

STATE OF CONNECTICUT

DEPARTMENT OF ENERGY & ENVIRONMENTAL

PROTECTION



Bureau of Natural Resources
Division of Forestry

FOREST RESOURCE MANAGEMENT PLAN
2018 through 2027

Pachaug State Forest

Glasgo, Green Falls, and Wickaboxet Blocks

14,343 acres

Griswold, North Stonington, Sterling and Voluntown

Approvals:

Christopher Martin *9/11/17*

Christopher Martin, Director
Division of Forestry

William Hyatt *9/28/17*

William Hyatt, Chief
Bureau of Natural Resources

Susan Whalen *October 6, 2017*

Susan Whalen, Deputy Commissioner
Outdoor Recreation and Natural Resources

Authors: Emery Gluck, Forester 1
Dan Evans, Forester 1

CT. Department of Energy and Environmental Protection
Division of Forestry
79 Elm St. 6th Floor
Hartford, CT 06106

Assistance from:

- Ann Kilpatrick, Min Huang, Shannon Kearney, Judy Wilson, Howard Kilpatrick, Mike Gregonis – DEEP Wildlife Division
- Lisa Wahle – Contractor to the Wildlife Management Institute at the CT DEEP, Wildlife Division
- Sherwood Raymond – DEEP Forestry
- Mark Darin – DEEP Parks Division
- Deb Corcoran – Field Support Services Division

Table of Contents

A. Executive Summary	1
B. History	4
C. Acres and Access	5
D. Special Use Areas	8
E. Resource Management Concerns	11
F. Wildlife Habitat	14
G. Vegetative Condition	19
H. Landscape Level Management.....	22
I. Specific Acquisition Desires	24
J. Public Involvement.....	24
K. Adaptive Management	25
L. Goals.....	26
M. Work Plan.....	27
Map A – Topographic.....	32
Map B – Basemap.....	33
Map C – Site Quality	34
Map D – Forest Type & Size Class	35
Map E – Special Features	36
Map F – Workplan.....	37
Map G – Invasive Plants	38
Appendix A – Reference.....	39
Appendix B – Definitions	40
Appendix C – Staff Project Review	45
Appendix D – Public Comment.....	61
Appendix E – Distribution List.....	69

A. Executive Summary

- Pachaug State Forest is a substantial component of the heavily forested landscape in eastern New London County and southwestern Rhode Island.
- The plan provides a landscape approach to forest management that takes into consideration the extent, condition, and management of adjoining private, municipal, and land trust forest land.
- The public involvement process was a collaborative effort between DEEP Wildlife and DEEP Forestry. A Wildlife Division representative and a forester from the Private and Municipal Lands program were included in Conservation Commission meetings to augment State Forest information with a landscape-level approach to forest stewardship. Town conservation commissions were introduced to DEEP's Young Forest Initiative, and a range of programs and opportunities available to municipal and private landowners. Input from the Commissions was solicited.
- **Assessment**
 - The forest analysis indicates that most of Pachaug's individual forest stands are generally in a crowded condition.
 - Overall forest health is tenuous as recent defoliations, droughts, inherent stand age, and additional environmental stressors will likely cause deterioration in tree health over time.
 - Invasive plants are present but not widespread in their distribution.
 - The overall forest has limited structural and habitat diversity due to limited amounts of very young forest stands and very old stands.
- **Key Challenges**
 - Several disturbance dependent ecosystems and individual species (pitch pine, oak, aspen, New England cottontail, etc.) are under-represented and/or are not sustaining themselves under current natural conditions. Even though there are several populations of pitch pine and a few of scrub oak, their continued decline is anticipated without intervention.
 - It is anticipated that forest health will continue to decline due to cumulative effect of previous and future gypsy moth defoliations, other pest infestations and drought.
 - Aquatic resources are being impacted by sediment and runoff from unauthorized vehicle-use on forest roads, trails, and around stream crossings.
 - The impact of unauthorized trail development and illegal-use is degrading forest infrastructure, and contributing to erosion and sedimentation of watercourses.
 - Invasive plants are expanding causing disruptions to the forest.

- **Opportunities**
 - A natural disturbance model of management that includes heavy harvests and occasionally prescribed burns on a relatively small portion of the forest during each management period could help halt the downward trajectory of some under-represented upland ecosystems and fauna populations.
 - The plan includes proposed authorized road upgrades in order to reduce sediment loading in the aquatic environment.
 - The plan provides public outreach and an opportunity for comment using the methods listed below. The comments have been included in the final plan:
 - Presentations to Conservation Commissions of area towns detailing Forest Resource Plan's goals and proposed bio-indicators and soliciting Commissions' input and any alternative indicators.
 - A Survey Monkey on the plan's bio-indicators that was posted on DEEP Forestry State Land Management's web site on January 24, 2017 was used to collect public input. A paper copy of the plan's bio-indicator was also available at the:
 - North Stonington Conservation Commission Meeting on January 25, 2017
 - Griswold Inland Wetlands / Conservation Commission Special Meeting on January 26, 2017
 - Voluntown Conservation Commission Meeting Presentation on March 2, 2017.
 - The area towns' first selectperson and conservation commission chairs have received copies of the draft plan. The towns have been informed that the draft plan will be on [Forestry Division's Website](#) upon completion.
- **Vision** – The desired future condition is a forest with healthy, diverse, and sustainable ecosystems.
- **Goals**
 - To promote biological diversity, especially under-represented upland ecosystems, plant populations, and wildlife habitats that are not adequately sustaining themselves under current natural conditions.
 - To maintain or improve aquatic system integrity.
 - To promote healthy and sustainable forests.
- **Indicators** - (attributes monitored to determine whether the plan's goals are being met).
 - **Sustain oak forests** – Release 30 oak and/or hickory saplings per acre 5 years after regeneration harvests.

- **Sustain Pitch pine ecosystem** – Promote and release pitch pine regeneration after regeneration harvests and/or fires.
- **Provide Early Successional habitat** – Regenerate 10% of active forest.
- **Retain Late Successional (LS) structure** – Retain an average two to four large (>16” in diameter) legacy, den or rotten trees/acre throughout the forest. Retain a minimum of three snags (12” DBH or greater) per acre, coarse woody materials (fallen trees / logs) and provide heterogeneity by creating variably sized gaps in the forest canopy and retain uncut patches in harvest areas.
- **Provide for LS Forest** – Maintain old forest characteristics (large diameter trees both living and dead, coarse-woody material on the ground, variably-sized canopy gaps, multiple age-classes of trees, tip-up mounds etc.) with passive management in areas designated Old Forestland, Inoperable and Inaccessible.
- **Healthy Forest Stands**– Thin 50% of the crowded forest stands increasing the average overstory tree size after harvest. Create a more balanced age class distribution. (i.e., less disparity between amount of acreage in young, middle age and older forests).
- **Minimize Stream Sedimentation** – Improve forest roads that provide DEEP access for forest management activities, fire control, and law enforcement.

B. History

- 1. Reason for acquisition** Pachaug was the 15th state forest to be established in Connecticut. The State started purchasing its land in 1928. The word Pachaug is derived from a Native term meaning bend in the river. According to the 1926 biennium Report of the State Forester, Austin F. Hawes stated “the chief purpose of state ownership of forests is to raise large timber which private owners cannot be expected to raise in any considerable amounts because of the time element.”
- 2. Development of the resource prior to and after acquisition** – The area was used by the Narragansett, Pequot and Mohegan Indians. Petroglyphs, a rock shelter, and a V-shaped wall with an opening used to funnel game animals to a killing site are among the artifacts found in Pachaug. The native development of the resource probably included applying fire to the forest to improve the habitat for their game animals and possibly clearing land with frequent repeat applications of fire.

The land appears to have been originally used primarily as a source of wood and for agriculture since European settlement. Trees with large low branches or stubs indicate that the tree once grew out in the open probably when the land was pasture. Numerous stonewalls and cellar hole provide evidence that at least part of the forest was cleared for agriculture. Several small cemeteries associated with abandoned farmsteads are located in the forest. As agriculture declined and pastures were abandoned, the forest reclaimed the cleared land. Charcoal was produced throughout the forest as witnessed by remnants of charcoal mounds and chimneys from collier’s huts. Tar Kiln Road and Charcoal Pit Road lead into the state forest and implying that pine tar and charcoal were historically produced in those locales. The repeated cutting and burning in the region prompted State Forester Austin Hawes to state in the 1928 biennium Report of the State Forester to suggest the “it is, perhaps, the most devastated part of New England”. The presence of dams with sluiceways indicate mills were also present.

The December 1943 edition of the Wooden Nutmeg stated that, “A charcoal kiln was built near the ranger headquarters in Sterling in the winter 1938 and 1939 to better utilize trees harvested from thinnings”. The State’s sawmill and shingle mill at Pachaug sawed pine and hemlock trees downed in the 1938 hurricane. An estimated 4 million board feet were blown down. More than 2 million board feet were salvaged including 1.3 million board feet of pine and hemlock logs that were sawed by state crews in 1939. Near the end of the salvage program a fire originating in the dry kiln destroyed 700,000 board feet of this salvaged lumber while stacked in the yard. Also destroyed were the sawmill shed and lumber storage sheds as well as the dry kiln.

- 3. Changes in the last ten years** – Pachaug State Forest was without an assigned DEEP state lands forester from 2007 to 2016. Forestry activities over that time period were limited to few previously planned harvests carried out by DEEP foresters assigned to other management areas. In the subject blocks, forestry operations carried out in the

last 10 years were limited to a 44 acre irregular shelterwood harvest, and a 43 acre initial shelterwood harvest.

The current Pachaug State Forest state lands forester was hired in 2016 through a cooperative agreement with the DEEP Wildlife Division. The position is two-thirds funded through Federal Wildlife Restoration dollars dispensed to each state by the US Fish and Wildlife Service. This allocation funds the creation of young forest habitat on State lands along with several other grant-qualifying activities generally associated with managing the State Forest system. The other one-third of the position funding comes from revenue from DEEP forest product sales statewide. This collaboration with DEEP Wildlife may come to represent a model for filling vacant positions without relying on CT General Funds.

C. Acres and Access

1. Acres

Pachaug State Forest is comprised of seven forest blocks. Forest blocks have been grouped together as individual management units which denote a geographic location, facilitate access, and track historic land use change. The three forest blocks under the scope of this management plan are the Wickaboxet, Glasgow, and Greenfalls Blocks. These blocks contain 14,343 acres of State forestland. 10,090 acres have the potential to be actively managed for forest products or wildlife habitat.

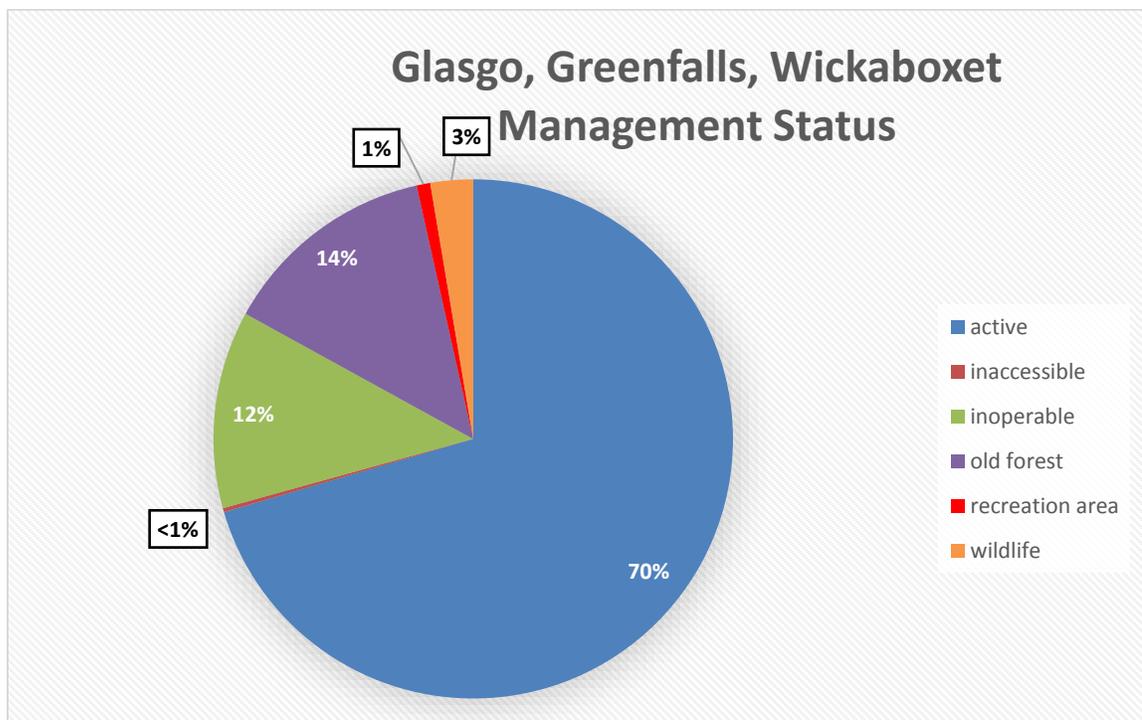
In order to better facilitate management planning across large acreage, forest stands are grouped into one of six categories based on the physical forest condition, and the intended management objectives.

- The active forestland designation refers to an area which is currently or has the ability to be actively managed for forest products or wildlife habitat through silvicultural operations conducted by the Division of Forestry.
- The inaccessible designation denotes an area which, because of steep, excessively rocky terrain or expansive wetland features, is unable to be physically accessed by equipment for forest management. Inaccessible areas may come under active management if road building or access improvement projects facilitate truck or machinery access to the area.
- Inoperable areas may be accessible but are not actively managed due to limiting physical site features such as water resources, wetlands, or steep slopes which prevent machinery from working safely.
- The term inactive categorizes forest acreage which is currently unstaffed by DEEP Forestry Personnel.
- A wildlife designation refers to areas where the primary management activities involve non-forest habitat and will be carried out by the DEEP Wildlife Division.

Examples include grasslands, waterfowl impoundments, water bodies, or maintained upland openings, such as old fields, which require periodic mowing.

- Old forestland management sites are areas designated to be left alone as long-term forest reserves. They may be areas distinct from the rest of the forest in terms of forest structure or composition. They may be biologically old stands, where the influence of harvesting or human manipulation is absent and natural processes are the main force driving forest succession.
- A recreation status indicates an area where the primary management activities will be carried out by DEEP Division of State Parks and Outdoor Recreation. These areas include campgrounds, picnic areas, or developed recreational sites. Recreation areas may have established lease agreements with a municipality, institution, or conservation organization. The percentage of the plan area encompassed by each management status is detailed below.

The Glasgow, Green Falls, and Wickaboxet Blocks consist of 14,343 acres of which 10,090 are classified for active management. In addition, 1,933 acres are classified as old forest land management site which is passively managed. Permanent or managed openings for wildlife comprise 379-acres and include impoundments, open marshland along the Wood River, and scrub oak areas intended to be maintained in early successional habitat.



2. Access

There are two separate 'road class' distinctions which make up the access roads in the Forest. Primary roads tend to be in relatively good condition, passable to sedans and low-clearance vehicles; they have been improved with gravel, graded, crowned, ditched, and they may be seasonally blocked (January 1 – April 1) with gates which prohibit public access. These roads provide access for public enjoyment, forest fire protection, non-commercial forest product permits, and commercial forest product harvests. Primary roads are likely to be improved with gravel to facilitate the forest product harvesting proposed in the plan.

Secondary roads may need improvements and typically cannot support access for log, or fire trucks. There may be encroaching brush, or areas of poor drainage, but these roads can be utilized in the skidding of forest products during a timber sale, or otherwise improved to provide access for brush trucks needed in the event of a forest fire.

Public access to the Glasgow Block is mainly from town roads. The Green Falls Block has access on Fish Road and Green Falls Roads as well as town roads and state roads. The Wickaboxet Block has access on Lawrence Road, Ericson Swamp Road, Pratt Road, Tippecanett Road, and the dirt sections of Bassett Mills Road and Shetucket Turnpike. The latter three are in poor condition.

There are 24 gates throughout the forest installed to restrict access to the woods roads. All terrain and off road vehicles get around most of the gates.

3. Inaccessible areas

Tippecanett Road and Shetucket Turnpike along the Rhode Island Line are currently inaccessible for truck access due to poor drainage conditions of the road. Due to their condition, both roads are considered forwarder trails until improvements can be prioritized. Currently road improvement priorities are centered on publically-traveled forest roads which will be utilized for hauling forest products within the first three years of plan implementation. The forest just north of Beach Pond has poor access and large areas of inoperability due to ledge and wetlands. A portion of this area has been designated an old forest land management site.

4. Right-of-Way(ROW)

According to the 1998-2008 Wickaboxet Block Vegetation Management Plan:

State ROW on private land

- Bassett Mills Rd. – The Jabs family grants State ROW through property to Compartment 4 Stand 6
- North Shore Rd. – Briggs Estate – The Briggs family grants State ROW over road to compartment 4

Private ROW across state land

- State grants Ricardelo family ROW through property to reach private inholding

5. Boundary Condition

The boundary (100.5 miles) ranges from good to very poor condition. Most of Glasgo Block has not been maintained for at least 30 years, and represents the highest priority boundary maintenance in the forest. DEEP Forestry has maintained over 10-miles of Glasgo Block boundaries in 2017 with the remainder scheduled over the next two years.

6. Known boundary problems

The previous Wickaboxet Plan mentions a dispute concerning the location of the state line in Compartment 4, North of Beach Pond. In 1998 this dispute was resolved and the line was marked using field evidence. The 1998 marking was maintained in 2005 and will be refreshed when the east side of Wickaboxet Block is maintained in 2017-2018.

D. Special Use Areas

1. Lakes, Ponds, Wetland Impoundments / Marshes

The management area includes or borders Beach Pond, Glasgo Pond, Doaneville Pond, Bailey Pond, Dawley Pond, Hodge Pond and Green Falls Reservoir. Wetland impoundments created and managed to provide emergent marsh habitat for waterfowl and other wetland-dependent wildlife include Heron, Great Meadow, Wickaboxet, Sue Hopkins, and Ericson Marshes. Hodge Pond, Green Falls Reservoir, and Peg Mill Brook support the banded sunfish, a Species of Special Concern. Banded sunfish distribution in Connecticut has been correlated with cold summer water temperatures, high water clarity (i.e. low turbidity) and abundant levels of aquatic plants.

2. Rivers and streams

The management area borders the Moosup River and contains part of Vaughn and Carson Brooks, Wood River, Great Meadows Brook, Myron Kinney Brook, Koistenen Brook, Dennison Brook, Bliven Brook, and Green Falls River.

