Recommendations to Improve & Enhance Wildlife Habitat at Clement Farm, Haverhill MA

Submitted to

City of Haverhill
Conservation Department

By

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Introduction

Mass Audubon's Ecological Extension Service was asked by the City of Haverhill Conservation Department to prepare this rapid natural resource inventory of the Clement Farm property in Haverhill, Massachusetts and to provide wildlife habitat management recommendations. During the Winter and Spring of 2012, we conducted site visits to determine the presence of wildlife, and to describe the understory of forest stands as defined in the Forest Management Plan prepared by New England Forestry Consultants, Inc. dated March 30, 2011. Based on our findings, we have prepared recommendations to protect and enhance the wildlife habitat values of the property.

Study Area

Clement Farm is a 52-acre property located on the east bank of the Little River in the northern part of Haverhill, Massachusetts, just minutes from the New Hampshire state line (Figures 1 & 2). The majority of the property consists of upland forests. Recreational ball fields are located in the extreme northern portion of the property, and stands of forested swamp are found in lower elevations adjacent to the river. In addition to recreational fields, the property features walking trails throughout the property, including along the banks of the river.

Figure 1. Clement Farm, Haverhill Massachusetts.

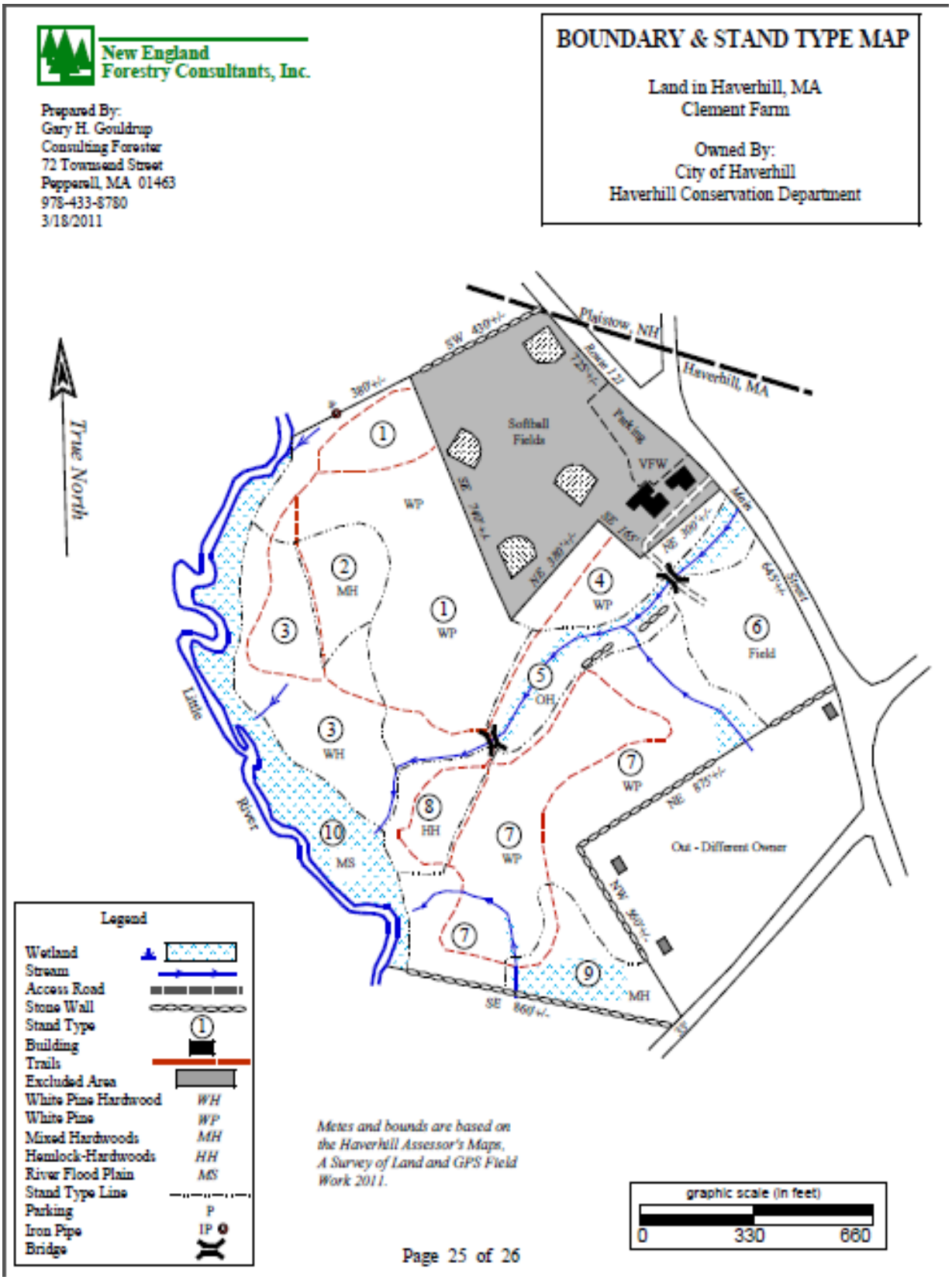

Figure 2. Forest stands delineated at Clement Farm, Haverhill Massachusetts. From 2012 Forest Management Plan.

Descriptions of Understory Plants in Forest Stands

To provide a more complete picture of the forest habitat at Clement Farm, we inventoried the herbaceous plants, shrubs and saplings found within each forest stand. The following descriptions of the understory are based on the forest stands delineated in the forest management plan noted above and shown in Figure 2.

WP 1

This is one of the largest forest stands on the property. It is dominated by a thick canopy of mature white pines which casts large portions of the forest floor in deep shade. The understory is characterized by open herbaceous and shrub layers, with few plants able to grow under the towering pines. The northern portion of this stand supports a dense grove of eastern hemlocks which is located on the steep slopes adjacent to the Little River. Here too, the dense canopy inhibits the growth of understory vegetation, except for regenerating hemlock. Plants in the herbaceous layer include: poison ivy, Canada mayflower, starflower, low-bush blueberry, Christmas fern, partridge