cannot be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.

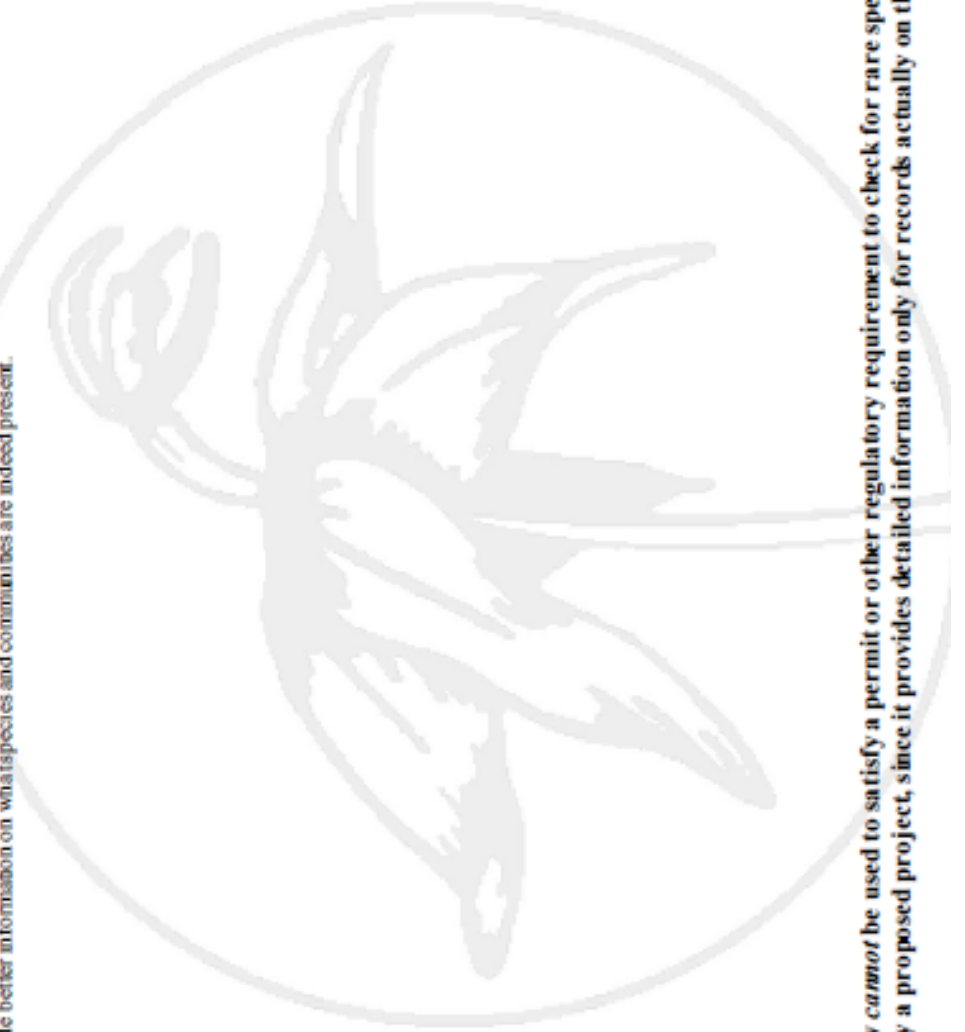


New Hampshire Natural Heritage Bureau

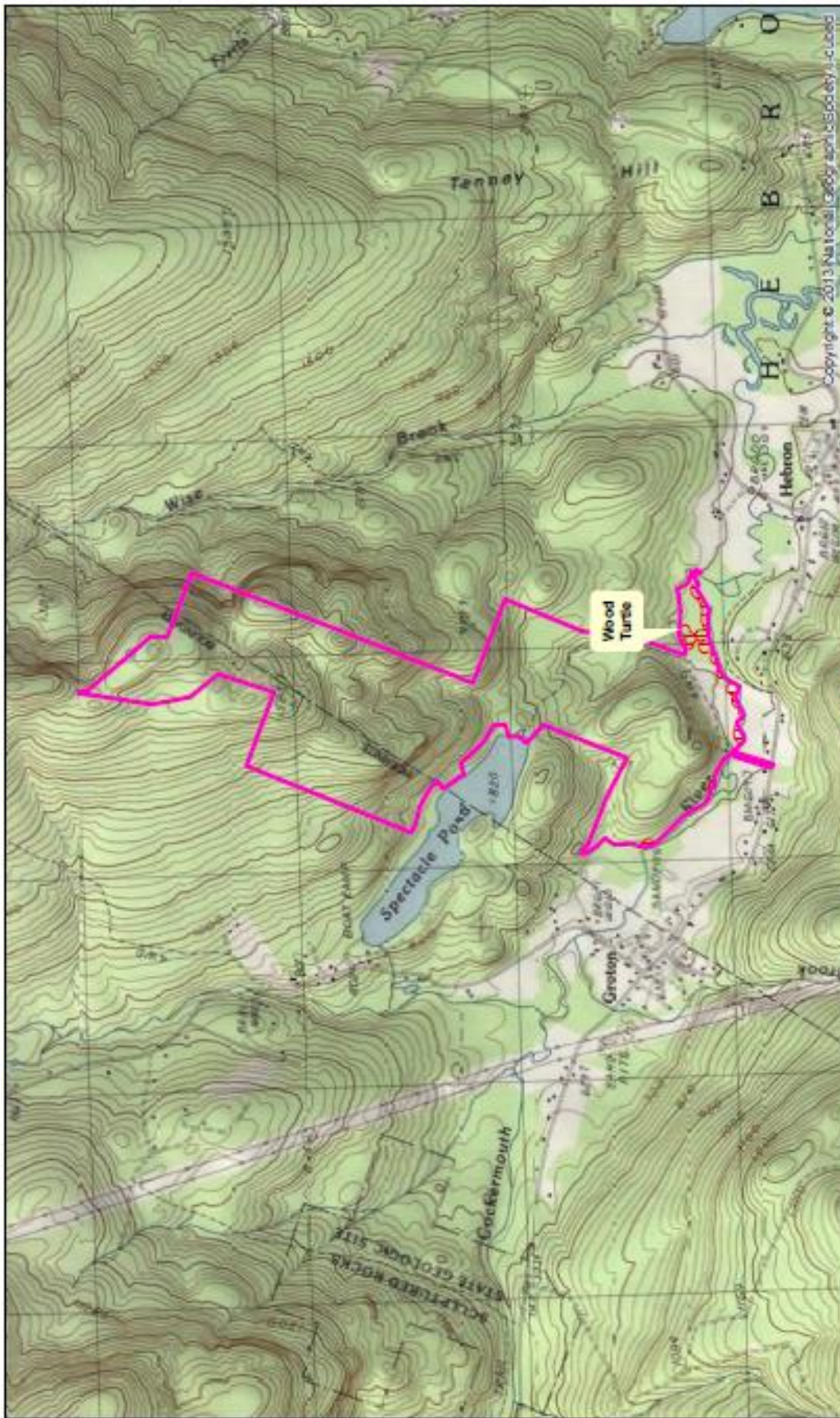
DNCR - Division of Forests & Lands
172 Pembroke Road, Concord, NH 03301
Phone: (603) 271-2214 Fax: (603) 271-6488

Rank suffix: 1-5 = Most (1) to least (5) imperiled. "-", U, NR = Not ranked. B = Breeding population, N = Non-breeding, H = Historical, X = Extirpated.

A negative result (no record in our database) does not mean that no rare species are present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.



NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



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**Natural Heritage Bureau
Landowner Report**

Project ID Number: 3859

NOTE: Any rare species and/or exemplary natural communities in this area are not shown unless they occur, at least in part, within the property bounds.



Property Bounds # of Records

	Property Bounds	# of Records
	Plant Occurrence	0
	Animal Occurrence	1
	Natural Community	0
	Ecological System	0



New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle - *Glyptemys insculpta*

<u>Legal Status</u>		<u>Conservation Status</u>	
Federal:	Not Listed	Global:	G3: Rare or Uncommon
State:	SpecialConcern	State:	S3: Rare or Uncommon
<u>Description at this Location</u>			
Quality Rank:	Fair		
Quality Comments:	-		
Detailed Description:	2015: Spring 2015 Survey: 25 turtles observed: 6 adult males, 3 adult females, 5 juvenile males, 2 juvenile females, and 9 juveniles, sex unknown. 2013: Spring 2013 Survey: 35 turtles observed: 15 adult males, 14 adult females, 4 juveniles males, 1 adult, sex unknown and 1 juvenile, sex unknown. Fall 2013 Survey: 6 turtles observed on 9/8: 3 adult males, 1 juvenile male, and 2 juveniles, sex unknown. 4 turtles observed on 9/19: 2 adult males and 2 juveniles, sex unknown. 10 turtles observed on 9/29: 6 adult males and 4 adult females. 2 adult males observed on 11/8. 2011: Area CM_11: 26 individuals observed, 4 female, 14 male, 8 juveniles of unknown sex. 2007: MJ07_10, MJ07_15, MJ07_37, MJ07_45, MJ07_49-MJ07_51: 7 turtles radiotracked, 4 males and 3 females. MJ07_4, MJ07_9, MJ07_13, MJ07_19, MJ07_21, MJ07_32, MJ07_33, MJ07_38, MJ07_39, MJ07_43, MJ07_46-MJ07_48, MJ07_52-MJ07_82: 44 individuals observed, 23 males, 11 females, 10 juveniles (not sexed). 1998: MJ98: 1 turtle observed.		
General Area:	2011: Area CM_11: Beach, bank and shrub swamp habitats along Cockermouth River. 2007: MJ07_4-MJ07_82: Multiple habitats, including river channel, riverbanks, wetlands, upland forest, and hayfields. 1998: MJ98: Young deciduous forest. Oak and alder are the predominant species.		
General Comments:	1998: MJ98: Appears to be a relict population with very few (if any) adult turtles left.		
Mgmt Comments:	-		
<u>Location</u>			
Survey Site Name:	Spectacle Brook		
Managed By:	Hebron, Town of		
County:	Grafton	Size:	55.4 acres
Town(s):	Hebron	Elevation:	620
Precision:	High		
Directions:	1998: MJ98: From Hebron, drive towards Groton on Hebron / Groton Road. Turn right a fter 2 miles on North Groton Road. At bridge, follow the Cockermouth River west (on foot) to the Spectacle Brook confluence ca. 0.25 miles upstream.		
<u>Dates documented</u>			
First reported:	1998-07-25	Last reported:	2015-06-21

DIRT – TREES – WILDLIFE ANALYSIS

Dirt to Trees to Wildlife Report

Project Name: Hebron Town Forest

Project Size: 445.43 acres

Date: Monday, March 21, 2022

The following report was generated by the Dirt to Trees to Wildlife tool. Based on a user-defined Area of Interest (AOI), the tool presents a main table of soils characteristics for an AOI along with a listing of Potential Forest Types. Details for each Potential Forest Type are presented in the appendix of this report, including a list of species that utilize the forest type for breeding habitat, general silvicultural guidelines that will maximize habitat quality for the listed species, and finally, recommendations for each Species of Greatest Conservation Need in said list. Please note that features less than 2 acres are omitted from the table below, which may result in a discrepancy between the Project Size listed above and the acreage totals at the bottom of this report.

Soil MU Symbol	Soil Map Unit Name	MU Acres	IFSG	Leak/Homer Soil Group	Leak/Homer Soil Group Acres	Potential DTW Forest Types
724B	Skerry-Tunbridge association	16.9	IB	10C. Fine Till over compact Till. May contain Enrichedsoils	16.9	Aspen Paper Birch Northern Hardwoods Non forest upland
104	Podunk fine sandy loam	5.23	IA	12. Floodplain	5.23	Aspen Non forest palustrine Non forest upland Silver Maple Northern Hardwoods Speckled Alder
61E	Tunbridge-Lyman-Rock outcrop complex	60.62	IIA	2. Shallow to Bedrock Loose Rock Exposed Ledge	60.62	Hemlock Northern Hardwoods Non forest upland Paper Birch Eastern White Pine Red Spruce (high elevations) Spruce-Fir (high elevations) Balsam Fir (high elevations)
726D	Rock outcrop-Lyman complex	49.47	NC	2B. Exposed Ledge	65.75	Non forest upland
726E	Rock outcrop-Lyman complex	16.28	NC			
102	Sunday loamy sand	7.65	IB	3. Outwash	37.74	Aspen Hemlock Non forest upland Northern Red Oak
36B	Adams loamy sand	8.89	IC			

36E	Adams loamy sand	21.2	IIA			Northern Red Oak Pine-Oak-Maple Eastern White Pine
703D	Becket-Monadnock association	23.59	IB	5A. Dry Compact Till	250.88	Aspen Paper Birch Northern Hardwoods Non forest upland
709D	Becket-Tunbridge association	60.04	IB			
710D	Becket-Lyman-Rock outcrop complex	147.28	IIA			
710E	Becket-Lyman-Rock outcrop complex	19.97	IIA			
255B	Monadnock and Hermon soils	5.88	IA	8. Fine Washed Till	5.88	Aspen Paper Birch Non forest upland Northern Hardwoods
Total		443.00			443.00	

Generated by <http://dirttreeswildlife.org>



FOREST TYPE: HEMLOCK

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species.