The fisheries resources in these streams are highly valued by DEEP. Efforts will be made to preserve and maintain existing instream, riparian, and water quality conditions. This can be accomplished through utilization of [best management practices](#) recommended by DEEP Forestry for all timber harvest operations that can include:

- Riparian corridors be protected with an undisturbed 100 ft. wide riparian buffer zone. A riparian wetland buffer is one of the most natural mitigation measures to protect water quality and fisheries resources. This policy and supporting documentation can be viewed on the DEEP website at: [Riparian Policy](#) or [Riparian Position Statement](#)

- The Inland Fisheries Division will review any forest road maintenance projects which involve culvert replacement. These projects will be evaluated to ensure fish passage needs are met.
- Forestry operations will avoid stream crossings if possible. If necessary, forestry will cross streams during periods of low flow using corduroy or temporary bridges. Log bridges should be constructed over streams that have either steep approaches or soft stream bottoms. Temporary bridges will be removed upon harvest completion. Forestry will consult recommended [stream crossing guidelines](#).
- Any proposed deviations from the abovementioned guidelines will be reviewed by the DEEP Inland Fisheries Division.

An interactive map detailing fish community resource information for specific waterways can be found at: [CT DEEP Fish Community Data](#)

3. Cultural sites

Pachaug State Forest has been well-documented as seasonal grounds for Narragansett, Pequot, and Mohegan Indians. Petroglyphs, a rock shelter, and a V-shaped wall with an opening used to funnel game animals to a killing site are among the documented artifacts in the forest. Further interest has developed around the native tribe's use of stone. Stone cairns, serpentine walls, earthen mounds, balance rocks, ancient spring wells, and interesting stone enclosures have also been identified as potential early cultural evidence of pre-European native use. (See Cultural Resource Concerns in next section).

4. Recreation

Green Falls Reservoir, Glasgo Pond, and Beach Pond have asphalt boat launches and can support vessels which arrive in tow. Great Meadow Dam and Wickaboxet Dam have low use boat launches suitable for car-top transported boats.

[Green Falls](#) Reservoir has a campground.

Dry Reservoir and Great Meadows have [Adirondack shelters](#).

The Pachaug Trail, Canconicus, Nehantic, and Narragansett Blue Trails are maintained by [Connecticut Forest and Park Association](#) Volunteers.

The [Pachaug Enduro Route](#) provides dirt bike opportunities through the management area. This is the only enduro route in the State which is open to registered motorcycle use outside of specific trail riding events.

The forest provides opportunities for hunting (small game, waterfowl, deer and turkey), trapping, fishing, and wildlife viewing (refer to the 2017 [Hunting and Trapping Guide](#) for season dates, licensing requirements and other regulations). The majority of the forest is open to firearms hunting; Maps for Pachaug State Forest showing the areas open to

hunting are available for viewing or printing on the DEEP's Hunting Area website [Pachaug Hunting Area Maps](#).

5. Critical Habitat

Numerous Natural Diversity Database (NDDDB) sites are located in the forest (see Special Feature Map F). On November 2, 2016 the Division of Forestry received the full NDDDB determination letter for the management area (see Appendix: C – Staff Project Review for NDDDB Determination Letter 201608022). It identifies by forest block, all known extant populations of state-listed Endangered, Threatened, and Special Concern species known to occur within or in close proximity to the boundaries of the management area. Resource protection guidelines and opportunities for habitat enhancement for state-listed and other Greatest Conservation Need species will be discussed with Wildlife and Fisheries staff as individual timber harvest and project plans are developed.

6. Natural Areas

The management area does not contain any designated Natural Area Preserves.

7. Old Forest Management Sites

Old Forest Management Sites are designated to recognize the intrinsic value of having some sizable remote areas of unmanaged forest. Though the sites are not necessarily older than much of the forest, it is expected that the reserve status will eventually lead to the development of old growth attributes such as canopy gaps, multiple age-classes of trees, standing and downed dead trees, and extensive moss and lichen growth. Although forest fires are very infrequent, suppression tactics such as burning out to natural fire breaks will be encouraged in Old Forestland Management sites. This may increase the area affected by fire and may increase ecological diversity. Tree cutting will be limited to forester or designee removing hazardous trees. There are a total of 1,933-acres of Old Forestland Management Sites to be designated under the scope of this plan. Two hundred and twenty three acres are on the north side of Beach Pond in the Wickaboxet block, while the remaining 1,710-acres occur in the Green Falls Block. The sizable Green Falls site includes hemlock dominated riparian forest along the Green Falls River, and forest interior upland oak sites along the Rhode Island state line. The Green Falls River site has supported a 2017 release of a non-indigenous ladybird beetle (*Sasajiscymnus tsugae*) for biological control of hemlock wooly adelgid (HWA). The release was spearheaded by researchers at the Connecticut Agricultural Experiment Station (CAES) with support from DEEP. The area will be monitored by CAES for HWA population changes, and beetle survivability following the release. The intent is to reduce the spread of HWA in this high ecological value forest community.

8. **Research Areas** – Research activities are ongoing on State land and carried out by numerous individuals, educational institutions, and government agencies. Scientific collector's permits are issued by the DEEP Wildlife Division after multi-disciplinary review by the Agency including comment from DEEP Forestry. New permits will be issued on an annual basis. Some of the past and ongoing research at Pachaug State Forest is detailed below.

A forest interior bird survey transect was established in the 1980's in compartments 15 & 16 of Wickaboxet Block. It originated as a long-term cooperative study between DEEP (then DEP) and Connecticut Ornithological Association, overseen by Dr. Robert Askins. The program was established to inventory forest interior bird species and examine management impacts on various types of birds. Follow-up point sampling was completed in 1997 by Dave Provencher. The survey does not affect management activities carried out by DEEP, and management has, and will continue to occur within the designated study area. At the onset of this study it was expected that future harvest recommendations would be made based on the information obtained through this study. Dr. Askins summarizes his forest interior bird research by stating "clear cut logging or similar harvesting methods increase the diversity and density of early successional birds without having major negative impacts on mature-forest specialists as long as recent harvest areas are <20% of total forest cover". (Askins, R., 2017, personal communication)

The USDA APHIS (Animal and Plant Health Inspection Service) PPQ (Plant Protection and Quarantine) program is permitted to establish insect traps in portions of Glasgo Block in 2017. APHIS will establish traps in compartments 3 and 5 along Hodge Pond Rd. in Voluntown in accordance with the terms of permit number 1617006. The permit is valid 5/1/17 – 12/31/17.

Researchers from the Connecticut Agricultural Experiment Station (CAES) have coordinated with the forestry division to release a non-native ladybird beetle (*Sasajiscymnus tsugae*) for the biological control of the non-native invasive hemlock wooly adelgid (HWA) insect. The 2017 release was targeted on a 118-acre confluence of eastern hemlock stands in Greenfalls Block. The area was selected due to the presence of HWA, its early stage of redevelopment following past HWA winter mortality, and the status of these stands as part of an unmanaged forest reserve. The stands represent a component of the 1,933-acres of Old Forestland Management Sites designated by this plan. Researchers from the CAES will monitor the area for subsequent decline in the HWA populations, and winter survivorship of the ladybird beetle. This research activity was approved in 2017 as part of scientific research permit 1717003.

- 9. Miscellaneous** – DEEP's homeowner firewood program was suspended in 2017 due to reduced interest in the program and time limitations of the forestry staff. All other forest products are sold as they historically have been using forest product harvest permits.

E. Resource Management Concerns

1. Trails

Volunteers from the Connecticut Forest and Park Association (CFPA) maintain the Pachaug, Canconicus, Nehantic, and Narragansett Trails, as part of their [blue-blazed hiking trail system](#). These authorized trails extend over 22 miles of the subject forest blocks. In addition there are authorized trails for motorcycle enduro riders, and horse

enthusiasts. Gravel forest access roads receive additional recreational use by a suite of user groups. Forest stands supporting authorized trails may be subject to silvicultural treatments. Statelands management foresters will follow approved standard operating procedures for conducting forest harvesting in close proximity to an approved recreational resource.

In addition to the authorized recreational use, there is ongoing unauthorized-use of forest roads and trails by motorized vehicles ranging from dirt bikes to street-legal jeeps and trucks. Much of this use is outright prohibited in the forest while some use originates on authorized trails and spills over into unauthorized areas. This is of particular concern on and around the blue-blazed hiking trail system where impacts to the recreational user group range from noise disturbance to physical trail degradation and soil erosion.

The plan includes the recommendation that the Department conduct a trail condition and public use assessment as the first step towards the development of a Pachaug State Forest recreation plan. The plan would address current and potential impacts to flora, fauna, forest ecosystem health, and the recreational user group, associated with illegal off-road vehicle use and unauthorized trail development. State lands management foresters will support and work with the Parks Division as needed to develop the plan.

2. Biological Threats

The potential introduction of the exotic invasive [Asian Long-horned Beetle](#) could lead to considerable mortality in the maple component of the forest. The introduction of [Emerald Ash Borer](#), another exotic invasive pest, should have less impact as it only affects ash which only comprises a very minor component of the forest. A locally significant [Gypsy Moth](#) infestation in 2016 defoliated large swaths of the management area including understory pine and smaller pine plantations. Significant decline in tree health is expected to occur in the impacted areas especially if there is successive defoliation in 2017. The moderate summer droughts in recent years combined with successive defoliations, poor growing sites and maturing age of the trees will probably eventually lead to increased mortality. The Division of Forestry monitors insect and disease issues affecting Connecticut Forests. Identifying and responding to tree health declines associated with forest pests is a challenge given current survey techniques, and limited staff resources.

The [Southern Pine Beetle](#) (SPB), native to the southeastern U.S., has expanded into Connecticut. Pitch pine, red pine and scots pine are vulnerable. Thinning is often effective at reducing stand susceptibility to SPB as it increases tree vigor and its pitch production which allows the tree to drown low populations of the borers with its exudation. Thinning also increases air flow within a stand, which could result in dispersion, dilution and disruption of SPB-mediated semiochemical pheromone plumes. Pheromone plumes are the chemical triggers emitted by SPB to attract nearby beetles towards an occupied host tree. Monitoring for the presence of this insect in Connecticut is a challenge given current survey techniques and limited staff resources.

The Connecticut Agricultural Experiment Station (CAES) is the primary State entity surveying for SPB in Connecticut.

The impact of climate change is expected to have negative impacts such as increased native and exotic vine growth. Some vines can strangle trees, induce tree crown breakage, and smother or prohibit tree regeneration.

The combination of deer browse, invasive plants and dense recalcitrant understory shrubs (predominantly sweet pepperbush, huckleberry and mountain laurel) threatens the long term sustainability of oak ecosystems. Deer heavily browse the more palatable oak regeneration while leaving the birch and only modestly browsing the maple. Invasive growth and insufficient fire have led to the development of previously uncommon dense understories where browsed shade-sensitive oaks rarely graduate to the forest canopy. The lack of sustainable oak ecosystems is a major concern. Investment in management activities such as mechanical site preparation and/or temporary short-term grazing of goats or sheep is anticipated to be necessary prior to any harvesting of trees in these areas in order for oaks seedlings to become established and competitive.

The continual loss of some of the last vestiges of shade intolerant trees such as aspen, pitch pine, gray birch, paper birch, scrub oak, and red cedar due to old age or shade from overtopping trees is a concern. Special efforts will be made to release and regenerate these species by creating favorable environmental conditions for their growth. Severe harvests and controlled burns are two management tools commonly employed to restore these under-represented trees in our forests.

3. Unauthorized or illegal activity

The unauthorized use of trails by 4x4 trucks, all-terrain vehicles (ATVs) and dirt bikes have created varying degrees of erosion. The most egregious damage is located along the south side of the Moosup River in Sterling, off Ericson Swamp Road (across from Wickaboxet Marsh) and along Great Meadow Brook, just off Shetucket Turnpike in Voluntown. In these locations ATVs are cutting down the banks, rutting the flood plain, and crossing the river. These locations have been brought to the attention of DEEP EnCon Police. Shetucket Turnpike will be blocked-off with highway barriers or boulders in an attempt to halt its weekly use by jeeps and other 4x4 trucks. Individual forest operation plans will specifically address trail closing measures off Ericson Swamp Rd. and near the Moosup River in Sterling.

4. Cultural Resource Concerns

Pachaug State Forest has been well-documented as seasonal grounds for Narragansett, Pequot, and Mohegan Indians. Petroglyphs, a rock shelter, and a V-shaped wall with an opening used to funnel game animals to a killing site are among the documented artifacts in the forest. Further interest has developed around the native tribe's use of stone. Stone cairns, serpentine walls, earthen mounds, balance rocks, ancient spring wells, and interesting stone enclosures have also been identified as potential early cultural evidence of pre-European native use. One of DEEP's core functions is the

protection of natural and cultural resources. The Division of Forestry will include the State Archeologist and State Historic Preservation Office (SHPO) in reviews of any forest operation plans which may affect known cultural resources. Resources or structures of unknown cultural significance will be brought to the attention of the State Archeologist and State Historic Preservation Office. All cultural resources identified in the field (native or colonial) will be protected during the implementation of forestry practices. Protection may range to include; outright avoidance, identification and buffering, operator instruction and supervision, or the employment of directional felling techniques.

F. Wildlife Habitat

1. Investment in habitat improvement

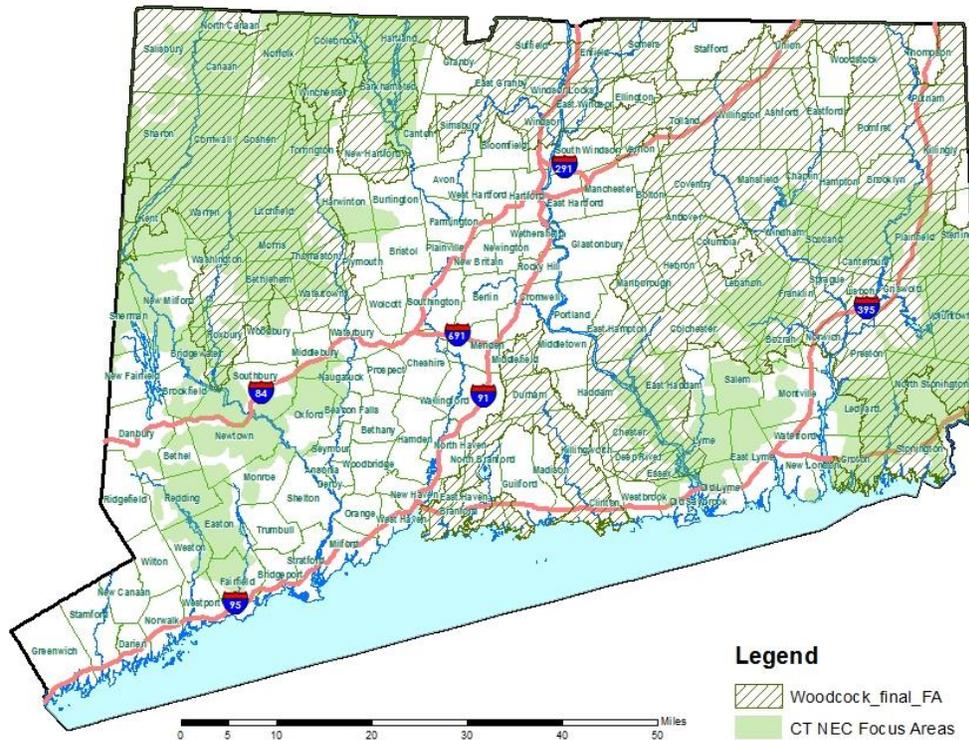
The Green Falls, Glasgo, and Wickaboxet Blocks all fall within habitat restoration focus areas for the New England Cottontail (NEC) (see [Cottontail Fact Sheet](#)) and American Woodcock. These species along with more than 50 other wildlife species of greatest conservation need depend upon the availability of early successional stage habitats, particularly dense young trees and shrubs less than three inches diameter at breast height and under 20 feet tall. The decline of such habitats has led to the species decline on a regional basis. In 2006, the NEC was formally designated by the U.S. Fish and Wildlife Service as a “candidate species” for potential listing as Federally Threatened or Endangered. On September 11, 2015, the Service announced that the NEC would not be listed based on the amount and distribution of suitable habitat available and future commitments by state and federal agencies to continue conservation and monitoring efforts. Following implementation of the plan the forest age class distribution of the management area would help meet the Wildlife Divisions Young Forest Initiative habitat goals. The NEC habitat goal for this focus area is 4,000 acres.

The Wickaboxet Block is adjacent to Rhode Island’s Nicholas Farm Wildlife Management Area which has been actively managed to create suitable NEC habitat. Part of this plan’s intent is to augment the neighboring habitat in Rhode Island with dense young forest habitat in the proximate part of Pachaug. An area close to the Nicholas Farm originating near a former gravel bank colonized by pitch pine can be regenerated if economically feasible or the Wildlife Division wants to invest in creating more young forest.

The Wildlife Division or The Field Support Services Division is requested to help sustain scrub oak and young forest habitat in the overgrown fields/shrubland opposite Wickaboxet Marsh by repeatedly masticating – cutting or grinding of small trees using a forestry (Fecon) mower or brontosaurus – scrub oak areas on a 10 year cycle. Forestry personnel intend to cut, burn or contract out mastication if Field Support Services or Wildlife cannot perform the work.



New England Cottontail & American Woodcock Focus Areas



In 1996, a 20-acre warm season grassland was established off of Shetucket Turnpike using a contracted heavy-duty brushcutting machine, and a Truax no-till seeder donated to the Wildlife Division by The Connecticut Chapter of the National Wild Turkey Federation (NWTf). The NWTf also provided funding for the field preparation (herbicide application) and purchase of the seed mix consisting of big bluestem, little bluestem, and Indian grass. The grassland has been maintained through a combination of mowing and prescribed burning using DEEP staff and equipment. Warm season grass fields provide excellent turkey brood habitat, serve as nesting sites for grassland birds such as bobolink, and provide a diversity of flowering plants used by butterflies and a myriad of insects. The Shetucket grassland will continue to be mowed by the Wildlife Division with assistance requested from Field Support Services or Parks. Assistance from Forestry in conducting a prescribed burn on the area every 4-5 years may be requested.

