CONNWOOD FORESTERS, INC.

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A FOREST OWNERS' COOPERATIVE ASSOCIATION ENGAGED SINCE 1945 IN THE STEWARDSHIP OF FORESTS FOR WOOD, WATER, WILDLIFE, RECREATION, AND AESTHETICS.

FOREST STEWARDSHIP PLAN:

PAULK HILL BROOK TRACT

PARCIAK CONSERVATION AREA

TOWN OF TOLLAND: CONSERVATION COMMISION

60 ACRES IN TOLLAND, CT
2022 – 2032

TABLE OF CONTENTS

GENERAL INFORMATION

Date Prepared:

April 2021 (Fieldwork)

Prepared By:

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Signatures:

Preparer: _____ **Date:** _____
Nathaniel Gosselin, Connwood Foresters, Inc.

As the authorized signer for the Town of Tolland, I have reviewed this management plan with my forester, and I understand the contents and agree that it reflects the Town of Tolland's goals and intention for the management of this property.

Property Owner: _____ **Date:** _____
Authorized Signer, Town of Tolland

INTRODUCTION

Upon request by the Town of Tolland, Connwood Foresters Inc, has prepared a ten-year (2022-2032) forest stewardship plan for multiple conservation areas in Tolland, CT. An inventory of the Parciak Conservation Area (PCA) property was conducted in April of 2022 in order to determine what management objectives are feasible and how best to implement these objectives through a natural resource stewardship plan. We will outline in this document broad landscape features and how this property fits into the surroundings, and for specific management recommendations the property will be broken down into the stand scale.

THE STEWARDSHIP OBJECTIVES ARE (NOT IN ORDER OF IMPORTANCE**):**

1. Water Quality
2. Soil Protection and Erosion Control
3. Forest Resiliency Pertaining to Climate Change
4. Wetland Conservation and Protection
5. Protection of Cultural Features
6. Controlling and Management of Pests/Invasive Species
7. Forest Resiliency Pertaining to Forest Diversity
8. Forest Management for Fish and Wildlife
9. Recreational Development

Without management, forests provide significant public services by regulating flood waters, increasing the storage capacity of the watershed, filtering, and infiltrating runoff to the water table, storing atmospheric carbon, and producing oxygen. Regardless of forest size, position in the landscape, or community type, each forested tract impacts human health. Whether humans choose to identify themselves as part of the natural community surrounding them or as separate, a healthy forest provides goods and services to society. Forest management is grounded in science by identifying and quantifying forest community types. The forest as a community type provides habitat, wildlife food sources, nutrient cycling, and countless other services, not directly serving humans, but important none the less. After assessing forest community type and structures, silvicultural treatments can be applied to mimic natural disturbances. This "natural disturbance" based activity regime allows the landowner to establish, enhance, or maintain structures and characteristics that achieve the management objectives.

This forest stewardship plan provides an organized and effective approach for the long-term protection and use of the forest resources. The plan summarizes the major management themes, feasibility of objectives, and a full account of the resources used to develop these recommendations (appendices.) The inventory of the forest allows the forester to field verify conditions and document information regarding the objectives. This data provides the basis for the recommendations

The recommendations within this plan are designed to cover a ten year management period. As management progresses on this property it may become apparent that some recommendations are no longer valid and others become critical. Please note that while these management activities are spaced out over ten years, order and timing can be rearranged to facilitate need and forest conditions as they change.

Resource concerns observed are:

1) *Growth and establishment of non-native invasive vegetation*
2) *Lack of growing space for the most desirable trees*
3) *Lymantria (Spongey Moth) – Drought mortality in oak overstory*
4) *Significant area of uniform structure*
5) *Erosion on hiking trails*
6) *Residential development, fragmentation, and loss of forest*
7) *Lack of forest management throughout the watershed*

REGIONAL CONTEXT

The Parciak Conservation Area (PCA) consists of about 69.5 acres in central Connecticut. The property is located between Bald Hill Road and Burbank Road in the town of Tolland, Tolland County. The property is about 2.3 miles south (driving) of the Campbell's Peaceful Valley Conservation Area. This acreage again is quite small compared to the town or county, but it is clearly at the northern boundary of the Skungamaug River and eastern boundary of the Hockanum River Watershed. Since in a county made up of over 266,880 acres, this parcel is only 0.026% of that total area, we would like to propose the Paulk Hill Brook watershed scale to keep the property in context of about 2000 acres (please see the watershed/land use map). Watershed area and location was calculated using the StreamStats program available on the USGS website. The watershed area (that includes both properties) is approximately 1300 acres. This is defined by regional topography and originates south of the property near the at Interstate 84, just north of Tolland Marsh Pond. The watershed is within the Town of Tolland boundary and is an important headwater area for the Paulk Hill Brook, similar to what Kollar Wildlife Management Area is to the Willimantic River or Crandall Park is to the Skungamaug River, and many other important open space parcels north of I-84 protecting area upgradient of federal infrastructure.

Throughout Connecticut, as farmland gets abandoned and reforested, total area of forest versus forest lost to development tends to remain equal. Reforestation of farmland is a finite reservoir of future forestland, and development pressures will likely increase proportionately to increasing population. Tolland County has experienced a population decrease from 2018 but may have seen a minor increase from 2020-2021 with 413 building permits issued and a median age of 37.7 for residents.

Area of Timberland by Forest-type Group and County (in thousands of acres)

County	White and red pine	Oak and hickory	Elm, ash, red maple	Northern hardwood	Other types[1]	All types
Fairfield	6.9	49.0	11.1	25.2	0.0	92.2
Hartford	11.7	105.6	26.7	66.4	20.0	230.4
Litchfield	53.9	177.6	25.3	162.5	7.2	426.5
Middlesex	1.7	99.4	19.6	42.0	0.0	162.7
New Haven	9.8	67.1	14.5	52.4	0.0	143.8
New London	3.5	172.5	35.0	42.1	9.3	262.4
Tolland	14.1	84.5	11.8	62.8	5.6	178.9
Windham	12.0	120.2	15.5	31.3	20.1	199.0
Total, all counties	113.7	875.8	159.6	484.7	62.3	1,696.1

[1]Includes spruce/fir (7.0 thousand acres in Litchfield County), hard pine (5.9 thousand acres in New London County), oak/pine (24.2 thousand acres in Hartford, Litchfield, New London, and Windham Counties), and aspen and birch (25.2 thousand acres in Hartford, Tolland, and Windham Counties).

(Wharton et al, 2004)

Tolland County contains fifth most (of 8) of counties for forest area with a majority as Oak/Hickory and Northern hardwoods. As with the entire state, Tolland County has had a steady decline is forest land tract size, with an exponential increase in ownership. The main value of this property is as a large undeveloped tract which limits the contribution of "edge habitat," the diversity loss due to fragmentation, and invasive species mobility (Butler et al, 2007). The intermediate sized contiguous/abutting parcels like PCA, Paulk Hill Conservation Area (biking park), Crandall Park, and State Land (216 Old Post Road) are mostly surrounding properties are one acre with larger road frontage or two acres with minimal road frontage and long thin shaped private lots. You can see this pattern of road development along Peter Green, Burbank, Bald Hill, Robin Circle, Old Post Road, Hidden Valley, and Old Kent Road North. Both development patterns expand the edge created by roadways and increase fragmentation, force all forest to be contained within or behind private development making forest management near impossible, and are considered low density inefficient uses of land. Although development along roadways cannot be fixed, acquisition of larger tracts by the Town of Tolland, State of Connecticut, and other institutions can yield a connected landscape. With public ownership, it is likely that the area can be maintained as large tracts of forest.

The conservation of open space parcels, like this one, is essential for Tolland and Tolland County, to retain its character and appeal as a rural town in Connecticut. The community maintained trail infrastructure, interest in how geology played a role in pre-settlement times, and preservation of the small sustenance farming history accommodate the diverse uses that change with the publics vision for forest resources. The Town plays a significant role in protection of waterways and headwaters by holding ownership and stewarding this property.

Utilizing the Land Use and Land Cover data from NOAA Data Access viewer, the following table outlines SCA and PVC property relative to the watershed:

LULC - ID	LULC - Name	Watershed Area (ac)	Percent of Watershed (%)	Conservation Area (ac)	Percent of Watershed (%)
2	Impervious	97.67	7.25	0.18	0.18
5	Developed, Open Space	105.82	7.86	0.22	0.21
8	Grassland/Herbaceous	6.55	0.49	0.00	0.00
11	Mixed Forest	1079.78	80.17	61.10	5.66
12	Scrub/Shrub	3.21	0.24	0.00	0.00
13	Palustrine Forested Wetlands	36.64	2.72	0.52	1.42
14	Palustrine Scrub/Shrub Wetland	1.08	0.08	0.00	0.00
15	Palustrine Emergent Wetland (Persistent)	3.71	0.28	0.00	0.00
20	Unconsolidated Shore	2.29	0.17	0.00	0.00
21	Open Water	10.05	0.75	0.00	0.00
22	Palustrine Aquatic Bed	0.03	0.00	0.00	0.00
	Total	**1346.84**			

From a land use perspective on the landscape/watershed scale, the property contributes significant acreage of Mixed Forest to the watershed. Additionally, even though the property contains almost completely forest, it contributes 1.42% of the forested wetland to the overall watershed. My estimate is that number is a bit underrepresented because of the white pine/red maple stand within the wetland. If that area would also be considered, this parcel would contribute between 15 and 20 percent of the watershed's forested wetland. The "headwater" characteristic, more specifically the filtering and storage capacity of freshwater, as well as the capacity to slow water from being channelized, reduces downstream flood potential and impact. An important side note to consider is that although this area contains wetlands and unique features, relative to town and state permitting, this area is ideal for development; therefore, it is desirable or easily converted to subdivisions like the suburban sprawl which surrounds the property. This site, although mostly even aged oak-hickory forest, is of high conservation priority. The Town of Tolland is contributing significantly to conservation goals by maintaining this, and other open space parcels.

SITE DESCRIPTION

On PCA, the forest structure follows a very typical pattern observed in Connecticut forests. The forest types are very much a function of hydrology where on upper/dry areas, the forest is mostly oak-hickory, containing red, black, scarlet and white oak species. As you progress down slope to flatter moister terrain, the trees are larger and contain a higher variety of northern hardwoods. The riparian area contains some sugar maple and ash, and in the lowlands adjacent to the road, it is a red maple swamp with a very interesting component of white pine. There are remnants of old roads (connecting to the Burbank Road entrance), but there doesn't appear to be any uniform or pure plantations. There are some interesting glacial erratic features (meteor rock) and exposed bedrock. The outcroppings make quite an intricate network of dens, likely used by small mammals and other wildlife. There were no past land use history features like stonewalls, cedar posts, and barbwire on the interior of the property. But like SCA and CPV, the swamp area had an individual stems of pitch pine. Pitch pine is serotinous, which means the cones are sealed shut with sap but open with fire, and the seeds then establish on the nutrient rich, mostly bare forest floor.

History:

The town purchased PCA from Thomas and Marianne Parciak in 2002. After a brief check of Sanborn Maps and Historical Army Corp of Engineers/USGS Topographical maps, it appears that as of 1892 the property was forested. Though the map shows Peter Green and Kozley Road, Bald Hill and Burbank did not show up on either map. Relative to Connecticut, this parcel was likely cleared (along with 75% of the State) around the mid 1800's. After a review of LiDAR data and available hillshade layers from CT ECO, there were not any charcoal mounds located, which means the area was cleared for farmland or for sand/minerals (or both.) There are many unknowns about how this land has been managed through history, but with a likely spring and presence of snowy quartz, this forest likely has likely been managed for centuries longer than it has been settled.

Access/Infrastructure:

There are two entrances with roadside parking, one on Bald Hill Road and the other along Burbank Road. There is no access for off-road parking. Both areas have fences which call attention to the trail head with CR code readers to access maps from a phone. This parcel is mostly undeveloped along each road, but is contiguous to a mostly forested, privately owned parcel to the south. The Burbank Road access appears to be part of an old cart path or farm road that switchbacks up to the northern section of the property. There is a commercial communications tower with gated access from Bald Hill Road, but the area is public prohibited. Some of the boundaries appear to be marked along the northern and western lines, but a survey or deed information was not provided to Connwood at the time of this report.

Recreation:

The town trail system for Parciak Conservation Area contains about two and a half miles of trail. The hiking trails appears to be used infrequently or used mostly by neighbors and their peacocks. There are two important educational features, meteor rock and snowy quartz that have fallen into disrepair. Although Connwood has not done a full assessment of trail infrastructure, waterbars may be needed along the Bald Hill Roadside of the trail, timber planking may need to be updated or added in certain sections of the trail, and the bridge near meteor rock many need to be rebuilt. The signs at each educational feature should also be refreshed. There are no facilities on site and the property remains undeveloped other than the hiking infrastructure in place. The existing management plan, attached at the end of this document, includes all permitted uses for both properties.

Topography:

The property's elevation changes roughly 227', from a low of about 777' near where Paulk (Spelled Polk in 1892 survey) Hill Brook stream discharges southerly towards CT-74 to a high of about 1004' near the lookout area at the top of the slope to the north. Although some tip-ups were observed, there appeared to be minimal pit-mound microtopography. In the wetland areas, microtopography is readily observable with many tip ups and decomposing wood which gives the ground a "lumpy" appearance. The moister retained here also plays a big role in preserving biomass (anaerobic digestion) and creating an expansive ground cover of skunk cabbage and Sphagnum.

Aspect:

The property has mostly southern faced slopes throughout the property. The wetlands along Burbank Road flow easterly discharging to a stream down gradient flowing south. Near the highest elevations in the north, the property is much flatter with a high variability in aspect, and it does appear to be both southern and northwestern facing aspect.

Soils:

Soils provide nutrients, moisture, and support for trees and other plant life in forest ecosystems. Soils help determine the types of trees and how well they grow on any given site. Soil quality varies greatly with topographic position. Upper slopes are dry and have thin, coarse soils whose nutrients have been leached to lower slopes. As a result, upper slopes typically have shorter, slower growing trees. Mid-slopes are moderately moist and have moderate soil nutrition. Lower slopes are moist and nutrient rich and support the most vigorous tree growth. The bases of slopes hold moisture and even though they are nutrient rich, they often support poor tree growth due to the abundance of water and lack of oxygen. Species composition and growth reflect this topographic soil pattern.

Soil types for Forest: Please refer to the appendix for the soil map and web soil survey report.

Map Unit Symbol	Component Name - Local Phase	Component Percent - Representative	Soil Area (acres from town parcel)	Rating	Farmland
3:			3.75		
	Ridgebury, extremely stony	40		CT wetland	no
	Leicester, extremely stony	35		CT wetland	no
	Whitman, extremely stony	17		CT wetland	no
52C:			8.25		
	Sutton, extremely stony	80		CT nonwetland	no
62C:			26.25		
	Canton, extremely stony	50		CT nonwetland	no
	Charlton, extremely stony	35		CT nonwetland	no
73C:			14.25		
	Charlton, very stony	50		CT nonwetland	no
	Chatfield, very stony	30		CT nonwetland	no
75E:			17.25		
	Charlton	30		CT nonwetland	no
	Chatfield	15		CT nonwetland	no

WATER RESOURCES

The property has a number of "head water" locations, potential seeps, and wetland storage areas that protect surface water from temperature increases, residential/industrial contaminants, and other pollutants. There is one channelized drainage, an unnamed tributary of Paulk Hill Brook, which inevitably drains into Tolland Marsh Pond (Skungamaug River). The Skungamaug River and Crandall Pond are listed on the 303(d) List of Impaired Waters as Category 4a (a TMDL is not required) for E. Coli contamination. Currently, a CT DEEP Watershed Management Plan does exist for Crandall Pond Watershed, which include Paulk Hill Brook. Although the greater watershed does have agricultural and urban pollutants, it is important to note that recreation and the increased frequency of trail systems with pets can cause a greater potential for E. Coli, nitrification, and phosphorus based algal blooms.

Since the inventory was completed spring, observable flow was noted for both the wetland starting Paulk Hill Brook and the intermittent watercourse which discharges to Paulk Hill Brook. Areas which may be wetlands were not field delineated at the time of the site visit but were GPSed for planning purposes. In some locations larger facultative wetlands species were present (to the extent observable prior to leaf out) indicating presence of potential wetlands and watercourses. The gradient has high potential from north to south but appears to really channelize and gain depth at lower elevations on the property. In these areas, the likely intermittent streams were carved into the hillside and look almost as if they were man-made. At the bottom of the slope, near Burbank Road and the wetlands, the flat overbank areas had microtopography and coarse woody debris (CWD) structures increasing storage capacity and creating habitat niches. Microtopography captures and retains moisture throughout the growing season. The soils in this area are well drained and are likely saturated seasonally, with ground water feeding the stream and wetlands during the rest of the year. Any significant ground or vegetation disturbance within 100 feet of wetland soils, watercourses, and waterbodies requires a permit from each town's Inland Wetlands Commission.

The wetlands and rolling hill topography prevent floods by slowing water runoff during storm periods, absorbing and storing sediment and nutrients that would otherwise harm downstream water bodies, storing and recharging groundwater during dry periods, and providing excellent wildlife habitat. Activities in or near wetlands should be limited to when the water table has receded or has frozen over.

Sustaining water quality requires preventing erosion to keep the soil and its nutrients in the forest and out of the wetlands and watercourses. This includes having different vertical and horizontal vegetative layers. A single aged forest tends to have a thick canopy which decreases the sunlight availability for the mid and understory level of the forest. A mid and understory layer can provide increased leaf surface area (potential interception during rain events). Increased leaf area also yields thicker organic soil layers (leaves create a wonderful barrier to erosion). A healthy and thick organic leaf litter layer also helps with natural sheet flow, moisture storage, and direct rainfall interception. Native species, herbaceous through canopy, tend to have significantly larger root systems which bind soil significantly. Erosion control methods on trails, adjacent to dirt roads, and as part of any forest activities can control the volume and velocity of water on unprotected soil. Such methods include installing water bars, spreading straw mulch, and spreading conservation seed mix. In addition, at least 50% of the tree canopy cover should be retained within 100 feet of wetlands and watercourses and no trees should be removed within 20 feet of wetlands and watercourses. Such measures provide a protective buffer that can filter out damaging pollutants, nutrients, and sediments before reaching water resources.

Please refer to 'Water Quality' section under General Recommendations, the Elevation/Contour Map, and the Stands Map which identifies approximate locations of intermittent streams.

CULTURAL RESOURCES

The property has cultural features like snowy quartz which has been highlighted in the Hartford Courant and other journalistic publications. Though this property does contain snowy quartz which was used as a "road sign" during pre-settlement times, it is unclear of the roll of these specimens. There should be extra care while working in these areas and no tree cutting adjacent to such features. Stonewalls, wolf trees, farmland to forest conversion features, and likely "excavated" areas which indicate past land uses were present within this forest. Stonewalls served many purposes: although stone piles were the main depository for fieldstone removed for tilling the land, as land was cleared from around 1815 to 1900, a wood shortage was experienced. Hence, stone piles were rearranged as stonewalls as boundary markers. In some locations, though not observed on this property, stonewalls also acted as barriers to keep livestock out of the crops. The stonewalls observed were limited to along Bald Hill Road No wire was observed along the property boundaries, but a boundary investigation was not the main objective of this management plan. Although wolf trees were mostly observed along woods road edges or along stonewalls, they serve as an indicator of age and species that may have been present prior to and during conversion to agricultural lands. Where white pine was present within the wetlands, some large diameter, weevilled wolf pine trees were present. Although charcoal mounds were not identified at the time of inventory, it is likely that all of the area was harvested for charcoal at one time. The forested area east of this parcel near Louise and Williams Road appear to have depressions and structures that may be charcoal mounds. There was a single stems of pitch pine observed adjacent to the flat/wet area near Burbank Road. Pitch pine have serotinous cones (that only open with heat); therefore, these trees can only reproduce and establish during fire events. The flat area of this property may have been periodically burned for hunting by Native American prior to the purchase of the land. Those activities likely didn't stop immediately and were continued by the settlers for brush management.

Since the history of Tolland's establishment is well documented within "The Early History of Tolland: An Address, delivered before the Tolland County Historical Society" by Loren Waldo circa August 22 and September 27, 1861, it makes sense to include the title for reference. The document does not mention this specific property, but it does have a comprehensive outline

of the many nations, tribes and groups which inhabited the area pre-settlement.

FOREST DEVELOPMENT

During forest development, the competition for water, nutrients, and sunlight drives a system of replacement. Once an agricultural field is abandoned, woody/tree species begin occupying this space. The first to establish abandoned agricultural land are known as early successional or "pioneer species." Trees can occupy a location at very high densities if germination and growing conditions support establishment. These conditions include varying degrees of moisture, temperature, exposure to mineral soils, and a vector/seed source to deposit them. As trees compete for sunlight, faster growing species and/or individuals tend to overtop intermediate or suppressed individuals. Typically, the pioneer species are short lived, but they create conditions for shade tolerant species to establish in the understory. Shade tolerant species can either establish or remain established falling behind in height as the young forest compete for sunlight.

There are a number of factors which cause variations of this process from forest to forest, but the competition for sunlight is always the same. As the codominant, intermediate, or suppressed trees succumb to lack of resources, disease, or natural disturbance, the trees are recycled back into the forest ecosystem utilized by a very complex range and scale of organisms (from mammals to bacteria). Once the mature trees die from old age, referred to as senescence, disease, natural disturbance, or are cut, the forest structure becomes more complex. The removal of an individual tree creates a gap in the canopy, and the race for the sunlight begins all over again. This process has occurred yielding mid successional stands of oak and hickory, both moderately shade tolerant species. Hardwood and oak forests are changing as gaps are created when the ash die, or oak succumb to drought and Lymantria. In some cases, the forest floor is occupied by non-native invasive species. This halts the successional trend, and in some cases, can revert land back to dense primary succession.

When a forest reaches an equilibrium, also called late successional forest, each time an individual tree dies, a gap is created. Depending on the age, spacing of the trees, soil quality or site index, this gap causes surrounding tree crowns to expand to fill in the canopy opening. When multiple trees die or larger gaps are created, the understory trees will fill the gap. In some circumstances, the understory trees may have established during the original forestation, but gap creation can also create conditions for regeneration to establish.

Forest management can contribute to accelerating succession, reverting succession, or attempting to maintain a forests current composition by mimicking natural disturbance. Foresters can help identify the healthiest and most vigorous trees to remain, increase in volume or value, and produce seed for wildlife or the following cohort. These decisions are made based on landowner objectives and what currently exists on the property. Some objectives like management for oak species will not make sense in a white pine plantation. However, it is possible to manage for habitat in a pine plantation that might encourage residency of oak mast consuming wildlife. Theoretically, an oak individual may establish and respond to a canopy disturbance, reestablishing oak components in a forest. A forest can always be managed for age, species composition, and other values using different disturbance regimes. In scenarios where bird habitat is desired or regeneration only occurs during larger scale, more intense disturbances, a disturbance like a forest fire/flood/or tornado can create the competition scenario when a forest was first being established.

It is typical to use the "stand" scale as a management unit. The stand is typically delineated by overstory species composition. Although each management unit may need a different treatment or have a different recommendation, many management schemes can be applied across stand boundaries and can be scheduled based on priority.

FOREST HEALTH

Biodiversity:

Biodiversity is the foundation of a forest's ability to provide public services. It represents the complexity of the community type that exists within a forested stand. Tree species affect forest floor conditions, availability of food, occurrence of insects or wildlife, etc.; therefore, tree species diversity can be used to estimate the overall range of species present in a forest ecosystem. As diversity increases, overall forest resilience increases. Although large scale disturbances tend to remove an entire forest (in New England that is approximately every 200 years), having a balanced forest keeps unplanned disturbance like drought/Lymantria impacts to a minimum. The reason why drought and Lymantria have made such a big impact is because of a mostly homogenous age and species composition.

Non-Native Invasive Species:

Connwood perform an assessment of health on the oak trees, which have been severely impacted by drought/Lymantria, and it is clear that this event will impact your forest for years to come. It is clear that Lymantria has passed through the property, but the current presence appears limited with damage being complete. They have been found in almost every town in Connecticut. This is an introduced species that is like a tidal wave but fortunately does not often yield 100% mortality. The black/scarlet oak, once dead tend to decay quickly and lose their value, but white/red oak tend to take longer to deteriorate. **Oak is a major component in most Stands within this tract. It is not a significant component in the red maple forested wetlands portions of the property.**

Tree damage from windstorms was present throughout the property. Trees were tipped over in areas where soils are thin, and the trees were not sufficiently anchored. Some older trees were also snapped in half. This is likely due to decreased strength above the stem where the crown is formed.

A concern for overall stand health is the presence of non-native invasive species. Berberis sp. (barberry), multiflora rose, honeysuckle, oriental bittersweet, and winged euonymus were present in the mixed hardwoods stands, very significant impact can be seen near the Burbank Road entrance. Species that are wind or bird disseminated were found in the wetter forests on the property. These invasive species did not have a significant presence in the portions of the forests where complexity was minimal (even aged with only a primary canopy layer).

WILDLIFE HABITAT

The wildlife habitat on the property provides the necessary food, shelter, and water for many types of animals found in this region. Habitat features include deciduous trees, coniferous trees, stream banks, vernal pools, brushy growth, fields, younger trees, older trees, large downed trees, small downed trees, thick understory within a forest, tip ups, microtopography and depressions, brush piles, tree cavities, boulder cavities, and the list goes on.

Overall the forest is lacking diversity in both tree species and tree sizes, as well as, important habitat features. The large diversity of tree species ensures a greater variety of foods and therefore a larger diversity of animals. The diversity of tree sizes affords many different roosting, nesting, and feeding opportunities for birds. The wood thrush, for example, sings from the upper canopy, nests in the mid-story, and feeds on the ground.

Cover:

Cover may be a hemlock tree for a screech owl (sleeping cover), a stonewall for a chipmunk (escape cover), a depression from a tip-up adjacent to a swamp for an eastern box turtle (overwintering and reproduction), or a dense patch of brush for a deer (resting cover). An animal's cover requirements are variable. Deer and grouse generally feed in relatively open areas of forests, but during a winter snowstorm they may seek refuge in a dense stand of conifers.