Reptiles and Amphibians

Northern redbelly snake

Birds

Great horned owl

[Long-eared owl*](#)

Northern saw-whet owl

Blue-headed vireo

Blue jay

Red-breasted nuthatch

Winter wren

Hermit thrush

Black-throated green warbler

Mammals

Snowshoe hare

Red squirrel

Deer mouse

Southern red-backed vole

[Hoary bat*](#)

[Indiana bat*](#)

[Little brown bat*](#)

[Northern long-eared bat*](#)

[Red bat*](#)

[Silver-haired bat*](#)

[Tri-colored bat*](#)

Porcupine

Gray fox

Red fox

Black bear

RECOMMENDATIONS

These recommendations are designed to optimize wildlife habitat conditions within this forest type. Other silvicultural options may apply, but they won't necessarily optimize potential habitat conditions for the full range of wildlife species that can occupy this type.

- Use uneven-aged management. Single tree or group selection—groups less than $\frac{1}{10}$ acre.
- Use a 200-year rotation age with entries every 20 years.
- Let 10 percent of the area in this type go to 250-plus years before rotating.
- Avoid entry during nesting season—April to June.
- Whole-tree harvest or cut-to-length is preferred.

FOREST TYPE: NORTHERN RED OAK

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species.

Reptiles and Amphibians

Marbled salamander	Timber rattlesnake*
Jefferson's salamander	Eastern hognose snake*
Northern redbelly snake	Northern black racer*

Birds

Cooper's hawk	Blackburnian warbler
Black-billed cuckoo*	Canada warbler*
Whip-poor-will*	Cerulean warbler*
Ruby-throated hummingbird	Golden-winged warbler*
Pileated woodpecker	Ovenbird
Blue jay	Eastern towhee*
Eastern bluebird	Rose-breasted grosbeak*

Mammals

Gray squirrel	Hoary bat*
Southern flying squirrel	Silver-haired bat*
White-footed mouse	Tri-colored bat*
Indiana bat*	Red fox
Northern long-eared bat*	Gray fox
Little brown bat*	Black bear
Red bat*	

RECOMMENDATIONS

These recommendations are designed to optimize wildlife habitat conditions within this forest type. Other silvicultural options may apply, but they won't necessarily optimize potential habitat conditions for the full range of wildlife species that can occupy this type.

- Use even-aged management. A three-cut shelterwood system is preferred.
- Use a 150-year rotation age with entries every 20 years.
- Let 10 percent of the area in this type age to 175 years before rotating.
- Avoid entry during nesting season—April to June.
- Whole-tree harvest or cut-to-length is preferred.

Species List and Recommendations, Forest Type: Northern Red Oak
Dirt to Trees to Wildlife

DirtTreesWildlife.org

FOREST TYPE: PINE-OAK-MAPLE

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species.

Reptiles and Amphibians

Marbled salamander	Northern black racer*
Jefferson's salamander	Black rat snake*
Five-lined skink*	Northern copperhead snake
Northern red-belly snake	Timber rattlesnake*
Eastern hognose snake*	Eastern box turtle*
Eastern worm snake	Fowler's toad*

Birds

Turkey vulture	Yellow-throated vireo
Sharp-shinned hawk*	Blue jay
Cooper's hawk	American crow
Broad-winged hawk*	Tufted titmouse
Red-tailed hawk	White-breasted nuthatch
American kestrel*	Blue-gray gnatcatcher
Barred owl	Eastern bluebird
Long-eared owl*	Wood thrush*
Wild turkey	Gray catbird
Mourning dove	Black-and-white warbler*
Black-billed cuckoo*	Prairie warbler*
Yellow-billed cuckoo*	Cerulean warbler*
Whip-poor-will*	Worm-eating warbler*
Common nighthawk*	Scarlet tanager*
Red-headed woodpecker	Eastern towhee*
Red-bellied woodpecker	Chipping sparrow
Downy woodpecker	Rose-breasted grosbeak*
Pileated woodpecker	Ovenbird
Northern flicker	Brown thrasher*
Least flycatcher	Common yellowthroat

Mammals

New England cottontail*	Little brown bat*
Snowshoe hare	Hoary bat*
Grey squirrel	Red bat*
Southern flying squirrel	Silver-haired bat*
Northern flying squirrel	Tri-colored bat*
White-footed mouse	Southern red-backed vole
Indiana bat*	Red fox
Northern long-eared bat*	

RECOMMENDATIONS

These recommendations are designed to optimize wildlife habitat conditions within this forest type. Other silvicultural options may apply, but they won't necessarily optimize potential habitat conditions for the full range of wildlife species that can occupy this type.

- Use even-aged management. A three-cut shelterwood system is preferred.
- Use a 150-year rotation age with entries every 20 years.
- Let 10 percent of the area in this type go to 175 years before rotating.
- Avoid entry during nesting season—April to June.
- Whole-tree harvest or cut-to-length is preferred.

FOREST TYPE: RED MAPLE

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species.

Reptiles and Amphibians

Blue spotted salamander *	Northern redbelly snake
Marbled salamander	Ribbon snake
Jefferson's salamander	Eastern hognose snake
Northern slimy salamander	Northern ringneck snake

Birds

Great blue heron	Warbling vireo
Green heron	Blue jay
Wood duck	Tree swallow
Common goldeneye	Black-crowned chickadee
Hooded merganser	Carolina wren
Common merganser	Winter wren
Red-shouldered hawk	Blue-gray gnatcatcher
Broad-winged hawk *	Veery *
American woodcock *	Gray catbird
Eastern screech owl	Cedar waxwing
Barred owl	Yellow warbler
Northern saw-whet owl	Chestnut-sided warbler
Ruby-throated hummingbird	Mourning warbler *
Red-headed woodpecker	Hooded warbler
Red-bellied woodpecker	Canada warbler *
Downy woodpecker	American redstart
Hairy woodpecker	Common yellowthroat
Pileated woodpecker	Song sparrow
Least flycatcher	Northern cardinal
White-eyed vireo *	Common grackle
Yellow-throated vireo	American goldfinch

Mammals

New England cottontail *	Tri-colored bat *
Virginia opossum	Woodland jumping mouse
Indiana bat *	Red fox
Northern long-eared bat *	Gray fox
Little brown bat *	Raccoon
Red bat *	Mink
Hoary bat *	Moose *
Silver-haired bat *	

RECOMMENDATIONS

These recommendations are designed to optimize wildlife habitat conditions within this forest type. Other silvicultural options may apply, but they won't necessarily optimize potential habitat conditions for the full range of wildlife species that can occupy this type.

- Use even-aged management. Cuts can range from 5 to 30 acres.
- Use a 100-year rotation age with entries every 10 to 15 years.
- Let 10 percent of the area in this type age to 150 years before rotating.
- In larger cut blocks (greater than 10 acres), leave patches of uncut trees, about $\frac{1}{3}$ acre for every 10 acres clear cut.
- Avoid entry during nesting season—April to June.
- Whole-tree harvest is preferred.

SPRUCE AND FIR FOREST TYPES

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species. Colors denote differences due to elevation.

Reptiles and Amphibians

None listed

Birds

Any Elevation	Additional Requirements
Boreal chickadee	
Dark-eyed junco	
Pine siskin	
Spruce grouse *	
Red-breasted nuthatch	
Golden-crowned kinglet	Spruce at low elevation
Gray jay	Spruce at low elevation
Red crossbill	Spruce at low elevation
Ruby-crowned kinglet	Spruce at low elevation
White-winged crossbill	Spruce at low elevation
Pine grosbeak	Spruce/Fir Mix when at low elevation
Hi Elevation Only	
Bicknell's thrush *	
Black-backed woodpecker	
Low Elevation Only	Additional

Requirements	
Bay-breasted warbler *	
Blackburnian warbler	
Cape May warbler *	
Common goldeneye	
Magnolia warbler	
Olive-sided flycatcher *	
Purple finch *	
Rusty blackbird *	
Sharp-shinned hawk *	
Swainson's thrush	
Three-toed woodpecker *	
Yellow-bellied flycatcher	
Hooded merganser	Fir Component
Blackpoll warbler	Spruce component
Blue-headed vireo	Spruce component
Northern parula	Spruce component
Evening grosbeak	Spruce type
Northern saw-whet owl	Spruce type
Hermit thrush	Spruce/Fir Mix
Merlin	Spruce/Fir Mix
Nashville warbler	Spruce/Fir Mix
Ruby crowned kinglet	BF Type
Yellow warbler	BF Type

SPECIES LIST (continued)

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species. Colors denote differences due to elevation.

Mammals

Any Elevation

Snowshoe hare
Red squirrel
Southern red-backed vole
[Long-tailed shrew](#)*
[American marten](#)*

Hi Elevation Only

[Rock vole](#)*
[Northern bog lemming](#)*
[Eastern small-footed bat](#)*
[Canada lynx](#)*

Low Elevation Only

Northern flying squirrel
Deer mouse
[Hoary bat](#)*
[Tri-colored bat](#)*
[Little brown bat](#)*
[Silver-haired bat](#)*
[Northern long-eared bat](#)*
[Indiana bat](#)*
[Red bat](#)*
Red fox
[Bobcat](#)*
[Moose](#)*

RECOMMENDATIONS

These recommendations are designed to optimize wildlife habitat conditions within this forest type. Other silvicultural options may apply, but they won't necessarily optimize potential habitat conditions for the full range of wildlife species that can occupy this type. *Colors denote differences due to elevation.*

For Low Elevation Types	Spruce/Fir Type	Spruce Type	Balsam Fir Type
Use uneven-aged management—group selection with groups size of xx acres	0.1 to 2	less than 1 acre.	3-10
Rotation Age xx years	90	120	75
Entry Cycle Every xx years	15	15-20	15
Let 10 percent of the area in this type age to xxx years before rotating.	120	150	100
Avoid entry during nesting season—April to June.			
Whole-tree harvest or cut-to-length is preferred.			

High-elevation (generally above 2,500 feet) forest types are normally situated on soils that are shallow to bedrock or poor in quality. The soil conditions, coupled with climate conditions at high elevations, result in slow vegetative reproduction and growth. Since the habitat provided by this type at these elevations contains a large proportion of SGCN species, special care must be taken when management takes place at high elevations in this type.

The management preference for optimal habitat is no management at all—allow natural processes to take place. If harvesting in this type at high elevation, contact your state wildlife agency before proceeding.

Composition and Structure Goals

- Within the managed area at least 60 percent should remain in stands with an average DBH of 4 inches or greater and a stocking of at least 90 square feet of basal area per acre.
- Leave 10 percent of the area unharvested. The remaining 30 percent of the area can be less than 4 inches in DBH and less than 90 square feet of basal area.
- Distribute these cut areas across the managed area rather than concentrating them.
- Direct management toward maintaining or increasing softwood types at high elevations.

Harvesting Provisions

- Use group selection with small groups— $\frac{1}{4}$ to $\frac{1}{2}$ acre is preferred.
- Install larger groups (up to 3 acres) or small clearcuts (3 to 5 acres) only where adequate regeneration is in place.
- Minimize residual stand damage.
- Minimize soil compaction.
- Winter harvest is preferred.
- Avoid whole-tree harvest. Use a cut-to-length harvest method, leaving tops and limbs in place.
- Retain three to five large live cull or cavity trees per acre.

FOREST TYPE: NON-FOREST PALUSTRINE

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species. Includes sedge meadow (1), shallow marsh (2), deep marsh (3), shrub swamp (4), bogs (5), ponds (6) and riparian (7).