The Wildlife Division is responsible for the management of five wetland impoundments/wildlife marshes located in the management area (i.e., Heron, Great Meadows, Wickaboxet, Sue Hopkins, and Ericson Marshes). The impoundments were built to create habitat for wetland-dependent wildlife, with a focus on providing high quality breeding sites for waterfowl. The impoundments were constructed using

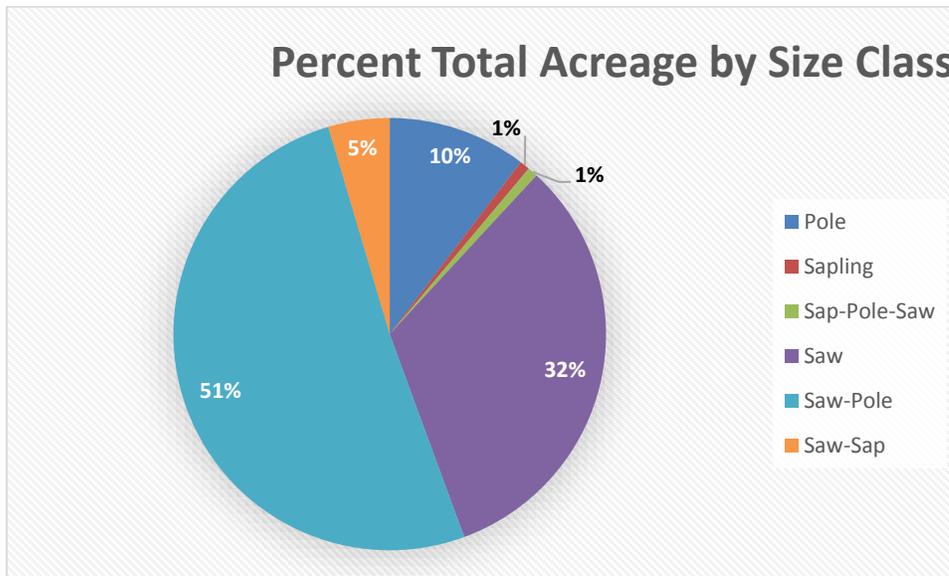
[Federal Aid in Wildlife Restoration Program](#) funds and have been maintained and repaired with funding provided by the Federal Aid Program, [Connecticut Duck Stamp Program](#), and Ducks Unlimited. [Wood duck](#) nest boxes have been installed, monitored and maintained by DEEP staff and volunteers at all impoundments since the 1960s. Beaver activity and a lack of manpower to regularly maintain the impoundments has resulted in structural degradation of the dams and water control structures, and impacted the Wildlife Division's ability to properly manage them for maximum wildlife benefits. In 2012 and 2013, the Wildlife Division conducted an assessment of all wildlife impoundments throughout the state to document their condition and maintenance needs. This information is being used to develop a long-term management strategy for dam repair and maintenance, water control structure replacement, and water level management at priority wetland sites.

In the fall of 2014, dam restoration work was completed by a licensed contractor at Great Meadow Marsh (75 acres) and Wickaboxet Marsh (15 acres) located in the Wickaboxet Block. The work completed at Great Meadow Marsh included: 1) the removal of shrubs, saplings and pole-sized trees from the dam; 2) dam and control structure repairs (e.g., beaver debris removal, filling in holes, stabilizing the face of the dam, minor concrete patch work, weir board replacement, etc.); and 3) blocking access by unauthorized vehicles that had caused severe erosion and structural damage on the dam and damage to the canoe/kayak launching area located in proximity to the dam. The work completed at Wickaboxet Marsh included: 1) removing debris from within and around the control structure; 2) repairing holes in the dam; and 3) repairing the emergency spillway that had been degraded by constant high water conditions due to beaver activity and illegal use by ATVs and other unauthorized vehicles. The Wildlife Division will continue to manage beaver populations and water levels at both sites, and requests that the Parks Division maintain the dams by mowing them (toe of slope to toe of slope) every 1-2 years.

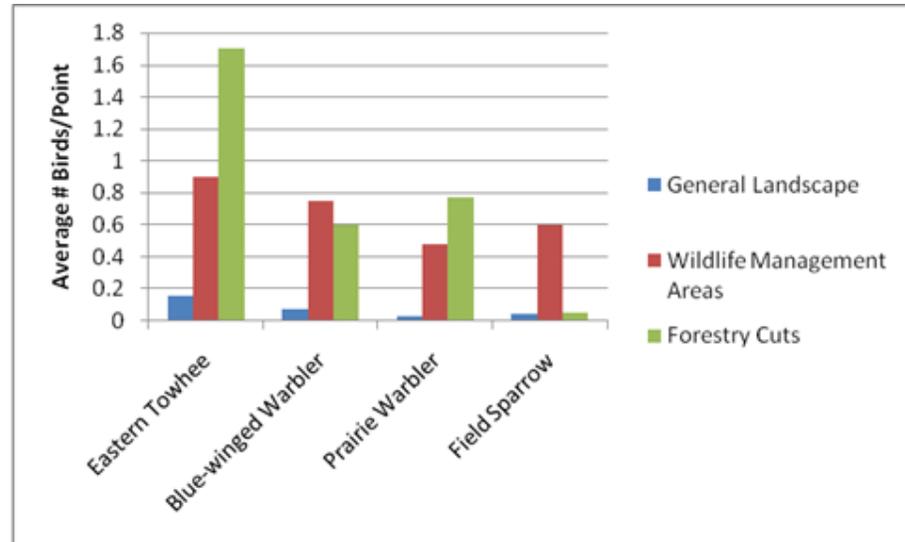
2. Existing Forest Diversity

The management area's forests are dominated by maturing sawtimber forest habitat (see pie chart below) that owes its origins to the widespread fires, clear-cutting, and farm abandonment that occurred around a century ago. That era of intensive forest use was followed by a long period of recovery which allowed the forest to increase in age, density, and continuity. Currently Pachaug represents one of the largest Core Forest blocks in southeastern New England. The management of disturbance-dependent forest types, and habitat structures will weigh potential impacts to core forest attributes. Where possible, large even-aged treatments will be located around the periphery of core forest areas to avoid unanticipated impacts to forest interior birds and other wildlife. However, according to research by Dr. Robert Askins "clear cut logging or similar harvesting methods increase the diversity and density of early successional birds

without having major negative impacts on mature-forest specialists as long as recent harvest areas are <20% of total forest cover". (Askins, R., 2017, personal communication)



Fields, shrub-lands, and young forest habitat (seedlings, saplings, sawtimber/ seedlings, and sawtimber / saplings forest stand size classes) are among the under-represented habitats in Pachaug and the rest of Connecticut. They are identified in [Connecticut's Wildlife Action Plan](#) as key habitat types. Over 80% of avian species dependent upon early successional habitat or young forest habitat are declining. Fields, shrublands, and young forest habitats are short-lived in their useful duration. They mature over time to older forests without appropriate disturbance or, in the case of fields, mowing or burning. The few existing young forest stands (saplings, sawtimber / seedlings, sawtimber / saplings) in this management area are the result of recent forest management. But many of the sawtimber / sapling and sapling stands have already outgrown their usefulness to wildlife species that depend on early successional plant communities. Early successional obligate birds benefit most from clear-cuts between 3-10 years post-harvest. Stands which support tree diameters greater than 3" DBH and vegetation more than 20-feet tall have grown beyond their usefulness for early successional wildlife. A relatively continuous influx of young forest habitat is needed to replenish areas that mature into older forest. This is not adequately occurring on the landscape. This habitat is threatened by decreased natural disturbance frequency (especially fire), a decrease in recently abandoned agricultural land, and a decrease in the intensity and size of forest regeneration cuts. There is an opportunity in this plan to conduct additional forestry regeneration cuts to create replacement young forest habitat. The results of 2012 bird surveys illustrated below, demonstrate the value of the cuts to shrubland birds.



Provided by Shannon Kearney, Wildlife Division

“In general, Forestry managed young forest habitat has very good occupancy and abundance of early successional birds. The graphic illustrates the relative abundance of 4 of our target species in each of the management types. For eastern towhee, blue-winged warbler, and prairie warbler, forest cuts are very important and support a significant number of birds compared to the general landscape. Field sparrow are observed more commonly on wildlife management areas because they prefer habitats with a higher percentage of herbaceous vegetation. (Kearney, S., 2015, personal communication)

Forest management will strive to promote biological diversity by emphasizing under-represented upland ecosystems and populations that are not adequately sustaining themselves under current natural conditions. The most positive influence forest management can have on habitat is to provide an array of different size classes within the upland forest. Since different wildlife species utilize different forest size classes for their primary habitat, promoting adequate amounts of forest in each of the different size-classes will benefit a range of native wildlife. A continuum of the forest size classes will be provided by generally managing on a 100-year rotation and regenerating at least 10% of the active forest during the Ten Year Management Plan. Promoting a forest landscape with 10 - 20% regenerating forests and permanent openings (power lines, brushy post-agriculture set aside acreage and scrub-shrub wetlands) should help optimize early successional species richness ([Options for managing early successional forests](#) p. 9). If the plan accomplishes its targets, the management area would help meet the NEC habitat goal of 4,000 acres for the Pachaug Focus Area. The Wildlife Division’s [Connecticut's Young Forest Initiative](#) is promoting this type of under-represented habitat.

The regeneration harvests will typically promote ecological complexity by retaining den trees and legacy trees as well as snags, coarse woody material and retention patches. A

strategy of consolidating harvest areas will provide for larger tracts of contiguous high quality young forest habitat. Regeneration cuts even have benefits for some forest interior birds as they use these substantially more open areas for post fledgling foraging habitat. Thinnings also provide potential habitat for interior birds that are found in partially open canopy forests such as Cerulean warblers ([Cerulean management guide](#)).

Partially open canopies provide better foraging opportunities for bats. The Northern long-eared bat (federally threatened listed species), Eastern small-footed bat, Little brown bat, and the Tri-colored bat have all been listed as state endangered species in 2015 due to the white nose syndrome. Forestry will incorporate habitat guidelines for these species as they are developed.

Pachaug State Forest, like most forests throughout Connecticut, have an understory that is exceedingly dominated by woody vegetation that have precluded grasses and forbes. It is likely that the latter two traditionally made up a significant component of the understory and greatly increased plant diversity. They historically proliferated after frequent dormant and growing season fires that thinned the forest creating more open woodlands before and after European settlement. Dense woody understories flourished with successful fire suppression in last 70 years. The forests of southeastern Connecticut have experienced a major increase in tree density in the last 100 to 140 years ([Net Change in Forest Density, 1873-2001](#)).

G. Vegetative Condition

1. Silviculture

The active forest, except scrub oak dominated areas, will be managed with even-aged management on a 100 year rotation (area management with 10% of the active forest regenerated during the 10 year plan). Scrub oak, a minor component, would ideally be managed on a 10 to 20 year rotation. The desired future condition of the managed forest after one rotation would have a size class distribution of approximately 10% seedling; 10% saplings; 30% poles and 50% sawtimber on the active forest. A minor amount of sawtimber will be retained as vertical structure in most regeneration harvests. Most of the sawtimber / seedling and sawtimber / sapling stands will be dominated by the younger age class and will be counted as such for purposes of the size class distribution.

Silvicultural work in the affected forest blocks will employ a range of treatments prescribed at the stand level to address resource needs or opportunities. The bulk of the silviculture is planned as irregular shelterwood harvesting designed to regenerate under-represented forest types on suitable sites. Thinning's will occur through half of the crowded but healthy sawtimber stands. Shelterwood silviculture will be employed widely as the most effective tool for regenerating oak forest. Additionally, portions of the area may experience salvage harvesting as a result of recent severe gypsy moth defoliations. Dormant and growing season prescribed fire

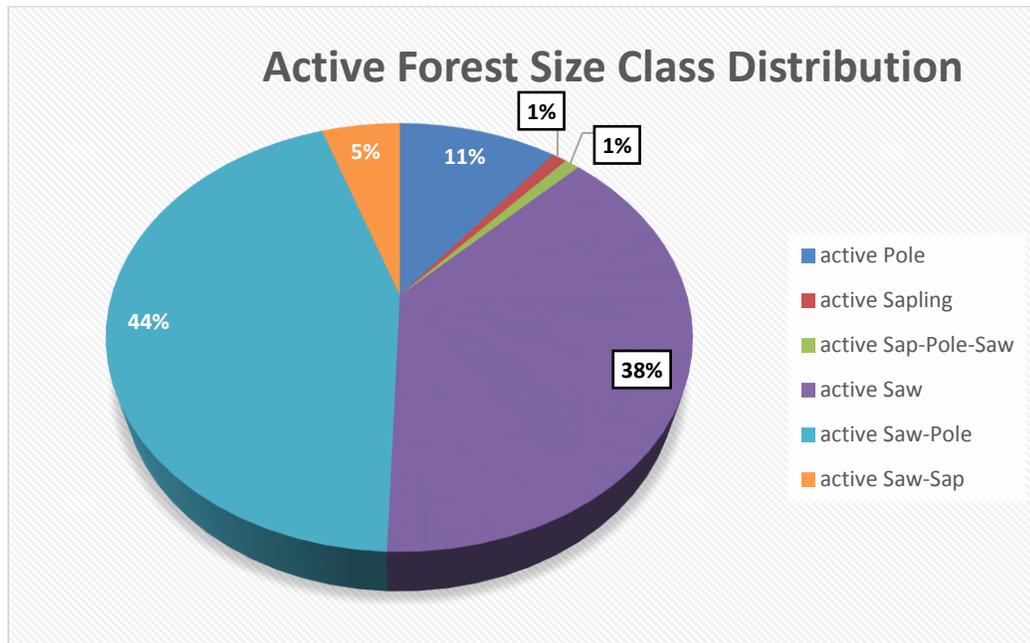
will be used to promote oak and pitch pine regeneration as well to encourage open woodlands and understory plant diversity.

2. Forest type, size Class and Condition on areas which have the ability to be actively managed

Active Forest Type Group by Size Class (Current Acres)

Type Group	Oak Hickory	Birch Beech Maple	Oak Pine	White pine	Exotic Softwoods	Other Pine	Total
Seedling	0	0	0	0	0	0	0
Sapling	89	0	0	5	0	0	94
Sawtimber/seedling	0	0	0	0	3	0	3
Sawtimber/sapling	183	0	174	81	31	54	523
Pole	756	0	137	131	38	0	1,062
Sawtimber/pole/sap	78	0	20	0	0	0	98
Sawtimber/pole	2,546	18	879	903	65	45	4,456
Sawtimber	2,027	0	958	556	137	176	3,854
Total	5,679	18	2,168	1,676	274	275	10,090

Even-Aged Forests	DBH Range
Seedling	<= 1"
Sapling	1.0" <= 4.9"
Pole	5.0" <= 11.9"
Small Sawtimber	12.0" <= 13.9"
Medium Sawtimber	14.0" <= 16.9"
Large Sawtimber	17.0" and larger
Two-Aged Forests	
Sawtimber – Seedling	>12.0" and <=1"
Sawtimber – Sapling	>12.0" and <=1" – 4.9"
Sawtimber – Pole	>12.0" and 5.0" – 11.9"
Multi-Aged Forests	
Sawtimber – Pole – Sapling	>12.0" and 5.0" – 11.9" and 0.1" – 4.9"



3. Forest Health

Invasive Plants -Though one of the least invaded forests, there are several sites in the forest that contain well established populations of exotic invasive plant species which will become more problematic over time. The plants noted during the last inventory include Japanese barberry, multi-flora rose, autumn olive, Japanese knotweed and oriental bittersweet. The latter two appear to be the most disruptive and have the most potential to grow exponentially, especially if a hurricane or other severe widespread disturbance were to create large and widespread canopy gaps throughout the forest. Invasive species threaten the health of the forest because they form monocultures and smother or preclude the regeneration of native species. This can drastically impact the sustainability of the forest. Invasive species do not support the native insect assemblages which would be more prevalent on native vegetation. The diminished competition from native plants reduces overall wildlife diversity in these areas. The goal is to contain established invasive populations and eradicate new populations before they become entrenched.

Invasive Insects – See Biological Threats Section E2.

Climate Change – It is expected that species at or near the southern extent of their native ranges will decline. Long-term species decline in southern New England may be witnessed by sugar maple, eastern white pine, aspens, eastern hemlock and gray/paper birch. It is anticipated that climate change will potentially be beneficial for oaks and pitch pine. The plan implementation should increase the amount of young vigorous oak and pitch pines stands. Thinnings should help the existing species that are predicted to experience long term decline stay healthy for a longer time frame.

Other stressors – The effect of drought and overcrowded forests are exacerbated due to the addition of recent gypsy moth defoliations and heavy imbalance to older forest stands. Older trees that are under stress are more vulnerable to slow or sudden deterioration of tree health and death than more robust younger trees.

Health improvement strategy - The silviculture (see Section G1) strategy provides an opportunity to slowly improve the overall long term health of the forest. It aims to slowly reduce the dominance of the vulnerable older age forest stands by incrementally replacing them with less vulnerable younger forests. The result will eventually be a forest with a more even distribution of acreage of young, middle age, and older forest stands. Less of the forest would be susceptible to windthrow from eminent hurricanes. Thinning crowded healthy stands should help these stands to better retain their health as the best trees would have more room to grow. The current crowded forest is experiencing a reduction in growth rate, which is a sign of decline in health.

H. Landscape Level Management

Pachaug State Forest is a substantial component of the heavily forested landscape in southeastern Connecticut. The forest landscape supports opportunities to benefit under-represented, disturbance-sensitive forest communities while also maintaining the forest interior attributes common within large blocks of core forest. This will be accomplished through thoughtful planning of the location, size, intensity, and seasonality of proposed forest product harvests. Where possible, large even-aged regeneration treatments will be applied on the periphery of core forest areas, and where feasible, treatment prescriptions will incorporate soft edge features designed to limit edge-effects and reduce even temporary habitat fragmentation.

The forest and landscape is within the Southern New England Coastal Hills and Plain Section and Southern New England Coastal Lowlands as delineated by the U.S. Forest Service's National Hierarchical Framework of Ecological Units. The landscape, which contains low density housing and a fair amount of farmland, is fairly rugged with and characterized by continuous forest cover. Small town centers on the peripheries account for some forest fragmentation. The forest landscape in the vicinity of the state forest and the other larger land holdings has significant amounts of valuable core forest. Core forest is defined, for the purposes of this plan, as contiguous forest that is at least 500-acres in size and 300' from other land uses including residences, farm land and paved roads.

Management strategies for Pachaug State Forest will take into account the trend and current condition of the rest of the landscape. The landscape appears to be dominated by maturing hardwood forests. However, there is a significant coniferous forest component. The [2013 U.S. Forest Service Forest Inventory Analysis](#) indicates that young seedling/ sapling forests are under-represented, occupying just over 5% of the State's forest. Habitat management for the New England cottontail on local private lands and

Rhode Island state land (Nicholas Farm) has created a modest amount of young forest habitat nearby. Additional severe disturbances will be continuously needed to provide adequate habitat for animals that depend on young brushy forests. Forestry regeneration operations in Pachaug State Forest are planned in the vicinity of those on private land and the Nicholas Farm in Rhode Island. Planning similar treatments in close proximity increases the regeneration effect and helps attract species with larger patch size requirements.

Young forests are under-represented because they are not sustaining themselves under current conditions. Native Americans had probably once helped sustain several disturbance-dependent ecosystems with the relatively frequent and widespread application of fire. These ecosystems will be promoted by providing similar disturbances that have historically sustained them as part of a natural disturbance model of management. Some ecologists view aboriginal management activities (including their use of fire) as part of the historic natural disturbance regime of an area. Since reintroducing widespread fire is not practical in this landscape, forest management will be tailored to sustain these ecosystems by tending the forest with judicious cutting of trees and limited application of controlled fire. Pitch pine ecosystems are prime example of ecosystems that have historically been perpetuated by fire and are not sustaining themselves under current conditions. It is estimated that 95% of Connecticut's pitch pine/scrub oak sand plains, one of Connecticut's 13 imperiled ecosystems, have been lost to development (Metzler, K.J. et al.) and the rest is threatened by succession. Pachaug probably has the largest population of pitch pine (also known as Candlewood) in Eastern Connecticut. Since pitch pine competes best in impoverished sites, whole tree harvesting will not be prohibited in areas designated for pitch pine enhancement as leaving tops will enrich these sites.