Dead Wood/ Snags:

A critical part of the forest habitat is dead wood. Standing dead trees (snags) and dead wood on the ground serve important habitat benefits. Over one-quarter of the wildlife species that potentially inhabit this property require dead wood, hollow trees, or rotten wood for some part of their life cycle. Dead wood provides cover, moisture, nest sites, and den sites.

Snags are standing dead trees that provide food and cover for over eighty-five wildlife species. Snags are important foraging sites for many species of birds and often serve as cavity trees when primary excavators, such as woodpeckers, initiate cavity development. Snags, especially those with good vantage points in clearing or along edges, are also used as perching sites for raptors, phoebes and other birds. A greater number of wildlife species will benefit from large snags (greater than 18 inches diameter) as opposed to numerous small ones. Large snags generally last longer and can be used by both large and small birds and mammals.

On average, each acre of forest should have at least six snags per acre, half of which should have diameters over 16". As you can see by this table, the young forest of Stands 1 & 5 are low in snags, which is typical of early successional forest. Additionally, if den trees and habitat features are being utilized, which were observed in Stand 3 (hemlock-hardwoods), increasing habitat adjacent to areas being occupied will benefit the established community.

Stand	Snags/Ac	16" +/Ac
PS1	3.5	2.2
PS2	None Tallied	None Tallied
PS3	2.9	None Tallied
PS4	7.4	10.1
PS5	4.6	6.1

Cavity or Den Trees:

Den trees are trees having the trunk or large limbs hollowed out by rot, with an opening to the outside. Cavities in trees of all sizes are essential to many species of birds and mammals. Blacked-capped chickadees and eastern bluebirds use cavities in stems less than 6 inches in diameter. Gray squirrels, screech owls, and various woodpeckers such as northern flickers use cavities in stems between 12 and 18 inches in diameter. Larger birds and mammals such as pileated woodpeckers, fishers, and raccoons require larger cavities in stems greater than 18 inches in diameter.

Brush Piles:

A small portion of brush should be piled wherever possible and practical to provide additional wildlife cover. Brush piles were observed just north of the field on CPV. Brush piles can be combined with efforts to move woody debris away from walking trails and wildlife openings. Small mammals and some birds (wrens) use such piles for cover and bears use them to den. Such piles are particularly desirable if located near water or the edge of forest openings. Large wood and rocks form the base, which are covered by progressively smaller branches to form a mound that is about 6 feet high and 15 feet across.

Conifers:

Some conifers (pine, hemlock, and cedar) should always be retained to provide mammals and birds protection from harsh winter weather. They provide food and cover for resting, roosting, and nesting. They also help to moderate the effects of inclement weather. Forests that contain both conifer and deciduous trees generally contain more wildlife species that either one exclusively. Ruffed grouse, white-tailed deer, red and northern flying squirrels, red-breasted nuthatches, golden and ruby-crowned kinglets, solitary vireos, and bay-breasted warblers are examples of Connecticut wildlife species attracted to conifers.

Perches:

Perching sites are most often found in old fields, pastures, roadsides, riparian corridors, and in stands with an overstory tree that clearly towers above all other forest vegetation. Supracanopy white pines, hemlocks, yellow poplars, and large roadside sugar maples are examples of high exposed perching sites. The exposed nature of these high perches provides excellent hunting and nesting sites for various raptors such as osprey, red-tailed hawks and kestrels that forage in non-forest cover types and open forests. Fences, utility lines, isolated deciduous shrubs, and woody sprout clumps less than 10 feet high can serve as low perches.

Travel Lanes:

Fence rows, stonewalls, drainage ways surrounded by tall herbaceous vegetation and low woody growth make excellent travel lanes. Stonewalls provide structure to wildlife habitats and are especially valuable as travel lanes. For small mammals, such as chipmunks, stonewalls serve as an important cover for nearly all daily functions. For larger species, stonewalls provide protective cover along which to travel. Where stonewalls boarder fields or woodland roads lush herbaceous edges may be

present.

Wildlife Food Sources

Food, a source of energy for growth, maintenance of good health, and reproduction is essential to all wildlife species. All animals must have an adequate seasonal supply of nutritious foods provided by a variety of habitat types. The seasons and weather can be an important factor in determining food availability. Insects, grasses, forbs, mast (nuts), and fruits as well as other animals are important food sources for wildlife in Connecticut. The following are two major sources of food for wildlife in the forest.

Hard Mast:

Hard mast is hard shelled seeds (nuts and acorns) that provide high caloric source of digestible lipids and carbohydrates needed by most resident and migratory wildlife species. Native hard mast-producing trees include the oaks, hickories, and beeches. A variety of hard mast producing tree species will ensure food all year and are insurance against seed failure of any one species. White oak acorns are particularly valuable because of their high protein content.

Fruit:

Fleshy (soft) fruits produced from a variety of native shrubs are an important food source for wildlife. Some common shrubs of high value are blueberry (highbush and lowbush), huckleberry, common juniper, serviceberry, spicebush, winterberry, dogwoods and sumac.

Rare Threatened and Endangered Species:

The CT DEEP Natural Diversity Database (NDDB) does NOT have any occurrence in PCA. A request for further information was not submitted.

GENERAL RECOMMENDATIONS

SITE IMPROVEMENTS

Access:

There are two main public access points on the tract. The Bald Hill Road access has an expanded shoulder which creates adequate space for three vehicles on the side of the road. This is not a heavily trafficked road; therefore, this type of parking is adequate. The Burbank Road entrance has a paved shoulder and pull off that appears big enough for one or two vehicles. The road into the woods appears to have a 15" reinforced concrete culvert. This parking area discharges directly into the wetland. The entrances each have a sign that indicates what property you are entering and the ownership. At each gate, signs indicate "allowed" and "prohibited" uses, QR codes to access management plans and maps, and printed trail maps. All trails are clearly marked and very well maintained. Vehicular access into the woods is limited to the road at the communications tower. This would serve as a good staging location for any firefighting activity. The town may consider reestablishing a gated woods road for firefighting access and emergency vehicles.

Infrastructure:

Maintaining good access roads/trails into the forest increases the value of the timber, aides in wildfire control, prevents trespass, aides in property maintenance, and improves forest recreation opportunities. There are old "wagon" roads throughout the property, potentially from previous forest management activities. The trail infrastructure including boardwalks, erosion control features, rock work, and signage should be documented and assessed on an annual basis.

Roads are critical for fire control equipment during a wildfire. PCA commercial communications easement has enough infrastructure to get off the road, and the trail corridors provide access throughout the property. These trails can also be quickly scarified to act as barriers to the spread of fires. The commercial communications easement is large enough to serve as potential equipment staging area. This commercial communications easement may also have a hydrant or water source which could be used in an emergency. This forest stewardship plan does not include emergency management planning details; however, since all areas are accessible by walking trails and are maintained, the Paulk Hill Brook Tract has sufficient infrastructure in place to manage fire.

Proper maintenance of trails is critical to preventing erosion. Maintenance means keeping water off the trails, with the trail surface remaining intact. Methods include water bars, broad based dips, planning trail layouts, and use of switchbacks. The trail system is well maintained and does not appear to be significantly contributing to erosion or sediment transport.

WATER RESOURCES

Water Quality:

Water quality typically involves stream degradation, risk management and assessment, and what activities on or adjacent to the property could produce point and nonpoint source pollution. Forests shade streams, intercept and regulate precipitation, act as a storage area or filter for runoff, and produce a layer of organic material which protect against mobilization of sediment. From a management perspective, protecting water quality requires assessing erosion potential of the soil, what activities are planned on the property, and the activity's proximity to waterbodies. Not all activities require significant erosion control and sediment protection practices, but if an activity causes mineral soils to be exposed or compacted and runoff has a path to discharge to a waterbody, planning activities and controls can make a difference. Simple controls can yield long term results. Since the forested areas on the property are used for recreation, there are not many risk factors that can contribute pollution directly to a water resource. If a forestry equipment were to be used on site, it is important control the volume and velocity of water on unprotected soil. The Connecticut Forestry Best Management Practices Manual addresses preventative measures like installing water bars, spreading straw mulch, and applying conservation mix seed as needed.

Stream/Wetlands Protection:

Although management near wetlands or watercourses have "rules-of-thumb" that change frequently, the high gradient streams found on the property should retain a minimum of 50% of the tree canopy cover within one hundred feet of watercourses. Additionally, trees should not be removed within twenty feet of watercourses. Depending on management goals and means

and methods, these distances also can apply to wetlands. Protective buffer can filter out damaging pollutants, nutrients, and sediments before reaching water resources. Forested buffers also provide shade for cold-water streams. Buffers typically also provide a natural source of forest debris (logs, branches, leaves etc.) that is an integral part of maintaining the biological/ecological health of wetlands and watercourses. During the inventory, course woody debris in streams were not observed, which directly contribute to reducing flow velocity and increasing storage capacity.

CULTURAL RESOURCES

The widely agreed upon definition of cultural resources includes any site, building, structure, object, or area that has value in American history, archaeology, architecture, engineering, or culture, and is at least 50 years old. At the time of this Forest Stewardship Plan, which would include anything from 1971 or earlier. Before colonization, the area was trafficked by people of the various Algonquin tribes. There are no known Native resources on the property documented at this time.

The farming and past land use history of this parcel is unclear at this time.

Meteor rock and snowy quartz should be considered cultural resources. Since they now serve as educational features on site, they should remain untouched and avoided during any forest management. Regardless, what does exist provides the story for reading the forested landscape, a window into the historical use of the land, and a perspective into the relationship between people that have occupied the land and the land itself. What remains also contributes diversity to the forested landscape, the same way natural disturbances create diversity in stand composition and structure.

BOUNDARIES/ MAPS

Boundaries are not well marked but appear to be established. In the northern section at the top of slope, the western bounds appear to be surveyed by LS#10839 Peterson. Signs indicating that one is "leaving" the property exist in some locations. The lines should be traversed annually, and blazed/painted every five years to observe adjacent landowner encroachment or any potential concerns.

INCENTIVES

This plan can be used as a basis to apply for funding to implement practices that are recommended in this plan. Please see the 'Summary of Management Recommendations.'

INVASIVES/VINES

Control methods include mechanical and chemical treatment. In a forest, cutting a vine can produce the desired results. Typically, in a mature forest, light availability will inhibit any reestablishment of non-native invasive vines. Research indicates that it is within the historical range of variability to have between 20 and 40 stems per acre of grape vine. We recommend leaving grape when possible because it is a quality, native seed source for a large variety of wildlife species. Invasive shrubs are more complicated, but cutting during the period when a plant transitions from growth to winter preparation may have good results. The stem will not be removed entirely with one treatment as the root system still exists, but this method may keep invasive species under control. The most effective control method is to cut the invasive and follow with an herbicide treatment during the growing season. Due to the proximity of water that may be used as a drinking water source, we do not recommend herbicide applications. For more information, visit the Invasive Plant Atlas of New England: invasives.ecb.uconn.edu/ipane. A more detailed treatment method is described in the stand recommendations.

AESTHETICS

There are many opportunities to improve the beauty or aesthetics of the property that fall outside of traditional landscaping. Two activities have already been mentioned and have benefits beyond aesthetics: vine and invasive species control. Most would agree that hanging vines and thorny invasive species have little beauty. Controlling vines and invasives creates a more park-like forest that appeals to most people because it is much easier to see through and walk through.

The top of slope may have good potential for a clear southern vista. One can achieve a view with minimal effort but cutting on a steep slope is complicated. Since the trees at the top of slope aren't significantly large, they can be cut and left in place. This view is also near the snowy quartz location; therefore, it may not be possible to remove all trees for a perfect view.

FOREST STAND DESCRIPTIONS AND RECOMMENDATIONS

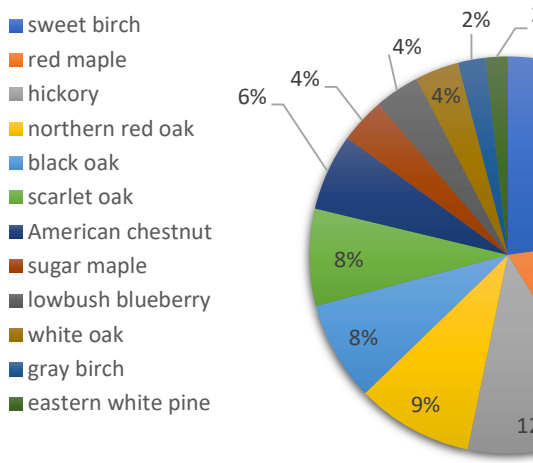
Stands are separate natural communities that are distinct from each other. Dividing a property into stands makes it possible to logically describe the property. Keep in mind that while stands are distinct, stand boundaries are often indistinct, where one stand will transition into the next stand over the course of 100 to 200 feet. Even within a single stand, there is a tremendous amount of variation.

The following stand descriptions are based on over 70 measurement points (10 BAF) using stratified random distribution throughout the property. At each measurement point, quantitative and qualitative data was recorded and will be summarized below.

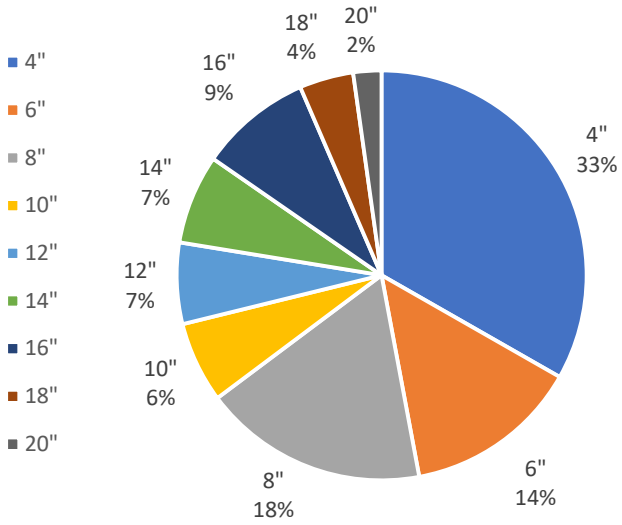
Each description begins with two graphs. The first shows the relative abundance of each species by percent. Not all species found in a stand will be included in this graph because some of the less common species did not fall within a measurement point. The second graph shows the relative abundance of different tree sizes based on the diameter of the tree measured at 4.5 feet off the ground.

PARCIAK STAND 1 (PS1): DRY OAK WOODLAND (16.3 ACRES)

SPECIES DIVERSITY



DIAMETER DISTRIBUTION



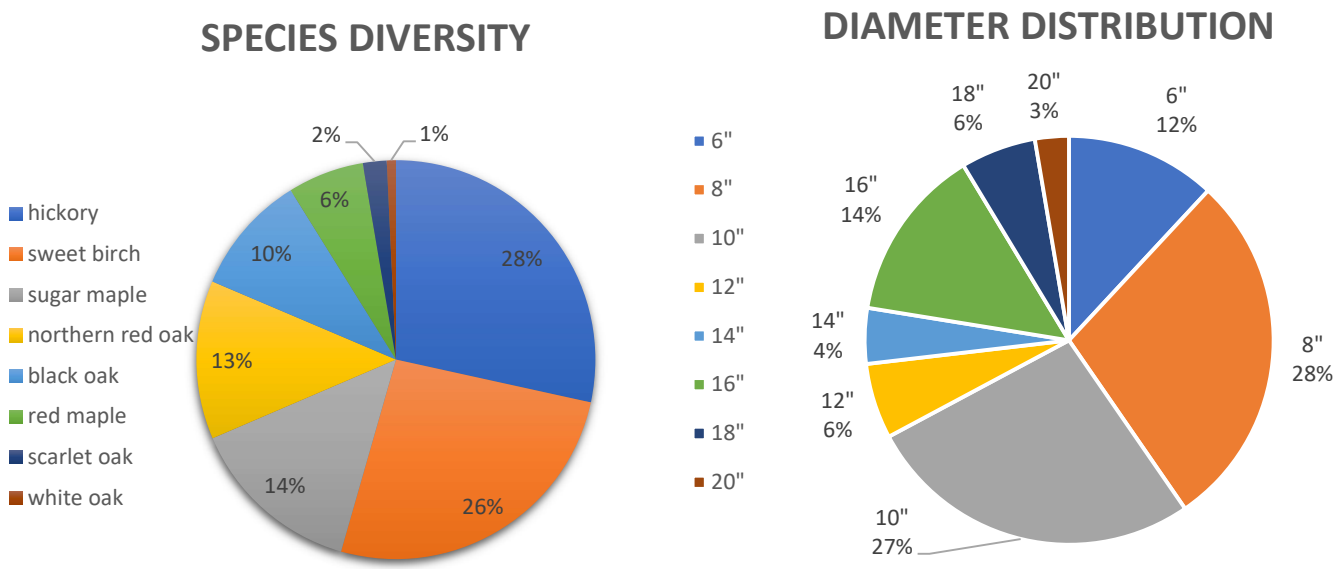
Other Species (not measured)	No applicable
Regeneration/Understory	No significant regeneration (deer browse)
Coarse Woody Debris	Low
Insect/Disease/Disturbance	Drought and Lymantria with occasional windthrow; formicidae
Invasives/Vines	Low presence of barberry, multiflora rose, Japanese knotweed
Canopy Closure	Average 84%
Basal Area per Acre	110
Trees per Acre	202
Volume per Acre	4500 BF
%UGS	42.5%
Mean Stand Diameter	8.6
Stocking Level	Over Stocked
Site Index	55
History	This acreage appears to be a "second forest" likely after land was cleared and chestnut blight removed that component of the forest. Shallow, well drained soils yield a low site index, but presence of sedges may indicate burning to maintain brush after clearing and potential grazing area.

This stand consists mainly of an oak (black, white, red, scarlet) canopy tree species, but where larger gaps or patches were created, a mid-story of red maple, sweet birch, and white pine are growing. Scrub vegetation (low bush blueberry, Viburnum, princess pine) weaves through the understory impacting the diversity and location of regeneration. Many of the residual trees are poorly formed and it is a common occurrence to see trees "snapped" in half. There were some impacts from Lymantria, and drought observed, but these already poorly formed stems make wonderful live dead hard and living centrally decayed habitats. Many excavators, hairy and downy woodpeckers, black capped chickadees, etc., were observed during inventory. Within this stand, there is a woods road along the western boundary, and the hiking trail bisects the stands in multiple locations. During inventory, very few if any small mammals were observed which is atypical for a hard mast dominated forest.

Recommendations

This stand can be managed by releasing white pine trees, leaving ~5 trees per acre in patches around existing den/habitat trees. The acreage and existing canopy do not allow for an intermediate harvest, but the stand can be left alone. If the stand remains untouched, the oak canopy will be replaced with red maple, sweet birch, and white pine. Likely, remaining that way with the inevitable complete loss of the oak species. Coarse wood debris (3-5 trees per acre) creation will greatly benefit small mammals. Dead trees along the trail should be removed as part of a commercial operation. Reduce BA to 80.

PARCIAK STAND 2 (PS2): DRY OAK FOREST (14.2 ACRES)



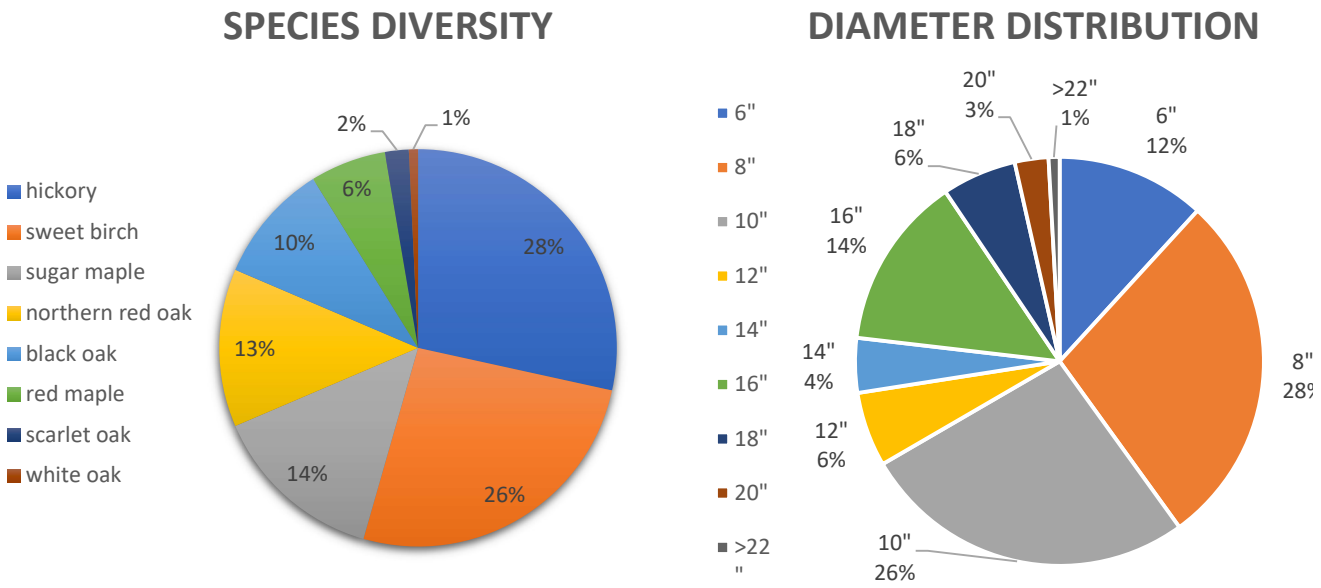
Other Species (not measured)	None Observed
Regeneration/Understory	Minimal to none
Coarse Woody Debris	None observed/minimal
Insect/Disease/Disturbance	Some spongey moth – drought damage, nectria on birch
Invasives/Vines	Barberry (low),
Canopy Closure	Average 92%
Basal Area per Acre	130
Trees per Acre	173
Volume per Acre	7000 BF
%UGS	22%
Mean Stand Diameter	10.9
Stocking Level	Over Stocked
Site Index	65
History	This contains the steepest slope on the site; an old wagon road does exist; therefore, it may have been used mainly for travel prior to the establishment of Burbank and Bald Hill Road. It was cleared at some point, but a sugar maple constituency

This stand is very much a transition zone from PS1 to PS3/PS4, but the main characteristic of this stand is the steep slope. The management in this stand should be limited to off the slope, but removal of some canopy can create both a vista view to the south and release some established sugar maple poles. This one was hard to ecotype because it is mostly just a transition zone, but it does contain the snowy quartz and a steep section of hiking trail. At the toe of the slope a road does exist, though it is unmaintained/abandoned, that is a feature of the past land use history. This area has been trafficked for quite some time. There are hazard trees along the trail, but it is both the hardest to access and most erodible.

Recommendations

The stand may be treated with TSI or ESI (eco stand improvement) to establish gaps to create species, age, and horizontal/vertical structure diversity and coarse woody debris. Trees should be girdled adjacent to sugar maple regeneration to allow for single tree sized gaps for a late successional component to this tract. Ecosystems like this one have seen a complete canopy change likely from gray birch to oak to now sugar maple. It is important to remove the density of sweet birch when creating gaps to contain nectria and create some stand diversity. We recommend thinning from below around the largest oak canopies to create a site ready for seedling establishment during the next big oak crop. Reduce BA to 80.

PARCIAK STAND 3 (PS3): MAPLE – ASH – OAK - HICKORY FOREST (2.6 ACRES)



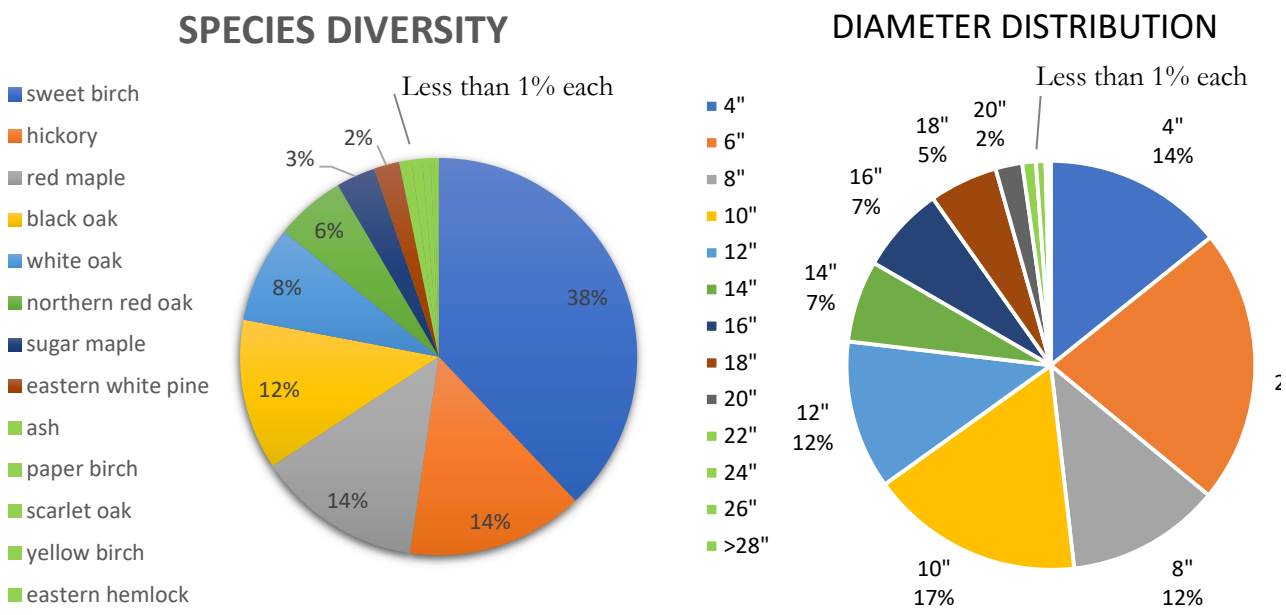
Other Species (not measured)	None Observed at the time of inventory.
Regeneration/Understory	No significant regeneration
Coarse Woody Debris	Average amount
Insect/Disease/Disturbance	Wind throw, ash dieback, Nectria
Invasives/Vines	grape, barberry
Canopy Closure	Average 67%
Basal Area per Acre	90
Trees per Acre	110
Volume per Acre	6000 BF
%UGS	60%
Mean Stand Diameter	10.9
Stocking Level	Fully Stocked
Site Index	Varies with slope position ~65
History	This area contains a fresh water source in the form of a seep, which likely has some historical relevance. There is little known about this stand, but it is a high potential stream which does over bank in some locations creating micro-niches within the stand.

