



## **BIODIVERSITY INITIATIVE SITE PLAN PITCH PINE/SCRUB OAK HABITAT RESTORATION**

*Tim Simmons, NHESP Ecological Restoration Program  
Brian Hawthorne, Habitat Biologist*

### **MONTAGUE PLAINS WILDLIFE MANAGEMENT AREA MONTAGUE, MASSACHUSETTS**

#### **Introduction**

The Massachusetts Division of Fisheries and Wildlife (DFW) Biodiversity Initiative plans to maintain and restore fire-adapted pitch pine/scrub oak habitat on 700 acres of the Montague Plains Wildlife Management Area (WMA) in Montague, MA. This site occurs on a glacial lake delta that supports a pitch pine scrub oak community that due to fire exclusion over the past several decades, has become overstocked by pitch pine and mixed white pine/oak forest that is currently 60-75 years old. Prior to agricultural practices the site was an oak dominated system with occasional pitch pine. After agricultural abandonment the previously plowed areas became overstocked with pitch pine over a low diversity understory. This creates conditions prone to dangerous high intensity fires (Clark & Patterson 2003). Returning the barrens portion to an oak dominated condition will increase public safety while improving habitat for many rare species. DFW will retain 40-50% of the existing forest canopy including most remnant tree oaks, as well as some pitch pines. About 50-60% of the existing forest canopy will be removed to re-establish the open-canopy pitch pine/oak-scrub oak community that supports high concentrations of conservation target species. Harvested trees will primarily include white pine, pitch pine and oak spp. The desired future condition for this site is a fire-adapted community of scattered overstory trees with a dense shrub-dominated understory that will support rare species such as the highly specialized barrens buck moth, as well as various declining wildlife species, especially shrubland birds such as Eastern towhee, brown thrasher, prairie warbler, and whip-poor-will.

Potential restoration sites for grassland, shrubland and young forest habitats are identified through recommendations by ecologists, biologists and land managers, based on land use composition analysis using GIS technology, and field visits to prospective sites. Sites are selected for restoration according to criteria including habitat patch size, landscape setting, species of conservation need present on or near the site, and the current vegetation status. Through this evaluation process, the extensive pitch pine-scrub oak natural communities in the Montague Plains Wildlife Management Area (WMA) in the town of Montague are identified as a high priority for restoration.

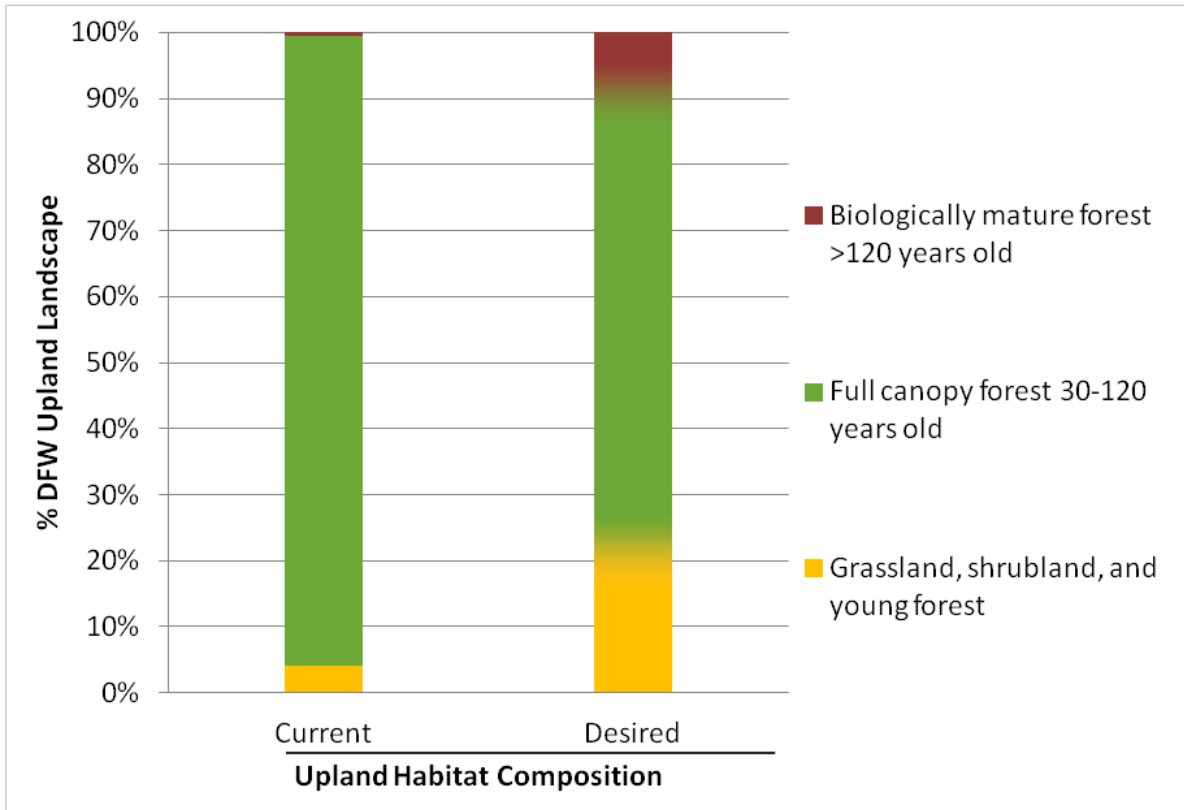
#### **Background**

DFW landscape goals for wildlife habitat (Fig. 1) have received broad public support and call for 20-25% of uplands in open habitats (including grassland, shrubland, and young forest) and 75-80% in a full-canopy forest condition, including 10-15% in forest reserves across approximately 180,000 acres of state WMA's. These goals are science-based and respond to the state-wide and regional decline in young forest, shrubland, and grassland habitat and associated wildlife caused by direct losses from development and alteration of natural disturbance processes (e.g. flooding, fires, etc.).

The DFW Biodiversity Initiative was established in 1996 to maintain and restore native diversity of flora and fauna through active land management, and has brought together Restoration Ecologists from the

DFW Natural Heritage & Endangered Species Program (NHESP) and University of Massachusetts professors and students along with Wildlife Biologists and Foresters from the DFW Habitat Program to conduct this extensive restoration effort. This effort will help address the decline of wildlife species of greatest conservation need associated with open habitats identified in the Massachusetts Wildlife Action Plan ([http://www.mass.gov/dfwele/dfw/habitat/cwcs/cwcs\\_home.htm](http://www.mass.gov/dfwele/dfw/habitat/cwcs/cwcs_home.htm)). The Wildlife Action Plan is a comprehensive strategy for identifying the state's key species requiring conservation actions and the habitats they occupy.