Forest management in Pachaug State Forest will emphasize sustaining the upland ecosystems that are under-represented on the forest landscape. This will be accomplished in areas and using methods which will not compromise the role of this critical Core Forest region within the heavily populated southern New England landscape.

Benefitting the Core Forest attributes, the plan establishes 1,933-acres of passively managed Old Forestland Management Sites. These forest reserves, intended to be left alone through the planning period, encompass a variety of growing sites, increasingly rare vegetation types, and high value riparian forest. Just as proposed young forest management in Sterling intends to beneficially augment activities on the RI DEM's Nicholas Farm, Old Forestland Management Site creation along the Rhode Island border in Voluntown augments activities on the passively managed 1,800-acre Camp Yawgoog Boy Scout camp in Rockville, RI. Locating similar land uses, or land management treatments in close proximity to one another can increase the cumulative effect which management has on the landscape.

I. Specific Acquisition Desires

In addition to a parcel on North Shore Road that was reviewed in 2016, six interior parcels in Wickaboxet Block in Voluntown would be desirable for acquisition if they come on the market or specifically offered to the state. They include:

- 26.34 acres off Bassett Mills Road NECOG GIS id # 040/16-00/258
- 1.1 acres north side of Shetucket Turnpike id# 05/001-00/0859
- 7.98 acres east side of Erickson Swamp Road id # 050/0040-00/0000
- A parcel (unknown size and id# adjacent to Compartment 2) south of Hazard Pond and the Wood River to the RI line
- A 6 +/- acre parcel (id #03459-30-009 adjacent to Compartment 14) on the east side of Bailey Road
- An 86 +/- acre parcel (unknown id # adjacent to Compartment 15) on the West side of Bailey Road

J. Public Involvement

Public involvement in the Pachaug Management Plan is based upon the [Montreal Process](#), which is the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. The United States is a signatory of the Montreal Process. Its view is that forest sustainability cannot be achieved without the support and understanding of its public. Key public involvement components of the Montreal Process include Criterion 7.1c. Provide opportunities for public participation in public policy and decision making and Criterion 7.2 a. Provide for public involvement activities and public education, awareness and extension programs and make available forest-related information.

Previous state-wide public involvement included the opportunity for various stakeholders groups to provide input into the state-wide Forest Resource Plan. Stakeholders were then invited to join The Forest Land Council. This group and the interested public participated in the roundtable-style Forest Forum, which provided input for the [Connecticut Forest Resource Assessment](#).

- Local public involvement for the Glasgow, Green Falls and Wickaboxet Forest Resource Management Plan included contacting town planners, conservation commissions, wetland commissions, or local land trusts and offering to present to them the plan's goals and seek input or comments on the proposed indicators (see I. Ten Year Goals below). The intention was that any public input would be reviewed and alternative indicators will be used if they can be economically monitored with the current resources and have been determined to have more scientific merit in reaching the goals stated below than the proposed indicators. A Survey monkey on the Plan's bio-indicators that was posted on DEEP Forestry State Land Management's web site on January 24, 2017

and used to collect public input. A paper copy of the plan's bio-indicator was also available at the:

- North Stonington Conservation Commission Meeting on January 25, 2017.
- Griswold Inland Wetlands/ Conservation Commission Special Meeting on January 26, 2017.
- Voluntown Conservation Commission Meeting Presentation on March 2, 2017.

Some comments received through the public process have described a concern about the level of active forest management which is proposed. A common thought suggests nature, or the forest should be left alone and allowed to take care of itself. This passive management approach is a valid suggestion and it's currently being applied to a measurable percentage of the forest. The 1,933-acre Old Forestland Management Sites will be managed under a passive approach, allowing the accumulation of late-successional forest characteristics. However, for generally underrepresented disturbance-sensitive forest types and species, a passive management approach fails to create the conditions necessary to perpetuate those declining populations. Given the goal of the plan to promote biological diversity, a widespread passive management approach is not scientifically merited to sustain declining species populations or forest types. Since no alternative bio-indicators that would achieve the stated goals were proposed, the Division of Forestry will utilize the proposed bio-indicators, and the best available science in managing our forests to sustain underrepresented forest communities and the individual plant and animal species which inhabit them. (See Appendix D: Public Involvement)

The towns' first selectman offices were notified by email when the Draft Management Plan was posted on the DEEP Forestry Division's website so they could notify their citizens and have the opportunity to give comment. A survey monkey website was set up to gather feedback and public input until May 26, 2017. The Draft management plan was put on the DEEP Forestry Division's State Land Management website on April 10, 2017.

K. Adaptive Management

This plan is based on an adaptive management format as there are many variables and uncertainties that will affect outcomes. Some of these include climate change and hurricane occurrence, both of which may stimulate and spread invasive plants. Other are the effects of the recent and future droughts and gypsy moth defoliations. With many unknowns, outcomes will be more uncertain so the flexibility of adaptive management is especially valuable. Outcomes of management actions will be monitored and provide feedback as to whether the plan is moving the forest toward the management goals. Adaptive management will allow changes to the plan if conditions change, there are undesirable outcomes, or new information becomes available. The adaptive management format follows the steps listed below:

- Problem assessment.
- Designing a management plan and monitoring program (biodiversity indicators) that will provide reliable feedback about the effectiveness of the chosen action.
- Implementation of the plan.
- Monitor indicators to determine how effectively actions are meeting management objectives.
- Evaluate the outcomes and compare to below stated Bio-indicators or “Desired future condition”.
- Adjust implementation.
- Repeat process for adjustments.

Climate Change adaptation strategies incorporate adaptive management principles. They also use similar approaches that are utilized when managing for a healthy and diverse forest. These can be found at [Climate Change Adaptation Strategies and Approaches](#).

L. Goals

- 1) To promote biological diversity or viable populations of forest species of plants and animals native to the area. Efforts will concentrate on upland ecosystems and populations that are not adequately sustaining themselves under current conditions.
- 2) To maintain or improve aquatic system integrity.
- 3) To promote healthy and sustainable forests.

Bio-indicators (quantitative or qualitative biological variables which can be measured and provide reliable feedback about the effectiveness of reaching stated management goals. Indicators are requisite for adaptive management).

- **Sustain oak forests**- Promote 30 free to grow oak or hickory saplings per acre by the time inventory for next ten year management plan occurs. This will yield a new forest with a 50% oak/hickory component and sustain ecologically valuable oak forests that would eventually succeed to other hardwoods without intervention.
- **Sustain/re-establish pitch pine ecosystem** – Promote pitch pine regeneration in appropriate harvests by introducing pitch pine seeds.
- **Provide Early Successional (ES) habitat** – Regenerate 10% of active forest area to provide seedling or sawtimber/seedlings* size class by end of management period.
*Stands with a minor sawtimber component (generally < 5 trees/ac) that do not significantly inhibit ES habitat.
- **Retain Late Successional (LS) structure** – Retain an average of 2 to 4 large (>16” in diameter) legacy, den or rotten trees/acre throughout the forest. Retain a minimum of three snags (12” or greater in diameter) per acre and coarse woody

materials (e.g., fallen trees/logs), and provide heterogeneity by creating variable sized gaps and retention patches.

- **Provide for LS Forest** – Maintain at least 20% of forest for old forest values with passive management in Old forestland, Inoperable, and Inaccessible management status classes (see map F, Workplan). Salvage or clean-up of natural disturbances will not take place except where it is a public safety issue. Uncommon trees such as pitch pine maybe promoted in these forests by felling but not harvesting a limited number of overtopping trees.
- **Healthy Forest Stands**– Thin 50% of the crowded forest stands increasing average overstory tree size after harvest. Create a more balanced age class distribution. (i.e. less disparity between amount of acreage in young, middle age and older forests).
- **Minimize Stream Sedimentation** – Gate more roads unsuitable for public vehicle traffic, stabilize more stream fords on woods roads and have more bridges at stream crossings on trails at end of plan period

M. Work Plan

1. Road Maintenance – May be accomplished via a Forestry Division project plan with Agency Support Services Division. Specific road improvement projects will be evaluated with the Agency Support Services Division District Supervisor on an annual basis. Road work will be funded out of either the Timber Revolving Fund, or Pittman-Robertson Wildlife Restoration funding. The specific funding source will be determined at the time of project implementation based on the type of silvicultural work the road is accessing and the relation of the planned work to the Pittman-Robertson Wildlife Restoration Grant.
 - Gravel, crown, and improve drainage on;
 - Ericson Swamp Road,
 - Tippecansett Road
 - Shetucket Turnpike
 - Additional woods roads need improvement to reduce erosion and provide forest management access on both sides of Hodge Pond Road.

Block	Road	Improvement	Length (ft.)	Year
Wickaboxet	Ericson Swamp	Dress, crown, ditch	1100	2018
Wickaboxet	Ericson Swamp	Dress, crown, grade	1500	2018
Greenfalls	Greenfalls Campground Rd.	Dress, crown	TBD	2018
Glasgo	Hodge Rd. (north & south)	Dress, crown	3700	2019
Wickaboxet	Sue Hopkins	Dress, crown	5800	2020
Wickaboxet	Old Greenwich Path	Dress, crown	1800	2020
Greenfalls	Fish Rd.	Dress, crown	3800	2021

Wickaboxet	Basset Mills Rd.	Dress	TBD	2021
Greenfalls	GF Campground Rd. (if needed)	Dress	TBD	2022
Wickaboxet	Old Voluntown Rd. (or) Shetucket TPKE	Dress	TBD	2023
Greenfalls	Fish Rd. (if needed)	Dress	TBD	2024
Wickaboxet	Ericson Swamp Rd. (if needed)	Dress	TBD	2025
Wickaboxet	Pratt Rd.	Dress, crown	TBD	2025
Greenfalls	Sand Hill Rd.	Dress, crown	TBD	2026

2. Gates – Forestry project plan with Agency Support Services
Purchase a spare gate.

3. Recreational or Scenic Work – Parks Division
It is recommended that the Department conduct a trail condition and public use assessment and develop a forest recreation plan to address current and potential impacts to flora and fauna and forest ecosystem health associated with illegal off-road vehicle use and unauthorized trail development/use. As funding becomes available, the Park and Recreation Supervisor may propose trail improvement and other recreation projects in accordance with the priority actions recommended in such plan.

4. Boundaries Maintenance – Forestry Division
Once in plan duration.

5. Stream Improvement - Forestry Division, Fisheries Division, volunteers and / or Agency Support Services Division

6. Upland wildlife opening work – Wildlife Division
The Wildlife Division is requested to maintain priority grassland habitats throughout the subject blocks, and evaluate the stands listed below to determine if re-establishing young forest habitat via Fecon mowing is a priority in these areas given local habitat needs, staffing, and economic resources.

Wildlife Division Non-Commercial Tree Felling or masticating in partial or complete stands.

Block	Compartment	Stand	Treatment	Acres	Purpose
Wickaboxet	12	3	Fecon*	11	Habitat

Wickaboxet	18	2	Fecon*	55**	Composition
Wickaboxet	19	2	Fecon*	109**	Habitat

*As staffing, resources, and wildlife priority allow

**Only a subset of this acreage would be subject to Fecon mowing

The Wildlife Division will continue to maintain wood duck nest boxes and a 50:50 mix of open water and emergent vegetation in the Wildlife Marshes to benefit waterfowl and other wetland-dependent wildlife. Management activities will include maintenance of the dam and water control structure (i.e., annual mowing, removal of beaver debris, beaver population management and water level manipulation). The State Lands Habitat Management Program will continue to provide assistance in monitoring beaver activity within the property and addressing problems where public health and safety and/or important habitats are being threatened. Assistance from Agency Support Services, Parks and the Wetlands Habitat and Mosquito Management Program in providing equipment and personnel may be requested.

7. Forest Stand Treatments –
a. **Silvicultural Harvests**

Block	Stand	Treatment	Acres	Year	Lead
Wickaboxet	1-3	TSI	5	2018	Forestry
Wickaboxet	15-3	TSI	9	2018	Forestry
Wickaboxet	1-9	Irregular shelterwood	95	2018	Forestry
Wickaboxet	7-6	Irregular shelterwood	12	2018	Forestry
Wickaboxet	7-8	Irregular shelterwood	25	2018	Forestry
Wickaboxet	12-2	Irregular shelterwood	7	2018	Forestry
Wickaboxet	12-3	Fecon mow	11	2018	Wildlife
Wickaboxet	12-8	Thinning	30	2018	Forestry
Wickaboxet	12-9	Irregular shelterwood	36	2018	Forestry
Wickaboxet	12-11	1 st shelterwood	5	2018	Forestry
Greenfalls	9-1	Salvage	19	2018	Forestry
Greenfalls	10-9	Salvage	72	2018	Forestry
Glasgo	2-11	Irregular shelterwood	37	2019	Forestry
Glasgo	3-3	Irregular shelterwood	8	2019	Forestry
Glasgo	3-6	Irregular shelterwood	39	2019	Forestry
Glasgo	3-8	Irregular shelterwood	42	2019	Forestry
Glasgo	3-17	Irregular shelterwood	15	2019	Forestry
Glasgo	4-4	1 st shelterwood	25	2019	Forestry
Glasgo	4-15	Irregular shelterwood	18	2019	Forestry
Glasgo	4-20	Irregular shelterwood	19	2019	Forestry
Glasgo	5-1	Irregular shelterwood	19	2019	Forestry
Glasgo	5-4	TSI	22	2019	Forestry

CT DEEP Division of Forestry
Pachaug S.F. Management Plan 2018-2027

Glasgo	5-9	Irregular shelterwood	14	2019	Forestry
Wickaboxet	14-9	Irregular shelterwood	8	2020	Forestry
Wickaboxet	17-2*	Irregular shelterwood	37	2020	Forestry
Wickaboxet	17-3	Irregular shelterwood	43	2020	Forestry
Wickaboxet	18-2	TSI	55	2020	Forestry
Wickaboxet	18-4	Irregular shelterwood	32	2020	Forestry
Wickaboxet	19-3	Irregular shelterwood	24	2020	Forestry
Wickaboxet	19-5	Thinning	14	2020	Forestry
Wickaboxet	19-8	Irregular shelterwood	30	2020	Forestry
Wickaboxet	21-1	Irregular shelterwood	35	2020	Forestry
Wickaboxet	19-2	Fecon Mow	109	2020	Wildlife
Greenfalls	2-1	Irregular shelterwood	35	2021	Forestry
Greenfalls	2-4	Thinning	9	2021	Forestry
Greenfalls	3-6	Irregular shelterwood	55	2021	Forestry
Greenfalls	3-12	Irregular shelterwood	34	2021	Forestry
Greenfalls	6-3	Thinning	18	2021	Forestry
Greenfalls	10-1	Irregular shelterwood	17	2021	Forestry
Greenfalls	10-12	Irregular shelterwood	30	2021	Forestry
Greenfalls	14-3	Thinning	12	2021	Forestry
Greenfalls	15-3	TSI	8	2021	Forestry
Greenfalls	15-7	TSI	41	2021	Forestry
Wickaboxet	3-3	Thinning	8	2022	Forestry
Wickaboxet	4-17	1 st shelterwood	7	2022	Forestry
Wickaboxet	6-4	Final shelterwood	6	2022	Forestry
Wickaboxet	6-6	1 st shelterwood	6	2022	Forestry
Wickaboxet	6-7	1 st shelterwood	14	2022	Forestry
Wickaboxet	6-13	Thinning	14	2022	Forestry
Wickaboxet	6-16	Thinning	4	2022	Forestry
Wickaboxet	10-5	1 st shelterwood	65	2022	Forestry
Greenfalls	1-7	Irregular shelterwood	13	2022	Forestry
Greenfalls	4-6	Thinning	45	2022	Forestry
Greenfalls	21-3	1 st shelterwood	51	2022	Forestry
Wickaboxet	15-1	Understory grazing	122	2022	Forestry
Wickaboxet	6-2	1 st shelterwood	28	2023	Forestry
Wickaboxet	6-5	Thinning	37	2023	Forestry
Greenfalls	10-4	1 st shelterwood	71	2023	Forestry
Greenfalls	10-5	Thinning	13	2023	Forestry
Greenfalls	10-7	Thinning	11	2023	Forestry
Greenfalls	10-14	Thinning	7	2023	Forestry
Greenfalls	12-7	Thinning	15	2023	Forestry
Greenfalls	12-19	1 st shelterwood	55	2023	Forestry
Greenfalls	19-1	Thinning	12	2023	Forestry
Wickaboxet	3-1	1 st shelterwood	110	2024	Forestry
Wickaboxet	8-1	Irregular shelterwood	18	2024	Forestry

CT DEEP Division of Forestry
Pachaug S.F. Management Plan 2018-2027

Wickaboxet	8-2	Thinning	32	2024	Forestry
Wickaboxet	16-4	Thinning	25	2024	Forestry
Wickaboxet	16-6	Thinning	33	2024	Forestry
Glasgo	5-5	Thinning	49	2025	Forestry
Greenfalls	3-14	Thinning	11	2025	Forestry
Greenfalls	4-1	Thinning	2	2025	Forestry
Greenfalls	10-6	Thinning	16	2025	Forestry
Greenfalls	10-10	Thinning	2	2025	Forestry
Greenfalls	10-13	Thinning	66	2025	Forestry
Greenfalls	10-20	Thinning	40	2025	Forestry
Greenfalls	18-6	Thinning	21	2025	Forestry
Wickaboxet	2-2	Irregular shelterwood	101	2026	Forestry
Wickaboxet	11-2	Thinning	18	2026	Forestry
Wickaboxet	11-5	Thinning	21	2026	Forestry
Wickaboxet	11-6	Thinning	62	2026	Forestry
Greenfalls	12-4	Thinning	18	2027	Forestry
Greenfalls	13-6	Thinning	17	2027	Forestry
Greenfalls	22-1	Thinning	58	2027	Forestry
Greenfalls	22-9	Thinning	45	2027	Forestry
Greenfalls	22-10	Thinning	3	2027	Forestry
Greenfalls	23-6	Thinning	37	2027	Forestry
Greenfalls	23-7	Thinning	11	2027	Forestry
Wickaboxet	15-1	1 st shelterwood**	122	2027	Forestry