This stand should be managed for ash regeneration and sugar maple, but it should also be protected because of the hydrology. The presence of non-native invasives indicates that seeds were deposited by birds or mammals which use this water source; therefore, it is of high importance to the natural community. The saturated ground within and adjacent to the intermittent stream does also support vegetation that is only present due to water content. This stand contains some windthrow and tip ups which creates structure from a relatively uniform forest. Though coarse woody debris within the stream was not assessed, this stream is very linear.

Recommendations

Mechanical treatment of non-native invasive species. Forest stand improvement to promote or steer species composition towards sugar maple/yellow birch/Ash. Remove sweet birch and red maple to provide more growing space to sugar maple trees. Fell 5-10 trees per acre adjacent or across the stream to enhance the existing habitat, in the form of cover for various reptiles/amphibians/small mammals. This area can be treated lightly within the context of a commercial harvest, but no more than 50% of the basal area should be removed. Reduce BA to 75.

PARCIAK STAND 4 (PS4): DRY OAK - HICKORY FOREST (28.3 ACRES)



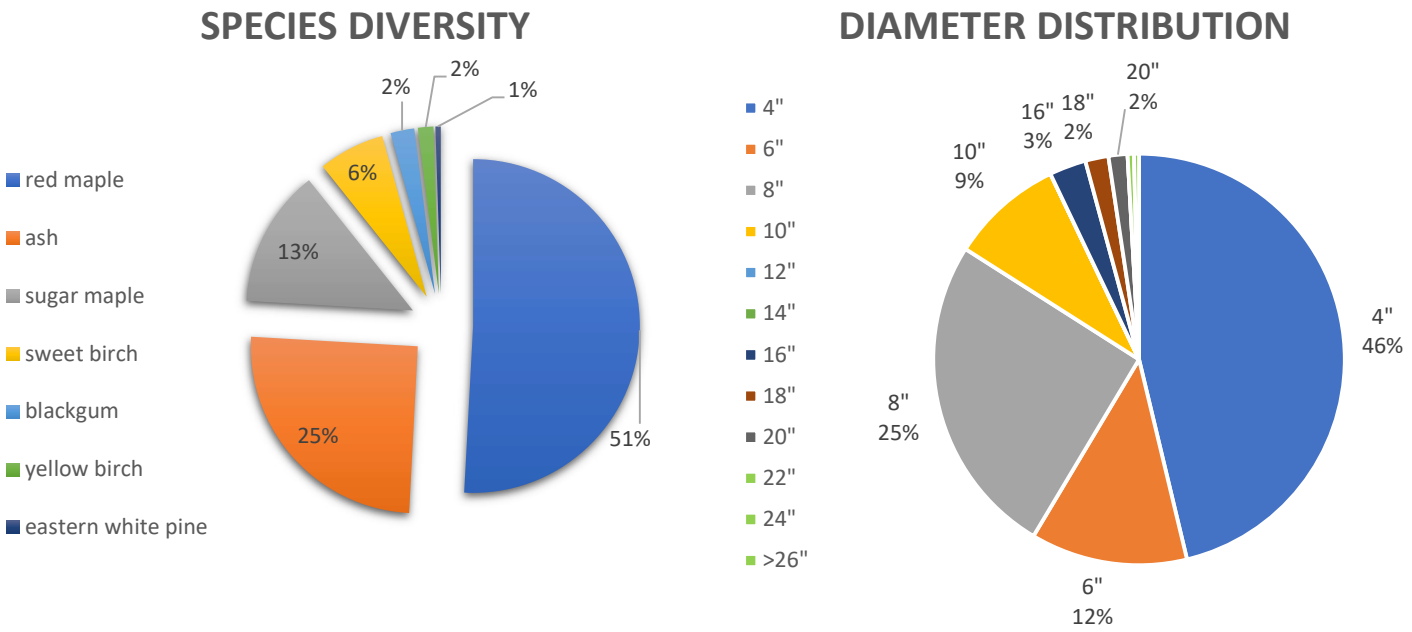
Other Species (not measured)	None observed at the time of inspection.
Regeneration/Understory	Minimal – red maple and sweet birch
Coarse Woody Debris	Minimal
Insect/Disease/Disturbance	Lymantria-drought dieback, nectria, natural wind pruning
Invasives/Vines	Barberry (low priority)
Canopy Closure	Average 84%
Basal Area per Acre	130
Trees per Acre	175
Volume per Acre	7000 BF
%UGS	15%
Mean Stand Diameter	9.8
Stocking Level	Over Stocked
Site Index	70
History	Unknown

This stand has large legacy trees making it one of the easiest to use standard silvicultural techniques to increase vertical and horizontal structure. Much of this forest is single aged with an oak overstory. There is minimal coarse woody debris and very little mid and understory. There are some sedges higher in the slope. Additionally, it appears that wind and hydrology play a large roll in movement of organic material and soil development. Places exist within this stand where leaf letter is almost not present because of the high gradient and limited woody debris on the ground; leaf litter and broken-down organics are washed down gradient.

Recommendations

As part of the management of this stand, gaps should be made in the form of a mix between thinning from below and a first phase shelterwood. Due to the variable topography and spatial layout of trees, no one prescription will work, but lowering the basal area to 70 would make sense. Since den trees do exist off the trail, and there are very active den birds in this forest, it is important to retain these features and create leave patches around these trees. This stand will benefit the most from gaps due to the location adjacent to the intermittent stream and wetlands along Burbank Road. Thinning from below should be focused on removing UGS black birch and red maple (both generalists and prolific seeders) while retaining the biggest, best and largest northern red oak specimen on site. Crown expansion on these legacy trees would benefit from ¼ - ½ acre patch cuts with these trees near the center or northern position of the gap. As part of the sale, 5 UGS trees should be left on the ground in 20 or so foot sections to improve the coarse woody debris within this stand. Additionally, we recommend a blended top lopping approach where it near 1ft around trails but mostly unlopped at further distances from the trails. Unlopped tops can increase bird habitat (safety when ground feeding) as new cohorts of shrubs or trees emerge with canopy removal. Reduce BA to 80.

PARCIAK STAND 5 (PS5): RED MAPLE - WHITE PINE SWAMP (7.0 ACRES)



Other Species (not measured)	None observed
Regeneration/Understory	None observed
Coarse Woody Debris	Less than average amount
Insect/Disease/Disturbance	Emerald ash borer
Invasives/Vines	barberry, multiflora rose, bittersweet, grape
Canopy Closure	50%
Basal Area per Acre	70
Trees per Acre	205
Volume per Acre	4000 BF
%UGS	32.5%
Mean Stand Diameter	6.8
Stocking Level	Under Stocked (below C-Line)
Site Index	70
History	This area has a gradual slope and high seasonal water table; likely used for planting crops or agricultural of some sort.

This stand consists of a red maple swamp with a sand deposit in the middle. The western most area of this stand is near the Burbank Road entrance and contains a wide variety of living ash trees, yellow birch, and maple. Heading south and easterly, increased presence of spice bush, high bush blueberry, and witch hazel occurs. This area contains the most invasive species and vines with very large patches of bittersweet, barberry, multiflora rose, and grape. The vegetation in this area is mostly determined by hydrology, and the change is quite abrupt when transitioning from skunk cabbage to moist soils adjacent to standing water. This area contains the one pitch pine on the property, which again relates to the potential use of fire for agriculture and for clearing brush.

Recommendations

This stand does not have the capacity to support a commercial operation but contains some interest habitats, which can be enhanced using ESI (eco stand improvement). The non-native invasive species should be removed completely, either pulled by hand or mechanically cut and left in place. Creating gaps will increase the presence of non-native invasives; therefore, this should only be done if invasive management and observation occurs annually. The no action option will be decreased diversity as the forest canopy is consumed or brought down by these invasives. Additionally, because they are prolific, they will outcompete forest tree regeneration and eventually expand into the forested area. Some landscape-based action that could enhance this area would be to work with adjacent landowners to plant native fruiting species and eliminate non-native invasives on their property (the likely source for the current situation.) Brush piles (3/ac) would make sense within 100ft of standing water.

SUMMARY OF MANAGEMENT RECOMMENDATIONS

The following table summarizes recommended forest management activities for the Paulk Hill Brook Tract in Tolland for the management period 2022 to 2032. Active management is a dynamic process; therefore, adjustments, updates, and revisions may be necessary due to unforeseen changes in environmental conditions (disease, insects, fire, and storm damage) or changes in the stated objectives.

Stand	Acres	Recommendations	Priority	Timing
All	60	Update Forest Management Plan	H	2032
ALL	60	Boundary Refurbishment	H	5-year interval
3, 4	8.25ac	Wildlife Brush Piles (9 total)	L	2022-2032
1, 2, 3, 4	8.25ac	Forest Stand Improvement (ECI) – Sweet Birch Removal and CWD Creation.	L	2022-2032
1, 2, 3, 4	8.25ac	CWD Increases (6 – 10" + / ac or ~30 trees)	M	2022-2032
2, 3, 5	3.75ac	Invasive species control/eradication	H	2022-23 (before any management occurs)
1, 2, 3, 4	35 ac	Irregular Shelterwood/Thinning	H	2022-23
1, 2, 3, 4	35 ac	Forest Stand Improvement (ECI) – crop tree release	L	2042
1, 2, 3, 4	35 ac	Irregular Shelterwood	L	2072

Boundary Refurbishment:
Length: ~8275ft
Paint Amount: 2 gallons yellow latex road marking paint ($120)
Signs (#): 250 signs ($200)
Is a survey available? Unknown (likely for northern section) Road frontage also helps!
Deed Research: ($720)
Labor: ($1250)

Total Cost: ~$2300 *potentially less if boundaries have been marked previously

Wildlife Brush Piles:
Labor: $1500

Total Cost: ~$1500

CWD & ECI & Invasive Species Control:
Labor: $2000

Total Cost: ~$2000

Irregular Shelterwood/Thinning:
Marking Paint: $250
Labor: $3000
Marketing, Administration, Bidding: $1500
Potential Gross Revenue: $20000-25000

Net Revenue: ~$15250

APPENDIX A: LIMITATIONS

Use of Report:

1. Connwood Foresters, Inc. (CFI) prepared this report on behalf of the Town of Tolland (Client) for the Paulk Hill Brook Tract of forestland, as outlined within the report and appendices, for the purposes outlined in the "Stewardship Objectives." Application of this report or findings outlined within this report to other forested properties may lead to inappropriate conclusions. CFI do not accept any responsibility for the consequences of such use(s). Reliance on this report by any party not identified within the agreement, shall be at that party's own risk and without any liability to CFI.

Standard of Care:

1. The findings and conclusions within this report are to be considered professional opinion and based on the limited data collected as part of accepted forest inventory methods. Conditions other that what has been described in this report may be found.
2. The services provided were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time and under similar ground conditions during a similar time of year. No warranty, expressed or implied, is made.

Forest Inventory Conditions:

1. The stand delineation and inventory data were based on field observations and documentation, as well as sample points collected at 4acre intervals. The boundaries between forested stands or management units were assessed using 2019 USGS orthophotography and field verified during the inventory. The nature and extent of variation between and within stands may not be evident without further data collection and mapping. If variation is found from the data outlined within each stand, it may be necessary to reconsider recommendations of this report.
2. GPS data was collected using a smart phone's location function. This data is not to be considered survey grade. Additional spatial data collected was processed and compared with available online data using a mapping program. Field spatial data was found to be at a relevant scale, accuracy, and intensity for the planning purposes of a forest management plan.

General:

1. The Observations in this report were made under the conditions stated therein. The conclusions presented were solely based upon the services, as outlined within the contract, and do not go beyond the scope of said services.
2. CFI has relied on information available from CT ECO, USGS, USDA, NOAA, and other parties as referenced within the report. CFI has not attempted to independently review or verify the accuracy or completeness of information.
3. CFI has not analyzed data beyond outlining what is present and how forest management can impact the objectives outlined within this plan. There are numerous methods and applications to further assess impact of forest management on sediment transport and loading, infiltration and evapotranspiration relationships, carbon and nitrogen fixing/storage potential, storm/rainfall impacts to flooding and storage, etc. CFI recognizes these are important considerations when identifying watershed and conservation decisions, but these were not included in the scope or budgeted time.
4. It is important to note that this plan is a snapshot of a dynamic forest. It is incorrect to assume that the present conditions of the forest will continue to represent the condition of the forest at some point in the future. If a healthy forested ecosystem is the goal of the Town of Tolland, continued inspection by a forester is warranted.

Additional Services:

1. CFI has the capacity to offer design and/or implementation services of the recommendations in this plan in the future. Connwood Foresters, Inc., if retained, can assist in damage from a natural disaster or a forest wide catastrophe, can reassess forest structures, damages, species composition, and existing or threatening insects or diseases, and can update objectives as resources or priorities change.

APPENDIX B: DEFINITIONS OF FORESTRY TERMS

AGS: Acceptable Growing Stock: Trees desirable for long-term growth/**UGS**: Undesirable Growing Stock

Basal Area: The area in square feet of the cross section of a tree at DBH

Board foot: Wood used for lumber that measures 1"x 12"x 12" (**MBF** = 1000 board feet)

Canopy: Where the leaves and upper branches in a tree are located

CTT: Crop Tree Thinning: Culturing individual trees with the greatest potential to produce specific benefits

DBH: Diameter at Breast Height: diameter of a tree at 4.5' above the ground

Girdling: Creates a cut area around the circumference of the tree that blocks the flow of food

Habitat: The foods, water, cover, and living space wildlife needs for survival

Hardwood: Broad-leaved trees that usually shed their leaves in the fall

Intermittent Stream: A small stream that usually does not flow all year

Mast: Tree seeds that supply valuable wildlife nutrition; Hard: acorns, nuts; Soft: berries

Overstory: Upper canopy of treetops

Pole or Pole timber: Trees having a DBH of 6 to 12 inches

Regeneration: New young trees

Sapling: Trees having a DBH of 1 to 6 inches

Sawtimber or Sawlog: Trees having a DBH greater than 12 inches

Seedling: Trees having a DBH less than 1 inch

Silviculture: The art, science, and practice of producing and tending a forest

Snag: A dead standing tree

Stand: Separate and distinct natural community

Understory: Vegetation layer below the upper canopy of treetops

TSI: Precommercial thinning where trees that have little or no value are killed or removed

STOCKING TABLE

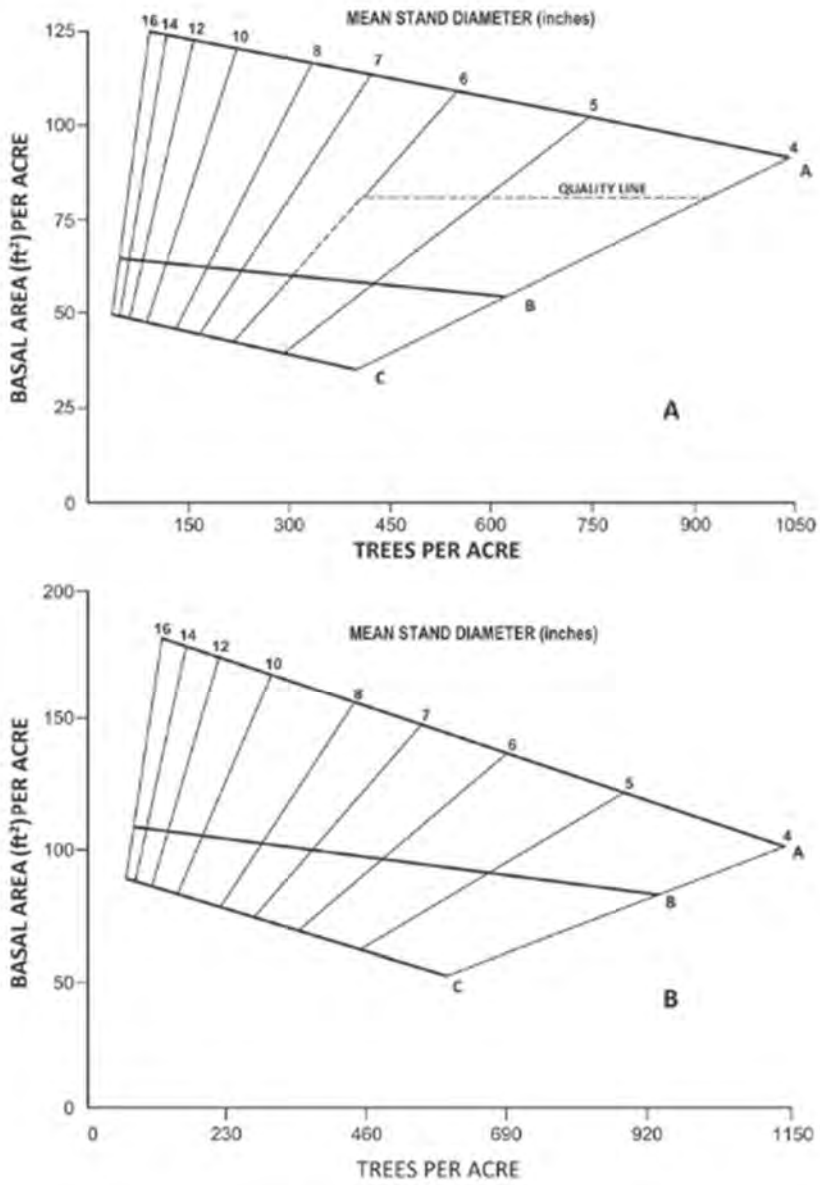


Figure 2.—Northern hardwood (A) and mixed-wood (B) stocking guides.

Source: Leak et al, 2014. USDA Publication: Silvicultural Guide to Northern Hardwoods in New England (p8 f-2.)

The diagram illustrates the relationship between basal area per acre, density (trees per acres), and the diameter of the tree of average basal area: • The A-line is based on a fully stocked stand that has never been thinned. Trees in stands above 100% are considered crowded, too slow growing for normal forest management, and overstocked. • The B-line is the point of full site occupancy with trees of maximum tree area. A stand on the B-line is thought to have trees with no competition, yet no space wasted. The area between the A-line and the B-line indicates the range of stocking where trees can fully utilize the site and should be considered fully stocked. The C-line is an estimate based on normal yield table of the lowest stocking that will grow to the B-line within ten years. This area of the chart is considered understocked.

Access Control (472)
Forest Boundary Marking

Implementation Requirements *Lifespan – 10 Years*

Producer:				Contract #:	
Location					
Farm #:		Tract #:		Forest Stand(s):	
Planner:				Date:	

DEFINITION
The temporary or permanent exclusion of animals, people, vehicles and equipment from an area. These specific Implementation Requirements have been developed for implementation of forest boundary marking.

PURPOSE
To achieve and maintain desired resource conditions by monitoring and managing the intensity of use by animals, people, vehicles, and equipment in coordination with the application schedule of practices, measures, and activities specified in the conservation plan.

CRITERIA
The Criteria, Considerations, and Specifications for this practice shall be in concurrence with the CT Field Office Technical Guide and the CT Conservation Practice Standard for this practice. ***See Standard for all required Criteria.***

PRACTICE REQUIREMENTS
This practice is intended to identify and delineate the boundary line of the landowner to minimize trespass that may adversely affect the resources on the subject property. Identification and delineation of the forest ownership boundary also minimizes the risk of trespass of the landowner, or his/her agents on abutting properties during the implementation of conservation practices.

Forest boundary lines will be marked with both paint blazes using boundary marking paint as well as signs along all interior boundary lines. Boundary lines along roads or railroads need only be marked with signs.

Paint blazes will be hand-sized blazes painted on the bole of trees on or within close proximity to the boundary. Trees on either side of the boundary line will be blazed, with paint blazes facing toward the boundary line.

Trees located on the line will receive a paint blaze on both sides of the tree. Trees located on the abutting property are to receive paint blazes only, no bark blazing or scribing on an abutters trees is permissible, and only trees that are within 5 feet of the property line are to be blazed on the abutting property.

Trees located on the landowner's property may receive bark blazing or scribing before receiving a paint blaze if preferred by the forester or landowner. Blaze trees on the landowner's property within 15 feet of the boundary line, although blazing trees as close to the line as possible is preferred.

Blazes must be located a minimum of 4.5 feet from the ground surface. Blazes around 6 feet from the ground surface tend to be more visible and are preferred.

Trees located on a property corner should receive a complete single ring of paint, located a minimum of 4.5 feet from the ground surface.

Yellow or white boundary marking paint is to be used. For durability, paint blazes are to be brushed on, spray paint is not permissible. Blue, orange or red paint is **NOT** permissible, as they are often used in marking cut or save trees in silvicultural operations.

The spacing of blazes will be a function of the site conditions and need to be spaced so that the blazes are reasonably visible from one to another as an individual approaches the boundary line, either from the subject property or an abutting property. The standard spacing between blazes is 50 feet. Exceptions to this occur when there is a section of boundary line that has no trees suitable for blazing near the boundary line, such as an open or shrubby wetland area. Conversely, areas of extremely thick understory like mountain laurel, may require a shorter distance between blazes.

Boundary signs are to be located along each boundary line and at each point of entry to the forested property such as roads or trails that enter the subject property. The spacing of boundary signs will be a function of the site conditions and need to be spaced so that the signs can reasonably be visible as the boundary line is approached from an abutting property.

Maximum boundary sign spacing is presented in the table below:

Minimum Sign Dimensions	Distance from Property Corner	Interior Boundary Line Spacing	Road Frontage Boundary Line Spacing
11" x 11"	50 ft	100 ft	200 ft
3.5" x 3.5"	25 ft	50 ft	100 ft

Boundary signs are to be made of durable materials (i.e. plastic or aluminum) such as the standard boundary or posted signs commercially available. The use of Tyvek signs or the use of thin plastic signs is **NOT** permissible. If using plastic boundary signs, a minimum thickness of 0.023 gauge is required and the signs must be a durable ridged plastic such as polyethylene with UV stabilizers.

Signs will be fixed to a live tree or a post with fasteners suitable to adequately anchor the sign. A minimum of two fasteners is required for each sign. Signs fixed to trees shall be installed so that the head of the nail is not tight against the sign and allows the tree to grow and push the sign out towards the head of the nail. Consider, thickness of bark on targeted trees when selecting the length of nail for attaching signs. Nails should be embedded a minimum of 1" into solid wood, while the head of the nail should protrude 1" away from the bark surface. The use of aluminum nails is recommended as they last longer and protect chainsaw operators.

If "Posted, No Trespassing" signs are to be used as boundary signs, the name and address of the landowner needs to be included on the sign. This is a necessary requirement under U.S. common law, so that the landowner can be contacted to request access to the property.

All signs are to be located on trees or posts on the boundary or proximal to the boundary of the landowner who is implementing the conservation practice. No signs should be installed on trees or posts that are on an abutting property.

Consideration regarding the placement of paint blazes and boundary signs should be given to abutting property owners who have a residence close to the property boundary. Variations such as only blazing one side of the tree if proximal to a residence or varying the spacing of blazes or signs in the immediate vicinity of the abutting residence are permissible. Locating blazes at ground level is also permissible when proximal to a residence.

Connecticut General Statues (CGS) are not specific regarding separation distances between signs for boundary marking. CGS 53a-109 and 53a-110a speak to criminal trespass, and simple trespass respectively. CGS 53a-109 states "A person is guilty of criminal trespass in the third degree when, knowing that such person is not licensed or privileged to do so: (1) Such person enters or remains in premises which are posted in a manner prescribed by law or reasonably likely to come to the attention of intruders or are fenced or otherwise enclosed in a manner designed to exclude intruders….."

Connecticut General Statues further protects landowners from timber trespass in Sec. 52-560, which states "Any person who cuts, destroys or carries away any trees, timber or shrubbery, standing or lying on the land of another or on public land, except as land subject to the provisions of section 52-560a, without license of the owner, and any person who aids therein, shall pay to the party injured five times the reasonable value of any tree intended for sale or use as a Christmas tree and three times the reasonable value of any other tree, timber or shrubbery; but, when the court is satisfied that the defendant was guilty throughout mistake and believed that the tree, timber or shrubbery was growing on his land, or the land of the person for whom he cut the tree, timber, or shrubbery, it shall render judgment for no more than its reasonable value."

The Connecticut General Statue 52-560a speaks to the damages associated with encroachment on state, municipal or nonprofit land conservation organization open space land, and allows the courts to order additional damages associated with any encroachment and states "…the court may award damages of up to five times the cost of restoration or statutory damages of up to five thousand dollars."

The intention of this conservation practice standard is **NOT** to provide legal protection to the landowner, and the landowner should seek advice from a land use attorney. NRCS does not make any claim to the accuracy or applicability of the above sited statutes and/or legal references. They are provided purely for informational purposes.

All work shall be in compliance with NRCS program policy and rules, and local and state laws. This includes but is not limited to the Connecticut Forest Practices Act and state and local wetlands regulations.

All necessary federal, state and municipal permits, approvals or waivers must be obtained before work commences and are the responsibility of the landowner.

This practice may be associated with other conservation practices to ensure full functionality and that resource concerns are addressed. See Conservation Plan for additional practices. Additional practices may include CPS-655 Forest Trails and Landings which may include Temporary Stream Crossings, CPS-314 Brush Management, CPS-560 Access Road, and CPS-666 Forest Stand Improvement.

Implementation Requirement Sheet
472 Access Control – Forest Boundary Marking

GENERAL INFORMATION

Forest Management Plan By:			Date:
FMP Addendum By (if applicable):			Date:
Total Property Acres:		Total Forested Acres:	
Stand #s:			

FOREST BOUNDARY MARKING

Forest Stand(s):				
	Total Distance (ft)	Paint Blazes Required	Signs Required	Estimated minimum # of signs based on Max separation distance*
Interior Boundary Line		☐ Yes ☐ No	☐ Yes ☐ No	
Road Frontage Boundary Line		☐ Yes ☐ No	☐ Yes ☐ No	

*Maximum boundary sign spacing is presented in the table below:

Minimum Sign Dimensions	Distance from Property Corner	Interior Boundary Line Spacing	Road Frontage Boundary Line Spacing
11” x 11”	50 ft	100 ft	200 ft
3.5” x 3.5”	25 ft	50 ft	100 ft

Additional Information or Operation and Maintenance Requirements (O&M):

REQUIRED:

Landowner understands practice requirement per Practice Standard and Implementation Requirements Sheet.