**Figure 1.** Current and desired upland habitat composition of over 123,800 acres of upland on 152,666 acres owned by Massachusetts Department of Fish and Game as of 2012.



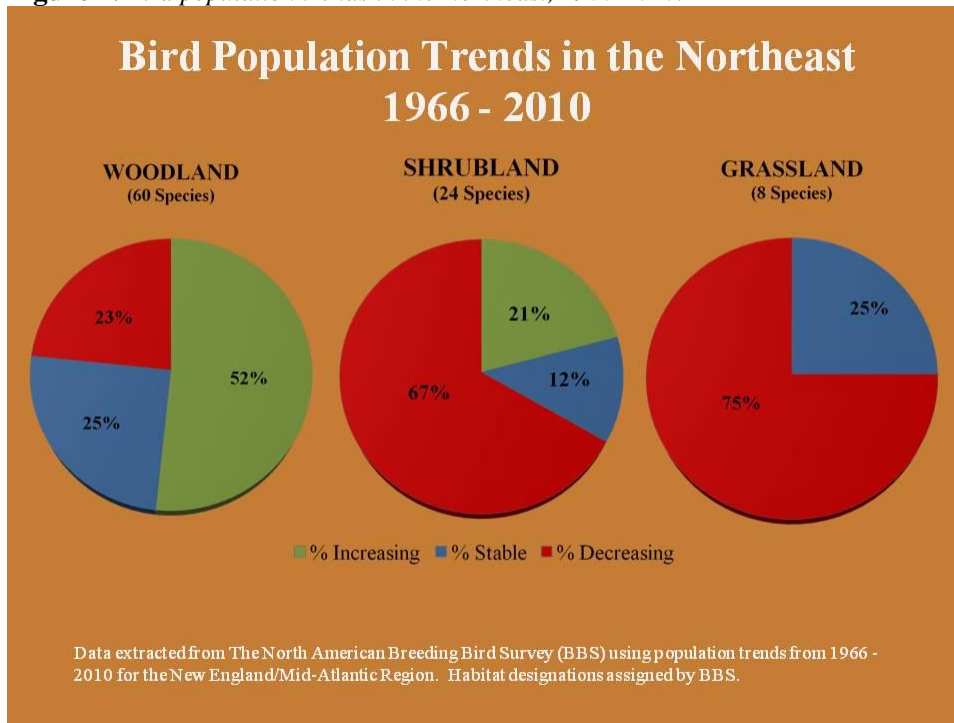
Open habitats such as grasslands, shrublands, and young forest have been a part of the New England landscape for millennia. Prior to European colonization, natural disturbance processes including beaver activity along thousands of streams throughout Massachusetts, and recurrent spring flooding along dozens of river courses generated extensive patches of open habitats across the state. Beaver dams form extensive shallow ponds that typically persist for years or decades until the beaver exhaust local food supplies and abandon the flowage. The abandoned dam soon falls into disrepair and ultimately breaches, allowing the extensive flowage to drain, leaving in its wake an open fertile site that is quickly colonized by herbs and shrubs that provide extremely beneficial wildlife habitat. Likewise, spring flooding following ice-out along major rivers resulted in flowing ice scouring extensive areas along the river banks that were typically colonized by herb and shrub vegetation after floodwaters subsided.

In addition, both wildfire and fires set by Native Americans along the coast and rivers (Patterson & Sassaman 1988) and in the uplands adjacent to major river valleys (Byers 1946) contributed additional, extensive open habitats. Windstorms also create patches of open habitat, but most wind events in northeastern forests typically result in small (<0.1 ha) openings (Runkle 1982, Lorimer and White 2003). Hurricanes and tornadoes (like those that devastated portions of several Massachusetts towns in June of 2011) do occur in southern New England, but relatively infrequently. While occasional major windstorms can create extensive patches of open habitat that can periodically bolster local populations of wildlife species that benefit from disturbance, the infrequent occurrence of major wind events typically cannot sustain populations of disturbance-dependent wildlife species over time. Rather, these species historically relied on more routine disturbance events like flooding and fire.

However, during the 18<sup>th</sup> century, beaver were extirpated from Massachusetts by unregulated trapping (Foster et al., 2002), then in the 19<sup>th</sup> century humans began constructing dams along streams and rivers, eliminating many open habitats that had formerly been provided by spring flooding events along major watercourses. During this same time period Native American tribes were decimated by European diseases like small pox and by conflict with European settlers, and fire became far less common in coastal areas and major river corridors. But in what can be seen as a great ecological irony, many native wildlife species associated with these natural disturbance habitats actually increased despite the extirpation of beaver, the damming of streams and rivers, and the substantial reduction in fire because much of Massachusetts' original forests were cleared for farming and fuelwood, creating a landscape dominated by open habitats where extensive old-growth forest had formerly occurred. These dynamic landscape changes created conditions where wildlife species associated with open habitats such as bobolinks and northern harriers thrived (Cronon 1983, Foster & Aber 2004, Whitney 1994).

As Massachusetts agricultural lands were abandoned from the 1850's into the early 1900's, and as the use of fuelwood gave way to fossil fuels in the mid-1800's, fallow fields and abandoned woodlots became very productive wildlife habitat for species such as American woodcock, whip-poor-will, prairie warbler, eastern towhee, field sparrow and New England cottontail. Eventually though, beginning around the 1960's, abandoned fields and woodlots succeeded to closed-canopy forest, and wildlife species dependant on grasslands, shrublands, and young forest habitats declined dramatically (Hill and Hagan 1991, Litvaitis 1993). This decline, along with limited forest regeneration cutting, and suppression of natural disturbance processes (i.e. flooding and fire) have resulted in a relative scarcity of these habitats in Massachusetts today (USDA 2000). The on-going decline of open habitats in New England is recognized as a serious threat to biodiversity; many wildlife species dependent on these habitat types are in decline (Askins 1998, DeGraaf & Yamasaki 2001, Litvaitis 2003). Native bird population trends show alarming declines for both grassland and shrubland birds, as well as for some forest nesting birds that move from mature forest after nesting to utilize food and cover resources found in open areas (Fig. 2). Consequently, all of the New England states include grassland, shrubland and young forest habitats and many associated wildlife species in their states' Wildlife Action Plans as species of conservation need ([http://www.teaming.com/state\\_wildlife\\_strategies.htm](http://www.teaming.com/state_wildlife_strategies.htm)).