*May be postponed due to understory shrub competition

**Treatment dependent upon adequately controlling understory shrub competition

Map A - Topographic

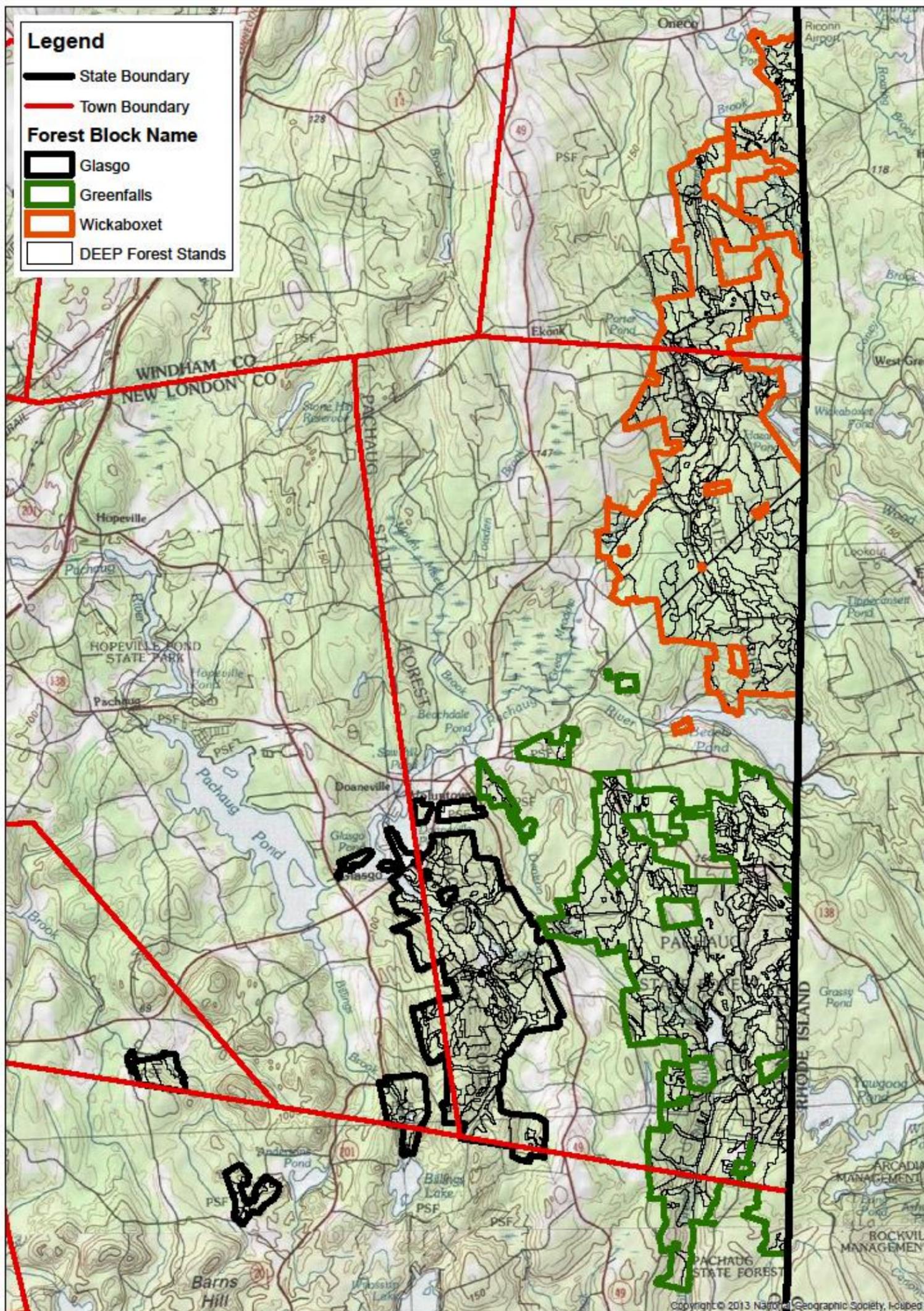
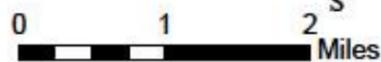


Map A - Topographic Pachaug State Forest Glasgo, Greenfalls, and Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1 : 65,000



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map B - Basemap

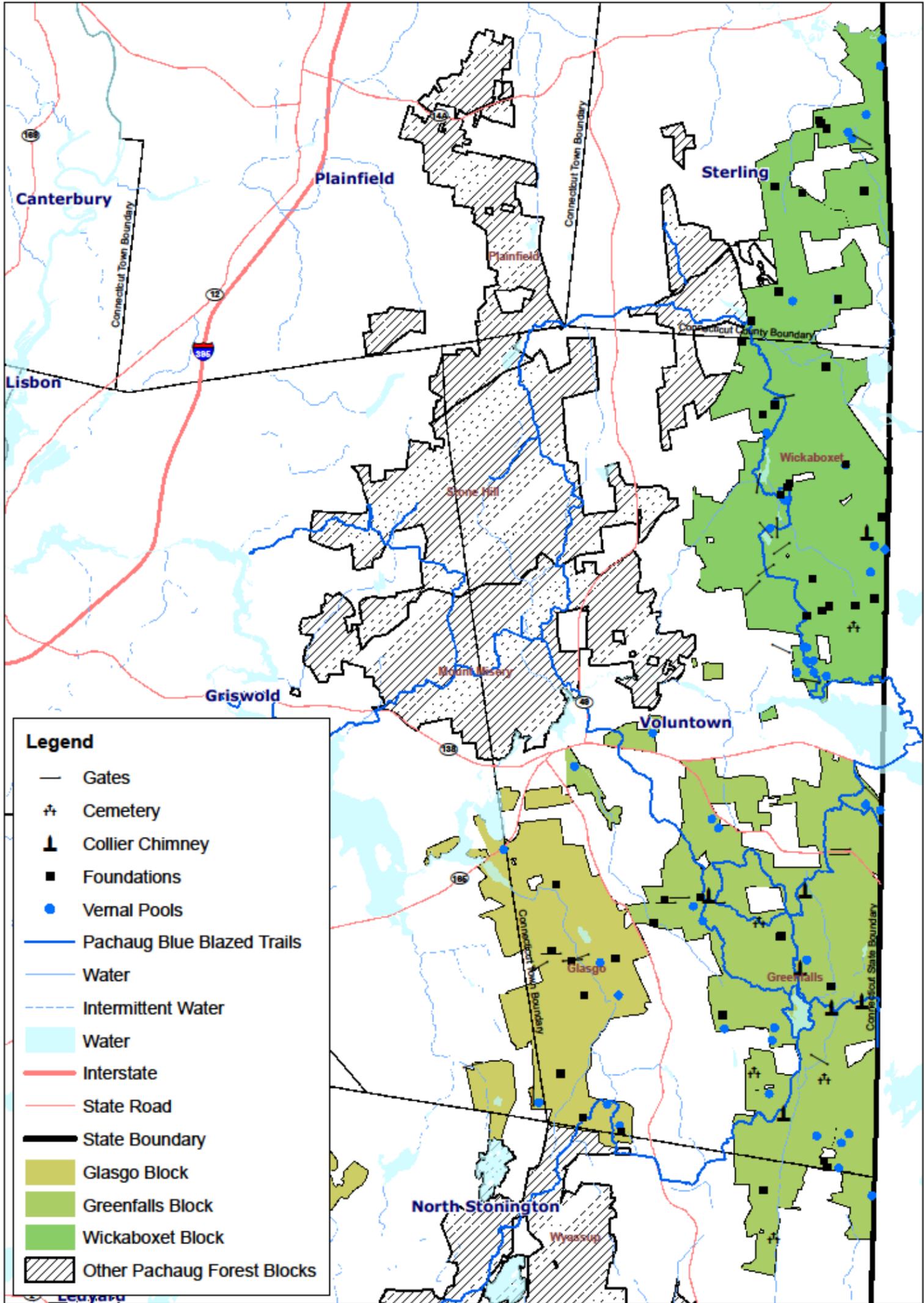
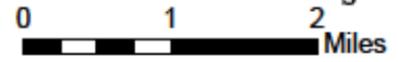


Map B - Base Pachaug State Forest
Glasgo, Greenfalls, Wickaboxet Blocks
 Voluntown, Griswold, Sterling, North Stonington, Connecticut
 14,343 Acres



February, 2017

Map Scale: 1 : 65,000



Legend

- Gates
- ⊕ Cemetery
- ⌋ Collier Chimney
- Foundations
- Vernal Pools
- Pachaug Blue Blazed Trails
- Water
- - - Intermittent Water
- Water
- Interstate
- State Road
- State Boundary
- Glasgo Block
- Greenfalls Block
- Wickaboxet Block
- Other Pachaug Forest Blocks

Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map C - Site Quality

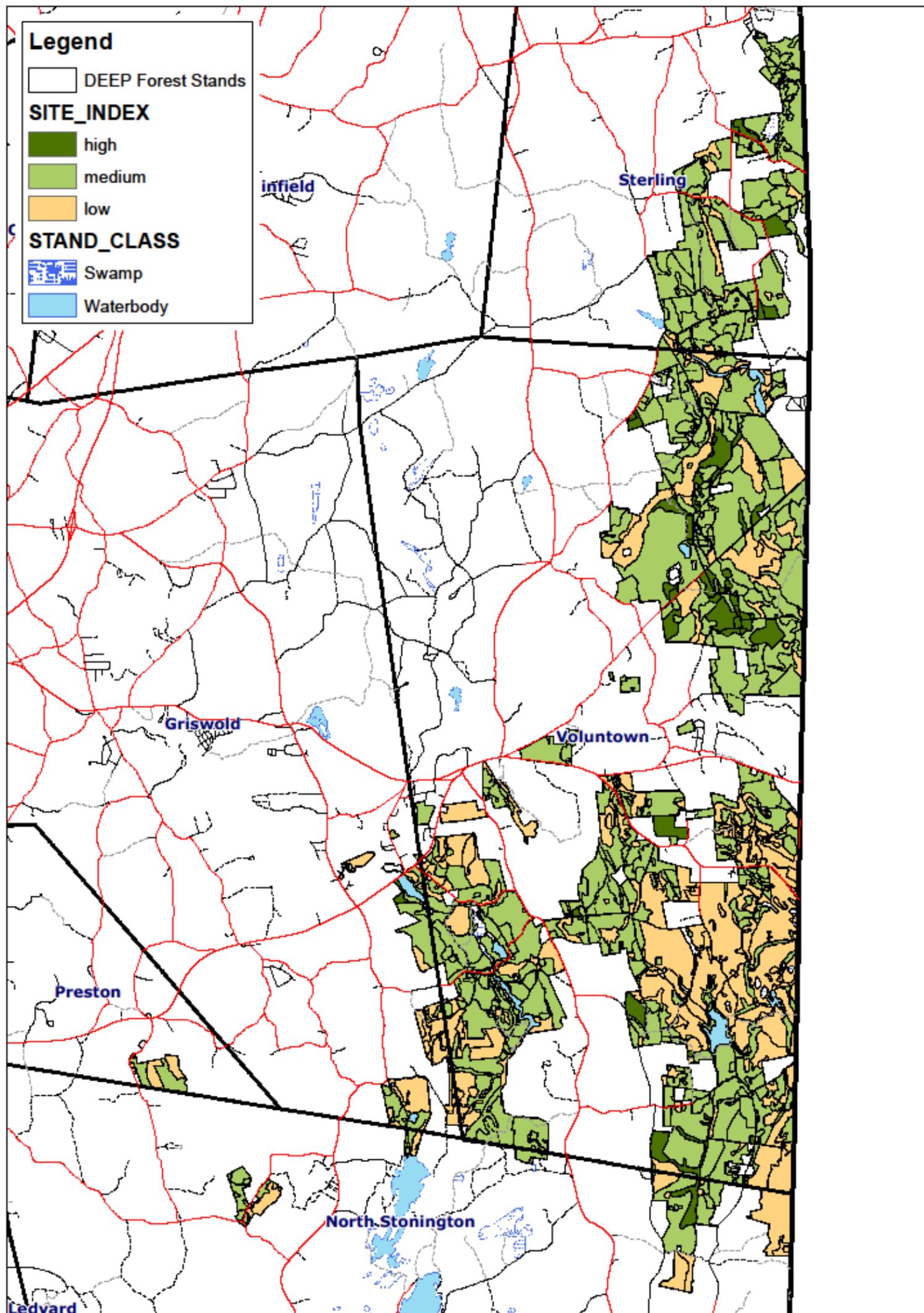
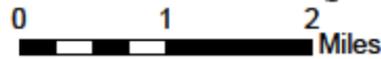


Map C - Site Quality Pachaug State Forest Glasgo, Greenfalls, Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1 : 65,000



NAD 1983 State Plane Connecticut FIPS 0600 Feet

Lambert Conformal Conic

Map D - Forest Type & Size Class

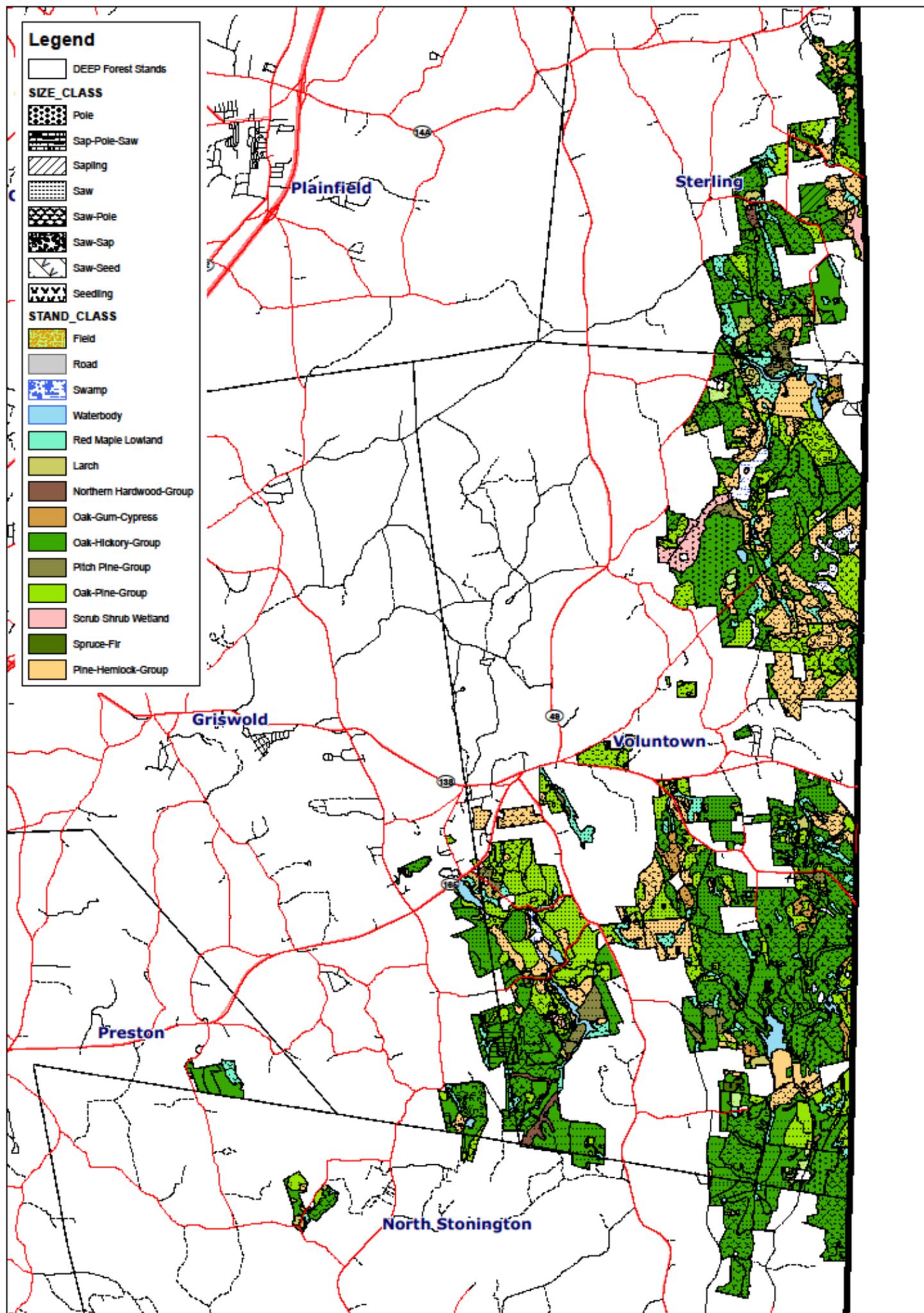


Map D - Forest Type & Size Class Pachaug State Forest Glasgo, Greenfalls, Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1:65,000



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map E - Special Features

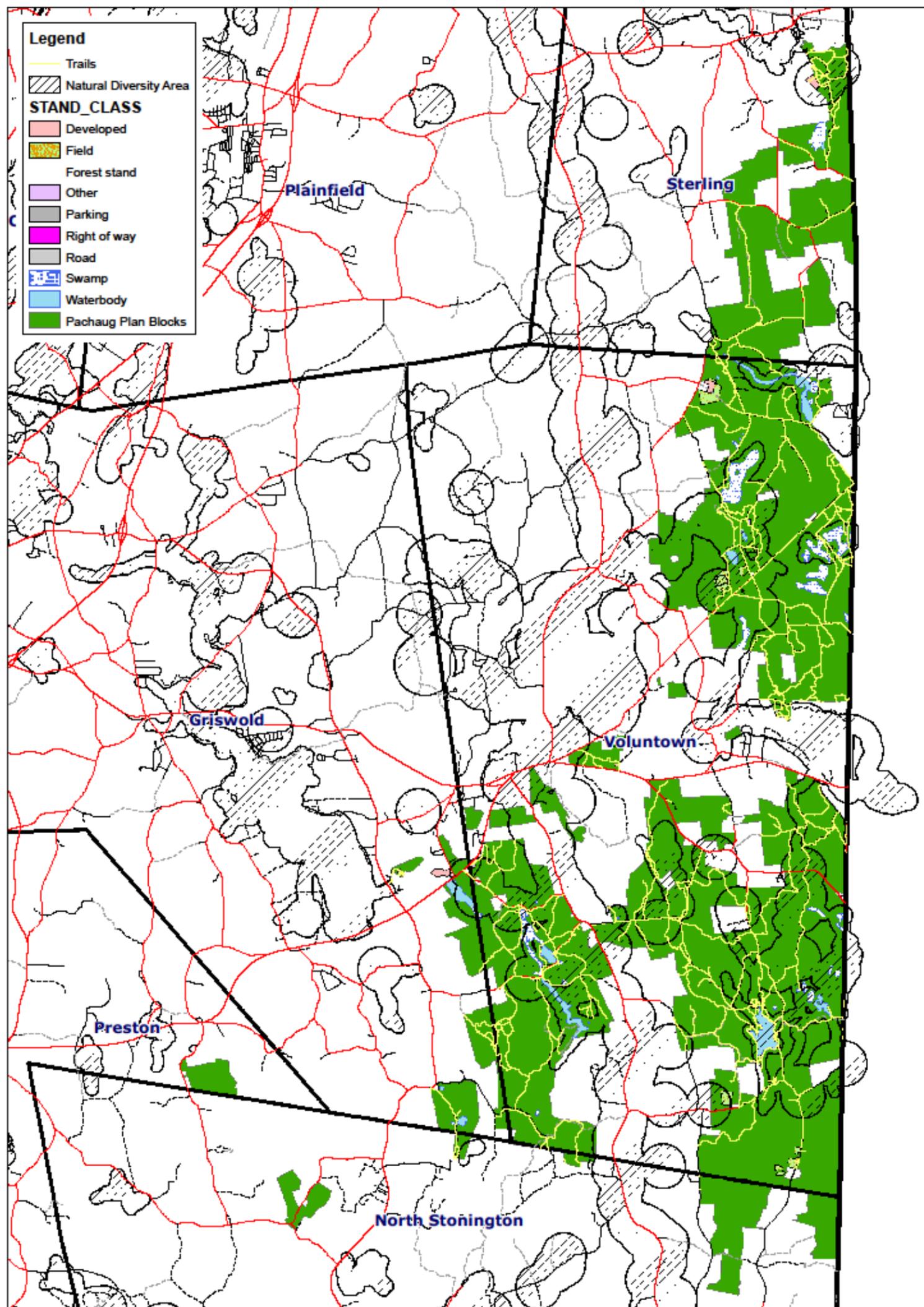


Map E - Special Features Pachaug State Forest Glasgo, Greenfalls, Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1:65,000