Landowner Signature: _____ Date: _____

NRCS Planner has necessary Job Approval Authority and has consulted with NRCS forestry staff in the planning and development of this Implementation Requirements Sheet.

NRCS Planner:_____ Date:_____

RECORD OF COMPLETION AND CHECK OUT CERTIFICATION

472 Access Control – Forest Boundary Marking

Producer:				Contract #:	
Location					
Farm #:		Tract #:		Stand #:	

Attachments:

- ☐ Map attached with actual installed extent and practice components delineated and labeled.
- ☐ Photos of completed practice.

Requirements:

-Boundary Marking

- ☐ Boundary signs posted along all boundary lines
- ☐ Boundary signs have landowner name & address (if posted, no trespassing signs used)
- ☐ Paint blazes along all interior boundary lines

Total Boundary Length		Boundary Sign Size	
Paint Blaze Color		Boundary Sign Material	
		Boundary Sign Color	

-

NRCS Inspector:	Final Inspection Date:	Stand #:	Installed Practice Extent:
Additional Information or Operation and Maintenance Requirements (O&M)			

Practice Certification Statement:		
I have inspected the implementation of this practice, have appropriate Job Approval Authority, and certify that it has been implemented according to the practice standard and the specifications in this implementation requirements document.		
Certified by:	**Title:**	**Date**

NRCS Natural Resources Conservation Service

Creating Brush Piles for Upland Wildlife

New Hampshire Conservation Practice Job Sheet 645

Definition

A brush pile is built from excess forest slash or blow down to enhance or supplement wildlife cover.

Program Notes:

Limit of 4 piles per landowner 15 feet round by 6 feet high.

Purpose

- Provide supplemental dense cover for wildlife such as: Cottontail Rabbits, Bobwhite Quail, Pheasants, Turkeys, Thrashers, Skunks, Raccoons, Mockingbirds, and Sparrows.

- Provide a variety of cover needs for wildlife, including nesting in dense cover, escape from avian predators such as hawks and owls, and mammalian predators such as raccoons and coyotes; perching on brush pile tops; and thermal cover created by shading; and protection from wind and precipitation.

Where used

For edge habitats, such as along field borders, fence rows, or riparian areas, one brush pile every 200 - 300 feet will provide adequate cover and travel lanes between food sources for most species.

- In abandoned fields, on edges of working crop fields, harvested or thinned forests, and other early successional habitat where shrub recovery is expected, create 2 piles per acre.
- Along woods roads and used to deter ATV use from wetland sections of road.
- Avoid the bottoms of drainage ways and low spots where standing water or flooding will reduce the usefulness of brush pile for upland wildlife species.

PLANNING CONSIDERATIONS

- Conduct a habitat assessment to determine if cover is a limiting factor for the targeted species. If natural ground cover is insufficient, brush piles may be appropriate as a short-term solution.
- If state or federally listed species are in the landscape consider potential risks of adding brush piles as they may benefit predators such as Foxes, Coyotes, Owls and Hawks.
- Brush piles should be a by-product of storm events or other land treatments, such as, forest stand improvement, brush management, or agricultural land clearing, rather than a specific practice.
- Consider planning additional practices, such as, Tree & Shrub Establishment (612), Early Successional Habitat Development (647), and Riparian Forest Buffer (391) to accompany brush pile establishment to provide more valuable cover and food resources in the long-term.
- Brush piles are usually most effective when located in habitat edges, such as, along forest roads and edges, agricultural field borders and corners, and along riparian areas.
- Brush piles situated in close proximity to other habitat elements required by the targeted species will be more beneficial.
- Several strategically placed medium-size piles (roughly 15’ in diameter and 6’ high) are better than one large one. Isolated piles are not as beneficial, nor as likely to be used.
- Avoid placing brush piles in grasslands since the addition of vertical structure in these settings can be detrimental to many native grassland birds.
- Keep brush piles away from houses and lawns to avoid problems with nuisance wildlife.
- Brush piles are flammable. Keep them away from buildings.
- Do not use materials that contain toxic substances (i.e. pressure treated lumber/posts, creosote railroad ties, lead painted surfaces, tires, etc.). These substances can cause wildlife mortality either through contact, consumption, or inhalation.

Operation and maintenance

This practice component will be inspected periodically and restored as needed to maintain the stated purpose. Additional operation and maintenance requirements will be developed on a site-specific basis to assure performance of the component as intended over time.

Specifications

Location

Brush piles should be constructed along edges of other cover types such as brush or

woodland. It is helpful if they are located near cultivated land or grassland since wildlife will need food and nesting cover close by. Spacing the brush piles at intervals of 100 to 200 feet will provide adequate cover as well as travel lanes.

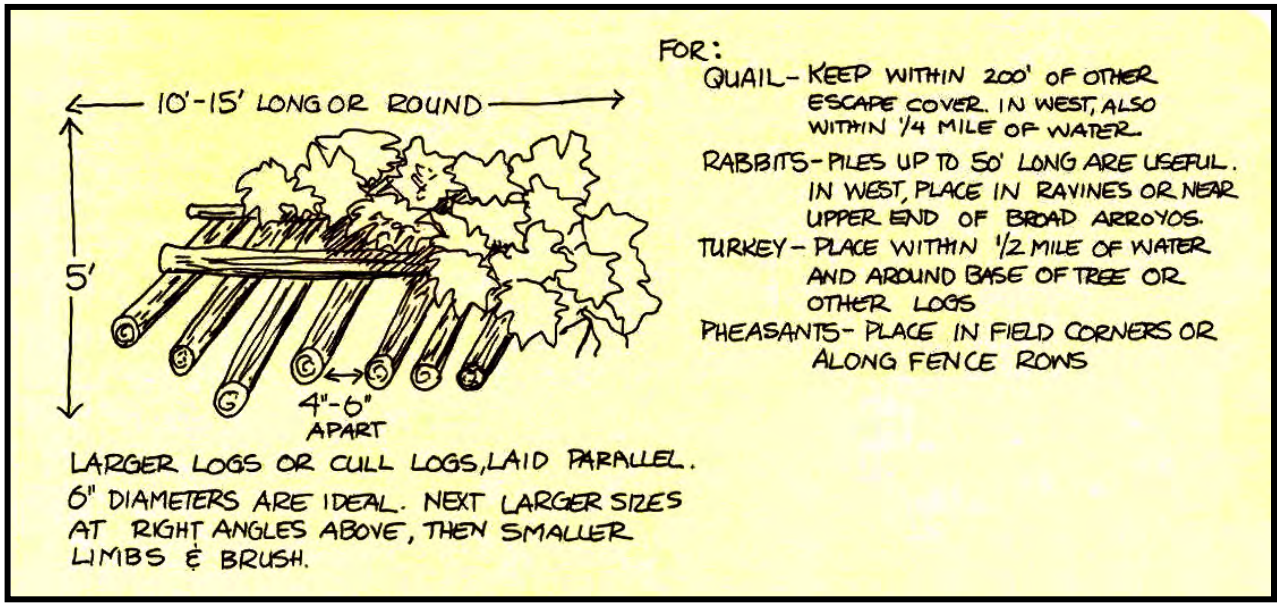
Construction

Properly constructed brush piles are more than just an armful of limbs in a pile. They will serve more wildlife, for a longer period of time, if they are carefully planned and constructed. The pile must be dense enough to constrain predators and provide shelter during bad weather and be loose enough around the edges to provide easy access.

The first step in brush pile construction is to build a base. Start with logs preferably, that are six to ten inches in diameter and six to eight feet long. Place four to ten poles on the ground parallel to each other, eight to twelve inches apart. Place more poles of the same size perpendicularly across the top of the first set of poles. Other materials can be used for the base such as large rocks or stumps or combinations of each. The large materials will serve to keep "tunnels" open under the pile after the brush is stacked on top.

After the base is constructed, pile limbs and brush on top until the brush pile is five feet high. Start with larger limbs first and gradually add smaller sized limbs. Make the pile denser in the middle and looser near the edge. It may be necessary to add more limbs in years to come as the pile decomposes and settles. Planting vines and shrubs near the edge will add years to the life of the brush pile.

Site-specific requirements are listed on the specifications sheet. Additional provisions are entered on the job sketch sheet. Specifications are prepared in accordance with the NRCS Field Office Technical Guide. See practice standard Upland Wildlife Habitat Management, Code 645.



Creating Brush piles for Upland Wildlife – Job Sheet

Landowner_____ Field number_____

Purpose (check all that apply)	
☐ Provide escape cover from mammalian predators such as raccoons and coyotes.	☐ Create thermal cover by creating shade.
☐ Provide escape cover from avian predators such as hawks and owls.	☐ Provide elevated resting sites.
☐ Provide a dense area of cover for wildlife.	☐ Provide wildlife cover for nesting and/or brood rearing.
☐ Create cover from precipitation	☐ Create cover from winds by creating a wind barrier

Layout		
Height (feet)	**Width (feet)**	**Length (feet)**
	Log Diameter (average)	**Log Diameter (average)**
	Log Length (average)	**Log Length (average)**
	Number of logs Used	**Number of logs Used**
Notes list any other materials used such as rocks or stumps.	Notes:	Notes :
Distance to nearest water source (ft):		
Distance to nearest brushpile or other source of cover (ft)		
Type of nearest cover		
☐ Check this box if tile is to be used to create burrows under the brushpile.		

Woody Plant Materials Information (If planted near brush pile to enhance use by wildlife)				
Species/cultivars:	Plants/acre:	Kind of stock[1]:	Planting dates:	Avg. Spacing[2]:
1				
2				
3				
4				

[1]BAreroot, COntainer, CUtting, Seed; include size, caliper, height, and age as applicable. [2]Spacing between plants to achieve plants/acre.

Temporary Storage Instructions (Refer to Practice Standard 612 Tree & Shrub Planting)

Planting stock that is dormant may be stored temporarily in a cooler or protected area. For stock that is expected to begin growth before planting, dig a V-shaped trench (heeling-in-bed) sufficiently deep and bury seedlings so that all roots are covered by soil. Pack the soil firmly and water thoroughly. Additional requirements:

Site Preparation (Refer to Practice Standard 612 Tree & Shrub Planting)

Remove debris and control competing vegetation to allow enough spots or sites for planting and planting equipment. Additional requirements:

Planting Methods (Refer to Practice Standard 612 Tree & Shrub Planting)

For container and bareroot stock, plant stock to a depth even with the root collar in holes deep and wide enough to fully extend the roots. Pack the soil firmly around each plant. Cuttings are inserted in moist soil with at least 2 to 3 buds showing above ground. Additional requirements:

Operation and Maintenance (Refer also to Practice Standard 612 Tree & Shrub Planting)

The brush pile must be inspected periodically and protected from damage so proper function is maintained. Replace or add material to compensate for decayed wood in the pile. Replace dead or dying tree/shrub stock and continue control of competing vegetation to allow proper establishment when planting is done near the brush pile.. Keep large dead and dying trees for cavity nesting birds and a source of large wood in upland habitats. Additional requirements:

APPENDIX C: FOREST INVENTORY SUMMARY DATA

Report List

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Tables

PS1, Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

There are no tree observations in any of the understory plots. Understory tables, and combined tables can not be generated.

Composition

Overstory only

	All species	black oak (*Quercus velutina*)	northern red oak (*Quercus rubra*)	scarlet oak (*Quercus coccinea*)	sweet birch (*Betula lenta*)	red maple (*Acer rubrum*)	hickory (*Carya*)	white oak (*Quercus alba*)	gray birch (*Betula populifolia*)	sugar maple (*Acer saccharum*)	American chestnut (*Castanea dentata*)
Basal area (sq.ft./ac.)	107.2	22.0	20.8	20.4	13.6	10.0	10.0	5.6	2.0	1.6	1.2
Percent of stand basal area (%)	100.0	20.5	19.4	19.0	12.7	9.3	9.3	5.2	1.9	1.5	1.1
Stems/area (stems/ac.)	202.1	16.1	20.9	14.6	48.9	40.7	26.3	7.9	4.9	8.1	13.8

Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule.

Overstory only

	All species	black oak (*Quercus velutina*)	northern red oak (*Quercus rubra*)	scarlet oak (*Quercus coccinea*)	sweet birch (*Betula lenta*)	red maple (*Acer rubrum*)	hickory (*Carya*)	white oak (*Quercus alba*)	gray birch (*Betula populifolia*)	sugar maple (*Acer saccharum*)	American chestnut (*Castanea dentata*)
Gross sawtimber volume (bd.ft.)	117,367	34,196	30,603	32,431	4,666	1,867	7,498	5,556	0	550	0
Net sawtimber volume (bd.ft.)	117,367	34,196	30,603	32,431	4,666	1,867	7,498	5,556	0	550	0
Gross pulpwood volume (cords)	282	53	54	54	37	31	26	16	9	3	0
Net pulpwood volume (cords)	226	42	43	43	29	24	21	13	7	3	0
Gross total volume (cords)	500	114	111	112	46	34	41	28	9	4	0
Net total volume (cords)	400	91	89	90	37	27	33	22	7	4	0

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Plant Species Composition and Diversity

PS1, Inventory, 2022

This report is from overstory data. Only live observations are included in the analysis. There are twenty five plot clusters in this stand.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the overstory, sorted by importance value.

Occurrence and Abundance

	Density	Rel Density	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
sweet birch	48.9	24.21	64.00	16.00	13.6	12.69	17.63
black oak	16.1	7.95	84.00	21.00	22.0	20.52	16.49
northern red oak	20.9	10.33	64.00	16.00	20.8	19.40	15.24
red maple	40.7	20.12	48.00	12.00	10.0	9.33	13.82
scarlet oak	14.6	7.22	48.00	12.00	20.4	19.03	12.75
hickory	26.3	13.02	32.00	8.00	10.0	9.33	10.12
white oak	7.9	3.91	24.00	6.00	5.6	5.22	5.04
American chestnut	13.8	6.80	12.00	3.00	1.2	1.12	3.64
sugar maple	8.1	4.03	12.00	3.00	1.6	1.49	2.84
gray birch	4.9	2.43	12.00	3.00	2.0	1.87	2.43

Totals	202.14	100.00	400.00	100.00	107.20	100.00	100.00

Description of Table Items:

- **Density** = Mean number of stems per acre, based on stems counted in each plot cluster.
- **Relative (Rel) Density** = Mean relative proportion or abundance of stems per acre by species. The mean number of stems of a particular species divided by total number of stems.
- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean basal area in square feet. The basal area of all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values.

Species Diversity

Measures of diversity are important in management and in environmental monitoring. Diversity relates to the variety and abundance of species in different areas, and most measures of diversity are related to species richness, species evenness (pattern of distribution of species), or heterogeneity. Hence, there are a variety of ways to measure and interpret diversity. The selection of a particular measure of diversity depends on sample size, availability of abundance data, and whether one is interested in species richness, evenness, or both.

Species Observed in the Stand

There were eleven species observed, based on a sample of twenty five clusters with a total of twenty four prism points using a 10 square feet per acre factor prism.

Core Flora

The core flora are those species common to every plot cluster. For this stand, none of the species are found in all plot clusters.

Measures of Similarity (Beta-diversity)

These measures provide an idea of stand-level diversity by indicating how the set of samples vary in terms of the variety and/or abundance of species found among them. With the exception of Whittaker's measure, each sample is compared with all other samples, one at a time, until all possible sample-pairs are computed. The stand level value is the mean of all sample-pairs.

The following table shows each measure with sample mean and range.

Similarity Indexes

Measure	Index	Range
Sørensen's Similarity Coefficient	0.4959	0.5714 - 1.0000
Jaccard's Similarity Coefficient	0.3662	0.4000 - 1.0000
Whittaker's Similarity Coefficient	1.5000	N/A*
Renkonen's (Percent Similarity)	29.0139	27.3676 - 100.0000
Morisita-Horn Similarity Index	0.3576	0.0261 - 1.0000

*Whittaker's measure is computed on multiple samples simultaneously, and therefore no individual sample pair values are computed.

- **Sørensen's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that occur in both samples.
- **Jaccard's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that are unique to each sample.
- **Whittaker's Similarity Coefficient** - Based on presence-absence of species. Low values indicate stronger similarity, and higher values indicate little or no similarity. The fewer species that samples share, the higher the value of Whittaker's measure (higher diversity or conversely, lower similarity).
- **Renkonen's Index (Percent Similarity)** - Based on abundance data, specifically, the relative abundance of species. Values range from 0-100, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.
- **Morisita-Horn Similarity Index** - Based on abundance data and somewhat sensitive to the most highly abundant species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.

Vegetation and Site Quality

Vegetation is often used as an indicator of site quality. Some tree species have relatively narrow requirements and their presence is indicative of a particular site. Many tree species can occur on a wide variety of sites. Their presence offers little indicator value, but their relative abundance and size may be important. Herbaceous species often are more restricted in their requirements, and may be more useful than tree species as plant indicators. Care must be taken to account for factors that are unrelated to site quality, such as plant competition, herbivory, and past events in the history of a stand such as drought, insects, and human disturbance. Also, species may be absent purely by chance. In highly disturbed, well-lighted conditions, interpretation of ground-cover species can be problematic, as they may only indicate high light intensity. Furthermore, the indicator value of species can change regionally with changes in climate and physiography.

Suggested Reading

- *Barnes, B.V., Zak, D.R., Denton, S.R., and Spurr, S.H. 1998. Forest Ecology, ed. 4. John Wiley and Sons, Inc., New York. 774 pp.*
- *Carmean, W. H. 1996. Site-quality evaluation, site-quality maintenance, and site-specific management for forest land in northwest Ontario. Ontario Ministry Nat. Res., Northwest Sci. and Technology Unit, NWST Tech. Report TR-105, Thunder Bay, ON. 121 pp.*
- *Coile, T.S. 1938. Forest classification: classification of forest types with special reference to ground vegetation. J. For. 36:1062-1066.*
- *Daubenmire, R. F. 1976. The use of vegetation in assessing the productivity of forest lands. Bot. Rev. 42:115-143.*
- *Monserud, R.A. 1984. Problems with site index: an opinionated review. p. 167-190 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
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return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Narrative

PS1, Inventory, 2022

Dead observations were ignored when calculating values in this report.

Physiography

There are no roads present on the stand.

Composition

The total basal area of the overstory and understory combined is 107.2 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 95.2 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 12.0 square feet per acre.

Relative Dominance

Species	Basal Area (sq.ft./ac.)	Relative Dominance (%)
black oak	22.0	20.52
northern red oak	20.8	19.40
scarlet oak	20.4	19.03
sweet birch	13.6	12.69
hickory	10.0	9.33
red maple	10.0	9.33
white oak	5.6	5.22
gray birch	2.0	1.87
sugar maple	1.6	1.49
American chestnut	1.2	1.12

This is a small sawtimber stand, with the following diameters:

Average diameters values (in.)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
scarlet oak	15.8	16.6	16.6	16.0	16.0
black oak	15.6	16.5	16.5	15.8	15.8
northern red oak	12.3	16.4	16.6	13.5	15.2
white oak	10.9	12.6	12.6	11.4	11.4
gray birch	8.6	8.8	8.8	8.6	8.6
hickory	7.4	11.8	12.5	8.3	9.9
sweet birch	6.5	9.4	10.3	7.1	9.0
red maple	6.3	8.0	8.5	6.7	7.7
sugar maple	5.5	8.0	9.3	6.0	7.9
American chestnut	4.0	4.0	0.0	4.0	0.0
All species	8.6	13.8	14.3	9.9	11.8

Structure

The stand relative density is 88 of the average maximum stocking expected in undisturbed stands of similar size and species. This density is higher than the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably moderate, while growth rate of the medium and smaller-sized trees is probably fair and mortality due to crowding moderate.

Relative density is a measure of tree crowding that accounts for both the size of the tree and the amount of space typically occupied by a tree of that size and species, so it is an especially useful measure in mixed species stands. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive or some trees will be crowded out and die, making room for more vigorous ones. On most stocking charts, 100% relative density is represented as the A-line. If relative density is at least 60% and below 100%, trees can fully occupy the growing site. Maximum stand growth occurs near 60% (the B-line), and enough trees occupy the site to discourage detrimental effects on growth form. The lower limit of stocking necessary to reach 60% (B-line) stocking in ten years on average sites is centrally represented as the C-line and corresponds roughly to 40% relative density.

Species	Relative density	Q-factor	AGS relative density
northern red oak	18	1.11	3
black oak	17	1.16	3
scarlet oak	16	1.26	3
sweet birch	10	1.30	3
hickory	9	1.24	3
red maple	8	1.41	3
white oak	5	1.08	3
sugar maple	1	1.27	3
gray birch	1	1.53	3
American chestnut	1	0.00	3

If this stand is managed under an even-age silvicultural system, the several species groups will mature more than 30 years apart. The estimated year of maturity is 2044. The effective stand age is about 89 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade tolerant species would make it difficult to apply selection cutting.

The shape of an uneven sized forest can be described with a measure called a q-factor. The q-factor defines the change of tree numbers across diameter classes. Q-factor typically range from 1.1 to 1.9, with the lower numbers typically applying to stands with shade tolerant species. The q-factor for this stand is 1.28. The table above lists the q-factor for each tree species. The q-factor could not be calculated for species displaying a value of zero. One inch size classes were used to compute the q-factor values.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves (78 % of AGS relative density).

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule. Total timber volume on this 16.3 acres stand is approximately 13,941 cubic feet of sawtimber plus 18,050 cubic feet of pulpwood for a total of 31,991 cubic feet. The net boardfoot volume averages 7,200.5 board feet per acre. The net pulpwood volume averages 1,107.4 cubic feet per acre. The net

cubic volume averages 1,962.7 cubic feet per acre. Gross volume estimates are made using the Scrivani-Wiant log rule. Total volumes by species are presented in the following table, sorted by net board foot volume.

Species	Total Net Board-foot Volume (bd.ft.)	% total	Total Net Pulpwood Cubic Volume (cu.ft.)	% total	Total Net Cubic Volume (cu.ft.)	% total
hickory	7,498	6.4	1,646	9.1	2,617	8.2
white oak	5,556	4.7	1,056	5.8	1,785	5.6
sweet birch	4,666	4.0	2,337	12.9	2,940	9.2
black oak	34,196	29.1	3,381	18.7	7,302	22.8
scarlet oak	32,431	27.6	3,473	19.2	7,192	22.5
northern red oak	30,603	26.1	3,441	19.1	7,128	22.3
red maple	1,867	1.6	1,954	10.8	2,193	6.9
sugar maple	550	0.5	216	1.2	288	0.9
gray birch	0	0.0	547	3.0	547	1.7
American chestnut	0	0.0	0	0.0	0	0.0
	117,367		18,050		31,991	

Timber value

Timber value is an estimate of the total dollar value of the wood products currently in the trees. It includes the prices of the trees where they are standing, before they are cut and transported to market, based on the prices the user has entered. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations. These figures include all live trees of acceptable and unacceptable growing stock.

Timber values

Species	Total Board-foot Value ($)	% total	Total Pulpwood Value ($)	% total	Total Timber Value ($)	% total
black oak	67.61	8.1	67.61	19.3	1,093.49	8.4
northern red oak	68.82	72.9	68.82	19.7	9,249.81	71.5
scarlet oak	69.45	3.1	69.45	19.8	458.63	3.5
white oak	21.11	13.2	21.11	6.0	1,688.03	13.0
red maple	39.08	1.1	39.08	11.2	179.09	1.4
hickory	32.93	0.7	32.93	9.4	122.90	0.9
sweet birch	46.74	0.4	46.74	13.4	102.73	0.8
sugar maple	4.33	0.3	4.33	1.2	48.36	0.4
gray birch	0.00	0.0	0.00	0.0	0.00	0.0
American chestnut	0.00	0.0	0.00	0.0	0.00	0.0
	12,592.96		350.07		12,943.04	

Regeneration Assessment

The deer impact as observed in the inventory is high. Establishment of the new stand will be limited by deer.

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Tables

PS3, Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

There are no tree observations in any of the understory plots. Understory tables, and combined tables can not be generated.

Composition

Overstory only

	All species	northern red oak (*Quercus rubra*)	black oak (*Quercus velutina*)	hickory (*Carya*)	sweet birch (*Betula lenta*)	red maple (*Acer rubrum*)	ash (*Fraxinus*)	sugar maple (*Acer saccharum*)
Basal area (sq.ft./ac.)	88.0	22.0	18.0	16.0	14.0	8.0	8.0	2.0
Percent of stand basal area (%)	100.0	25.0	20.5	18.2	15.9	9.1	9.1	2.3
Stems/area (stems/ac.)	108.0	15.0	10.7	14.0	25.5	10.3	9.5	22.9

Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule.

Overstory only

	All species	northern red oak (*Quercus rubra*)	black oak (*Quercus velutina*)	hickory (*Carya*)	sweet birch (*Betula lenta*)	red maple (*Acer rubrum*)	ash (*Fraxinus*)	sugar maple (*Acer saccharum*)
Gross sawtimber volume (bd.ft.)	19,105	5,441	5,098	3,330	1,854	1,500	1,882	0
Net sawtimber volume (bd.ft.)	19,105	5,441	5,098	3,330	1,854	1,500	1,882	0
Gross pulpwood volume (cords)	35	10	6	6	6	4	3	0
Net pulpwood volume (cords)	28	8	5	5	5	3	2	0
Gross total volume (cords)	71	20	15	13	10	7	7	0
Net total volume (cords)	57	16	12	10	8	5	5	0

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Plant Species Composition and Diversity

PS3, Inventory, 2022

This report is from overstory data. Only live observations are included in the analysis. There are five plot clusters in this stand.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the overstory, sorted by importance value.

