Forest Management Plan for

Dillant Hopkins Airport

Owned by the City of Keene

Located in Swanzey, New Hampshire

Plan created November, 2016

An open grown silver maple, growing in the Silver maple-false nettle-sensitive fern floodplain forest associated with the Ashuelot River, located on the Keene Dillant Hopkins Airport ownership.

Plan Prepared For:
City of Keene
Dillant Hopkins Airport
80 Airport Road
Keene, NH
603-357-9835-3331

Plan Prepared By:
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FOREST INFORMATION SUMMARY

Landowner: City of Keene
Physical Address: 80 Airport Road, Keene NH
Mailing Address: 80 Airport Road, Keene NH
Phone: 603-357-9835
Email: (Jack Wozmak, Airport Manager) jwozmak@ci.keene.nh.us
Tract Name: Dillant Hopkins Airport
Acres: 888 acres, according to town records
Located in: Swanzey, New Hampshire
Tax Map/Lot: Map 37, Lots: 19-1, 19-2, 19-3, 19-4, 19-5, 21, T21-T40, T41-T52, FIRE, PLANT, TERM,
Deed Book/Page:
Conserved Status: 12.3 acres of Edgewood Civic Association Land, Fee Ownership through the City of Keene
Tree Farm Status: Not enrolled
Cost Share Status: None
ROW: Frontage on Old Homestead Highway on the south and eastern boundary, Airport Road provides access into the tract to the terminal, gated road provides access to the water treatment facility.
Deed Restrictions summary related to forest land management: Warranty Deed, Book 799, Page 144. (See Deed for specific language and complete content)

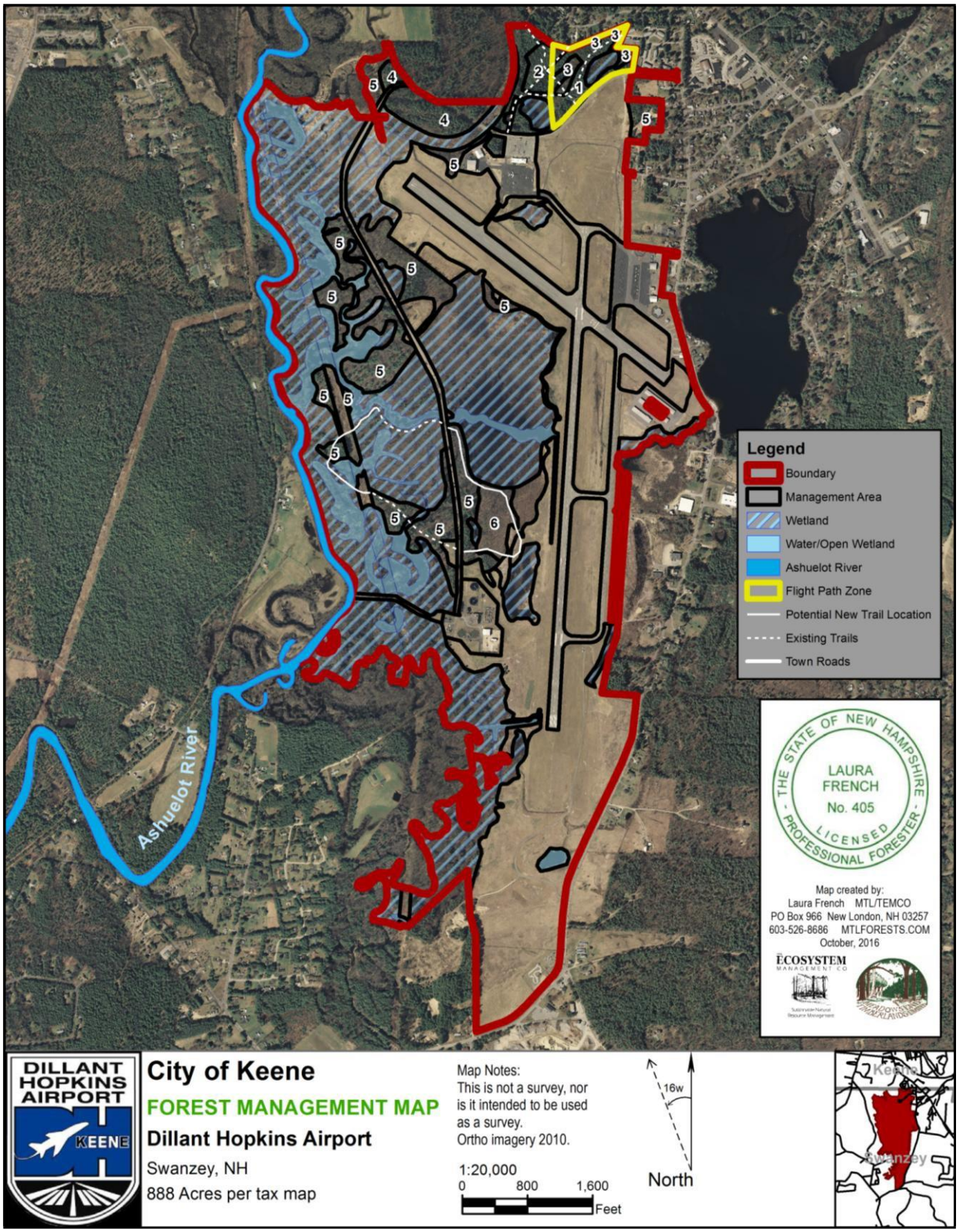


Figure 1: Forest Management Map of Dillant Hopkins Airport showing boundary, management areas, trails, wetlands, Ashuelot River, and Flight Path Zone.

PLAN INTRODUCTION AND PURPOSE

This plan's purpose is to provide the landowner, the City of Keene, with a comprehensive description of the natural resources on the Dillant Hopkins Airport and proposed management activities. It is meant to be a "User's Guide" that reflects the landowner's objectives and will remain flexible as changes in the property condition or objectives change through time. This plan is meant to actively cover a 10-year period, though it will remain useful for a far longer period of time and may be updated and amended as needed, rather than re-created. This plan meets and exceeds the requirements of the Tree Farm program, Documented Stewardship category of New Hampshire's Current Use Program, and the Natural Resource Conservation Service (NRCS) programs. It has been prepared by licensed New Hampshire forester Laura French, #405.

View of a portion of the significant wetland system that surrounds the open runway system of the Dillant Hopkins Airport. The wetlands and open grass and shrubland provide excellent habitat, especially for songbirds, waterfowl, and birds of prey.

PROPERTY LOCATION AND BRIEF DESCRIPTION

The Dillant Hopkins Airport, located in the town of Swanzey, is owned by the City of Keene, New Hampshire. It was purchased by the city in 1942 and was named to honor Thomas David Dillant from Keene and Edwin Chester Hopkins from Swanzey, who died fighting in World War II. During the fall of 2016 a funeral was held at the airport after the remains of Hopkins, a 3rd Class Fireman who served onboard the USS Oklahoma during the Japanese attacks on Pearl Harbor, were identified using modern technology after nearly 75 years.

Although there is no commercial airline service, the airport hosts two runways and sees multiple daily flights operated with a mix of commuter, regional prop, and mainline jet service. According to the City of Keene website, the airport also "serves a role in fostering other activities and programs with many different and varied organizations. These include the Civil Air Patrol, Boy Scout programs and the Young Eagles Program. Development of the Airport will continue to permit an expansion of these and other services to the community for the benefit of all."

The approximately 888 acre tract lies within the town of Swanzey bordering the Keene town line and is accessed by Airport Road. The tract is a well-known birding hotspot, notable for its wide expanse of floodplain forest and grassland habitat. The tract borders the Ashuelot River and includes about 400 acres of maintained grassland buffering the runways, 135 acres of upland forest, another 100 acres of floodplain forest, and about 200 acres of wetland. The combination of habitats provides hosts several threatened, endangered, and species of special concern, along with providing exceptional birding opportunities.

Approximately 12 acres located on the northernmost section of the ownership is conserved under fee ownership with the City of Keene. This conserved land makes up part of the approximately 34-acre Edgewood Forest donated to the City of Keene in the 1960's by the Edgewood Civic Association, which hosts a mix of pine and hardwood forest, spruce and pine plantation, and two wetland systems and borders the Edgewood neighborhood. The forest, a much loved part of the neighborhood which includes about 80 homes and hosts a historic civic association, provides an important buffer between the community and the airport. Though not managed by the City of Keene as a park or recreation area, the forest provides opportunities for a variety of activities including connecting with nature, walking, and bird watching. Additionally, the forest and its associated wetlands have been closely studied by students of Antioch University. A detailed forest management plan for the Edgewood Forest was competed by students of the Wildlife and Forest Management Course in December, 2013. A digital copy of this plan is available upon request. As such, the forest has been the center of a long running dialogue between the airport (and the Federal Aviation Administration) and the neighborhood over management recommendations regarding safety issues around impaired visibility because of the height of the tall white pine trees that dominate the area. Those circumstances, along with a desire to evaluate the natural resources of the airport land, initiated discussions to create a long term forest management plan for the ownership that in part, will provide recommendations for managing the Edgewood Forest for the long term and for the good of both the community and the airport. In addition, an Environmental Impact Statement, prepared by Stantec Consulting Services Incorporated in the fall of 2016, provides detailed descriptive information and management strategies congruent with the recommendations provided below.

GREATER LANDSCAPE PERSPECTIVE

In addition to bordering the Ashuelot River and hosting an impressive array of grassland and floodplain forest that hosts rare and threatened species as well as uncommon natural communities, the Dillant Hopkins Airport is situated amongst a vast array of conserved land. The 1,900 acre Yale-Toumey Forest lies just across the Ashuelot River. This forest, a part of the Yale School of Forestry ownership, among other things is known to host archeologically and cultural significant remnants of Native American fishing weirs. The weirs were used seasonally to capture fish and eels, providing a significant food source.

On a larger scale, the 13,000 acre Pisgah State Park is located 7 miles to the southwest, the 3,500 acre Monadnock Reservation owned by the Society for the Protection of New Hampshire Forests and hosts the popular hiking destination Mount Monadnock sits 7 miles to the southeast, the 2,700 acre Keene Watershed sits 2.5 miles to the northeast, and the 12,000 acre privately owned Andorra Forest is 10 miles away in Stoddard. In all, the surrounding landscape hosts an impressive array of conservation lands and natural resources.

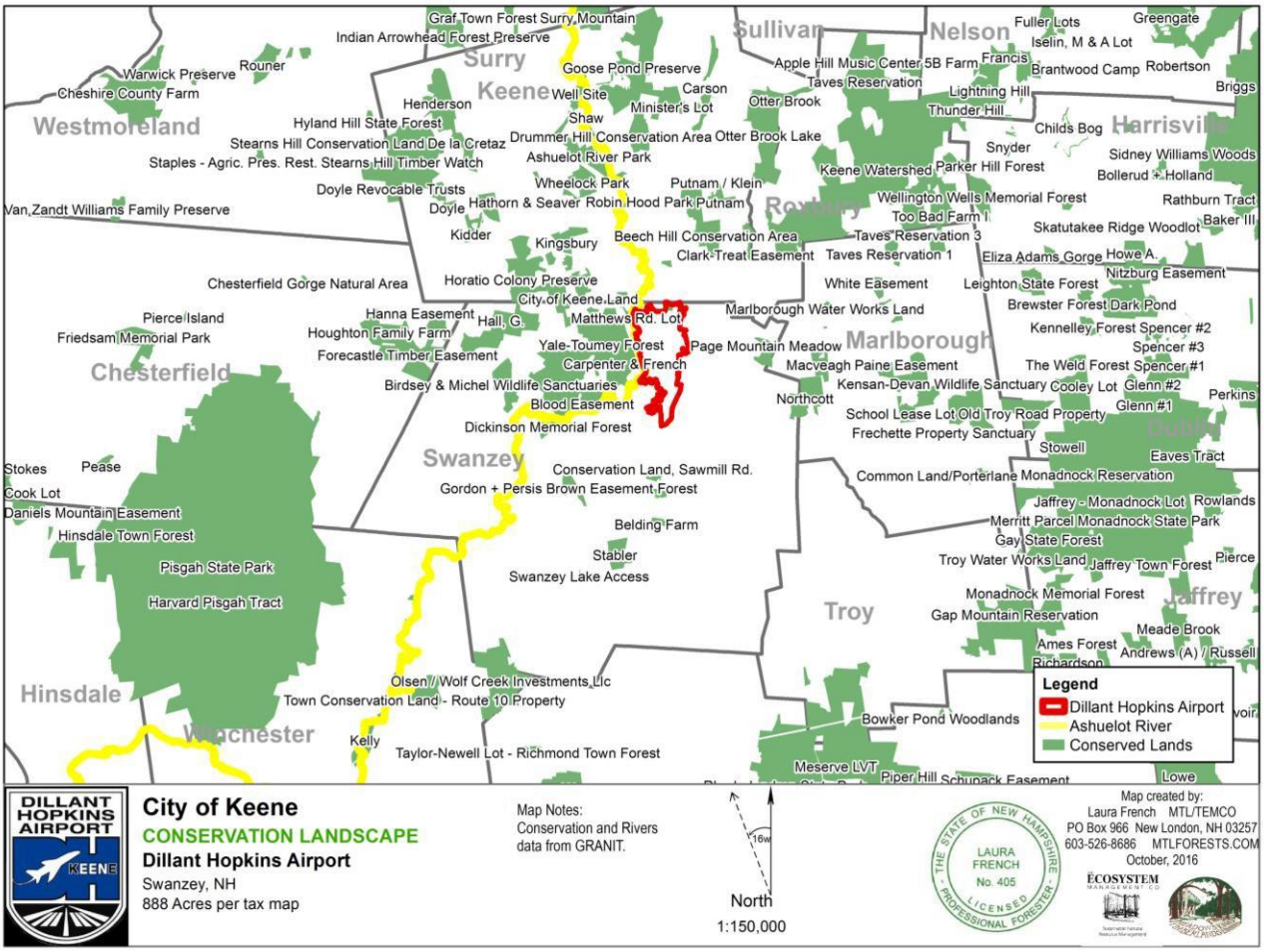


Figure 2: Map showing conserved land surrounding the Dillant Hopkins Airport at a landscape level.

LANDOWNER OBJECTIVES

It is not always possible, nor practical, to achieve every landowner objective on each acre of land. Some objectives, "*Be responsible stewards of the land"* for example, by their nature are practiced on the entire parcel. But often the more specific objectives are better applied to sections of the land best suited to meet those objectives, though often multiple landowner objectives can be met in the same area. For example, the habitat of certain wildlife species can often be improved while meeting objectives for growing timber. Red oak, a hard mast food source for many wildlife species such as white tailed deer and turkeys is also a good tree to grow for timber. In addition, the opening of the forest canopy during timber harvesting allows more sunlight to hit the forest floor, prompting growth of herbaceous and woody trees and shrubs providing browse, shelter and structural complexities utilized by almost all wildlife species.

Other wildlife objectives could be met through forest management. For example, some forest stands could be improved based on the wildlife habitat they provide. Snag trees and down logs could be created, living cavity trees could be managed for by releasing them from competition. Perch trees could be released or intentionally left protected to meet specific habitat requirements. Forest species diversity could be increased through selective thinning. Forest structure can be manipulated to provide habitat in different levels of the forest.

For wildlife species that require dense, undisturbed, mature forest, timber harvesting likely would not be a complimentary management objective. The inverse is true as well; old agricultural areas that have not yet reforested are excellent places to manage open wildlife habitat with a lot of edge through periodic mowing and/or brush hogging. Dynamic planning that allows for islands of shrubby vegetation within these areas would provide shelter and often harbor soft mast species as a food source. Pruning of old apple trees found in these areas is another way to improve wildlife habitat. In these areas timber harvesting obviously is not a compatible objective, but recreation could be if hiking trails were created to provide opportunities for wildlife viewing.

A landowner who has multiple and multifaceted objectives should first clearly identify and then prioritize them. The forest management plan created to meet these objectives is a crucial tool providing an analysis of what the landowner has to work with, a detailed management scheme in which objectives are met according to priority and practicality, and a projection of the expected outcome of management.

Dillant Hopkins Landowner Objectives:

The Dillant Hopkins Airport is owned by the city of Keene. The management objectives listed here apply to the undeveloped portion of the ownership, including the forestland, wetland, and grassland areas. The ownership is unusual in that it includes a large percentage of wetland and floodplain forest not suitable for traditional silvicultural goals, instead being best managed passively. For that reason, management objectives will differ for areas of high priority active management, low priority active management, and passive management. Additionally, given the history of the Edgewood Forest and its strong connection with the community, management will there focus beyond silvicultural recommendations to including complementary management activities, ranging from improved trails, educational kiosks and interpretive signs, geo-cache activities for children,

birding trails, to planting fruit and berry producing trees and shrubs and wildlife habitat plantings and enhancements.

Keene Dillant Hopkins Primary Management Goals:

- Practice sustainable, long term land management;
- Use a balanced, sensitive approach to land management;
- Provide recreational opportunities for the public, especially around bird watching;
- Enhance wildlife habitat compatible with airport safety, especially bird habitat;
- Protect sensitive and rare habitats and ecosystems;
- Protect habitat for threatened, endangered, and species of special concern;
- Protect soils and water quality;
- Manage the Edgewood Forest for ecologically based land use focusing on long-term health, functionality, aesthetics, recreation, and community involvement while meeting airport safety objectives as well as maintaining visual and sound the screening to the greatest extent possible;
- Manage Grasslands to maximize ecological function while maintaining airport functionality.

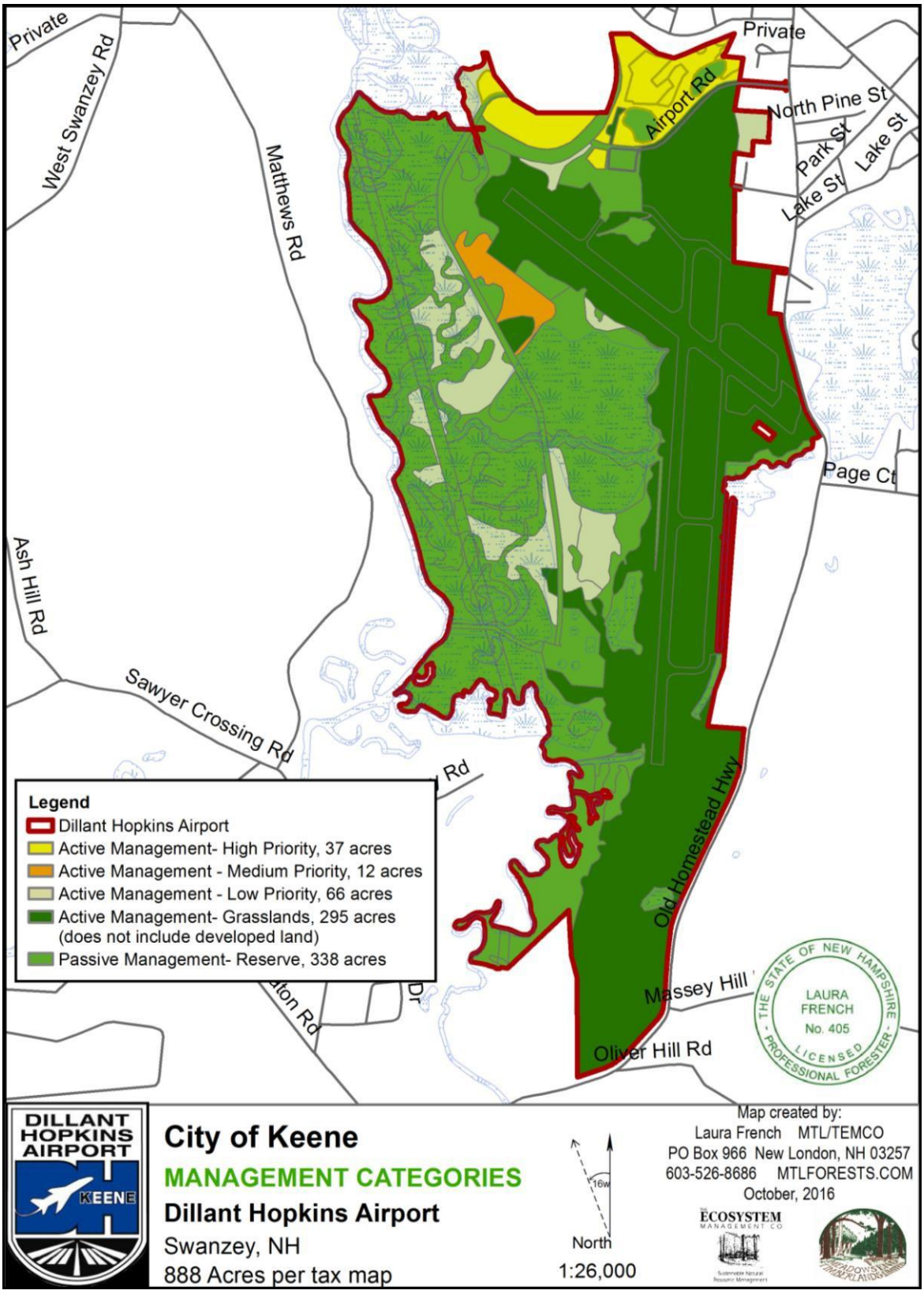


Figure 3: Map showing management categories on Dillant Hopkins Airport.

WOODLOT HISTORY

Prior to European settlement, the land use history of Dillant Hopkins Airport was similar to the surrounding New England landscape. Prior to European arrival, Indian tribes used the lands here for hunting, fishing, and seasonal agriculture for several thousand years. In fact, according to the New Hampshire Department of Environmental Services (NH DEC), the southern Ashuelot River region was inhabited by Squakheag Indians. Twelve culturally significant Native American sites have been identified along the Ashuelot, 7 of those within the town of Swanzey. Land use by Native Americans most certainly impacted the landscape, but arguably unsubstantially compared to European settlers. Up until the early 1700's the greater landscape remained relatively undisturbed except for small villages established primarily further south in Massachusetts and southern New Hampshire in the 1600's. The forest and wetlands of the airport saw little change until the mid-1700's, when European settlements began to take hold. The river was a major source of food and power, and the settlers began to clear the land for agriculture.

From there, the story is similar to much of New England. By the 1800's, most of the forest in the area was cleared, and by the time of the great sheep boon in the mid-1800's little forest remained. Things stayed this way until after the end of the Civil War, when a great mass of settlers began to move west in search of land that was easier to work and better for agriculture. By the early to mid-1900's, vast stretches of pasture, crop land and hay fields were abandoned and allowed to re-forest, and giving way to the largely even-aged forest we see here today. Evidence of past agricultural use can be seen throughout the airport ownership, most notably in the form of dug channels for draining land, remnant sections of wire fence and stonewalls.

The forest was largely in early growth stages when the land was purchased by the City of Keene for the airport in 1942. Since then, only sporadic forest management has occurred, primarily with the single objective of removing trees as they grow into sight lines for safety measures.

More specific information is known about the Edgewood neighborhood. It was established in 1913 on lands that were once part of the Keene Driving Park, which was itself established in 1875 for horse racing. The Park went on to host numerous public events including automobile racing, agricultural fairs, and parades. As mentioned earlier, the Edgewood neighborhood was well established with its own Civic Association. Parades and concerts were regularly held on the "common", which was given to them in 1945 by the Keene Forestry Association. The Edgewood Forest in turn was given to the City of Keene in 1956.

Approximately 5 acres of Norway spruce and Scot Pine plantations occur in the Edgewood Forest. These trees are what remains of a tree nursery started in 1906 by Albert Proell, the manager of the Keene Forestry Association, on some of the abandoned agricultural land that made up part of the Keene Driving Park. The nursery, which established trees from seed for reforestation efforts, is thought to be the first and one of the largest of its kind. The trees that stand now on the forest were planted about 40 years ago, and have seen little management since. Pictures from the 1920's show vast expanses of planted seedlings and are included in the Appendix. Other sections of the forest have been selectively cut to remove tall trees that interfere with safety protocol of landing planes, which has led to an ongoing discourse between the neighborhood and the airport. The neighborhood wants to keep the trees and protect the surrounding forest and wetlands, but understand safety

measures have to be met- which also are the same objectives of the airport. These circumstances led to the establishment of this Forest Management Plan, with a primary goal to manage the Edgewood Forest sustainably and for the long term while meeting safety objectives. Additionally, an Environmental Assessment (EA) was completed by Stantec Consulting Services, Inc. to evaluate the potential environmental consequences of implementing the activities recommended by this plan within the Edgewood Forest. The EA found no evidence of potential significant impact on environmental, visual, audio, or air quality. A link to the draft EA can be found on the City of Keene Website at: https://www.ci.keene.nh.us/sites/default/files/draft_final_ea_rpt_0.pdf .

FOREST INVENTORY PROCEDURES

A forest inventory was conducted to evaluate the timber types, wildlife and bird habitats, recreational and cultural resources found on the property. The forest inventory also was used to evaluate the stocking and composition of the forest and the volume of the merchantable timber on the woodlot. Data was collected at points established on a systematic grid.

For the cruise a 20-BAF prism was used to sample trees 5.5 inches and larger at each point. The trees which fell within the sample at each point were recorded by species, diameters tallied to the nearest inch, growing stock status, and crown position. The trees were also tallied as sawlogs, pulpwood, or a combination of the two. A 5-BAF prism was used to collect data including species, diameter, status, and crown position on trees between 2 and 6 inches in diameter. Information on snags, cavity trees, and regeneration was also collected. Photographs were taken at each point and at other points of interest.

Products estimated in tallied trees greater than 6 inches in diameter were graded in multiples of eight feet. Hardwood sawlogs were estimated to a 10 inch small-end diameter while spruce and fir softwood logs were estimated to a 6 inch small-end diameter and pine to an 8 inch small-end diameter. Pulpwood was estimated in eight foot lengths up to a minimum 4 inch top.

In order to more accurately determine volume and make forest management and wildlife habitat recommendations, the property was broken into separate management areas called forest stands. Stands were differentiated from each other primarily on the basis of natural community type and past land use, but also considered soils, tree size, species composition, and density. As with any large piece of land, there are many micro-stands on the property (small areas within a larger stand that are distinct, such as a small pocket of rocky ground or a forested seep) but these variations are too subtle to map and too numerous to describe. These subtleties are best left to the intuitive forester to sort out when applying any sort of silvicultural treatment.

The computer program ASSISI was used to process the data collected at the sample points to the entire forest. The detailed computer program output is not included as part of this plan but is available, if needed, from The Ecosystem Management Company. Often to simplify operations on a large tract, forest stands are compiled to make up operational compartments. Compartments are helpful to identify sections of the property that utilize the same access system.

Stand type abbreviations include primary species, size class, and density. Primary species have a 2-letter abbreviation. Size class ranges from 1-4, and crown closure/density ranges from A-D:

Size Class:

1: Seedlings or regeneration - 90% of stems < 3" DBH;

2: Saplings or small poles 3” to 8” DBH;

3: Large poles and/or small sawtimber 9” to 12” DBH;

4: Sawtimber 13” DBH and larger.

Crown Closure/Density:

A: 75-100% crown closure of co-dominant or dominant trees;

B: 50-74% crown closure of co-dominant or dominant trees;

C: 25-49% crown closure of co-dominant or dominant trees;

D: 0-24% crown closure of co-dominant or dominant trees.

GEOLOGICAL ATTRIBUTES

Physiographic Regions

Northern New England can be broken down into different physiographic regions, also called eco-regions. The regions are separated from one another based on a combination of climate regimes, topography, surficial geology, and soils. This in turn influences the plant and animal distribution in those regions.

Dillant Hopkins Airport Physiographic Regions:

The Dillant Hopkins Airport is located in the one of three distinct regions found in the state, called the Vermont-New Hampshire Upland Section. According to the book Natural Communities of New Hampshire[1] this section covers the southwestern portion of the state. From maximum elevations of 2200 feet, it slopes southeastward to its boundary with the Gulf of Maine Coastal Plain. It is a sloping plateau dissected by steep, narrow valleys and underlain by granite, gneiss, and schist. This region is divided into four subsections: (1) Sunapee Uplands, (2) Hillsboro Inland Hills and Plains, (3) Vermont Piedmont, and (4) Northern Connecticut River Valley.

The airport occurs in the Hillsboro Inland Hills and Plains, characterized by isolated hills and peaks of hard, resistant rock (mostly granite) commonly referred to as monadnocks. Numerous small lakes and narrow valley streams are scattered through the area. Drumlins are also distinctive glacial features. Soils are typically shallow and stony and less fertile, which is reflected in the composition and distribution of plant communities.

Topography and Aspect

The present land formations of New England were shaped by the latest glaciation during the Pleistocene Era, which began approximately two million years ago. At that time New England was covered by ice

1 Natural Communities of New Hampshire, Daniel Sperduto and William Nichols, 2004.

approximately 1 mile thick. The glaciers receded 10,000 to 12,000 years ago leaving behind the mountains, hills, gullies and valleys we are familiar with today. Following primary succession where pioneer species including lichen, algae and fungi in combination with abiotic factors like wind and water slowly built up soils, the forest began to re-grow. Over long periods of the forest has evolved to the mix of species found here today largely determined by soils type, topography, and aspect but also shaped by more recent land use history.

Dillant Hopkins Airport Topography and Aspect:

The very nature of land required for an airport means there is little topography here, with the bulk of the ownership existing on largely level ground. The greatest slope occurs as you head east towards the Ashuelot River, where the ground very mildly slopes towards the river. Given the levelness, there is no predominant aspect, except for a very mild west facing aspect again as you head towards the river.

The elevation ranges from 480 feet near the Ashuelot River to 500 feet on the airfield.

Soils

Soils are the substrate upon which all trees grow. Soil productivity is influenced by the rock from which the soil is derived. For example, soils derived from limestone, or calcium-rich bedrock, tend to be more nutrient rich because of a higher pH. As pH increases more nutrients become available. On the other hand, soils derived from granite, or more acidic bedrock, tend to have a lower pH which locks up nutrients. Not only do different soil types largely drive the mix of vegetation found on a site, soil is critical to productive tree growth, one of the primary objectives of forest management. Sound forest management strives to grow the tree species best suited for the site. Fighting the site, for example trying to grow high quality sugar maple on acidic soils, will result in poorly formed, low vigor trees with a higher susceptibility to insect and disease problems. Hence, it is important to consider your soil types when determining landowner and management objectives. Additionally, maintenance and consideration of the long-term productivity of the soil resource is critical to the sustainable forest management.

The threats to the soil resource include the loss of soil through erosion, compaction of the soil from heavy equipment traffic, and nutrient loss through both leaching and timber harvesting. Erosion results in the direct loss of soil. Compaction reduces soil productivity. Most soil types include about 50% space between particles and soil compaction, which eliminates this space, directly reduces the amount of air and water soil can hold which is required for most soil processes. Nutrient leaching increases when soil is exposed during a timber harvest and when intensive timber repeatedly harvesting occurs

Measures to avoid these threats include[2]:

- Avoid whole-tree removal, particularly on low-fertility sites (i.e., shallow to bedrock soils, coarse sands, wetlands, and area with high water tables), unless replacement of nutrients and organic matter is considered;
- Conduct harvest operations during the season of the year that is most appropriate for the site. Operating

2 Soil management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

on snow or frozen ground, whenever possible, minimizes effects of the soils and forest floor;

- Choose harvest equipment to suit the site and minimize disturbance. For example, in dry conditions, and in some wet conditions, consider using tracked vehicles to reduce rutting;
- Minimize skid-trail width using techniques such as bumper trees when appropriate;
- Establish skid trails that follow land contours where possible rather than directed straight uphill;
- When possible, conduct whole-tree harvests of hardwoods during dormant leaf-off season to retain nutrients on site;
- Avoid or minimize practices that disturb the forest floor, remove the organic soil or cover it with mineral soils, except as necessary to accomplish silvicultural goals and to regenerate certain tree species.

Dillant Hopkins Airport Soils:

There are several different soil types on the Dillant Hopkins Airport. The soils are mapped by the United States Department of Agriculture, NRCS (formally the Soil Conservation Service). A general soils map and is included in the appendix.

Soil types have been broken down into six different forest productivity classes including IA, IB, IC, IIA, IIB, and NC. They are described by the NRCS as follows:

- **IA:** This group consists of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple. Successional stands frequently contain a variety of hardwoods such as beech, sugar maple, red maple, white birch, yellow birch, aspen, white ash, and northern red oak in varying combinations with red and white spruce, balsam fir, hemlock, and occasionally white pine. Hardwood competition is severe on these soils. Softwood regeneration is usually dependent upon persistent hardwood control efforts;
- **IB:** The soils in this group are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood species such as red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with red spruce, balsam fir, and hemlock. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control;
- **IC:** The soils in this group are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., red spruces and hemlock. Balsam fir is a persistent component in many stands, but is shorter lived than red spruce

and hemlock. White pine, red maple, aspen, and paper birch are common in early and mid-successional stands. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management;

- **IIA:** This diverse group includes many of the same soils as in groups IA and IB. However, these mapping units have been separated because of physical limitations which make forest management more difficult and costly, i.e., steep slopes, bedrock outcrops, erosive textures, surface boulders, and extreme rockiness. Usually, productivity of these soils is not greatly affected by their physical limitations. However, management activities such as tree planting, thinning, and harvesting are more difficult and more costly. Due to the diverse nature of this group, it is not possible to generalize about successional trends or to identify special management opportunities;
- **IIB:** The soils in this group are poorly drained. The seasonal high water table is generally within 12 inches of the surface. Productivity of these poorly drained soils is generally less than soils in other groups. Successional trends are toward climax stands of shade tolerant softwoods, i.e., spruce in the north and hemlock further south. Balsam fir is a persistent component in stands in northern New Hampshire and red maple is common on these soils further south. Due to abundant natural reproduction in northern New Hampshire, these soils are generally desirable for production of spruce and balsam fir, especially pulpwood. Red maple cordwood stands or slow-growing hemlock sawtimber are common in more southerly areas. However, due to poor soil drainage, forest management is somewhat limited. Severe windthrow hazard limits partial cutting, frost action threatens survival of planted seedlings, and harvesting is generally restricted to periods when the ground is frozen;
- **NC:** Several mapping units in the survey are either so variable or have such a limited potential for commercial production of forest products they have not been considered. Often an on-site visit would be required to evaluate the situation.