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map F - Workplan

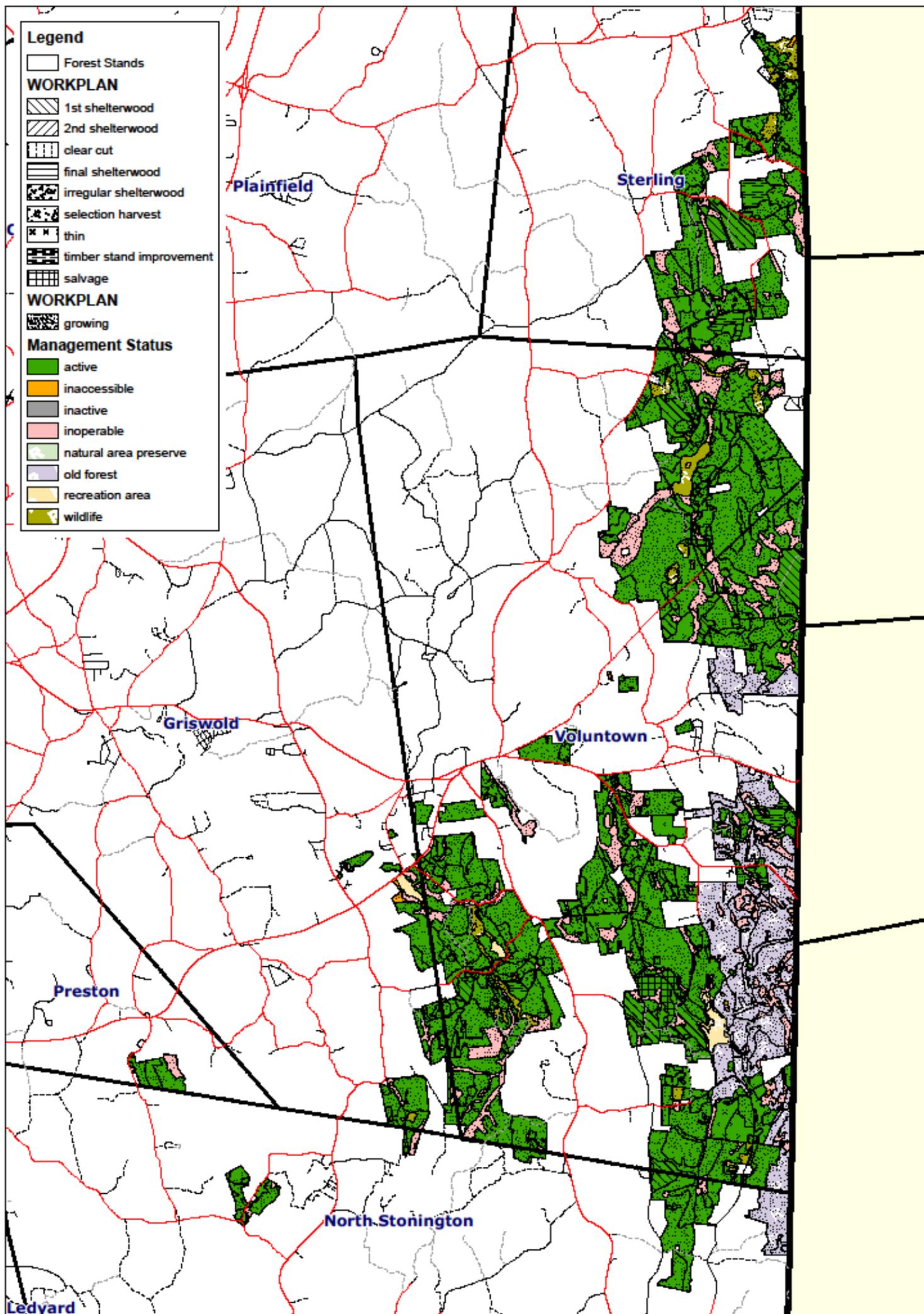


Map F - Work Plan Pachaug State Forest Glasgow, Greenfalls, Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1:65,000



Legend

- Forest Stands
- WORKPLAN**
- 1st shelterwood
- 2nd shelterwood
- clear cut
- final shelterwood
- irregular shelterwood
- selection harvest
- thin
- timber stand improvement
- salvage
- WORKPLAN**
- growing
- Management Status**
- active
- inaccessible
- inactive
- inoperable
- natural area preserve
- old forest
- recreation area
- wildlife

Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map G – Invasive Plants

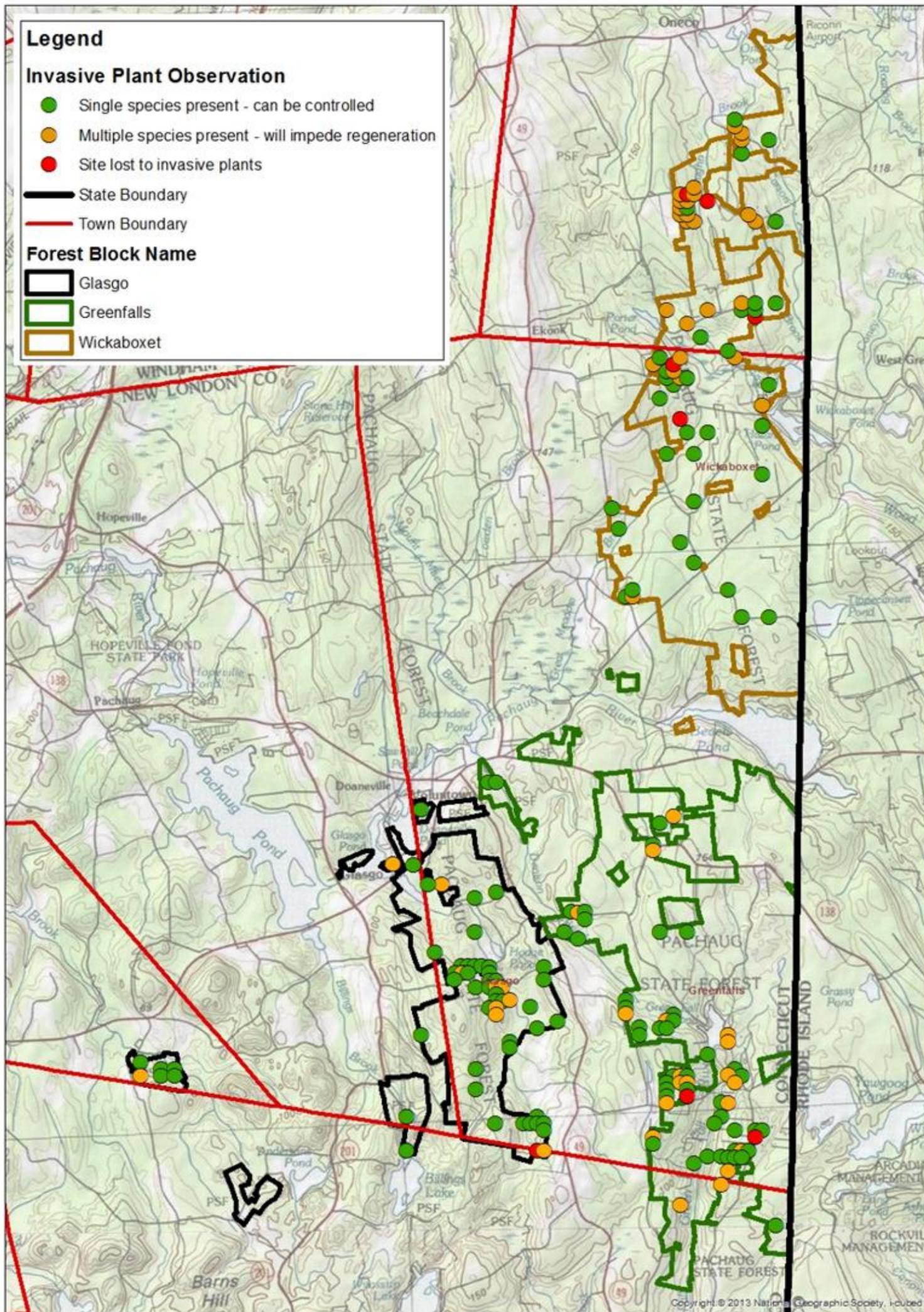


Map G - Invasive Pachaug State Forest Glasgo, Greenfalls, and Wickaboxet Blocks Voluntown, Griswold, Sterling, North Stonington, Connecticut 14,343 Acres



February, 2017

Map Scale: 1 : 65,000



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0900 Feet

Projection: Lambert Conformal Conic

Appendix A – Reference

- Askins, R. A., B. Zuckerberg, and L. Novak. (2007). Do the size and landscape context of forest openings influence the abundance and breeding success of shrubland songbirds in southern New England? *Forest Ecology and Management* (250), pp. 137-147.
- Metzler, K. J. and D. L. Wagner. (1998). Thirteen of Connecticut's most imperiled ecosystems. Internal report (draft) of the State Geological and Natural History Survey of Connecticut Department of Environmental Protection, 79 Elm Street, Hartford, Connecticut.
- Nowak, J. et. al. (2015). Southern Pine Beetle Infestation in Relation to Forest Stand Conditions Previous Thinning's and Prescribed Burns. *Journal of Forestry* (113), pp. 5.
- Prasad, A. M., L. R. Iverson., S. Matthews., M. Peters. (2007-ongoing). A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. <http://www.nrs.fs.fed.us/atlas/tree>, Northern Research Station, USDA Forest Service, Delaware, Ohio.

Appendix B – Definitions

This glossary contains a list of commonly used forestry terms.

- **acre** A unit of measure describing surface area. One acre contains 43,560 square feet. A football field (without the end zones) is 45,000 square feet -- slightly larger than an acre. The inside of a professional baseball diamond is about 1/4 of an acre.
- **advance regeneration** Young trees that have become established naturally in a forest before regeneration methods are applied. In other words, the regeneration is present in advance of any treatment.
- **age class** The trees in a stand that became established at, or about, the same time. The range of tree ages in a single age class is usually less than 20 percent of the expected age of that class.
- **basal area** The area of the cross section of a tree's stem at 4 1/2 feet above ground, or breast height, in square feet. Basal area of a forest stand is the sum of the basal areas of the individual trees in the stand. It is usually reported in square feet of BA per acre and is used as a measure of stand stocking, stand density, and stand volume.
- **board-foot volume** The amount of wood products expressed as the number of boards 1 foot wide by 1 foot long and 1 inch thick that are sawn from logs.
- **biological diversity** The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. Also, the variety of ecological structures and functions at any one of these levels.
- **Best Management Practices** Procedures and treatments that lessen soil erosion, sedimentation, stream warming, movement of nutrients, and visual quality during or following activities that alter the land.
- **buffer strip** An area of land that is left relatively undisturbed to lessen impacts of treatments next to it. Common examples include visual buffers used to screen the view from roads, and stream side buffers used to protect water quality.
- **canopy** The continuous cover of branches and foliage formed collectively by the crowns of trees.
- **Clearcutting** An even-aged silvicultural technique involving the removal of all stems in the stand. Strip cutting is a form of clearcutting.
- **Core forest** A contiguous forest that is at least 500-acres and 300' from other land uses including residences, farm land and paved roads.
- **crop tree** Any tree selected to provide a specific benefit such as mast, dens, veneer, or sawtimber. Crop trees are usually selected when they are young.
- **cutting cycle** The planned interval between treatments in forest stands.

- **damaging agent** Any one of various factors that injure trees. They include some insects, diseases, wildlife, abiotic factors, and human activities.
- **dbh** Diameter at breast height; the diameter of the trunk of a tree measured at 4 1/2 feet above ground level. It is measured on the uphill side of the tree.
- **den tree** A living tree that has holes in the trunk, or stem, from broken branches and decay, or hollow trunks; a cavity tree.
- **even-aged stand** A stand containing trees in the main canopy that are within 20 years of being the same age. Even-aged stands sometimes are designated by age-class (10-year-old stand, 40-year-old stand) or broad size-class: seedling stand (most trees are <1 inch dbh); sapling stand (trees 1-4 inches dbh); poletimber stand (trees 5-10 inches dbh); and sawtimber stand (trees > 10 inches dbh).
- **even-aged system** A planned sequence of treatments designed to maintain and regenerate a stand with one age class.
- **forest condition** Generally, the current characteristics of forested land including but not limited to cover type, age arrangement, stand density, understory density, canopy density, and forest health.
- **forest cover type** A category of forests based on the kind of trees growing there, particularly the composition of tree species. Forest cover types are often referred to as forest types, cover types, stand types, or types.
- **group selection** An uneven-aged silvicultural technique involving the removal of trees in groups usually 1/10 to 2/3 acre in size, but sometimes up to 1 to 2 acres on large properties. Group selection can be applied in combination with single-tree selection between groups.
- **horizontal diversity** The degree of complexity of the arrangement of plant and animal communities, and other habitats across a large area of land.
- **inactive forest** – Management category designated for forests currently unstaffed by the DEEP Division of Forestry
- **interior species** Species found only or primarily away from the perimeter of a landscape element. Species commonly requiring or associated with interior habitat conditions.
- **intermediate cuttings** Silvicultural cuttings applied in the culture of even-aged stands and are normally noncommercial (no products sold) or commercial thinnings (timber sold), designed to favor certain species, sizes, and qualities of trees by removal of competitors. Thinning's designed to grown quality timber commonly maintain a closed canopy; however, low-density thinning (50-70% residual crown cover) can be used to hasten diameter growth and stimulate understory development for wildlife purposes. At rotation age, the stand in considered to be mature and a regeneration cutting is applied to produce a new stand.

- **intermediate treatment** Any treatment or "tending" designed to enhance growth, quality, vigor, and composition of the stand after seedlings are established and before mature trees are regenerated. For example, thinning is an intermediate treatment.
- **mast tree** A tree that produces nutlike fruits such as acorns, beechnuts, hickory nuts, seeds of certain pines, cherries, apples, samaras. Hard mast includes acorns, beechnuts, and hickory nuts. Soft mast includes cherries, apples, and samaras (on maple and ash trees).
- **matrix** The matrix is the dominant landscape element on a landscape in which smaller differentiated elements (patches) are embedded. It is commonly highly connected throughout the landscape.
- **native plant** A species that naturally occurs in a given location where its requirement for light, warmth, moisture, shelter, and nutrients are met.
- **non-commercial treatment** Any activity that does not produce at least enough value to cover the direct costs of that treatments.
- **overtopped** A condition or position where a tree's crown is completely covered by the crowns of one or more of its neighboring trees. An overtopped tree's crown is entirely below the general level of the canopy and does not receive any direct sunlight either from above or from the sides.
- **patch** A patch is a relatively homogeneous area that differs in some way from its surroundings (e.g., woodlot in a corn field, conifer plantation in a mixed-deciduous forest).
- **plantation** A forest stand in which most trees are planted or established from seed sown by people. Typically, planted trees are in rows, with equal spacing between each tree in a row and between rows.
- **pole** A tree, usually young, that is larger than 4 inches dbh and smaller than 8 to 11 inches dbh.
- **prescribed burn** The application of fire in forested or other areas, usually under specific conditions of weather and fuel moisture, to control vegetation for silvicultural purposes or to reduce hazards.
- **regeneration** The seedlings and/or saplings in a new forest stand or age class. Natural regeneration originated from seeds, sprouts, or root suckers.
- **Regeneration method** A cutting method by which a new age class is created. These methods include clearcutting, seed tree, shelterwood, single-tree selection, and group selection; also called reproduction method.
- **Regeneration cuttings** Silvicultural cuttings designed to naturally regenerate the stand by providing for seedling (or vegetative stems) establishment or development, or both. Two even-aged techniques; clearcutting and shelterwood, and two uneven-aged techniques; single-tree selection and group selection.
- **rotation** The planned interval of time between treatments that regenerate a stand.