Occurrence and Abundance

	Density		Frequency		Dominance		

		Rel Density		Rel Frequency		Rel Dominance	Importance Value
sweet birch	25.5	23.61	80.00	26.67	14.0	15.91	22.06
northern red oak	15.0	13.92	40.00	13.33	22.0	25.00	17.42
hickory	14.0	12.93	40.00	13.33	16.0	18.18	14.82
black oak	10.7	9.93	40.00	13.33	18.0	20.45	14.57
red maple	10.3	9.58	60.00	20.00	8.0	9.09	12.89
sugar maple	22.9	21.22	20.00	6.67	2.0	2.27	10.05
ash	9.5	8.81	20.00	6.67	8.0	9.09	8.19
Totals	108.01	100.00	300.00	100.00	88.00	100.00	100.00

Description of Table Items:

- **Density** = Mean number of stems per acre, based on stems counted in each plot cluster.
- **Relative (Rel) Density** = Mean relative proportion or abundance of stems per acre by species. The mean number of stems of a particular species divided by total number of stems.
- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean basal area in square feet. The basal area of all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values.

Species Diversity

Measures of diversity are important in management and in environmental monitoring. Diversity relates to the variety and abundance of species in different areas, and most measures of diversity are related to species richness, species evenness (pattern of distribution of species), or heterogeneity. Hence, there are a variety of ways to measure and interpret diversity. The selection of a particular measure of diversity depends on sample size, availability of abundance data, and whether one is interested in species richness, evenness, or both.

Species Observed in the Stand

There were eight species observed, based on a sample of five clusters with a total of five prism points using a 10 square feet per acre factor prism.

Core Flora

The core flora are those species common to every plot cluster. For this stand, none of the species are found in all plot clusters.

Measures of Similarity (Beta-diversity)

These measures provide an idea of stand-level diversity by indicating how the set of samples vary in terms of the variety and/or abundance of species found among them. With the exception of Whittaker's measure, each sample is compared with all other samples, one at a time, until all possible sample-pairs are computed. The stand level value is the mean of all sample-pairs.

The following table shows each measure with sample mean and range.

Similarity Indexes

Measure	Index	Range
Sørensen's Similarity Coefficient	0.4124	0.2857 - 1.0000
Jaccard's Similarity Coefficient	0.3067	0.1667 - 1.0000
Whittaker's Similarity Coefficient	1.3333	N/A*
Renkonen's (Percent Similarity)	19.7961	10.7041 - 71.3468
Morisita-Horn Similarity Index	0.1937	0.0259 - 0.8456

*Whittaker's measure is computed on multiple samples simultaneously, and therefore no individual sample pair values are computed.

- **Sørensen's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that occur in both samples.
- **Jaccard's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that are unique to each sample.

- **Whittaker's Similarity Coefficient** - Based on presence-absence of species. Low values indicate stronger similarity, and higher values indicate little or no similarity. The fewer species that samples share, the higher the value of Whittaker's measure (higher diversity or conversely, lower similarity).
- **Renkonen's Index (Percent Similarity)** - Based on abundance data, specifically, the relative abundance of species. Values range from 0-100, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.
- **Morisita-Horn Similarity Index** - Based on abundance data and somewhat sensitive to the most highly abundant species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.

Vegetation and Site Quality

Vegetation is often used as an indicator of site quality. Some tree species have relatively narrow requirements and their presence is indicative of a particular site. Many tree species can occur on a wide variety of sites. Their presence offers little indicator value, but their relative abundance and size may be important. Herbaceous species often are more restricted in their requirements, and may be more useful than tree species as plant indicators. Care must be taken to account for factors that are unrelated to site quality, such as plant competition, herbivory, and past events in the history of a stand such as drought, insects, and human disturbance. Also, species may be absent purely by chance. In highly disturbed, well-lighted conditions, interpretation of ground-cover species can be problematic, as they may only indicate high light intensity. Furthermore, the indicator value of species can change regionally with changes in climate and physiography.

Suggested Reading

- *Barnes, B.V., Zak, D.R., Denton, S.R., and Spurr, S.H. 1998. Forest Ecology, ed. 4. John Wiley and Sons, Inc., New York. 774 pp.*
- *Carmean, W. H. 1996. Site-quality evaluation, site-quality maintenance, and site-specific management for forest land in northwest Ontario. Ontario Ministry Nat. Res., Northwest Sci. and Technology Unit, NWST Tech. Report TR-105, Thunder Bay, ON. 121 pp.*
- *Coile, T.S. 1938. Forest classification: classification of forest types with special reference to ground vegetation. J. For. 36:1062-1066.*
- *Daubenmire, R. F. 1976. The use of vegetation in assessing the productivity of forest lands. Bot. Rev. 42:115-143.*
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- *Kotar, J. and Coffman, M. 1984. Habitat-type classification system in Michigan and Wisconsin. p. 100-113 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
- *Kuchler, A.W. 1964. The potential natural vegetation of the conterminous United States. Am Geogr. Soc., Spec. Publ. No. 36. 154 pp.*
- *Rowe, J. S. 1969. Plant community as a landscape feature. In Greenidge, K.N.H., Ed. Essays in Plant Geography and Ecology. Nova Scotia Museum, Halifax.*
- *Spies, T.A., and Barnes, B.V. 1985. Ecological species groups of upland northern hardwood-hemlock forest ecoystems of the Sylvania Recreation Area, Upper Peninsula of Michigan. Can. J. For. Res. 15:961-972.*

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Narrative

PS3, Inventory, 2022

Dead observations were ignored when calculating values in this report.

Physiography

There are no roads present on the stand.

Composition

The total basal area of the overstory and understory combined is 88.0 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 88.0 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 0.0 square feet per acre.

Relative Dominance

Species	Basal Area (sq.ft./ac.)	Relative Dominance (%)
northern red oak	22.0	25.00

black oak	18.0	20.45
hickory	16.0	18.18
sweet birch	14.0	15.91
red maple	8.0	9.09
ash	8.0	9.09
sugar maple	2.0	2.27

This is a small sawtimber stand, with the following diameters:

Average diameters values (in.)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
black oak	17.4	18.0	18.0	17.5	17.5
northern red oak	15.7	18.9	18.9	16.4	16.4
hickory	14.1	15.8	15.8	14.5	14.5
ash	12.2	13.0	13.0	12.4	12.4
red maple	11.1	15.0	15.0	11.9	11.9
sweet birch	9.4	12.0	12.0	10.0	10.0
sugar maple	4.0	4.0	0.0	4.0	0.0
All species	10.9	15.8	16.1	12.2	13.6

Structure

The stand relative density is 67 of the average maximum stocking expected in undisturbed stands of similar size and species. This density is within the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth rate of the medium and smaller-sized trees is probably good and mortality due to crowding low.

Relative density is a measure of tree crowding that accounts for both the size of the tree and the amount of space typically occupied by a tree of that size and species, so it is an especially useful measure in mixed species stands. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive or some trees will be crowded out and die, making room for more vigorous ones. On most stocking charts, 100% relative density is represented as the A-line. If relative density is at least 60% and below 100%, trees can fully occupy the growing site. Maximum stand growth occurs near 60% (the B-line), and enough trees occupy the site to discourage detrimental effects on growth form. The lower limit of stocking necessary to reach 60% (B-line) stocking in ten years on average sites is centrally represented as the C-line and corresponds roughly to 40% relative density.

Species	Relative density	Q-factor	AGS relative density
northern red oak	19	1.13	3
black oak	14	1.12	3
hickory	13	1.11	3
sweet birch	9	1.16	3
ash	5	1.17	3
red maple	5	1.14	3
sugar maple	2	0.00	3

If this stand is managed under an even-age silvicultural system, the several species groups will mature more than 30 years apart. The estimated year of maturity is 2033. The effective stand age is about 97 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade tolerant species would make it difficult to apply selection cutting.

The shape of an uneven sized forest can be described with a measure called a q-factor. The q-factor defines the change of tree numbers across diameter classes. Q-factor typically range from 1.1 to 1.9, with the lower numbers typically applying to stands with shade tolerant species. The q-factor for this stand is 1.16. The table above lists the q-factor for each tree species. The q-factor could not be calculated for species displaying a value of zero. One inch size classes were used to compute the q-factor values.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves (67 % of AGS relative density).

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule. Total timber volume on this 2.6 acres stand is approximately 2,295 cubic feet of sawtimber plus 2,228 cubic feet of pulpwood for a total of 4,523 cubic feet. The net boardfoot volume averages 7,348.2 board feet per acre. The net pulpwood volume averages 857.1 cubic feet per acre. The net cubic volume

averages 1,739.7 cubic feet per acre. Gross volume estimates are made using the Scrivani-Wiant log rule. Total volumes by species are presented in the following table, sorted by net board foot volume.

Species	Total Net Board-foot Volume (bd.ft.)	% total	Total Net Pulpwood Cubic Volume (cu.ft.)	% total	Total Net Cubic Volume (cu.ft.)	% total
ash	1,882	9.9	194	8.7	420	9.3
sweet birch	1,854	9.7	369	16.6	610	13.5
red maple	1,500	7.9	237	10.6	421	9.3
northern red oak	5,441	28.5	621	27.9	1,258	27.8
black oak	5,098	26.7	401	18.0	979	21.6
hickory	3,330	17.4	407	18.3	835	18.5
sugar maple	0	0.0	0	0.0	0	0.0
	19,105		2,228		4,523	

Timber value

Timber value is an estimate of the total dollar value of the wood products currently in the trees. It includes the prices of the trees where they are standing, before they are cut and transported to market, based on the prices the user has entered. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations. These figures include all live trees of acceptable and unacceptable growing stock.

Timber values

Species	Total Board-foot Value ($)	% total	Total Pulpwood Value ($)	% total	Total Timber Value ($)	% total
northern red oak	12.42	82.3	12.42	27.9	1,644.70	81.1
black oak	8.02	7.7	8.02	18.0	160.94	7.9
red maple	4.73	5.7	4.73	10.6	117.26	5.8
hickory	8.14	2.0	8.14	18.3	48.09	2.4
ash	3.88	1.1	3.88	8.7	26.47	1.3
sweet birch	7.38	1.1	7.38	16.6	29.63	1.5
sugar maple	0.00	0.0	0.00	0.0	0.00	0.0
	1,982.53		44.57		2,027.10	

Regeneration Assessment

The deer impact as observed in the inventory is high. Establishment of the new stand will be limited by deer.

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Tables

PS2, Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

There are no tree observations in any of the understory plots. Understory tables, and combined tables can not be generated.

Composition

Overstory only

	All species	hickory (*Carya*)	northern red oak (*Quercus rubra*)	black oak (*Quercus velutina*)	sweet birch (*Betula lenta*)	sugar maple (*Acer saccharum*)	red maple (*Acer rubrum*)	scarlet oak (*Quercus coccinea*)	white oak (*Quercus alba*)
Basal area (sq.ft./ac.)	128.0	30.0	27.0	27.0	20.0	13.0	5.0	5.0	1.0
	100.0	23.4	21.1	21.1	15.6	10.2	3.9	3.9	0.8

Percent of stand basal area (%)									
Stems/area (stems/ac.)	172.6	49.1	22.2	16.8	44.9	24.4	10.7	3.3	1.3

Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule.

Overstory only

	All species	**hickory (*Carya*)**	**northern red oak (*Quercus rubra*)**	**black oak (*Quercus velutina*)**	**sweet birch (*Betula lenta*)**	**sugar maple (*Acer saccharum*)**	**red maple (*Acer rubrum*)**	**scarlet oak (*Quercus coccinea*)**	**white oak (*Quercus alba*)**
Gross sawtimber volume (bd.ft.)	114,171	17,412	33,637	40,937	3,987	8,917	1,014	7,320	948
Net sawtimber volume (bd.ft.)	114,171	17,412	33,637	40,937	3,987	8,917	1,014	7,320	948
Gross pulpwood volume (cords)	323	84	65	51	61	32	17	11	2
Net pulpwood volume (cords)	259	67	52	40	48	26	14	9	2
Gross total volume (cords)	538	119	128	124	69	50	19	24	4
Net total volume (cords)	430	95	102	99	55	40	16	19	4

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Plant Species Composition and Diversity

PS2, Inventory, 2022

This report is from overstory data. Only live observations are included in the analysis. There are one plot clusters in this stand.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the overstory, sorted by importance value.

Occurrence and Abundance

	Density	**Rel Density**	**Frequency**	**Rel Frequency**	**Dominance**	**Rel Dominance**	**Importance Value**
hickory	49.1	28.44	100.00	12.50	30.0	23.44	21.46
sweet birch	44.9	26.00	100.00	12.50	20.0	15.63	18.04
northern red oak	22.2	12.85	100.00	12.50	27.0	21.09	15.48
black oak	16.8	9.75	100.00	12.50	27.0	21.09	14.45
sugar maple	24.4	14.12	100.00	12.50	13.0	10.16	12.26
red maple	10.7	6.18	100.00	12.50	5.0	3.91	7.53

scarlet oak	3.3	1.92	100.00	12.50	5.0	3.91	6.11
white oak	1.3	0.74	100.00	12.50	1.0	0.78	4.67
Totals	172.65	100.00	800.00	100.00	128.00	100.00	100.00

Description of Table Items:

- **Density** = Mean number of stems per acre, based on stems counted in each plot cluster.
- **Relative (Rel) Density** = Mean relative proportion or abundance of stems per acre by species. The mean number of stems of a particular species divided by total number of stems.
- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean basal area in square feet. The basal area of all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values.

Species Diversity

Measures of diversity are important in management and in environmental monitoring. Diversity relates to the variety and abundance of species in different areas, and most measures of diversity are related to species richness, species evenness (pattern of distribution of species), or heterogeneity. Hence, there are a variety of ways to measure and interpret diversity. The selection of a particular measure of diversity depends on sample size, availability of abundance data, and whether one is interested in species richness, evenness, or both.

Species Observed in the Stand

There were nine species observed, based on a sample of one clusters with a total of ten prism points using a 10 square feet per acre factor prism.

Core Flora

The core flora are those species common to every plot cluster. For this stand, none of the species are found in all plot clusters.

Measures of Similarity (Beta-diversity)

These measures provide an idea of stand-level diversity by indicating how the set of samples vary in terms of the variety and/or abundance of species found among them. With the exception of Whittaker's measure, each sample is compared with all other samples, one at a time, until all possible sample-pairs are computed. The stand level value is the mean of all sample-pairs.

The following table shows each measure with sample mean and range.

Similarity Indexes

Measure	Index	Range
Sørensen's Similarity Coefficient	-1.#IND	0.0000 - 0.0000
Jaccard's Similarity Coefficient	-1.#IND	0.0000 - 0.0000
Whittaker's Similarity Coefficient	0.0000	N/A*
Renkonen's (Percent Similarity)	-1.#IND	0.0000 - 0.0000
Morisita-Horn Similarity Index	-1.#IND	0.0000 - 0.0000

*Whittaker's measure is computed on multiple samples simultaneously, and therefore no individual sample pair values are computed.

- **Sørensen's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that occur in both samples.
- **Jaccard's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that are unique to each sample.
- **Whittaker's Similarity Coefficient** - Based on presence-absence of species. Low values indicate stronger similarity, and higher values indicate little or no similarity. The fewer species that samples share, the higher the value of Whittaker's measure (higher diversity or conversely, lower similarity).
- **Renkonen's Index (Percent Similarity)** - Based on abundance data, specifically, the relative abundance of species. Values range from 0-100, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.
- **Morisita-Horn Similarity Index** - Based on abundance data and somewhat sensitive to the most highly abundant species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.

Vegetation and Site Quality

Vegetation is often used as an indicator of site quality. Some tree species have relatively narrow requirements and their presence is indicative of a particular site. Many tree species can occur on a wide variety of sites. Their presence offers little indicator value, but their relative abundance and size may be important. Herbaceous species often are more restricted in their requirements, and may be more useful than tree species as plant indicators. Care must be taken to account for factors that are unrelated to site quality, such as plant competition, herbivory, and past events in the history of a stand such as drought, insects, and human disturbance. Also, species may be absent purely by chance. In highly disturbed, well-lighted conditions, interpretation of ground-cover species can be problematic, as they may only indicate high light intensity. Furthermore, the indicator value of species can change regionally with changes in climate and physiography.

Suggested Reading

- *Barnes, B.V., Zak, D.R., Denton, S.R., and Spurr, S.H. 1998. Forest Ecology, ed. 4. John Wiley and Sons, Inc., New York. 774 pp.*
- *Carmean, W. H. 1996. Site-quality evaluation, site-quality maintenance, and site-specific management for forest land in northwest Ontario. Ontario Ministry Nat. Res., Northwest Sci. and Technology Unit, NWST Tech. Report TR-105, Thunder Bay, ON. 121 pp.*
- *Coile, T.S. 1938. Forest classification: classification of forest types with special reference to ground vegetation. J. For. 36:1062-1066.*
- *Daubenmire, R. F. 1976. The use of vegetation in assessing the productivity of forest lands. Bot. Rev. 42:115-143.*
- *Monserud, R.A. 1984. Problems with site index: an opinionated review. p. 167-190 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
- *Kotar, J. and Coffman, M. 1984. Habitat-type classification system in Michigan and Wisconsin. p. 100-113 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
- *Kuchler, A.W. 1964. The potential natural vegetation of the conterminous United States. Am Geogr. Soc., Spec. Publ. No. 36. 154 pp.*
- *Rowe, J. S. 1969. Plant community as a landscape feature. In Greenidge, K.N.H., Ed. Essays in Plant Geography and Ecology. Nova Scotia Museum, Halifax.*
- *Spies, T.A., and Barnes, B.V. 1985. Ecological species groups of upland northern hardwood-hemlock forest ecoystems of the Sylvania Recreation Area, Upper Peninsula of Michigan. Can. J. For. Res. 15:961-972.*

return to top

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File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Narrative

PS2, Inventory, 2022

Dead observations were ignored when calculating values in this report.

Physiography

There are no roads present on the stand.

Composition

The total basal area of the overstory and understory combined is 128.0 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 128.0 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 0.0 square feet per acre.

Relative Dominance

Species	Basal Area (sq.ft./ac.)	Relative Dominance (%)
hickory	30.0	23.44
black oak	27.0	21.09
northern red oak	27.0	21.09
sweet birch	20.0	15.63
sugar maple	13.0	10.16
scarlet oak	5.0	3.91
red maple	5.0	3.91
white oak	1.0	0.78

This is a small sawtimber stand, with the following diameters:

Average diameters values (in.)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
black oak	17.1	17.3	17.3	17.2	17.2
scarlet oak	16.6	16.8	16.8	16.6	16.6
northern red oak	14.2	17.0	17.0	14.9	14.9
white oak	12.0	12.0	12.0	12.0	12.0
hickory	10.1	12.1	12.1	10.6	10.6
sugar maple	9.2	12.2	12.2	9.9	9.9
red maple	9.2	9.6	9.6	9.3	9.3
sweet birch	8.8	9.8	9.8	9.0	9.0
All species	10.9	14.0	14.0	11.7	11.7

Structure

The stand relative density is 103 of the average maximum stocking expected in undisturbed stands of similar size and species. This density is well above the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably moderate, while growth rate of the medium and smaller-sized trees is probably poor and mortality due to crowding high.

Relative density is a measure of tree crowding that accounts for both the size of the tree and the amount of space typically occupied by a tree of that size and species, so it is an especially useful measure in mixed species stands. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive or some trees will be crowded out and die, making room for more vigorous ones. On most stocking charts, 100% relative density is represented as the A-line. If relative density is at least 60% and below 100%, trees can fully occupy the growing site. Maximum stand growth occurs near 60% (the B-line), and enough trees occupy the site to discourage detrimental effects on growth form. The lower limit of stocking necessary to reach 60% (B-line) stocking in ten years on average sites is centrally represented as the C-line and corresponds roughly to 40% relative density.

Species	Relative density	Q-factor	AGS relative density
hickory	26	1.14	3
northern red oak	24	1.13	3
black oak	21	1.78	3
sweet birch	14	1.32	3
sugar maple	11	1.23	3
scarlet oak	4	1.58	3
red maple	3	1.46	3
white oak	1	0.00	3

If this stand is managed under an even-age silvicultural system, the several species groups will mature more than 30 years apart. The estimated year of maturity is 2046. The effective stand age is about 87 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade tolerant species would make it difficult to apply selection cutting.

The shape of an uneven sized forest can be described with a measure called a q-factor. The q-factor defines the change of tree numbers across diameter classes. Q-factor typically range from 1.1 to 1.9, with the lower numbers typically applying to stands with shade tolerant species. The q-factor for this stand is 1.27. The table above lists the q-factor for each tree species. The q-factor could not be calculated for species displaying a value of zero. One inch size classes were used to compute the q-factor values.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves (103 % of AGS relative density).

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule. Total timber volume on this 14.2 acres stand is approximately 13,710 cubic feet of sawtimber plus 20,695 cubic feet of pulpwood for a total of 34,404 cubic feet. The net boardfoot volume averages 8,040.2 board feet per acre. The net pulpwood volume averages 1,457.4 cubic feet per acre. The net cubic volume averages 2,422.8 cubic feet per acre. Gross volume estimates are made using the Scrivani-Wiant log rule. Total volumes by species are presented in the following table, sorted by net board foot volume.

Species	Total Net Board-foot Volume (bd.ft.)	% total	Total Net Pulpwood Cubic Volume (cu.ft.)	% total	Total Net Cubic Volume (cu.ft.)	% total
sugar maple	8,917	7.8	2,073	10.0	3,203	9.3

scarlet oak	7,320	6.4	701	3.4	1,543	4.5
black oak	40,937	35.9	3,236	15.6	7,918	23.0
sweet birch	3,987	3.5	3,880	18.7	4,396	12.8
northern red oak	33,637	29.5	4,191	20.2	8,199	23.8
hickory	17,412	15.3	5,346	25.8	7,620	22.1
red maple	1,014	0.9	1,114	5.4	1,245	3.6
white oak	948	0.8	155	0.7	281	0.8
	114,171		20,695		34,404	

Timber value

Timber value is an estimate of the total dollar value of the wood products currently in the trees. It includes the prices of the trees where they are standing, before they are cut and transported to market, based on the prices the user has entered. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations. These figures include all live trees of acceptable and unacceptable growing stock.

Timber values

Species	Total Board-foot Value ($)	% total	Total Pulpwood Value ($)	% total	Total Timber Value ($)	% total
black oak	64.72	9.6	64.72	15.6	1,292.83	9.8
northern red oak	83.81	79.2	83.81	20.2	10,174.89	77.4
sugar maple	41.45	5.6	41.45	10.0	754.79	5.7
white oak	3.10	2.2	3.10	0.7	287.37	2.2
hickory	106.91	1.6	106.91	25.8	315.86	2.4
scarlet oak	14.03	0.7	14.03	3.4	101.87	0.8
red maple	22.28	0.6	22.28	5.4	98.34	0.7
sweet birch	77.59	0.4	77.59	18.7	125.44	1.0
	12,737.49		413.89		13,151.38	

Regeneration Assessment

The deer impact as observed in the inventory is high. Establishment of the new stand will be limited by deer.

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Tables

PS5, Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

There are no tree observations in any of the understory plots. Understory tables, and combined tables can not be generated.

Composition

Overstory only

	All species	ash (*Fraxinus*)	red maple (*Acer rubrum*)	sugar maple (*Acer saccharum*)	sweet birch (*Betula lenta*)	eastern white pine (*Pinus strobus*)	blackgum (*Nyssa sylvatica*)	yellow birch (*Betula alleghaniensis*)
Basal area (sq.ft./ac.)	70.0	38.3	18.3	3.3	3.3	3.3	1.7	1.7
Percent of stand basal area (%)	100.0	54.8	26.2	4.8	4.8	4.8	2.4	2.4
Stems/area (stems/ac.)	206.5	51.8	104.9	27.6	13.3	1.1	4.8	3.1

Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule.

Overstory only

	All species	ash (*Fraxinus*)	red maple (*Acer rubrum*)	sugar maple (*Acer saccharum*)	sweet birch (*Betula lenta*)	eastern white pine (*Pinus strobus*)	blackgum (*Nyssa sylvatica*)	yellow birch (*Betula alleghaniensis*)
Gross sawtimber volume (bd.ft.)	28,748	25,297	0	0	0	3,451	0	0
Net sawtimber volume (bd.ft.)	28,748	25,297	0	0	0	3,451	0	0
Gross pulpwood volume (cords)	75	40	21	2	4	2	3	3
Net pulpwood volume (cords)	60	32	17	1	3	2	2	2
Gross total volume (cords)	125	84	21	2	4	8	3	3
Net total volume (cords)	100	67	17	1	3	7	2	2

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Plant Species Composition and Diversity

PS5, Inventory, 2022

This report is from overstory data. Only live observations are included in the analysis. There are one plot clusters in this stand.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the overstory, sorted by importance value.

Occurrence and Abundance

	Density	Rel Density	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
ash	51.8	25.08	100.00	14.29	38.3	54.76	31.38
red maple	104.9	50.83	100.00	14.29	18.3	26.19	30.43
sugar maple	27.6	13.36	100.00	14.29	3.3	4.76	10.80
sweet birch	13.3	6.42	100.00	14.29	3.3	4.76	8.49
eastern white pine	1.1	0.51	100.00	14.29	3.3	4.76	6.52
blackgum	4.8	2.31	100.00	14.29	1.7	2.38	6.33
yellow birch	3.1	1.48	100.00	14.29	1.7	2.38	6.05
Totals	206.46	100.00	700.00	100.00	70.00	100.00	100.00

Description of Table Items:

- **Density** = Mean number of stems per acre, based on stems counted in each plot cluster.
- **Relative (Rel) Density** = Mean relative proportion or abundance of stems per acre by species. The mean number of stems of a particular species divided by total number of stems.
- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean basal area in square feet. The basal area of all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values.

Species Diversity

Measures of diversity are important in management and in environmental monitoring. Diversity relates to the variety and abundance of species in different areas, and most measures of diversity are related to species richness, species evenness (pattern of distribution of species), or heterogeneity. Hence, there are a variety of ways to measure and interpret diversity. The selection of a particular measure of diversity depends on sample size, availability of abundance data, and whether one is interested in species richness, evenness, or both.

Species Observed in the Stand

There were eight species observed, based on a sample of one clusters with a total of six prism points using a 10 square feet per acre factor prism.

Core Flora

The core flora are those species common to every plot cluster. For this stand, none of the species are found in all plot clusters.