The vast majority of the forest soils are Rippowam-saco complex and Raynham-wareham complex, part of the IIB group. These soils are poorly drained, with successional trends towards shade tolerant softwoods including red spruce and hemlock. Early and mid-successional stands often contain a mix of hardwoods such as red maple, yellow, gray and paper birch, aspen, and white and black ash in varying mixtures with red spruce, hemlock, balsam fir and white pine.

The upland soils in the Edgewood Forest are Ceasar loamy sand, in the IC Group. These soils support less site demanding hardwood such as northern red oak and white birch. Successional trends are toward stands of shade tolerant softwood including red spruce and hemlock, but with management can be swayed towards oak and pine.

Several other small pockets of other soils types exist, but are too scattered and numerous to describe.

They are depicted in the soils map, coded for their particular soils grouping.

Wetland and Water Resource

Water features are an integral part of the forest ecosystem. Brooks, streams, ponds and wetlands all provide essential riparian habitat and functions. According to the publication Good Forestry in the Granite State, riparian areas provide flood control, regulate streamflow and protect water quality by filtering and retaining sediment, nutrients, and other pollutants from upslope areas. Riparian areas also regulate temperature of aquatic habitat by shading streams, provide large, woody material to create pools, riffles, debris-jams, and related aquatic habitat, provide leaves, twigs, fruit and insects which contribute energy to drive aquatic food webs.

Riparian areas also provide habitat for feeding, cover, and travel for many amphibians, birds, furbearers, and reptiles. Tall trees within riparian areas provide primary nesting sites for bald eagles, osprey, and colonial water birds. Topography, elevation, bedrock, and soils dictate the water features found on a particular tract of land. The protection of water quality is an integral part of sound, sustainable forest management.

The following are recommended actions to improve and manage the wetland and water resource[3]*:*

Riparian, Wetland and Stream Ecosystems:

- Establish Riparian Management Zones (RMZs) along streams, rivers, wetlands, ponds, and lakes;
- Include maintaining or restoring riparian functions and values as a silvicultural objectives in RMZs;
    - Retain trees with cavities, standing dead trees, downed logs, and large supracanopy trees (especially white pine);
    - Leave wind firm trees that are well-distributed. Leave other vegetation, including existing groundcover;
    - Choose a regeneration system most likely to maintain riparian functions and values and rapidly regenerate the site with the desired trees. Choosing a method is complicated by wet soils and the desire to maintain forest structure that contributes to wildlife habitat and other ecological values;
    - Use uneven-aged techniques such as single tree or small group selection, maintaining 60 to 70 percent crown closure or full stocking as recommended in silvicultural guides;
    - Use even-aged techniques such as shelterwood or patch cuts to achieve regeneration goals when rapid regeneration is likely;

- Locate new truck roads and log landings outside RMZs, except where doing so would result in greater overall adverse environmental impacts;
- Deign roads and skid trails within RMZs to minimize the long-term impacts of water quality and wildlife habitat. Apply BMPs. Put roads to bed using BMPs to stabilize the soil, control run-off, and control unwanted vehicular access at the end of the harvest;
- Minimize ground disturbance. Operate ground-based equipment when the ground is dry or frozen.

3 Good Forestry in the Granite State: Recommended Voluntary Forest Management Practices for New Hampshire, 2010.

- Time harvesting to avoid disturbance to nesting birds and other sensitive species;
- Leave the area closest to the stream, pond or wetland unharvested to provide increased protection to aquatic habitat, protect wildlife trails, and allow a reliable long-term supply of cavity trees, snags, and down woody material. Larger zones increase the protection of nontimber values; however, no-harvest zones may not always be consistent with ecological or silvicultural objectives;
- Keep trees along banks to stabilize shorelines;
- Avoid leaving isolated riparian management zones with long distances of abrupt edge. Riparian forests next to heavy cuts, agricultural, or urban land uses may be subject to increased edge effects (e.g. invasives, nest predation) and risk of blowdowns. Practices that minimize these risks include limiting harvest within the riparian management zone, increasing the width of the zone, or feathering the edges of a heavy cut.

Dillant Hopkins Airport Wetland and Water Resource:

Protection of the wetland and water resources on Dillant Hopkins Airport is a high priority. The tract borders the Ashuelot River, one of New Hampshire's "Designated Rivers". According to the NH Department of Environmental Services, "a designated river is managed and protected for its outstanding natural and cultural resources in accordance with The Rivers Management & Protection Act". The Ashuelot River "hosts one of the oldest known sites of human activity in New Hampshire, dating back 10,500 years. The river has also been identified by the U.S. Fish and Wildlife Service as one of the four most important refuges for the federally-listed endangered dwarf wedge mussel." Though no known occurrence of the mussel have been reported on the ownership, no active management will occur in riparian zones and wetlands associated with the river.

Three wetlands located within the Edgewood Forest have been studied in depth by students at Antioch University and were part of the Stantec EA. The easternmost wetland includes a dwarf shrub bog with black spruce and larch around the perimeter and open water in the center. A smaller strip of wetland located between the bog wetland and Airport Road has also been identified. And the westernmost wetland is a red-maple swamp with associated tall shrubs dominated by highbush blueberry and winterberry.

The wetlands on the ownership are important. They help reduce impacts from storm damage and flooding, maintain good water quality in the Ashuelot River, and help recharge groundwater. In addition, they are important sites for biodiversity. Of the total 880+ acre ownership, 265 acres (about 30%) are wetland including about 74 forested wetland acres, 137 shrub wetland acres, and 54 acres of riverine wetland. The wetland system here is complex, with meandering drainage systems, dug channels from olden days of agriculture as well as newer drainage channels to keep water from the runway system, isolated shrub wetlands, and immense systems with both emergent and submergent vegetation. In addition to ecosystem services mentioned above, this host of wetlands provides ample recreational and education opportunities, as well as pleasing aesthetic resource.

Because the wetland and riparian system on the ownership is complex, mapping a buffer zone on the bulk of the tract would be ineffective as a management tool. Management recommendations have been prescribed for only a small percentage of the ownership occurring on dry upland forest located away from the

riparian zones. Within these areas, follow guidelines above using a 100' buffer on all wetlands within those areas (Stands 1-5, with stand 5 being low priority). To protect wetlands, riparian systems and water quality elsewhere no active management has been recommended. No management will occur within 300 feet of the Ashuelot River.

NATURAL PROCESSES

One of the objectives of sustainable management is to mimic natural processes occurring on both forest and open land. Certain natural processes can be sped up, slowed down, or enhanced through management. Some processes in which nature sets the precedent cannot be “managed” at all. To consider the role these processes play in management activities, it is important to identify and explore the major ones.

Succession

This is a process which takes place naturally on any piece of land, be it forest, wetland, open land, or even developed land. The temporal scale on which this is viewed is important. On a geologic time scale processes such as glaciation, global temperature, and plate tectonics all play a role. In the life of an individual, land-use patterns play the biggest role, but natural disturbances, insect and disease infestations, fire, and natural aging processes all contribute to succession. The process of succession heavily influences silvicultural prescriptions and management objectives.

Different trees species are predisposed to grow in certain conditions and in terms of forest succession this is dictated by the amount of sunlight available to the seedling. It is expressed as a plants shade tolerance. In general, if allowed to develop naturally, a forest will develop from early successional species that generally require full sunlight to develop, such as white birch, aspen and white pine, to late successional trees like hemlock, red spruce, sugar maple, beech, and yellow birch that can regenerate in their own shade.

Often, early successional species also require some sort of soil scarification and typically are fast growing and shorter lived than late successional species. As early successional species develop they shade the ground as their crowns spread in the canopy, changing the growing conditions on the forest floor to favor late successional, more shade tolerant species. Once a forest hits a late successional stage it will remain in that state until there is a disturbance, such as a wind storm, that changes the amount of sunlight hitting the forest floor and thereby bringing it back to an earlier stage of succession. Wildlife habitat and the species that use a particular habitat change as succession progresses.

Wetland areas undergo change over time as well. Areas of open water become filled in over long periods of time, a process known as eutrophication. Bogs generally exhibit patterns of zonation: on the fringes they are wooded, there is then a zone of partially decomposed peat, and towards the middle there may be open water. Streams change course over time, forming oxbows and new channels. They also erode deep ravines and change the topography over time.

While every management decision cannot possibly be analyzed on every level, it is important to consider what the possible outcomes of a management decision might be. Through prudent consideration, management can be designed to achieve a set of desired results, including accelerating or retarding successional trends.

Water & Nutrient Cycling

This natural process is crucial in maintaining the long-term stability of a forested ecosystem. All types of vegetation, including trees, are involved in nutrient and water cycling. The removal of all trees and other vegetation from a site will lead to less water uptake and thus more runoff. Increased runoff often leads to the leaching of nutrients in the soil which changes down-stream water chemistry. Many nutrients are sequestered in trees and vegetation. The inevitable result of the removal of vegetation from a site is a loss of some nutrients. How water and nutrients are "managed" have important implications for forest productivity.

Most of a tree's nutrients are concentrated in the leaves, limbs and branches. The bole of the tree has relatively few reserve nutrients. There is some concern that whole-tree harvesting can deplete nutrients from a site because the entire tree is removed. In a thinning situation on productive soils where only a portion of the trees are removed, this is probably not a concern. In clear-cuts, or when whole-tree methods are employed on the same area repeatedly, the potential for nutrient loss is real and must be considered. Soils and sites influence nutrient status and leaching as much as the vegetation. Dry sandy soils or thin soils on high elevations and ridgelines are inherently low in fertility and are prone to rapid leaching.

Adaptation

A plant's ability to adapt over time helps it to survive in a changing world. Furthermore, the passing of genes from one generation to the next allows the best adapted to thrive. Trees that are expressing themselves well are usually well-adapted to their environment. An example is red spruce's ability to withstand the harsh growing conditions of the area in which it lives- high elevation and with thin, dry soils. Red spruce has adapted to its environment over thousands of years. Well adapted trees should be encouraged through management decisions favorable to them. While the genetic makeup (genotype) of individual trees or stands of trees is not practical to determine, forest management should encourage trees of superior appearance (phenotype) and high vigor that are free from obvious defects.

Disturbance

All natural systems are prone to disturbance, and forests are no exception. Ice storms, fire, micro-bursts of high winds, hurricanes, floods, long-term weather patterns, and insect and disease outbreaks all affect forests. Approximately 12,000 years ago, New England was covered by ice perhaps a mile thick. When the glacier first retreated, the landscape resembled the arctic tundra. It has changed dramatically since then, and is now a fairly complex forest system. More recent disturbances are often responsible for creating a multiple age structure to a natural forest. For example, a small area of blow-down created by a high wind will often regenerate to shade-intolerant species, thereby setting back succession.

As with the majority of forestland in New Hampshire this forest saw widespread destruction from the great hurricane of 1938. It is still possible to see the "pit and mound" structures created when tree roots are pulled from the ground as the trees were blown down. The root ball eventually decays, but leaves a mound of soil next to the

pit where the roots once were. These pit and mound structures resulting from the '38 hurricane can be found throughout New England. New Hampshire sustained some of the highest winds from that storm and as a result lost a record amount of timber, mostly pine.

The 1938 hurricane and the more recent 1998 ice storm which affected millions of acres of forestland in New England are examples of natural disturbances that had wide spread effects. If allowed to recover without human influence, the forest will, over time, grow back usually with a more complex structure than it had before.

A more diverse forest has many more niches for biological development. This increased complexity leads to a wide variety of species. In areas of significant disturbance, the most severely damaged trees will begin to decay and rot. As the dead and dying trees decompose, the abundance of snags will dramatically increase. An increase in wood boring insects will be followed by an increase in woodpeckers and other insectivores that will excavate cavities for other birds and small mammals. As limbs and broken tops of the trees begin to decompose, nutrients will leave the wood and leach into the soil. Some nutrients will be recycled further as the snags begin to fall and decompose. The cycle of the forest is thus a continuum consisting of many inter-relationships.

No discussion about disturbances would be complete without considering human impacts. Human disturbances in recent history have done more to influence the present state of our forests than any natural events. Human disturbances of the forest include clearing, logging, fire, pollution, and the introduction of exotic species. In the 300 years since European settlement, virtually all of the forests in New England have been cut; some areas have been cut more than five times. Much of the land was stumped and used for agricultural purposes. Soils were depleted by a lack of attention to water and nutrient cycling. Intensive development and subsequent paving of former forest land eliminates natural processes for the foreseeable future. Air pollution and global warming pose real threats to our forests. The introduction of chestnut blight and Dutch elm disease essentially extirpated those species from our forests. The introduction of invasive exotic species poses similar threats. Invasive exotic species are a cause of great concern because of their prolific nature and exotic characteristics enable them to vastly out-compete native plants, having a drastic impact on biodiversity. Should any large scale disturbance, natural or human-caused, occur an adaptive approach to management would occur.

NATURAL COMMUNITIES[4]

As written in the book *Natural Communities of New Hampshire* by Daniel Sperduto and William Nichols, "Natural communities are recurring assemblages of plants and animals found in particular physical environments. New Hampshire has a fascinating and complex variety of natural communities, from tidal marshes to alpine meadows, river banks to mountain forests, and streams to lakes. Each type of natural community has a unique set of environmental conditions that support certain species adapted to those conditions.

Just as individual organisms can be classified into species, plant assemblages can be classified into natural community types. Classifying natural communities is a useful way of viewing the landscape because it allows us to distill the broad range of complex interactions between species and their environments into a limited

4 All information on Natural Communities referenced from the publication: Natural Communities of New Hampshire, Daniel Sperduto and William Nichols, New Hampshire Natural Heritage Bureau and The Nature Conservancy, 2004.

number of units that share certain key features.

Natural community types are usually defined in terms of plants because they are easy to study, often compose the physical structure to which most other organisms respond, and are sensitive indicators of physical and biological factors that influence many types of organism.

The need to classify natural communities is fundamentally pragmatic: People need a way to sort out, understand, and communicate about nature's complexity on order to be good stewards."

Determining natural community types can be a challenge because it is uncommon to find land that has not been influenced by human intervention. Past agricultural and silvicultural practices often change the plant communities that you would find on any given acre naturally. Identifying natural communities then becomes a process of understanding the past management activities, the physical conditions of the site, and the plant communities currently found there and determining to the best of our ability what community would occupy that site without human intervention. Natural community types found here have been identified on a broad level to the best of our ability. A more comprehensive and detailed study by an ecologist would be required to determine natural community types on a more fine-grained and certain basis.

Dillant Hopkins Airport Natural Communities:

All descriptions of natural communities are taken from the Natural Communities of New Hampshire publication. The most significant natural community on the airport ownership is the Silver maple-false nettle-sensitive fern floodplain forest, listed as a state level community of concern. Occupying approximately 275 acres of the tract, this community has been described as one of the best large patch floodplains on a medium size river in New Hampshire. According to the NH Natural Communities publication, this community is found primarily in central and southern parts of the state on various large and medium-sized rivers. The canopy is dominated by silver maple which forms a tall, arching, cathedral-like ceiling above the level floodplain adjacent to the river channel. American elm is a frequent associate. The understory is distinguished by a diverse and variable ground cover, abundant sensitive fern, and the presence of small-spiked false nettle and sweet wood-reed. There is a high degree of microtopographic variation, with sand levees, vernal pools, soil depressions surrounding large tree trunks, and sloughs. It is most common on the Merrimack River and along medium-sized rivers such as the Ashuelot and the Contoocook. It also sometimes occurs as a very narrow border along riverbanks, transitional to other floodplain forest types (e.g., *red maple floodplain forest*).

As you gradually rise elevation out of the floodplain forest, the community shifts towards Mesic-Appalachian oak-hickory forest which dominates the rest of forested area. This community occurs on mesic and dry-mesic sites in coastal and southern New Hampshire and is characterized by a broad diversity of trees, including Appalachian oaks and hickories, white pine, and transitional hardwood trees. Heaths and other dry site understory plants are absent or in low abundance, as are species characteristic of more northern forests, such as sugar maple, yellow birch, and wood ferns.

This community has a diverse tree canopy, dominated by red oak, black oak, white pine, red maple, and sometimes black birch. Shagbark hickory is also frequently present, but usually not as a dominant. Other frequent

trees found in lower abundance in the canopy or sub-canopy include black cherry, white oak, white ash, paper birch, American beech, and hemlock. Although American beech and hemlock are typically not dominant, they may be expected to increase in importance in later successional examples. Sassafras, basswood, and sugar maple are infrequent. Other enriched site species (e.g., certain herbs) are typically absent.

The tall shrub layer is typically sparse or absent. When present, it consists of maple leaved viburnum, beaked hazelnut, American witch-hazel, and highbush blueberry. Low or trailing shrubs and tree-clubmosses are frequent as a group, but typically constitute low cover. They include poison-ivy, eastern spicy-wintergreen, partridge-berry, and a variety of club mosses and ground-cedars.

Beyond the forested areas, the ownership includes a mix of shrub wetlands, shrublands, and maintained grasslands. According to information in the New Hampshire Wildlife Action Plan, shrublands and other woody early-successional habitats are declining in New Hampshire and throughout the Northeast as are the associated wildlife species. Patch size is a key component of shrublands as wildlife habitats. For example, Golden-winged warblers occupy patches that are at least 10 hectares, whereas state endangered New England cottontails occupy patches in southeastern New Hampshire ranging from 0.2 to 15 hectares. Vegetation structure is also very important to shrubland habitat as some species require thick understory such as the New England cottontail and other species require dense canopy cover in addition to the shrub cover like the American woodcock. Some of the other species that can be found in shrublands include ruffed grouse, smooth green snake, wood turtle and the state threatened black racer. If left alone, many shrublands will naturally succeed into forests and therefore, natural disturbances or specific management practices should be allowed to occur to sustain this habitat. Additionally, habitat fragmentation and habitat loss due to development threatens shrubland habitats. Some conservation strategies for shrublands include habitat restoration and management.

The grasslands here are maintained through regular mowing. According to the Wildlife Action Plan, pre-colonial grasslands in New Hampshire were probably only maintained by beaver and fires started by lightening and Native Americans. The numerous agricultural lands maintained by early European settlers provided ideal habitat for some wildlife species that need grassland habitat. As these agricultural lands were abandoned, these populations began to decline and are now on the state endangered list such as the eastern hognose snake, northern harrier, upland sandpiper and on the state threatened list such as the grasshopper sparrow. Other species also benefit from these open grass fields such as wood turtles and numerous species of butterflies. Development and natural forest succession have reduced grassland habitat in the state. Grasslands require maintenance and must be mowed to prevent them from becoming shrublands or forests. Only 8% of NH grasslands are currently under conservation easements. Reclaiming and maintaining grasslands are two important conservation strategies for grassland habitats. Many grassland and potential grassland habitat are on private land and landowners can help restore and conserve them.

RARE SPECIES AND UNIQUE NATURAL COMMUNITIES

As you would expect with an ownership hosting this array of natural communities there are multiple records of endangered, threatened, and species of special concern have been recorded on or near the Dillant

Hopkins Airport with the Natural Heritage Inventory, in Concord, New Hampshire. One record of state listed threatened species includes the grasshopper sparrow, and five species are state listed special concern, including Northern leopard frog, horned lark, vesper sparrow, Eastern meadowlark and the wood turtle. In addition, two species have a conservation rank of imperiled at a global and statewide level, including the spot-winged glider and the marsh wren. The silver maple-false nettle-sensitive fern floodplain forest natural community, described above, has a statewide conservation status of imperiled. Except for the Northern leopard frog, all species were recorded in the grassland areas of the airport, further exemplifying its significance.

Many of the same species were also reported within one mile of the ownership including the Northern leopard frog, horned lark, vesper sparrow, grasshopper sparrow, Eastern meadowlark and wood turtle. In addition, the federally endangered dwarf wedge mussel, and the state level endangered long-headed Windflower were recorded within one mile of the ownership.

The Natural Heritage Bureau records are included in the Appendix. Conservation measures will be listed in the wildlife sections below. Additionally, close adherence to conservation practices discussed in New Hampshire's "Good Forestry in the Granite State" and Best Management Practices, in addition to recommendations from the book Biodiversity in the Forests of Maine will help to protect these and any unknown occurrences.

Also worth mentioning is the Northern Long-Eared Bat, newly listed as threatened. Northern long-eared bats use their maternity roost trees and hibernacula repeatedly for many years. Unless a survey or other information indicates otherwise, if the habitat around a roost is intact and the tree is suitable, we would conclude that the tree is likely an occupied maternity roost during the pup season (June 1 - July 31). Similarly, we would assume that a hibernaculum remains occupied unless a survey or other information indicates otherwise.

Therefore, if you have a northern long-eared bat roost tree or hibernacula documented on or near your project area, any incidental take of bats will be exempted by the 4(d) rule if you follow these conservation measures:

- Do not conduct any activities within ¼ mile of known, occupied hibernacula;
- Do not cut or destroy a known, occupied roost tree from June 1 to July 31 (the pup season);
- Do not clearcut (and similar harvest methods that cut most or essentially all trees from an area, *e.g.*, seed tree, shelterwood, and coppice) within a ¼ mile of known, occupied roost trees from June 1 to July 31.

INVASIVE EXOTIC SHRUBS

Invasive exotic shrubs and vines, such as barberry, Asiatic bittersweet, Japanese honeysuckle, multifora rose, and both glossy and common buckthorn, well established throughout much of New England are causing a new realm of problems for landowners because they are able to out-compete what native trees and shrub regeneration we do have. These shrubs are responsible for a decline in biodiversity and are capable of greatly impeding the regeneration of native trees as they die or are harvested. Most invasives were introduced as

landscaping plants. Their great popularity and success are due to their prolific growing characteristics. Buckthorn was often planted as a hedgerow because of its fast and dense growth. Barberry is a common landscape shrub because of its attractive form and very hardy growing characteristics. Honeysuckle, ironically, was introduced as a wildlife conservation plant because of the great amount of soft mast, or berries, it produces. All three produce great quantities of berries, which are all eaten by songbirds, turkeys, and many other wildlife species which then spread their seeds through their excrement.

The characteristics that made these shrubs successful as introduced plants are the very reasons they are such a problem in the natural landscape. They are prolific, hardy, produce vast quantities of seeds, and virtually are able to out-compete all native vegetation. They typically leaf out earlier in the spring and keep their leaves longer into the fall, providing them a much longer growing season and competitive advantage. Their seeds last many years in the soils and can build up to great quantities that germinate when conditions are favorable, such as an increase in sunlight on the forest floor after a harvest.

The problem doesn't end there. Controlling invasive exotic shrubs is nearly impossible after they have become established. Even if you eradicate them completely from your land, a daunting task at that, their seed will continue to be distributed from neighboring land by birds and other wildlife. Still, putting an effort into controlling them will have short term benefits which may be enough to give native plants a chance to get established. Ignoring them and opening up the forest through a harvest gives them the greatest advantage.

Dillant Hopkins Airport Invasive Species:

Invasive species exist in variable amounts throughout the ownership. The most significant populations are near forested edges, and include glossy buckthorn, barberry, Rugosa rose, and bittersweet. Though their presence does not occur in dense thickets, they are well-enough established to be of concern. Exempting management from the floodplain forest will help to reduce the rate of spread there. In designated areas of management where disturbance will occur, control efforts can be taken to help minimize the impact and reduce spread over time. Prior to harvest existing shrubs should be identified and pulled whenever possible. Much of this can be done by hand. Early spring and late fall are the best times, as invasives tend to leaf out early and keep their leaves longer-- meaning that at early spring and late fall into early winter they will be the only shrub with green leaves. After the harvest, the same areas should be monitored and invasives pulled as they regenerate. There are many sources available for invasive identification information. A good place to start is the UNH Cooperative Extension website (https://extension.unh.edu/Forests-Trees/Invasive-Plants).

Their presence is inevitable, and does not mean there should not be active management. Just the opposite actually, as active management tends to prompt taking actions to control their spread. Active management of the airport presents an opportunity for the landowner and interested community members to get involved through potential workshops to identify invasives and demonstrate manual control methods.

WILDLIFE ECOLOGY

Habitats

The American Heritage Dictionary defines habitat as "the area or type of environment in which an organism or ecological community normally lives or occurs". Wildlife habitat takes on many different forms. The components of habitat -- *food*, *water*, *cover* and *spatial relationships* -- are all interrelated.

Food for animals varies widely. Herbaceous plants, woody plants, mast or nuts, fruits and berries, insects and grubs, prey, and carrion are all eaten by wildlife. The location and abundance of food sources plays a primary role in determining the quality of the habitat for any species.

Water is required by all living things. Standing water, running water, seeps, and springs are all used. Some animals use water only periodically, while others live in and around it.

Cover is analogous to protective shelter. Cavities in trees, brush piles, nests, ledge outcrops, dense softwood cover and holes in the ground are used to provide cover for different animals.

Spatial relationships, or patterns, tie the habitat components together. If all the habitat requirements of a particular species are found within its "home range", the animal will probably remain in the vicinity. Creating the proper juxtaposition of food, cover, and water is important for wildlife to be attracted to and remain in a particular area. Travel corridors are used by many species to move from one habitat type to another. Ridgelines, streams, and other riparian areas commonly serve as travel corridors.

Habitat Types

Forested Habitat

Forest habitats can be classified in several different ways. One is by species composition, another is through age-class or successional stage, and a third is the vertical diversity or the distribution of canopy layers within a forest. The more diverse a property is in these three areas typically increases the diversity, or "richness", of wildlife that can be found there. Different wildlife species use different tree species, different layers of the forest structure, and different size or age class trees. Some songbirds can only be found in the upper canopy of hardwood trees for example, while other songbirds prefer specific species of tree, such as the pine siskin. Snags and down logs are important parts of forest structure as well. A large number of songbirds and small mammals require tree cavities for nesting, and standing dead trees provide important feeding sites as well.

The upland hardwood areas attract species which browse and/or feed on hard mast, notably white-tailed deer, turkeys, and black bear. Many resident and neo-tropical birds also use these upland areas. Birds such as the red-eyed vireo, white breasted nuthatch, chickadee, hermit thrush, and various woodpeckers are likely visitors to these areas. Softwood areas, especially those along riparian zones are used by many species. Furbearers, such as mink, beaver, otter, fisher, raccoon, and ermine could all be expected. Some of the dense softwood areas could be used both as deer yard and as a corridor for wildlife movement.

According to Good Forestry in the Granite State, deer wintering areas are important for the survival of deer in New Hampshire because it is near the northern limit of their geographic range. Special habitat characteristics of deer wintering areas allow deer to maximize their daily food intake and minimize the amount of

energy they expend to move, keep warm, and avoid predators. Most deer wintering areas occur at elevations below 2,000 feet in lowland softwood stands, such as eastern hemlock in the southern part of the state. Deer wintering areas are often associated with watercourses and riparian areas. Only about 3% of New Hampshire's land base meets the habitat requirements for deer wintering. Deer use of wintering areas varies within and between winters, based mainly on differences in snow depth. Deer move into wintering areas when snow depth exceeds 10 to 12 inches. During mild winters deer may range far from softwood shelter or not use a wintering area at all.

Wetland Habitat

In terms of resource value and diversity, riparian areas exceed all others in importance. The areas around streams and other wetland areas provide critical habitat including breeding and nesting sites for many species. Riparian areas also filter runoff thereby keeping the water clean. Riparian areas also are used as travel corridors for animals and fish moving to different habitats and from property to property. Characteristics of good corridors include softwood for cover and steep stream banks which aid in allowing the animals a sense of protection.

Openland and Edge Habitat

According to Good Forestry in the Granite State, "Nonforested uplands and wetlands ... provide necessary habitat for about 22 percent of new England's wildlife species and seasonally important habitat to nearly 70 percent, including "species of greatest conservation need" such as eastern towhee and New England cottontail. The value of these openings depends on the surrounding landscape. They are more beneficial in large areas of continuous forest cover than in areas with a mixture of forest and nonforest habitats."

The size of the opening is important as well. In general, openings less than 2 acres usually don't attract wildlife species that don't already occur in the vicinity. But, small openings increase the amount and type of foraging and cover available to species already present.

The edge of openings is important as well. Edges occur at the boundary of two habitats, and have their own distinct characteristics and often high levels of biodiversity. Maximizing edge is generally a good way to increase diversity and quality of habitat.

Habitat Management Approach

Two approaches to wildlife habitat management are commonly applied. The *featured species* approach caters to one or two chosen species. Management specifically for white tailed deer or for ruffed grouse is an example. The species richness approach focuses on creating and improving a variety of habitat types to maximize benefit to wildlife.

The *species richness* approach to habitat management is generally the most applicable technique; however, some practices are aimed at specific species. Birds of all types are of special interest to the landowners. Fortunately, managing for a diversity of wildlife species will in fact improve bird habitat as well since different birds use different species mixes, canopy layers, and different types of opening sizes, and communities. Managing for

species richness attempts to provide habitats for as many different species as the property can support. The species richness approach encourages a diverse, healthy ecosystem.

Another common goal for management is to maintain a forest structure typical of a natural forest and to encourage natural forest processes. Manipulation of the forest to benefit a particular species will be discouraged on a large scale. While certain management practices will be beneficial to some species and detrimental to others, the overall goal of management is to create a rich and diverse habitat for wildlife.

Certain wildlife practices should be routinely followed during logging operations, or as separate wildlife habitat enhancement activities. An example is the practice of leaving or creating dead or dying snags where they do not endanger people or aesthetic values. Snags are very important to many species, especially birds and insects. Another practice is to leave or create some coarse woody debris on the ground for use by insects, invertebrates, and fungi. Course woody debris should include large diameter low-value trees, which are cut or fall naturally and left in place in the woods. These large pieces of decomposing wood are important for nutrient cycling, water retention, carbon sequestering and microbial activities. Black bears often work these logs over looking for grubs and ants. Several reptiles and amphibians utilize the moist cover provided by these decaying logs. Coarse woody debris is a component of the natural forest and contributes to ecosystem function.

Recommendations for wildlife habitat management[5]:

Snags, cavity trees, and down logs:

- Avoid damaging existing downed woody material during harvesting, especially large (16"+) hollow logs and stumps;
- Leave downed woody material on site after harvest operations when possible;
- Leave several sound downed logs well distributed on the site, where possible. Especially important are logs >12 inches dbh and > 6 feet long. Hollow butt sections of felled trees are also good choices;
- Create additional snag trees by girdling large cull pine where possible. Attempt to retain or create a minimum of 4 secure cavity or snag trees per acre, with one exceeding 24" dbh and three exceeding 14" dbh. In areas lacking cavity trees, retain live trees of these diameters with defects likely to lead to cavity formation;
- Retain as many live trees with existing cavities and large unmerchantable trees as possible;
- When possible, avoid disturbing cavity trees, snags, and upturned trees roots from April to July to avoid disrupting nesting birds and denning mammals;
- Retain trees with cavities standing dead trees, downed logs, large trees, and large super canopy trees in the riparian management zone to the greatest extent possible.

5 Wildlife habitat management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

Habitat Connectivity:

- Avoid harvests that isolate streams, ponds, vernal pools, deer wintering areas, or other sensitive habitats;
- Maintain the matrix of the landscape in relatively mature, well-stocked stands. Where even-aged management is practiced, consider the cumulative effects of multiple cuts and include wider habitat connectors as necessary;
- Consider opportunities for coordinating habitat connectivity with other, on-going land-management efforts that maintain linear forested ecosystems, such as hiking trial corridors and natural buffer strips retained to protect water quality. This may require expanding the physical size of the connector habitat and increasing structural values to fulfill multiple management goals. Also consider the potential for effects that may arise because of incompatible uses (e.g., heavily-used ATV or snowmobile routes around and through deer yards).

Beaver influenced ecosystems:

- To the extent possible, locate new roads where they will not be at risk from flooding by beavers, or provide a base for the construction of new dams.

Vernal Pools:

- Identify and mark vernal pool edges in spring when they are filled with water to prevent damage during harvests conducted when pools are difficult to detect;
- Avoid any physical disturbance of the vernal pool depression;
- Keep the depression free of slash, tree tops, and sediment form forestry operations;
- Maintain a shaded forest floor, without ruts, bare soil, or sources of sediment that also provides deep litter and woody debris around the pool. Avoid disturbing the organic layer or drainage patterns within the pool watershed;
- Whenever possible, conduct harvests when the rough is frozen or snow covered.