**Figure 2.** Bird population trends in the Northeast, 1966-2010.



Beaver returned to Massachusetts in the early 1900's and with the introduction of trapping regulations their population increased in size. This provided some high quality wildlife habitats, but human land use (primarily urban and suburban development, and road construction) eliminated many sections of low gradient streams from beaver activity (beaver are routinely removed from sections of stream wherever roads cross streams through culverts or under bridges, and beaver are also routinely removed when their flooding activities pose a threat to well fields, septic fields, or other development infrastructure). In short, after beaver were extirpated from Massachusetts, human population increased rapidly, and the same types of places preferred by beaver (relatively flat areas with good access to fresh, flowing water) are also preferred for human development. So, while beaver are once again part of our landscape today, their ability to establish extensive patches of open habitat has been substantially constrained by human development.

### **Montague Plains WMA Landscape Setting**

The Montague Plains WMA is located in the town of Montague (Franklin County), Massachusetts, within the northern portion of the Connecticut Valley. Montague Plains and the adjacent Bitzer Hatchery contain about 1,673 acres in one relatively contiguous block located in the rural north-central portion of the state. This block represents the largest WMA in the Connecticut Valley Forest Management Zone. Montague Plains falls between Turners Falls Road to the west, Turners Falls to the north, and the village of Lake Pleasant. Bitzer is located on the west side of and adjacent to Montague Plains and falls on both sides of Turner Falls Road.

In addition, this WMA is located in the northern portion of the Connecticut River Valley ecoregion, of which is approximately 22% is permanently protected open space. Almost 60% of this ecoregion is developed. This ecoregion has distinctive moderate climate, rich floodplain soils and generally level topography compared to adjacent ecoregions. The Montague Plains WMA is located

within the Connecticut River watershed and the extensive aquifer is the water supply for the nearby Montague Fish Hatchery.

One unnamed intermittent stream drains from Wills Hill onto the sandplain and was diverted from its natural channel in the 1940's by Plains Road, near the intersection with Bartlett Road. The 1941 USGS topographic map (Greenfield quadrangle, 7.5 minute series, surveyed 1936) shows a small pond or spring along this drainage at the end of a trail. It is unclear where the original channel flowed.

MPWMA is located on flat terrain within a mostly developed landscape. This WMA lies in close proximity to the Montague WMA (located in an adjacent ecoregion and different FMZ). Additional state forest land owned and managed by the Department of Conservation and Recreation (DCR) lies within the boundary of this WMA and potentially complements this forest habitat.

### **Site History**

The 1,500+ acre Montague Plains WMA was acquired in 1999 from Northeast Utilities in order to protect one of the largest inland examples of pitch pine/scrub oak natural community remaining in Massachusetts and the Northeast region. The site comprised predominately even-aged, closed canopy forest habitat, although elements of a regionally important fire-adapted pitch pine/scrub oak natural community were still present at the site at the time of acquisition. Of the 1,500+ acres, roughly 700 acres were/are transitional Northern Hardwood/Mixed Oak forest, while about 800 acres were mixed pine/oak forest with inclusions of tree oak and scrub oak. Much of this WMA has historically been influenced by fire, but human fire exclusion beginning in the early 1900's allowed for the build-up of dangerous fuel loads that have the potential to result in uncontrollable crown fires that readily threaten private property and lives. Indeed, wildfires that originated within what is now the Montague Plains WMA destroyed houses in the nearby village of Lake Pleasant in 1938. There have been more than 100 wildfires reported in the last 75 years.

Pitch pine/scrub oak natural communities are the most fire-prone vegetation types in New England, and significant evidence exists suggesting that fire was an important influencing factor on the vegetation at Montague Plains for centuries before European settlement. A mosaic of pitch pine and scrub oak in various proportions occurs throughout the xeric soils of the Plains mixed with a small amount of central hardwoods. The adjacent Wills Hill area contains mixed hardwood forest habitat on loamy soils.

The Pitch Pine/Scrub Oak natural community is rare in Massachusetts and among the most imperiled in the United States [<http://www.mass.gov/eea/docs/dfg/nhosp/natural-communities-facts/priority-natural-commun.pdf>]. In fact, Montague Plains is the largest remaining inland occurrence of this community type in New England. The pitch pine/scrub oak plant association found at Montague Plains develops on droughty, low nutrient soils and are fire-maintained and fire-dependent. The pitch pine/scrub oak natural community at Montague Plains developed on excessively drained, Windsor loamy sand soils and flat topography. Agricultural landuse over much of the area included tilling of the soil. In these plowed areas, a near monoculture stand of pitch pine revegetated following farm abandonment (Motzkin et.al. 1999). Although most of the Plain was abandoned for agricultural use prior to 1960 and historical aerial photographs show three small fields still being actively used for agriculture as recently as 1966, all agricultural use appears to have ceased by 1971. These aerial photographs show that most of the closed canopy pitch pine in the central part of Montague Plain grew since 1966. Some of the threats to this community include development, introduction of non-specific bio-control agents, the introduction of non-native invasive plants, fire exclusion and fragmentation (DFW 2006).

While most of the species within this uncommon natural community respond and recover well from fire, the highly combustible plant materials found in the crowns of these dense, mature pitch pine

stands produce a dangerous situation in close vicinity to human communities. The hazards associated with the occurrence of an active crown fire can be measured in acres burned, lives lost, and homes damaged or destroyed. Crown fires occur at high rates of spread, are difficult to control and result in long lasting ecological effects. Duveneck (2005) estimated that under early spring moisture conditions, crown fire events are possible within the dense pitch pine stands on the Montague Plains WMA with canopy wind speeds as low as 21 miles per hour. In contrast, within a recently thinned (no longer dense) pitch pine stand, Duveneck (2005) estimated that canopy wind speeds exceeding 60 miles per hour would be required to maintain an active crown fire (under the same seasonal moisture conditions).

DFW began restoration of open-canopy pitch pine/scrub oak at Montague Plains in 1998. This effort included tree clearing on about 185 acres to thin the canopy within dense pitch pine stands (priority was initially given to closed-canopy stands adjacent to residential areas to reduce wildfire danger to people and property), mowing of fire breaks, and carefully implemented prescribed fires conducted by trained crews. Additional acreage of remnant scrub-oak has also been managed using a combination of mowing and burning and areas beneath some powerlines have been managed with regular burning. Biological monitoring of plant and wildlife response has been conducted on these areas throughout the past decade, and has shown that target species have responded very favorably to initial restoration efforts (Table 1 & 2). These restoration efforts are intended to not only maintain and restore the pitch pine/scrub oak habitat on site, but to simultaneously reduce fuel loads and the risk of a running crown fire in the event of a wildfire.