Measures of Similarity (Beta-diversity)

These measures provide an idea of stand-level diversity by indicating how the set of samples vary in terms of the variety and/or abundance of species found among them. With the exception of Whittaker's measure, each sample is compared with all other samples, one at a time, until all possible sample-pairs are computed. The stand level value is the mean of all sample-pairs.

The following table shows each measure with sample mean and range.

Similarity Indexes

Measure	Index	Range
Sørensen's Similarity Coefficient	-1.#IND	0.0000 - 0.0000
Jaccard's Similarity Coefficient	-1.#IND	0.0000 - 0.0000
Whittaker's Similarity Coefficient	0.0000	N/A*
Renkonen's (Percent Similarity)	-1.#IND	0.0000 - 0.0000
Morisita-Horn Similarity Index	-1.#IND	0.0000 - 0.0000

*Whittaker's measure is computed on multiple samples simultaneously, and therefore no individual sample pair values are computed.

- **Sørensen's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that occur in both samples.
- **Jaccard's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that are unique to each sample.
- **Whittaker's Similarity Coefficient** - Based on presence-absence of species. Low values indicate stronger similarity, and higher values indicate little or no similarity. The fewer species that samples share, the higher the value of Whittaker's measure (higher diversity or conversely, lower similarity).
- **Renkonen's Index (Percent Similarity)** - Based on abundance data, specifically, the relative abundance of species. Values range from 0-100, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.
- **Morisita-Horn Similarity Index** - Based on abundance data and somewhat sensitive to the most highly abundant species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.

Vegetation and Site Quality

Vegetation is often used as an indicator of site quality. Some tree species have relatively narrow requirements and their presence is indicative of a particular site. Many tree species can occur on a wide variety of sites. Their presence offers little indicator value, but their relative abundance and size may be important. Herbaceous species often are more restricted in their requirements, and may be more useful than tree species as plant indicators. Care must be taken to account for factors that are unrelated to site quality, such as plant competition,

herbivory, and past events in the history of a stand such as drought, insects, and human disturbance. Also, species may be absent purely by chance. In highly disturbed, well-lighted conditions, interpretation of ground-cover species can be problematic, as they may only indicate high light intensity. Furthermore, the indicator value of species can change regionally with changes in climate and physiography.

Suggested Reading

- *Barnes, B.V., Zak, D.R., Denton, S.R., and Spurr, S.H. 1998. Forest Ecology, ed. 4. John Wiley and Sons, Inc., New York. 774 pp.*
- *Carmean, W. H. 1996. Site-quality evaluation, site-quality maintenance, and site-specific management for forest land in northwest Ontario. Ontario Ministry Nat. Res., Northwest Sci. and Technology Unit, NWST Tech. Report TR-105, Thunder Bay, ON. 121 pp.*
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- *Monserud, R.A. 1984. Problems with site index: an opinionated review. p. 167-190 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
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- *Spies, T.A., and Barnes, B.V. 1985. Ecological species groups of upland northern hardwood-hemlock forest ecoystems of the Sylvania Recreation Area, Upper Peninsula of Michigan. Can. J. For. Res. 15:961-972.*

return to top

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File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Narrative

PS5, Inventory, 2022

Dead observations were ignored when calculating values in this report.

Physiography

There are no roads present on the stand.

Composition

The total basal area of the overstory and understory combined is 70.0 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 70.0 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 0.0 square feet per acre.

Relative Dominance

Species	Basal Area (sq.ft./ac.)	Relative Dominance (%)
ash	38.3	54.76
red maple	18.3	26.19
sweet birch	3.3	4.76
sugar maple	3.3	4.76
eastern white pine	3.3	4.76
blackgum	1.7	2.38
yellow birch	1.7	2.38

This is a small sawtimber stand, with the following diameters:

Average diameters values (in.)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
eastern white pine	24.0	24.0	24.0	24.0	24.0
ash	10.7	15.3	15.3	11.6	11.6
yellow birch	10.0	10.0	10.0	10.0	10.0

blackgum	8.0	8.0	8.0	8.0	8.0
sweet birch	6.7	7.0	7.0	6.8	6.8
red maple	5.2	7.3	9.1	5.7	8.7
sugar maple	4.6	5.0	6.0	4.7	6.0
All species	6.8	12.4	13.6	7.9	10.1

Structure

The stand relative density is 48 of the average maximum stocking expected in undisturbed stands of similar size and species. This density is below the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth rate of the medium and smaller-sized trees is probably good and mortality due to crowding low.

Relative density is a measure of tree crowding that accounts for both the size of the tree and the amount of space typically occupied by a tree of that size and species, so it is an especially useful measure in mixed species stands. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive or some trees will be crowded out and die, making room for more vigorous ones. On most stocking charts, 100% relative density is represented as the A-line. If relative density is at least 60% and below 100%, trees can fully occupy the growing site. Maximum stand growth occurs near 60% (the B-line), and enough trees occupy the site to discourage detrimental effects on growth form. The lower limit of stocking necessary to reach 60% (B-line) stocking in ten years on average sites is centrally represented as the C-line and corresponds roughly to 40% relative density.

Species	Relative density	Q-factor	AGS relative density
ash	23	1.25	3
red maple	16	1.31	3
sugar maple	3	1.50	3
sweet birch	3	1.33	3
yellow birch	1	0.00	3
blackgum	1	0.00	3
eastern white pine	1	0.00	3

If this stand is managed under an even-age silvicultural system, the several species groups will mature more than 30 years apart. The estimated year of maturity is 2049. The effective stand age is about 88 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade tolerant species would make it difficult to apply selection cutting.

The shape of an uneven sized forest can be described with a measure called a q-factor. The q-factor defines the change of tree numbers across diameter classes. Q-factor typically range from 1.1 to 1.9, with the lower numbers typically applying to stands with shade tolerant species. The q-factor for this stand is 1.24. The table above lists the q-factor for each tree species. The q-factor could not be calculated for species displaying a value of zero. One inch size classes were used to compute the q-factor values.

Trees of acceptable quality for future growing stock provide enough stocking by themselves to warrant stand management (48 % of AGS relative density).

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule. Total timber volume on this 7.0 acres stand is approximately 3,190 cubic feet of sawtimber plus 4,816 cubic feet of pulpwood for a total of 8,006 cubic feet. The net boardfoot volume averages 4,106.8 board feet per acre. The net pulpwood volume averages 688.0 cubic feet per acre. The net cubic volume averages 1,143.7 cubic feet per acre. Gross volume estimates are made using the Scrivani-Wiant log rule. Total volumes by species are presented in the following table, sorted by net board foot volume.

Species	Total Net Board-foot Volume (bd.ft.)	% total	Total Net Pulpwood Cubic Volume (cu.ft.)	% total	Total Net Cubic Volume (cu.ft.)	% total
ash	25,297	88.0	2,543	52.8	5,349	66.8
eastern white pine	3,451	12.0	159	3.3	543	6.8
sugar maple	0	0.0	112	2.3	112	1.4
red maple	0	0.0	1,368	28.4	1,368	17.1
blackgum	0	0.0	183	3.8	183	2.3
sweet birch	0	0.0	259	5.4	259	3.2
yellow birch	0	0.0	192	4.0	192	2.4
	28,748		4,816		8,006	

Timber value

Timber value is an estimate of the total dollar value of the wood products currently in the trees. It includes the prices of the trees where they are standing, before they are cut and transported to market, based on the prices the user has entered. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations. These figures include all live trees of acceptable and unacceptable growing stock.

Timber values

Species	Total Board-foot Value ($)	% total	Total Pulpwood Value ($)	% total	Total Timber Value ($)	% total
ash	50.86	88.0	50.86	52.8	354.42	80.3
eastern white pine	3.18	12.0	3.18	3.3	44.59	10.1
sugar maple	2.23	0.0	2.23	2.3	2.23	0.5
red maple	27.36	0.0	27.36	28.4	27.36	6.2
blackgum	3.67	0.0	3.67	3.8	3.67	0.8
sweet birch	5.19	0.0	5.19	5.4	5.19	1.2
yellow birch	3.84	0.0	3.84	4.0	3.84	0.9
	344.97		96.32		441.29	

Regeneration Assessment

The deer impact as observed in the inventory is high. Establishment of the new stand will be limited by deer.

return to top

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File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Tables

PS4, Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

There are no tree observations in any of the understory plots. Understory tables, and combined tables can not be generated.

Composition

Overstory only

	All species	black oak (*Quercus velutina*)	sweet birch (*Betula lenta*)	northern red oak (*Quercus rubra*)	white oak (*Quercus alba*)	red maple (*Acer rubrum*)	hickory (*Carya*)	eastern white pine (*Pinus strobus*)	sugar maple (*Acer saccharum*)	ash (*Fraxinus*)	scarlet oak (*Quercus coccinea*)	paper birch (*Betula papyrifera*)	yellow birch (*Betula alleghaniensis*)	eastern hemlock (*Tsuga canadens*
Basal area (sq.ft./ac.)	113.4	30.9	25.0	15.9	11.9	11.3	10.0	2.5	1.9	1.3	1.3	0.9	0.3	
Percent of stand basal area (%)	100.0	27.3	22.0	14.0	10.5	9.9	8.8	2.2	1.7	1.1	1.1	0.8	0.3	
Stems/area (stems/ac.)	173.4	20.1	66.7	9.9	12.9	23.6	25.3	3.6	5.6	1.8	1.2	1.5	0.6	

Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule.

Overstory only

	All species	black oak (*Quercus velutina*)	sweet birch (*Betula lenta*)	northern red oak (*Quercus rubra*)	white oak (*Quercus alba*)	red maple (*Acer rubrum*)	hickory (*Carya*)	eastern white pine (*Pinus strobus*)	sugar maple (*Acer saccharum*)	ash (*Fraxinus*)	scarlet oak (*Quercus coccinea*)	paper birch (*Betula papyrifera*)	yellow birch (*Betula alleghaniensis*)	eastern hemlock (*Tsuga canadens*

Gross sawtimber volume (bd.ft.)	218,452	91,860	14,593	45,256	23,249	14,774	15,419	5,620	1,972	2,363	2,799	547	0
Net sawtimber volume (bd.ft.)	218,452	91,860	14,593	45,256	23,249	14,774	15,419	5,620	1,972	2,363	2,799	547	0
Gross pulpwood volume (cords)	531	121	132	73	61	61	42	10	9	6	7	6	2
Net pulpwood volume (cords)	425	97	106	58	49	49	34	8	7	5	5	5	2
Gross total volume (cords)	940	283	162	156	108	91	73	21	12	11	12	7	2
Net total volume (cords)	752	227	130	125	86	72	58	17	10	9	9	6	2

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Plant Species Composition and Diversity

PS4, Inventory, 2022

This report is from overstory data. Only live observations are included in the analysis. There are thirty two plot clusters in this stand.

Species Occurrence and Abundance

This table combines all height classes (if applicable) into a statistical summary for the overstory, sorted by importance value.

Occurrence and Abundance

	Density	Rel Density	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
sweet birch	66.7	38.47	87.50	19.44	25.0	22.04	26.65
black oak	20.1	11.60	81.25	18.06	30.9	27.27	18.98
red maple	23.6	13.62	62.50	13.89	11.3	9.92	12.48
hickory	25.3	14.59	46.88	10.42	10.0	8.82	11.28
northern red oak	9.9	5.72	56.25	12.50	15.9	14.05	10.76
white oak	12.9	7.42	53.13	11.81	11.9	10.47	9.90
eastern white pine	3.6	2.10	15.63	3.47	2.5	2.20	2.59
sugar maple	5.6	3.24	12.50	2.78	1.9	1.65	2.56
ash	1.8	1.02	9.38	2.08	1.3	1.10	1.40
scarlet oak	1.2	0.67	9.38	2.08	1.3	1.10	1.29
paper birch	1.5	0.89	9.38	2.08	0.9	0.83	1.27
yellow birch	0.6	0.33	3.13	0.69	0.3	0.28	0.43
eastern hemlock	0.6	0.33	3.13	0.69	0.3	0.28	0.43
Totals	173.39	100.00	450.00	100.00	113.44	100.00	100.00

Description of Table Items:

- **Density** = Mean number of stems per acre, based on stems counted in each plot cluster.
- **Relative (Rel) Density** = Mean relative proportion or abundance of stems per acre by species. The mean number of stems of a particular species divided by total number of stems.

- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean basal area in square feet. The basal area of all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values.

Species Diversity

Measures of diversity are important in management and in environmental monitoring. Diversity relates to the variety and abundance of species in different areas, and most measures of diversity are related to species richness, species evenness (pattern of distribution of species), or heterogeneity. Hence, there are a variety of ways to measure and interpret diversity. The selection of a particular measure of diversity depends on sample size, availability of abundance data, and whether one is interested in species richness, evenness, or both.

Species Observed in the Stand

There were fourteen species observed, based on a sample of thirty two clusters with a total of thirty two prism points using a 10 square feet per acre factor prism.

Core Flora

The core flora are those species common to every plot cluster. For this stand, none of the species are found in all plot clusters.

Measures of Similarity (Beta-diversity)

These measures provide an idea of stand-level diversity by indicating how the set of samples vary in terms of the variety and/or abundance of species found among them. With the exception of Whittaker's measure, each sample is compared with all other samples, one at a time, until all possible sample-pairs are computed. The stand level value is the mean of all sample-pairs.

The following table shows each measure with sample mean and range.

Similarity Indexes

Measure	Index	Range
Sørensen's Similarity Coefficient	0.5770	0.2857 - 1.0000
Jaccard's Similarity Coefficient	0.4294	0.1667 - 1.0000
Whittaker's Similarity Coefficient	1.8889	N/A*
Renkonen's (Percent Similarity)	39.0997	15.1601 - 100.0000
Morisita-Horn Similarity Index	0.4644	0.1074 - 1.0000

*Whittaker's measure is computed on multiple samples simultaneously, and therefore no individual sample pair values are computed.

- **Sørensen's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that occur in both samples.
- **Jaccard's Similarity Coefficient** - Based on presence-absence of species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. This measure gives more weight to species that are unique to each sample.
- **Whittaker's Similarity Coefficient** - Based on presence-absence of species. Low values indicate stronger similarity, and higher values indicate little or no similarity. The fewer species that samples share, the higher the value of Whittaker's measure (higher diversity or conversely, lower similarity).
- **Renkonen's Index (Percent Similarity)** - Based on abundance data, specifically, the relative abundance of species. Values range from 0-100, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.
- **Morisita-Horn Similarity Index** - Based on abundance data and somewhat sensitive to the most highly abundant species. Values range from 0-1, where low values indicate little or no similarity, and higher values indicate stronger similarity. The variable 'Basal Area' was used in the calculation.

Vegetation and Site Quality

Vegetation is often used as an indicator of site quality. Some tree species have relatively narrow requirements and their presence is indicative of a particular site. Many tree species can occur on a wide variety of sites. Their presence offers little indicator value, but their relative abundance and size may be important. Herbaceous species often are more restricted in their requirements, and may be more useful than tree species as plant indicators. Care must be taken to account for factors that are unrelated to site quality, such as plant competition, herbivory, and past events in the history of a stand such as drought, insects, and human disturbance. Also, species may be absent purely by chance. In highly disturbed, well-lighted conditions, interpretation of ground-

cover species can be problematic, as they may only indicate high light intensity. Furthermore, the indicator value of species can change regionally with changes in climate and physiography.

Suggested Reading

- *Barnes, B.V., Zak, D.R., Denton, S.R., and Spurr, S.H. 1998. Forest Ecology, ed. 4. John Wiley and Sons, Inc., New York. 774 pp.*
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- *Coile, T.S. 1938. Forest classification: classification of forest types with special reference to ground vegetation. J. For. 36:1062-1066.*
- *Daubenmire, R. F. 1976. The use of vegetation in assessing the productivity of forest lands. Bot. Rev. 42:115-143.*
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- *Kotar, J. and Coffman, M. 1984. Habitat-type classification system in Michigan and Wisconsin. p. 100-113 in Bockheim, J.G, Ed. Proc. Symposium: Forest Land Classification: Experience, Problems, Perspectives. NCR-102 North Central For. Soils Comm., Soc. Am. For., USDA For. Serv. And USDA Conserv. Serv., Madison, Wisc.*
- *Kuchler, A.W. 1964. The potential natural vegetation of the conterminous United States. Am Geogr. Soc., Spec. Publ. No. 36. 154 pp.*
- *Rowe, J. S. 1969. Plant community as a landscape feature. In Greenidge, K.N.H., Ed. Essays in Plant Geography and Ecology. Nova Scotia Museum, Halifax.*
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return to top

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File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:22

Timber Narrative

PS4, Inventory, 2022

Dead observations were ignored when calculating values in this report.

Physiography

There are no roads present on the stand.

Composition

The total basal area of the overstory and understory combined is 113.4 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 110.6 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 2.8 square feet per acre.

Relative Dominance

Species	Basal Area (sq.ft./ac.)	Relative Dominance (%)
black oak	30.9	27.27
sweet birch	25.0	22.04
northern red oak	15.9	14.05
white oak	11.9	10.47
red maple	11.3	9.92
hickory	10.0	8.82
eastern white pine	2.5	2.20
sugar maple	1.9	1.65
ash	1.3	1.10
scarlet oak	1.3	1.10
paper birch	0.9	0.83
yellow birch	0.3	0.28
eastern hemlock	0.3	0.28

This is a small sawtimber stand, with the following diameters:

Average diameters values (in.)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
northern red oak	16.6	19.0	19.0	17.2	17.2
black oak	16.4	17.9	17.9	16.8	16.8
scarlet oak	13.5	15.5	15.5	14.0	14.0
white oak	12.6	14.4	14.4	13.0	13.0
ash	11.4	11.5	11.5	11.4	11.4
eastern white pine	11.0	11.7	11.7	11.2	11.2
paper birch	10.5	10.7	10.7	10.6	10.6
eastern hemlock	10.0	10.0	10.0	10.0	10.0
yellow birch	10.0	10.0	10.0	10.0	10.0
red maple	8.4	12.0	12.5	9.3	10.9
sweet birch	7.8	9.7	9.9	8.3	8.7
hickory	7.3	12.9	13.9	8.5	10.7
sugar maple	7.1	12.0	12.0	7.8	7.8
All species	9.8	14.4	14.6	11.0	11.7

Structure

The stand relative density is 87 of the average maximum stocking expected in undisturbed stands of similar size and species. This density is higher than the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably moderate, while growth rate of the medium and smaller-sized trees is probably fair and mortality due to crowding moderate.

Relative density is a measure of tree crowding that accounts for both the size of the tree and the amount of space typically occupied by a tree of that size and species, so it is an especially useful measure in mixed species stands. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive or some trees will be crowded out and die, making room for more vigorous ones. On most stocking charts, 100% relative density is represented as the A-line. If relative density is at least 60% and below 100%, trees can fully occupy the growing site. Maximum stand growth occurs near 60% (the B-line), and enough trees occupy the site to discourage detrimental effects on growth form. The lower limit of stocking necessary to reach 60% (B-line) stocking in ten years on average sites is centrally represented as the C-line and corresponds roughly to 40% relative density.

Species	Relative density	Q-factor	AGS relative density
black oak	24	1.19	3
sweet birch	18	1.23	3
northern red oak	14	1.17	3
white oak	10	1.21	3
hickory	9	1.22	3
red maple	7	1.22	3
sugar maple	2	1.20	3
scarlet oak	1	1.14	3
eastern white pine	1	1.01	3
paper birch	1	1.70	3
ash	1	0.69	3
yellow birch	0	0.00	3
eastern hemlock	0	0.00	3

If this stand is managed under an even-age silvicultural system, the several species groups will mature more than 30 years apart. The estimated year of maturity is 2042. The effective stand age is about 91 years.

If this stand is managed under an all-age silvicultural system, the distribution of diameters, proportion of sawtimber, and density of shade tolerant species would make it difficult to apply selection cutting.

The shape of an uneven sized forest can be described with a measure called a q-factor. The q-factor defines the change of tree numbers across diameter classes. Q-factor typically range from 1.1 to 1.9, with the lower numbers typically applying to stands with shade tolerant species. The q-factor for this stand is 1.26. The table above lists the q-factor for each tree species. The q-factor could not be calculated for species displaying a value of zero. One inch size classes were used to compute the q-factor values.

Trees of acceptable quality for future growing stock provide a fully stocked stand by themselves (85 % of AGS relative density).

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'International 1/4 inch' log rule. Total timber volume on this 28.3 acres stand is approximately 26,152 cubic feet of sawtimber plus 33,981 cubic feet of pulpwood for a total of 60,132 cubic feet. The net boardfoot volume averages 7,719.1 board feet per acre. The net pulpwood volume averages 1,200.7 cubic feet per acre. The net cubic volume averages 2,124.8 cubic feet per acre. Gross volume estimates are made using the Scrivani-Wiant log rule. Total volumes by species are presented in the following table, sorted by net board foot volume.

Species	Total Net Board-foot Volume (bd.ft.)	% total	Total Net Pulpwood Cubic Volume (cu.ft.)	% total	Total Net Cubic Volume (cu.ft.)	% total
hickory	15,419	7.1	2,688	7.9	4,664	7.8
red maple	14,774	6.8	3,902	11.5	5,793	9.6
sweet birch	14,593	6.7	8,476	24.9	10,375	17.3
black oak	91,860	42.1	7,722	22.7	18,127	30.1
northern red oak	45,256	20.7	4,643	13.7	9,972	16.6
eastern white pine	5,620	2.6	637	1.9	1,367	2.3
white oak	23,249	10.6	3,904	11.5	6,911	11.5
scarlet oak	2,799	1.3	425	1.2	745	1.2
ash	2,363	1.1	396	1.2	686	1.1
sugar maple	1,972	0.9	557	1.6	791	1.3
paper birch	547	0.3	379	1.1	451	0.7
yellow birch	0	0.0	146	0.4	146	0.2
eastern hemlock	0	0.0	106	0.3	106	0.2
	218,452		33,981		60,132	

Timber value

Timber value is an estimate of the total dollar value of the wood products currently in the trees. It includes the prices of the trees where they are standing, before they are cut and transported to market, based on the prices the user has entered. If specific product codes were entered during inventory, values are determined using those products and prices, otherwise a default product mix is used in calculations. These figures include all live trees of acceptable and unacceptable growing stock.

Timber values

Species	Total Board-foot Value ($)	% total	Total Pulpwood Value ($)	% total	Total Timber Value ($)	% total
northern red oak	92.87	54.2	92.87	13.7	13,669.71	53.1
red maple	78.04	4.4	78.04	11.5	1,186.07	4.6
white oak	78.08	27.8	78.08	11.5	7,052.67	27.4
black oak	154.43	11.0	154.43	22.7	2,910.24	11.3
sweet birch	169.51	0.7	169.51	24.9	344.63	1.3
hickory	53.75	0.7	53.75	7.9	238.78	0.9
sugar maple	11.13	0.6	11.13	1.6	168.87	0.7
eastern white pine	12.74	0.3	12.74	1.9	80.19	0.3
scarlet oak	8.49	0.1	8.49	1.2	42.08	0.2
ash	7.93	0.1	7.93	1.2	36.28	0.1
yellow birch	2.92	0.0	2.92	0.4	2.92	0.0
paper birch	7.58	0.0	7.58	1.1	14.14	0.1
eastern hemlock	2.13	0.0	2.13	0.3	2.13	0.0
	25,069.10		679.61		25,748.71	

Regeneration Assessment

The deer impact as observed in the inventory is high. Establishment of the new stand will be limited by deer.

return to top

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:18

Overstory Vegetation Summary

Parciak Conservation Area, Inventory, 2022

The values in this report are calculated from the overstory plot data only.

Characteristics by Stands

Stand	Stand area (ac.)	Land cover	Forest type	Size class	Over mean dbh (in.)	Canopy closure (%)	Ht. to canopy (ft)
PS1	16.3	Broadleaf forest	oak northern hardwoods	small sawtimber	8.6	84	
PS3	2.6	Broadleaf forest	oak northern hardwoods	small sawtimber	10.9	66	
PS2	14.2	Broadleaf forest	oak northern hardwoods	small sawtimber	10.9	92	
PS5	7.0	Broadleaf forest	other hardwoods	small sawtimber	6.8	48	
PS4	28.3	Broadleaf forest	oak northern hardwoods	small sawtimber	9.8	84	

Stand	Over basal area (sq.ft./ac.)	Over rel. density (%)	Decid. midstory (%)	Conif. midstory (%)	Mix. midstory (%)
PS1	107.2	88	0	0	0
PS3	88.0	67	0	0	0
PS2	128.0	103	0	0	0
PS5	70.0	48	0	0	0
PS4	113.4	87	0	0	0

Characteristics across Stands

Variable	Weighted mean	Minimum	Maximum
Overstory Basal Area (sq.ft./ac.)	109.6	70.0	128.0
Overstory Trees Per Unit Area (stems/ac.)	180.99	108.01	206.46
Overstory Medial DBH (in.)	14.0	12.4	15.8
Overstory Medial Merchantable DBH (in.)	14.4	13.6	16.1
Overstory Quadratic Mean DBH (in.)	10.6	7.9	12.2
Overstory Mean DBH (in.)	9.5	6.8	10.9
Overstory Quadratic Mean Merchantable DBH (in.)	11.6	10.1	13.6

Canopy Closure (%)	82	48	92
Deciduous Midstory (%)	0	0	0
Coniferous Midstory (%)	0	0	0
Mixed Midstory (%)	0	0	0

Area by forest type and size class

area in acres

Forest type	Regeneration	Sapling	Pole	Small sawtimber	Large sawtimber	Totals
oak northern hardwoods	0.0	0.0	0.0	61.4	0.0	61.4
other hardwoods	0.0	0.0	0.0	7.0	0.0	7.0
Totals	0.0	0.0	0.0	68.4	0.0	68.4

APPENDIX D: FOREST SOILS REPORT

Hazard of Erosion and Suitability for Roads on Forestland

State of Connecticut

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
3:							
Ridgebury, Extremely Stony	40	Not rated		Slight		Poorly suited	
		Not rated; Kfact				Wetness	1.00
						Rock fragments	0.50
						Dusty	0.00
Leicester, Extremely Stony	35	Not rated		Slight		Poorly suited	
		Not rated; Kfact				Wetness	1.00
						Rock fragments	0.50
						Dusty	0.00
Whitman, Extremely Stony	17	Not rated		Slight		Poorly suited	
		Not rated; Kfact				Ponding	1.00
						Wetness	1.00
						Rock fragments	0.50
						Dusty	0.00
52C:							
Sutton, Extremely Stony	80	Not rated		Severe		Moderately suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	0.50
						Wetness	0.50
						Rock fragments	0.50
						Dusty	0.00
62C:							
Canton, Extremely Stony	50	Not rated		Severe		Moderately suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	0.50
						Rock fragments	0.50
						Dusty	0.00
Charlton, Extremely Stony	35	Not rated		Severe		Moderately suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	0.50
						Rock fragments	0.50
						Dusty	0.00
73C:							
Charlton, Very Stony	50	Not rated		Severe		Moderately suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	0.50
						Dusty	0.00

Hazard of Erosion and Suitability for Roads on Forestland

State of Connecticut

Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
73C:							
Chatfield, Very Stony	30	Not rated		Severe		Moderately suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	0.50
						Dusty	0.00
73E:							
Charlton	45	Not rated		Severe		Poorly suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	1.00
						Dusty	0.00
Chatfield	30	Not rated		Severe		Poorly suited	
		Not rated; Kfact		Slope/erodibility	0.95	Slope	1.00
						Dusty	0.00

Hydric Soils

State of Connecticut

[This report lists only those map unit components that are rated as hydric. Dashes (---) in any column indicate that the data were not included in the database. Definitions of hydric criteria codes are included at the end of the report]

Map symbol and map unit name	Component	Percent of map unit	Landform	Hydric rating	Hydric criteria
3:					
Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	Ridgebury, extremely stony	40	Depressions	Yes	2
	Leicester, extremely stony	35	Depressions	Yes	2
	Whitman, extremely stony	17	Depressions	Yes	2, 3
	Swansea	2	Swamps	Yes	1, 3
52C:					
Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	Leicester, extremely stony	3	Depressions	Yes	2
62C:					
Canton and Charlton fine sandy loams, 3 to 15 percent slopes, extremely stony	Leicester, extremely stony	5	Depressions	Yes	2
73C:					
Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	Leicester, very stony	5	Depressions	Yes	2
73E:					
Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	Leicester	5	Depressions, Drainageways	Yes	2

Hydric Soils

This table lists the map unit components that are rated as hydric soils in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2003) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and others, 2002).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2B3). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long or very long duration during the growing season.
4. Soils that are frequently flooded for long or very long duration during the growing season.