Reptiles and Amphibians

Blandine's turtle * 7	Snapping turtle 6
Bull frog 6	Spotted salamander 6
Common musk turtle 6	Spotted turtle * 6
Eastern ribbon snake * 1	Spring peeper 2
Eastern spiny softshell turtle 7	Wood turtle * 7
Four-toed salamander 5	Blue-spotted salamander * 1,2,4,5
Fowler's toad * 7	Painted turtle 2,3,6
Green frog 7	Smooth green snake * 1, 4,7
Jefferson's salamander 6	Northern leopard frog * 1,2
Mink frog * 6	Bog turtle 1,6
Northern dusky salamander 7	Red-spotted newt 3,6
Northern red-bellied cooter 6	Eastern hognose snake * 7
Northern two-lined salamander 7	

Birds

Alder flycatcher * 4	King rail 2
American bittern 2	Least bittern * 2
American coot 3	Lincoln's sparrow 5
Barred owl 7	Louisiana waterthrush 7
American black duck * 2	Mallard duck 2
Black tern 2,3	Northern harrier * 1,2
Black-crowned night-heron 4	Northern shoveler 2
Blue-winged teal 2	Palm warbler 5
Canada goose 2	Pied-billed grebe 2,3
Cerulean warbler * 7	Pileated woodpecker 7
Common grackle 4	Red-bellied woodpecker 7
Common merganser 7	Red-shouldered hawk 2
Common moorhen 2	Red-winged blackbird 2
Common snipe 4	Rusty blackbird * 5
Common yellowthroat 4,7	Sedge wren 1
Downy woodpecker 7	Song sparrow 7
Eastern screech owl 7	Sora * 2
Eastern wood-pewee 7	Swamp sparrow 4
Gadwall 3	Tufted titmouse 7
Glossy ibis 4	Veery 7
Gray catbird 7	Virginia rail 2
Great blue heron 2	Warbling vireo 7
Green heron 2	White-eyed vireo 4
Green-winged teal 2	Wilson's warbler 5
Hairy woodpecker 7	Wood duck 7

Species List and Recommendations, Forest Type: Non-Forest Palustrine
Dirt to Trees to Wildlife

DirtTreesWildlife.org

Yellow warbler 7
[Yellow-breasted chat](#)* 7

Yellow-crowned night-heron 4

Mammals

Beaver 4,6,7
Long-tailed weasel 7
Masked shrew 5
Mink 2,3,7
[Moose](#)* 7
Muskrat 2
[New England cottontail](#)* 4
[Northern hog lemming](#)* 1,5
[Indiana bat](#)*1,6,7
[Northern long-eared bat](#)*1,6,7
[Little brown bat](#)*1,6,7

[Red bat](#)*1,6,7
[Hoary bat](#)*1,6,7
[Silver-haired bat](#)*1,6,7
[Tri-colored bat](#)*1,6,7
Northern river otter 7
Northern short-tailed shrew 1,7
Smoky shrew 4,5
[Southern bog lemming](#)* 1,2
Star-nosed mole 1,7
[Water shrew](#)* 1 to 7

RECOMMENDATIONS

Setting overall general management recommendations for the non-forest palustrine type with all its components is impractical. Each Species of Greatest Conservation Need preferring this type as breeding habitat has its own management recommendations that include specific treatments applied to the habitat components needed by that species.

There are several riparian guidelines and laws governing riparian management which should be reviewed on a state-by-state basis.

For New Hampshire, the following chapters in goodforestry.org address riparian guidelines and other related resources:

- [4.1 Water Quality](#)
- [4.2 Wetlands](#)
- [4.3 Forest Management in Riparian Areas](#)
- [4.4 Stream Crossings and Habitat](#)
- [7.2 Seeps](#)
- [7.3 Vernal Pools and the Surrounding Forest](#)

FOREST TYPE: NON-FOREST UPLAND

SPECIES LIST

Asterisk denotes Species of Greatest Conservation Need. Hyperlinks take you to recommendations specific to the species. Includes agricultural fields (1), grasslands (2), forbs (3), pasture land (4), old field/shrub complexes (5), savannah (6) and orchards (7) other (8). ("Other" is identified as derelict buildings, structure debris, caves, mines, ledges, cliffs, talus slopes or stable banks.)

Reptiles and Amphibians

[Blanding's turtle](#)* 1,2

[Eastern hognose snake](#)* 4

[Northern black racer](#)* 2

[Black rat snake](#)* 5

[Eastern box turtle](#)* 2

[Wood turtle](#)* 2

Birds

[American kestrel](#)* 4

Gray partridge 2

Pheasant 3

Bobwhite quail 3

Killdeer 1

Upland sandpiper 4

Willow flycatcher 4,5

[Eastern kingbird](#)* 7

Loggerhead shrike 6

Horned lark 2

[Purple martin](#)* 1,2,3

[Cliff swallow](#)* 1,2,3

[Bank swallow](#)* 1,2

Northern rough-winged swallow 1,2

Eastern bluebird 7

Northern mockingbird 5

[Blue-winged warbler](#)* 5

[Golden-winged warbler](#)* 5

[Prairie warbler](#)* 5

Common yellow throat 4

[Yellow-breasted chat](#)* 4

Chipping sparrow 6

[Field sparrow](#)* 5

[Vesper sparrow](#)* 2

Savanna sparrow 2

Grasshopper sparrow 2

Song sparrow 5

[Bobolink](#)* 2

[Eastern meadowlark](#)* 2

Orchard oriole 7

Baltimore oriole 6

American goldfinch 4

Mammals

Least shrew 2

Eastern mole 4

Eastern cottontail rabbit

Woodchuck 1,2,4

[Eastern small-footed bat](#)* 8

[Little brown bat](#)* 8

[Big brown bat](#)* 1,8

White-footed mouse 5

Meadow vole 2,3

Woodland vole 2,7

Meadow jumping mouse 2,3

Ermine 5

[Hoary bat](#)* 8

[Indiana bat](#)* 8

[Northern long-eared bat](#)* 8

[Red bat](#)* 8

[Silver-haired bat](#)* 8

[Tri-colored bat](#)* 8

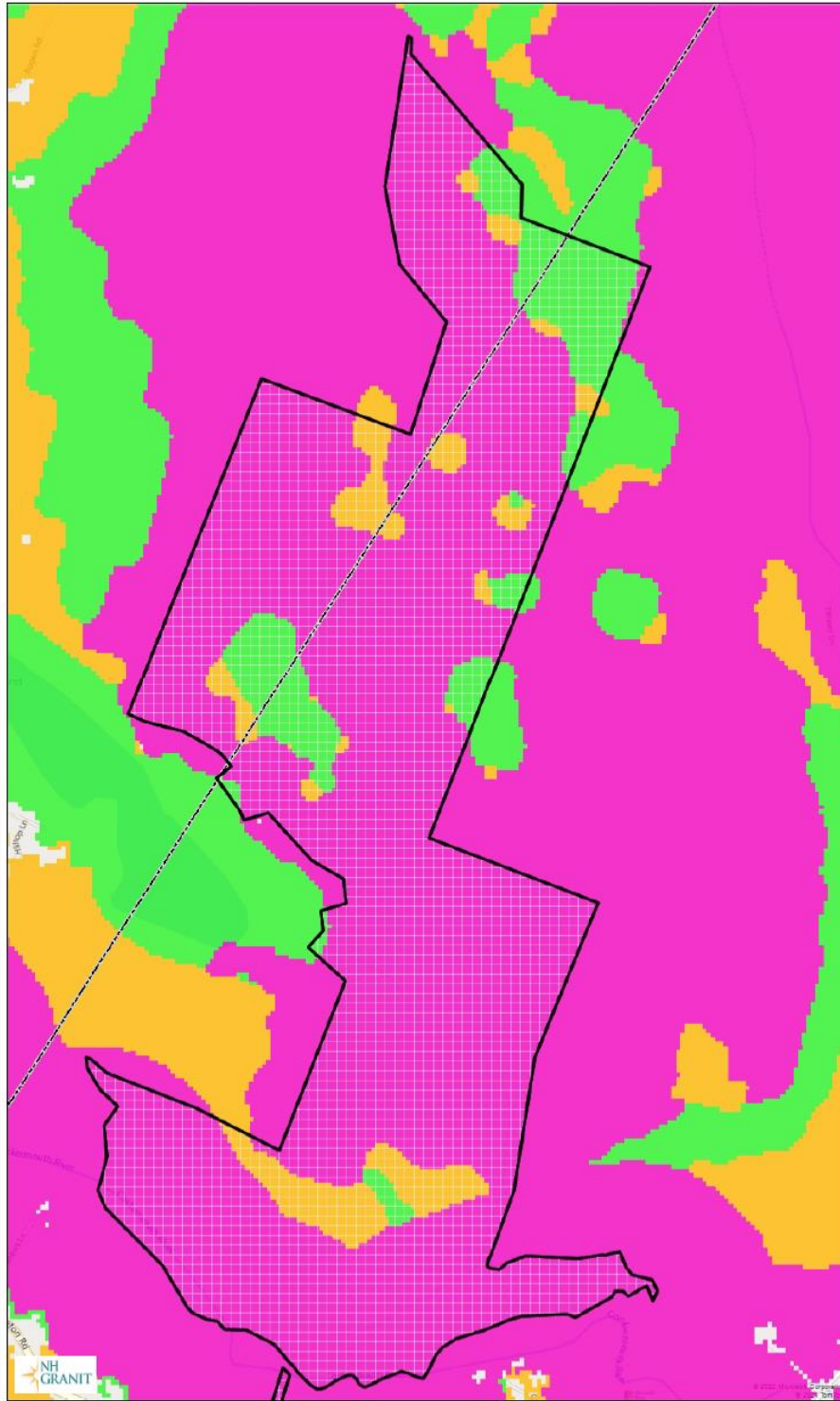
RECOMMENDATIONS

Setting overall general management recommendations for the non-forest upland type with all its components is impractical. Each Species of Greatest Conservation Need preferring this type as breeding habitat has its own management recommendations that include specific treatments applied to the habitat components needed by that species.

In general, mowing, brush-hogging or grazing schedules that retain the desired condition such as grass, pasture, or orchard over time and space is recommended. Pasture, grassland and orchard can occur on a multitude of different soils and their presence is not dictated by soil type—although they tend to be on better soils.

NH WILDLIFE ACTION PLAN MAPS & WOOD TURTLE FACT SHEET

Hebron Town Forest - NH Wildlife Action Plan Habitat Ranks



Legend

- State
- County
- City/Town
- WAP 2020: Highest Ranked Wildlife Habitat
 - 1 Highest Ranked Habitat in NH
 - 2 Highest Ranked Habitat in Region
 - 3 Supporting Landscape

Map Scale

1: 12,988



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Map Generated: 3/23/2022

Notes



Wood Turtle

Glyptemys insculpta

Federal Listing	N/A
State Listing	SC
Global Rank	
State Rank	S3
Regional Status	Very High



Photo by Ethan Nedeau

Justification (Reason for Concern in NH)

The wood turtle is a species of high regional concern (conservation concern and high regional responsibility) in the northeast that warrants federal endangered or threatened species listing considerations (NEPARC 2010, Therres 1999). Many states across the species range have reported declines, population structures with a disproportionate number of adults, or local extirpations (Ross et al. 1991, Garber and Burger 1995, Ernst 2001a, Daigle and Jutras 2005, Willoughby et al. 2013). In New England, the wood turtle is listed as a species of special concern in Maine (Hunter et al. 1999), Massachusetts (Massachusetts Natural Heritage and Endangered Species Program 2007), Connecticut (Connecticut Department of Energy and Environmental Protection 2014), New Hampshire, and Vermont (Vermont Nongame and Natural Heritage Program 2013). Historically, wood turtles were considered one of the most common turtle species in New Hampshire (Oliver and Bailey 1939). A petition to list the wood turtle as threatened under the Endangered Species Act by the Federal government was declined in the mid-1990s; the U.S. Fish and Wildlife Service stated the petition did not present “substantial scientific or commercial information indicating that listing the species is warranted” (USFWS 1995). Life history traits including late sexual maturation (Ontario: 17-18 years, Brooks et al. 1992) and limited fecundity (Garber 1989, Farrell and Graham 1991, Ross et al. 1991, Brooks et al. 1992) make wood turtles extremely vulnerable to increased adult mortality. Wood turtles depend on high rates of adult survival to compensate for a large mortality in the early stages of life. A model developed by Compton (1999) predicted that the annual removal of only 2 adult wood turtles from a stable population of 100 individuals would result in the extirpation of the population in less than 80 years. Human populations are rapidly expanding in New Hampshire (Society for the Protection of New Hampshire Forests 2005). As a result, residential and commercial development and human recreation opportunities are increasing, likely reducing the local viability of wood turtle populations (Tuttle and Carroll 1997, M. N. Marchand, personal observation).