Throughout the past century, Montague Plains has been extensively used for passive recreation and illegal ATV trespass has continually occurred at the site. As part of on-going restoration efforts, large stones or logs have been placed at access points to minimize un-permitted off-road vehicles that damage habitat. Future efforts include the installation of gates and guard rails at key access points in collaboration with the electric utility which owns rights of way across the Montague Plain. The 2003-4 timber harvests created patches of open canopy forest, shrubland habitat, and young forest habitat adjacent to power line habitat, fields, and mature forest, providing an aesthetically pleasing mix of habitat conditions. These habitat restoration efforts will also provide additional habitat for a number of game and non-game species. Currently the tract is an important local area frequented by birdwatchers and other naturalists. Hunting opportunities and other passive recreational uses such as hiking, bird watching, and viewing of butterflies and moths will be enhanced by the proposed treatment.

### **Historical/Cultural Resources**

The area proposed for habitat restoration occurs on previously farmed soils. Prior to previous management at the site the area was reviewed for archaeological sensitivity for pre-historic sites, using the key developed by the MA Historical Commission. The site has less preferred aspect, xeric outwash deposits that were less likely to be used for Native American agriculture (Motzkin et al. 1999) and is farther from a water source than sites most likely to have pre-European settlements. The harvesting techniques used for areas are consistent with protecting these resources. There was a large Native American village in what is now Turners Falls.

In addition, DFW consults with the MHC regarding potential for pre-historic Native American sites on all managed properties, and for the MPWMA, MHC has determined that there is no likely impact on pre-historic artifacts at this site. DFW applies Best Management Practices (BMPs) to conserve both potential historic (e.g. Native American encampment areas) and visible cultural resources (e.g., stone piles, stone walls and cellar holes) at all sites by mapping cultural resources with GPS, by using existing roads whenever possible, by establishing landing areas on previously utilized roadside sites, and by preventing heavy machinery from crossing stone walls and foundations, and by restricting machinery to

operating under dry or frozen conditions to minimize disruption of any historical artifacts that may lie beneath the soil surface.

### Rare Species

A review of the Massachusetts NHESP Atlas determined that the MPWMA has been identified as habitat for at least 22 species of declining or rare species occur within this uncommon natural community including: Nantucket shadbush (*Amelanchier nantucketensis*), New Jersey tea (*Ceanothus americanus*), spreading tick trefoil (*Desmodium humifusum*), fringed gentian (*Gentianopsis crinita*), wild lupine (*Lupinus perennis*), white rattlesnake root (*Prenanthes alba*), spring rock spike moss (*Selaginella rupestris*), blueberry sallow (*Apharetra dentata*), New Jersey tea inchworm (*Apodrepanulatrix liberaria*), frosted elfin (*Callophrys irus*), pine woods underwing (*Catocala sp*), Northern hairstreak (*Fixsenia ontario*), geometer moth (*Glena cognataria*), William's tiger moth (*Grammia williamsii*), slender clearwing sphinx moth (*Hemaris gracilis*), barrens buckmoth (*Hemileuca maia*), pine barrens itame (*Itame sp.*), barrens metarranthis moth (*Metarranthis apiciaria*), pink sallow (*Psectraglaea carnosa*), pine barrens zale (*Zale sp.*), pine barrens zanclognatha (*Zanclognatha martha*) and the eastern box turtle (*Terrapene carolina*) (DFW 2006). DFW Biodiversity Initiative Habitat Restoration Site Plans are reviewed by NHESP staff biologists. The current proposed work is subject to timing restrictions for eastern box turtle (Table 1). Mitigation was not required for the protection of other rare species documented on this site (Table 1). Site Plans are also reviewed by NHESP staff for the presence of any element occurrence (EO) records within the timber sale areas (EO's document rare species occurrences that may not have been mapped yet in Atlas, and thus would not be mitigated during a timber sale in the absence of direct consultation with NHESP staff).

Table 1. Rare and declining species documented on the Montague Plains WMA (DFW unpublished data).

Common Name	Scientific Name	Rank	State Status	General Habitat	Habitat Specifics
Nantucket shadbush	<i>Amelanchier nantucketensis</i>	G3QS3	special concern	pine barrens	Shrub openings
New Jersey tea	<i>Ceanothus americanus</i>	G5S3	watch-list	dry, open woods and thickets	Open woodlands and edges
spreading tick trefoil	<i>Desmodium humifusum</i>	G1G2 QS1	endangered	dry woods	Open areas
fringed gentian	<i>Gentianopsis crinita</i>	G5S4	watch-list	open to semi-open wetlands; stream margins	Open habitats
wild lupine	<i>Lupinus perennis</i>	G5S3	watch-list	sunny areas in sandy soils	Grassland-open woods
white rattlesnake root	<i>Prenanthes alba</i>	G5S4	watch-list	moist to wet woodlands	Openings in oak woods
spring rock spikemoss	<i>Selaginella rupestris</i>	G5S4	watch-list	rock outcrops or sunny gravelly soil	Neutral, rock outcrop
New Jersey tea inchworm	<i>Apodrepanulatrix liberaria</i>	G4S1S 2	threatened	Oak barrens	foodplant
frosted elfin	<i>Callophrys irus</i>	G3S2S 3	special concern	Savanna/grassland	foodplant
pine woods underwing	<i>Catocala sp1</i>	G5S3	special concern	pine barrens	foodplant
northern	<i>Fixsenia ontario</i>	G4S3	special	Oak woodlands	Nectar sources

hairstreak			concern		
a geometer moth	<i>Glena cognataria</i>	G4S3	watch-list	Heath barrens	foodplant
William's tiger moth	<i>Grammia williamsii</i>	G4S1	threatened	grasslands	grassland
slender clearwing sphinx moth	<i>Hemaris gracilis</i>	G4S2	special concern	Heath barrens	Foodplant and nectar
barrens buckmoth	<i>Hemileuca maia</i>	G5S1	threatened	pitch pine barrens	foodplant
pine barrens itame	<i>Itame</i> sp1	G3S2S3	special concern	pine barrens	foodplant
barrens metarranthis moth	<i>Metarranthis apiciaria</i>	GUS1	endangered	pine barrens	Open woodlands
pink sallow	<i>Psectraglaea carnosa</i>	G3S2S3	special concern	Oak barrens	foodplant
pine barrens zale	<i>Zale</i> sp1	G3QS2S3	special concern	pitch pine - scrub oak barrens	Foodplant pine needles
pine barrens zanclognatha	<i>Zanclognatha martha</i>	G4S2	threatened	maturing pitch pine stands	foodplant
eastern box turtle	<i>Terrapene carolina carolina</i>	G5S3	special concern	forests, esp. moist open deciduous	Forage and nesting
<b>Declining Bird Species:</b>					
Brown thrasher	<i>Toxostoma rufum</i>				Shrubland
Whip poor will	<i>Caprimulgus vociferus</i>				Open woodlands
Eastern towhee	<i>Pipilo erythrophthalmus</i>				Shrub and open woods
Prairie warbler	<i>Dendroica discolor</i>				Shrubland

In addition MPWMA provides important habitat for woodcock, wild turkey and ruffed grouse. New England Cottontail (*Lepus transitionalis*) were studied on the Plain in the 1950's but have not been observed recently.