Grasslands:

- Mow fields after August 1st, the end of grassland-breeding bird season. Mowing even later (August-October) is ideal, since this allows late-flowering wildflowers such as aster and goldenrod to provide nectar for migrating butterflies;
- Raise mowing bar to six inches or more in areas with grassland bird concentrations.

Dillant Hopkins Airport Wildlife Habitat Types:

The wildlife habitat provided on the Dillant Hopkins Airport is quite diverse, especially for bird species. The mix of open wetland, shrub wetland, forested wetland, palustrine wetland, along with open and mowed grassland and mixed forest provides an excellent mix of habitat types. Because bird habitat is more conducive to

airport objectives (over mammals that can interfere with flight take-off and landings) the wildlife discussion will focus there, but management will not be to the exclusion of other compatible wildlife.

Of the total ownership, habitat types include roughly 20% mixed forest of which the bulk is influenced by the floodplain of the Ashuelot River, 8% more typical floodplain forest, 15% shrub wetland, 6% wetland with emergent vegetation, 3% in the power line, 2% shrub land, 43% maintained land around and including the runway mostly consisting of mowed grassland, and the remainder in roadways and developed land.

Management goals should strive to accomplish the following:

- Protect wetland and water resources;
- Monitor and remove invasive exotic shrubs to the extent possible;
- Create additional snags, cavity tree candidates and down logs;
- Avoid disturbing wet depressions that could host vernal pools;
- Protect travel corridors;
- Protect interior forest conditions, especially in floodplain forest;
- Release existing browse and mast producing shrubs: blueberry, viburnums, Rubus sp., hazelnut, winterberry, etc;

Dillant Hopkins Airport Bird Habitat

The bird habitat features of the ownership include the vast amounts of maintained grassland, shrubby pockets and edges, and mixed floodplain forest surrounding numerous wetland and riparian features. At over 350 acres, the most significant of these features is the maintained grassland, especially in combination with the floodplain forest and wetland features.

The Dillant Hopkins Airport is designated as one of New Hampshire's Birding Hotspots. According the eBird website, 160 bird species have been identified here. Of those species, 4 are on the state's endangered list (in danger of extinction in New Hampshire because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination), 4 are on the state's threatened list (species that are likely to become endangered in the near future if conditions surrounding them begin, or continue, to decline), and 8 are species of special concern (either specie that are near-threatened or "responsibility species" -- species for which a large portion of their global or regional range [or population] occurs in New Hampshire and where actions to protect these species habitat will benefit the species' global population). A complete listing of the eBird count list is included in the Appendix, as well as a chart showing what bird species you can expect to find at the Dillant Hopkins Airport at different times of the year. The roadway leading to the water treatment facility provides excellent access for birders, without intruding into their habitat-- a near ideal situation. A list of the eBird records has been included in the Appendix.

In addition, Audubon of Vermont has compiled some management considerations for bird habitat that would be applicable to management throughout New England. These recommendations, intended for the actively managed forest areas of the airport, are generalized below:

Silviculture

- **Retain, release, and regenerate soft mast species** such as black cherry, serviceberry, and apple that produce food sources in late summer which are critical for preparing for successful migration. Rubus species that dominate openings are also important sources of soft mast for birds;
- **Retain, release, and regenerate yellow birch** (*Betula alleghaniensis*) whenever possible since the branches and foliage of this species are preferentially chosen foraging substrates for many insect-eating bird species including blackburnian warbler, black-throated green warbler, and scarlet tanager;
- **Retain softwood inclusions in hardwood stands** and hardwood inclusions in softwood stands. Overstory inclusions resulting from site conditions are more practical to maintain than those that are a result of disturbance history;
- **Control and monitor invasive plants.** Migratory songbirds will eat buckthorn, autumn olive, barberry, and honeysuckle berries during the post-breeding season when they are fueling up for fall migration, but the berries are not nutritious. When non-native invasive plants are present, strive to locate larger groups/patches near already disturbed areas (e.g. agricultural lands) and away from interior sections;
- **Maintain closed-canopy buffers along beaver ponds, wetlands, and riparian areas.** Layout riparian buffers to have variable widths based on stream morphology; avoid abrupt edges;
- **Retain a minimum of six snags per acre** with one tree > 18” DBH and three > 12” DBH and designate 3-5% of total stocking as potential cavity trees and source of future snags. Where lacking, actively recruit snags through girdling. Birch and aspen are preferred species;
- **Use snags and potential cavity trees as nuclei for retained patches during larger cuttings.** Retained patches may be islands or peninsulas extending from adjacent stands. Use woodland seeps and springs, which are early season sources of insects, green vegetation, and earthworms as nuclei for uncut patches to retain snags, cavity trees, and other site-specific features. Retained patches may be islands or peninsulas extending from adjacent stands;
- **Recognize that vertical structure is naturally limited in early and mid-successional stages.** Look for opportunities to enhance vertical structure over time;
- **Consider and protect vernal pools and riparian buffers** when laying out extent and location of openings;
- **Cluster intermediate treatments** conducted in the matrix in between groups along trails, and away from openings and sensitive sites;
- **Manage for age-class diversity** over larger ownerships (>200 acres) where opportunities exist.

Operations

- **Keep woods roads and skid trails <20 feet wide** to avoid creating fragmenting barriers for interior forest species, such as the wood thrush and ovenbird;
- **Incorporate bends and twists into woods roads** and skid trails when laying out a new network. Nest parasites such as brown-headed cowbirds will travel into forest interiors along straight openings, but will

avoid bends;

- **When feasible, avoid operating during peak breeding season** (15 May to 15 August). See table of breeding dates in the companion document *Birds with Silviculture in Mind* for individual species;
- **Operate during winter** under frozen conditions when appropriate to protect habitat features such as understory layers, leaf litter, forest floor topography, soils, and woody debris;
- **Leave as much woody debris on site as possible**. Avoid whole-tree harvesting when feasible. When appropriate, return landing debris to the woods;
- **Leave several large downed logs** well-distributed throughout the stand to serve as drumming sites for ruffed grouse and important habitat for man life forms;
- **Avoid disturbing existing tip-ups, stumps, and logs** during harvest and operations;
- **Create scattered slash piles** of fine woody debris where possible post-harvest to enhance songbird cover and foraging opportunities;
- **Protect shrub patches as well as tree seedlings and saplings during harvesting.** Avoid damage to understory layers during harvest and skidding operations by:
    - Using directional felling techniques;
    - Carefully laying out skid trails to avoid patches of advance regeneration;
    - Winching instead of skidding from each stump, when feasible;
    - Harvesting when a heavy snowpack is present.

FOREST STRUCTURE and MANAGEMENT APPROACH

Structure and Age Class Distribution

The size and distribution of vegetation layers make up the structure of the forest including vertical spacing and horizontal layers. Vertical spacing is simply the density of individual plants, shrubs and trees. The horizontal layers are usually described in four levels including ground cover, understory, mid-story, and overstory. The ground cover includes herbaceous plants and small woody plants. The understory includes trees seedlings and small saplings and woody shrubs. The mid-story includes pole size trees and tall saplings, topped by the overstory of the largest trees. Often the different horizontal layers with the exception of ground cover are associated with different age classes of trees, but this is not always the case. A slow, growing shade tolerant trees species, such as Eastern hemlock, can remain in the understory for many years biding time until space an opening above is created. Age structure in a forest system can be simple, with one distinct age class called even-aged. Two-aged forests are just as they sound, two distinct age classes. And forest with more complex age structure are called un-even aged.

Understanding forest structure conditions is important for management. It determines the general type of silviculture to be applied and is closely related to biological diversity and wildlife habitat.

Dillant Hopkins Airport Structure and Age Class Distribution:

The discussion on forest structure will apply primarily to the sections of the forest intended for active management. The remainder of the area generally includes the floodplain forest, riparian zones, and wetlands includes a diversity of structure, but primarily can be described as having a nearly complete canopy cover except over areas of wetland and riparian zones, dominated by trees that are 80 to 100 plus years old. The exception are the sections of forest near the runway areas that have been cleared in the past and now are dominated by a younger age class of 40 years or so, and areas along the floodplain that have are more variable due to flooding disturbances.

The areas of the ownership to be under active management include the Edgewood Forest, and two mixed stands of pine-hardwood uplands. The first of these is located on the south side of the road just after the gate to the Water Treatment Facility and the second is on the east side of the road just beyond the large wetland and field system that crosses the road below the 90 degree turn.

For a relatively small acreage, the Edgewood Forest has a fairly high level of structural diversity. In addition to the two wetland systems within the forest system, it includes a mix of naturally established and planted forest systems. The naturally established forest is evenaged, and dominated by a pine overstory of approximately 80 to 100 years old. Mixed in are red oak and red maple, though many of these are of a younger age class. Other sections of the forest are younger, as a result of cutting done by the airport to reduce tree heights in certain areas. Here, the dominant trees are 30 to 40years old. The plantations include areas of Scot's pine and Norway spruce, and appear to be around 40 to 50 years old.

The other two sections of forest outside the Edgewood area are similar to the pine stands within Edgewood, dominated by pine approximately 80 to 100 years old with a mix of red oak and red maple.

Stocking, Timber Quality, and Volumes

Stocking is a term used by foresters to describe the relative density of the trees in a stand. Stands may be under stocked, over stocked, or fully stocked. Stands which are fully stocked have trees which are wholly utilizing the growing space available to them. Volume refers to the quantity of merchantable timber found on the property. Timber quality specifically relates to the products found in a tree. A poor quality timber tree may be an excellent quality wildlife tree, and vice versa.

Dillant Hopkins Airport Stocking, Timber Quality, and Volumes:

Because of the minimal level of management that has occurred on the ownership over the years, stocking levels generally falls into the "overstocked" category. Fully stocked conditions mean the tree density is optimum for timber growth, typically the "B-line" on USFS stocking guides where "A" is overstocked, "B" is fully stocked, and "C" is under stocked. Overstocked conditions don't necessarily mean the forest is unhealthy, instead it means that it is not achieving maximum potential growth rates. Areas of the forest that will be managed passively will remain in overstocked conditions until a natural disturbance occurs. Areas that will be actively managed will either be reduced to fully stocked conditions, or depending on the forest type an landowner objectives will be managed more

intensively to create or release a new age class.

Timber quality here is what you would expect for the forest types and past land use history. The quality of timber is generally fair to poor. It includes an increasing amount of developing red oak and a mix of white pine ranging from decent quality to poor quality or "cull"- meaning it has no commercial value. Average timber volumes have been reported for the ownership, but values have less meaning than stand level data because of the range of management objectives. Additionally, and very importantly, the reported inventory numbers appear to be an inflated representation of actual volumes, specifically in reference to the volume of Norway spruce and white pine in the Edgewood Forest and within Stand 4 The reported data represents actual locations on the tract, but by chance over-represents what occurs on average.

Forest Health

Forest health can be discussed on an individual tree or disease, or it may refer to the functioning of the complete forest ecosystem. Many forest diseases and pests are ubiquitous and found on a landscape level. At times their presence can signify the forest as a whole is unhealthy, or they can signify more isolated, individual health issues. Health concerns include a whole host of issues, such as tree diseases, insect pests, invasive exotic shrubs, pollution, and soil acidification. Sound forest management can reduce the negative impacts of health issues and often improves overall forest health, where poor management often exacerbates health problems.

Dillant Hopkins Airport Forest Health:

Health issues on the Dillant Hopkins forest typical problems you would expect to find, though none call for salvage treatment. Improvement based silviculture that targets diseased or low vigor trees giving healthy trees more room to grow should provide adequate maintenance. As usual white pine suffers the most problems, some related to insect damage and others to fungi. The fungus red rot is present here; a common problem for pine which typically occurs only in over mature trees or stressed trees growing on a poor site or in overcrowded conditions. Red rot is a decay fungus that typically infects trees through a wound or branch scar and rots the tree from the inside out. White pine blister rust is an interesting disease and is also present here. It requires 2 hosts to complete its life cycle, white pine and a shrub from the Ribes family, such as Current or Gooseberry. The fungus spends half its life on the Ribes and the other half on the pine, typically creating sunken cankers near the base of the tree. It is likely that some root and butt rot is also present in the spruce on the high, dry sites.

Damage from the white pine weevil is also present. The white pine weevil targets the bud on the leaded stem in a sapling to pole size pine for laying its eggs, which kills the bud forcing one of the lateral branches to take over as the new leaded. This results in a crooked or multi-stemmed pine, which doesn't affect the health of the tree. Properly thinning a stand targeting infected trees for removal is often adequate control measures. When working in the pine, trees showing the presence of any of these diseases should be targeted for removal.

Spider heart is present in the oak. Spider heart appears from the outside as a black seam on the butt of red oak. It is often associated with poor growing conditions, though not always. It degrades the butt log of the

tree.

Beech bark disease, another common problem in northeast forests, is present as well and is infecting the majority of the beech found here. This disease has an interesting story as well. It is caused by a fungus that is disseminated by the wind. It enters its host, the American beech, through holes made by the beech scale for depositing eggs. Presence of scale insects is easily detected by inspecting the bark. The scale insects overwinter under a white, felty coating which appears like tiny white speckles on the bark. The fungus can also be seen, especially well with a magnifying glad, and looks like clumps of red-orange waxy material oozing out of tiny cracks or holes in the bark. These infected holes turn into cankers which eventually girdle the tree, killing it by cutting off its food supply from the roots.

Sterile conk of birch can be found here as well. This trunk rot appears as a large black mass of fungal tissue extruding from a bark canker. The conk itself is sterile while the host tree is alive, but, once it dies the conk then sporulates, spreading on the wind. The presence of the conk indicates severe decay. Treatment should target infected trees for removal and improving vigor on residual trees.

Other diseases and insect problems not noted on the tract by should be discussed include hemlock wooly adelgid and emerald ash borer. Hemlock Woolly Adelgid (HWA) is present in surrounding towns and continues a slow spread through southern New Hampshire. Because it is likely HWA will become a reality here, management strategies should be geared towards increasing vigor (and therefore resilience) in the existing hemlock.

Emerald ash borer, a non-native wood-boring beetle wreaking havoc on urban forests and ash populations has recently been detected in New Hampshire. Fortunately for Dillant Hopkins, ash is a minimal component. Management objectives in preparation for the inevitable arrival of the ash borer here include maintaining an ash component where it exists in the forest and promoting a diversity of native species. Because of the low volume, and scattered nature of ash here, pre-salvage harvest is not recommended and could be more devastating to the ash population than the beetle itself. With small populations of ash, there is a chance the beetle could pass over this area for other areas of higher density ash.

Growth Rates and Allowable Cut

An in depth growth study was beyond the scope of this management plan; some rules-of-thumb do apply. A tree's growth is directly related to the substrate (soil) on which it is located. Wet, ledgy, and dry areas do not promote rapid growth of trees. Lower elevation and cool moist but well drained areas support better tree growth as the soils are deeper and more fertile. The average woodlot in New England grows at a rate of .42 cords per acre per year. Additionally, the average managed woodlot in New Hampshire grows at a rate of 2 to 4 percent per year.

Allowable cut is the volume that can be sustainably harvested from a defined area. Typically allowable cut is equal to or less than growth, and is calculated by multiplying the growth rate times the area times the years between harvest entries.

Dillant Hopkins Airport Growth Rates and Allowable Cut:

It is likely the growth rates on Dillant Hopkins Airport fall within the lower end of the average range of 2 to

4 percent per year. The potential acres under likely high priority management is about 52 acres. The .42 cords per acre growth rate per year yields about 22 cords of growth per year on average.

Given the lack of substantial harvesting in the past and the mix of landowner obligations to meet airport safety guidelines, the silvicultural approach selected within Edgewood Forest involves a fairly heavy removal, followed by a long period of growth--meaning that even heavy one-time removals are well within the allowable cut.

Harvest History

The recent harvest history of individual tracts of land is ideally garnered though records kept by the landowner, but often this is not the case. When no records exist, the history is gleaned through field evidence including age and distribution of stumps, existing or historical access infrastructure, and through forest structure.

Much of the land in New England has a similar history when looking back a hundred years or more. Agricultural use peaked in the mid 1800's and declined through the beginning of last century. Around 1900, about 80% of the land in New England was open for agricultural use and only 20% was forested. By the late 1900's the inverse was true, with only 20% open and 80% forested. This means the average overstory tree is likely to be around 80 years old. And the average forest has been cut at least twice in that time period. Assessing the history of harvesting on a piece of land is an important component of management planning.

Dillant Hopkins Airport Harvest History:

Outside of regular maintenance to keep roadways and power lines clear, little active management has occurred on the airport except for removing tall trees from flight path areas. Some entire sections were cleared around 30 years ago including approximately 1.5 acres within the Edgewood Forest and other patches adjacent to the open land surrounding the runway. Other areas were selectively cut focusing solely on the tall trees.

Forest Management Approach

Forest management utilizes a combination of silvicultural techniques that typically are separated into two general categories, even-age and unevenaged management. Evenaged management methods include clearcut (removal off all trees within a designated area), seed tree (similar to a clearcut but with residual trees for seed source), shelterwood (removal of most overstory trees leaving enough to create sufficient shade to create a micro-environment for regeneration; once regeneration is established the residual overstory trees are removed in either one or two further entries) , overstory removal (removal of the overstory to release established regeneration) and patch cut (a small clearcut, usually less than 2 or 3 acres in size) applications and may be used to regenerate a new stand when deemed necessary. Unevenaged management methods generally include single tree (removal of single trees to regenerate shade tolerant species) and group selection (removal of groups of trees to regenerate shade tolerant species) used to regenerate small areas resulting in uneven age classes in a given stand. Often though, applied techniques fall somewhere in between these two text-book defined categories. One may define a large group opening (unevenage management) as a small clear-cut (evenage management). Improvement thinnings often fall somewhere in between as well, depending on the intended results and the actual results. A

thinning may result in improved growth of the overstory trees, an even-aged treatment. A thinning may also provide similar conditions as single tree selection, an unevenaged technique, and result in regeneration of shade-tolerant species. Crop tree release, a practice where designated “crop trees” are released from shade of competing trees on typically 2 to 3 sides, falls somewhere in between as well. Given the variability of site quality and stocking, even within a defined stand, unless evenaged management is specifically called for, management typically will fall in the unevenage category.

Traditionally, the intent of unevenage management is to attain forest stocking conditions that mimic a specific diameter/age distribution. But, practically speaking, unevenage management is often carried out as a simpler form of multiple-age management resulting in the introduction of a new age-class on a portion of a stand each harvest entry. Given the even-aged condition of the majority of land in New England, encouraging multiple age classes is a more attainable, practicable goal and in effect, desirable goal. To clarify discussion of management technique the term multiple-age management will replace traditional uneven-aged management, but will utilize the same techniques including single tree and group selection.

Applied Silviculture

Below are the generalized silvicultural systems and methods that will be broadly applied to the natural forest communities found on the ownerships and the forest stands within. The methods and their corresponding cutting cycles, rotation ages and target diameters are described and will serve as management guidelines for application in the field. Silvicultural systems are designed to grow and regenerate trees for timber. Comprehensive management will combine components of silviculture described below with other practices to meet the entire complex of ownership objectives which often include but are not limited to wildlife habitat, protection and enhancement of riparian and wetland systems, and enhancement of natural biodiversity.

Red Oak Silviculture

Silviculture will focus on high quality saw timber and on creating and maintaining multiple age classes of species well suited to the site. Multiple age classes will primarily occur in pockets as the stand is treated over time, with the goal of the oldest age class reaching 100+ years.

Twenty-year harvest intervals should result in an average of 20% of the overstory removed at each entry over a 100 year span. Even-aged stands that are being converted to multiple-age will take several entries to establish stocking that can support this type of sustainable harvest.

The art and science of growing red oak is complicated due to regeneration challenges. Good seed years for oak average every 3-5 years. However, two major obstacles affect the germination success of the acorn. As a highly coveted food resource by most wildlife, the acorn is heavily used and if the wildlife does not find the acorn, insects like the acorn grub do. According to USFS studies, up to 500 acorns are required to produce one seedling, but generally 1% of acorns become available for regenerating northern red oak successfully. Thus, the availability of viable acorns is naturally scarce.

To successfully germinate, the acorn prefers exposed mineral soil, ideally in well-drained, deep loams. Scarifying the duff layer during logging operations in the snow-less seasons best does this. Oak’s overall survival

is most importantly related to light intensity levels. For the seedlings/saplings to photosynthesis optimally it requires 30% light intensity in the open, where under a closed forest canopy light intensities are less ten 10%. Therefore, heat and space is critical. Once the seed germinates rapid and vigorous taproot development occurs. This root growth contributes to another challenge of oak management, where it causes very slow initial shoot development and competition for light from other species is very common. Thus, achieving lasting regeneration success of oak, weeding of interfering species is often a requirement. The success of regenerating oak is highly dependent on the combination of the availability of viable seed, soil scarification, adequate light levels, implementation of weeding applications and seed distribution by wildlife.

Overall, the oak silvicultural system will be multiple-age. Methods of this system to best achieve the requirements of oak will involve mainly singletree and group selection silviculture. These methods will be used for both regeneration and thinning applications. Cutting cycles of oak dominant types will be between 15-25 years with crop tree diameters of 16-22 inches. During thinning and release applications it is important to maintain minimal direct light exposure to oak boles. Maturing and mature oak stems have large reserves of sensitive hidden buds that respond easily to increased light levels, resulting in epicormic branching and severe quality lose. During these cutting entries, releasing crop trees on eastern and northern sides, while maintaining heavier shade conditions on the south and west sides will ensure less opportunity for epicormic branching.

White Pine Silviculture

White pine trees generally produce a seed crop every 7 to 10 years during a period commonly known as a "cone year". The 100-200 seeds produced by each cone are delicately small and remain viable for a short period after dispersal, approximately a year. Because the pine seed is so small, it does not have the stored energy necessary to grow through the forest duff layer, particularly under shady conditions. This means exposed mineral soil, ideally in deep well-drained sandy loams, and heat are required for successful seed germination. Keeping this in mind, these conditions need to be present during the seeds year of viability. To create these requirements, the silvicultural method most appropriate for pine, or most softwood regeneration for that matter, is evenage. Silvicultural techniques that are best applied where opportunity exists are patch, shelterwood and seed tree cuts. These techniques provide the stand dynamics required for pine regeneration that include space, heat, light, uniform canopy level, tight geotropic structure, hence an evenaged structure. Timing of treatments is most effective during the snow-less season, where maximum soil scarification is attained.

Another variable in obtaining sufficient pine regeneration is the overall ability of the soil to grow hardwood trees. A soil with a high site index for hardwoods is best suited to grow hardwood. In these soils there is a high level of available nutrients that will undoubtedly permit a layer of hardwood regeneration so thick that whatever pine is established will be overgrown readily. This hardwood competition is often seen on the nutrient poor sites as well, but these soils that are better suited for pine. On these sites pre-commercial weeding of the hardwoods is required for the pine continuance. This hardwood competition is due to the fact that once the seed germinates it has a slow growth rate for approximately 5 years before more rapid growth begins. Site wise, sandy soils, well-drained and low cation exchange, provide excellent pine sites. Timing, silvicultural technique and soil type is critical to promote the continuity of the pine resource.

Definitions of Silvicultural Treatments

Definitions of specific silvicultural treatments are listed below and are largely taken from the Society of American Foresters dictionary. Deviations from these treatments will be specified in stand prescriptions.

Crown Thinning (Evenage management): the removal of trees from the dominant and codominant crown classes in order to favor the best trees of those same crown classes;

Free Thinning (Evenage or Multiple-Age management): the removal of trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position;

Low Thinning (Evenage or Multiple-Age management): the removal of trees from the lower crown classes to favor those in the upper crown classes;

Selection Thinning (Evenage or Multiple-Age management): the removal of trees in the dominant crown class in order to favor the lower crown classes;

Patch Cut (Evenage or Multiple-Age management): the cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class (typically all Patch Cuts are laid out by delineating the boundary with marking paint; Patch Cut size will be specified in Silvicultural Prescription);

Strip Cut (Evenage management): the cutting of essentially all trees in a strip, producing a fully exposed microclimate for the development of a new age class (all Strip Cuts laid out by delineating the boundary with marking paint; Strip Cut dimensions will be specified in Silvicultural Prescription);

Clear Cut (Evenage management): the cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class (all Clear Cuts laid out by delineating the boundary with marking paint; Clear Cut size will be specified in Silvicultural Prescription);

Seed Tree (Evenage management): the cutting of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class in fully exposed microenvironment; (seed trees may or may not be removed after regeneration is established depending on 1: harvest opportunity 2: protection of established regeneration 3: long term success of regeneration);

Shelterwood (Evenage or Multiple-Age management): the cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment —note the sequence of treatments can include three types of cuttings: (a) an optional preparatory cut to enhance conditions for seed production, (b) an establishment cut to prepare the seed bed and to create a new age class, and (c) a removal cut to release established regeneration from competition with the overwood; cutting may be done uniformly throughout the stand (uniform shelterwood), in groups or patches (group

shelterwood), or in strips (strip shelterwood); in a strip shelterwood, regeneration cuttings may progress against the prevailing wind;

Single Tree Selection (Multiple-Age management): individual trees of all size classes are removed more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration;

Group Selection (Multiple-Age management): trees are removed and new age classes are established in small groups; the width of groups is commonly approximately twice the height of the mature trees with smaller openings providing microenvironments suitable for tolerant regeneration and larger openings providing conditions suitable for more intolerant regeneration (Patch Cutting differentiated from Group Selection in that Group boundaries are not delineated with marking paint where Patch Cut boundaries are; Group Selection size will be specified in Silvicultural Prescription);

Crop Tree Release (Evenage and Multiple-Age management): the crown release of selected trees on two to preferably three sides (Number of Crop Trees to be released per acre will be specified in Silvicultural Prescription).

Sustainability

It is recognized that from a social, economic, and wildlife habitat standpoint, forests must be managed in a sustainable, long-term way. Because trees can either naturally regenerate or be replanted in an area from which they have been harvested, trees are considered a renewable resource. For this reason it is possible to harvest trees in a forest, repeatedly, in a way that is sustainable. This implies that portions of the forest may be clear-cut or regenerated at certain times. A balanced age class distribution, as previously discussed, is typically utilized for sustainable forest management. On smaller tracts often there isn't enough acreage to efficiently manage for balanced age classes, so sustainable forest management is accomplished though managing for multiple age classes of trees combined with health, vigorous growth, diversity, and soil/water quality. This type of management allows for sustained periodic harvesting on a regular basis, though some entries will be more improvement based. The scale of sustainability varies with the size of the ownership. The treatments prescribed in this plan are designed to be sustainable over the long term. All of the stands which call for uneven-age management will be able to be re-visited every 15 to 20 years (the "cutting cycle"). Stands which call for even-age management will ultimately have to be regenerated at the end of their rotation age (60 to 120 years, depending on species and forest type), though interim thinning can be applied at 10-20 year intervals in most timber types.

The modern view of sustainability recognizes the need for the entire ecosystem to be sustained, not just one component of the system like timber. If all of the components of the forest are considered, the entire system can function in a sustainable fashion. The Northern Forest Lands Council has identified the following benchmarks of sustainability:

- Maintenance of soil productivity;
- Conservation of water quality, wetlands, and riparian zones;
- Maintenance or creation of a healthy balance of forest size and age classes;
- Protection of unique or fragile natural areas;
- Conservation and enhancement of habitats that support a full range of native flora and fauna;
- A continuous flow of forest products;
- The improvement of the overall quality of the timber resource;
- The consideration of aesthetic concerns during timber harvesting;
- The continuation of opportunities for recreation.

Forest Economics

Economics, while often not an overriding management goal, is an essential part of the management objectives. The carrying costs of owning land alone are expensive. In addition, forestry services critical to proper long-term management involves some expense. In well-managed forests these costs are often viewed as necessary capital investments or annual expenses to achieve owner objectives. Timber management is a primary way for landowners to generate modest income from a naturally renewable resource through careful, thoughtful, and forward thinking management.

Forests add in value in three ways. *Physical growth* accounts for the gains in volume over time. The faster an individual tree grows, the faster the tree increases in value if it is of sufficient quality. Whatever the product, additional volume increases value.

The second way forests increase in value is through *product development*. As a sapling, a tree has no merchantable value. Pole timber can often be marketed as firewood or pulpwood. Once a tree grows into the sawtimber size class (and if it is of sufficient quality) it can be sold for sawlogs or even veneer. The per-unit value increase from pulpwood to sawlogs to veneer is very large, in some cases 1000% or more. It would be unwise from an economic standpoint to cut a pulpwood size tree that could eventually grow into a valuable saw log. Furthermore, an individual tree growing rapidly into sawtimber size is a tree which will have a high rate of return, as will a stand of such trees.

The third way forests add -- or possibly lose -- value is through *relative price changes* in the value of various forest products. The demand for forest products is cyclical, especially for low-value, bulk commodity items such as pulpwood and chip wood.

Briefly, thoughtful forest management can positively influence growth rates, quality of growing stock and thus product development, with an educated awareness of market trends. This “value-growth” approach is a key part of sustainable management and allows for periodic economic returns.

OPERATIONAL CONSIDERATIONS

Boundaries and Property Survey

Identification and monumentation of property boundaries is one of the first management tasks every landowner should undergo, regardless of their interest in active harvesting. The old idiom is true, good fences

make good neighbors. Clearly marked boundary lines prevents a multitude of problems, not the least of which is timber trespass.

Property boundaries often include a mix of stone walls and sections of barbed wire fence, but this isn't always the case. Boundary lines should be monumented with permanent blazes which are cut into trees using an ax and then painted with a long-lasting paint. Proper blazing techniques are specific, with rules about location and size of the blaze depending on its location along the line. To protect the historical integrity of a line, new blazes should not be made over old blazes. The blazes should be painted every 10 to 15 years. If monumentation doesn't exist, a survey may be required to establish the location of the boundary lines.

Dillant Hopkins Boundary and Survey:

A survey entitled Dillant-Hopkins Airport Property Survey, prepared by the City of Keene Engineering Department in April of 1981 exists for the ownership, but little monumentation occurs on the ground. Boundaries are a combination of roads, river, field edge, and some interior forest lines. The interior forest lines should be located, blazed and painted as soon as possible, especially in areas of active management.

Conservation Easement

The most powerful tool for ensuring the long-term existence of open green space is the conveying of conservation easements on part or all of the property. Precluding development on the property will do more to protect wildlife and their habitat over the long run and provide the forestland required for recreation, education and timber production for the future.

Dillant Hopkins Airport Conservation Easement:

A warranty deed, book 799 page 144, held by the City of Keene exists for 12.3 acres of the Edgewood Forest. Land use restrictions include the following:

1. No roads or other public ways, including the presently existing road, shall be constructed, used or maintained on or within the herein described premises for any purpose other than as an access road for fire protection purposes and/or to install, repair and maintain such water, sewer, electric or telephone lines as may from time to time be installed on, under or over said premises.
2. No buildings of any kind will be erected, used or otherwise maintained on said premises.
3. Such premises shall be maintained in a natural wooded state substantially in the same condition in which the premises are on the date of this deed.
4. No camping, picnicking or other recreational use will be permitted on said premises.
5. No parking areas will be constructed, maintained or used by the City of Keene on its adjacent land within 200 feet of the within described premises.
6. No airport beacon light will be located on adjacent land of the City o Keene nearer to the within described premises than is the present airport beacon light at the Keene airport.
7. The City of Keene, by accepting this deed, agrees to erect and maintain a gate, or other similar barrier,

on the presently existing road through the within described premises at a point not more than two hundred feet distant from Greenwood Avenue and to keep the same closes so as to bar traffic over such road except when such road is being used for the limited purposes permitted by this deed.

Access, Operability, and Water Quality Protection

Most management requires a network of skid trails, truck roads and wood landings. Efficient and sound layout of this important infrastructure is an art in itself. There are a whole host of requirements, rules, and recommendations for forest roads and trails and location of landings. In most states a reference of Best Management Practices exists outlining regulations to prevent erosion and protect water quality during timber operations. General rules of thumb apply, roads and skid trails should not be too steep, should neither be located on sensitive sites nor too close to water, wetland and riparian areas, should be appropriately sized, and should utilize proper water diversion structures. Often the access network is the most expensive component of land management, but when properly laid out they not only facilitate timber harvesting, they can enhance landowner access, improve wildlife habitat, and provide recreational assets.

Any time heavy equipment is used in the woods there is the potential for water quality problems. Skid trails in the wrong place or used during the wrong time of the year can cause soil erosion and sedimentation. To avoid water quality problems, proper planning is critical. The timing of the job is the most important factor in maintaining water quality. Access roads and skid trails should be properly laid out initially. Soil compaction and rutting is the most eminent danger where the ground is wet. Knowledge of specific soil characteristics, drainage location and, often, winter logging can minimize impacts.