Distribution

The wood turtles range extends from Maine to Minnesota, south to Virginia and Iowa in the United States, as well as southern Canada from Nova Scotia to Ontario (Ernst et al. 1994). The northeast United States comprises a significant portion of the wood turtle’s global range (Therres 1999). Wood turtles appear to be distributed throughout New England, but are less common in coastal zones (Klemens 1993) and absent from offshore islands (Jones 2007). In New Hampshire, wood turtles likely occur throughout much of the state excluding higher altitudes such as the White Mountains Region (Taylor 1993, New Hampshire Natural Heritage Bureau 2005). High elevation records for southern New England include 442 m (1450 ft) at Norfolk, Connecticut, 497 m (1630 ft) Becket, Massachusetts, and 518 m (1700 ft) Plainfield, Massachusetts (Klemens 1993).

Appendix A: Reptiles

Scarcity of deep, low gradient streams may be the limiting factor at high elevation as opposed to altitude (Klemens 1993).

Habitat

Wood turtles (*Glyptemys insculpta*) are associated with rivers and streams with hard sand or gravel substrate (Ernst et al. 1994), but make extensive use of surrounding uplands during the summer (Compton et al. 2002, Tuttle and Carroll 2003, Arvisais et al. 2004). Most wood turtle terrestrial activity often is within 300 m of streams and rivers (Kaufmann 1992, Arvisais et al. 2002, Remsburg et al. 2006). Habitat use and home range may vary among individuals of a local population (Kaufmann 1992, Compton 2002) with females generally moving greater distances than males (Jones et al. 2014). A mosaic of river or streams, forest, dense shrub thickets, and bare sandy substrate, may attract turtles and provide habitat for a higher density of turtles in these areas (Kaufmann 1992). In Maine, activity areas of wood turtles were near streams and rivers and had moderate forest cover (Compton et al. 2002). Within activity areas, wood turtles in Maine selected areas that were near water, non-forested, and with low canopy cover (Compton et al. 2002). Compton et al. (2002) and Arvisais et al. (2004) attributed this difference in selection at the 2 spatial scales to a preference for forest edges, where sunlight penetration and plant growth favors abundant basking and feeding opportunities. Some anthropogenic disturbances (e.g., agriculture, hayfields, abandoned gravel pits) may also provide habitat heterogeneity that wood turtles prefer.

Wood turtles can be found closer to the river after emerging from hibernation in late April and May (Tuttle 1995). At this time and throughout the summer, dense riparian and early successional shrub thickets are extremely important cover (Kaufmann 1992, Compton 2002, Arvisais et al. 2004). Alder (*Alnus spp.*), dogwoods (*Cornus spp.*), and arrowwood (*Viburnum spp.*) are good cover plants along riparian areas and other edges (D. Carroll, personal communication). A mixture of herbs and grasses (e.g., meadow-sweet, *Spiraea latifolia*, goldenrod *Solidago spp.*), shrubs (e.g., dogwoods), and vines (e.g., Virginia creeper *Parthenocissus quinquefolia*, grape *Vitis spp.*) reduce detection from humans and other predators and provides an abundance of food for the turtles (D. Carroll, personal communication). Food resources include green leaves, algae, mosses, fruit, fungi, seeds, insects and a variety of animal matter, including carrion, eggs, earthworms, mollusks, tadpoles, and newborn mice (Oliver and Bailey 1939, Harding and Bloomer 1979, Ernst et al. 1994, Niederberer and Siedel 1999). Emergent marshes, swamps, and vernal pools may be used during spring and summer (Hunter et al. 1999, Arvisais et al. 2004). At night wood turtles enter shallow forms under grass, leaves and brush, fallen logs, and flood debris (Harding and Bloomer 1979, Ernst 1986, Farrell and Graham 1991). For thermoregulation, Dubois et al. (2009) illustrated that wood turtles energetically benefit from a semi-aquatic lifestyle, entering rivers at night when terrestrial air temperatures fall below that of water temperatures.

Female wood turtles lay eggs during late May to early July in sparsely vegetated, sandy-gravelly well-drained soils, often near water (Harding and Bloomer 1979, Klemens 1993, Buech et al. 1997). Natural (e.g., sandbars, sandy banks) and anthropogenic (e.g., gravel and sand pits, railroad beds) sites may be used to excavate nests (Brooks et al. 1992, Tuttle and Carroll 1997, Buech et al. 1997). Hatchlings emerge from the nest chamber between mid-August and early October (Ernst et al. 1994) and tend to move down-slope to the safety of rivers or shaded canopy using vision, olfaction, auditory cues, and positive geotaxis (Tuttle and Carroll 2005).

Turtles begin to return to the river daily in September and October before settling into hibernation before mid-November (Tuttle 1995). Hibernation sites include undercut banks, submerged tree snags and woody debris in rivers, wildlife burrows, and deep pools (Garber 1989, Ernst and McBreen 1991). Most wood turtles hibernate in the same location annually (Garber 1988) and may hibernate

Appendix A: Reptiles

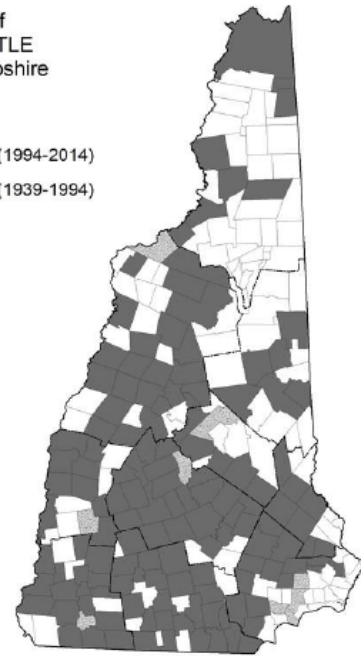
communally (Harding and Bloomer 1979).

NH Wildlife Action Plan Habitats

- Coldwater Rivers and Streams
- Floodplain Habitats
- Grasslands
- Shrublands
- Warmwater Rivers and Streams

Distribution of
WOOD TURTLE
in New Hampshire

■ Current (1994-2014)
■ Historic (1939-1994)



Distribution Map

Current Species and Habitat Condition in New Hampshire

There have been 88 corroborated occurrences of wood turtles in NH and 4,627 km of modeled stream habitat. Statewide, 33% of the landscape is in optimal habitat condition and 36% of stream habitat is potentially impaired (Jones et al. 2014).

Population Management Status

NHFG will participate in the Northeast Regional Conservation Needs Program (Status and Conservation of the Wood Turtle in the Northeastern United States) through State Wildlife Grants. Statewide surveys will be conducted starting in 2015 to assess the condition of wood turtle populations in the state. Independent researchers (e.g., David Carroll, Mike Jones) and universities (Umass, St. Anselm College, Plymouth State) have conducted local monitoring, mark-recapture, and radio telemetry studies.

Regulatory Protection (for explanations, see Appendix I)

- CITES - Convention on International Trade of Endangered Species of Wild Fauna and Flora
- NHFG Rule FIS 803.02. Importation.
- NHFG Rule FIS 804.02. Possession.
- NHFG Rule FIS 811.01 Sale of Reptiles.
- NHFG FIS 1400 Nongame special rules
- Fill and Dredge in Wetlands - NHDES

New Hampshire Wildlife Action Plan **Appendix A Reptile-64**

Appendix A: Reptiles

- Rivers Management and Protection Program - NHDES
- Comprehensive Shoreland Protection Act - NHDES
- Alteration of Terrain Permitting - NHDES

Quality of Habitat

The following estimates are the percentages of wood turtle habitat in optimal landscape condition by county in New Hampshire: 34% in Belknap, 46% in Carroll, 42% in Cheshire, 45% in Coos, 45% in Grafton, 25% in Hillsborough, 34% in Merrimack, 4% in Rockingham, 7% in Strafford, and 44% in Sullivan (Jones et al. 2014). The following estimates are the percentages of wood turtle habitat that is potentially impaired by county in New Hampshire: 28% in Belknap, 22% in Carroll, 25% in Cheshire, 19% in Coos, 25% in Grafton, 48% in Hillsborough, 29% in Merrimack, 74% in Rockingham, 62% in Strafford, and 23% in Sullivan (Jones et al. 2014).

Habitat Protection Status

The total area of known and potential wood turtle habitat protected in occupied watersheds ranged from 0 to 2,193 ha (mean = 518 ha). Only 29% (27 of 93) of occupied watersheds had more than 20% protection of wood turtle habitat, though a number of watersheds where wood turtles have not been documented have a greater degree of protection. The actual habitat quality of these protected areas is not known and should be ascertained. Also, areas listed as conservation land may not be protecting wood turtles because of permitted land or recreational uses. Therefore, protection status for wood turtles may be much lower than what is represented in the conservation lands data layer used for these analyses.

Habitat Management Status

There is no habitat management being conducted for the wood turtle by NHFG, although recommendations pertaining to wood turtles have been made to private landowners by NHFG. Habitat management will be initiated at priority wood turtle sites in future years under an existing USFWS multi-state competitive state wildlife grant.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat impacts from development of surrounding uplands (Threat Rank: High)

Residential and commercial development results in impervious surface and removal of natural vegetation, both of which result in loss of upland habitat for wood turtles. Conversion of disturbed sites (e.g., gravel pits) to impervious surfaces or manicured lawns reduces the quality of nesting habitat. Increased recreational opportunities (e.g., hiking trails, canoeing, and kayaking trails) along streams and rivers can result in removal of dense riparian vegetation and trampling of sandbars and other potential nesting areas.

Habitat loss and fragmentation is listed as the main threat for the decline of the wood turtle

Appendix A: Reptiles

throughout its range (Kaufmann 1992, Ernst 2001a). Wood turtles utilize broad, level valleys in the northeast which are commercially and agriculturally converted at a high rate, thus facilitating population declines (Jones et al. 2014). In New Hampshire, large wetland systems are being bisected by development, especially in the southern portion of the state (Tuttle 1995) and the human population and associated development is rapidly expanding (Society for the Protection of New Hampshire Forests 2005). Wood turtles use upland habitats extensively during the summer (Ernst 1986, Kaufmann 1992, Tuttle and Carroll 2003, Arvaisis et al. 2004). Development and other habitat alterations within the summer activity range of wood turtles may result in mortality and injuries to wood turtles (Harding and Bloomer 1979, Saumure and Bider 1998, Marchand and Litvaitis 2004) and loss of vegetative cover making turtles more visible to predators and collectors.

Mortality from mowing and agricultural machinery and vehicles (Threat Rank: High)

The maintenance of agricultural crops and hayfields may result in collision with adult turtles using the area during the summer. The loss of individuals, especially adult females, can have a severe impact on the population due to the low recruitment of juveniles into the breeding population. However, compatible (i.e., individual turtles not killed) management of agricultural lands and hayfields near riparian areas may provide some beneficial foraging and nesting resources.

Observed impacts of agriculture on a wood turtle population, as compared to a forested population, include: lower numbers of juveniles, decreased growth during the second decade of life, and increased shell injury (Saumure and Bider 1998). A study by Erb and Jones (2011) found that mower blade height and style (i.e., sickle bar or rotary) have differential effects on turtle strikes, but crushing from mower tires may be the most significant cause of agricultural related mortality. Numerous wood turtles in New Hampshire have been found in hay pastures dead from apparent collision (M. Marchand, personal observation). Female wood turtles have been observed nesting in agricultural fields (Kaufmann 1992) increasing their risk for collision and potential loss of the nest.

Mortality of individuals from vehicles on roadways (Threat Rank: High)

New Hampshire's human population density and associated development is rapidly increasing (Society for Protection of New Hampshire Forests 2005). Increasing human population densities are associated with increasing road densities and traffic volume, and road widening. Turtles are relatively slow when traveling through upland habitat, and individual turtles are extremely vulnerable when crossing moderate to high traffic roads. Small annual losses of only 1 to several adult wood turtles may result in population extirpation.