At least 2 vernal pools occur within this site plan unit and are afforded the same protection as certified vernal pools during active management activities (Figure 5). Because some animals are completely dependent upon vernal pools for part of their life cycle, the list of these "obligate" ephemeral vernal pool species includes many rare species. The two vernal pools are located on the Wills Hill portion of Montague Plains. Vernal pools have not been observed within or adjacent to the past or proposed treatment units on Montague Plains WMA.



## **Biological Monitoring**

Bio-monitoring at MPWMA began in the 1970's and continues to the present day. Results of long-term monitoring of birds, lepidoptera and vegetation are used to:

- 1) Assess results of habitat enhancement and management for species of conservation need.
- 2) Verify the suitability of the management regime and adapt as necessary.
- 3) Find and treat any invasive exotics that may colonize the site.

**Table 2. History of Biological Monitoring**

<b>Year</b>	<b>Type of survey</b>
1970 – present	Surveys of nocturnal and diurnal lepidoptera
1986-1990	Forest inventory plots to document abundance and condition of forest resources
1995 – present	Permanent grid system of plots established by Harvard Forest staff to document vascular plants and community structure
2005	An additional 35 DFW forest inventory plots (allowable harvest) inventoried
2004/2005	Assessment of potential vernal pools
1978-present	Vascular plant surveys
2004-2006	Pre-harvest plant inventories (Form 3)
August, 2007	Pre-harvest plant survey for contract CV-MP-TS2
2000-present	USFS staff sampled bird communities at 63 permanent plot locations within CV-MP-TS1 and CV-MP-TS2
2006-2010	Radiotelemetry study of box turtles

A variety of monitoring efforts have taken place within the site plan unit dating from 1986 – present (Table 2). Forest inventory plots were sampled throughout some of the DFW WMAs from 1986-1990 to document the abundance and condition of the forest resources. Additional forest inventory plots (allowable harvest plots) have been laid out to further document the condition of the forest communities within the property. This aspect of the inventory is complete (35/35 plots). A field assessment of potential vernal pools (PVPs) was conducted during the spring and summer of 2004 and 2005. Each of the 4 PVPs on this WMA were visited and documented and 2 were found to be functional. These 4 pools were mapped using GPS to facilitate appropriate planning and mitigation during subsequent management activities.

Forest communities scheduled for treatment to create young forest communities or more structurally diverse forest communities will be inventoried for rare plants and non-native invasive plants before the implementation of the treatment and monitored after the treatment. A permanent grid system of study plots (132) was established in 1995 by Harvard Forest staff documents the vascular plants as well as the community structure of this WMA. Additional data from these plots gathered by University of Massachusetts researchers have been used to measure fuel loading and fuel types. A subset of the same plots (63) was used to define bird census stations which are monitored by USFS ornithologists and technicians to determine management effects on avifauna. These plots were GPS located by a DFW consultant. Plots located within CV-MP-TS1 were re-established and re-measured by DFW staff prior to the 2002-2004 prescription. Others plots will be re-measured in the future. The pitch pine – scrub oak plant community on the Montague Plain WMA has been thoroughly documented.

Each treatment will be monitored to determine the extent to which the new community represents the desired outcome and complements the future desired dynamic. Monitoring will also help managers to

design future management actions, to continue to document rare plant and animal trends and to continue to prioritize additional areas for conservation action. Monitoring will provide data that can be used to correct the course of management decisions in the future.

The USFS bird census also has plots at Montague Plains, within the scrub oak burn units and at sites within the adjacent untreated landscape. Researchers completed samples before the treatments were implemented and continue to sample plots following the treatments. Preliminary results include documentation of the presence of brown thrashers, nesting prairie warblers, whip-or-wills and other habitat specialists like the Pine Barrens Buck Moth that are either not found within the surrounding landscape or are present at low population densities. Cooperative monitoring efforts will continue within the uncommon plant communities of this WMA.

Entomologically, Montague Plains has been surveyed for nocturnal and diurnal Lepidoptera periodically since the 1970s. A University of Massachusetts Master of Science candidate conducted a radiotelemetry study of box turtles at the WMA recently.

Additional pre-harvest plant inventories were completed during 2004-6 field seasons. These inventories use an adaptation of the NHESP "Form 3" and can be accessed from the Forestry Program's Form 3 database. Data collected include landform, coarse woody debris, soil, evidence of land use history and disturbance, height and cover class of forest strata, and a complete species list with cover class.

### **Environmental Permitting**

Management activities on DFW and other state-owned land in Massachusetts are subject to a variety of Federal and Massachusetts laws and regulations. Many of these regulations focus on preventing damage to water and wetland resources, while others protect endangered species and cultural resources, or prevent accidental fire damage. The full text of Massachusetts General Laws is available at [www.state.ma.us/legis/legis.htm](http://www.state.ma.us/legis/legis.htm).

DFW habitat restoration projects comply with permit requirements of the Massachusetts General Law (MGL) Chapter 132, The Forest Cutting Practices Act (when applicable), and specific components of MGL Chapter 131, The Wetlands Protection Act which requires Forest Cutting Plan or Site Plan review by the Massachusetts Natural Heritage & Endangered Species Section staff for any management activities that coincide with estimated or priority habitat for rare species. DFW management activities that do not fall within estimated or priority habitats are still reviewed by Natural Heritage for potential element occurrences (EO's) of rare species that are not reflected in the estimated or priority datalayers. Mitigation procedures, if necessary, recommended by Natural Heritage to conserve rare species are implemented.

### **Site Description**

At MPWMA approximately 350 acres have been previously managed through prescribed fire, canopy thinning, understory mowing, invasive plant treatments and combinations of these practices. Approximately 100 acres of this had not been plowed during agricultural use, and these areas are dominated by scrub oak with occasional tree oak, pitch and white pine. The remaining 250 acres of pitch pine forest were closed canopies of dense pitch pine over a suppressed shrub and herb layer reflecting the site's recovery from 18<sup>th</sup> – mid 20<sup>th</sup> century agricultural uses.