Buffer strips along wetland areas and other riparian zones should not be encroached upon. Predetermined buffer widths can be somewhat impractical for planning purposes. A better method is to use on-site indicators and conditions to determine adequate buffer widths. Despite this, some recommended buffer widths are presented on Brooks, Water and Wetlands section of this plan providing a general outline of buffer guidelines. Factors such as topography, a distinctive change in forest cover type, evidence of travel corridors and concentration areas for wildlife, recreational use, and aesthetic concerns should all be used to determine appropriate buffer widths and locations. Depending on the situation, some thoughtful and sensitive individual tree harvesting can be done within buffers to encourage a diverse forest structure.

After any logging, water bars and other drainage-control structures should be installed. Landing areas or places of exposed soil should be seeded and mulch hay may also be required. All brook crossings should be properly restored with the banks mulched and seeded. The most effective safeguard of water quality is a careful equipment operator with common sense and proper supervision from the forester. All access roads and interior skid roads should be maintained according to the publication Best Management Practices For Forestry by the State of New Hampshire Department of Resources and Economic Development. Another good resource for roads is Good Forestry in the Granite State.

Dillant Hopkins Airport Access and Operability:

Uncommon habitat, wetlands, riparian systems, and fragile ground make access inappropriate on a significant portion of the Dillant Hopkins Airport ownership. Elsewhere, access to the sections of the ownership under active management is very good. The Edgewood Forest, the primary focus of management, is adjacent to the Airport Road and includes a network of trails and possible access routes on the dry, upland sections. A landing site exists on the north side of Airport Road about 500 feet east of the terminal parking lot. Two other areas of active management, including the pine stand on the south side of the Water Treatment road just beyond the gate to the Water Treatment Facility has excellent access and operability. A small landing can be created central to this area, with truck access to Airport Road. The last area, located of the east side of the Water Treatment road just beyond the large wetland crossing can be accessed through a field adjacent to the road. Operability here is good, with level terrain on the upland forest sections avoiding the wetland and riparian areas. A landing site can be located within the field area. Follow practices and recommendations in Best Management Practices For Forestry by the State of New Hampshire Department of Resources and Economic Development and the publication Good Forestry in the Granite State.

Local Markets and Logging Capacity

As of the last few years the markets have been so variable it is difficult, if not impossible to predict what they will be a year or even a month from now. Though in general conditions have slowly improved and are better than they were during the midst of the economic crisis of recent years.

Understanding wood markets is essential to a successful timber harvest, and takes diligent attention. Establishing good, long lasting relationships with mills in the area and as far as Canada is also integral component. Given the variability of markets, successful timber harvest planning needs to be flexible to accommodate changing market conditions.

The local logging capacity and infrastructure are in place to carry out the treatments prescribed in this plan. However, due to the uncertainty in current markets and unstable weather patterns, many loggers are finding it difficult to make ends meet. TEMCO foresters have established long term relationships with what we consider to be the best loggers out there. To maintain these relationships we try our best to provide consistent work, but at certain times weather and market conditions prevent steady work.

Currently, several different methods of logging are available to accomplish prescribed silvicultural treatments. There are positive and negative aspects to each method, and the type of equipment needs to be matched to the terrain and the objectives of the job.

Traditionally, the most common method of logging involves the use of rubber-tired cable ‘skidders’, which skid trees to the landing that are cut with chainsaws. This equipment is capable of working on steep rugged ground with little difficulty. Large diameter trees are not a problem for well-powered skidders. A well-planned job can leave the forest appropriately stocked as skidders can maneuver quite well. There are, however, some down sides to this method. The skidder operators have to be both highly trained and conscientious. Skidders can have an impact on soils if they are not operating at the right time of year or if they are not operated in a thoughtful, professional manner. Soil compaction and soil rutting can have detrimental impacts on long-term soil productivity.

In more recent years a mechanized form of logging has become more common in this region. Mechanical tree harvesters cut the trees instead of a chainsaw. The harvester is commonly on tracks, similar to an excavator. The machine has a harvesting saw-head mounted on a boom, with a fifteen to twenty foot reach. Trees are cut and placed in bunches in the woods and are then dragged to the landing area by either grapple or cable skidders. This logging system has several benefits, most of which involve the mechanical harvester. The harvester has the ability to cut a tree, carry it upright, and place it anywhere. The trees are generally placed in bundles along a skid trail, avoiding damage to the trees left behind. A good harvester operator can cut enough trees to keep two or more skidders busy. As long as the harvester operator is skilled, the skidder operators can do their job with minimal damage to the residual trees. This system of logging is capable of producing a high volume of wood in a short amount of time. This may or may not be good, depending on the objectives. All the soil compaction issues raised above are valid here as well.

So called low-impact logging methods involve the use of animals, bulldozers, or forwarders. The first two are slow, and they cannot economically drag wood very far. They can work on steep slopes, however. A forwarder is a skidder-like piece of equipment that carries the trees out of the woods, rather than dragging them. There is less ground pressure applied so soil compaction can be kept to a minimum. The forwarder is highly maneuverable and it can work in very tight spaces. This logging method is often called a cut -to-length system because the trees are processed (bucked) where they lie. The cut up wood is then loaded onto the forwarder. When it heads to the landing it is not dragging seventy or more feet of tree behind it. Forwarders work best on fairly level ground and are not well-suited to steep or rocky ground. Forwarders have the ability to carry the wood quite a distance, and they require minimal landing space. The relatively high cost of this logging system could be offset by lower road construction costs.

New equipment for logging is always being developed. The push towards an ecosystem approach to forest management will result in the design of more environmentally friendly logging equipment. High flotation tires, tracked equipment and biodegradable hydraulic and chainsaw oils are examples.

Forest Products Utilization

Any time a tree is cut, it is important that it is utilized in such a way that the most value is derived from it. The first step in proper utilization is to know the markets. Specifications for forest products can vary widely from one mill to the next. Once a destination for a particular product is chosen, each tree needs to be carefully evaluated before it is cut. A mistake that turns a veneer log into a saw log can be very costly, especially if it recurs throughout the job.

With the exception of cut-to-length systems, most utilization decisions are made on the landing. A piece of equipment called the loader-slasher has become very commonplace with the advent of mechanized logging. The slasher portion is a circular saw which cuts the trees to a specific product length. The loader handles the tree and is capable of loading trucks and piling the tops of the trees to be chipped. This is a quick, safe and economical way of processing the wood, but it does have some drawbacks. The loader operator is quite a distance from the wood that is being sawn, thus high value logs may not be carefully looked at and cut precisely

enough to maximize return to the landowner.

The more traditional method of bucking trees into products involves the chainsaw. The trees are skidded to the landing, measured, and cut by hand. The logger has more of an opportunity to look the entire tree over carefully. After the wood is cut, it is important to properly sort the wood by grade and product so the trucker delivers to the designated mill or processing facility.

Accomplishing Treatments

Commercial treatments are those which involve the harvesting and selling of forest products. These treatments should be laid out and supervised by a forester. The most crucial part of good forest management takes place on the ground, not in this document. The science of forest management is still in its infancy, and the intuition of the forester on the ground is crucial to success. There are many components of a timber harvesting operation that need to fall into place if the treatment is to be successful. The two most important components are a knowledgeable, willing seller and a willing, competent buyer. A stable market for the product being sold is also important.

If an agreement can be made between the seller and buyer through a timber sale contract, the logistics of the operation need to be fully considered. Suitable access and landing areas need to be located; the timing of the operation, payment schedules, and other issues need to be addressed. Patience is often required, as well as good weather conditions. Market issues play an important role as well.

Archaeological Attributes

Protection and enhancement of archaeological attributes should be an objective of every landowner. Stonewalls, cellar holes, and old wells are the most common features found on forestland. These cultural artifacts provide an important link to past land use and history. Guidelines exist to protect these features, and in general are obvious- don’t damage or disrupt existing features. If a stonewall must be crossed, either create a permanent bar-way or be prepared to replace stones after the job has been completed.

Dillant Hopkins Airport Archaeological Attributes:

The most notable archaeological attributes on the airport are the numerous dug channels likely used to help drain areas in agricultural use back in the 1800's and into the 1900's. Not much was noted for stone structures or barbed wire fence dating back to agrarian times, and no cellar holes were located on the tract--though that doesn't mean there aren't any. Avoid disturbing all archaeological attributes during management activities.

COMPLEMENTARY MANAGEMENT OBJECTIVES FOR THE DILLANT HOPKINS AIRPORT

Recreation, Education and Aesthetics

Recreation, education, and aesthetics on the Dillant Hopkins Airport will be addressed on two levels, one

for the Edgewood Forest and the second for the remainder of the ownership. Given the history, the use patterns, the site, and the connectivity of the Edgewood Forest to the Community, this area can sustain a higher level of human use. On the remainder of the ownership a more delicate balance is needed between protecting important wildlife habitat along with preventing unwarranted disturbances to wildlife and providing opportunity for the public to recreate on the tract is an ownership objective. Input from various local institutions, including UNH Extension and NH Audubon have led to the following recommendations for recreation opportunities.

Recreation, Education and Aesthetic Management Recommendations:

- Within Edgewood Forest:
    - Maintain and improve existing recreational trails. Harvesting operations will utilize sections of the existing trail system, resulting in a wider width of these sections after harvest is completed. These sections will be left clear, without piles of brush or debris, with a smooth surface, and water control compatible with multiple uses including walking, biking, and snowshoeing.
- Edgewood and Elsewhere:
    - Designate recreational trails to target observation points in selected habitat types. Use signs to communicate importance of staying on designated trails at specified times of year to minimize impact on wildlife and habitat. (Potential new trail locations and existing trails delineated in Figure 1, Forest Management Map);
    - Recommend dogs continue to be allowed, but must be on leash or under voice control at all times. Education about destructive dog behavior to wildlife and their habitat is an important message;
    - Post signs educating public about protecting wood turtles and their habitat. Specifically state collection of wood turtles not allowed;
    - Interpretive Signs are a cost effective way of furthering the connection between people and the environment here including such things as tree and shrub identification, wetland descriptions, wildlife habitat components, and geological or topographical features.
    - Educational opportunities are really only limited by creativity and interest. The UNH extension service is staffed with individuals available to help with educational workshops and events. Coordinating with school groups and other organizations such as NH Audubon could lead to other opportunities;
    - Limit educational tours and outings to roadways and designated trails.

Edgewood Forest Complementary Management Recommendations

Given the history of the Edgewood Forest and its strong connection with the community, management will focus beyond silvicultural recommendations to manage the forest sustainably and for the long term given the flight safety requirements. Numerous opportunities exist on Edgewood Forest for complementary management

activities, ranging from improved trails, educational kiosks and interpretive signs, geo-cache activities for children, birding trails, to planting fruit and berry producing trees and shrubs and wildlife habitat plantings and enhancements. The silvicultural management recommendations, which are described in detail below in the stand description section, will create a significant change within the flight path portion of the forest, creating conditions suitable for a wide variety of activities to enhance the community forest. The options are only limited by practical implementation and coordinated efforts between the airport and community members.

Possible complementary management actions within the Edgewood Forest include:

- Improved trail network for hiking, biking, snowshoeing, and skiing, with an improved focus on loop trails;
- Interpretive trails with an emphasis on a variety of topics including wildlife habitat, ecology, bird habitat, tree and plant identification, soil information, wetland ecology;
- Coordinate with a local geo-cache partner to create an active geocache program here for children and school programs;
- Wildlife habitat enhancements such as creating cavity trees, down logs, brush piles, plantings of mast producing trees and shrubs;
- Pollinator plantings for bees.

Forest Reserve Area

Forest Reserve Areas provide opportunities to capture elements of biodiversity that are missing from managed areas. They also can provide opportunity for higher levels of carbon sequestration and provide a greater "wilderness" character for recreational opportunities. At this point in time, though not officially a "Reserve Area" the vast majority of the forested areas, including floodplain forest, forested wetlands, and associated wetland and riparian systems, have only passive management recommendations. These areas, shown on the map below, will not receive active management and will be allowed to progress naturally over time. In the event of a natural disturbance regime, such as a severe windstorm, or the introduction of a devastating disease or pest, these areas may receive management in response to the specific circumstances.

Additionally, some short trails and wildlife observation points have been recommended to help guide wildlife viewers to targeted areas and avoiding more sensitive areas.

OTHER CONSIDERATIONS

Social Climate

There always have been mixed feelings among the general public concerning forest management and, in particular, timber harvesting. While many people use forest products, most do not fully understand how they are produced. People’s perceptions of what may be happening and what is actually occurring are often quite different. A timber harvesting project designed for wildlife habitat improvement or salvage cutting due to wind storm damage or other natural disturbances may sometimes require patch clear cutting. The idea of any type of tree cutting may upset people unless they understand that it was thoughtfully planned and done purposefully with due

consideration for the environment.

Tours of the property or signage for educational purposes can often stimulate interest in management and dispel negative assumptions. In addition to the TEMCO foresters, the Extension and County Foresters may be willing to assist owners with educational events.

Tree Farm

The American Tree Farm System is the largest and oldest woodland certification system in America. It specializes in certifying management of private forests as sustainable in ecological and economic terms. Tree Farm works "to give people the tools they need to be effective stewards of America's forests", provides recognition and validation of family forest owners commitment to sustainable stewardship, and helps protect the forest for future generations. In addition, Tree Farm Certification provides access to some better timber markets. Eligibility requirements are a woodlot with at least 10 acres that is under a forest management plan which meets Tree Farm Standards (this document meets trees farm standards). To enroll, the forest must be inspected to verify the Tree Farm Standards have been met.

Taxes, Laws and Required Permits

New Hampshire:

Best Management Practices: BMP's are for protecting water quality during forest harvests. Some BMP's are mandatory and others are voluntary. All BMP's are documented in Best Management Practices for Forestry: Protecting New Hampshire's Water Quality;

Current Use: Current Use is an "open space" taxation program (RSA 79-A). It is a property taxing strategy designed to encourage landowners to keep their open space undeveloped. It taxes agricultural and forestland on its "current use" rather than its real estate market value. Minimum requirements are 10 acres in size and buildings and other improvements must be excluded. Landowners must apply to their town and commit their land to open space conservation. When land is developed it is charged a land use change tax. Current use tax rates are variable, with the lowest rates given to un-posted land under Stewardship Category. This plan meets the Stewardship Category of Current Use;

Timber Tax Law: Ten percent of the value of every timber sale is returned to towns where cutting takes place (RSA 227-J:5 and 79:10). The State of New Hampshire requires filing an "Intent to Cut" form for loggers, foresters and landowners who wish to harvest timber. The Intent to Cut form is for tax purposes since timber is only taxed once it is cut, and is used to make municipal assessing officials aware of cutting operations. Once filed, a Report of Wood Cut form is filed with the town;

Wetlands Law: If harvesting is to occur in or near wetland areas, or which requires stream crossings, a Notification of Minimum Wetlands Impact must be filed with NH DES;

Driveway Permit: A driveway permit is required for vehicles entering a state road from the harvest site. The Driveway Permit application needs to be sent to and approved by the Dept. of Transportation;

Basal Area Law: This law (RSA 227:J:9) regulates cutting over 50% of the basal area adjacent to certain waters and along public highways and requires a Basal Area Variance Request;

Slash Law: The slash law (RSA 227-J:10) is intended to reduce fire danger caused by slash and to improve the aesthetics along roads and water bodies. It prohibits leaving slash in or near year round streams, bodies of water, and along public roads, along railroad beds, on or within 25 feet of the property of another, in a cemetery, and within 100 feet of any occupied structure.

TRACT AND STAND LEVEL DATA

RECOMMENDED PRACTICE SCHEDULE

Dillant Hopkins Airport

Stand #	Stand Type	Acres	Treatment	Priority	Year
1	WP-H 3/4A	18.7	Modified Overstory Removal within Flight Zone only; Hazard Tree Removal and Crop Tree Release Elsewhere	HIGH	2016
1	WP-H 3/4A	+/- 2	Non-commercial Improvement Work (giving priority to high aesthetic areas)	optional	ASAP
1	WP-H 3/4A	18.7	Crop Tree Release and Improvement Work	HIGH	+/-2045
2	Spruce-Pine Plantation	5.2	Minimal improvement work associated with Stand 1 Harvest- Crop Tree Release	HIGH	2016
2	Spruce-Pine Plantation	+/- 2	Non-commercial Improvement Work (giving priority to high aesthetic areas)	optional	ASAP
3	Mixed Hardwood 2/3 A	2.9	Minimal improvement work associated with Stand 1 Harvest- Crop Tree Release	HIGH	2016
3	Mixed Hardwood 2/3 A	2.9	Non-commercial Improvement Work (giving priority to high aesthetic areas)	optional	ASAP
4	White Pine-Hardwood 3/4 A	12.8	Modified Seed Tree	HIGH	2016
	Conversion Area by Airport Terminal	1.1	Clearcut	HIGH	2016
5	Hardwood-White Pine 2-4 A/B	11.5	Future Conversion Area Modified Seed Tree	MED	2016
5	Hardwood-White Pine 2-4 A/B	67.8	Remainder of Stand 5 Leave to Develop Naturally	--	--
6	Young Mixed Hardwood 2A	8.1	Non-commercial Improvement Work (giving priority to high aesthetic areas)	optional	ASAP
7	Silver Maple-Mixed		Passive management only	--	--
all			Blaze and paint boundary lines		asap
all			Update forest management plan		2026

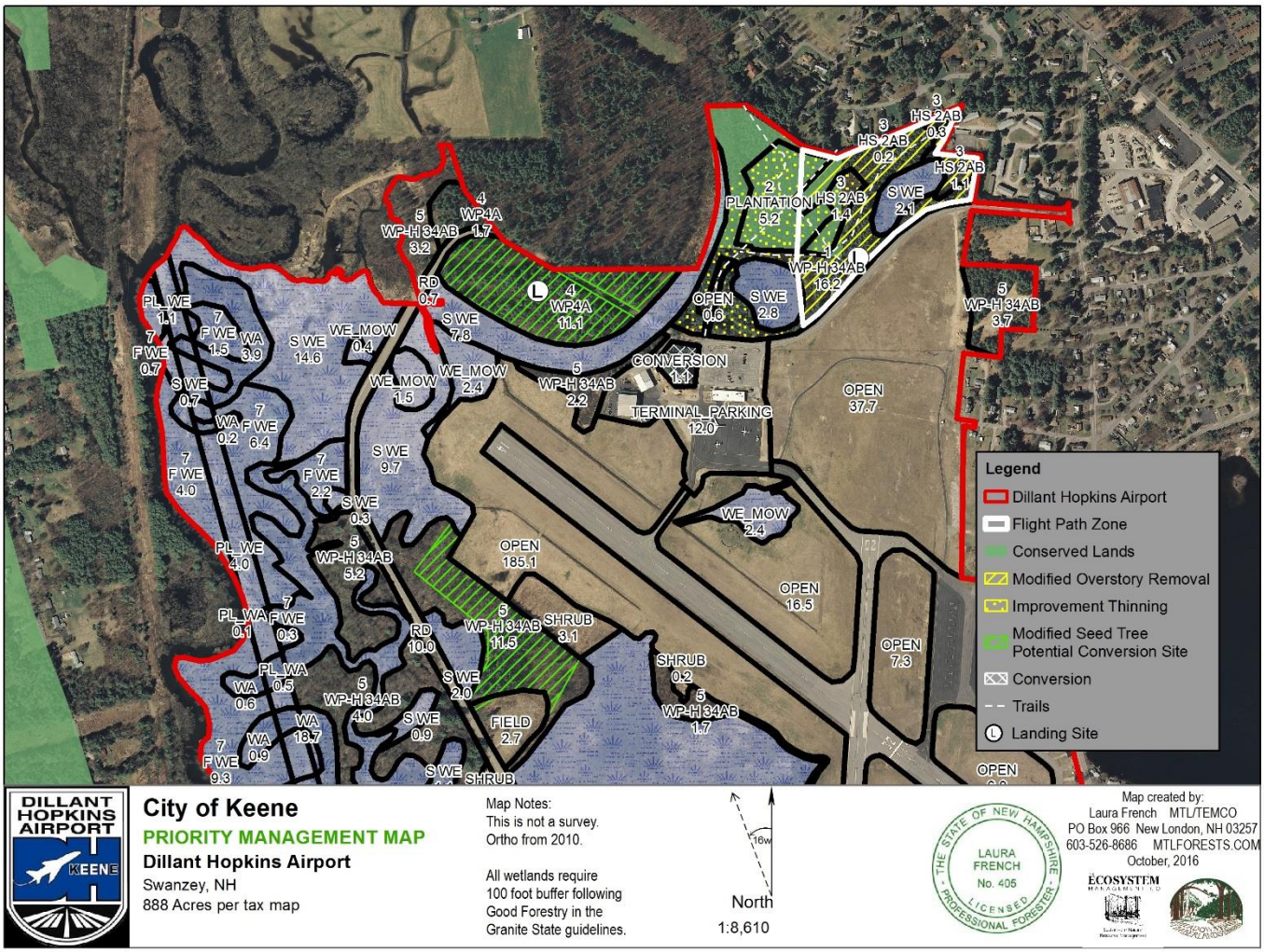


Figure 4: Map showing location and layout of High and Medium Priority management activities.

Stand 1 Edgewood Forest White Pine-Hardwood 3/4A 18.7 acres

The large white pine that dominate the Edgewood Forest are about 60 to 80 years old (left photo).

Typical diseases of white pine, such as blister rust, are often found in a stand of this age (right photo).

The crowns of the white pine illustrate their individual health and vigor (left photo).

Several foot trails are located throughout the forest, such as this one which passes by a once "open grown" white pine.

In other sections of the pine forest, a well-defined understory of hardwood trees has become established (left photo).

And the stand borders two well studied wetlands including a red maple swamp (right photo) and a heath-shrub bog.

General attributes

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	80+/- years		
Stocking Level:	Overstocked		
Past Management History:	Minimal harvesting for tree height reduction in flight path.		
Insects/Damage/Disease:	Typical white pine health issues including red rot, white pine blister rust, and weevil damage.		
Timber Quality:	Pine is dominant, and variable in quality due to age and health issues.		
Invasives:	Scattered buckthorn, bittersweet, and barberry noted.		
Total BA Per Acre:	168	Trees Per Acre:	262
Total AGS BA Per Acre:	67	% AGS Sawtimber:	65.2%
Quadratic MSD:	10.8	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak.

Silvicultural Objectives

Management system:	Multiple age management. Modified Shelterwood.
Desired Composition:	Maintain natural community type. Promote red oak.
Crop tree target diameter:	RO 24"+
Wildlife Management:	Mast tree release, release of browse and blueberry production. Create/protect snags, cavity tree recruitment, down logs. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain

Access to Town Road and Landing Sites:	See Access Section above. Entire stand accessible within ownership to Airport Road. Landing site adjacent to Airport Road, does not require truck road.
Truck/woods Roads:	No truck roads required. Only recreational trail system and short access road to old fire tower exists currently.
Terrain:	Gentle terrain, with minimal slope. Good ground and operable; avoid wetland areas using a 100 foot buffer following Good Forestry in the Granite State guidelines listed above.

General Description: Stand 1 includes the 60-80 year old white pine dominated sections of Edgewood Forest. It includes the section within the flight path that needs to be treated to meet airport safety guidelines. Trees over 65-70 feet in height interfere with safe navigation of incoming and outgoing planes.

Pine dominates the site, with a variable but generally well-established hardwood understory, with a good representation of oak regeneration. Though not captured in the forest inventory data, scattered red and white oak exist in the overstory as well. Because this area has seen little to no management, the pines are naturally weeding themselves out, with those of high vigor and health exerting their dominance.

The stand surrounds three wetland systems, a red maple swamp on the west side, and a heath dominated bog on the east side, and a small strip wetland between the bog and Airport Road.. The wetland systems are surrounded by a band of shrubs, dominated by blueberry, winterberry and alder. These systems provide excellent wildlife habitat as well as enhance the natural biodiversity of the ownership.

Recreational trails exist throughout the stand, used both for walking and biking, as well as snowshoeing in the winter.

Management here will vary depending on the section of the forest, ranging from leaving it to develop naturally to a removal of the pine overstory to release and promote the oak component of the forest. In these areas, the removal of the pines is required to meet the airport safety guidelines mentioned above. The wetlands will be protected with a 100 foot buffer as recommended in the publication Good Forestry in the Granite State.

Silviculture Management Objectives: Leave the bulk of the area outside the flight path zone to develop naturally, with some hazard tree removal and improvement harvesting where prudent. In the flight path zone, the long term objective is to establish an oak dominated forest, managed primarily for aesthetics, wildlife, recreation, and as a protective buffer between the airport and

the Edgewood Community. Use modified overstory removal of the pine to establish and release the oak, which will develop into the long-term forest structure better suited to meet airport safety guidelines because of lower mature tree heights. Timing the harvest with a good oak seed year is ideal, and fortunately 2016 has seen record acorn production. The oak forest is intended to be a long-term legacy forest, receiving minimal management to promote health, vigor and removals of hazards. The harvest involves a significant removal, designed to maximize growth and production of the hardwood understory. Over time (+/-30 years), improvement thinnings will be required to select for the best quality hardwood trees to dominate the future forest, ideally a mix of red and white oak, with lesser amounts of red maple and beech.

Wildlife Habitat Improvement Objectives: Retain standing dead trees and down logs where suitable to improve habitat. Follow wetland buffer guidelines. Encourage growth of understory shrubs for shelter and berry production. Retain oak and healthy hardwoods in the overstory for mast and structure. Consider topping tall pines within the wetland buffer to create short snags, while still protecting water quality.

Management Actions:

2016:

Modified Overstory Removal of pine within flight path zone. Retain healthy hardwoods in the overstory, especially oak. Protect hardwood mid-story and understory from unnecessary disturbance. Follow wetland buffer guidelines. May top tall pines in the buffer rather than removing them to create snags.

Crop Tree Release and Hazard Tree Removal in areas outside flight zone to promote growth on best overstory pine and remove hazards. Minimal removals, focused on areas adjacent to trails. Follow wetland buffer guidelines.

ASAP:

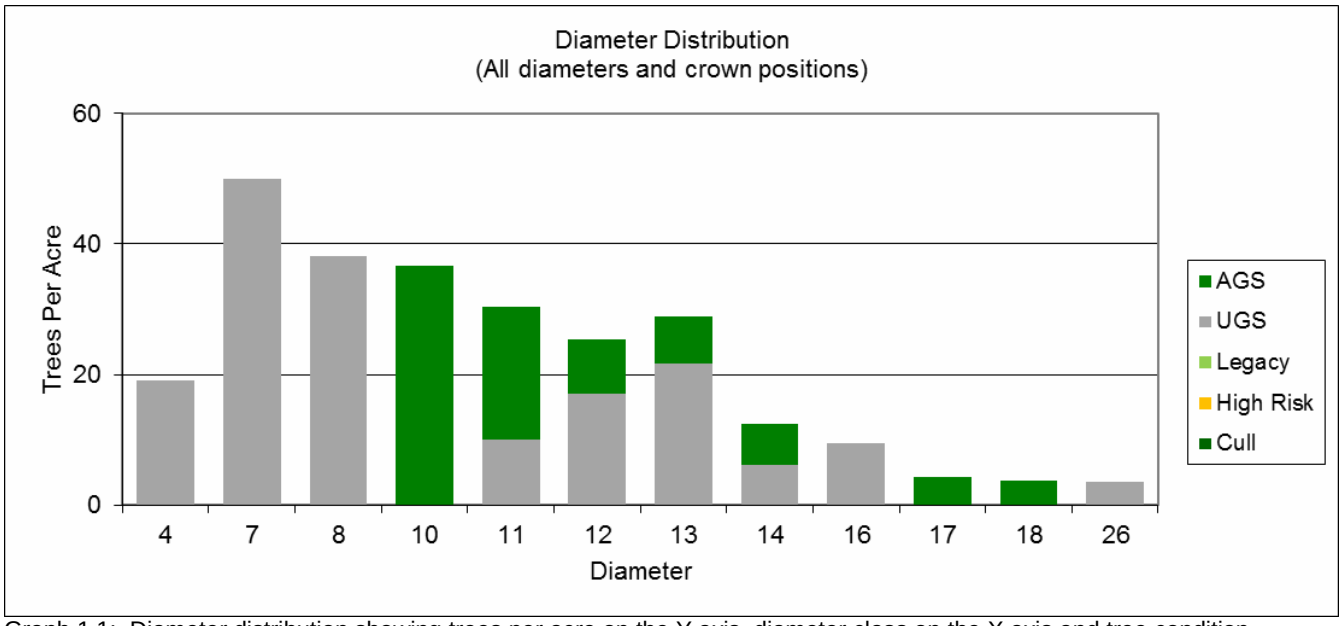
Stand-alone Non-commercial Manual Improvement Operation prioritizing areas along trails to improve aesthetics and wildlife habitat, as well as release crop trees. Hand/chain saw work.

2045+/-:

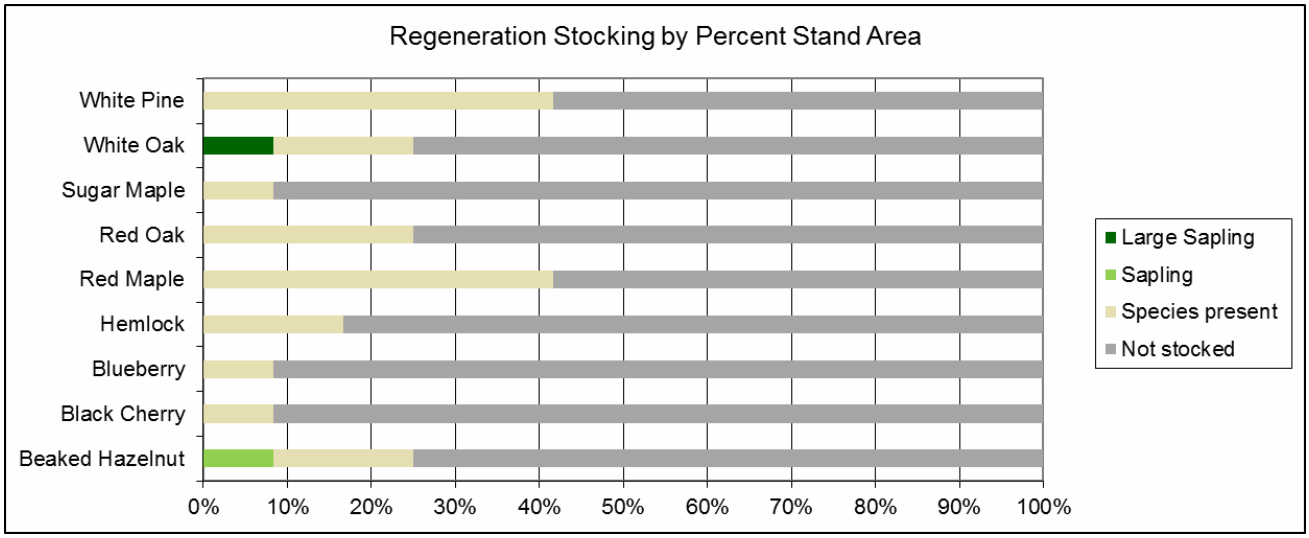
Non-commercial Thinning to improve growth on best quality hardwoods and to remove white pine that become established from 2016 harvest.

Table 1.1: Forest Composition and Volume.