Roads located near local turtle populations can lead to population declines via mortality of individuals and altered population structures, including skewed age or sex ratios (Ernst and McBreen 1991, Klemens 1989, Garber 1989, Marchand and Litvaitis 2004, Steen and Gibbs 2004). Sixty-seven percent of dead wood turtles reported in New Hampshire were located on roads (New Hampshire Natural Heritage Bureau 2005). There are 23 watersheds with no major roads in potential wood turtle habitat, but only 1 known occupied watershed without major roads. The mean number of stream road crossings per occupied watershed is 30. Jones et al. (2014) assert that despite a lack of baseline data, road mortality is likely the primary cause of population declines in the urbanized east coast.

Habitat degradation from dams that impound rivers and alter hydrology (Threat Rank: High)

The construction of dams may alter the natural flow of a stream. The impoundment of water and regulated release may reduce natural erosion processes that create nest sites, and flood any nests

Appendix A: Reptiles

that are laid when water levels are low. Also, turtles hibernating in the undercut banks of streams may freeze when water discharge is stopped. Dams or ineffective culverts under roadways may impede the movement of turtles, fragmenting populations and reducing gene flow. Channelization of streams may also alter natural stream flow by increasing water velocity causing sections of river to be unusable for the wood turtle. Dredging may cause sediment loading in rivers, degrading water quality.

At a dam site in Maine, female wood turtles delayed nesting and eventually relocated their nest sites due to lack of water flow needed to maintain nesting areas (Compton 1999). Water releases resulted in the flooding of 25% of nests at the site each year. Flooding later in the season could result in a higher mortality rate of developing wood turtle embryos. In Québec, Canada, Saumure et al. (2007) observed dead juveniles entombed in a streambank after a dredging project with subsequent bank collapses and stabilizations.

Mortality from increased flooding of rivers and streams (Threat Rank: Medium)

Severe hot or cold temperatures can result in breeding, nesting, and overwintering phenology disruptions. Severe storms and flooding can degrade wood turtle habitat as well as cause the removal of individuals from a population via direct mortality or washing downstream.

The specific environmental triggers for breeding, nesting, and overwintering are not well understood, but thermal triggers and river ice-out are most widely assumed. Greaves and Litzgus (2007) reported that wood turtles in Ontario, Canada entered and exited hibernation between 4°C and 5°C. Erratic temperature swings and unusual weather patterns may be problematic for a species dependent on thermal cues, but this threat is poorly understood for wood turtles in New Hampshire. Flooding from severe storms may have similar impacts to wood turtles as that of Natural Systems Modifications (7.2 Dams and Water Management/Use) where erosion degrades habitat and increased stream flow may wash individuals downstream removing them from local populations (see Compton 1999, Saumure et al. 2007).

Mortality from casual collection of individuals from the wild or moving animals to a different location (Threat Rank: Medium)

Commercial collection of wood turtles for the pet trade has a profound influence on the extirpation of a wood turtle population. Wood turtles often hibernate in groups making them easy for collectors to target in the early spring when they bask on the banks of the river close to the water's edge before wandering into their summer ranges.

Illegal collection has eliminated entire populations of wood turtles in some areas and is considered a serious threat for the species (NatureServe 2014). The NHFG has no evidence of commercial collection of wood turtles in New Hampshire. However, reptile dealers have advertised wood turtles in New Hampshire in the past (Levell 2000). In 1992 a wood turtle sold for \$75, in 1994 a pair sold for \$275 (RESTORE: The North Woods et al. 1994). In the United States, the price of wood turtles has climbed from \$20 in the 1960's to over \$300 today (Jones et al. 2014). As the species becomes less common it is likely that the market value of illegally collected turtles will increase. Most states in the northeast have documented commercial collection of wood turtles with widespread evidence across the species range (Jones et al. 2014). Adults are collected more often because they are easiest to find, reducing the ability of the population to reproduce (Ernst 2001b).

Mortality from the commercial collection of individuals from the wild (Threat Rank: Medium)

Appendix A: Reptiles

Commercial collection of wood turtles for the pet trade has a profound influence on the extirpation of a wood turtle population. Wood turtles often hibernate in groups making them easy for collectors to target in the early spring when they bask on the banks of the river close to the water's edge before wandering into their summer ranges.

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Mortality from subsidized or introduced predators (Threat Rank: Medium)

Adult, hatchling, and egg depredation is a major conservation concern for wood turtles. Hatchlings and nests seem to be the most frequently targeted by mid-sized mammalian predators and some birds.

In New Hampshire, Tuttle and Carroll (2005) documented hatchling predation by both an eastern chipmunk (*Tamias striatus*) and an avian species – possibly great blue heron (*Ardea herodias*). Other predators may include, but are not limited to; raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), fisher (*Martes pennanti*), skunk (*Mephitis mephitis*), bullfrog (*Lithobates catesbeianus*), raven (*Corvus corax*), and coyote (*Canis latrans*) (Harding and Bloomer 1979, Marchand et al. 2002, Wirsing et al. 2012, Jones et al. 2014, Paterson et al. 2014). Areas where human activity is high (i.e., recreation or landscape alteration), subsidized meso-predators, such as raccoons, may be higher in density and may increase predation pressure (Wirsing et al. 2012). Further, rivers and creeks have been shown to have higher predator densities, which may explain a study conducted by Paterson et al. (2012), where they found higher predation of hatchling wood turtles than swamp/marsh associated Blanding's turtles (*Emydoidea blandingii*). Adult depredation seems to be less common, but evidence of attempts has been documented in turtles with scarring, and missing limbs and tails (Hunter et al. 1999).

List of Lower Ranking Threats:

Mortality and species impacts from impervious surface run-off

Species impacts from competition (with introduced species)

Habitat degradation from introduced or invasive plants (Phragmites and Japanese knotweed)

Habitat conversion and degradation from bank stabilization

Mortality and disturbance from increased recreation (hiking, mountain biking, OHRV)

Mortality of individuals from forestry equipment

Habitat conversion due to development of nesting habitat

Actions to benefit this Species or Habitat in NH

Conserve priority wood turtle parcels

Primary Threat Addressed: Habitat impacts from development of surrounding uplands

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

Conserve priority wood turtle parcels

General Strategy:

Several priority wood turtle sites have been identified (Jones and Willey 2013) and additional monitoring is being conducted to inform a regional conservation plan. These sites will be updated over time as new information becomes available. Priority sites will be incorporated into NH Wildlife Action Plan revision maps and incorporated into state land conservation funding consideration (e.g., Aquatic Resource Mitigation Fund, LCHIP). NHFG staff will provide technical assistance to land trusts, NRCS, and towns in identifying and conserving priority parcels. NHFG staff will also provide technical assistance in developing management objectives compatible with wood turtle conservation.

Political Location:

Statewide

Watershed Location:

Statewide

Monitor wood turtle populations

Objective:

Implement long-term and rapid assessment monitoring using standardized regional protocol.

General Strategy:

Implement long-term and rapid assessment monitoring using standardized regional protocol (Jones et al. 2014). Rapid surveys should be used to gather additional information for sites with minimal information. Long-term monitoring should be implemented at all high priority sites and repeated every 5-10 years. Additional targeted monitoring could target nesting areas or habitat quality of particular stream reaches.

Political Location:

Statewide

Watershed Location:

Statewide

Mowing guidelines development and implementation

Primary Threat Addressed: Mortality from mowing and agricultural machinery and vehicles

Specific Threat (IUCN Threat Levels): Agriculture & aquaculture

Objective:

Develop guidelines for minimizing harm to wood turtles in areas where agricultural activities occur

Appendix A: Reptiles

and implement guidelines by providing technical assistance to landowners.

General Strategy:

Mowing guidelines have been developed for wood turtles in other states. Guidelines should be developed for NH or NH should adopt guidelines developed within other states or the northeast region. Once guidelines are developed, NHFG should work with landowners at priority wood turtle sites to enhance habitat quality or minimize risk of mortality to turtles. NHFG should provide guidelines to partners (e.g., NRCS) that work with landowners.

Political Location:

Statewide

Watershed Location:

Statewide

Identify priority habitat at wood turtle sites.

Objective:

Identify priority wood turtle areas.

General Strategy:

Use a combination of habitat modelling, radiotelemetry, and site assessments to evaluate site conditions and importance for wood turtle populations. At priority sites where nesting areas not known, mature females should be tracked via radiotelemetry.

Political Location:

Statewide

Watershed Location:

Statewide

Maintain & enhance nesting habitat

Primary Threat Addressed: Habitat conversion due to development of nesting habitat

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

Create, enhance, and maintain multiple nesting areas at each priority wood turtle site.

General Strategy:

Nesting guidelines need to be developed for wood turtles. A complete overview of nest enhancement guidelines can be found in Guidelines for Nest Site Management and Creation within High Priority Blanding's Turtle Sites in the Northeastern United States available at blandingsturtle.org. Existing nesting areas should be identified, protected, and enhanced as necessary. Large disturbed areas, including active and abandoned excavation areas, are often important nesting areas for turtles when they occur in proximity to suitable wetlands. Loaming and planting excavated areas often reduces their suitability for nesting turtles and many other wildlife species (e.g., black racers, eastern hognose snake, New England cottontail, bank swallow, kingfisher, shrubland and grassland birds). Managers should use extreme caution when augmenting or restoring known nesting habitat for wood turtles and management should occur outside of the nesting and incubation period. In areas where nesting opportunities appear to be few, far from wetlands, or when turtles must cross roads to reach, new

Appendix A: Reptiles

nesting areas may be created. Landowners and land managers are encouraged to work with NH Fish & Game to identify nest enhancement projects, especially in priority Blanding's turtle sites. Nesting area creation or management should be monitored using visual surveys or camera surveys to assess use and document threats to nesting turtles, eggs, or young (predation, disturbance, etc.). Nesting areas should be systematically surveyed every five years to ensure that tree species are not shading the area.

Political Location:

Statewide

Watershed Location:

Statewide

Minimize disturbance to wood turtles from recreational activities.

Primary Threat Addressed: Mortality and disturbance from increased recreation (hiking, mountain biking, OHRV)

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Minimize impacts of recreation on wood turtle populations by using recreation guidelines and incorporating species' needs into property management plans

General Strategy:

The potential negative influence of recreational trails on wood turtle populations may be reduced through a combination of management techniques. Recreation guidelines have not been developed for NH but similar concerns and management techniques are outlined in Guidelines for Recreational Areas within High Priority Blanding's Turtle Sites in the Northeastern United States available at blandingsturtle.org. Objectives and Guidelines for Recreational Trails in High Priority Blanding's Turtle Sites: 1. Prevent direct adult mortality caused by ATVs, OHRVs, trucks, bikes, etc. 2. Minimize disturbance of adults, particularly nesting females. 3. Minimize mortality of nests, hatchlings, and juvenile turtles. 4. Maintain the integrity of confirmed and potential nesting habitat. Specific actions could include: 1.) Seasonal closures of ATV/OHRV trails bisecting sensitive wetland areas and turtle movement corridors; 2.) seasonal (24 May to 4 July) or afternoon/evening (>16:00 h) closures to protect nesting females where trails bisect nesting habitat or nesting corridors; 3) Permanent closures of ATV/OHRV trails in known and potential nesting areas. 4) Increased, targeted law enforcement presence during sensitive time periods when turtle movements are frequent and relatively predictable (e.g., June); 5) Trail relocation to avoid bisecting sensitive wetland complexes and to avoid separating suitable wetland habitats from suitable nesting habitats. 6) Avoid placing hiking trails or sports fields in or adjacent to nesting areas.

Political Location:

Statewide

Watershed Location:

Statewide

Develop and promote the use of forestry guidelines in areas where wood turtles occur

Primary Threat Addressed: Mortality of individuals from forestry equipment

Specific Threat (IUCN Threat Levels): Biological resource use

Appendix A: Reptiles

Objective:

Develop and encourage use of wood turtle forestry guidelines to minimize impacts to wood turtle populations.

General Strategy:

Forestry protocols have not been developed for wood turtles at this time so that would be needed first. Guidelines for Forestry Activities within High Priority Blanding's Turtle Sites in the Northeastern United States have been developed by the Northeast Blanding's turtle working group and are available at blandingsturtle.org.