References:

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Forestland Productivity

State of Connecticut

[This report shows only the major soils in each map unit]

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
3:				
Ridgebury, extremely stony	Eastern white pine	63	114	American elm, Blackgum, Green ash, Pin oak, Red maple, Swamp white oak, Yellow birch
	Northern red oak	66	43	
	Red maple	62	---	
	Sugar maple	56	29	
	White ash	60	---	
Leicester, extremely stony	Eastern white pine	69	129	Green ash, Red maple, Tuliptree
	Northern red oak	56	43	
	Red maple	70	43	
	Yellow birch	---	---	
Whitman, extremely stony	Blackgum	52	---	---
	Eastern white pine	56	100	
	Northern red oak	70	---	
	Red maple	60	29	
	Red spruce	44	86	
	White oak	57	---	
52C:				
Sutton, extremely stony	Black cherry	72	43	Eastern white pine, European larch, Northern red oak, Norway spruce, White oak, White spruce
	Eastern white pine	62	114	
	Northern red oak	62	43	
	Red spruce	50	114	
	Sugar maple	54	29	
	White oak	---	---	
62C:				
Canton, extremely stony	Eastern hemlock	---	---	Beech, Bitternut hickory, Black oak, Eastern hemlock, Eastern white pine, Gray birch, Mockernut hickory, Northern red oak, Pignut hickory, Red maple, Shagbark hickory, Sugar maple, White ash, White oak, Yellow birch
	Eastern white pine	58	100	
	Northern red oak	52	29	
	Red maple	55	29	
	Shagbark hickory	---	0	
	Sugar maple	55	29	
	White oak	---	---	

Forestland Productivity

State of Connecticut

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
62C:				
Charlton, extremely stony	Eastern hemlock	---	---	Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, Scarlet oak, Sugar maple, Tuliptree, White ash, White oak
	Eastern white pine	65	114	
	Northern red oak	65	43	
	Red maple	55	29	
	Red pine	70	129	
	Red spruce	50	114	
	Shagbark hickory	---	0	
	Sugar maple	55	29	
	White oak	---	---	
73C:				
Charlton, very stony	Eastern hemlock	---	---	Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, Scarlet oak, Sugar maple, Tuliptree, White ash, White oak
	Eastern white pine	65	114	
	Northern red oak	65	43	
	Red maple	55	29	
	Red pine	70	129	
	Red spruce	50	114	
	Shagbark hickory	---	0	
	Sugar maple	55	29	
	White oak	---	---	
Chatfield, very stony	Eastern hemlock	---	---	Eastern hemlock, Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, White oak
	Northern red oak	70	57	
	Sugar maple	65	43	
	White ash	75	43	
	White oak	---	---	
73E:				
Charlton	Eastern hemlock	---	---	Eastern hemlock, Eastern white pine, Northern red oak, White oak
	Eastern white pine	65	114	
	Northern red oak	65	43	
	Red maple	55	29	
	Shagbark hickory	---	0	
	Sugar maple	55	29	
	White oak	---	---	
Chatfield	Eastern hemlock	---	---	Eastern hemlock, Eastern white pine, Northern red oak, White oak
	Northern red oak	70	57	
	Sugar maple	65	43	
	White ash	75	43	
	White oak	---	---	

Physical Soil Properties

State of Connecticut

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
3:														
Ridgebury, extremely stony	0-1	---	---	---	0.20-0.60	10.00-705.00	0.17-0.30	---	75-100	---	---	2	3	86
	1-6	35-71	23-50	0-17	0.60-1.20	1.00-100.00	0.11-0.25	0.0-1.3	5.0-15	.37	.37			
	6-10	35-71	23-50	0-17	1.20-1.70	1.00-100.00	0.10-0.20	0.0-1.3	0.1-4.0	.43	.43			
	10-19	35-71	23-50	0-17	1.50-1.80	1.00-100.00	0.10-0.18	0.0-1.2	0.1-1.5	.32	.49			
	19-66	35-71	23-50	0-17	1.80-2.00	0.00-1.00	0.05-0.16	0.0-1.2	0.0-0.4	.32	.49			
Leicester, extremely stony	0-1	---	---	---	0.20-0.60	10.00-705.00	0.15-0.30	---	75-100	---	---	5	3	86
	1-7	39-63	27-49	4-17	0.89-0.99	1.00-100.00	0.13-0.29	0.0-1.3	5.0-24	.24	.24			
	7-18	34-71	22-49	2-17	1.15-1.64	1.00-100.00	0.11-0.20	0.0-0.9	0.8-6.0	.37	.37			
	18-24	34-71	22-49	2-17	1.67-1.86	1.00-100.00	0.11-0.20	0.0-1.0	0.5-5.1	.43	.43			
	24-39	50-72	24-46	2-10	1.67-1.86	1.00-100.00	0.11-0.16	0.1-0.6	0.1-1.1	.32	.43			
	39-65	50-72	24-46	2-10	1.67-1.86	1.00-100.00	0.08-0.16	0.0-0.6	0.1-0.3	.32	.43			
Whitman, extremely stony	0-1	---	---	---	0.16-0.35	10.00-705.00	0.03-0.63	---	75-100	---	---	2	3	86
	1-10	31-72	22-58	0-17	0.62-1.22	1.00-100.00	0.04-0.30	0.0-1.2	5.2-24	.37	.37			
	10-17	34-72	22-50	0-17	1.30-1.73	1.00-100.00	0.04-0.21	0.0-1.3	0.3-5.3	.32	.49			
	17-61	34-72	22-50	0-17	1.69-2.07	0.00-1.00	0.03-0.13	0.0-1.7	0.0-0.4	.49	.49			
52C:														
Sutton, extremely stony	0-2	---	---	---	0.20-0.60	10.00-705.00	0.17-0.30	---	75-100	---	---	5	3	86
	2-7	39-68	23-50	2-17	0.67-1.25	1.00-100.00	0.10-0.30	0.0-1.6	4.0-25	.24	.24			
	7-19	34-71	22-49	2-17	1.31-1.66	1.00-100.00	0.10-0.20	0.0-1.3	0.1-6.0	.37	.37			
	19-27	34-71	22-49	2-17	1.31-1.66	1.00-100.00	0.10-0.20	0.0-1.3	0.1-6.0	.37	.37			
	27-41	50-72	24-46	2-10	1.41-1.60	1.00-100.00	0.10-0.17	0.0-0.7	0.1-1.2	.24	.43			
	41-62	50-72	24-46	2-10	1.41-1.60	1.00-100.00	0.08-0.17	0.0-0.7	0.1-1.2	.24	.43			

Physical Soil Properties

State of Connecticut

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
62C:														
Canton, extremely stony	0-2	---	---	---	0.20-0.60	10.00-705.00	0.17-0.30	---	75-100	---	---	3	3	86
	2-5	42-69	25-50	1-10	1.12-1.48	1.00-100.00	0.10-0.22	0.0-1.1	2.0-12	.24	.24			
	5-16	42-69	25-50	1-10	1.46-1.59	1.00-100.00	0.10-0.20	0.1-0.8	0.3-2.8	.43	.43			
	16-22	42-69	25-50	1-10	1.46-1.59	1.00-100.00	0.10-0.20	0.1-0.8	0.2-2.8	.28	.43			
	22-67	75-95	4-24	0-5	1.60-1.64	10.00-705.00	0.03-0.13	0.0-0.3	0.0-0.5	.15	.28			
Charlton, extremely stony	0-2	---	---	---	0.22-0.32	10.00-705.00	0.12-0.45	---	75-100	---	---	5	3	86
	2-4	39-68	23-50	2-15	0.67-1.24	1.00-100.00	0.10-0.30	0.0-1.2	4.0-25	.24	.24			
	4-27	34-71	23-50	3-18	1.31-1.66	1.00-100.00	0.09-0.22	0.1-1.1	0.1-6.0	.28	.43			
	27-65	45-72	24-50	4-11	1.41-1.60	1.00-100.00	0.08-0.18	0.1-0.6	0.1-1.2	.20	.43			
73C:														
Charlton, very stony	0-2	---	---	---	0.22-0.32	10.00-705.00	0.12-0.45	---	75-100	---	---	5	3	86
	2-4	39-68	23-50	2-15	0.67-1.24	1.00-100.00	0.10-0.30	0.0-1.2	4.0-25	.24	.24			
	4-27	34-71	23-50	3-18	1.31-1.66	1.00-100.00	0.09-0.22	0.1-1.1	0.1-6.0	.28	.43			
	27-65	45-72	24-50	4-11	1.41-1.60	1.00-100.00	0.08-0.18	0.1-0.6	0.1-1.2	.20	.43			
Chatfield, very stony	0-1	---	---	---	0.20-0.60	10.00-705.00	0.16-0.30	---	75-100	---	---	2	3	86
	1-2	35-68	23-53	2-15	0.73-1.32	1.00-100.00	0.09-0.34	0.0-1.2	4.0-25	.28	.28			
	2-30	34-71	25-57	0-18	1.10-1.66	1.00-100.00	0.10-0.25	0.0-1.2	0.1-6.0	.24	.37			
	30-40	---	---	---	---	0.00-0.01	0.00	---	---	---	---			
73E:														
Charlton	0-4	57-72	20-40	3-8	1.25-1.45	4.00-42.00	0.12-0.14	0.0-2.9	2.0-6.0	.28	.28	5	3	86
	4-7	57-72	20-40	3-8	1.30-1.45	4.00-42.00	0.09-0.14	0.0-2.9	0.5-1.0	.37	.37			
	7-19	57-72	20-40	3-8	1.35-1.50	4.00-42.00	0.09-0.14	0.0-2.9	0.0-0.5	.43	.43			
	19-27	57-72	20-40	3-8	1.35-1.55	4.00-42.00	0.08-0.14	0.0-2.9	0.0-0.5	.20	.37			
	27-65	57-72	20-40	1-8	1.35-1.60	4.00-42.00	0.08-0.13	0.0-2.9	0.0-0.5	.20	.37			

Physical Soil Properties

State of Connecticut

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
73E:														
Chatfield	0-1	0	0	0	0.30-0.55	14.00-42.00	0.08-0.40	---	50-95	---	---	2	5	56
	1-6	52-83	10-30	7-18	1.25-1.45	4.00-42.00	0.09-0.13	0.0-2.9	2.0-6.0	.05	.15			
	6-15	37-83	10-45	7-18	1.30-1.45	4.00-42.00	0.08-0.17	0.0-2.9	0.5-2.0	.15	.32			
	15-29	50-83	10-28	7-18	1.35-1.50	4.00-42.00	0.08-0.13	0.0-2.9	0.0-0.5	.20	.37			
	29-80	---	---	---	---	0.07-141.00	---	---	---	---	---			

APPENDIX E: WETLANDS & WILDLIFE RESOURCES

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File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:33

Wildlife Species Potential

Parciak Conservation Area, Inventory, 2022

NEWILD: New England Wildlife

Species List:

Species by stand

Species List	PS1	PS3	PS2	PS5	PS4
Gray Treefrog	X	X	X	X	X
Bullfrog	X	X	X	X	X
Pickerel Frog	X	X	X	X	X
Wood Turtle	X	X	X	X	X
Eastern Hognose Snake	X	X	X		X
Eastern Worm Snake	X	X	X		X
Timber Rattlesnake	X	X	X		X
Common Goldeneye	X	X	X		X
Sharp-shinned Hawk	X		X		X
Cooper's Hawk		X		X	
Northern Goshawk	X	X	X	X	X
Red-shouldered Hawk	X		X		X
Peregrine Falcon	X	X	X	X	X
Ruffed Grouse		X		X	
Eastern Screech-Owl	X	X	X	X	X
Great Horned Owl	X	X	X	X	X
Barred Owl	X	X	X	X	X
Great Gray Owl				X	
Long-eared Owl	X	X	X	X	X
Northern Saw-whet Owl	X		X		X
Common Nighthawk	X	X	X	X	X
Red-bellied Woodpecker	X	X	X		X
Yellow-bellied Sapsucker	X	X	X	X	X
Hairy Woodpecker	X	X	X	X	X
Great Crested Flycatcher		X		X	
Blue Jay	X	X	X	X	X

American Crow	X	X	X	X	X
Black-capped Chickadee	X	X	X	X	X
Boreal Chickadee				X	
Tufted Titmouse	X	X	X	X	X
Red-breasted Nuthatch				X	
White-breasted Nuthatch	X	X	X	X	X
Brown Creeper	X	X	X	X	X
Golden-crowned Kinglet				X	
Blue-gray Gnatcatcher		X		X	
Yellow-throated Vireo		X		X	
Red-eyed Vireo	X		X		X
Blackburnian Warbler	X		X		X
Scarlet Tanager	X		X		X
White-throated Sparrow	X	X	X		X
Dark-eyed Junco	X	X	X	X	X
Purple Finch	X	X	X	X	X
Red Crossbill				X	
White-winged Crossbill				X	
Pine Siskin				X	
American Goldfinch				X	
Evening Grosbeak				X	
Little Brown Myotis	X	X	X	X	X
Keen's Myotis	X	X	X	X	X
Indiana Myotis	X	X	X	X	X
Silver-haired Bat	X	X	X	X	X
Eastern Pipistrelle		X		X	
Big Brown Bat	X	X	X	X	X
Red Bat	X		X		X
Gray Squirrel	X				
Red Squirrel	X		X		X
Southern Flying Squirrel	X				
Northern Flying Squirrel	X				
Beaver	X	X	X	X	X
Porcupine	X	X	X	X	X
Coyote	X				
Raccoon	X	X	X	X	X
River Otter	X	X	X	X	X
Mountain Lion				X	

Habitats and features used in species rules:

Habitats and features

NEWILD feature	NED variable	PS1	PS3	PS2	PS5	PS4
Habitat Type	**MDWILD Habitat type NED Cover type NED Forest type**	Northern red oak Broadleaf forest oak northern hardwoods	Northern red oak Broadleaf forest oak northern hardwoods	Northern red oak Broadleaf forest oak northern hardwoods	Northern hardwoods Broadleaf forest other hardwoods	Northern red oak Broadleaf forest oak northern hardwoods
Size Class	**Size class**	small sawtimber	small sawtimber	small sawtimber	small sawtimber	small sawtimber
High perch	**High Perches Present**	absent	absent	absent	absent	absent
Low perch	**Low Perches Present**	absent	absent	absent	absent	absent
Canopy < 15%	**Canopy Closure (%)**	84	66	92	48	84
Canopy 16 - 30%	**Canopy Closure (%)**	84	66	92	48	84
Canopy 31 - 70%	**Canopy Closure (%)**	84	66	92	48	84
Canopy > 70%	**Canopy Closure (%)**	84	66	92	48	84
Deciduous Midstory 10-30' zone	**Deciduous Midstory (%)**	0	0	0	0	0
Coniferous Midstory 10-30' zone	**Coniferous Midstory (%)**	0	0	0	0	0
Mixed Midstory 10-30' zone	**Mixed Midstory (%)**	0	0	0	0	0
Deciduous seedlings, saplings, shrubs in 2-10' zone	**Shrub layer deciduous species (%)**	0.0	0.0	0.0	0.0	0.0
Coniferous seedlings, saplings, shrubs in 2-10' zone	**Shrub layer coniferous species (%)**	4.0	0.0	0.0	0.0	0.0
Mixed deciduous, coniferous vegetation in 2-10' zone	**Shrub layer deciduous species (%)**	0.0	0.0	0.0	0.0	0.0
Mixed deciduous, coniferous vegetation in 2-10' zone	**Shrub layer coniferous species (%)**	4.0	0.0	0.0	0.0	0.0
Ericaceous in 2-10' zone	**Shrub layer ericaceous species (%)**	0.0	0.0	0.0	0.0	0.0

Ground vegetation <30% coverage in 0-2' zone	**Ground layer cover (% cover)**	2.4	0.0	0.0	0.0	0.0
Ground vegetation 30-75% coverage in 0-2' zone	**Ground layer cover (% cover)**	2.4	0.0	0.0	0.0	0.0
Ground vegetation >75% coverage in 0-2' zone	**Ground layer cover (% cover)**	2.4	0.0	0.0	0.0	0.0
Wetland vegetation and temporary pools	**Temporary Ponds**	absent	absent	absent	absent	absent
Rocky floor	**Percent Cover Rock (% cover)**	0.0	0.0	0.0	0.0	0.0
Dead and down material	**Coarse Woody Debris (cu.ft./ac.)**	0.0	0.0	0.0	0.0	0.0
Forest litter and moss	**Leaf litter cover (% cover)**	0.0	0.0	0.0	0.0	0.0
Subterranean	**Caves**	absent	absent	absent	absent	absent
Subterranean	**Rock Crevices**	absent	absent	absent	absent	absent
Seeps	**Seeps**	absent	absent	absent	absent	absent
Woods road	**Roaded**	absent	absent	absent	absent	absent
Slash piles	**Percent Plot Clusters with High Slash (% plots)**	0	0	0	0	0
Slash piles	**Percent Plot Clusters with Low Slash (% plots)**	0	0	0	0	0
Mast and fruit	**Percent Plot Clusters with Soft Mast (%)**	8	0	0	0	0
Mast and fruit	**Percent Plot Clusters with Hard Mast (%)**	96	100	100	100	100

The following NEWILD features do not have a corresponding NED variable and are ignored in the analysis:

- Waterside tree bole, Dead, at least 6" dbh
- Waterside tree bole, Live, at least 12" dbh
- Waterside tree bole, Live, at least 16" dbh
- Non-Waterside tree bole, Dead and soft, less then 6"
- Non-Waterside tree bole, Dead and hard, 6-12"
- Non-Waterside tree bole, Dead and hard, 12-18"
- Non-Waterside tree bole, Live, columnar decay, 8-12"
- Non-Waterside tree bole, Live, broken top, 12-18"
- Non-Waterside tree bole, Live, broken top or large limb >18"
- Non-Waterside tree bole, Live, hollow >24"
- Wetland shrubs in 2-10' zone

- Waterside decaying logs
- Deciduous overstory inclusions
- Coniferous overstory inclusions
- Gravel and soil

Connecticut Inland Wetlands (CT)

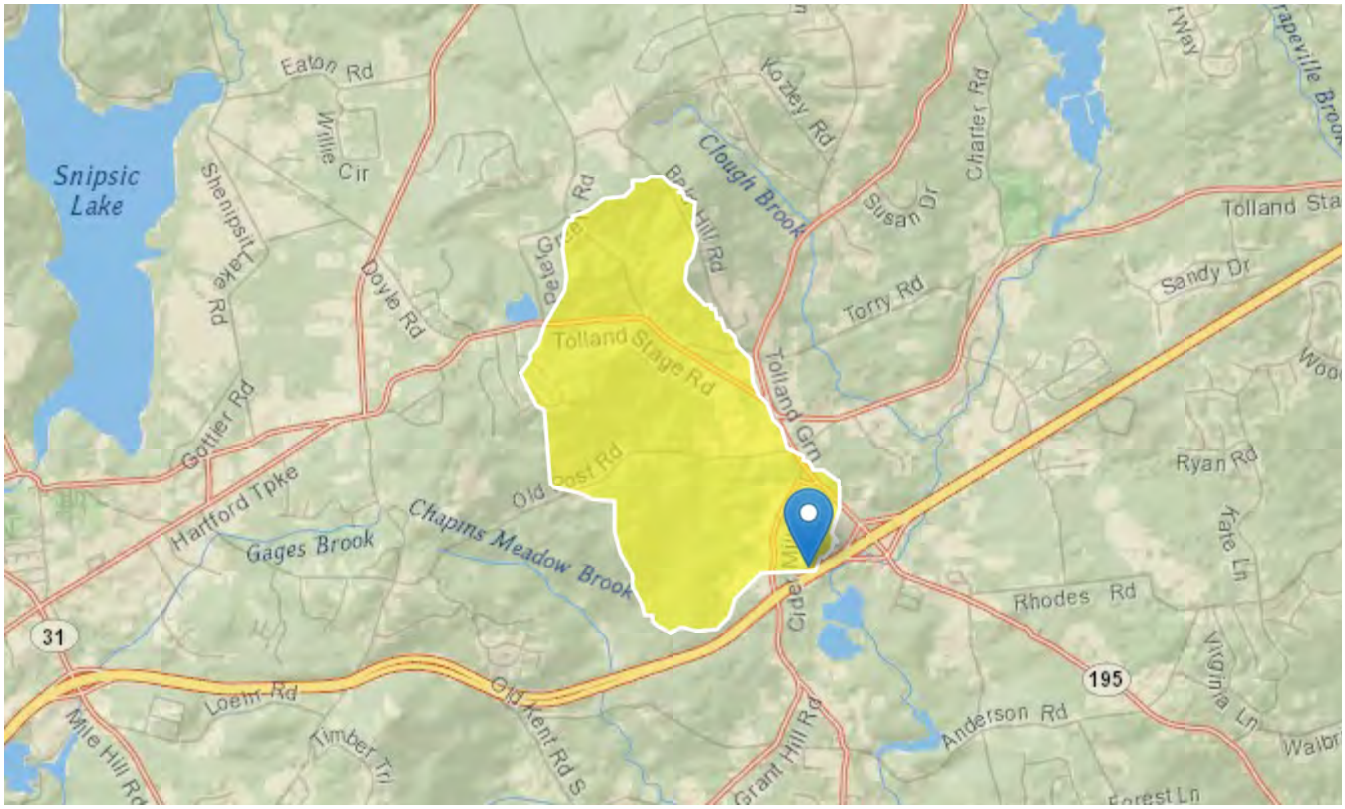
State of Connecticut

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The State of Connecticut recognizes all poorly and very poorly drained soils, alluvial soils, and soils on flood plains as wetlands. This report shows only the major soils in each map unit. Run this report and include minor components]

Map symbol and soil name	Pct. of map unit	Inland wetlands (CT)
		Rating
3:		
Ridgebury, extremely stony	40	CT wetland
Leicester, extremely stony	35	CT wetland
Whitman, extremely stony	17	CT wetland
52C:		
Sutton, extremely stony	80	CT nonwetland
62C:		
Canton, extremely stony	50	CT nonwetland
Charlton, extremely stony	35	CT nonwetland
73C:		
Charlton, very stony	50	CT nonwetland
Chatfield, very stony	30	CT nonwetland
73E:		
Charlton	45	CT nonwetland
Chatfield	30	CT nonwetland

StreamStats Report

Region ID: CT
Workspace ID: CT20220616204710325000
Clicked Point (Latitude, Longitude): 41.86186, -72.36647
Time: 2022-06-16 16:47:32 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
CAT1ROADS	Length of interstates lmtd access highways and ramps for lmtd access highways, includes cloverleaf interchanges (USGS Ntl Transp Dataset)	0.00878	miles
CAT2ROADS	Length of sec hwy or maj connecting roads; main arteries & hwys not lmtd access, usually in the US Hwy or State Hwy systems (USGS Ntl Transp Dataset)	0	miles

Parameter Code	Parameter Description	Value	Unit
CAT3ROADS	Length of local connecting roads; roads that collect traffic from local roads & connect towns, subdivisions & neighborhoods (USGS Nat Transp Dataset)	1.36	miles
CAT4ROADS	Length of local roads; generally paved street, road, or byway that usually have single lane of traffic in each direction (USGS Ntnl Transp Dataset)	4.02	miles
CROSCOUNT1	Number of intersections between streams and roads, where the roads are interstate, limited access highway, or ramp (CAT1ROADS)	0	dimensionless
CROSCOUNT2	Number of intersections between streams and roads, where the roads are secondary highway or major connecting road (CAT2ROADS)	0	dimensionless
CROSCOUNT3	Number of intersections between streams and roads, where roads are local conecting roads (CAT3ROADS)	1	dimensionless
CROSCOUNT4	Number of intersections between streams and roads, where roads are local roads (CAT4ROADS)	4	dimensionless
CRSDFT	Percentage of area of coarse-grained stratified drift	7.2	percent
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	192	feet per mi
DRNAREA	Area that drains to a point on a stream	1.55	square miles
ELEV	Mean Basin Elevation	740	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	8	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	5.03	inches
I24H200Y	Maximum 24-hour precipitation that occurs on average once in 200 years	9.37	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	6.22	inches