- **runoff** Surface streamflow leaving a watershed. Sources of runoff are precipitation falling in the channel, overland flow (rare in forested areas), and subsurface water exiting from soils and bedrock. In this Guide, runoff is synonymous with streamflow.
- **sapling** A tree, usually young, that is larger than a seedling but smaller than a pole-sized tree. Size varies by region, but a sapling is usually taller than 6 feet and between 1 and 4 inches in dbh.
- **sawtimber** Trees greater than 11" in diameter
- **sedimentation** The accumulation of organic and mineral soil particles and rocks in streams and water bodies due to erosion. Sedimentation often accompanies flooding. The application of Best Management Practices will usually protect against sedimentation during and after treatments.
- **seed tree** A tree that produces seed. Seed trees are usually mature and high in quality.
- **seedling** A tree grown from a seed. Usually the term is restricted to trees smaller than saplings, or less than 6 feet tall or smaller than 1 inch dbh.
- **shade intolerance** The relative inability of a plant to become established and grow in the shade.
- **shade tolerance** The relative capacity of a plant to become established and grow in the shade.
- **shelterwood** An even-aged silvicultural technique involving the removal of the understory and lower crown canopy trees to allow the new stand to regenerate under shade. Subsequent removal of the overstory in one or several cuts.
- **silvicultural system** A planned process whereby a stand is tended, and re-established. The system's name is based on the number of age classes (for example even-aged or two-aged), and/or the regeneration method used (for example, shelterwood, crop-tree, or selection).
- **silvicultural treatment** A process or action that can be applied in a controlled manor according to the requirements of a prescription or plan to a forest community to improve real or potential benefits.
- **silviculture** The art, science, and practice of establishing, tending, and reproducing forest stands with desired characteristics.
- **single-tree selection** An uneven-aged silvicultural technique involving the removal of trees singly or in groups of 2 or 3, which maintains a continuous canopy and an uneven-aged or uneven-sized mixture.
- **site** The combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.
- **snag** A standing dead tree without branches, or the standing portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

- **softwoods** A term describing both the wood and the trees themselves that in most cases have needles or scale-like leaves (the conifers); gymnosperms.
- **species composition** The collection of plant species found in an area. Composition is expressed as a cover type, or a percentage of either the total number, the density, or volume of all species in that area.
- **stand** An area of trees of a certain species composition (cover type), age class or size class distribution and condition (quality, vigor, risk), usually growing on a fairly homogeneous site. The trees are sufficiently uniform in spacing, condition, age arrangement and/or forest type to be distinguished from neighboring stands. The conditions of the site are relatively uniform, including soil properties, water drainage, slope, exposure to weather, and productivity. Stands of 5 acres and larger commonly are recognized, though minimum stand size depends upon size of ownership and intensity of management.
- **stand composition** The collection of plants, particularly trees, that are found in a stand.
- **stand condition** The number, size, species, quality, and vigor of trees in a forest stand.
- **stand density** A quantitative measure of the proportion of area in a stand actually occupied by trees. This is an absolute measure rather than a relative measure, or percentage.
- **stand structure** The arrangement of trees of different sizes and ages in a stand.
- **succession** A gradual and continuous replacement of one kind of plant and animal community by a more complex community. The environment is modified by the life activities of the plants and animals present thereby making it unfavorable for themselves. They are gradually replaced by a different group of plants and animals better adapted to the new environment.
- **thinning** The removal of some trees to improve and enhance the vigor and growth of other trees. Thinning enhances forest health and allows you to recover any excess of potential mortality.
- **understory** The small trees, shrubs, and other vegetation growing beneath the canopy of forest trees and above the herbaceous plants on the forest floor.
- **uneven-aged stand** A stand with trees in three or more distinct age classes, either intermixed or in small groups, growing on a uniform site; a stand containing trees of several 20-year age-classes. These stands generally contain trees of many sizes (seedling through sawtimber) due to the range in age as well as differences in growth rate among species.
- **vertical diversity** The extent to which plants are layered within an area. The degree of layering is determined by three factors: 1. the arrangement of different growth forms (trees, shrubs, vines, herbs, mosses and lichens); 2. the distribution of different tree and shrub species having different heights and crown characteristics; and 3. the number of trees of different ages.

	<p>preserve and maintain existing instream, riparian, and water quality conditions. This can be accomplished through utilization of best management practices recommended by DEEP Forestry for all timber harvest operations that can include:</p> <ul style="list-style-type: none">• Riparian corridors be protected with an undisturbed 100 ft. wide riparian buffer zone. A riparian wetland buffer is one of the most natural mitigation measures to protect water quality and fisheries resources. This policy and supporting documentation can be viewed on the DEEP website at: Riparian Policy or Riparian Position Statement• The Inland Fisheries Division will review any forest road maintenance projects which involve culvert replacement. These projects will be evaluated to ensure fish passage needs are met.• Forestry operations will avoid stream crossings if possible. If necessary, forestry will cross streams during periods of low flow using corduroy or temporary bridges. Log bridges should be constructed over streams that have either steep
--	--

	<p>approaches or soft stream bottoms. Temporary bridges will be removed upon harvest completion. Forestry will consult recommended stream crossing guidelines.</p> <ul style="list-style-type: none"> • Any proposed deviations from the abovementioned guidelines will be reviewed by the DEEP Inland Fisheries Division. <p>An interactive map detailing fish community resource information for specific waterways can be found at: CT DEEP Fish Community Data</p> <p>Happy to make any additional suggested changes to the section above.</p> <p>Dan</p> <p>Initials: _____ Date: _____</p>
<p>Discipline: Agency Support Services Hi Dan... I reviewed old school but I did make attempt at viewing online. I only had limited success and I'm quite sure it was me!</p> <p>Anyway ... 2 questions.</p> <ol style="list-style-type: none"> 1. What is masticating ??? is that fecon or brontosaurus? 2. What is the treatment ... TSI? <p>I always learn when I review the forestry plans – they are well prepared and informative. When I was new in this position – Emery took the brunt of A LOT of my questions.</p> <p>Good luck with your Plan. -Deb Initials: DC Date: 3/21/2017</p>	<p>Discipline: Hi Deb,</p> <p>Thanks for taking the time to review the plan. If you're ever interested in exploring the maps more I'm always happy to field questions, even over the phone.</p> <ol style="list-style-type: none"> 1. You got it. Masticating refers to the grinding or chewing action done by either fecon mower or brontosaurus. 2. TSI stands for Timber Stand Improvement – generally a non-commercial cutting treatment designed to adjust species composition or accelerate growth rates in a young forest. <p>Thanks for your comments and feedback at our planning meeting. Looking forward to</p>

	<p>learning more as we get involved in our yearly roadwork assessments.</p> <p>Dan</p> <p>Initials: _____ Date: _____</p>
<p>Discipline: Parks Hi Dan,</p> <p>My only comments/questions would pertain to recreational use.</p> <ol style="list-style-type: none"> 1. What is the mechanism for recreational users of the forest to comment on this plan? I realize that you approached the town conservation boards in the area, but I'm wondering for example, how would a hunter be able to send in a comment or be aware that he/she could comment? I think recreational use of the forest is very important to a large diverse group of users and their comments might be helpful. Reaching out to them might also educate these groups as to why certain policies and procedures are followed. 2. The pie chart that shows percentages of forest area by different category (page 5), shows recreational area in this particular location at 1% of the 15,000+ acres. Does this include trails and is it possible to better describe this number? <p>Just my thought's, but otherwise your plan looks very good to me for you to proceed.</p> <p>Thank you for letting me comment.</p> <p>Mark</p> <p>Initials: MD Date: 4/4/2017</p>	<p>Discipline: Hey Mark,</p> <p>Thanks for your comments. I've copy and pasted them into the relevant section of the plan. I also try to answer all review questions with the reviewers. Even though we kind of talked about these issues in the office, my written responses are below;</p> <ol style="list-style-type: none"> 1. I think it was decided at some point in the past that including the wide range of recreational user groups (Enduro Riders, NEMBA, CT Horse Council, CT AMC, etc.) in the review of each site specific management plan would greatly complicate the review process, especially for plans which don't have a lot of recreation information. Rather, DEEP Parks and CFPA comment as representatives of the wider recreational community. However, those specific rec. stakeholder groups were at the table during the planning and development of the Statewide Forest Resource Plan – which provides the context for the forest-based resource management plans. Emery describes this a bit in the Public Involvement section: <i>Previous state-wide public involvement included the opportunity for various stakeholders groups to provide input into the state-wide Forest Resource Plan. Stakeholders were then invited to join The Forest Land Council. This group and the interested public</i>

	<p><i>participated in the roundtable-style Forest Forum, which provided input for the Connecticut Forest Resource Assessment.</i></p> <p>2. I tweaked the accompanying description of these recreation areas in the body of the plan. The section now better-describes what is meant by “recreation area”. That part now reads: <i>A recreation status indicates an area where the primary management activities will be carried out by DEEP Division of State Parks and Outdoor Recreation. These areas include campgrounds, picnic areas, or developed recreational sites. Recreation areas may have established lease agreements with a municipality, institution, or conservation organization.</i></p> <p>The statistic does not include an acreage attributed to trails. I calculated a quick distance of the blazed hiking trail system and imbedded that in the portion where trails are described – section E1 now reads: <i>Volunteers from the Connecticut Forest and Park Association (CFPA) maintain the Pachaug, Canconicus, Nehantic, and Narragansett Trails, as part of their blue-blazed hiking trail system. These authorized trails extend over 22 miles of the subject forest blocks. In addition there are authorized trails for motorcycle enduro riders, and horse enthusiasts. Gravel forest access roads receive additional recreational use by a suite of user groups. Forest stands supporting authorized trails may be subject to</i></p>
--	--

	<p><i>silvicultural treatments. Statelands management foresters will follow approved standard operating procedures for conducting forest harvesting in close proximity to an approved recreational resource.</i></p> <p>Thanks again for your comments Mark, they led to more information imbedded into the recreation sections of the plan. Happy to discuss any of these points in more detail, or respond to any follow-up questions or suggestions.</p> <p>Thanks, Dan</p> <p>Initials: _____ Date: _____</p>
<p>Discipline: Wildlife Hi Dan,</p> <p>Following up on our phone conversation this morning, attached you will find comments from the Wildlife Division staff on the Pachaug 10-Year Plan. The first attachment contains all of the comments from Min, Judy, Shannon, Mike, Howard and me. The second attachment contains all of Lisa’s comments (she inserted her comments into an earlier version I had sent her, so just ignore the comments I made; the first attachment has all of my comments). Lisa and I will see you tomorrow morning at 9:30. We look forward to reviewing our comments with you and helping you move things forward.</p> <p>Thanks!</p> <p>Ann</p> <p>Ann M. Kilpatrick District Wildlife Biologist Eastern District Headquarters Wildlife Division Bureau of Natural Resources</p>	<p>Discipline:</p> <p>Wildlife comments were received and discussed with the district biologist on 4/6/17. Forestry incorporated the majority of those comments in the final plan.</p> <p>Initials: _____ Date: _____</p>



November 2, 2016

Emery Gluck
DEEP Division of Forestry
18 Ranger Rd
Haddam, CT 06438-1211
Emery.gluck@ct.gov

NDDB Determination No: 201608022

Project: 10 Year Forest Resource Management Plan for Glasgo, Green Falls and Wickaboxet Blocks of Pachaug State Forest in Griswold, North Stonington, Preston, Sterling and Voluntown

Dear Emery Gluck,

I have reviewed Natural Diversity Data Base (NDDDB) maps and files regarding the 10 Year Forest Resource Management Plan for Glasgo, Green Falls and Wickaboxet Blocks of Pachaug State Forest in Griswold, North Stonington, Preston, Sterling and Voluntown, Connecticut. According to our records, there are State-listed species (RCSA Sec. 26-306) as well as species of conservation concern documented in close proximity and may occur within the proposed project area.

According to our records, the following State-listed plant species have been documented within the Glasgo, Greenfalls, and Wickaboxet blocks of Pachaug State Forest in southeastern Connecticut:

- **Low frostweed (*Crocanthemum propinquum*)**
Protection Status: State Special Concern
Habitat: Dry, open, sandy soil. Blooms mid-late Jun.
- **Panic grass (*Dichanthelium scabriusculum*)**
Protection Status: State Endangered
Habitat: Alluvial soils. Blooms Vernal.:Jun,Jul Autumnal:Jul, Aug, Sep, Oct.
- **Spike-rush (*Eleocharis microcarpa* var. *filiculmis*)** Protection Status: State Special Concern,
Historic Habitat: Acidic sandy pond shores. Blooms late Aug.
- **Rough aster (*Eurybia radula*)**
Protection Status: State Endangered
Habitat: Open swamps, shores and moist roadsides. Blooms Jul, Aug, Sep.
- **Showy aster (*Eurybia spectabilis*)**

Protection Status: State Threatened

Habitat: Dry, rocky or sandy soil, often among pines. Blooms late Aug – Oct.

▪ **Featherfoil (*Hottonia inflata*)**

Protection Status: State Special Concern

Habitat: Shallow water and ditches. Blooms/fruits May – Jul.

▪ **Golden-heather (*Hudsonia ericoides*)**

Protection Status: State Endangered

Habitat: Open, sandy soils, and acid rocks. (G). Blooms late May, Jun, early Jul.

▪ **Water pennywort (*Hydrocotyle umbellata*)**

Protection Status: State Endangered

Habitat: Shallow water, wet soils, pond shores. Blooms Jul, Aug, Sep.

▪ **Inkberry (*Ilex glabra*)**

Protection Status: State Threatened

Habitat: Swamps and swamp borders, in sandy soil. Blooms Jun.

▪ **Clasping-leaved water-horehound (*Lycopus amplexans*)**

Protection Status: State Special Concern

Habitat: Swamps and pondshores in sandy or peaty soils. Blooms Aug – Sep.

▪ **Climbing fern (*Lygodium palmatum*)** Protection Status: State Special Concern

Habitat: Moist pine-oak-maple woods, moist thickets, and stream margins, usually on acidic, nutrient poor soils. Recognizable year-round.

▪ **Nuttall's milkwort (*Polygala nuttallii*)**

Protection Status: State Threatened

Habitat: Dry, open, sandy soils and rocky crevices. Blooms Jul - Sep.

▪ **Pondweed (*Potamogeton confervoides*)**

Protection Status: State Endangered

Habitat: Shallow waters of sandy or peaty ponds and streams. Blooms Aug, Sep.

▪ **Bog aster (*Oclemena nemoralis*)**

Protection Status: State Endangered

Habitat: Found in bogs and boggy shores. Blooms Aug, Sep.

▪ **Pod grass (*Scheuchzeria palustris* ssp. *americana*)**

Protection Status: State Endangered

Habitat: Wet bogs, quagmires, and peaty shores. Blooms May-Jul.

▪ **Nutrush (*Scleria triglomerata*)**

Protection Status: State Endangered

Habitat: Dry or moist sandy soil. Blooms May-Jun.

▪ **Northern yellow-eyed grass (*Xyris montana*)**

Protection Status: State Threatened

Habitat: Sphagnum bogs and wet sands of ponds. Blooms Jul-Sep.

▪ **Small's yellow-eyed (*Xyris smalliana*)**

Protection Status: State Endangered

Habitat: Sandy bogs, wet sandy depressions, and shores of ponds. Blooms Jul-Oct.

The majority of species listed above tend to occur in open woodlands or areas of early-successional habitat. Forest management activities thus have the potential to benefit rare plant species by enhancing existing habitat or creating new areas of appropriate habitat into which these species might disperse. It is important to note, however, that populations of rare plants are often small and may easily be lost if existing plants are not adequately protected. Forest management activities may impact State-listed plants through trampling, soil compaction/disturbance, covering plants with mulch or woody debris, or conversion of existing habitat to an unsuitable habitat type (ex: converting closed-canopy forest to shrubland).

To minimize the risk of impacting State-listed plant species, cutting plans should be submitted to the Natural Diversity Data Base (NDDDB) for review. NDDDB staff will identify species known to occur within the proposed management area along with maps and guidance for avoiding impacts. For questions regarding State-listed plant species, please contact Nelson DeBarros (nelson.debarros@ct.gov).

Wildlife Species general recommendations are grouped below by Taxa, Relevant Contact, and Habitat Group. An excel table is available with this information if that format would assist with your planning. Please contact me if you would like information in this form.

Birds Shannon Kearney (Shannon.kearney@ct.gov)

Early Successional

Blue-winged warbler
GCN- Most Important

Vermivora pinus

Site abundance estimates for blue-winged warblers where they were found were among the higher levels at these sites compared to other sites around the state (DEEP Shrubland Surveys). They were, however, notably absent from the more northern shrubland survey sites in this area, despite being present at 65% of all surveys across the state. This absence is most likely a result of local site characteristics. Conservation of blue-winged warblers in southeastern Connecticut is recommended, because in this area of the state, their presence will not interfere with potential golden-winged warbler nesting sites. But it is worth noting that other areas had greater abundance and consistency of BWWA observations like: Lyme Block, Naugatuck, and Meshomasic had greater occupancy, but lower abundance. Miles/Housatonic, and Macedonia also had consistent observations of BWWA, which may be detrimental to the GWWA in those areas. Maintenance and creation of even aged early successional cuts will benefit this species.

Prairie Warbler
GCN- Most Important

Setophaga discolor

This area had a notable consistency and the highest abundance of observations of prairie warbler compared to other surveyed areas across the state (DEEP Shrubland Surveys). Maintenance and creation of even aged early successional cuts will benefit this species.

Whip-poor-will
SC

Antrostomus vociferus

The management areas delineated in southeastern Connecticut are the most suitable habitat in the state to support long-term persistence of whip-poo-will. Birds will nest within open understory of mature forest, and sing and forage in early successional openings. Any protection or enhancement of patches of early successional habitat, especially pitch pine, adjacent to forest blocks in this area will benefit this species, at present no birds have yet been documented in these specific blocks, most likely because of lack of specific survey points. The wildlife division is specifically interested in how this species is responding to early successional cuts.

Mature Forest

Black-throated blue warbler
GCN- Very Important

Dendroica caerulescens

This species, normally more prevalent in the northwest corner of Connecticut, was detected regularly in DEEP Forest interior bird surveys in this area. To benefit this species in large forest blocks, maintain or create hardwood and mixed wood stands with 50-80% canopy cover and a dense understory (0-5' layer).

Wood Thrush
GCN- Most Important

Hylocichla mustelina

Despite a lower ranking by the regional LCC model (<http://northatlanticlcc.org/projects/wildlifehabitat-models-for-terrestrial-vertebrates/wood-thrush-model-documentation/view>), on the ground surveys by DEEP Wildlife indicated notable consistency of detections. This indicates that there is consistent presence of wood thrush breeding in these forest blocks. Management that includes retaining mid-story cover (0-5' layer) for nesting will benefit this species. Maintain or create wellstocked uneven-aged, sawtimber hardwood stands with >80% canopy cover and moist leaf litter. When performing cuts, avoid disturbance and dessication of leaf litter and soil conditions. The wildlife division is specifically interested in rates of reproduction of this species adjacent to large forest evenaged cuts.

Worm-eating warbler
GCN- Very Important

Helmitheros vermivorus

This area had notable consistency and abundance of worm-eating warbler compared to other forest interior bird routes across the state (DEEP Forest Interior Surveys). This forest interior bird likes a good shrub layer in the forest. Fledgelings benefit from early successional openings in the interior of the forest.

Fish

Banded sunfish
SC

Enneacanthus obesus

DEEP Fisheries Biologists review permit applications submitted to DEEP regulatory programs to determine whether projects might adversely affect listed species.

Invertebrates Laura Saucier (Laura.saucier@ct.gov)

Early Successional

Henry's elfin
SC

Callophrys henrici

Habitat: Open woodlands, shrub swamps with highbush blueberry. Host plants include introduced buckthorns (*Rhamnus* spp.), holly (*Ilex* spp.), particularly the American holly (*I. opaca*), and redbud (*Cercis canadensis*). Winterberry (*Ilex verticillata*) is also a suspected host plant. Managing for open woodlands and shrub swamps up to 2km from occurrence will benefit this species.

Henry's elfin butterfly has only been found in recent years in a few locations in Connecticut though its host plant (*Frangula* sp.) is increasing rapidly.

Persius duskywing
E

Erynnis persius persius

Habitat: Sandy barrens, open woodlands, woodland edges, barrens, and powerline rights-of-way with hostplants. Host plants include wild indigo (*Baptisia tinctoria*) and lupine (*Lupinus* spp.).

This butterfly is considered rare through much of its range where it is typically found in sand barrens, open woodlands, or open wetlands in close proximity to its host plants. Larvae of this species feed on legumes such as Sundial lupine (*Lupinus perennis*) and Wild indigo (*Baptisia tinctoria*).

Forest management activities that will create suitable habitat for the host plants named above, within 1km of occurrence will benefit this species.