Political Location:

Statewide

Watershed Location:

Statewide

Enforce wildlife regulations

Primary Threat Addressed: Mortality from the commercial collection of individuals from the wild

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Enforce wildlife regulations pertaining to the illegal collection, possession, or sale of wood turtles in New Hampshire.

General Strategy:

In NH, it is illegal to kill, harm, possess, collect, or sell a wood turtle without a permit from the NHFG. Because the removal of individual wood turtles from the wild can impact local populations, enforcement of rules and laws pertaining to this species are particularly important. NHFG biologists will work with NHFG law enforcement staff to identify violations and enforcement actions. NHFG staff will also work with neighboring states to identify origin of animals during confiscations.

Political Location:

Statewide

Watershed Location:

Statewide

Outreach to landowners

Primary Threat Addressed: Mortality from casual collection of individuals from the wild or moving animals to a different location

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Provide information on the status and risks of species via various media outlets to educate public on importance of not collecting or moving turtles.

General Strategy:

NHFG will increase landowner knowledge of the species' status and threats by developing materials and messages on various media including Facebook, NHFG webpage, and press releases to other

Appendix A: Reptiles

media outlets (newspaper, radio, television).

Political Location:

Statewide

Watershed Location:

Statewide

Minimize road mortality to wood turtles

Primary Threat Addressed: Mortality of individuals from vehicles on roadways

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

Minimize mortality of wood turtles on roadways.

General Strategy:

NHFG will work with NHDOT, NHDES, towns, and other partners to minimize road mortality of wood turtles on roadways. Specific targeted actions will include: avoid placement of new roads in priority wood turtle landscapes, avoid upgrading unpaved roads to paved surfaces in priority wood turtle landscapes, designing roadways to minimize mortality such as avoiding use of steep curbing, upgrading culverts/underpasses to increase opportunities for safe passage of turtles, place turtle crossing signs to educate motorists in priority wood turtle areas, and manage vehicle speed by reducing speed limits or installing speed bumps. Priority landscapes for implementation will need to be assessed using a combination of habitat modelling, turtle road crossing data, and local knowledge.

Political Location:

Statewide

Watershed Location:

Statewide

Regional coordination

Objective:

Coordinate with other regional, national, or international initiatives to conserve wood turtles.

General Strategy:

A northeast wood turtle working group was formed during the development of a regional wood turtle status assessment (Jones et al. 2014). This working group has continued as part of a competitive state wildlife focused on conservation planning and priority action implementation for wood turtles in the northeast. NHFG will continue to participate in these regional, national, or international discussions and meetings to further the conservation purposes of wood turtles.

Political Location:

Watershed Location:

Evaluate impacts and develop environmental review guidelines

Primary Threat Addressed: Habitat impacts from development of surrounding uplands

Appendix A: Reptiles

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

Evaluate all projects that have potential to cause harm to wood turtle populations and provide guidance to minimize impacts to those populations.

General Strategy:

NHFG will review proposed activities (residential and commercial development, recreation, bridge replacement, dam licensing, habitat management, etc) that has the potential to harm wood turtles. NHFG will work with applicants and permitting staff from other state and federal agencies, primarily Department of Environmental Services (Wetlands Bureau) and U.S. Army Corps of Engineers, to identify avoidance and minimization conditions for permit applicants. NHFG will develop guidelines for consistent and effective review of projects potentially impacting wood turtles. Guidelines will consider scenarios where impacts should be avoided and scenarios where impact minimization of mitigation may be appropriate. Pre- and post- construction monitoring of wood turtles and associated habitat (e.g., floodplains, nesting areas) should be considered as a component of project review. Protection should be prioritized according to condition of habitat and wood turtle population.

Political Location:

Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Habitat information came from the Northeast Wood Turtle Working Group (2011), peer-reviewed literature, and a wood turtle species viability report conducted by the White Mountain National Forest (unpublished document, originally prepared by K. Marchowsky 2001; revised by M. Marchand 2002). The Reptile and Amphibian Reporting Program (RAARP), Wildlife Sightings, and NHHNB databases were used to assess distribution. Neighboring state websites were consulted for recent distribution information. Habitat maps were produced by NHFG using available GIS data layers from various sources (metadata available upon request).

The Northeast Wood Turtle Working Group (2011) as part of the Regional Conservation Needs (RCN) report, Status and Conservation of the Wood Turtle (Jones et al. 2014), used a “corroborated occurrence” method to amalgamate multiple occurrences, sightings, specimens, and observations (within 2 km of each other and ≤ 30 years apart) along the same section of stream habitat. This effort was implemented to minimize pseudoreplication with individual turtles that may have been displaced by floods, migrated long distances, or released from captivity. Data for this analysis was provided by NHFG and the New Hampshire Natural Heritage Bureau, Forest and Lands Program, Department of Resources and Economic Development (DRED). Other datasets were received from B. Wicklow, Jones and Sievert, Jones and Willey, and several museums. There were 88 corroborated occurrences in New Hampshire. Further condition information was obtained from the NHHNB Element Occurrence database. Threat assessments were conducted by a group of NHFG biologists (Michael Marchand, Brendan Clifford, Loren Valliere, Josh Megysey).

Data Quality

Observations from RAARP and Wildlife Sightings were reviewed for quality before inclusion. However,

Appendix A: Reptiles

distribution information is not complete, and new town records are likely. Information has been collected on a few populations by researchers (i.e., Michael T. Jones) conducting mark-recapture studies, and Tuttle and Carroll (1997, 2003) conducted an intensive population study for NHFG in the early 1990s.

Wood turtle may occupy many of the available watersheds in the state, but only portions of watersheds have been documented (93 known of 319 potential), and only a few populations have been studied in detail through mark-recapture and radio telemetry.

2015 Authors:

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2005 Authors:

Heidi Holman and Michael Marchand, NHFG

Literature

- Arvais, M., E. Levesque, J.-C. Bourgeois, C. Daigle, D. Masses, and J. Jutras. 2004. Habitat selection by the wood turtle (*Glyptemys insculpta*) at the northern limit of its range. *Canadian Journal of Zoology* 82: 391-398.
- Brooks, R. J., C.M. Shilton, G.P. Brown, and N.W.S. Quinn. 1992. Body size, age distribution, and reproduction in a northern population of wood turtles (*Glyptemys insculpta*). *Canadian Journal of Zoology*. 70: 462-469.
- Buech, R. R., and M. D. Nelson. 1991. How to create wood turtle nesting areas. Draft final report to Minnesota Department of Natural Resources. St. Paul, Minnesota, USA.
- Buech, R.R., L.G. Hanson, and M.D. Nelson. 1997. Identification of wood turtle nesting areas for protection and management. *Proceedings: Conservation, Restoration and Management of Tortoises and Turtles – An international Conference*. New York Turtle and Tortoise Society, pp. 383-391.
- Buhlmann, K. A., and C. P. Osborn. 2011. Use of an artificial nesting mound by wood turtles (*Glyptemys insculpta*): A tool for turtle conservation. *Northeastern Naturalist* 18(3):315-334.
- Compton, B. W., J. M. Rhymer, and M. McCollough. 2002. Habitat selection by wood turtles (*Glyptemys insculpta*): an application of paired logistic regression. *Ecology* 83:833-843.
- Compton, B.W. 1999. Ecology and conservation of the wood turtle (*Glyptemys insculpta*) in Maine. Master's Thesis. University of Maine. Orono, Maine, USA.
- Daigle, C., J. Jutras. 2005. Quantitative evidence of decline in a southern Québec wood turtle (*Glyptemys insculpta*) population. *Journal of Herpetology* 39(1):130-132.
- Dubois, Y., G. Blouin-Demers, B. Shipley, D. Thomas. 2009. Thermoregulation and habitat selection in wood turtles *Glyptemys insculpta*: chasing the sun slowly. *Journal of Animal Ecology* 78:1023-1032.
- Erb, L., M. T. Jones. 2011. Can turtle mortality be reduced in managed fields? *Northeast Naturalist* 18(4):498-496.
- Ernst, C. and McBreen, J.F. 1991. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward. Blacksburg, Virginia, USA.
- Ernst, C. H. 1986. Environmental temperatures and activities in the wood turtle, *Glyptemys insculpta*. *Journal of Herpetology* 20:222-229.
- Ernst, C. H. 2001a. Some ecological parameters of the wood turtle, *Glyptemys insculpta*, in southeastern

Appendix A: Reptiles

- Pennsylvania. *Chelonian Conservation and Biology* 4:94-99.
- Ernst, C. H., R. W. Barbour, and J. E. Lovich. 1994. *Turtles of the United States and Canada*. Smithsonian Institution Press, Washington, D.C., USA.
- Ernst, C.H. 2001b. An overview of the North American genus *Glyptemys* Ritgen, 1828. *Chelonian Conservation and Biology* 4: 211-216.
- Farrell, R. F. and T. E. Graham. 1991. Ecological notes on the turtle *Glyptemys insculpta* in northwestern New Jersey. *Journal of Herpetology* 25: 1-9.
- Garber, S. D., and J. Burger. 1995. A twenty year study documenting the relationship between turtle decline and human recreation. *Ecological Applications* 5: 1151-1162.
- Garber, S.D. 1988. Migratory behavior in turtles. *Plastron Papers* 19: 15-21.
- Garber, S.D. 1989. Turtle hibernation. In: *Proceedings of the 13th International Herpetological Symposium*. Phoenix, Arizona. June 20-24 1989. Editor: Michael J. Uricheck.
- Gibbs, J.P. and W.G. Shriver. 2002. Estimating the effects of road mortality on turtle populations. *Conservation Biology* 16:1647-1652.
- Greaves, W. F., and J. D. Litzgus. 2007. Overwintering ecology of wood turtles (*Glyptemys insculpta*) at the species' northern range limit. *Journal of Herpetology* 41(1):32-40.
- Harding, J. H. and T. J. Bloomer. 1979. The wood turtle, (*Glyptemys insculpta*): a natural history. *Herpetological Bulletin New York Herpetological Society* 15: 9-26.
- Hunter, M. L., A.J.K. Calhoun, and M. McCollough. 1999. *Maine amphibians and reptiles*. University of Maine Press. Orono, Maine, USA.
- Jones, M. T. 2007. Seasonal movements and demographics of two wood turtle (*Glyptemys insculpta*) populations in the White Mountains of New Hampshire. Report prepared for White Mountain National Forest Wildlife/TES Program, Laconia, NH and New Hampshire Fish and Game Department, Nongame and Endangered Wildlife Program, Concord, NH.
- Jones, M. T., and P. R. Sievert. 2011. An Assessment of bank stabilization and agriculture in wood turtle habitat on the lower Deerfield River, MA. Report prepared for Massachusetts Natural heritage and Endangered Species Program, Division of Fisheries and Wildlife, Westborough, MA.
- Jones, M. T., L. L. Willey, P. R. Sievert, T. S. B. Akre. 2014. Status and conservation of the wood turtle in the northeastern United States. State Wildlife Grants (SWG) and Regional Conservation Needs (RCN) Program. Report.
- Kaufmann, J. H. 1992. Habitat use by wood turtles in central Pennsylvania. *Journal of Herpetology* 26:315-3210
- Klemens, M.W. 1989. The methodology of conservation: Pages 1-4 in Swingland, I.R. and M.W. Klemens eds. *The Conservation biology of tortoises*. Occasional papers of the IUCN Species Survival Commission no.005. University of Kent, United Kingdom.
- Klemens, M.W. 1993. *Amphibians and reptiles of Connecticut and adjacent regions*. Connecticut Department of Environmental Protection. Hartford, Connecticut, USA.
- Kolbe, J.J. and F.J. Janzen. 2002. Impact of nest-site selection on nest success and nest temperature in natural and disturbed habitats. *Ecology* 83: 269 –281.
- Levell, J. P. 2000. Commercial exploitation of Blanding's turtle, *Emydoidea blandingii*, and the wood turtle, *Glyptemys insculpta*, for the live animal trade. *Chelonian Conservation and Biology* 3:665-674.