The next phase of proposed treatment for FY 2014 will maintain and restore approximately 250 additional acres of fire adapted pitch pine/scrub oak habitat (Figs. 3 & 4). Approximately 141 acres of full-canopy forest (units T1-T5) composed of pitch pine, white pine, and occasional tree oaks will have

the majority of the tree canopy removed to stimulate understory regeneration of scrub oak, other native shrubs, and tree oaks, and the understory will be mowed to reduce fuel loads in order to facilitate prescribed burning. An additional 109 acres of previously thinned open-canopy forest (units M1-M4) composed of scattered pitch pine and tree oak above a dense understory of regenerating tree oak, scrub oak, and pine will be mowed to reduce fuel loads in order to facilitate prescribed burning. 103 acres of these open canopy areas were originally mowed with a fecon type tracked machine, then had 70-80% of the tree canopy cleared in 2007 through 2009 to facilitate future management using prescribed fire to maintain/enhance native pitch pine/scrub oak communities. Six acres will be mowed for the first time. Prescribed fire and mowing/mulching has been applied to portions of this property in recent years, but not all acres scheduled for treatment could be completed due to logistical issues (limited availability of fire crews coupled with the need for appropriate weather conditions) and fiscal constraints (lack of funds to contract mowing). Units T3, T4, T5 and M1 are subject to NHESP restrictions for Eastern box turtles.

Prescribed fire is the preferred management tool for maintaining pitch pine/scrub oak habitats, and is best applied within 2-3 years of initial mowing, and given that 4-10 years has now passed since initial mowing on these acres (Units M2 – M4), fuel loads are now too high for burning, and need to be reduced mechanically.

The site comprises eight Management units (Fig. 3 & 4), and a desired future condition (DFC) is presented for each unit so that units will collectively provide the desired pitch pine/scrub oak habitat.

### **Treatment Units T1-T5**

#### Current Condition and Proposed Treatments:

These units are relatively flat, full canopy pitch pine and oak forest (>75% canopy cover) with some understory patches of scrub oak, native shrubs, and trees. All stems  $\geq 4''$  DBH that are not marked or otherwise identified for retention shall be cut and removed from the site. All stems  $< 4''$  DBH that are not marked or otherwise identified for retention shall be mowed/mulched in place to within  $\leq 2''$  of the ground.

All stumps from mowed/mulched stems  $< 4''$  DBH shall be flush cut to within  $\leq 2''$  of the ground and remain on site or ground with a stump grinder, or other machinery approved by DFW to a depth of  $\geq 2''$  below ground level.

Desired Future Condition: Open scrub oak shrubland and heathland beneath an open canopy forest of tree oak and pitch pine, maintained on a 3-7 year interval with mowing/burning.

### **Treatment Units M1-M4**

#### Current Condition and Proposed Treatments:

These units are relatively flat open canopy forest (20-30% canopy cover) with thick patches of scrub oak and tree oak sprouts 4-10 feet tall, pitch pine 2-7 feet tall, and a small percentage of other mixed shrubs and saplings. All stems that are not marked or otherwise identified for retention shall be mowed/mulched in place. All stumps from mowed/mulched stems can remain on site provided they are within  $\leq 2''$  above the ground, or, if mowed/mulched stems originate from existing stumps, within  $\leq 2''$  above the existing stump height.

Desired Future Condition (DFC): Open scrub oak shrubland and heathland beneath an open canopy forest of tree oak and pitch pine, maintained on a 3-7 year interval with mowing/burning.

## **Management Goals and Strategy**

The primary goal is to restore the pitch pine/ scrub oak natural community of the MPWMA and maintain it to support viable populations of rare and declining species of conservation need. The timing of all management actions (prescribed fire, mowing, tree clearing, stump grinding, seeding, and invasive plant control) will include consultation with NHESP to ensure that the activities conserve species of conservation need. The strategy to accomplish this goal involves: 1) vegetation management; 2) invasive species control; and 3) biological monitoring.

### ***1) Vegetation Management***

The next round of vegetation management will be implemented in the winter/spring of 2014. The first phase will involve a timber harvest, as prescribed below. Trees with merchantable value will be harvested using a whole tree harvest system and skidded to landings (Fig. 4 & 5) for removal as logs, cordwood, or chips. Some pitch pine, tree oaks, and other trees of particular conservation value will be retained. Ideally, mechanically treated areas will be left with desired shrub species retained, little to no slash, and occasional soil scarification from machinery to promote the establishment of desired vegetation.

Tree removal action per Unit will be executed as following:

- **T1:** Mark to cut, with 50-60% tree cover remaining (pitch pine and tree oak). Retained crowns will be sparsely spaced or occurring in very sparsely spaced aggregations of 2-4 stems. Mow/mulch understory shrubs and trees. This unit is to be maintained as an open pitch pine & scrub oak shrubland maintained on a 3-7 year interval with mowing/burning.
- **T2:** Mark to cut, with 50-60% tree cover remaining (pitch pine and tree oak). Retained crowns will be sparsely spaced or occurring in very sparsely spaced aggregations of 2-4 stems. Mow/mulch understory shrubs and trees. This unit is to be maintained as an open pitch pine & scrub oak shrubland maintained on a 3-7 year interval with mowing/burning.
- **T3:** Mark to cut, with 50-60% tree cover remaining (pitch pine and tree oak). Retained crowns will be sparsely spaced or occurring in very sparsely spaced aggregations of 2-4 stems. Mow/mulch understory shrubs and trees. This unit is to be maintained as an open pitch pine & scrub oak shrubland maintained on a 3-7 year interval with mowing/burning.
- **T4:** Mark to cut, with 50-60% tree cover remaining (pitch pine and tree oak). Retained crowns will be sparsely spaced or occurring in very sparsely spaced aggregations of 2-4 stems. Mow/mulch understory shrubs and trees. This unit is to be maintained as an open pitch pine & scrub oak shrubland maintained on a 3-7 year interval with mowing/burning.
- **M1-M4:** Mow/mulch understory shrubs and trees. These units will be maintained as an open pitch pine & scrub oak shrubland maintained on a 3-7 year interval with mowing/burning.

All units will have understory mowing complete. In units that will also undergo timber harvesting mowing can be complete either before or after the timber harvest is complete. Mowing will likely be completed by a Brontosaurus or Fecon Bullhog mounted on a tracked loader or similar mower. Native shrubs will be retained where possible. Invasive exotic vegetation has not been documented within these treatment units.

Prescribed fire is the preferred management tool for maintaining pitch pine/scrub oak habitats, and is best applied within 2-3 years of initial mowing. Maintenance of these pitch pine/scrub oak areas will likely be by a combination of mowing and prescribed fire on a frequency dependant upon the response of target and non-target shrubland species. Initially, these treatments may need to be employed on a more frequent basis, with mowing occurring roughly on a 3-5 year rotation. However, after a few cycles of mowing and prescribed fire, it is expected that these Units will become much less management dependant as species such as scrub oak begin to dominate the shrub layer. Prescribed fire will be applied according to a previously prepared Fire Management Plan that was written in 2003 by Kennedy Clark and William Patterson through the University Of Massachusetts Department Of Natural Resources Conservation which describes all the details necessary to conduct prescribed burning safely while also meeting management goals. A fire prescription for the site was completed in 2004 and is revised as necessary.