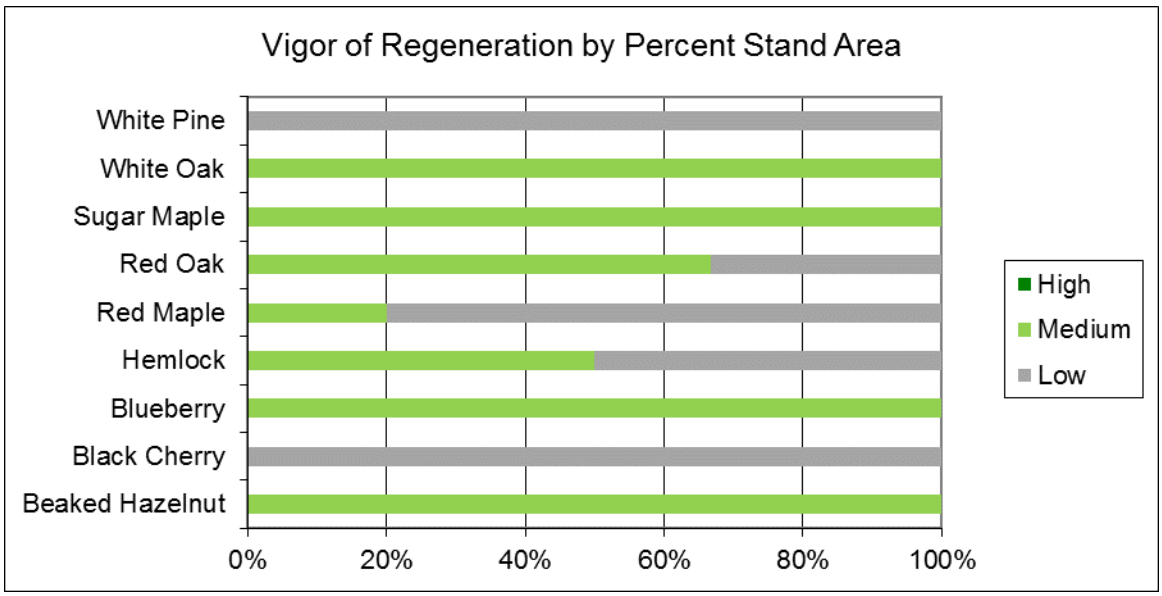
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Red Maple	10.3%	0	0	1	0.0	0.0	1.3	0	0	0%
Total Hardwood Per Acre:	***10.3%***	***0***	***0***	***1***	***0.0***	***0.0***	***1.3***	***0***	***0***	100%
										0%
Norway spruce	4.2%	436	0	1	0.0	0.0	2.4	0	436	100%
Red Pine	5.0%	772	0	1	0.0	0.0	2.3	0	772	0%
White Pine	80.6%	8,520	3,269	36	0.0	0.0	57.7	0	7,266	100%
Total Softwood Per Acre:	***89.7%***	***9,729***	***3,269***	***38***	***0.0***	***0.0***	***62.3***	***0***	***8,474***	
										100%
Total Volume Per Acre:	**100.0%**	**9,729**	**3,269**	**39**	**0**	**0**	**64**	**0**	**8,474**	
Stand Volume:		**157,606**	**52,960**	**630**	**0**	**0**	**1,031**	**0**	**137,280**	



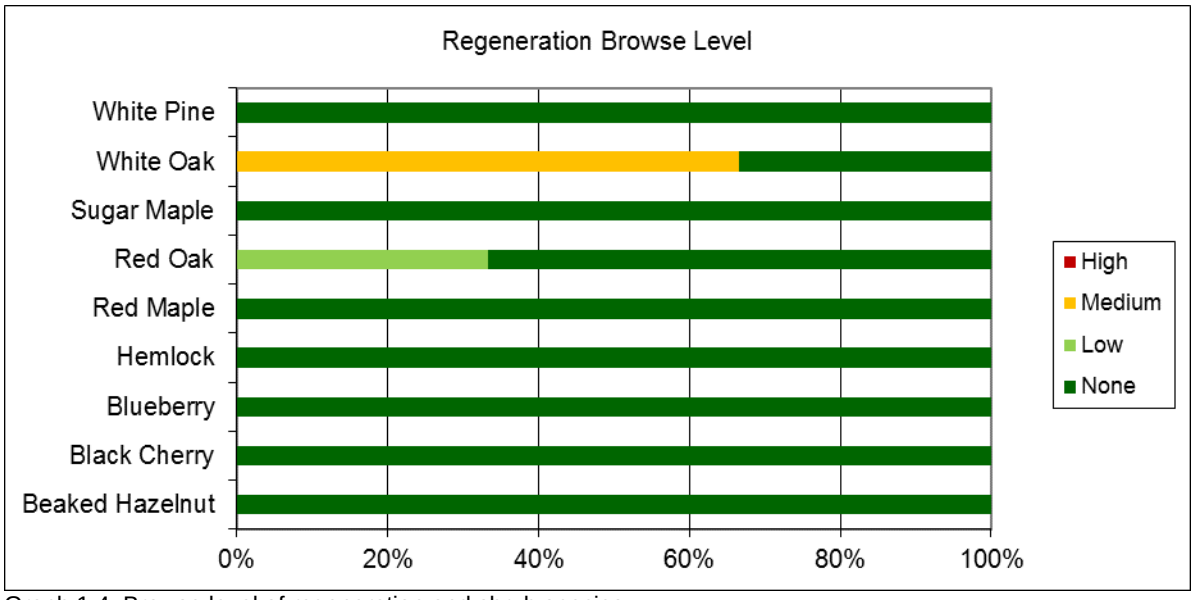
Graph 1.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 1.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 1.3: Vigor of regeneration and shrub species.



Graph 1.4: Browse level of regeneration and shrub species.

Table 1.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"			15.1	15.1
12-18"				
>18"				
Grand Total			15.1	**15.1**

Table 1.3: Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

Stand 2 Edgewood Forest Pine-Spruce Plantation 5.2 acres

Norway Spruce trees, planted about 40 years ago as part of the tree nursery started by Albert Proell on 1906.

The nursery grew nursery stock from seed for reforestation efforts.

Some sections of the nursery were planted with Scot Pine, now known to be a poor choice to grow here because differences in climate and soils between its native habitat (Eurasia) and North America resulting in a poor growing form for timber (left photo).

Areas within the Scots Pine have died, resulting in the regeneration of white pine in the openings made in the forest (right photo).

A fair amount of aspen has become established within the plantation, but much of it is low vigor and/or diseased succumbing to common decay fungus (left photo).

In some of the openings white cedar has become established (right photo).

General attributes

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	40+/- years		
Stocking Level:	Overstocked		
Past Management History:	No recent management.		
Insects/Damage/Disease:	No serious disease concerns. Natural thinning occurring due to overstocked conditions.		
Timber Quality:	Variable. Scot pine with typical poor form. Norway spruce best vigor trees of good quality.		
Invasives:	None noted, but likely occurrences including buckthorn, barberry, and bittersweet.		
Total BA Per Acre:	138	Trees Per Acre:	371
Total AGS BA Per Acre:	80	% AGS Sawtimber:	91.5%
Quadratic MSD:	8.2	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak.

Silvicultural Objectives

Management system:	Even aged management.
Desired Composition:	For time being manage for Norway spruce. Scot pine not a desired species.
Crop tree target diameter:	NS 18"
Wildlife Management:	Mast tree release. Create/protect snags, cavity tree recruitment, down logs. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain

Access to Town Road and Landing Sites:	See Access Section above. Entire stand accessible within ownership to Airport Road. Landing site adjacent to Airport Road, does not require truck road.
Truck/woods Roads:	No truck roads required. Only recreational trail system and short access road to old fire tower exists currently.
Terrain:	Level terrain. Good ground and operable; avoid wetland areas using a 100 foot buffer following Good Forestry in the Granite State guidelines listed above.

General Description: Stand 2 includes the areas of Norway spruce and Scot pine plantation that remain from the nursery established by Albert Proell in 1906. The nursery was established to grow trees from seed to be used for reforestation projects and was the one of the first and largest of its kind. The current trees were planted about 40 years ago, and have received little to no management since. The Scot pine exhibit typical poor form due to difference in soil and climate conditions in their native range of Eurasia. The Norway spruce are growing well, with those of higher vigor and better health showing dominance. Despite minimal past management, or perhaps because of it, the areas of Norway spruce have a high aesthetic quality with an open understory and mossy forest floor. The opposite is true for the Scot pine, as it has tended to fall apart.

Silviculture Management Objectives: Given that the bulk of the plantation is outside the flight path, and that the overall heights are below the safety guidelines, no management need occur here to meet airport safety standards. Additionally, given the high recreational use of the area and the aesthetic quality of the Norway spruce, no management is recommended where the spruce dominates. Where Scot pine dominates, small patches and group removals to clear the trees that are breaking apart and otherwise low vigor or poor health is recommended. These areas, especially where they border trails can be allowed to regenerate naturally, or could be planted with a variety of trees and/or shrubs to benefit wildlife, diversity, and aesthetics.

Wildlife Habitat Improvement Objectives: Consider planting fruit, berry or nut producing trees and shrubs in areas cleared of Scot pine. Retain standing dead trees and down logs where appropriate.

Management Actions:

2016:

Patch and Small Group removals to clear areas where Scot pine is breaking apart and otherwise low vigor or

poor health. Allow to regenerate naturally or consider planting with fruit/berry or nut producing trees and shrubs to enhance wildlife habitat and aesthetics.

Follow up from 2016 Harvest:

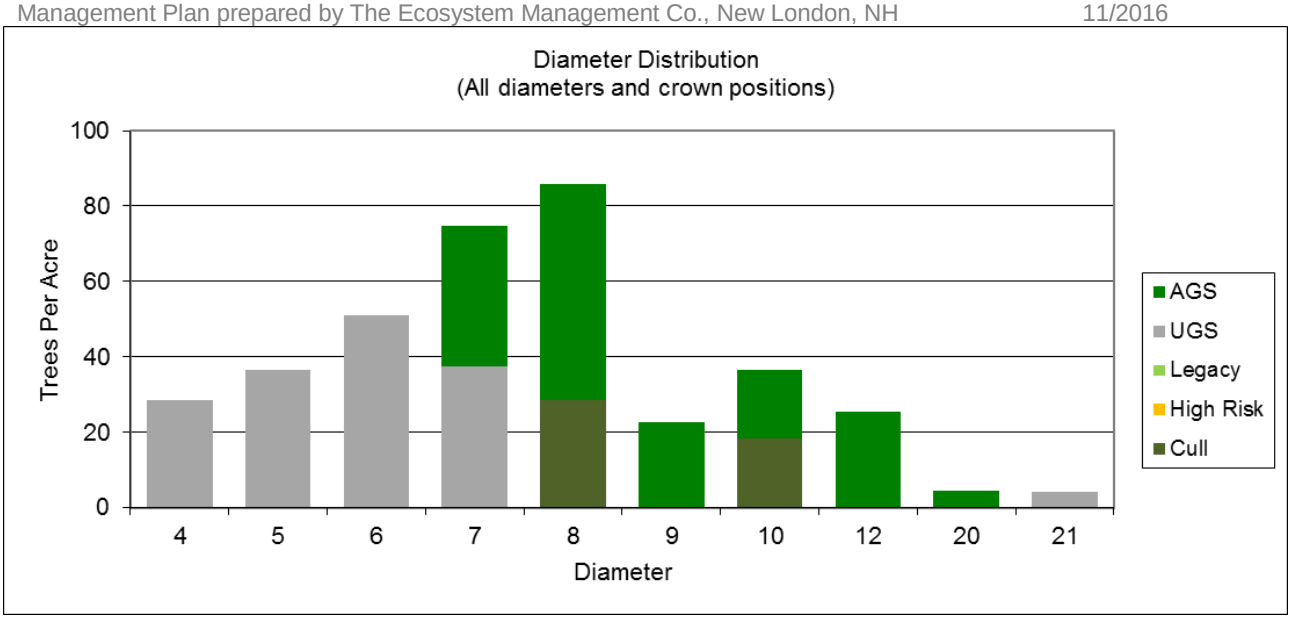
Non-commercial Improvement Work prioritizing areas along trails to improve aesthetics and wildlife habitat, as well as release crop trees. Hand/chain saw work.

2045+/-:

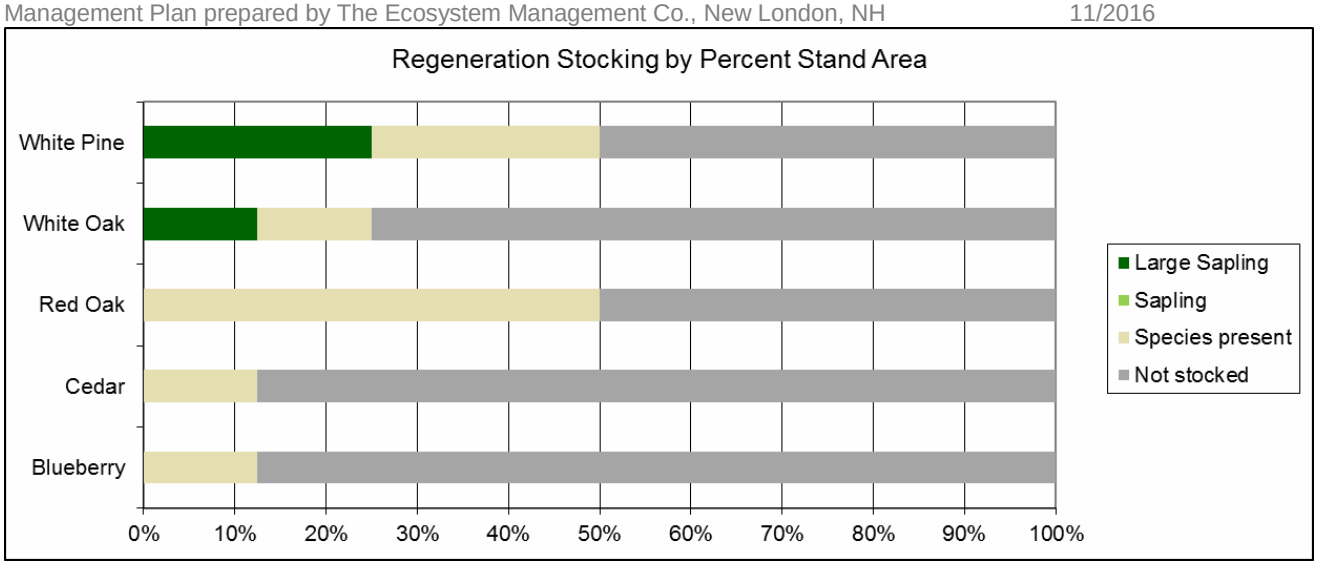
Non-commercial Thinning or Commercial Thinning (depending on forest condition) to improve growth on best stems, improve aesthetics, and improve wildlife habitat.

Table 2.1: Forest Composition and Volume.

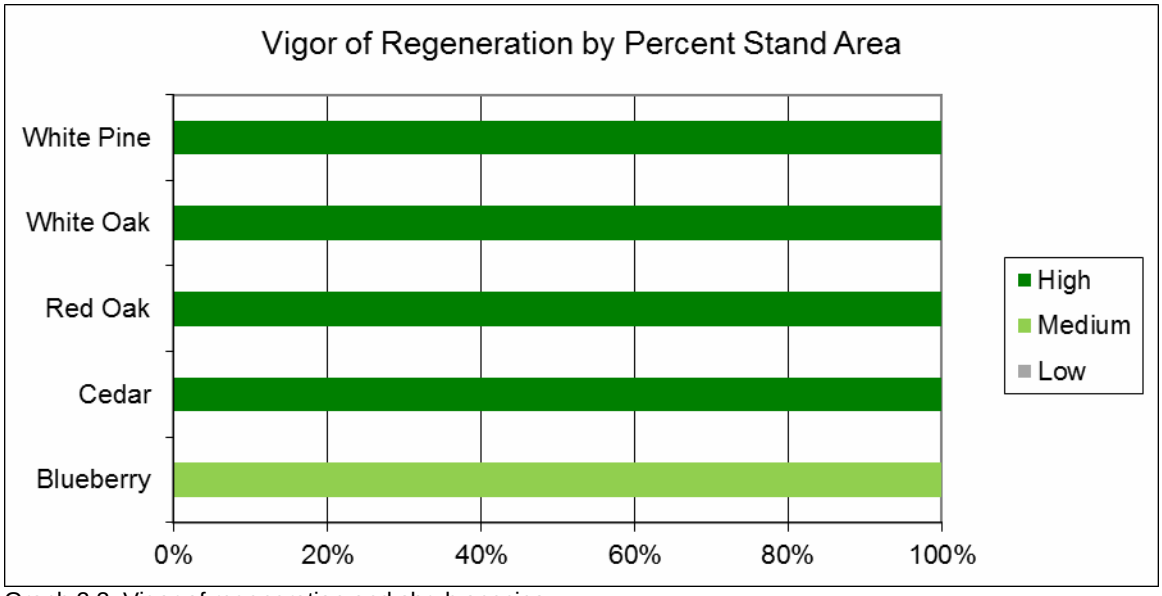
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Cords	High Risk	AGS Saw	% AGS Saw
Aspen	15.4%	0	0	0	0.0	0.0	0.0	0	0	0%
White Birch	7.4%	0	0	3	0.0	0.0	2.8	0	0	100%
Total Hardwood Per Acre:	***22.8%***	***0***	***0***	***3***	***0.0***	***0.0***	***2.8***	***0***	***0***	0%
										100%
Norway spruce	64.9%	4,522	0	11	0.0	0.0	21.4	0	4,522	0%
Scotch Pine	9.4%	0	0	2	0.0	0.0	2.1	0	0	100%
White Pine	2.9%	499	896	6	0.0	0.0	8.4	0	892	
Total Softwood Per Acre:	***77.2%***	***5,021***	***896***	***20***	***0.0***	***0.0***	***32.0***	***0***	***5,414***	100%
Total Volume Per Acre:	**100.0%**	**5,021**	**896**	**22**	**0**	**0**	**35**	**0**	**5,414**	100%
Stand Volume:		**26,111**	**4,659**	**116**	**0**	**0**	**181**	**0**	**28,153**	



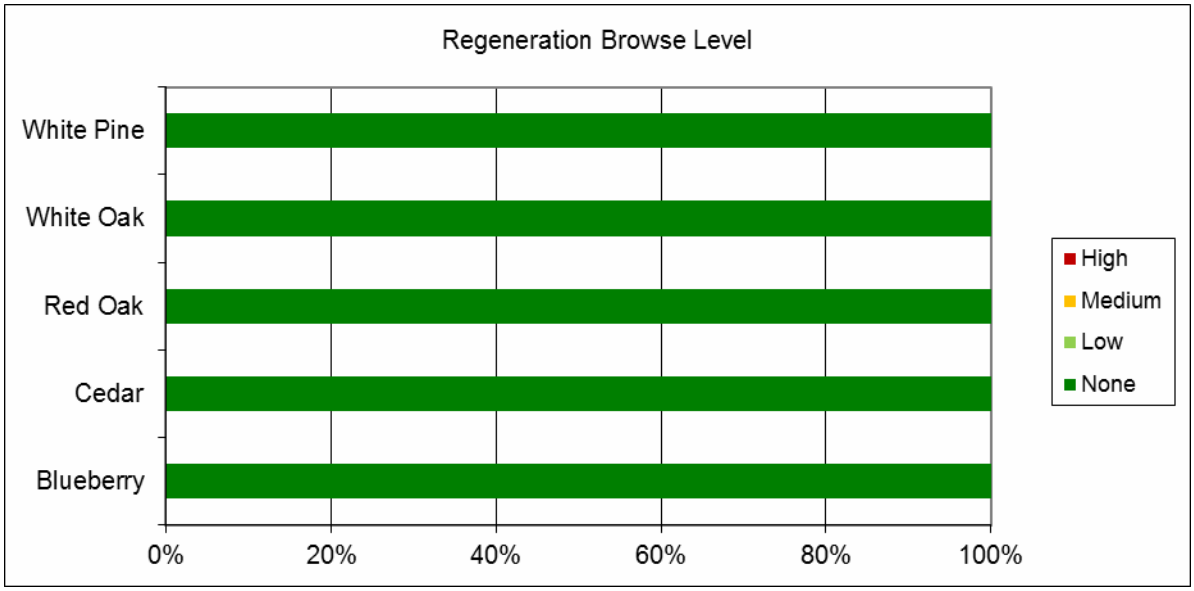
Graph 2.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 2.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 2.3: Vigor of regeneration and shrub species.



Graph 2.4: Browse level of regeneration and shrub species.

Table 2.2: Standing dead trees per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"				
12-18"				
>18"				
Grand Total				**0**

Table 2.3: Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

Stand 3 Edgewood Forest Mixed Hardwood 2/3A 2.9 acres

Sections of Edgewood Forest were cleared about 20 to 30 years ago to remove tall trees within the flight path. These sections have grown back with a dense stocking of pole-size trees dominated by red oak.

Stumps from the past harvesting can still be found throughout these areas.

General Attributes

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	25+/- years		
Stocking Level:	Fully to overstocked.		
Past Management History:	No recent management after stand initiation.		
Insects/Damage/Disease:	No serious disease concerns. Natural thinning occurring due to overstocked conditions.		
Timber Quality:	Young stand. Best potential for timber in red oak.		
Invasives:	None noted, but likely occurrences including buckthorn, barberry, and bittersweet.		
Total BA Per Acre:	93	Trees Per Acre:	645
Total AGS BA Per Acre:	23	% AGS Sawtimber:	0%
Quadratic MSD:	5.1	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak.

Silvicultural Objectives

Management system:	Even aged management.
Desired Composition:	Manage towards natural community type, focusing on red oak.
Crop tree target diameter:	RO 24"+
Wildlife Management:	Mast tree release. Create/protect snags, cavity tree recruitment, down logs. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain

Access to Town Road and Landing Sites:	See Access Section above. Entire stand accessible within ownership to Airport Road. Landing site adjacent to Airport Road, does not require truck road.
Truck/woods Roads:	No truck roads required. Only recreational trail system and short access road to old fire tower exists currently.
Terrain:	Level terrain. Good ground and operable; avoid wetland areas using a 100 foot buffer following Good Forestry in the Granite State guidelines listed above.

General Description: Stand 3 is a small area within the Edgewood Forest where the overstory was removed about 30 years ago and the resulting young stand has grown up. It is dominated by hardwood, especially red maple but with scattered nice oak. In some areas pine has come in fairly strong, but in general is low vigor and showing signs of decline and disease. This section of forest is a good illustration of the expected growth after the modified overstory removal in Stand 1 if it were left unmanaged. Future thinning management here will favor red oak and discriminate against pine. Under ideal conditions, this stand would be non-commercially thinned by hand (meaning not mechanical operation, but using chainsaw). Unfortunately, given poor markets and the unlikelihood of finding an operator willing to do this work, it is unlikely that will occur. For the time being, the forest will be left to develop naturally, as the dominant trees assert themselves, a process called stem exclusion in forestry terms. Should an opportunity arise to complete this work in a non-commercial fashion (leaving the downed material in the woods, but lopped to a low height), the stand would benefit from treatment.

Silviculture Management Objectives: Short term management objectives are to promote growth on best quality hardwood stems, especially oak. Long term objectives for this area is an oak dominated forest, managed primarily for aesthetics, wildlife, recreation, and as a protective buffer between the airport and the Edgewood Community. Consider removal of some of the low vigor and diseased white pine along harvest access routes for Stand 1. Retain and protect all red oak. Consider oak and other quality hardwood crop tree release. Should opportunity for a stand-wide non-commercial treatment arise, thin the stand to the b-line (60 to 80 square feet) managing for best quality oak and discriminating against all pine. Retain hemlock.

Wildlife Habitat Improvement Objectives: Short term objectives are to promote oak for mast. As the forest develops, opportunities may arise for the creation and maintenance of standing dead trees and down logs to improve habitat.

Management Actions:
Coordinated with mechanical harvest is Stand 1:

2016:

Crop Tree Release along trails/access to Stand 1 harvest to promote growth on red oak and best quality hardwood.

Non-commercial Improvement Work prioritizing areas along trails to improve aesthetics and wildlife habitat, as well as release crop trees. Hand/chain saw work.

ASAP:

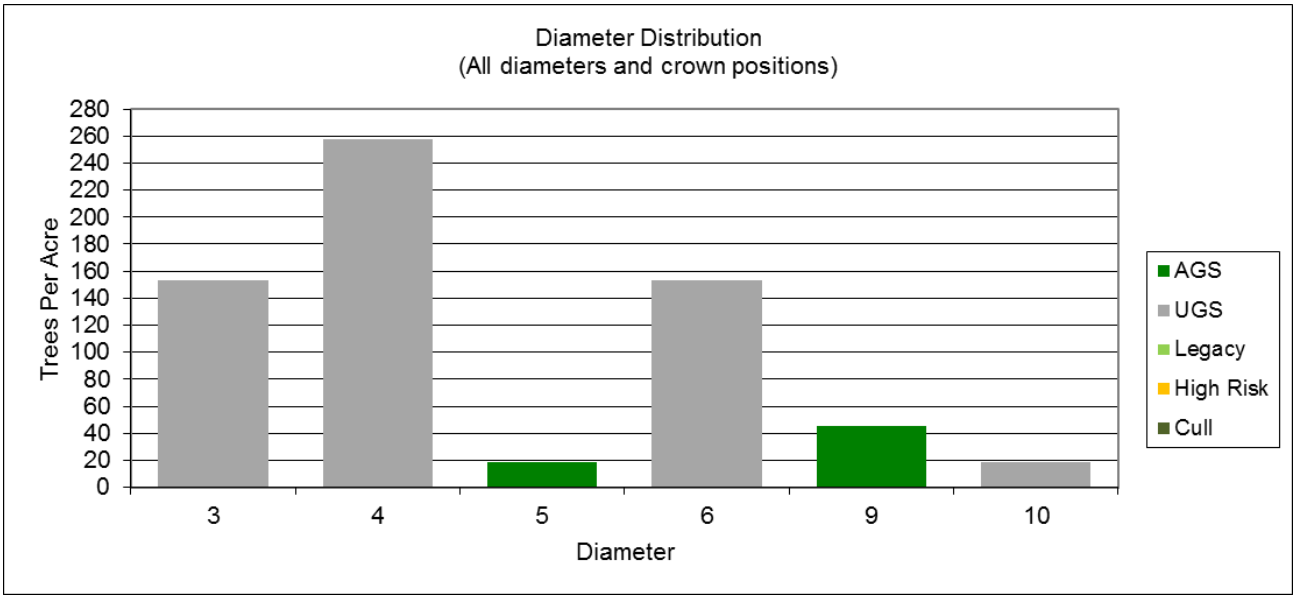
Stand-alone Non-commercial Manual Improvement Operation prioritizing areas along trails and with high aesthetic objectives to improve aesthetics, improve wildlife habitat, release desired crop trees (oak), and remove pine, Retain all healthy hemlock. Keep trails clear, be mindful of aesthetics, and lop all downed wood and debris to within 3 feet of the ground, keeping debris away from trails.

2045+/-:

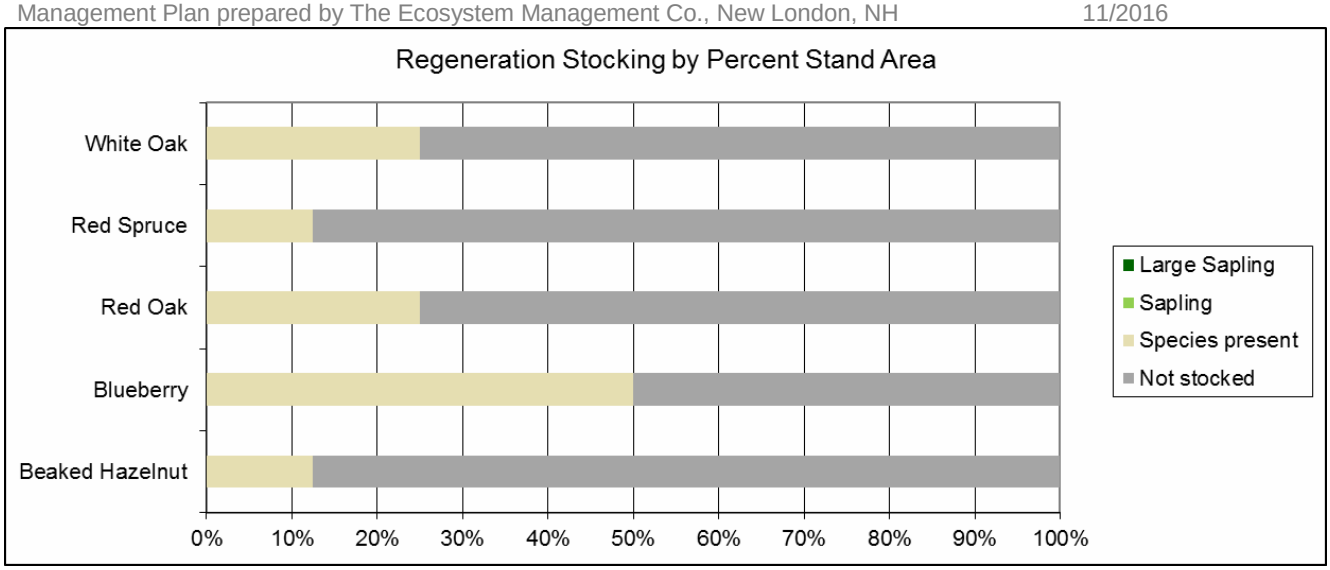
Non-commercial Thinning or Commercial Thinning (depending on forest condition) to improve growth on best stems, improve aesthetics, and improve wildlife habitat.

Table 3.1: Forest Composition and Volume.

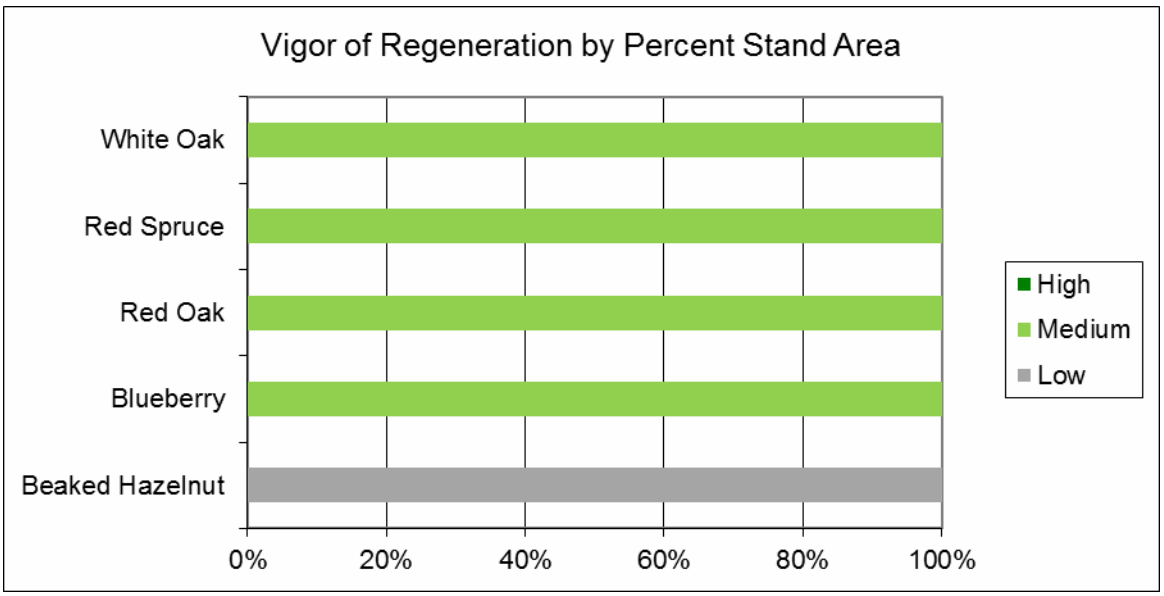
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Aspen	8.5%	0	0	3	0.0	0.0	2.7	0	0	0%
Red Maple	47.1%	0	0	4	0.0	0.0	4.0	0	0	100%
Red Oak	20.9%	0	0	2	3.0	.0	5.1	0	0	0%
White Oak	23.5%	0	0	1	0.0	0.0	0.8	0	0	100%
Total Hardwood Per Acre:	***100.0%***	***0***	***0***	***10***	***3.0***	***0.0***	***12.6***	***0***	***0***	0%
										100%
Total Volume Per Acre:	**100.0%**	**0**	**0**	**10**	**3**	**0**	**13**	**0**	**0**	
Stand Volume:		**0**	**0**	**28**	**9**	**0**	**37**	**0**	**0**	



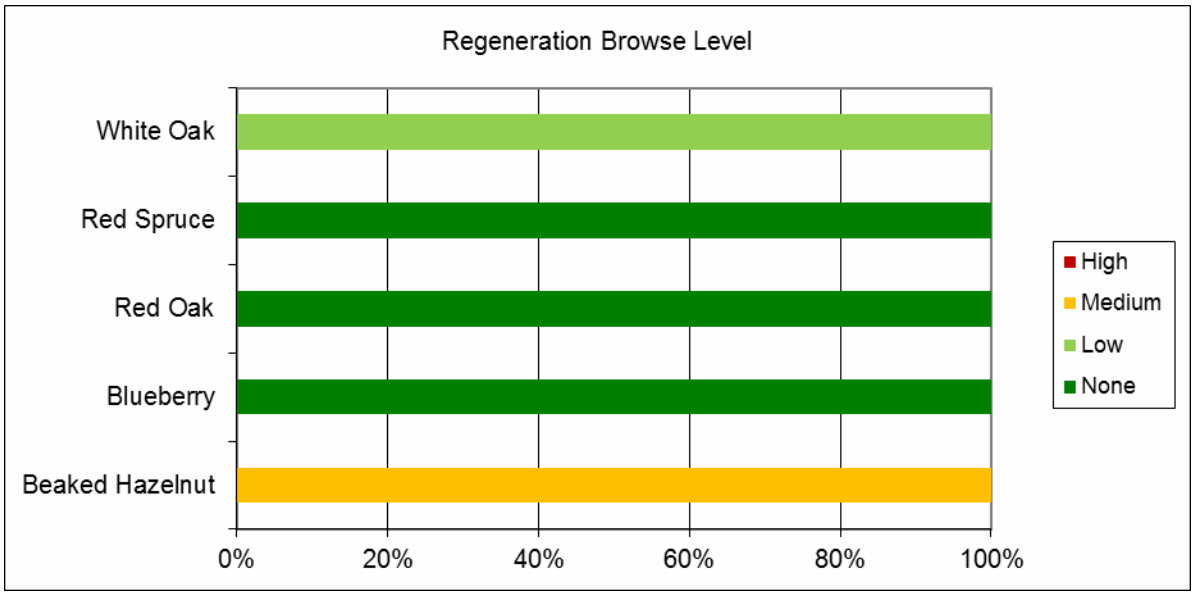
Graph 3.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 3.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 3.3: Vigor of regeneration and shrub species.



Graph 3.4: Browse level of regeneration and shrub species.