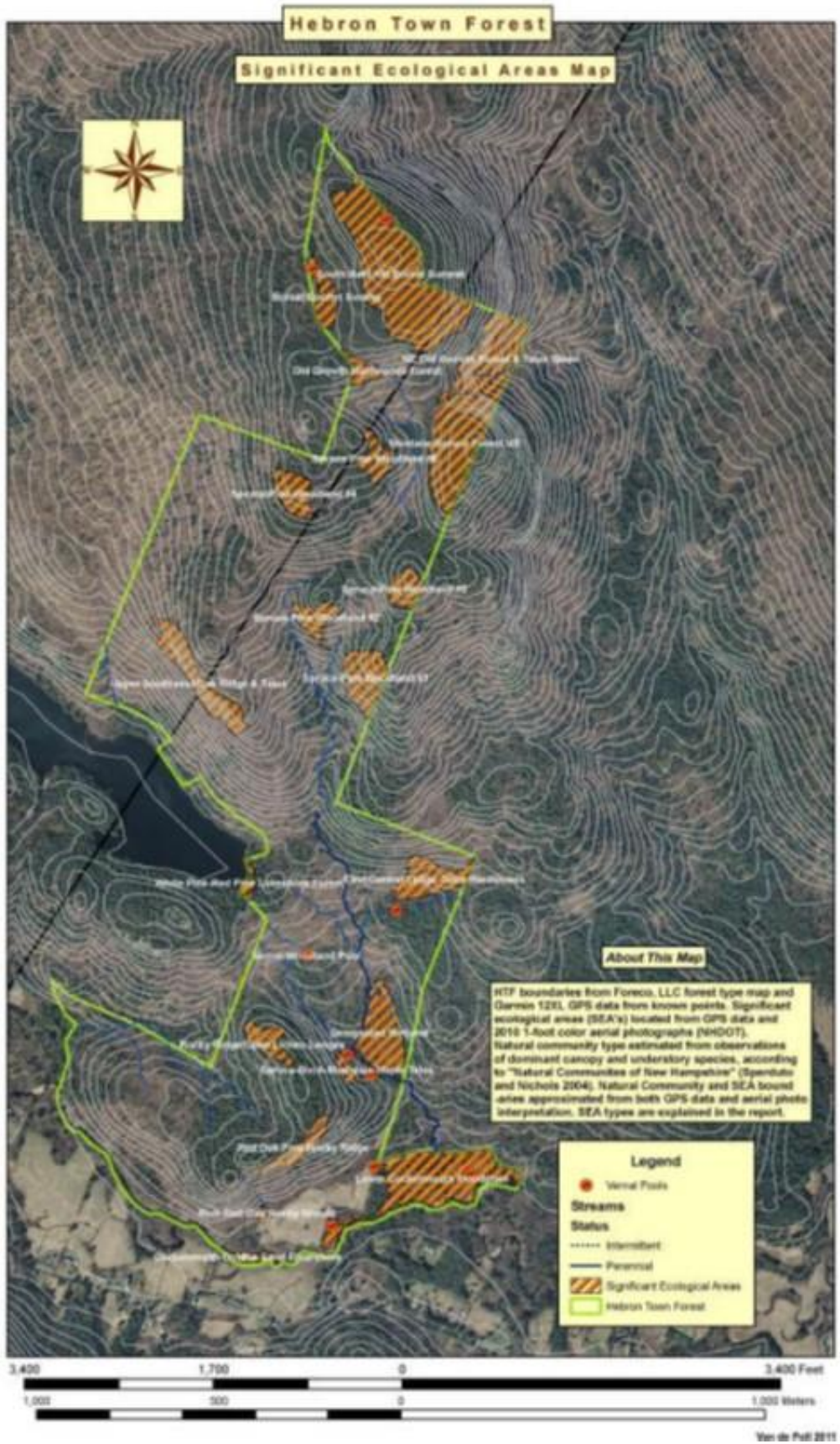
Appendix A: Reptiles

- Marchand, M.N. and J.A. Litvaitis. 2004. Effects of habitat features and landscape composition on the population structure of a common aquatic turtle in a region undergoing rapid development. *Conservation Biology* 18: 758-767.
- Massachusetts Natural Heritage and Endangered Species Program. 2007. Massachusetts List of Endangered, Threatened and Special Concern Species. Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, USA.
- NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 4, 2005).
- NEPARC. 2010. Northeast Amphibian and Reptile Species of Regional Responsibility and Conservation Concern. Northeast Partners in Amphibian and Reptile Conservation (NEPARC). Publication 2010-1.
- Neuman-Lee, L. A., and F. J. Janzen. 2011. Atrazine exposure impacts behavior and survivorship of neonatal turtles. *Herpetologica* 67(1): 23-31.
- New Hampshire Natural Heritage Bureau. 2005. Database of Rare Species and Exemplary Natural Community Occurrences in New Hampshire. Department of Resources and Economic Development, Division of Forests and Lands. Concord, New Hampshire, USA.
- Niederberger, A. J., and M. E. Seidel. 1999. Ecology and status of a wood turtle (*Glyptemys insculpta*) population in West Virginia. *Chelonian Conservation and Biology* 3: 414-418.
- Oliver, J. A. and J. R. Bailey. 1939. Amphibians and reptiles of New Hampshire exclusive of marine forms: Pages 195-217 in H.E. Warfel, editor, Biological Survey of Connecticut watershed. New Hampshire Fish and Game Department. Concord, New Hampshire, USA.
- Paterson, J. E., B. D. Steinberg, J. D. Litzgus. 2012. Revealing a cryptic life-history stage: differences in habitat selection and survivorship between hatchlings of two turtle species at risk (*Glyptemys insculpta* and *Emydoidea blandingii*). *Wildlife Research* 39:408-418.
- Paterson, J. E., B. D. Steinberg, J. D. Litzgus. 2014. Effects of body size, habitat selection and exposure on hatchling turtle survival. *Journal of Zoology* 294(4):278-285.
- Remsberg, A. J., T. L. Lewis, P. W. Huber, K. A. Asmus. 2006. Home ranges of wood turtles (*Glyptemys insculpta*) in northern Michigan. *Chelonian Conservation and Biology* 5(1): 42-47.
- RESTORE: The North Woods, S.D. Garber, J. Burger, J.H. Harding, C. Ernst, S.E. Tuttle, J. Davis, and Biodiversity Legal Foundation. 1994. Petition for a rule to list the North American Wood turtle (*Glyptemys insculpta*) as threatened under the Endangered Species Act. Unpublished manuscript submitted to the U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.
- Ross, D. A., Brewster, K.N, Anderson, R.K., Ratner, N. and Brewster, C.M. 1991. Aspects of the ecology of wood turtles, *Glyptemys insculpta*, in Wisconsin. *Canadian Field Naturalist*. 105:363-367.
- Saumure, R. A., and J. R. Bider. 1998. Impact of agricultural development on a population of wood turtles (*Glyptemys insculpta*) in southern Quebec, Canada. *Chelonian Conservation and Biology* 3:37-45.
- Saumure, R. A., T. B. Herman, R. D. Titman. 2007. Effects of haying and agricultural practices on a declining species: The North American wood turtle, *Glyptemys insculpta*. *Biological Conservation* 135:581-591.
- Society for the Protection of New Hampshire Forests. 2005. New Hampshire's Changing Landscape. Population growth and land use changes: what they mean for the Granite State. Executive Summary. Concord, New Hampshire, USA.

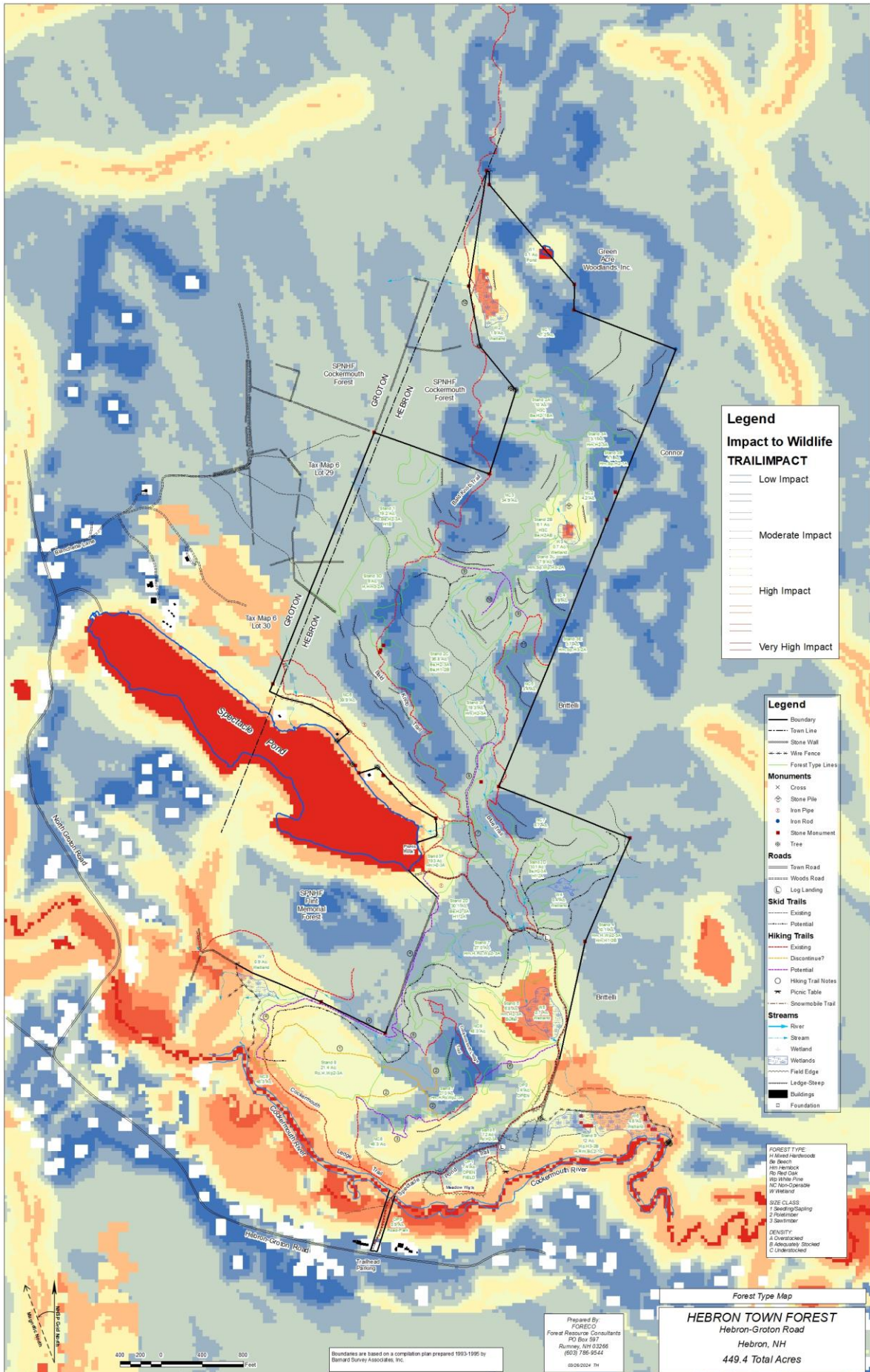
Appendix A: Reptiles

- Sperduto, D.D. and W.F. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau. Concord, New Hampshire, USA.
- Steen, D.A and J.P. Gibbs. 2004. Effects of roads on the structure of freshwater turtle populations. *Conservation Biology* 18: 1143-1148.
- Therres, G.D. 1999. Wildlife Species of regional conservation concern in northeastern United States. *Northeast Wildlife* 54: 93-100.
- Tuttle S. E., and D. M. Carroll. 2005. Movements and behavior of hatchling wood turtles (*Glyptemys insculpta*). *Northeast Naturalist* 12(3):331-348.
- Tuttle, S. E., and D. M. Carroll. 2003. Home range and seasonal movements of the wood turtle (*Glyptemys insculpta*) in southern New Hampshire. *Chelonian Conservation and Biology*, 4 (3): 656-663.
- Tuttle, S. E., and D. M. Carroll. 1997. Ecology and natural history of the wood turtle (*Glyptemys insculpta*) in southern New Hampshire. *Chelonian Conservation and Biology* 2:447-449.
- Tuttle, S.E. 1995. The ecology and natural history of the wood turtle (*Glyptemys insculpta*) in southern New Hampshire, final report. Concord, New Hampshire, USA.
- U.S. Fish and Wildlife Service (USFWS). 1995. 90-day finding for a petition to list the wood turtle (*Glyptemys insculpta*) as threatened. *Federal Registrar* 60(102): 27954-27955.
- Vermont Nongame and Natural Heritage Program. 2013. Rare and Uncommon Native Animals of Vermont. Vermont Fish and Wildlife Department. Waterbury, Vermont, USA.
- Willoughby, J. R., M. Sundaram, T. L. Lewis, B. J. Swanson. 2013. Population decline in a long-lived species: The wood turtle in Michigan. *Herpetologica* 69(2):186-198.
- Wirsing, A. J., J. R. Phillips, M. E. Obbard, D. L. Murray. 2012. Incidental nest predation in freshwater turtles: inter- and intraspecific differences in vulnerability are explained by relative crypsis. *Oecologia* 168:977-988.