## ***2) Invasive Exotic Species Monitoring and Control***

Exotic species are widely recognized as a primary threat to rare species after habitat destruction (Wilcove et al 1998, Wilson 1992), and the economic cost of invasive exotic control can be enormous (OTA 1993, Pimentel et al 2000). If left unchecked, invasive exotic plants can quickly become the dominant species, displacing native species and degrading ecosystems (Mack et al 2000). Invasive plants often thrive on disturbance (Hobbs and Huenneke 1992, Hobbs and Humphries 1995), a concern because maintenance of early-successional habitat is dependent on disturbance. Early control measures, when the invasion is relatively contained, are preferred to minimize costs (Hobbs and Humphries 1995).

At Montague Plains, non-native invasive plants can be found as scattered roadside populations; however the property itself is relatively free of invasive plants. The property contains numerous unmaintained roads and trails which are occasionally used by unauthorized all terrain vehicles. The risk of increasing the percentage of invasive plants along roadside locations disturbed areas is possible and should be monitored.

Typical invasive exotic control options include chemical (herbicide) and/or mechanical methods (e.g. individual plant pulling, repeated mowing). Any herbicide used will be registered with MA Dept. of Agricultural Resources for use in Massachusetts and will comply with state and federal pesticide application regulations. DFW biological monitoring activities specifically document both rare and invasive plant species.

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Figure 3.

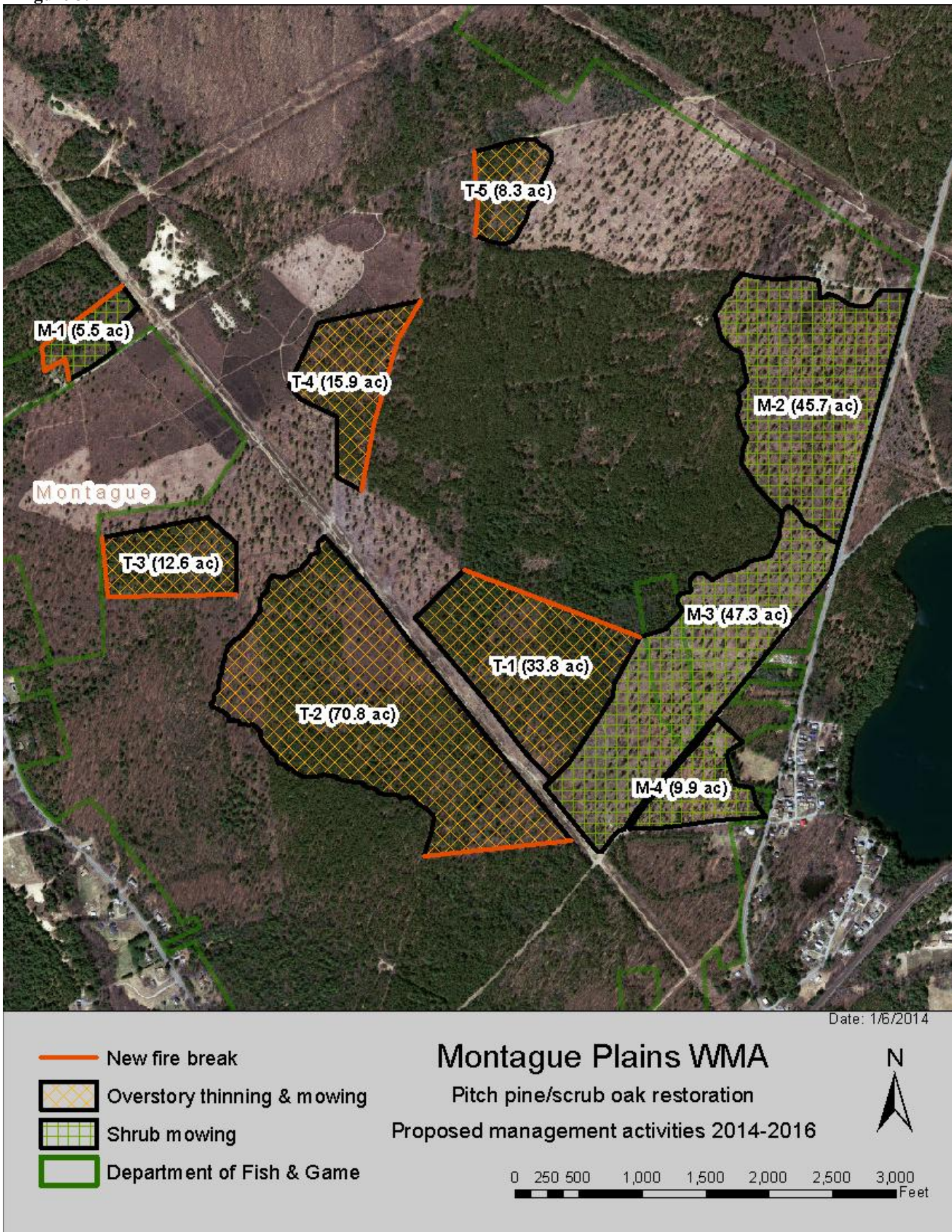
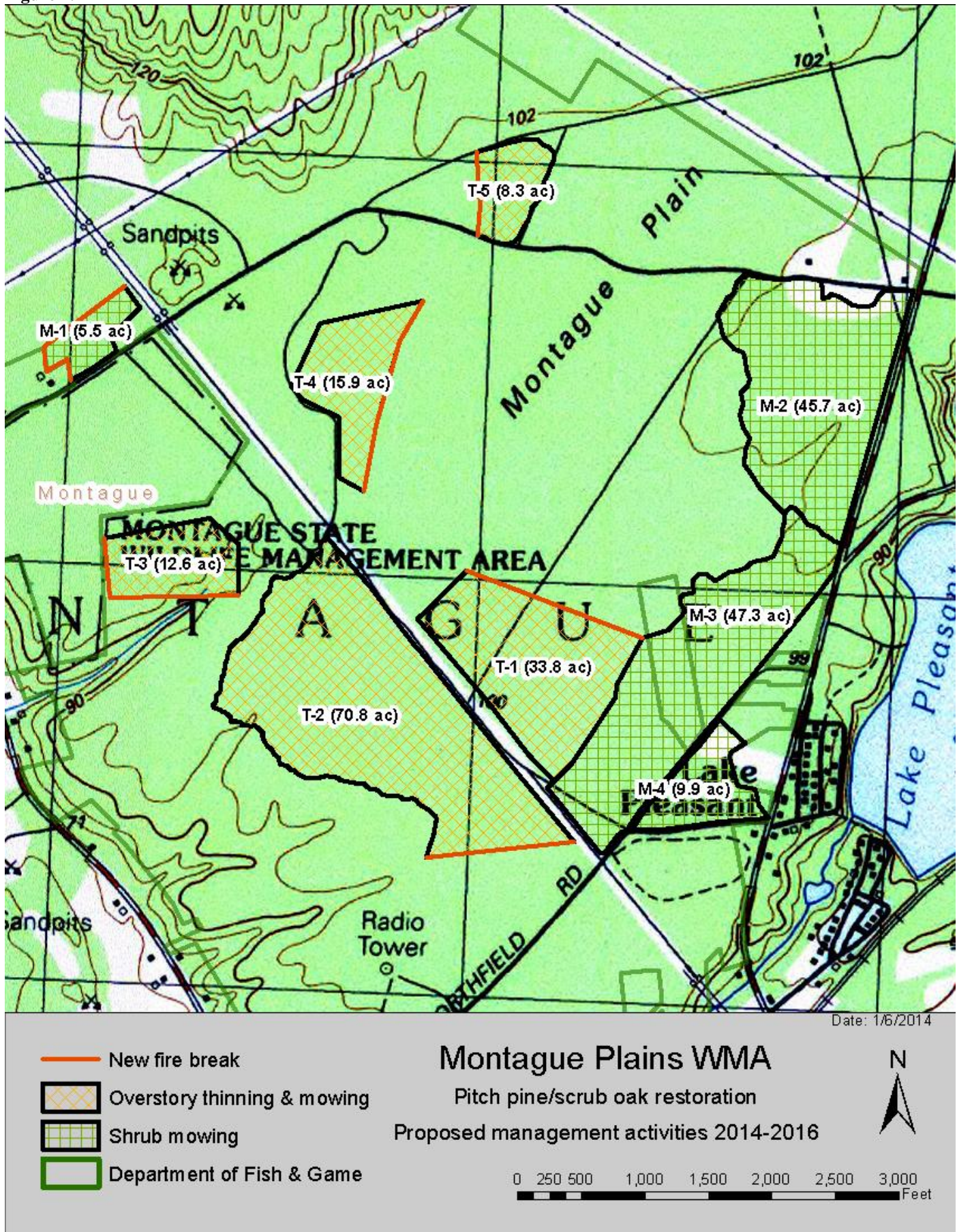