Table 3.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"			50.9	50.9
12-18"				
>18"				
Grand Total			**50.9**	**50.9**

Table 3.3: Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

Stand 4 White Pine 3/4A 12.8 acres

White pine dominates the forest on either side of the access road to the water treatment facility just beyond the gate at the airport terminal.

Volumes reported appear inflated compared to field observations, a result of poor data statistics.

This section of the airport ownership is slated for potential future development. Until that time, management here will continue to focus on improved growth and quality of the pine and establishment of the hardwood understory.

General attributes

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	80+/- years		
Stocking Level:	Overstocked		
Past Management History:	No recent management.		
Insects/Damage/Disease:	Typical white pine health issues including red rot, white pine blister rust, and weevil damage.		
Timber Quality:	Pine is dominant, and variable in quality due to age and health issues.		
Invasives:	Scattered buckthorn, bittersweet, and barberry noted.		
Total BA Per Acre:	198	Trees Per Acre:	186
Total AGS BA Per Acre:	93	% AGS Sawtimber:	70.0%
Quadratic MSD:	13.9	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak.

Silvicultural Objectives

Management system:	Multiple age management
Desired Composition:	Maintain pine and oak.
Crop tree target diameter:	RO 20+", WP 20"
Wildlife Management:	Mast tree release. Create/protect snags, cavity tree recruitment, down logs. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain

Access to Town Road and Landing Sites:	See Access Section above. Entire stand accessible within ownership and potential internal landing site. Stand adjacent to Water Treatment access road..
Truck/woods Roads:	Short truck road required to access landing off maintained road.
Terrain:	Gentle terrain, with minimal slope. Good ground and operable; avoid wetland areas using a 100 foot buffer following Good Forestry in the Granite State guidelines listed above.

General Description: Stand 4 includes about 13 acres of pine dominated upland forest located on either side of the water treatment facility access road, just beyond the gate at the airport terminal. This area has been flagged as a high priority for management and is a potential future conversion site. The stand is dominated by white pine, but includes a significant amount of red maple. The pine here is variable in quality and health, with typical pine health issues listed above. The volumes reported here are higher that actual do to sampling variability.

Regeneration is variable, including scattered red oak, some red maple, a fair amount of low bush blueberry, and light presence of beech, pine and aspen.

Along with treating this stand, a 1.1 acre conversion harvest will be prescribed on 1.1 acres adjacent to the airport terminal. This section is of similar structure to Stand 4, but will be converted out of forest use.

A 100 foot buffer will be established to protect the wetland that borders Stand 4 on the south. Management within the buffer will follow guidelines in the publication Good Forestry in the Granite State.

Silviculture Management Objectives: Management objectives in Stand 4 include improving growth on the best quality white pine while releasing existing regeneration and mid-story trees, and creating conditions conducive to new regeneration elsewhere. This will be accomplished through a modified seed tree harvest, leaving an even spacing of the best overstory pine totaling about 30 to 40 square feet of basal area.

Wildlife Habitat Improvement Objectives: Because there are no trails in this section, standing dead trees can be maintained or created in sections of the stand not adjacent to the road, but especially along the wetland edge. Maintain existing perch

trees on wetland edge. Elsewhere create or protect down logs.

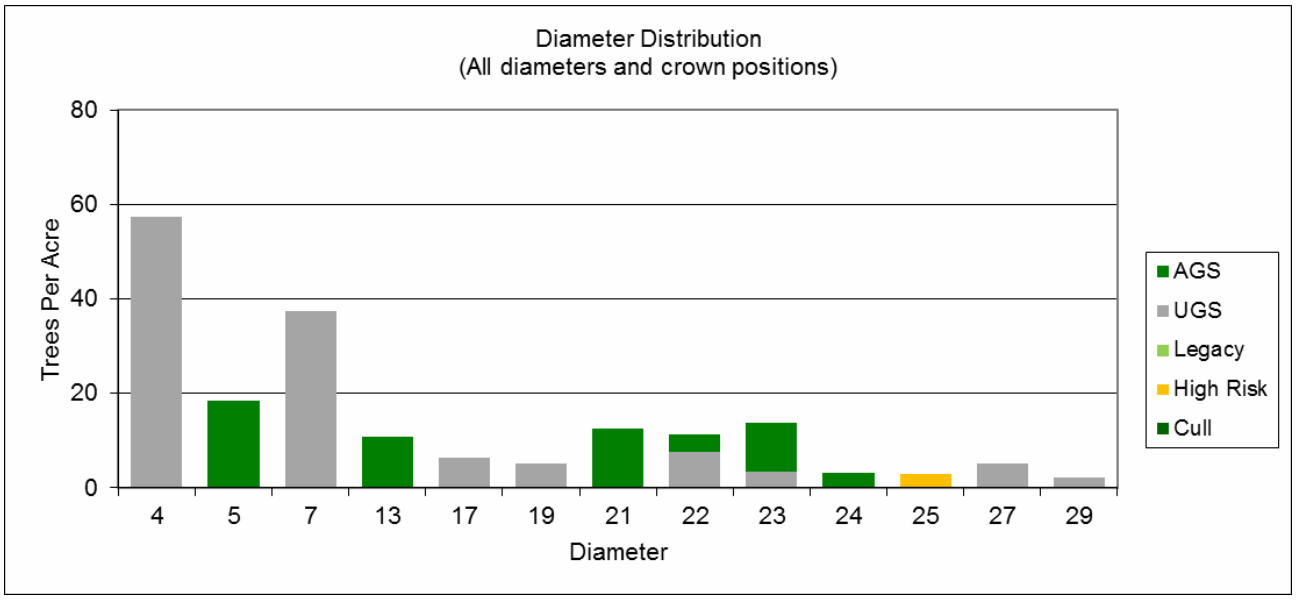
Management Actions:

2016:

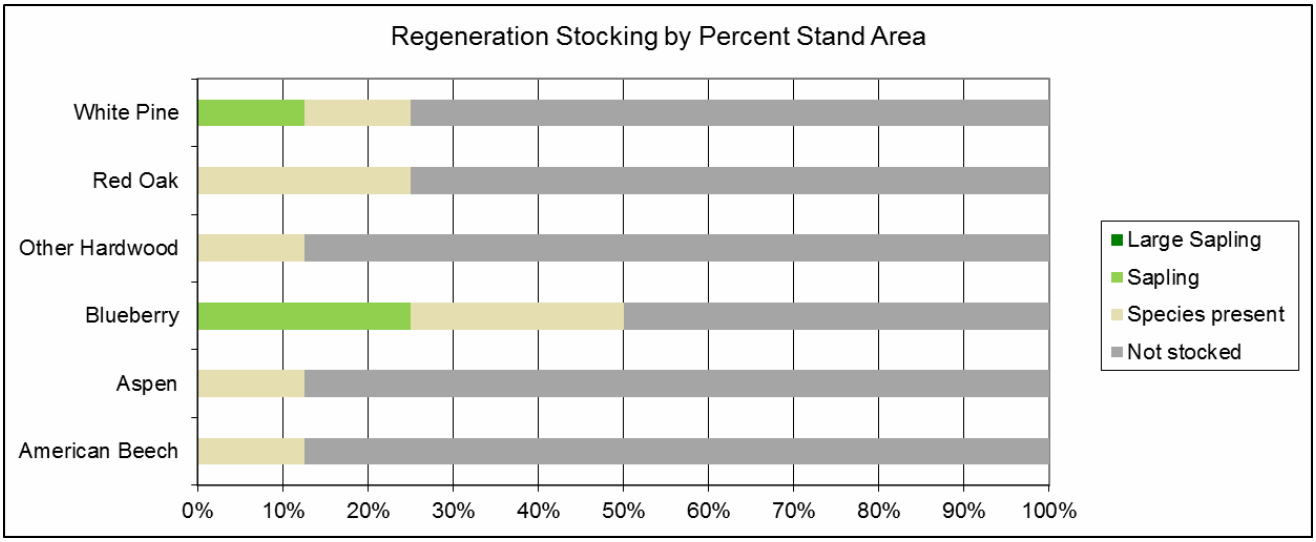
Modified Seed Tree to remove all but 30 to 40 square feet of the best overstory pine. Protect existing understory stocking as best as possible. In addition, complete harvest of conversion area adjacent to the terminal parking area.

Table 4.1: Forest Composition and Volume.

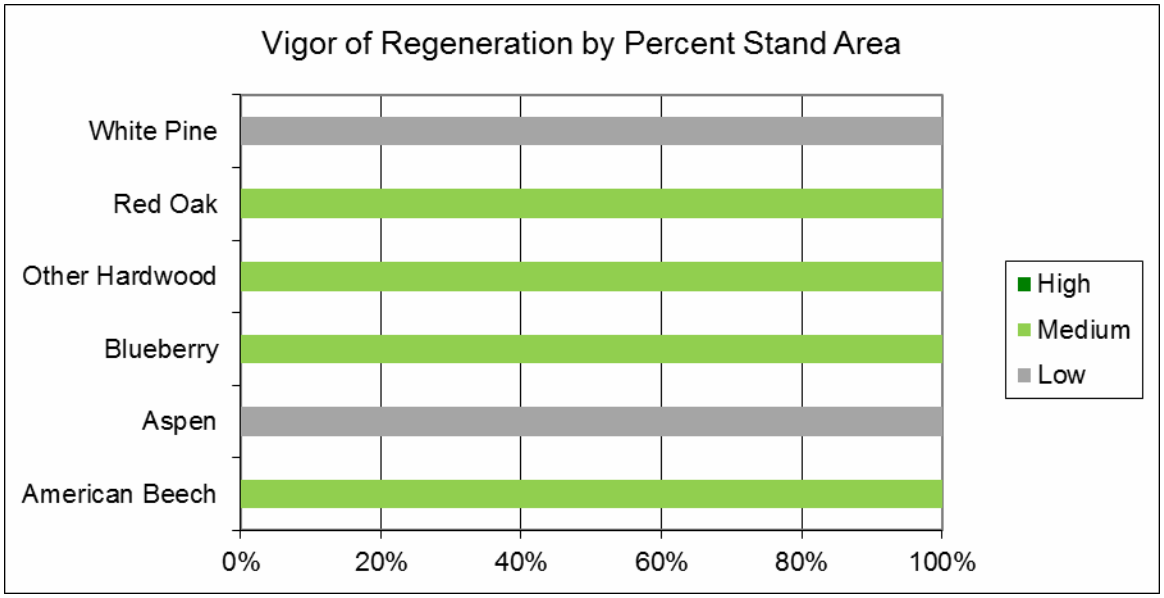
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Red Maple	43.6%	796	310	4	0.0	0.0	5.8	0	1,106	100%
Total Hardwood Per Acre:	***43.6%***	***796***	***310***	***4***	***0.0***	***0.0***	***5.8***	***0***	***1,106***	0%
										100%
White Pine	56.4%	14,250	10,210	34	0.0	0.0	75.8	1,504	16,800	0%
Total Softwood Per Acre:	***56.4%***	***14,250***	***10,210***	***34***	***0.0***	***0.0***	***75.8***	***1,504***	***16,800***	100%
Total Volume Per Acre:	**100.0%**	**15,047**	**10,520**	**38**	**0.0**	**0.0**	**81.5**	**1,504**	**17,906**	100%
Stand Volume:		**213,664**	**149,386**	**535**	**0**	**0**	**1,158**	**21,354**	**254,262**	



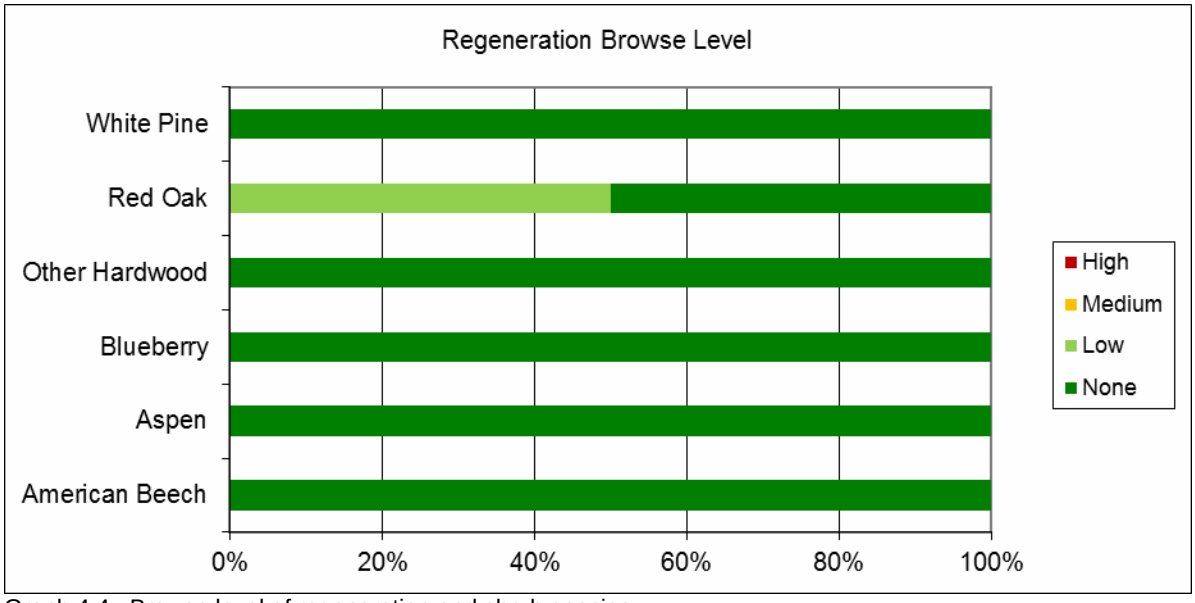
Graph 4.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 4.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 4.3: Vigor of regeneration and shrub species.



Graph 4.4: Browse level of regeneration and shrub species.

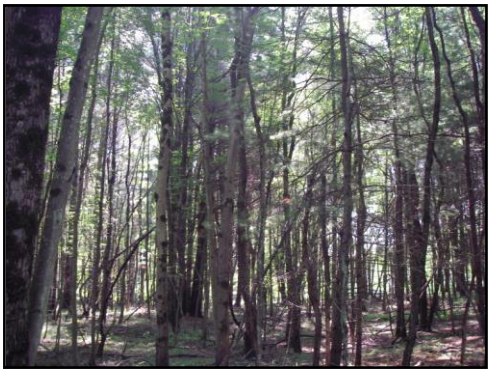
Table 4.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"				
12-18"				
>18"	6.6			6.6
Grand Total	**6.6**			**6.6**

Table 4.3: Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"				
12-18"		8.1		8.1
>18"				
Grand Total		**8.1**		**8.1**

Stand 5 Hardwood-White Pine 2-4AB 67.8 acres



Stand 5 includes multiple different areas of hardwood-pine forest. This is the bulk of the upland forest outside of Edgewood.

Like all forested areas on the ownership it borders wetlands, floodplain forest, or riparian areas (left photo).

In some sections, a sparse hardwood understory is becoming established (right photo).

Many of the pines here have small crowns, illustrating a relatively low vigor (left photo).

What often happens in sites like this, oak grows in under pine, and vice versa (right photo).

General attributes.

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	80+/- years		
Stocking Level:	Overstocked		
Past Management History:	No recent management.		
Insects/Damage/Disease:	Typical white pine health issues including red rot, white pine blister rust, and weevil damage.		
Timber Quality:	Pine is dominant, and variable in quality due to age and health issues.		
Invasives:	Scattered buckthorn, bittersweet, and barberry noted.		
Total BA Per Acre:	143	Trees Per Acre:	382
Total AGS BA Per Acre:	49	% AGS Sawtimber:	50.9%
Quadratic MSD:	8.3	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak

Silvicultural Objectives.

Management system:	Multiple Age. LOW PRIORITY.
Desired Composition:	Manage towards natural community type, focusing on oak, pine and scattered hemlock.
Crop tree target diameter:	Red oak 24"; White pine 24"
Wildlife Management:	Mast tree release. Create/protect snags, cavity tree recruitment, down logs. Consider patch opening for early successional habitat. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain.

Access to Town Road and Landing Sites:	Variable. All accessible to Water Treatment Facility Access Road. Wetland buffers greatly limit access and priority for management.
Truck/woods Roads:	Access to power line occurs just north of water treatment facility. Otherwise, no roads exist.
Terrain:	Gentle to moderate slope; wetlands, riparian zones and associated buffers greatly limit access and potential operability of site.

General Description: Stand 5 includes multiple non-contiguous sections of pine-hardwood upland forest, most of which occurs east of the powerline. About 11.5 acres of this stand, located on the east side of the water treatment facility access road somewhat southwest of the terminal area, is designated as medium priority harvest with a potential future conversion goal. Access to this section is through a 2.7 acre field on the access road. The other +/-56 acres of Stand 5 make up the remainder of the operable upland forest outside of the Edgewood Forest excluding Stand 4 and the +/- 8 acres of pole sized hardwood that make up Stand 6. Although active management is possible here, it is low priority. Given the amount of wetland and floodplain forest surrounding these areas, it best serves as a contiguous forest buffer. Additionally, because of the large percentage of open and edge habitat, mature contiguous forest serves an important function for the ownership in terms of wildlife habitat protection and enhancement. This is not to say management cannot or should not occur here, but if it does it should be in response to a specific objective and be geared towards maintaining continuous forest cover.

The stand is dominated by pine, which is of variable quality and health, typical conditions found in a largely unmanaged forest. The hardwood is a mix of oak and red maple, with scattered other species including cherry and aspen. Regeneration is typical of this forest type, with a mix of pine, oaks, hickory, red maple, beech, and a mix of shrubs including blueberry, viburnums, and beaked hazelnut with a presence of invasive exotic shrubs dominated by honeysuckle and buckthorn scattered throughout.

Silviculture Management Objectives: The objectives for the stand are different for the medium priority future conversion area and the rest of the low priority areas. For the future conversion area, management objectives are to improve growth on the best quality overstory trees white releasing existing regeneration and mid-story trees, and creating conditions conducive to new regeneration elsewhere. Use a modified seed tree harvest similar to that recommended for Stand 4, leaving the best quality 30 to 40 square feet of overstory pine and oak. Time harvest with good acorn production. 2016 is proving to be an excellent oak seed year, with good seed years occurring approximately every 3 to 5 years for oak and 3 to 10 years for pine.

Utilize 100 foot wetland buffer guidelines recommended in Good Forestry in the Granite State.

Elsewhere in the low priority areas, silviculture treatments are not recommended during this planning period, unless higher priority is given to timber production in the ownership objectives. In that case, continue with modified seed tree style harvest in patches, but use more conservative management within the 100 foot wetland buffers. Within the buffers, retain at least b-line stocking (100 square feet). Maintaining forested wetland buffers at the B-line will eliminate many of the small sections of Stand 5 for active management using Seed Tree silviculture because the sections are not large enough to include areas beyond the buffer.

Wildlife Habitat Improvement Objectives: Because there are no trails in this section, standing dead trees can be maintained or created in sections of the stand not adjacent to the road, but especially along the wetland edge. Maintain existing perch trees on wetland edge. Elsewhere create or protect down logs.

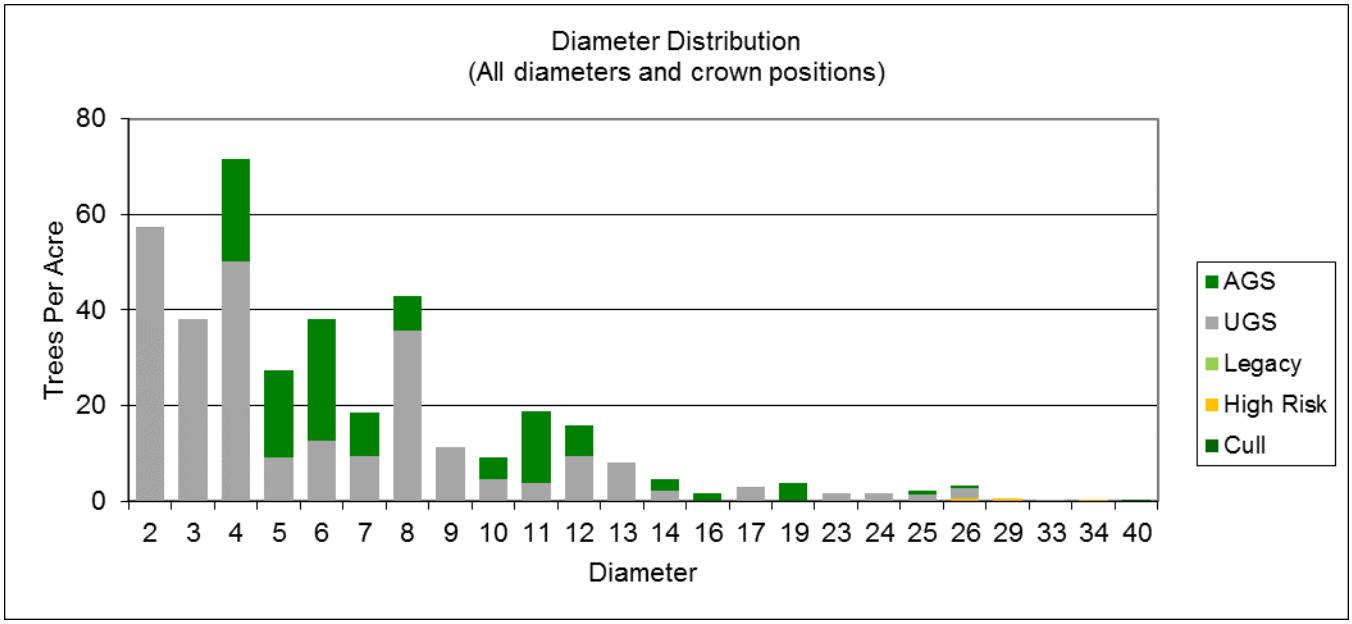
Management Actions:

2016:

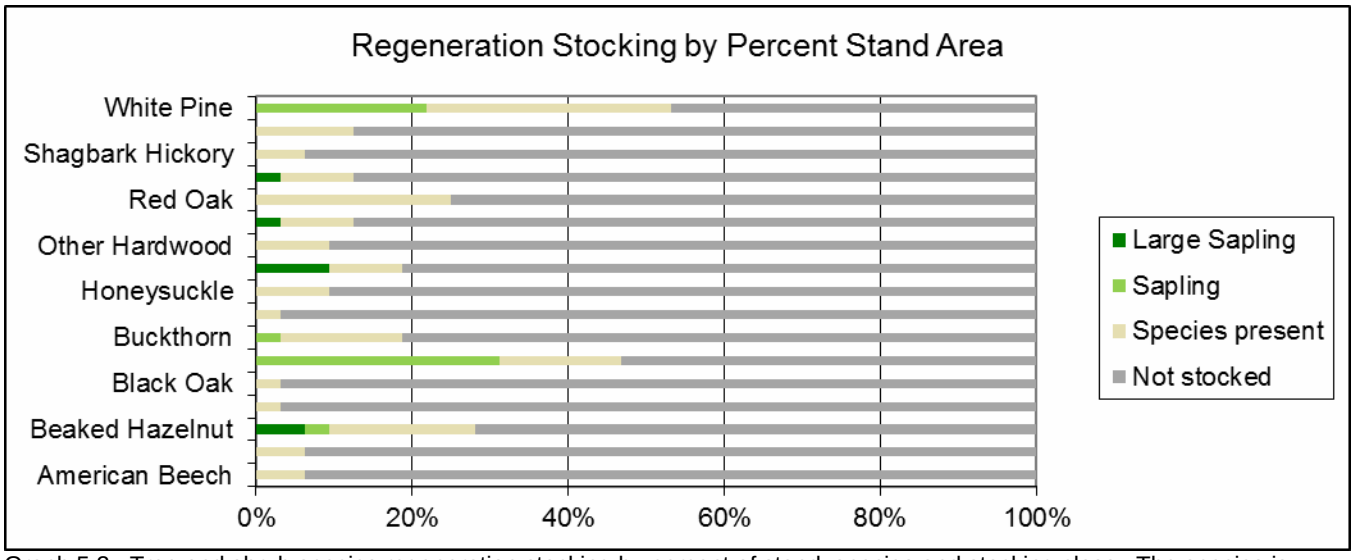
Modified Seed Tree to remove all but 30 to 40 square feet of the best overstory pine and oak in the 11.6 acres future conversion area. Protect existing understory stocking as best as possible. Use 100 foot wetland buffer as recommended in Good Forestry in the Granite State. Elsewhere, leave to develop naturally.

Table 5.1: Forest Composition and Volume.

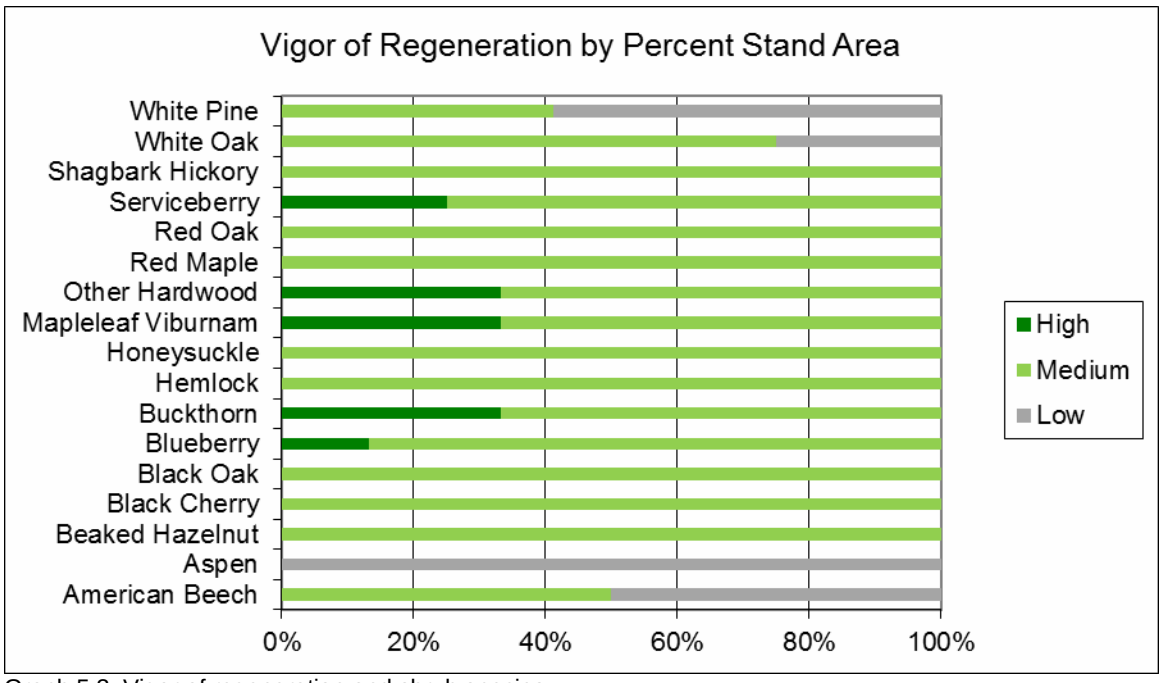
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Aspen	17.3%	193	115	4	0.0	0.0	4.3	0.0	193	63%
Black Cherry	19.9%	0	0	3	0.0	0.0	2.6	0.0	0	0%
Black Oak	3.1%	437	74	1	0.4	0.0	2.4	130.0	380	75%
Red Maple	31.6%	205	213	8	0.2	0.0	8.9	0.0	212	51%
Red Oak	8.9%	163	0	2	0.6	0.0	3.4	0.0	163	100%
Total Hardwood Per Acre:	***80.7%***	***998***	***402***	***18***	***1.1***	***0.0***	***21.5***	***130.0***	***948***	68%
White Pine	19.3%	3,073	970	12	0.0	0.0	19.6	406.7	1,821	45%
Total Softwood Per Acre:	***19.3%***	***3,073***	***970***	***12***	***0.0***	***0.0***	***19.6***	***406.7***	***1,821***	45%
Total Volume Per Acre:	**100.0%**	**4,071**	**1,372**	**30**	**1**	**0**	**41**	**537**	**2,769**	51%
Stand Volume:		**276,003**	**93,014**	**2,011**	**78**	**0**	**2,788**	**36,391**	**187,741**	



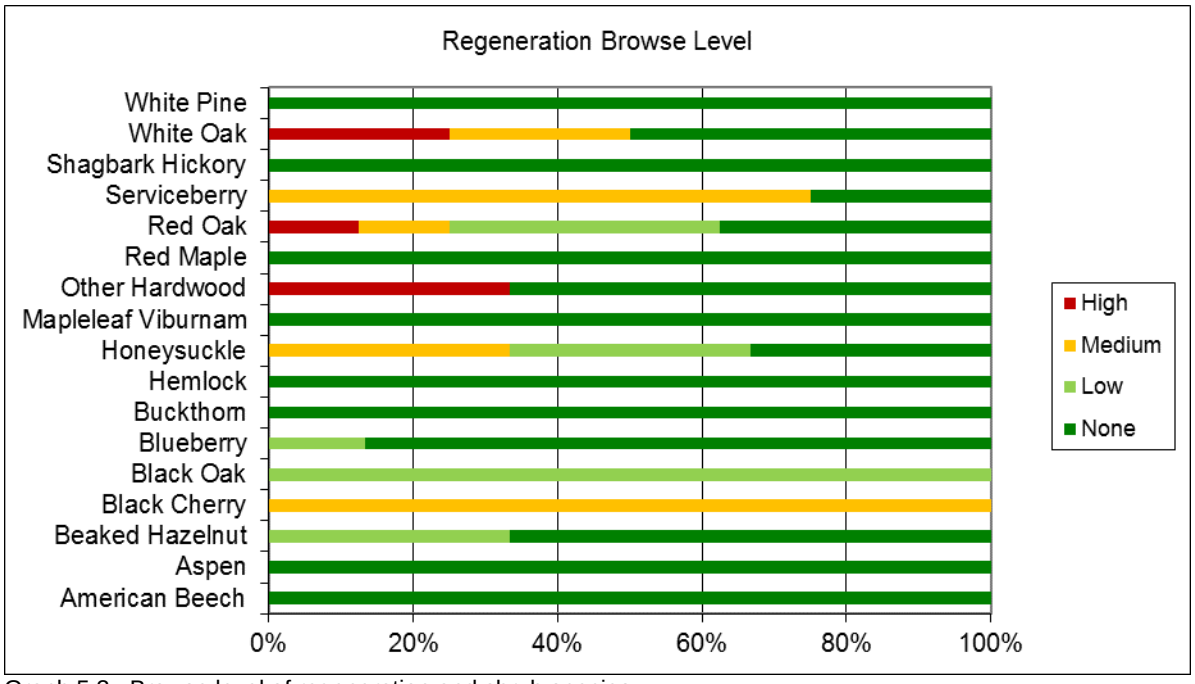
Graph 5.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 5.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered “stocked” if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 5.3: Vigor of regeneration and shrub species.



Graph 5.3: Browse level of regeneration and shrub species.

Table 5.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"	3.8		5.7	9.4
12-18"				
>18"				
Grand Total	**3.8**		**5.7**	**9.4**

Table 5.3 Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

Stand 6 Young Mixed Hardwood 2A 8.1 acres

This section of forest was cleared about 30 years ago, and is adjacent to open land surrounding the runways.

The forest here is densely stocked with hardwoods, dominated by red maple with a few scattered red oak.

In some sections dense patches of fern have become established (left photo).

And stumps can be found throughout the stand, evidence of the last harvest event.

General attributes.

Natural Community Type:	Mesic Appalachian oak-hickory forest		
Stand Age:	25+/- years		
Stocking Level:	Overstocked		
Past Management History:	No recent management after stand initiation.		
Insects/Damage/Disease:	No serious disease concerns. Natural thinning occurring due to overstocked conditions.		
Timber Quality:	Young stand. Best potential for timber in red oak.		
Invasives:	None noted, but likely occurrences including buckthorn, barberry, and bittersweet.		
Total BA Per Acre:	93	Trees Per Acre:	800
Total AGS BA Per Acre:	13	% AGS Sawtimber:	0%
Quadratic MSD:	4.6	Site Quality:	Well drained outside of wetland areas. Group 1C soils best suited for white pine and oak

Silvicultural Objectives.

Management system:	Convert to Multiple Age.
Desired Composition:	Manage towards natural community type, focusing on oak.
Crop tree target diameter:	Red oak 24"
Wildlife Management:	Mast tree release. Create/protect snags, cavity tree recruitment, down logs. Consider patch opening for early successional habitat. Review wildlife habitat management guidelines in "Habitat Management Approach" above.

Access and Terrain.

Access to Town Road and Landing Sites:	Access to Water Treatment Facility road requires drainage crossing. No existing landing site.
Truck/woods Roads:	No existing roads or trails within Stand.
Terrain:	Gentle slope; adjacent to large wetland system.

General Description: Stand 6 has similar structure to Stand 3, but occurs outside of Edgewood Forest, occupying about 8 acres adjacent to the open land and wetland surrounding the runway above the water treatment facility. This young hardwood stand grew up after the overstory was removed about 30 years ago. It is dominated by hardwood, especially red maple but with scattered nice oak. Like Stand 3, this section of forest is a good illustration of the expected growth after the modified overstory removal in Stand 1 if it were left unmanaged. At this point in time, the forest will be left to develop naturally, as the dominant trees assert themselves, a process called stem exclusion in forestry terms.