Pink Sallow
T

Psectranglaea carnosa

Habitat: Sandplain pitch pine-scrub oak barrens and heathlands. Larvae have been raised on blueberry (*Vaccinium Cyanococcus* spp.), and chokeberry (*Aronia* spp.). Enhancements and protection to pitchpine/scrub habitat within 2km of occurrence will benefit this species

Sleepy Duskywing
T

Erynnis brizo

Habitat: Oak or oak-pine scrub, chaparral, barrens; on well-drained sandy or shaly soils. Host plant includes scrub oak (*Quercus ilicifolia*), black oak (*Quercus velutina*), and scarlet oak (*Quercus coccinea*).

The Sleepy duskywing skipper (*Erynnis brizo*) has a listed habitat of oak or oak-pine scrub, chaparral, barrens; on well-drained sandy or shaly soils. The caterpillar hosts are oak or oak-pine scrub, chaparral, barrens; on well-drained sandy or shaly soils. Protections and enhancements to balds and barrens of this type within 1km of occurrence will benefit this species.

Pitch Pine

Black-eyed zale
E

Zale curema

Habitat: Pitch pine woodlands. Host plant is pitch pine (*Pinus rigida*). Any efforts to improve this habitat within 2km of records will benefit this species.

Atlantic White Cedar Swamp

Bombardier beetle
SC

Brachinus patruelis

Habitat: Sandy clayish banks of creeks, specifically found in Atlantic White Cedar Swamp. Improvements and protections of this habitat will benefit this species.

Hessel's hairstreak
E

Callophrys hesseli

Habitat: Atlantic white cedar stands in swamps, bogs, along the floodplains of blackwater streams and rivers, and along spring runs. Hostplant is Atlantic white cedar (*Chamaecyparis thyoides*), though larvae have been raised on highbush blueberry (*Vaccinium corymbosum*) and chokeberry (*Aronia* spp.) Protecting and enhancing Atlantic White Cedar Swamps within 1km of occurrence will benefit this species.

Wetlands

Atlantic bluet
T

Enallagma doubledayi

The Atlantic bluet is a damselfly associated with coastal plain ponds and lakes. Specifically highly vegetated lakes and ponds. Reduce impact around occupied lankes, ponds, swamps, and vegetated streams that feed these areas. Adults will forage in upland habitat up to 1/2 mile from breeding areas. Pesticide use that may affect adults or food sources should be reviewed in these areas.

Bog copper
SC

Lycaena epixanthe

Habitat: Open sphagnum bogs, fens, lake margins. Host plants are cranberries (*Vaccinium macrocarpon* and *Vaccinium oxycoccos*).

The Bog copper is a fairly conspicuous butterfly that is associated with sphagnum bogs in Connecticut. Activities that alter the physical or chemical nature of the aquatic habitat, cause siltation or any source of pollution will be detrimental. Protect and buffer any sphagnum bogs associated in this area.

Common sanddragon

Progomphus obscurus

T

Habitat: Clear, sandy-bottomed lake or pond and sometimes fresh streams or rivers. Specifically protect and do not disturb sandbars in small streams and shallow so wide lakes associated with occurrence and within 1.2 km of occurrence to protect larval areas. Pesticide use that may affect foraging adults should be reviewed within 1/2km of breeding locations.

Scarlet bluet

Enallagma pictum

SC

Habitat: Acidic, sandy ponds with floating vegetation. Associated with water lillies (Nymphaeaceaea spp.).

The Scarlet Bluet damselfly is associated with wetland habitats. Damselflies lay their eggs inside of plant stems but the Wildlife Division can't find any references to a particular plant. Protect plants from removal in breeding pools and surrounding pools within 1.2km of known breeding locations. Pesticide applications that may harm flying/foraging adults within 1/2km of breeding sites should be reviewed.

Mammal (bats) Kate Moran (kate.moran@ct.gov)

Wetlands

Hoary bat

Lasiurus cinereus

SC

Hoary bats are found in Connecticut during the spring and summer seasons and migrate south to overwinter. Their diet primarily consists of moths and beetles. These bats will roost high in large coniferous and deciduous trees. They typically do not roost on buildings. Long-term impacts can be minimized by retaining large diameter coniferous and deciduous trees whenever possible. Establishing wooded buffers adjacent to wetland areas, will help maintain potential roosting habitat.

Red bat

Lasiurus borealis

SC

Red bats are considered to be "tree-roosting" bats. They roost out in the foliage of deciduous and coniferous trees, camouflaged as dead leaves or cones. Red bats are primarily solitary roosters. They can be found roosting and feeding around forest edges and clearings. Typically, larger diameter trees (12-inch DBH and larger) are more valuable to these bats. Additionally, trees with

loose, rough bark such as maples, hickories, and oaks are more desirable than other tree species due to the increased cover that the loose bark provides. Large trees with cavities are also utilized by this species. Retaining the above mentioned trees, wherever possible, will benefit this species. Using best management practices around wetland features, including vernal pools, will benefit this species.

Silver-haired bat
SC

Lasionycteris noctivagans

Using best management practices around wetland features, including vernal pools, will benefit this species.

Reptiles Brian Hess (brian.hess@ct.gov)

Early Successional

Eastern hognose snake
SC

Heterodon platirhinos

The eastern hognose snake (*Heterodon platirhinos*- Species of special concern) has been declining due to loss of suitable habitat. It favors areas of well drained sandy/gravelly soils along the edges of second-growth deciduous forest. This species is dormant from 1 November to 15 April. The wildlife division is specifically interested in updating and documenting any evidence of this species in this area.

Eastern Box Turtle
SC

Terrapene carolina carolina

In Connecticut, this terrestrial turtle inhabits a variety of habitats, including woodlands, field edges, thickets, marshes, bogs, and stream banks. Typically, however, box turtles are found in well-drained forest bottomlands and a matrix of open deciduous forests, early successional habitat, fields, gravel pits, and or powerlines. The Wildlife Division is specifically interested in locating any hibernating locations for this species so they can be flagged and avoided during forest operations.

This species is very sensitive to adult mortality because of late maturity (10 years old) and long life span (50-100years). Maintaining forested habitat is essential for the conservation of Eastern Box Turtles. The impacts of timber harvesting are recognized as having significantly fewer lasting effects as compared to other permanent changes in land use, such as residential and commercial development. However, certain precautions should be taken during timber harvesting in order to maintain the longterm viability of Eastern Box Turtle populations within forested areas. The primary concern about forestry practices within Eastern Box Turtle habitat is the direct mortality of adults due to crushing by motorized vehicles during harvesting and scarification. This could occur at any time during the Eastern Box Turtle activity season since they are primarily terrestrial and it could even occur during the winter since the turtles overwinter in upland forests, usually within a few inches of the soil surface. Habitat alterations that are of concern include suppression of plant growth from wood chips since these turtles forage on the forest floor. Disturbance of fallen trees and

removal of snags that serve as future sources of large woody debris are also concerns, because these turtles will overwinter beneath fallen trees, often in the pit created by the root mound. Also, fallen trees are used for cover during the active season.

§ Maintain a patchwork of harvest practices in this area to meet the different life stages of this species. Including both mature forest and forest openings. If the only available sun-exposed ground is along roadsides, road mortality may occur as females seek nesting grounds and individuals bask.

Site specific species locations redacted

This determination is valid for two years. Please submit an updated NDDDB Request for Review if the scope of the proposed work changes or if work has not begun by **November 2, 2018.**

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Bureau of Natural Resources and cooperating units of DEEP, independent conservation groups, and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the NDDDB should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated in the NDDDB as it becomes available.

Please contact me if you have any questions (shannon.kearney@ct.gov; 860-424-3170). Thank you for consulting with the Natural Diversity Data Base and continuing to work with us to protect State-listed species.

Sincerely,

/s/ Shannon B. Kearney
Wildlife Biologist

Cc: Nelson DeBarros, Plant Ecologist

Appendix D – Public Comment

The results of the Pachaug Forest Management Plan Survey Monkey are below:

A copy of the survey distributed at Town meetings:

Pachaug State Forest – 10-Year Forest Resource Management Plan Survey

- **Available online:** <https://www.surveymonkey.com/r/PachaugStateForest>

1. Did you attend a Pachaug State Forest Management Plan meeting in 2017? (North Stonington, Griswold, Voluntown)?
 - a. Yes
 - b. No
2. How useful was the information presented at the meeting?
 - a. Extremely useful
 - b. Quite useful
 - c. Moderately useful
 - d. Slightly useful
 - e. Not at all useful
 - f. Not applicable (I did not attend a meeting)
3. Please rank the importance of the following management goals. Write 1-3 next to the applicable goal.
 - a. To promote bio-diversity by promoting upland ecosystems that are not adequately sustaining themselves under current conditions. _____
 - b. To maintain or improve aquatic ecosystems integrity. _____
 - c. To promote healthy and sustainable forests. _____
4. Indicators monitor progress toward our forest management goals. The proposed indicators include: (1) Provide for late successional forest – maintain 20% of forest in old forest land management status. (2) Provide for early successional habitat – regenerate 10% of active and inactive forest management status. (3) Retain late successional forest structure – retain an average of 2 to 4 legacy, den, rotten, or dead trees per acre and retain uncut patches in harvest areas. (4) Sustain oak forests – release 30 oaks and hickories per acre by the time the forest inventory for the next forest management plan is conducted. (5) Increase pitch pine – re-introduce and release pitch pine regeneration after harvests. (6) Healthy forest stands – thin 50% of the crowded forest stands increasing the average overstory tree size and age class diversity after the harvest. (7) Minimize stream sedimentation – improve forest roads and bridge crossings that can be stabilized to minimize erosion.

Are there alternative indicators that should be considered?

5. Do you have any other comments, questions, or concerns?

Hard copy survey responses received:



Pachaug State Forest – 10-Year Forest Resource Management Plan Survey

- Available online: <https://www.surveymonkey.com/r/PachaugStateForest>

1. Did you attend a Pachaug State Forest Management Plan meeting in 2017? (North Stonington, or Griswold)?
 - a. Yes
 - b. No
2. How useful was the information presented at the meeting?
 - a. Extremely useful
 - b. Quite useful
 - c. Moderately useful
 - d. Slightly useful
 - e. Not at all useful
 - f. Not applicable (I did not attend a meeting)
3. Please rank the importance of the following management goals. Write 1-3 next to the applicable goal.
 - a. To promote bio-diversity by promoting upland ecosystems that are not adequately sustaining themselves under current conditions. 3
 - b. To maintain or improve aquatic ecosystems integrity. 2
 - c. To promote healthy and sustainable forests. 1
4. Indicators monitor progress toward our forest management goals. The proposed indicators include: (1) Provide for late successional forest – maintain 20% of forest in old forest land management status. (2) Provide for early successional habitat – regenerate 10% of active and inactive forest management status. (3) Retain late successional forest structure – retain an average of 2 to 4 legacy, den, rotten, or dead trees per acre and retain uncut patches in harvest areas. (4) Sustain oak forests – release 30 oaks and hickories per acre by the time the forest inventory for the next forest management plan is conducted. (5) Increase pitch pine – re-introduce and release pitch pine regeneration after harvests. (6) Healthy forest stands – thin 50% of the crowded forest stands increasing the average overstory tree size and age class diversity after the harvest. (7) Minimize stream sedimentation – improve forest roads and bridge crossings that can be stabilized to minimize erosion.

Are there alternative indicators that should be considered?

It confuses me and others that here is this push to save the bienny, yet hunters are allowed into the refuge areas!

Help me with this!

5. Do you have any other comments, questions, or concerns?

I wish bio-diversity was my personal choice, I stand by my choices, somehow 'e' can include bio-diversity.

Thank you for your good work,



Pachaug State Forest – 10-Year Forest Resource Management Plan Survey

- Available online: <https://www.surveymonkey.com/r/PachaugStateForest>

1. Did you attend a Pachaug State Forest Management Plan meeting in 2017? (North Stonington, or Griswold)?

- a. Yes
- b. No

2. How useful was the information presented at the meeting?

- a. Extremely useful
- b. Quite useful *Haven't read all the handouts yet.*
- c. Moderately useful
- d. Slightly useful
- e. Not at all useful
- f. Not applicable (I did not attend a meeting)

3. Please rank the importance of the following management goals. Write 1-3 next to the applicable goal.

- a. To promote bio-diversity by promoting upland ecosystems that are not adequately sustaining themselves under current conditions. 1
- b. To maintain or improve aquatic ecosystems integrity. 3 *Not really sure*
- c. To promote healthy and sustainable forests. 2

4. Indicators monitor progress toward our forest management goals. The proposed indicators include: (1) Provide for late successional forest – maintain 20% of forest in old forest land management status. (2) Provide for early successional habitat – regenerate 10% of active and inactive forest management status. (3) Retain late successional forest structure – retain an average of 2 to 4 legacy, den, rotten, or dead trees per acre and retain uncut patches in harvest areas. (4) Sustain oak forests – release 30 oaks and hickories per acre by the time the forest inventory for the next forest management plan is conducted. (5) Increase pitch pine – re-introduce and release pitch pine regeneration after harvests. (6) Healthy forest stands – thin 50% of the crowded forest stands increasing the average overstory tree size and age class diversity after the harvest. (7) Minimize stream sedimentation – improve forest roads and bridge crossings that can be stabilized to minimize erosion.

Are there alternative indicators that should be considered?

The cost of all this. We used to just let nature take its course - Now we have to manage EVERYTHING!!! We don't let natural selection do anything. Will we ever have large, noble wolf trees in our landscape again? They inspire

5. Do you have any other comments, questions, or concerns? *awe and majesty and got that way because they had room and were left alone.*

I didn't hear all of Lisa Warkter talk because I had to leave early but I've heard her elsewhere. I object to the "Sunny" being the poster child for all this tree clearing. It needs too much help - DOGS NOT RELOCATE WELL (USERS L.A)

Summary of online Survey Monkey responses received during the Public Comment period

Pachaug Forest Management Plan - Public Comment

Q1

Did you attend a Pachaug State Forest Management Plan meeting in 2017 in Griswold or North Stonington?

- Answered: 2
- Skipped: 0

YesNo

Answer Choices	Responses
Yes	100.00% 2
No	0.00% 0
Total	2

Q2

How useful was the information presented at the meeting?

- Answered: 2
- Skipped: 0

Extremely
useful
Quite useful
Moderately
useful
Slightly useful
Not at all
useful
Not applicable
(I did not...

Answer Choices	Responses
Extremely useful	100.00% 2
Quite useful	0.00% 0
Moderately useful	0.00% 0
Slightly useful	0.00% 0
Not at all useful	0.00% 0
Not applicable (I did not attend a meeting)	0.00% 0
Total	2

Q3

Please rank the importance of the following management goals.

- Answered: 2
- Skipped: 0

To promote bio-diversit...
To maintain or improve aqua...
To promote healthy and...

	Most Important	Somewhat Important	Least Important	Total	Weighted Average
To promote bio-diversity by promoting upland ecosystems and populations that are not adequately sustaining themselves under current conditions.	50.00% 1	50.00% 1	0.00% 0	2	2.50
To maintain or improve aquatic ecosystems integrity.	0.00% 0	0.00% 0	100.00% 2	2	1.00
To promote healthy and sustainable forests.	50.00% 1	50.00% 1	0.00% 0	2	2.50

Q4

Indicators monitor progress towards our forest management goals. The proposed indicators include: (1) Provide for Late Successional forest - Maintain 20% of forest in old forest land management status. (2) Provide for Early Successional habitat - Regenerate 10% of active and inactive forest management status. (3) Retain Late Successional structure - Retain an average of 2 to 4 legacy, den, rotten or dead trees/acre and retain uncut patches in harvest areas. (4) Sustain oak forests - Release 30 oaks and hickories per acre by the time the forest inventory for the next forest management plan is conducted. (5) Increase pitch pines - Re-introduce and release pitch pine regenerations after harvests. (6) Healthy Forest Stands - Thin 50% of the crowded forest stands increasing the average overstory tree size after the harvest and increase age class diversity. (7) Minimize Stream Sedimentation - Improve forest roads that can be stabilized and bridge crossings to minimize erosion. Are there alternative indicators that should be considered?

- Answered: 1
- Skipped: 1

The above list appears to be all encompassing. Unfortunately, I am not qualified to ascertain if there are "alternative indicators" in addition to the aforementioned indicators.

1/27/2017 10:00 AM

Q5

Do you have any other comments, questions, or concerns?

- Answered: 2
- Skipped: 0

The presentation by all three presenters was EXCELLENT! In addition to the presentation being very informative, it was also very educational! As I mentioned to Dan, the State should provide this presentation to grammar schools to teach young children about the importance of woodland and forest habitats.

1/27/2017 10:00 AM

Could you possibly add suggestions or BMP's for control of invasive species? Excellent presentation that was very much appreciated by the Griswold IWWCC. We look forward to reviewing the 10 year management plan as well as having you back in the future. Thank you.

1/27/2017 8:57 AM

DEEP responses to survey's received:

[REDACTED]

February 10, 2017

Dear [REDACTED]

Thank you for your response to the Pachaug State Forest 10 year Forest Management Plan survey. The biological indicators (question # 4 in the survey) is a recent concept used in natural resource management planning to measure whether the management activities are moving the forest in the direction of the stated goals or the desired future condition of the forest. We are seeking input on the appropriateness of the indicators or alternative indicators from locals as an opportunity for public participation in the decision making process.

The plan strives to promote all under-represented upland forest ecosystems and to eventually obtain the full array of forest structural and compositional diversity. This should provide adequate habitat for all native threatened species including the New England Cottontail.

These ecosystems and species are under-represented because they are not sustaining themselves under current natural conditions. Most require recently disturbed areas to meet their habitat or environment requirements. Fire was historically a major source of disturbance that created the new habitat that many of the diminished species need. It has been estimated that fire frequency was historically at least 100 times as frequent as it is today and most of today's fires are less severe. Native Americans have been a source of fire since shortly after the last glaciers receded. That is enough time that some species and ecosystems have evolved to be dependent upon fire. Where there were Native Americans, there was fire. Some ecologists view aboriginal management techniques (including fire) as part of an ecosystem's natural disturbance regime.

The way the plan tries to promote bio-diversity is to apply just enough disturbance so it mimics the historic amount of natural disturbance. The outcome should be adequate amounts of recently disturbed and undisturbed environments for all native species and ecosystems. Though there will be a little prescribed fire used to accomplished the goals, the commercial harvest of trees will be used as a proxy for fire and will be the dominant management tool. Commercial forestry operations, if done right, are the most economical way to promote biological diversity in upland forest ecosystems. Widespread application of fire is not tenable due to air pollution, public concern, and lack of personnel and good burn days.

I hope I have answered your concerns and question adequately. Dan Evans and I appreciated the opportunity to present to North Stonington residents. Thanks again for your survey response. Regards.

Emery Gluck

Appendix E – Distribution List

First selectman's office notified that management plan on DEEP website.

Conservation Commissions: Voluntown, Griswold, Sterling, North Stonington

DEEP District Staff

DEEP Hartford Forestry