Figure 4.



**Appendix I. Understory species present (excludes listed species)**

Eleven understory plots were sampled at MPWMA / Bitzer Hatchery and resulted in the following species list. This list is likely not fully representative of all understory species present in the site plan unit.

<b>LATIN_NAME:</b>	<b>CommonName:</b>
<i>Acer pensylvanicum</i>	Striped Maple
<i>Acer rubrum</i> var. ?	Red Maple
<i>Acer saccharum</i>	Sugar-maple
<i>Amelanchier</i> sp.	A Shadbush
<i>Aralia nudicaulis</i>	Wild Sarsaparilla
<i>Aronia</i> sp.	Chokeberry Genus
<i>Aster divaricatus</i>	White Wood-aster
<i>Betula alleghaniensis</i>	Yellow Birch
<i>Betula lenta</i>	Black Birch
<i>Betula papyrifera</i>	Paper-birch
<i>Betula</i> sp.	A Birch
Bryophytes	Mosses and Liverworts
<i>Carex</i> sp.	A Sedge
<i>Carya glabra</i>	Pignut
<i>Carya ovata</i>	Shagbark-hickory
<i>Carya</i> sp.	Hickory Genus
<i>Castanea dentata</i>	American Chestnut
<i>Chimaphila maculata</i>	Striped Pipsissewa
<i>Coptis trifolia</i> ssp. <i>groenlandica</i>	Goldthread
<i>Cornus canadensis</i>	Bunchberry
<i>Corylus</i> sp.	A Hazelnut
<i>Cypripedium acaule</i>	Pink Lady's Slipper
<i>Dennstaedtia punctilobula</i>	Hay-scented Fern
<i>Diphasiastrum digitatum</i>	Southern Ground-cedar
<i>Dryopteris intermedia</i>	Intermediate Wood-fern
<i>Fagus grandifolia</i>	American Beech
<i>Fraxinus americana</i>	White Ash
Fungi	Fungi
<i>Gaultheria procumbens</i>	Wintergreen
<i>Gaylussacia baccata</i>	Black Huckleberry
Grass, unidentified	Unknown grass
<i>Hamamelis virginiana</i>	Witch-hazel
<i>Ilex verticillata</i>	Winterberry
<i>Juniperus communis</i>	Common Juniper
<i>Kalmia angustifolia</i>	Sheep-laurel
<i>Kalmia latifolia</i>	Mountain-laurel
Lichens	Lichens
Lichens and Fungi	Lichens and Fungi
<i>Lycopodium dendroideum</i>	Northern Ground-pine
<i>Lycopodium hickeyi</i>	Hickey's Clubmoss
<i>Lycopodium obscurum</i>	Ground-pine
<i>Maianthemum canadense</i>	Canada Mayflower

<i>Maianthemum racemosum</i>	False Solomon's Seal
<i>Medeola virginiana</i>	Indian Cucumber-root
<i>Mitchella repens</i>	Partridge-berry
Mosses and Fungi	Mosses and Fungi
Non-Vascular Species	Non-Vascular Species
<i>Nyssa sylvatica</i>	Black Gum
<i>Osmunda cinnamomea</i>	Cinnamon-fern
<i>Osmunda claytoniana</i>	Interrupted Fern
<i>Pinus strobus</i>	White Pine
<i>Polystichum acrostichoides</i>	Christmas-fern
<i>Prunus serotina</i>	Black Cherry
<i>Pteridium aquilinum</i> var. ?	Bracken Fern
<i>Quercus alba</i>	White Oak
<i>Quercus coccinea</i>	Scarlet Oak
<i>Quercus prinus</i>	Chestnut-oak
<i>Quercus rubra</i> var. ?	Red Oak
<i>Quercus</i> sp.	Oak Genus
<i>Quercus velutina</i>	Black Oak
<i>Rhododendron</i> sp.	A Rhododendron/Azalea
<i>Rubus</i> sp.	Blackberry/Dewberry Genus
<i>Smilax herbacea</i>	Carrion-flower
<i>Thelypteris noveboracensis</i>	New York Fern
<i>Trientalis borealis</i>	Starflower
<i>Tsuga canadensis</i>	Eastern Hemlock
<i>Uvularia sessilifolia</i>	Wild Oats
<i>Vaccinium angustifolium</i> var. ?	Lowbush Blueberry
<i>Vaccinium corymbosum</i>	Highbush-blueberry
<i>Vaccinium pallidum</i>	Early Sweet Blueberry
<i>Viburnum acerifolium</i>	Maple-leaf Viburnum
<i>Vitis</i> sp.	Grape Genus