Silviculture Management Objectives: Long term objectives for this area is an oak dominated forest, managed primarily for wildlife. Manage should discriminate against pine here because of proximity to runways and the flight path. Retain and protect all oak. Should opportunity for a stand-wide non-commercial treatment arise, thin the stand to the b-line (60 to 80 square feet) managing for best quality oak and discriminating against all pine. Otherwise, for the time being allow stand to continue to develop naturally in the stem exclusion stage.

Wildlife Habitat Improvement Objectives: Short term objectives are to promote oak for mast. As the forest develops, opportunities may arise for the creation and maintenance of standing dead trees and down logs to improve habitat.

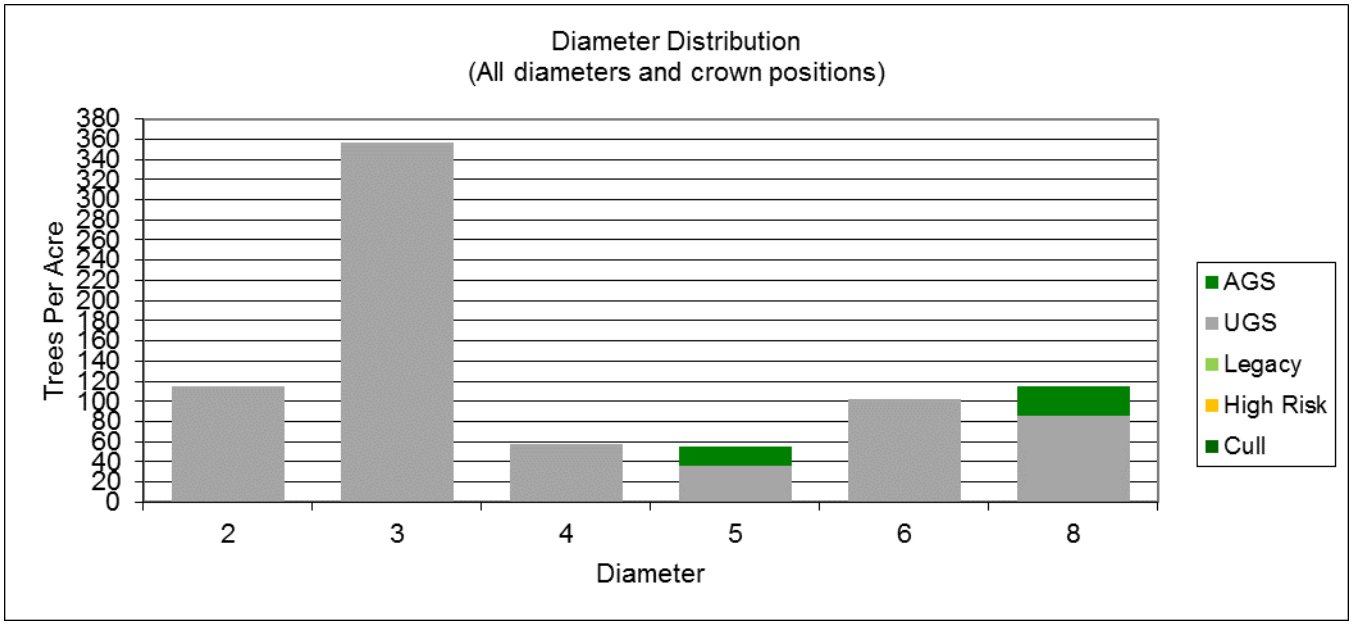
Management Actions:

ASAP:

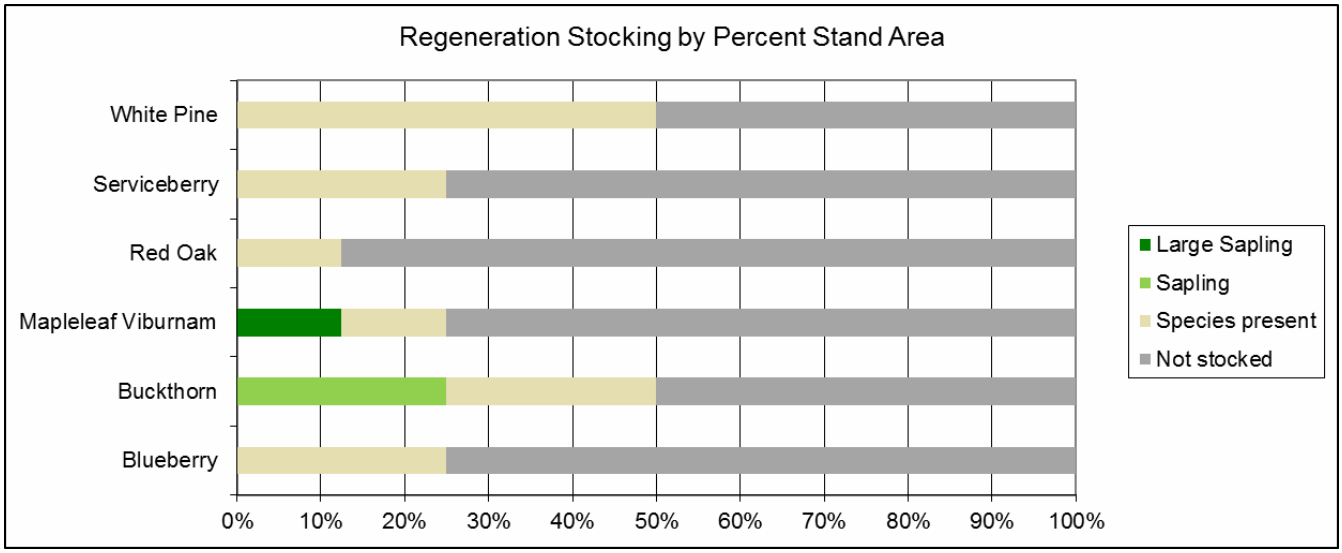
Stand-alone Non-commercial Manual Improvement Operation (If operator is found to work manually in Stand 3, consider continuing work here, but giving Stand 3 priority) prioritizing areas along trails and with high aesthetic objectives to improve aesthetics, improve wildlife habitat, release desired crop trees (oak), and remove pine, Retain all healthy hemlock. Keep trails clear, be mindful of aesthetics, and lop all downed wood and debris to within 3 feet of the ground, keeping debris away from trails.

Table 6.1: Forest Composition and Volume.

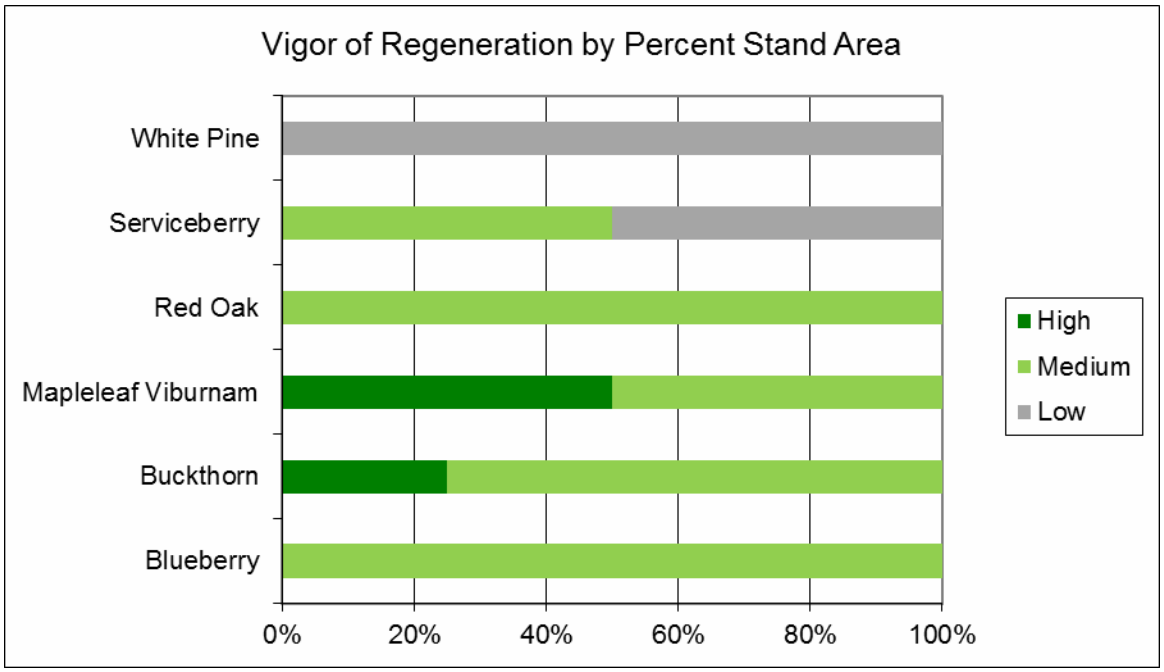
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Black Cherry	13.2%	0	0	2	0	0	2	0	0	0%
Red Maple	86.8%	0	0	11	0	0	11	0	0	0%
Total Hardwood Per Acre:	***100.0%***	***0***	***0***	***13***	***0***	***0***	***13***	***0***	***0***	0%
Total Volume Per Acre:	**100.0%**	**0**	**0**	**13**	**0**	**0**	**13**	**0**	**0**	100%
Stand Volume:		**0**	**0**	**105**	**0**	**0**	**105**	**0**	**0**	



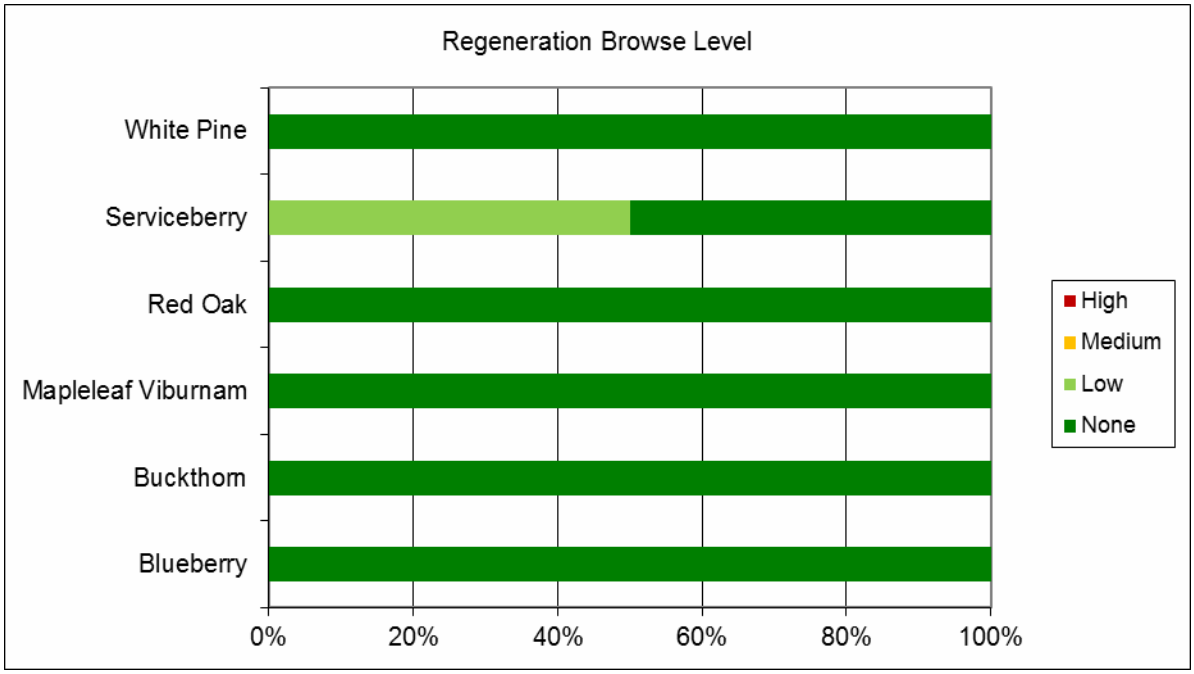
Graph 6.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 6.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 6.3: Vigor of regeneration and shrub species.



Graph 6.4: Browse level of regeneration and shrub species.

Table 6.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"				
12-18"				
>18"				
Grand Total				**0**

Table 6.3 Down logs per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

Stand 7 Silver Maple-false nettle-sensitive fern floodplain forest 122.4 acres

Stand 7 includes the floodplain forest sections of the ownership. It occurs throughout the ownership, and is one of the largest examples of the Silver Maple-false nettle-sensitive fern natural community type on a medium size river in New Hampshire.

The forest stocking is variable, with some areas more open due to past disturbances, and others with more dense stocking (left photo).

Picture of the false nettle that occurs throughout the floodplain forest (right photo).

Painted turtles sunning themselves on a emergent log in one of the riparian drainages which feeds into the Ashuelot River (left photo).

Swamp white oak, a relatively uncommon trees species in New Hampshire, can be found throughout the floodplain forest (right photo).

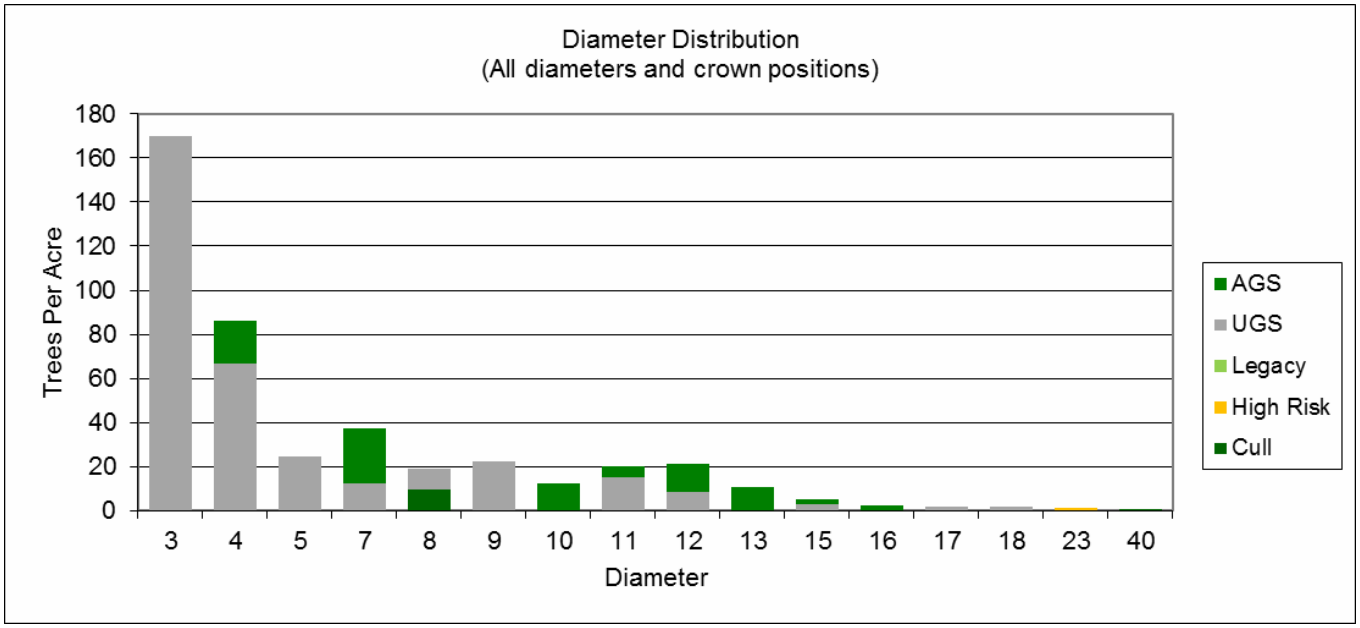
General attributes.

Natural Community Type:	Silver Maple-false nettle-sensitive fern forest		
Stand Age:	80+ years		
Stocking Level:	Fully to Overstocked		
Past Management History:	No recent management.		
Insects/Damage/Disease:	No serious diseases noted.		
Timber Quality:	Not applicable. Not managed for timber resources.		
Invasives:	Scattered buckthorn, barberry, bittersweet.		
Total BA Per Acre:	119	Trees Per Acre:	438
Total AGS BA Per Acre:	45	% AGS Sawtimber:	80.0%
Quadratic MSD:	7.1	Site Quality:	Some enriched soils here.

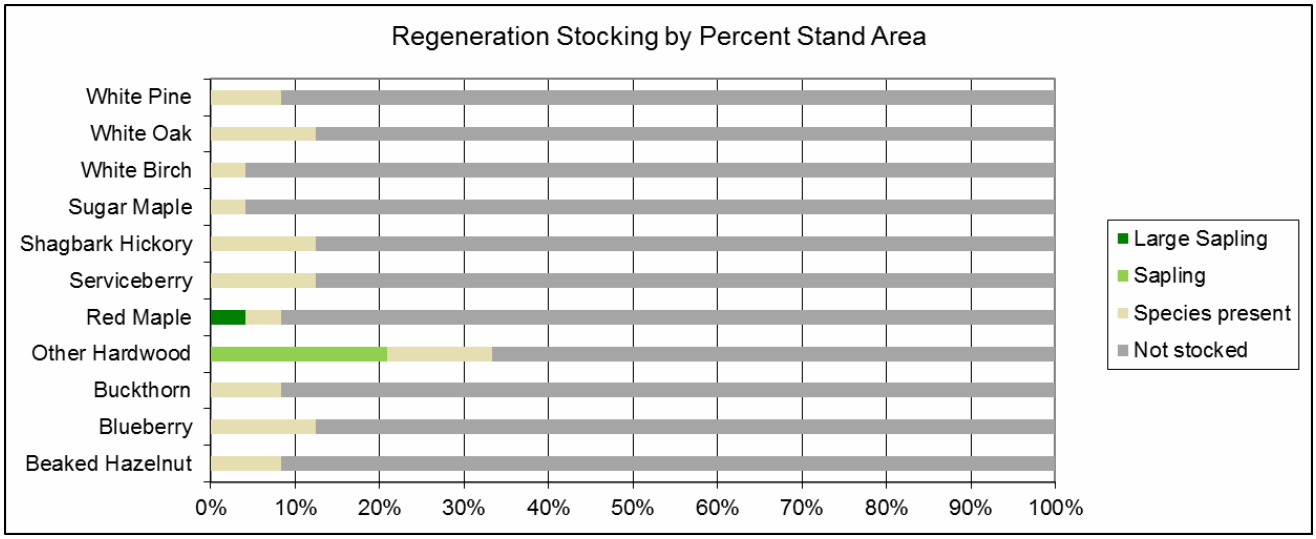
General Description: Stand 7 makes up the residual forest areas, dominated by the Silver maple-false nettle-sensitive fern forest. It is a floodplain forest, associated with the Ashuelot River and corresponding riparian tributaries and wetlands. It has been documented that the Dillant Hopkins Airport ownership hosts one of the largest examples of this natural community type on a medium size river in the state. To protect the important function of this area and the associated rare, threatened and endangered species and community types, this stand will be left to develop naturally, except for the recommendation to hand pull invasive exotic shrubs whenever found. More detailed information on this forest type can be found in the natural community section above.

Table 7.1: Forest Composition and Volume.

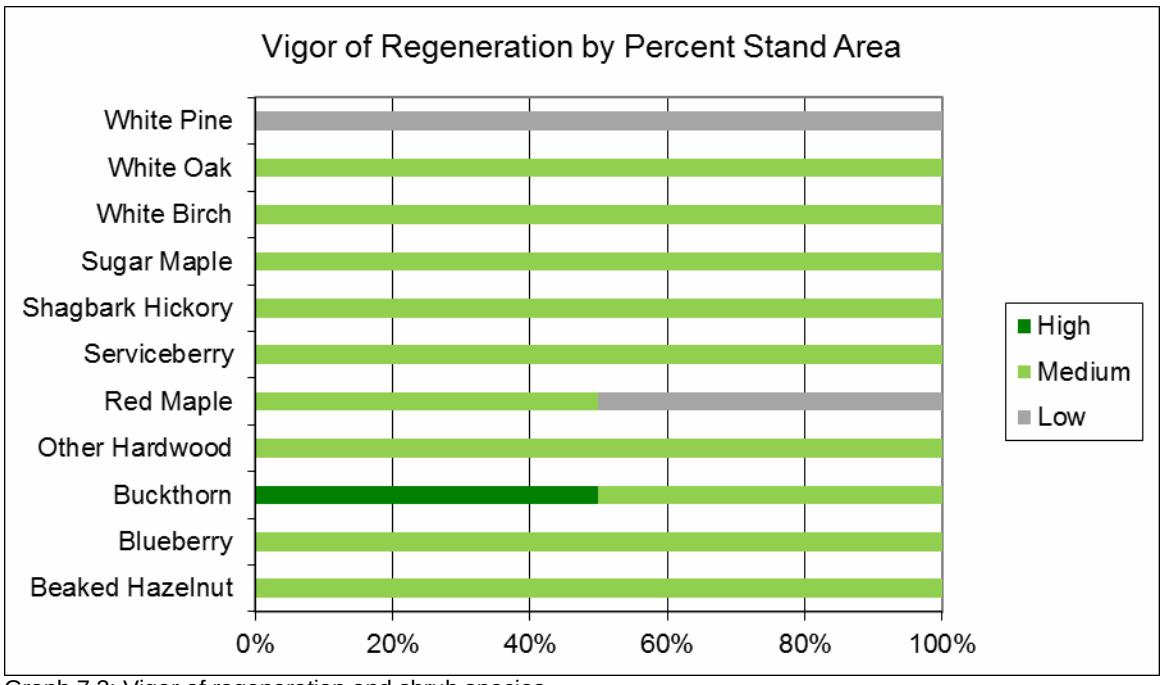
Species	% TPA	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Legacy (cd)	Total Volume in Cords	High Risk	AGS Saw	% AGS Saw
Aspen	1.7%	0	0	1	0.0	0.0	1.1	0.0	0	0%
Black Cherry	6.1%	0	0	0	0.0	0.0	0.3	0.0	0	0%
Other Hardwood	6.1%	0	0	0	0.0	0.0	0.0	0.0	0	0%
Red Maple	85.9%	1,559	489	20	2.0	0.0	25.2	304.6	1,639	80%
Total Hardwood Per Acre:	***99.8%***	***1,559***	***489***	***21***	***2.0***	***0.0***	***26.6***	***304.6***	***1,639***	80%
Total Volume Per Acre:	**100.0%**	**1,559**	**489**	**21**	**2**	**0**	**27**	**305**	**1,639**	80%
Stand Volume:		**35,084**	**11,009**	**465**	**45**	**0**	**598**	**6,855**	**36,872**	



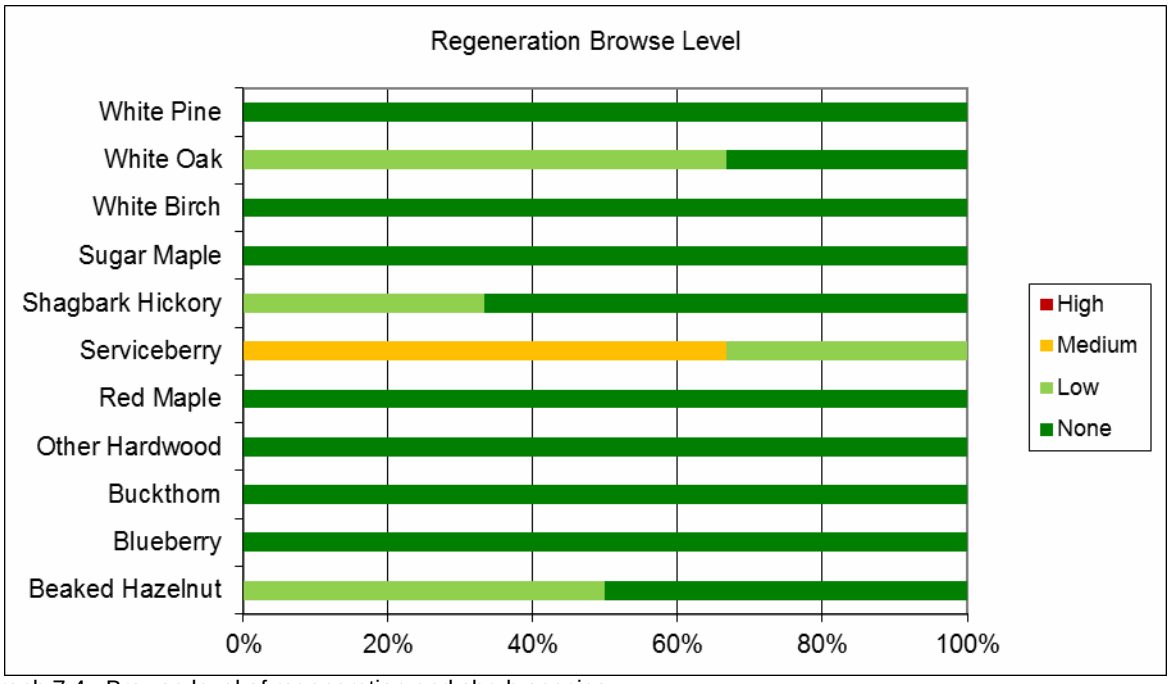
Graph 7.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



Graph 7.2: Tree and shrub species regeneration stocking by percent of stand, species and stocking class. The species is considered “stocked” if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 7.3: Vigor of regeneration and shrub species.



Graph 7.4: Browse level of regeneration and shrub species.

Table 7.2: Snags per acre by size and decay class.

DBH Class	Moderately punky	Punky throughout	Sound	Grand Total
<12"	17.0	7.5		24.5
12-18"			3.6	3.6
>18"	1.7			1.7
Grand Total	**18.7**	**7.5**		**29.8**

Table 7.3

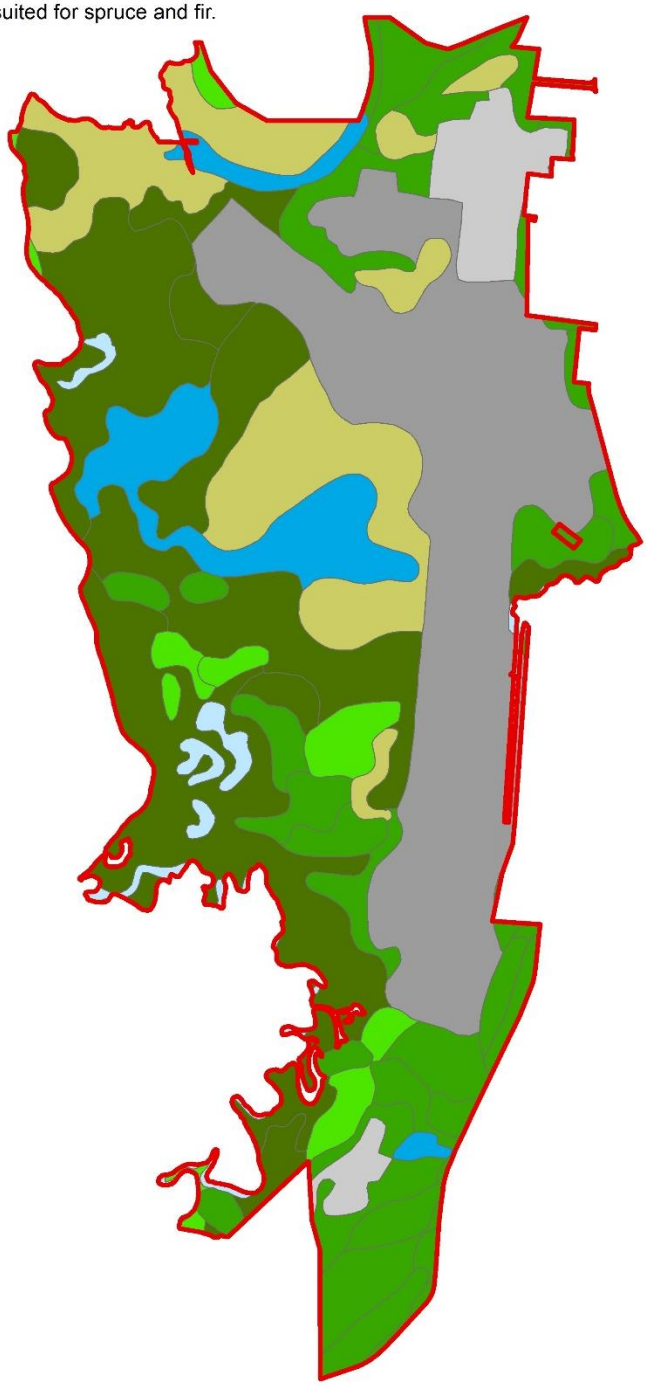
DBH Class	Moderately punky	Punky throughout	Grand Total
<12"			
12-18"			
>18"			
Grand Total			**0**

APPENDIX – A

City of Keene Dillant Hopkins Airport

Soils Map and Soils Information

Group IA: More fertile. Best suited for high quality hardwoods such as sugar maple.
Group IC: Best suite for white pine
Group IIB: Poorly drained. Best suited for spruce and fir.
Non-Commercial. Wetland soils.
Gravel Pit
Udorthents, smoothed
Ponded
Water



DILLANT HOPKINS AIRPORT KEENE

City of Keene
SOILS MAP
Dillant Hopkins Airport
Swanzey, NH
888 Acres per tax map

Map Notes:
Soils information from USDA SSURGO

16w
North

THE STATE OF NEW HAMPSHIRE LAURA FRENCH No. 405 LICENSED PROFESSIONAL FORESTER

Map created by:
Laura French MTL/TEMCO
PO Box 966 New London, NH 03257
603-526-8686 MTLFORESTS.COM
October, 2016

ECOSYSTEM MANAGEMENT CO.

APPENDIX – B

Forestry Terms For The Woodland Owner

Forestry terms for the woodland owner

Carol B.Trokey, The School of Natural Resources
Fred Bergman, Missouri Department of Conservation
Updated by Jeffrey Smith

As a woodland owner, you may hear or see unfamiliar terms used by foresters or in your forest management plan or timber sale contract. Forestry is a specialized field with its own terms and abbreviations. This guide will define many of the terms commonly used in forestry and woodland management.

Acre - An area of land containing 43,560 square feet.
Advanced Reproduction - Young trees established before a regeneration cutting.
Aspect - The direction that a slope faces (north, south, etc).
Basal Area - The cross-sectional area of a tree, in square feet, at 4.5 feet from the ground (breast height). When the basal area of all trees in a stand are summed, the result is expressed as square feet of basal area per acre, which is a measure of a stand's density.
Biltmore Stick - A graduated stick used to estimate tree diameters by holding it against the tree at breast height.
Board Foot - A unit for measuring wood volumes. It is commonly used to express the amount of wood in a tree, sawlog or individual piece of lumber. A piece of wood one foot long, one foot wide and one inch thick (144 cubic inches).
Bolt - A short log or a squared timber cut from a log, usually less than 8 feet long.
Browse - Twigs and buds of small shrubs and trees eaten by deer and livestock.
Buck - To saw felled trees into shorter lengths.
Buffer Strip - A protective strip of land or timber adjacent to an area requiring attention or protection. For example, a protective strip of unharvested timber along a stream.
Cambium - The growing layer of cells beneath bark of a tree from which new wood and bark develop.
Canopy - The more or less continuous cover of branches and foliage formed collectively by the tops (crowns) of adjacent trees.
Cavity Tree - See Den Tree.
Chain - A unit of linear measurement; 66 feet.
Clearcut - A harvest and regeneration technique that removes all trees from an area. Also called a regeneration cut.
Clinometer - An instrument for measuring vertical angles or slopes.
Co-Dominant Tree - Trees whose crowns form the general level of the forest canopy and receive full sunlight only from above.
Conifer - A cone-bearing tree with needles, such as pines, spruces and firs that produces wood commonly known as softwood.
Cord - A stack of wood containing 128 cubic feet. A standard cord measures 4 feet X 4 feet X 8 feet of wood and air.
Crop Tree - A tree identified to be grown to maturity for the final harvest cut, usually on the basis of its location with respect to other trees and its timber quality.
Crown - The branches and foliage of a tree.
Cruise - A survey of forest land to locate timber and estimate its quantity by species, products, size, quality or other characteristics; the estimate obtained in such a survey.
Cruiser Stick - See Biltmore.
Cull - A tree or log of merchantable size that, because of a defect, is useless for its intended purpose.
DBH - See Diameter Breast Height.
Defect - That portion of a tree or log which makes it unusable for the intended product. Defects include rot, crookedness, cavities and cracks.
Den Tree - A living tree with a hollow cavity in the top large enough to shelter wildlife. Also called cavity

tree.
Dendrology - The study of the identification of trees.
Diameter Breast Height (DBH) - The diameter of a tree at 4.5 feet above the ground.
Diameter Inside Bark (DIB) - The diameter inside the bark; used in log scaling.
Diameter Tape - A specially graduated tape used to directly determine tree diameter when stretched around the circumference of the tree stem.
Dibble Bar - A flat or round metal tool used to make holes for planting seedlings.
Dominant Tree - Tree with its crown above the general level of the canopy that receives full sunlight from above and partial light from the sides.
Edge - In wildlife management, the area where the variety of types of food, cover, water or terrain required by a particular species come together.
Even-Aged Management - Forest management with periodic harvest of all trees on part of the forest at one time, or over a short period to produce stands containing trees all the same or nearly the same age or size.
Face Cord - A stack of wood 4 feet high and 8 feet long, composed of logs of varying length.
Felling - The process of cutting standing trees.
Firebreak - A natural or constructed barrier utilized to stop or check fires.
Firsts and Seconds (FAS) - The highest standard grade for hardwood lumber.
Forest - A plant community dominated by trees and other wood plants.
Forest Inventory - See Cruise.
Forest Type - A group of tree species that, because of their environmental requirements, commonly grow together. Example - the oak-hickory type.
Forester - A person who has been professionally educated in forestry at a college or university.
Girdling - Completely encircling the trunk of a tree with a cut that severs the bark and cambium of the tree, usually resulting in the death of the tree.
Grading - Evaluating and sorting trees, logs or lumber according to quality.
Habitat - The type of place in which the plant or animal lives, such as forest habitat, grassland habitat and marsh habitat.
Hardwood - A term describing broadleaf trees, usually deciduous, such as oaks, maples, ashes, etc.
Harvest - In general use, removing all or portions of the trees on an area. It can mean removing trees on an area to 1) obtain income, 2) develop the environment necessary to regenerate the forest, and on occasions, 3) to achieve special objectives such as development of special wildlife habitat needs, in contrast with intermediate cuttings.
Heel-In - To store young trees before planting by placing in trench and covering roots with soil.
Height, Merchantable - Tree height up to which a particular product may be obtained. For example, if 8-inch minimum diameter sawlogs were being cut from a tree, its merchantable height would be its height up to a diameter of 8 inches.
Height, Total - Tree height from ground level to top.
High-Grading - Cutting only the high value trees from a forest property.
Hypsometer - A graduated stick used to estimate tree height. It is often combined with a Biltmore stick.
Increment Borer - An auger-like instrument with a hollow bit, used to extract cores from trees for growth and age determination.
Intermediate Cut - Removing immature trees from the forest sometime between establishment and stand harvest to improve the quality of the remaining forest stand. Contrast with a harvest cut.
Intermediate Trees - Trees with crowns below the general level of the canopy, receiving some sunlight from above but none from the sides.
Landing - A place where logs are taken to and loaded on trucks for transport to mill.
Log Rule - A table showing estimated amount of lumber that can be sawed from logs of given lengths and diameters. Commonly used in Missouri are:
1. Doyle Rule is a simple formula used in the eastern and southern United States; it underestimates the amount of lumber in small logs and overestimates large logs.