Parameter Code	Parameter Description	Value	Unit
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	2.96	inches
I24H500Y	Maximum 24-hour precipitation that occurs on average once in 500 years	11.18	inches
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	7.11	inches
I24H5Y	Maximum 24-hour precipitation that occurs on average once in 5 years	4.14	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	13.6	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	3.22	percent
LFPLENGTH	Length of longest flow path	2.39	miles
MAPM	Mean Annual Precip Basin Average	48.63	inches
NOVAVPRE	Mean November Precipitation	4.4	inches
PRCWINTER	Mean annual precipitation for December through February	3.8	inches
SGSL	Total stream length intersecting sand and gravel deposits (in miles)	0.74	miles
SOILPERM	Average Soil Permeability	4.077	inches per hour
SSURGOCCDD	Percentage of area with hydrologic soil types C, D, or C/D from SSURGO	0.1163	percent
STRMTOT	total length of all mapped streams (1:24,000-scale) in the basin	3.46	miles
WETLAND	Percentage of Wetlands	0.42	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Statewide DA only SIR 2020 5054]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.69	325

Peak-Flow Statistics Parameters [Statewide Multiparameter SIR 2020 5054]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.69	325
I24H2Y	24 Hour 2 Year Precipitation	2.96	inches	2.77	3.32
SSURGOCCDD	Percent soil type C or D from SSURGO	0.1163	percent	0.118	0.945
I24H5Y	24 Hour 5 Year Precipitation	4.14	inches	4	4.7
I24H10Y	24 Hour 10 Year Precipitation	5.03	inches	4.86	5.79
I24H25Y	24 Hour 25 Year Precipitation	6.22	inches	5.99	7.22
I24H50Y	24 Hour 50 Year Precipitation	7.11	inches	6.81	8.3
I24H100Y	24 Hour 100 Year Precipitation	8	inches	7.62	9.38
I24H200Y	24 Hour 200 YearPrecipitation	9.37	inches	8.7	11.22
I24H500Y	24 Hour 500 Year Precipitation	11.18	inches	10.1	13.64

Peak-Flow Statistics Flow Report [Statewide DA only SIR 2020 5054]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
Drainage Area Only 50-percent AEP flood	90.2	ft^3/s	35
Drainage Area Only 20-percent AEP flood	158	ft^3/s	35
Drainage Area Only 10-percent AEP flood	215	ft^3/s	36.3
Drainage Area Only 4-percent AEP flood	299	ft^3/s	37.8
Drainage Area Only 2-percent AEP flood	371	ft^3/s	39.8
Drainage Area Only 1-percent AEP flood	450	ft^3/s	42.4
Drainage Area Only 0.5-percent AEP flood	539	ft^3/s	44.4
Drainage Area Only 0.2-percent AEP flood	671	ft^3/s	48

Peak-Flow Statistics Disclaimers [Statewide Multiparameter SIR 2020 5054]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [Statewide Multiparameter SIR 2020 5054]

Statistic	Value	Unit
50-percent AEP flood	42.1	ft^3/s
20-percent AEP flood	78	ft^3/s
10-percent AEP flood	111	ft^3/s
4-percent AEP flood	164	ft^3/s
2-percent AEP flood	208	ft^3/s
1-percent AEP flood	258	ft^3/s
0.5-percent AEP flood	332	ft^3/s
0.2-percent AEP flood	440	ft^3/s

Peak-Flow Statistics Flow Report [Area-Averaged]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
Drainage Area Only 50-percent AEP flood	90.2	ft^3/s	35
Drainage Area Only 20-percent AEP flood	158	ft^3/s	35
Drainage Area Only 10-percent AEP flood	215	ft^3/s	36.3
Drainage Area Only 4-percent AEP flood	299	ft^3/s	37.8
Drainage Area Only 2-percent AEP flood	371	ft^3/s	39.8
Drainage Area Only 1-percent AEP flood	450	ft^3/s	42.4
Drainage Area Only 0.5-percent AEP flood	539	ft^3/s	44.4
Drainage Area Only 0.2-percent AEP flood	671	ft^3/s	48
50-percent AEP flood	42.1	ft^3/s	
20-percent AEP flood	78	ft^3/s	
10-percent AEP flood	111	ft^3/s	
4-percent AEP flood	164	ft^3/s	
2-percent AEP flood	208	ft^3/s	
1-percent AEP flood	258	ft^3/s	

Statistic	Value	Unit	ASEp
0.5-percent AEP flood	332	ft^3/s	
0.2-percent AEP flood	440	ft^3/s	

Peak-Flow Statistics Citations

Ahearn, E.A., and Hodgkins, G.A.,2020, Estimating flood magnitude and frequency on streams and rivers in Connecticut, based on data through water year 2015: U.S. Geological Survey Scientific Investigations Report 2020–5054, 42 p. (https://doi.org/10.3133/sir20205054)

Flow-Duration Statistics

Flow-Duration Statistics Parameters [Duration Flow 2010 5052]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.92	150
ELEV	Mean Basin Elevation	740	feet	168	1287
CRSDFT	Percent Coarse Stratified Drift	7.2	percent	0.1	55.1

Flow-Duration Statistics Flow Report [Duration Flow 2010 5052]

Statistic	Value	Unit
25 Percent Duration	3.56	ft^3/s
99 Percent Duration	0.0404	ft^3/s

Flow-Duration Statistics Citations

Ahearn, E.A.,2010, Regional regression equations to estimate flow-duration statistics in Connecticut: U. S. Geological Survey Scientific Investigations Report 2010-5052, 45 p. (http://pubs.usgs.gov/sir/2010/5052/)

Seasonal Flow Statistics

Seasonal Flow Statistics Parameters [Duration Flow 2010 5052]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.92	150
PRCWINTER	Mean Annual Winter Precipitation	3.8	inches	3.19	4.4
CRSDFT	Percent Coarse Stratified Drift	7.2	percent	0.1	55.1

Seasonal Flow Statistics Flow Report [Duration Flow 2010 5052]

Statistic	Value	Unit
25 Percent Duration December to February	3.82	ft^3/s
50 Percent Duration December to February	2.21	ft^3/s
75 Percent Duration December to February	1.29	ft^3/s
95 Percent Duration DEC FEB	0.57	ft^3/s
99 Percent Duration December to February	0.275	ft^3/s
25 Percent Duration March to April	6.51	ft^3/s
50 Percent Duration March to April	4.09	ft^3/s
75 Percent Duration March to April	2.8	ft^3/s
95 Percent Duration March to April	1.65	ft^3/s
99 Percent Duration March to April	1.18	ft^3/s
25 Percent Duration July to October	0.954	ft^3/s
50 Percent Duration July to October	0.387	ft^3/s
75 Percent Duration July to October	0.171	ft^3/s
80 Percent Duration July to October	0.139	ft^3/s
99 Percent Duration July to October	0.0166	ft^3/s

Seasonal Flow Statistics Citations

Ahearn, E.A.,2010, Regional regression equations to estimate flow-duration statistics in Connecticut: U. S. Geological Survey Scientific Investigations Report 2010-5052, 45 p. (http://pubs.usgs.gov/sir/2010/5052/)

May Flow-Duration Statistics

May Flow-Duration Statistics Parameters [Duration Flow 2010 5052]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.92	150
CRSDFT	Percent Coarse Stratified Drift	7.2	percent	0.1	55.1

May Flow-Duration Statistics Flow Report [Duration Flow 2010 5052]

Statistic	Value	Unit
May 25 Percent Duration	4.29	ft^3/s
May 50 Percent Duration	2.76	ft^3/s
May 75 Percent Duration	1.87	ft^3/s
May 95 Percent Duration	0.983	ft^3/s
May 99 Percent Duration	0.63	ft^3/s

May Flow-Duration Statistics Citations

Ahearn, E.A.,2010, Regional regression equations to estimate flow-duration statistics in Connecticut: U. S. Geological Survey Scientific Investigations Report 2010-5052, 45 p. (http://pubs.usgs.gov/sir/2010/5052/)

June Flow-Duration Statistics

June Flow-Duration Statistics Parameters [Duration Flow 2010 5052]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.92	150
CRSDFT	Percent Coarse Stratified Drift	7.2	percent	0.1	55.1

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
WETLAND	Percent Wetlands	0.42	percent	0.3	18.1

June Flow-Duration Statistics Flow Report [Duration Flow 2010 5052]

Statistic	Value	Unit
June 25 Percent Duration	2.22	ft^3/s
June 50 Percent Duration	1.13	ft^3/s
June 75 Percent Duration	0.601	ft^3/s
June 90 Percent Duration	0.399	ft^3/s
June 99 Percent Duration	0.166	ft^3/s

June Flow-Duration Statistics Citations

Ahearn, E.A.,2010, Regional regression equations to estimate flow-duration statistics in Connecticut: U. S. Geological Survey Scientific Investigations Report 2010-5052, 45 p. (http://pubs.usgs.gov/sir/2010/5052/)

November Flow-Duration Statistics

November Flow-Duration Statistics Parameters [Duration Flow 2010 5052]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.92	150
NOVAVPRE	Mean November Precipitation	4.4	inches	3.48	4.93
CRSDFT	Percent Coarse Stratified Drift	7.2	percent	0.1	55.1

November Flow-Duration Statistics Flow Report [Duration Flow 2010 5052]

Statistic	Value	Unit
November 25 Percent Duration	3.23	ft^3/s
November 50 Percent Duration	1.74	ft^3/s

Statistic	Value	Unit
November 75 Percent Duration	0.775	ft^3/s
November 90 Percent Duration	0.351	ft^3/s
November 99 Percent Duration	0.116	ft^3/s

November Flow-Duration Statistics Citations

Ahearn, E.A.,2010, Regional regression equations to estimate flow-duration statistics in Connecticut: U. S. Geological Survey Scientific Investigations Report 2010-5052, 45 p. (http://pubs.usgs.gov/sir/2010/5052/)

Bankfull Statistics

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.07722	940.1535

Bankfull Statistics Parameters [New England P Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	3.799224	138.999861

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.55	square miles	0.07722	59927.7393

Bankfull Statistics Flow Report [Appalachian Highlands D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	18.2	ft
Bieger_D_channel_depth	1.27	ft
Bieger_D_channel_cross_sectional_area	23.5	ft^2

Bankfull Statistics Disclaimers [New England P Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [New England P Bieger 2015]

Statistic	Value	Unit
Bieger_P_channel_width	28.6	ft
Bieger_P_channel_depth	1.51	ft
Bieger_P_channel_cross_sectional_area	43.3	ft^2

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	14.4	ft
Bieger_USA_channel_depth	1.32	ft
Bieger_USA_channel_cross_sectional_area	21.7	ft^2

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	18.2	ft
Bieger_D_channel_depth	1.27	ft
Bieger_D_channel_cross_sectional_area	23.5	ft^2
Bieger_P_channel_width	28.6	ft
Bieger_P_channel_depth	1.51	ft
Bieger_P_channel_cross_sectional_area	43.3	ft^2
Bieger_USA_channel_width	14.4	ft
Bieger_USA_channel_depth	1.32	ft
Bieger_USA_channel_cross_sectional_area	21.7	ft^2

Bankfull Statistics Citations

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub /1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&

utm_medium=PDF&utm_campaign=PDFCoverPages)

Application Version: 4.9.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.0

APPENDIX F: CARBON, CLIMATE, AND RESILIENCY

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
File version: 3.30.1
Last saved: 6/22/2022
Report generated: 06/23/2022 13:34

Carbon Storage

Parciak Conservation Area, Inventory, 2022

Total Live Carbon (tons)

Stand	Area (ac.)	Foliage	Stem	Branch	Bark	Total Aboveground	Root	Total Biomass
PS1	16.3	14	426	156	87	683	129	812
PS3	2.6	2	59	20	12	93	17	110
PS2	14.2	15	453	163	92	722	136	858
PS5	7.0	3	87	37	18	145	28	173
PS4	28.3	26	788	279	159	1,252	237	1,489
Totals	68.4	60	1,812	655	367	2,895	548	3,442

Total Dead Carbon (tons)

Stand	Area (ac.)	Foliage	Stem	Branch	Bark	Total Aboveground	Root	Total Biomass
PS1	16.3	1	20	7	4	32	6	37
PS3	2.6	0	1	0	0	2	0	3
PS2	14.2	0	0	0	0	0	0	0
PS5	7.0	0	0	0	0	0	0	0
PS4	28.3	1	19	6	4	30	6	35
Totals	68.4	1	40	14	8	63	12	75

Total Live and Dead Carbon (tons)

Stand	Area (ac.)	Foliage	Stem	Branch	Bark	Total Aboveground	Root	Total Biomass
PS1	16.3	15	446	163	91	714	135	849
PS3	2.6	2	61	20	12	95	18	113
PS2	14.2	15	453	163	92	722	136	858
PS5	7.0	3	87	37	18	145	28	173
PS4	28.3	27	807	286	163	1,282	242	1,524
Totals	68.4	61	1,853	669	375	2,958	560	3,518

File name: C:\Users\ngoss\Desktop\CONNWOOD FORESTERS_Projects_2022\Tolland MP\Parciak_InventoryData_TownofTolland.NED3
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Climate change report

Parciak Conservation Area, Inventory, 2022

Climate Informed Metrics

Climate Informed Metric Summary

Stand	Area (ac.)	Relative Density	Richness	Overstory Evenness	Understory Evenness	Woody Debris	Seedlings	Saplings
PS1	16.3	88	9	0.909	0.918		4.0	68.8
PS3	2.6	67	6	0.967	0.000		0.0	22.9
PS2	14.2	103	8	0.846	0.000		0.0	0.0
PS5	7.0	48	7	0.675	0.000		0.0	95.5
PS4	28.3	87	13	0.735	0.000		0.0	25.1

- **Relative Density**= Relative density (stocking) provides information about the area within a stand that is occupied by trees. Ideal stocking levels will varying based on forest type, species composition, and management objectives. Information about stocking levels may help to identify whether stands are having a reduced or increased growth response under a changing climate. Further, there is some evidence that maintaining stands at somewhat lower densities may increase their resistance and resilience to droughty conditions (http://www.nrs.fs.fed.us/pubs/46366), which are expected to increase in some areas.
- **Tree Species Diversity (Richness and Evenness)**= Climate change is expected to have substantial effects on forest ecosystems, with many forest types having species that are expected to decline. In general, species-rich communities have exhibited greater resilience to extreme environmental conditions and greater potential to recover from disturbance than less diverse ecosystems. Less diverse ecosystems are generally considered to be more vulnerable to climate change and associated stressors. Species richness is the number of species that are present and provides a very simple measure of diversity. Species evenness integrates information about the relative abundance of individual species to assess whether a stand is dominated by one or a few species or if stand composition is relatively even across many species. Together, these metrics can help managers evaluate whether their "eggs are all in one basket".
- **Large Coarse Woody Debris**= Course woody debris, especially large wood that takes longer to decompose important to nutrient cycling and helps maintain biodiversity by providing habitat for a wide range of species, including birds, mammals, reptiles, amphibians, insects, and invertebrates. Where conditions become warmer and drier, coarse woody debris may also help to retain moisture in soils and near the soil surface. This can help to create microclimates beneficial to plants, particularly during germination, and animals. At the same time, course woody debris can serve as fuel in fire-dependent forests or in forests that experience droughty conditions, potentially increasing fire risk.
- **Seedlings and Saplings**= Changes in climate may affect plant germination in various ways. Warmer temperatures and altered precipitation and moisture may affect the maturation and dispersal of seeds, seed persistence in soils, germination rates, or germinant success. For these reasons, the seedlings may provide an early warning system for greater changes that may occur in the future. The abundance and composition of seedlings (< 1 inch DBH) and saplings (1-4 inches DBH) can provide valuable information about the future forest.

Climate Risk Metrics

Many forests are already responding to changing conditions, and climate change is anticipated to have a pervasive influence on forests over the coming decades. Many changes are expected to influence the habitat of tree species- warmer temperatures, altered precipitation, and increased stressors may decrease the ability for certain species to persist in some areas, while increasing the potential habitat available for others.

This report provides information for natural resource managers to assess some of the potential risks of climate change on the areas that they manage by showing anticipated changes in tree species' habitats at a regional scale. Importantly, local site conditions and past and current management ultimately determine how a forest will respond to climate change- thus, it is up to the manager to consider how regional climate impacts pertain to a particular location and set of management objectives. For more information on incorporating climate change into management, view the *Forest Adaptation Resources* www.forestadaptation.org/far.

The following tables help to identify the proportion of a stand that may be at risk of decline as a result of climate change. These data are based on modeled changes in habitat suitability using the Climate Change Tree Atlas (www.nrs.fs.fed.us/atlas/tree). Data are presented under two climate change scenarios- a low climate change scenario (PCM B1) and a high climate change scenario (GFDL A1FI)- in order to demonstration a potential *range* of change that may be expected by the end of the century (2070-2100). Details on this approach are available at www.nrs.fs.fed.us/pubs/54364.

Species identified as being at risk are projected to have 20% or greater decrease in suitable habitat in the region that was selected for analysis. Species that are projected to have a large decrease in suitable habitat (suitable habitat is expected to decrease 50% or more) may be at an even greater risk. **This does not mean that the species are projected to die or disappear- rather, this indicates that habitat suitability is expected to be lower, making conditions less suitable for the particular species across the region.**

At a stand level, a species is likely to be at greatest risk when a species is projected to decrease under both climate change scenarios *and* when local conditions and expertise suggest that the species is vulnerable to anticipated changes in the region. Published regional assessments provide valuable information about regional climate change impacts on forests, including additional information on how individual species may respond. These can be accessed online at www.forestadaptation.org/vulnerability-assessment. The data used for this risk assessment are from the **New England: Southern New England** assessment area.

Overstory (> 4.5 inch DBH)

Overstory (> 4.5 inch DBH)

Stand	Area (ac.)	Basal Area	Stems Per Area	At Risk Percent Under Low Emissions	At Risk Percent Under High Emissions
PS1	16.3	106.0	139.0	0.0	47.8
PS3	2.6	88.0	86.5	0.0	57.7
PS2	14.2	128.0	172.6	0.0	41.1
PS5	7.0	61.7	111.0	6.9	43.7
PS4	28.3	113.8	150.9	4.0	54.2

Established Regeneration(1-4.5 inch DBH)

Established Regeneration(1-4.5 inch DBH)

Stand	Area (ac.)	Basal Area	Stems Per Area	At Risk Percent Under Low Emissions	At Risk Percent Under High Emissions
PS1	16.3	6.0	68.8	0.0	65.3
PS3	2.6	2.0	22.9	0.0	0.0

PS2	14.2	0.0	0.0	-1.$	-1.$
PS5	7.0	8.3	95.5	0.0	70.0
PS4	28.3	2.2	25.1	0.0	63.5

Seedlings (<1 inch DBH)

Seedlings (<1 inch DBH)

Stand	Area (ac.)	Basal Area	Stems Per Area	At Risk Percent Under Low Emissions	At Risk Percent Under High Emissions
PS1	16.3	0.0	4.0	100.0	100.0
PS3	2.6	0.0	0.0	-1.$	-1.$
PS2	14.2	0.0	0.0	-1.$	-1.$
PS5	7.0	0.0	0.0	-1.$	-1.$
PS4	28.3	0.0	0.0	-1.$	-1.$

- **Basal Area**= The basal area (square feet) of the stand.
- **Stems Per Acre**= The mean stems per acre, based on stems counted in each stand.
- **At Risk Percent Under Low Emissions**= The percentage of the stand at risk based upon the Importance Values for species considered to be potentially at risk from climate change (change class is Decrease or Large Decrease) under a less harsh climate scenario (PCM B1)
- **At Risk Percent Under High Emissions**= The percentage of the stand at risk based upon the Importance Values for species considered to be potentially at risk from climate change (change class is Decrease or Large Decrease) under a harsh climate scenario (GFDL A1FI)

APPENDIX G: PHOTOLOG

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 1	**Date:** 4/2022

Direction Photo Taken:
From Hunter Road looking westerly

Description:
Gravel road access to parking/turn around area. Parking is at top of slope and drive is mostly crowned. Water sheds down gradient into woods.

Photo No. 2	**Date:** 4/2022

Direction Photo Taken:
Down and northerly.

Description:
Site appears to be unvandalized and informational exhibit appears new and intact. Wood fence, trail map, and entrance sign all appear to be in good shape with no wear.

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 3	**Date:** 4/2022

Direction Photo Taken:
North of Stoppleworth looking north.

Description:
Large woody debris in stream, white pine advanced regeneration along well defined brook.

Photo No. 4	**Date:** 4/2022

Direction Photo Taken:
Northeast corner of property looking north.

Description:
Interesting geological feature.

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 5	**Date:** 4/2022

Direction Photo Taken:
Top of slope at northeastern corner of property

Description:
Scrub pine and oak, pitch pine, and black cherry ecosystem.

Photo No. 6	**Date:** 4/2022

Direction Photo Taken:
Northeastern portion of property looking uphill/east.

Description:
Apparent unfinished trail to very nice view.

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 7	**Date:** 4/2022

Direction Photo Taken:
Center of Stand 1 north section

Description:
Remnants of previous timber harvest and significant white pine regeneration in the background.

Photo No. 8	**Date:** 4/2022

Direction Photo Taken:
Edge of stand 1 and stand 2 in the northern section.

Description:
Very common den occurrence in poorly formed or standing dead trees .

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 9	**Date:** 4/2022

Direction Photo Taken:
Stand 3 in the northern section near Hunter Road

Description:
Very wonderful habitat: Fine woody debris, coarse woody debris, tip ups, vertical and horizontal structure. This is exactly how it should look (though its not very pretty).

Photo No. 10	**Date:** 4/2022

Direction Photo Taken:
Adjacent top previous picture in Stand 3

Description:
Quite the change!

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 11	**Date:** 4/2022
Direction Photo Taken: Middle of property in stand 2	
Description: Two stages of white pine regeneration, seedlings in front and advanced regeneration in the background. This is how the white pine stand impacts management on adjacent stands.	

Photo No. 12	**Date:** 4/2022
Direction Photo Taken: Stand 1 near the western boundary line that zig zags	
Description: 20 to 30 year old hardwood pole stand.	

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Stoppleworth Conservation Area	**Project No.** 2022.027142.972

Photo No. 13	**Date:** 4/2022
Direction Photo Taken: Near the center of south portion of stand 1	
Description: Flat area with pooling water. Important habitat on property.	

Photo No. 14	**Date:** 4/2022
Direction Photo Taken: Central area of Stand 1	
Description: Interesting geological feature along ridge of stand 1.	

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Campbell's Peaceful Valley Conservation Area	**Project No.** 2022.027142.972

Photo No. 15	**Date:** 4/2022

Direction Photo Taken:
Western edge of property looking south

Description:
Where the Stand 3 and Stand 1 intersect, a beautiful stone bridge and culvert, as well as, a wolf white oak tree (indicator of past landuse).

Photo No. 16	**Date:** 4/2022

Direction Photo Taken:
Field adjacent to adler-maple swamp,

Description:
Small mammal habitat feature built in field.

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Campbell's Peaceful Valley Conservation Area	**Project No.** 2022.027142.972

Photo No. 17	**Date:** 4/2022
Direction Photo Taken: Stand 2 near the center of the property; between the field and Stand 3	
Description: Another indicator of past land use history.	

Photo No. 18	**Date:** 4/2022
Direction Photo Taken: Southern portion of stand 1.	
Description: Likely den.	

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Campbell's Peaceful Valley Conservation Area	**Project No.** 2022.027142.972

Photo No. 19	**Date:** 4/2022

Direction Photo Taken:
Northern section of stand 1.

Description:
Larger sized American chestnut with beginning of chestnut blight towards top of picture.

Photo No. 20	**Date:** 4/2022

Direction Photo Taken:
Stand 1 near the center

Description:
Interesting geological feature.

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Parciak Conservation Area	**Project No.** 2022.027142.972

Photo No. 21	**Date:** 4/2022

Direction Photo Taken:
Parking area off Bald Hill Road

Description:
Overview of parking area.

Photo No. 22	**Date:** 4/2022

Direction Photo Taken:
Near center of stand 1.

Description:
Poorly formed scrub oak stand that has important wildlife features (snags and coarse woody debris).

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Parciak Conservation Area	**Project No.** 2022.027142.972

Photo No. 23	**Date:** 4/2022

Direction Photo Taken:
Northeastern portion of stand 3

Description:
Natural disturbance creating microtopography and important watershed features (both for flooding and infiltration, but also exposed mineral soil and pools)

Photo No. 24	**Date:** 4/2022

Direction Photo Taken:
Seep headwater at northern tip of stand 4

Description:
Important seasonal spring feeding a stream down gradient. Upland water sources create biodiversity supporting ash, sugar maple, and yellow birch..

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Parciak Conservation Area	**Project No.** 2022.027142.972

Photo No. 25	**Date:** 4/2022
Direction Photo Taken: At snow quartz	
Description: New sign needed for snow quartz location.	

Photo No. 26	**Date:** 4/2022
Direction Photo Taken: Western edge of stand 4 near Burbank Road parking area.	
Description: Non-native invasive species mess.	

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Parciak Conservation Area	**Project No.** 2022.027142.972

Photo No. 27	**Date:** 4/2022
Direction Photo Taken: Near Burbank Road parking area in Stand 4	
Description: Very large, healthy ash tree.	

Photo No. 28	**Date:** 4/2022
Direction Photo Taken: Eastern edge of Stand 4.	
Description: A lone pitch pine.	

Client Name: Town of Tolland – Conservation Commission	**Site Location:** Parciak Conservation Area	**Project No.** 2022.027142.972

Photo No. 29	**Date:** 4/2022

Direction Photo Taken:
Edge of stand 3 and 4.

Description:
Grape vines offer native soft mass. These tend to be in concentrated areas and not "all consuming" like bittersweet.

Photo No. 30	**Date:** 4/2022

Direction Photo Taken:
At meteor rock.

Description:
Feature and informational look in good condition free of vandalism.

APPENDIX H: MAPS