SIGNIFICANT ECOLOGICAL AREAS MAP

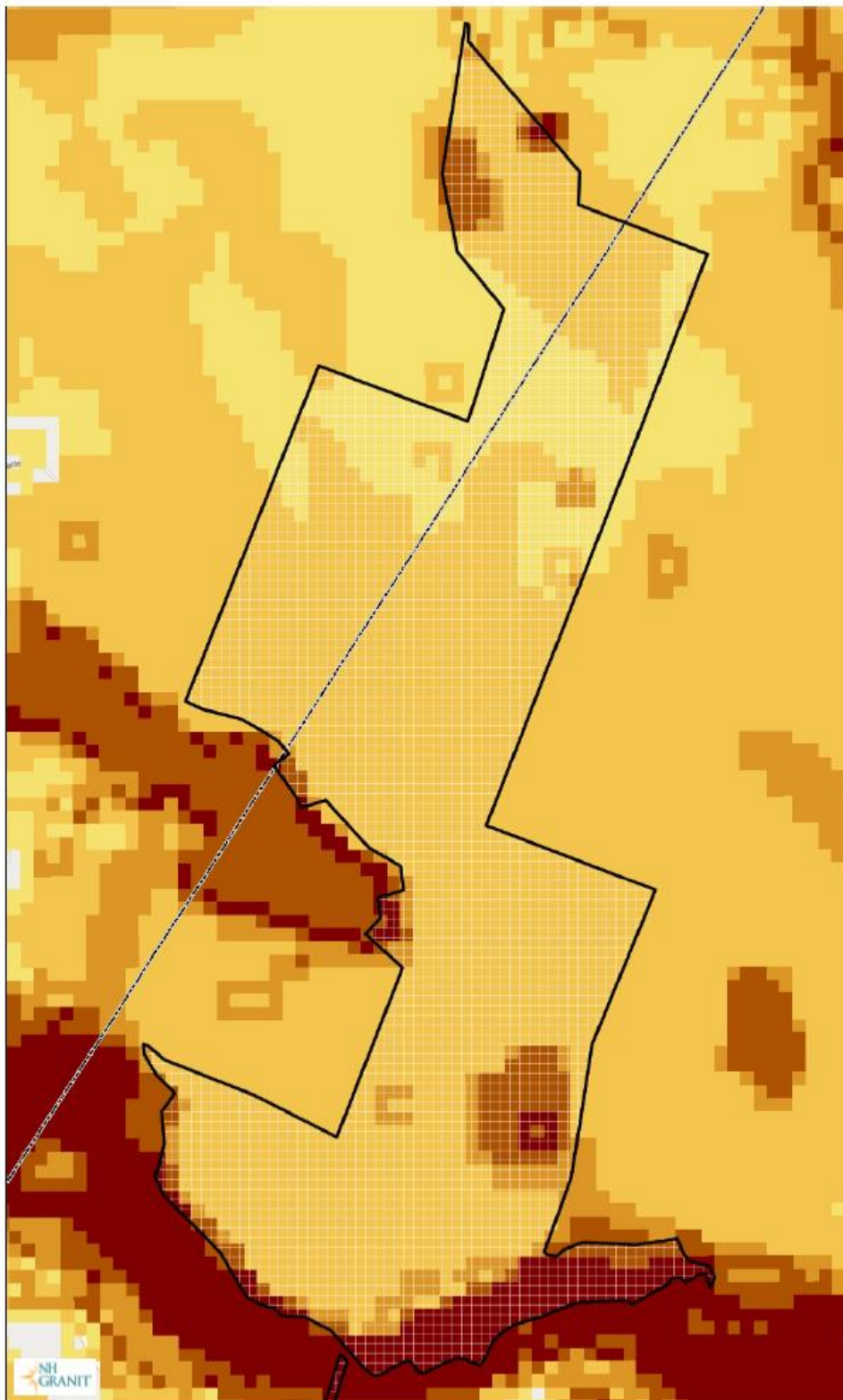


TRAILS IMPACT ON WILDLIFE MAP



INVASIVES MAP

Hebron Town Forest - NH Invasives Mgt. Priority Areas



Legend

- State
- County
- City/Town
- Invasive Plant Management Priority Areas
 - High : 11

Map Scale

1: 12,988



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Map Generated: 3/23/2022

Notes



GLOSSARY

GLOSSARY

ACCESS: The place or ability to enter a woodlot from an existing public road.

BASAL AREA: The cross-sectional area of a tree at 4½ feet above the ground, usually measured in square feet.

BLAZE: An ax mark on a tree denoting a boundary line.

BIOMASS: Commonly refers to the entire mass of living tree material above stumpage height.

BOARD FEET: A measure of wood by volume. One board foot is the volume of wood equal to a piece 12 inches long by 12 inches wide by one inch thick. Many “log rules” are available for converting raw material to board foot units. Log rules are closely linked with the local forest industries and vary with geographical areas. The “International ¼ inch Log Rule” is commonly used in most areas of the Northeast. Board feet per acre (BF/A) is a measure of tree density in a forest stand.

BOLTWOOD: Wood which is used for turning stock and for the eventual manufacture of countless small items, such as buttons, golf tees, dowels and wooden toys. Boltwood mills buy the raw material in four-foot lengths (bolts) and/or log length form.

CAPITAL GAINS: Increase in value over time of an asset. For tax purposes, it is the sale price of an eligible asset less its cost.

CORD: The standard cord of wood is an imaginary rack, or stack of wood, measuring 4 feet by 4 feet by 8 feet and containing 128 cubic feet of wood, bark and voids. Tables are available for estimating the number of cords represented by standing trees. Cords per acres (CDS/A) is a measure of density in a forest stand.

DBH (Diameter at Breast Height): The average diameter of a standing tree, measured outside the bark, at a point 4½ feet above the ground.

DEFECT: Internal rot, knots, or other defects in a live tree. The extent of unseen defect can be estimated from the history of a stand and from evidence of external damage from ice, wind, fire, insects, logging operations, etc.

DEPLETION ALLOWANCE: A tax benefit derived from “depleting” timber harvested as defined by the Internal Revenue Service.

FIREWOOD: Similar to pulpwood in that it is wood, not fit for higher uses such as sawlogs and veneer but it is used for heat production rather paper production.

FLAGGING: The practice of hanging plastic ribbon as temporary markers in the woods for such things as boundary location and skid trail layout.

GROWTH: The amount of fiber added to a tree over a period of time. Usually expressed in cubic feet per acre per year or board feet per acre per year.

HARDWOOD: Hardwood trees are generally of the broad leaved species, also known as “deciduous” trees. Some more economically important hardwood species are maples, birches, ashes, and beech.

INACCESSIBLE: Describes land which cannot be logged at the present time because there is no economical way to get the timber out.

LOGGING COSTS: Include cost of cutting and yarding, trucking, internal road construction, and agent’s fees.

MANAGEMENT PLAN: A document which analyzes the forest on a woodlot and makes suggestions for future activities thereon.

MATURE: Describes a tree which is at its peak as far as biological or economic conditions are concerned.

MBF: Thousand board feet (see “board feet”).

MEAN STAND DIAMETER: The average diameter of a group of trees measured at diameter breast height (DBH).

MERCHANTABLE HEIGHT: The height of a tree where the merchantable portion of it ends. Usually at about 4" - 6 " in diameter.

MIXED WOOD: Describes a stand condition where both softwood and hardwood are present in significant amounts.

MULTIPLE USE: Concurrent use of the forest resources for more than one goal such as timber production, wildlife habitat, watershed management, etc.

NON-COMMERCIAL: A stand which is not able to be operated economically either due to terrain or size and value of the timber present.

OPEN AREA: Unforested land, typically hayfield, built up areas, or overgrown fields.

OPERABLE: Before a stand of timber can be logged (operated) on a commercial basis, it must have some minimum volume of timber. Just as markets vary from one geographical area to another, so does the minimum volume required to operate a stand profitably.

OVERMATURE: A condition in which a tree or stand is past its peak of either economic value or biological growth.

POINT SAMPLING: Statistical approach determining volumes in a forest. Commonly done with a prism at point randomly selected on a grid network spread out all over the property.

PRISM: In forestry, a prism is a calibrated wedge of glass which deflects light rays at a specific offset angle. In conducting a timber cruise, trees seen through the prism from fixed points are measured and are easily converted to “per acre” figures.

PULPWOOD: Wood or trees used to make pulp, from which paper products are manufactured. Trees of poor form and/or quality (rough and rotten), and of small size, are commonly tallied as pulpwood during a timber cruise.

SAWLOG: The portion of wood cut from a tree which will yield timbers, lumber, railroad ties and other products which can be sawn with conventional sawmill equipment.

SELECTIVE HARVESTING: The process of choosing some trees to cut over others based on such criteria as species, age, quality, location, health, etc., with the owner’s long-term goals for management in mind.

SILVICULTURE: The practice of growing trees.

SITE INDEX: A measure of the ability of an area to grow timber.

SITE CLASS: Stands fit into size classes based on the size of trees which occupy them.

Sawlog - A live tree which measures over 10 inches in diameter 4½ feet from the ground.

Pole - A live tree which measures between 4 and 10 inches in diameter 4½ feet from the ground.

Sapling - A live tree taller than 4½ feet but less than 4 inches in diameter 4½ feet from the ground.

Seedling - A live tree less than 4½ feet tall.

SOFTWOOD: A class of tree species retaining their needles year round, also known as Conifers such as pine, hemlock, and spruce.

SOIL SUITABILITY: The general quality of the soil to provide a good medium for the growth of timber products.

SOIL TYPE: A general description of depth and water content of soil.

STAND: A group or area of trees or forest having similar characteristics and requiring similar management practices.

STEMS: A term used to describe individual trees usually in the phrase “stems per acres.”

STOCKING: The amount, usually in trees and less frequently in basal area or volume per acre of a stand.

Overstocked - A stand condition where there are too many trees present to maximize growth and yield.

Adequately Stocked - A favorable stand condition where growth and yield are in near optimum levels.

Understocked - A stand condition where yield is lessened because all growing space is not adequately utilized.

STUMPAGE VALUE: The value of the standing tree. It consists of the mill price (M) paid for the logs, less the total logging costs (L) for cutting the timber and trucking the wood to the mill. Stumpage value is crucial to the forest owner; it represents his profit on timber sales to the mill, and may be determined by using the formula: $S = M - L$.

TIE AND PALLET: Logs that are too rough, short, small or crooked to be marketed as high quality sawlogs, but which can be sawn into railroad ties or pallet stock.

TIMBER CRUISE: A “cruise,” or initial timber appraisal, is an inspection of a forest tract, conducted in order to determine the species composition, volume and value of timber of the tract. Other considerations during a cruise include site characteristics, reproduction and growth capacities of the species on the tract, operability, and the availability of markets.

TIMBER LIQUIDATION VALUE: The timber liquidation value (TLV) of a forest is the value of all the standing trees in operable stands. The value depends upon many variables, including logging costs and delivered mill prices, and may change from month to month.

TIMBER TYPE LINE: A boundary between two different stands of trees.

TRUCKING: Moving logs or other wood products from the landing area to the mill. One of the costs of logging.

VENEER: Veneer logs are turned on a lathe to produce thin sheets of wood to be used in the production of veneer, plywood and paneling. Veneer logs are usually the highest quality logs produced in a logging operation.

VOLUME: A quantitative measure of the amount of wood in a tree, stand, or woodlot usually expressed in board feet, cords, tons, or cubic feet.

WETLAND: Area of property which has surface water or high water table and is not able to economically grow trees.

WHOLE TREE CHIPS: Wood fiber produced when the remains of a tree are ground up after logs and pulp have been removed.

YARDING: The transport of logs or whole trees from the stump to yard, where wood is sorted. Yarding is usually done with rubber-tired “skidders,” with tractors or with horses.