2. International 1/4" Rule is a formula rule allowing 1/2" taper for each 4 feet of length and 1/16" shrinkage for each one-inch board; closely approximates the actual sawmill lumber tally.
Logger - An individual whose occupation is harvesting timber.
Lump Sum Timber Sale - Standing timber is sold for a fixed amount agreed upon in advance; the sale may cover a given acreage, tracts, certain species or diameter classes of trees. Distinguished from a scale or unit sale in which payment is based on the amount harvested (e.g. so much per thousand board feet).
Mast - Nuts of such trees such as oak, walnut and hickory that serve as food for many species of wildlife.
Mature Tree - A tree that has reached the desired size or age for its intended use.
MBF - Abbreviation for One Thousand Board Feet.
Merchantable - The part of a tree or stand of trees that can be manufactured into a salable product.
Multiple Use - Land management for more than one purpose, such as wood production, water, wildlife, recreation, forage and aesthetics.
Overstocked - Forest or stand condition where more trees are present than at normal or full stocking.
Overstory - That portion of the trees in a stand forming the upper crown cover.
Overtopped - See Suppressed Trees.
Pallet - Tray constructed from wood used to store, load and unload various materials.
Planting Bar - A hand tool used to plant seedlings. (See Dibble Bar)
Plot Sample Cruise - A method of estimating standing timber, stocking or volume whereby all trees above a minimum diameter are tallied on plots with fixed boundaries.
Point Sample Cruise - A method for estimating standing timber, stocking or volume without establishing sample plot boundaries. An instrument such as a prism is used to make a 360^{o} sweep from a series of sampling points, counting at each the number of stems that breast-height diameters appear larger than the fixed angle of the instrument. The average stem number multiplied by a factor appropriate to both the fixed angle and the units of measurement chosen gives the basal area per unit area of stand. (Also called variable plot sampling, prism cruising)
Pole Saw - A saw attached to a long pole for pruning tree limbs without using a ladder.
Pole Timber - Trees from 6" to 12" in diameter at breast height.
Prescribed Burning - Use of controlled fire to dispose of unwanted material, following a planned prescription of fuel, weather or other conditions.
Props - In mining, a round, squared or split timber that supports the roof.
Prism, Wedge - An instrument that incorporates a fixed angle and can be used to determine basal area. See Point Sample Cruise.
Pruning - Removing live or dead branches from standing trees to improve wood quality.
Pulpwood - Wood cut primarily for manufacture of paper, fiberboard or other wood fiber products.
Regeneration Cut - See Clearcut.
Release - To free trees from competition by cutting, removing or killing nearby vegetation.
Reproduction - Young trees. The process by which a forest is renewed; either artificially by direct seeding or planting or naturally by self-sown seeds and sprouts.
Riparian Zone - The area adjacent to, or on the bank of, rivers and streams. Identified by vegetation, wildlife, and other characteristics unique to these locations.
Rotation - The number of years required to establish and grow trees to a specified size, product or condition of maturity. For example, oaks may have an 80-year rotation for sawlogs and Scotch pine a 10-year rotation for Christmas trees.
Salvage Cut - Harvesting damaged or defective trees for their economic value.
Sapling - Trees from 2" to 6" in diameter at breast height.
Sawtimber - Trees 12" diameter breast height and larger, from which a sawn product can be produced.
Scale Stick - A flat stick calibrated so log volumes can be read directly when the stick is placed on the small end of a standard log.
Scaling - Estimating usable wood volume in a log.
Seed Tree Harvest - Removing nearly all trees from the harvest area at one time, but leaving a few

scattered trees to provide seed for a new forest. Sometimes used in Missouri to regenerate pine.
Seedlings - New trees growing from seeds or sprouts less than 2" in diameter at breast height. Also, trees grown in a nursery for one or more years.
Selection Harvest - Harvesting of trees in small groups or as individual trees at periodic intervals to maintain an uneven-age stand. May be described as single tree or group selection system.
Shade Tolerance - The capacity of a tree to develop and grow in the shade of and in competition with other trees. An example of high shade tolerance is sugar maple.
Shearing - To trim back and shape tree branches, making foliage dense and giving the tree a conical form. Used to produce Christmas trees.
Shelterwood Harvest - A harvesting method that entails a series of partial cuttings over a period of years in the mature stand. Early cuttings improve the vigor and seed production of the remaining trees. The trees that are retained produce seed and also shelter the young seedlings. Subsequent cuttings harvest shelterwood trees and allow the regeneration to develop as an even-aged stand.
Silviculture - The art and science of producing and tending a forest.
Site - 1) A tract of land with reasonably uniform soil and climatic factors; 2) an area evaluated for its ability to produce a particular forest or other vegetation based on the combination of biological, climatic and soil factors.
Site Index - An expression of forest site quality based on the height of a free-growing dominant tree at age 50. (or age 100 in western United States).
Site Preparation - Preparing an area of land for forest establishment. May include clearing, chemical vegetation control or burning.
Skid Trail - A road or trail over which equipment or horses drag logs from the stump to a landing.
Skidding - Pulling logs from where they are cut to a landing or mill.
Slash - Debris left after logging, pruning, thinning or brush cutting. May include tree tops, branches, bark or debris left after wind or fire damage.
Snag - A standing dead tree from which leaves and most of branches have fallen. Used for wildlife.
Softwoods - See Conifer.
Stand - A grouping of trees with similar characteristics (such as species, age, or condition) that can be distinguished from adjacent groups. A stand is usually treated as single unit in management plan.
Stave Bolts - Material cut from the white oak group and used in the manufacture of wooden barrels.
Stocking - An indication of the number of trees in a stand as compared to the desirable number of trees for best growth and management. See Overstocked, Understocked.
Stumpage - The value of timber as it stands uncut in the woods (on the stump).
Succession - The replacement of one plant community by another until ecological stability is achieved.
Suppressed Trees - Trees with small crowns that are entirely below the level of the canopy, receiving no direct sunlight. Also called overtopped trees.
Thinning - Generally, a cutting or killing of trees in an immature stand to reduce the tree density and concentrate the growth potential on fewer, higher quality trees resulting in larger trees with faster growth.
Timber Stand Improvement (TSI) - All thinnings made during life of a forest stand for the purpose of improving the composition or productivity of the stand. TSI methods may include removing vines, thinning, cull tree removal and pruning.
Tree Farm - A privately owned forest or woodland in which producing timber crops is a major management goal, certified as a "Tree Farm" by the American Tree Farm System, an organization sponsored by the American Forest Foundation, Washington, D.C. Tree Farm is a registered trademark of the American Forest Foundation.
Undesirable Growing Stock - Trees of low quality or less valuable species that should be removed in a thinning.
Understocked - Insufficiently stocked with trees.
Understory - That portion of the trees and shrubs in a forest forming lower layer of vegetative growth.
Uneven-Aged Management or Stand - A stand of trees containing at least three age classes intermingled on the same area.

Veneer/Veneer Log - A thin sheet of wood sliced or peeled on a veneer machine and often used for plywood or surfacing furniture; veneer logs are the large (usually more than 18 inches in diameter), knot-free, high-quality logs from which veneer is obtained.
Volume - The amount of wood in a tree, stand of trees or log according to some unit of measurement (board foot, cubic foot, etc.)
Volume Table - A table estimating volume of wood in a standing tree based on measurements of tree, most commonly DBH and merchantable height.
Wolf Tree - An overmature tree of very large size.

APPENDIX – C

Historical Photos and Documentation

Edgewood Developer Albert Proell Dies

Albert K. Proell, 80, manager of the Keene Forestry Assn. for more than 50 years and the man responsible for development of Edgewood, the city's first real subdivision, died in his home, 59 Greenwood Ave., Saturday night after a period of failing health.

The forest nursery, said to be the first in this country established for the purpose of raising forest trees from seed for reforestation purposes, was organized by Mr. Proell in 1906.

Associated with him in this enterprise were the late Charles G. Shedd, Orville E. Cain, former Keene mayors and the late Wallace L. Mason, Keene banker.

Under his guidance the nursery grew to become one of the largest of its kind and shipped seedlings to all sections of the United States.

In 1913 Mr. Proell, with the assistance of the late Samuel Wadsworth of Keene, laid out the Edgewood section on the site of the old Keene Driving Park to gain an entrance to the nursery and establish a layout for residential development.

Born in Germany

Born in Nuremburg, Germany on Oct. 14, 1880, the son of Conrad and Ida (Littenauer) Proell, he was a graduate of Elangon University. He was married in 1910 to Rosalba Peale Smith, daughter of C. Lawrence Smith, dean of arts and sciences of Harvard University and granddaughter of Rembrandt Peale, world famed portrait painter. She died in 1930.

Mr. Proell was one of the organizers and first president of the Cheshire County Fish and Game Club, a member of the Keene Country Club, a former member of the Laymen's League of the Unitarian Church, a senior member of the New England Section of the American Foresters and an honorary member of the Society of American Foresters.

Private funeral services will be held at Greenlawn Cemetery tomorrow at 10 a.m. The Rev. Richard R. Gross, minister of the Unitarian Church, will conduct the service. The Aldrich-Huntley Funeral Home is in charge of arrangements. There are no calling hours. It is requested that flowers be omitted.

Obituaries

Mrs. Michael A. Cahalane

Ellen T. Cahalane, 73, of 29 North Lincoln St., wife of Michael A. Cahalane and a life-long resident of Keene, died Sunday morning in her home.

She was born in Keene on May 25, 1887, the daughter of Patrick and Ann (Winn) Hickey.

Besides her husband, she is survived by one daughter, Mary E. Cahalane of Keene; one sister, Mrs. Eugene J. Sullivan of Gardner, Mass.; one brother, John H. Hickey of Lawrence, Mass.; several nieces and nephews.

The funeral will be held Tuesday morning from her home follower by a High Mass of Requiem in St. Bernard's Church at 9 o'clock. Burial will be in St. Joseph's Cemetery.

Friends may call at her home this afternoon and evening.

Arrangements are under direction of the Frank J. Foley Funeral Home, 49 Court St.

Mrs. Frank Harkins

Mrs. Gertrude Adeline Harkins, 85, widow of Frank Harkins and a resident of the Woodward Home, 194 Court St., since 1940, died this morning.

Born in Montpelier, Vt. on Jan. 12, 1875, the daughter of Samuel L. and Adeline (Fadden) Smith, she was married in Keene June 20, 1894. Mr. Harkins died Oct. 5, 1951.

She was a member of St. James [illegible]

Weather Elsewhere

By THE ASSOCIATED PRESS

	High	Low	Pr.
Albany, cloudy	52	46	.18
Albuquerque, cloudy	71	43	..

Nixon Hits At Tactics Of Kennedy

Continued from Page One

left behind assurances to his supporters that they "haven't seen anything yet" in intensive campaigning.

"These are the two weeks in which people make up their minds," Nixon told a crowd which assembled in Washington's Union Station to see him aboard his special train.

"Whatever has happened up to this point," he said, "you haven't seen anything yet. "I understand this is a diesel train, but I am going to pour on the coal from now on."

This was interpreted aboard this 16-car special train as another indication that the vice president is convinced the only way he can wrest the presidency from his Democratic opponent, Sen. John F. Kennedy, is to take the offensive until Election Day.

The vice president's advisers were conceding it is possible they are behind right now in the bidding for New York's 45 electoral votes. But they think they are ahead—and Democrats dispute this—in the contest for California's 32.

This situation makes Nixon's trip through the northern industrial tier a critical one. Here he must charm enough voters, in states which have had a recent habit of going Democratic, to make up for the possible loss of New York. Harry S. Truman won without New York. No Republican has done it for a long time.

Sen. Kennedy Swings Into Illinois Today

Continued from Page One

creasing U. S. military power to better this country's bargaining position and for an arms control research institute to solve the technical problems of disarmament enforcement.

In Lacrosse, Kennedy said that on farm matters, Nixon is "using the exact same phrases as well as the exact same program that

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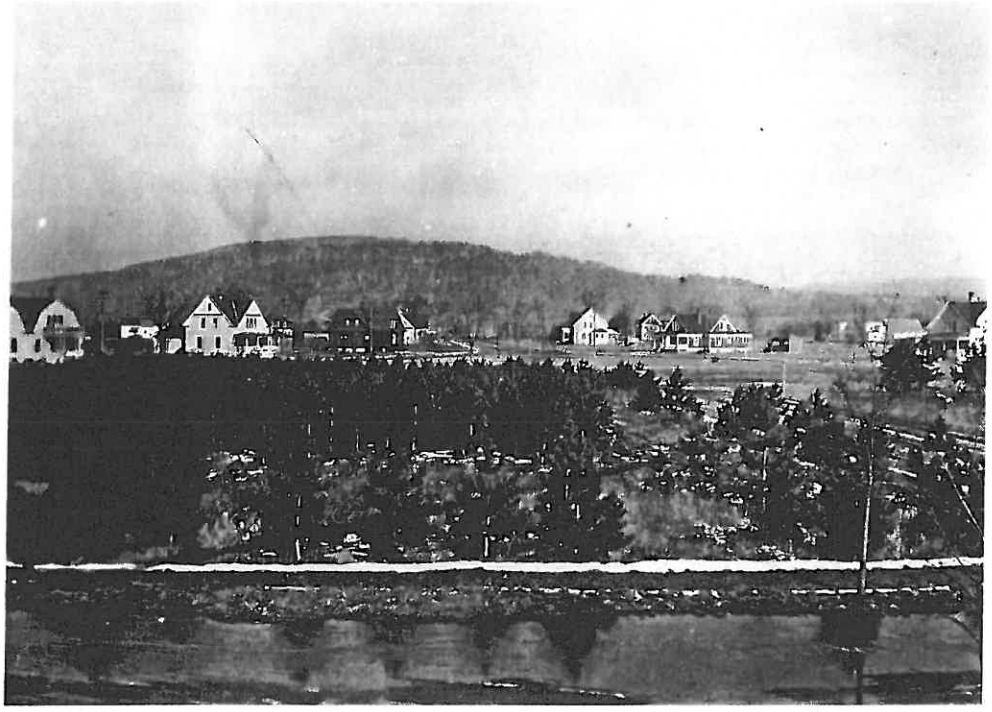
Wells, former po
ficer of the U. S
emy at West Po

Enrollment at
versities in Jap
nine per cent of
of college age.



Edgewood - view from the west ('~~20s or '30s?~~) 1926

View across Keene Forestry to Edgewood ('20s - '30s?)

Keene
Forestry
('20s - '30s?)

APPENDIX – D

New Hampshire Natural Heritage Bureau

Records of Rare Species and Exemplary Natural Communities

New Hampshire Natural Heritage Bureau

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

To: Laura French
Meadowsend Timberlands
PO Box 966
New London, NH, 03257

From: Sara Cairns, NH Natural Heritage Bureau
Date: 2016-10-14
Re: 2016-10-12

NHB File ID: 2503
Project type: Landowner Request

Town: Swanzey, NH
Location: Map 37; Lots 19-1, 19-2, 19-3, 19-4, 19-5, 21, T21-T40, T41-T52, FIRE, PLANT, TERM

I 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):

	Mapping Precision	% within tract	Last Reported	Listing Status		Conservation Rank	
Invertebrate Species (For more information, contact Kim Tuttle, NH F&G at 271-6544)				**Federal**	**NH**	**Global**	**State**
Spot-winged Glider *(Pantala hymenaea)*	High	100	2004	--	--	G5	S2
Natural Community				**Federal**	**NH**	**Global**	**State**
Silver maple - false nettle - sensitive fern floodplain forest	High	60	1997	--	--		S2
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)				**Federal**	**NH**	**Global**	**State**
Northern Leopard Frog *(Rana pipiens)*	High	44	2009	--	SC	G5	S3
Horned Lark *(Eremophila alpestris)*	High	90	2006	--	SC	G5	S3B
Marsh Wren *(Cistothorus palustris)*	High	100	2014	--	--	G5	S3B
Vesper Sparrow *(Pooecetes gramineus)*	High	90	2012	--	SC	G5	S2B

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

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

Grasshopper Sparrow *(Ammodramus savannarum)*	High	91	2011	--	T	G5	S2B
Eastern Meadowlark *(Sturnella magna)*	High	96	2015	--	SC	G5	S3B
Wood Turtle *(Glyptemys insculpta)*	High	5	2009	--	SC	G4	S3

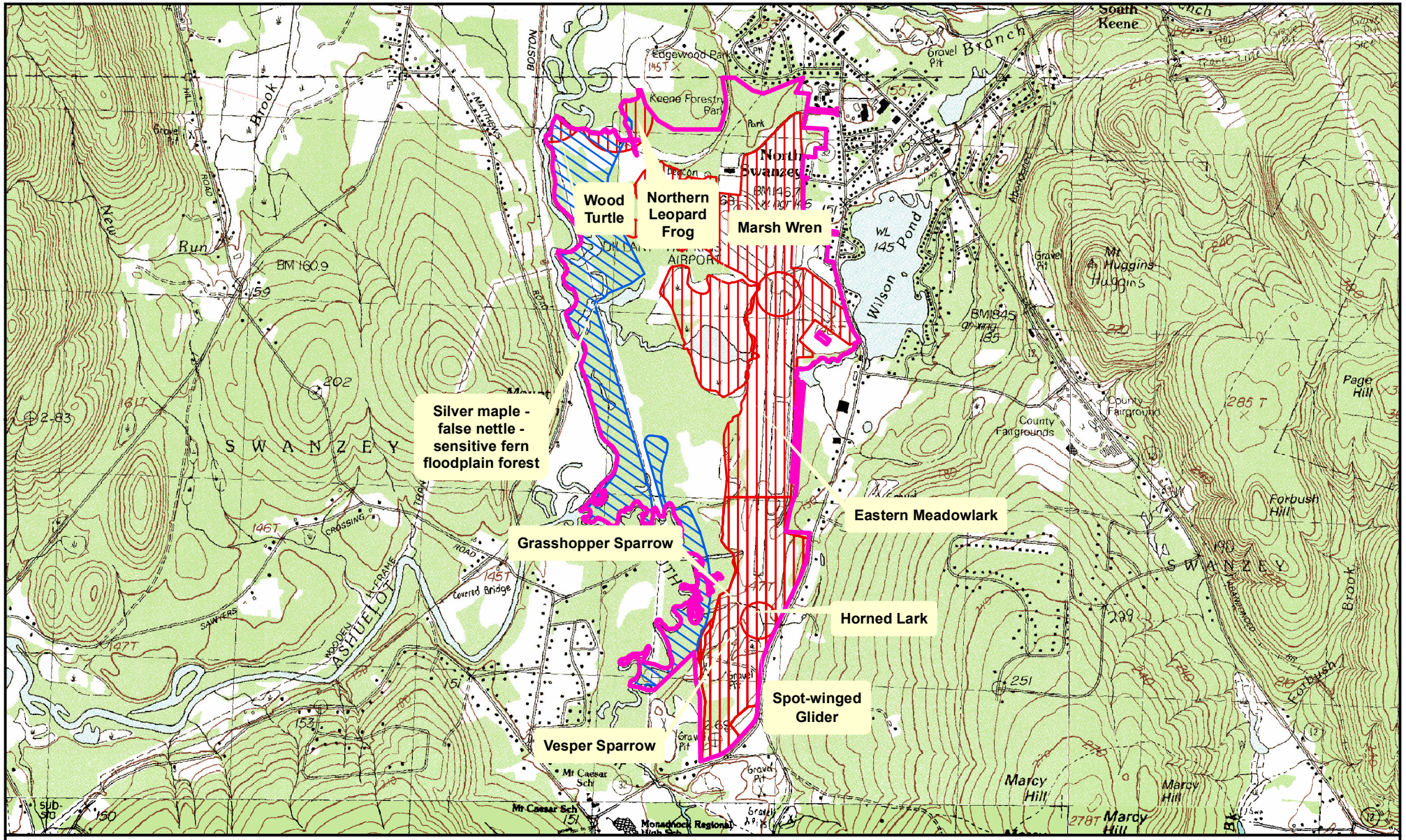
NHB records within one mile of the property(s):

	Last Reported	Listing Status		Conservation Rank	
Invertebrate Species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Dwarf Wedge Mussel *(Alasmidonta heterodon)*	2006	E	E	G1	S1
Natural Community		**Federal**	**NH**	**Global**	**State**
Silver maple - false nettle - sensitive fern floodplain forest	1997	--	--		S2
Plant species		**Federal**	**NH**	**Global**	**State**
long-headed windflower *(Anemone cylindrica)*	1909	--	E	G5	SH
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Northern Leopard Frog *(Rana pipiens)*	2010	--	SC	G5	S3
Horned Lark *(Eremophila alpestris)*	1995	--	SC	G5	S3B
Vesper Sparrow *(Pooecetes gramineus)*	2002	--	SC	G5	S2B
Grasshopper Sparrow *(Ammodramus savannarum)*	2002	--	T	G5	S2B
Eastern Meadowlark *(Sturnella magna)*	2015	--	SC	G5	S3B
Wood Turtle *(Glyptemys insculpta)*	2010	--	SC	G4	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)
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.



Natural Heritage Bureau
Landowner Element Occurence
Reporting

Project ID Number: 2503

	# of Records
Property Bounds	
Plant Occurence:	*0*
Animal Occurence:	*8*
Natural Community:	*1*
Ecological System:	*0*

0 0.1 0.2 Mile

NH Natural Heritage Bureau

Department of Resources and Economic Development — New Hampshire Forests & Lands

New Hampshire Natural Heritage Bureau - Animal Record

Northern Leopard Frog *(Rana pipiens)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Special Concern	State:	S3: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2009: Area 12393: 1 observed.2008: Area 11539: Adult males heard. Too many to count.
General Area:	2008: Area 11539: Area they were calling from is described as shrub - wetland and flooded forests. Also a wet meadow nearby.
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	South Ashuelot Confluence		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	32.8 acres	Elevation:	
Precision:	High		
Directions:	2009: Area 12393: (W 72 16 18.102 / N 42 47 50.226).2008: Area 11539: Swanzey. Northern end of Airport Road between 90 degree turn in road and Ashuelot River.		

Dates documented			
First reported:	2008-04-19	Last reported:	2009-04-17

New Hampshire Natural Heritage Bureau - Animal Record

Horned Lark *(Eremophila alpestris)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Special Concern	State:	S3B: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2006: 3 individuals observed between 4/29 and 5/28. 2005: 2 individuals observed between 6/17 and 6/30. 2004: 1 adult male, 1 adult female, 2 immature, sex unknowns (Obs_id 2450).
General Area:	2004: Terrestrial - Grassland / Field (Obs_id 2450).
General Comments:	2006: Not surveyed since this time. 2004: at least 2 young produced, and seen being fed on multiple occasions in late May/early June (Obs_id 2450).
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	128.9 acres	Elevation:	
Precision:	High		
Directions:	2004: South end of Dillant-Hopkins Airport (Obs_id 2450).		

Dates documented			
First reported:	2004-05-21	Last reported:	2006-05-28

New Hampshire Natural Heritage Bureau - Animal Record

Marsh Wren ***(Cistothorus palustris)***

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Not Listed	State:	S3B: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2014: 1 observed on 7/7. 2013: 1 observed on 7/5. 2012: 2 observed between 5/8 and 6/24. 2010: 1 observed between 5/7 and 5/21. 2006: 2 observed on 6/1. 2005: 3 observed on 6/17. 2004: 8 observed on 7/16. á
General Area:	
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	57.0 acres	Elevation:	
Precision:	High		
Directions:			

Dates documented			
First reported:	2004-07-16	Last reported:	2014-07-07

New Hampshire Natural Heritage Bureau - Animal Record

Vesper Sparrow *(Pooecetes gramineus)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Special Concern	State:	S2B: Imperiled

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2012: Airport grounds - south end: 1 individual observed on 6/24. 2011: Airport grounds - south end: 1 individual observed between 5/7 and 5/11. 2009: Airport grounds - south end: 2 individuals observed on 5/23. 2008: Airport grounds - south end: 4 individuals observed between 5/24 and 7/19. 2007: Airport grounds - south end: 4 individuals observed between 5/25 and 6/12. 2005: Airport grounds - south end: 1 individual observed on 5/21. 2004: 4 adult males, 2 adult females. How observed: heard, seen (Obs_id 2449).
General Area:	2004: Terrestrial - Grassland / Field (Obs_id 2449).
General Comments:	2004: at least 4 territories (maybe 5), one bird observed carrying food, suggesting young were nearby (Obs_id 2449).
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	129.0 acres	Elevation:	
Precision:	High		
Directions:	2004: Dillant-Hopkins Airport - south end (Obs_id 2449).		

Dates documented			
First reported:	2004-05-21	Last reported:	2012-06-24

New Hampshire Natural Heritage Bureau - Animal Record

Grasshopper Sparrow *(Ammodramus savannarum)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Listed Threatened	State:	S2B: Imperiled

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2011: Airport grounds - south end: 1 individual observed between 5/21 and 5/30. 2010: Airport grounds - south end: 2 individuals observed between 5/22 and 7/5. 2009: Airport grounds - south end: 2 individuals observed on 5/23. 2007: Airport grounds - south end: 3 individuals observed between 5/26 and 6/12. 2006; Airport grounds - south end: 4 individuals observed between 5/20 and 7/7. 2005: Airport grounds - south end: 9 individuals observed between 6/17 and 7/8, including fledglings and adults carrying food. 2004: 4 adult males, 2 adult females. How observed: heard, seen (Obs_id 2442). 2 adult males. How observed: heard, seen (Obs_id 2441). 2 adult males. How observed: heard, seen (Obs_id 2440). 3 adult males, 1 adult female. How observed: heard, seen (Obs_id 2443). 2003: 2 adult males, 1 adult unkown (Obs_id 764).
General Area:	2004: Terrestrial - Grassland / Field (Obs_id 2442).
General Comments:	2004: one female observed carrying food on July 16, suggesting young were nearby (Obs_id 2442).
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	150.1 acres	Elevation:	

Precision:	High
Directions:	2004: Dillant-Hopkins Airport: south end of main runway (Obs_id 2442, 764). Runway intersection area (Obs_id 2441). Northwest end (Obs_id 2440). Extreme southern end of property (Obs_id 2443).

Dates documented			
First reported:	2003-06-06	Last reported:	2011-05-30

New Hampshire Natural Heritage Bureau - Animal Record

Eastern Meadowlark *(Sturnella magna)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Special Concern	State:	S3B: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2015: 3 individuals observed between 5/1 and 5/14. 2014: 3 individuals observed between 5/11 and 6/15. 2013: 2 individuals observed between 5/15 and 7/5. 2011: 3 individuals observed between 5/8 and 5/30. 2010: 2 individuals observed between 5/2 and 7/5. 2009: 3 individuals observed between 5/17 and 8/25. 2008: 1 individual observed between 5/24 and 7/15. 2007: 4 individuals observed between 5/2 and 6/12. 2006: 4 individuals observed between 5/18 and 7/14. 2005: 11 individuals observed between 5/21 and 7/8, including immatures on 6/30.
General Area:	
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	None		
Town(s):			
Size:	349.9 acres	Elevation:	
Precision:	High		
Directions:			

Dates documented			
First reported:	2005-05-21	Last reported:	2015-05-14

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle *(Glyptemys insculpta)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G4: Widespread and apparently secure but with cause for longterm concern
State:	Special Concern	State:	S3: Rare or Uncommon

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2009: Area 12314: 1 female observed, about 8-9" long and 6-7" wide. Area 12375: 1 observed. Area 12394: 1 observed, estimated 6 years old.2002: Area 12215: 1 male observed.
General Area:	2009: Area 12314: Field. Area 12375: Bank of Ashuelot River. Area 12394: Roadside.
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Mount Cresson		
Managed By:	Yale-Toumey Forest		
County:	Cheshire		
Town(s):	Swanzey		
Size:	61.9 acres	Elevation:	

Precision:	High
Directions:	2009: Area 12314: Near 139 Matthews Road, Swanzey. Area 12375: In Ashuelot near Keene - Swanzey town line. Area 12394: Rte. 32, just east of bridge over Ashuelot (42.87664 / 72.27605. WGS 84).2002: Area 12215: Cross-country trail behind Keene State College athletic fields, Krif Road.

Dates documented			
First reported:	2002-08-17	Last reported:	2009-08-05

New Hampshire Natural Heritage Bureau - Animal Record

Spot-winged Glider *(Pantala hymenaea)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G5: Widespread and secure
State:	Not Listed	State:	S2: Imperiled

Description at this Location	
Quality Rank:	Not Ranked
Quality Comments:	
Detailed Description:	2004: Species observed.
General Area:	
General Comments:	
Mgmt Comments:	

Location			
Survey Site Name:	Dillant-Hopkins Airport		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	7.7 acres	Elevation:	
Precision:	High		
Directions:			

Dates documented			
First reported:	2004-05-21	Last reported:	2004-05-21

New Hampshire Natural Heritage Bureau - Natural Community Record

Silver maple - false nettle - sensitive fern floodplain forest

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	
State:	Not Listed	State:	S2: Imperiled

Description at this Location	
Quality Rank:	Excellent
Quality Comments:	
Detailed Description:	1997: Extensive floodplain patches exist along this portion of the Ashuelot River, characterized by closed and open or patchy canopy closure of Acer saccharinum (silver maple) in the low floodplain, and silver maple, Acer rubrum (red maple), and Prunus serotina (black cherry) in the high terrace floodplain. The dbh of one silver maple was 62.6 inches. Patches of Onoclea sensibilis (sensitive fern), Cinna latifolia (drooping woodreed), Boehmeria cylindrica (false nettle), Cinna arundinacea (common woodreed), Matteuccia struthiopteris (ostrich fern), Bidens frondosa (common beggar-ticks), and scattered Parthenocissus quinquefolia (Virginia creeper) created a patchwork of dominant herbs and vines.
General Area:	1997: Highly variable microtopography along this stretch creates a variable natural community assemblage with slough channels, emergent marshes, flowing and still water, levees, high and low terraces, etc. Soils were predominantly fine sandy loams with loamy sands as well. Powerlines, open fields (old and newly cut) at edges, the airport, cutting of trees that had fallen across the river were the signs of human influence along this stretch, but they seem to have had little influence on the floodpla in dynamics. Edge species encroach slightly, but the interior floodplain seems to be in good condition, and free of major influence. On the western side of the river, the road may pose some disturbance, but perhaps not to the floodplain on the eastern side.
General Comments:	This is one of the best large patch floodplains on a medium size river in New Hampshire.
Mgmt Comments:	

Location			
Survey Site Name:	South Ashuelot Confluence		
Managed By:	None		
County:	Cheshire		
Town(s):	Swanzey		
Size:	273.7 acres	Elevation:	460 feet

Precision:	High
Directions:	From Rte. 9 in Keene take Rte. 32 south to Sawyer's Crossing. Park at covered bridge. Canoe upstream to confluence.

Dates documented			
First reported:	1997-07-30	Last reported:	1997-07-30