berry, hay-scented fern, and pink lady's slipper. Shrubs contained in the understory consist primarily of regenerating canopy trees, such as pignut hickory, sugar maple, black cherry, and white pine, with some beaked hazelnut, and striped maple, a plant which is more commonly found in western Massachusetts due to its preference for cooler climates. At Clement Farm, the hemlock ravine found along the Little River likely creates a micro-habitat that suits this plant.

MH 2

Stand MH 2 consists of a large blow down with a markedly different character from the rest of the forest. Here, large gaps in the canopy allow ample sunlight to penetrate to the forest floor. In response, colonies of hay-scented fern carpet the ground, and species found in the herbaceous layer of adjacent stands are found in greater abundance due to the increased sunlight, such as partridge berry, starflower, and Canada mayflower. The shrub layer is also much denser than the adjacent forest, and patches of black birch saplings are scattered about brambles of raspberry and blackberry. Occasional sapling white pine and black oak are also present, as are alien invasive glossy buckthorn and shrub honeysuckle.

WH 3

The canopy here is dominated by white pine, red oak, red maple, white ash, and pig-nut hickory. Overall, the understory of stand WH 3 is similar in species composition and structure to stand WH 1, with a moderately tall herbaceous layer consisting of Canada mayflower, trout

lily, Jack-in-the-Pulpit, and bedstraw, as well as seedling white pine, pignut hickory, and black cherry. Wetter portions of this stand include spotted touch-me-not, and sensitive fern, In some portions of this stand the herbaceous layer is all but absent due to an infestation of non-native shrub honeysuckle, which is so dense as to completely dominate the understory. In these areas, little to no herbaceous vegetation, or other shrubs, can grow. Where the shrub honeysuckle has not taken hold, shrubs and saplings such as sassafras, maple-leaved viburnum, and regenerating white pine, black birch, and white oak can be found.

WP 4

Located near the ball fields, parking lot, and VFW buildings, stand WP 4 is described in the forest management plan as a likely red pine and Colorado blue spruce plantation that now includes white pines, Scotch pine, Norway spruce, and pitch pine. The area is actively used as a picnic area, and therefore understory growth is limited to patches of grass and ferns, and there are no shrubs or saplings.

OH 5

Stand OH 5 is located along the upper reaches of a small stream flowing through the central portion of the property, which empties into the Little River. The understory of stand OH 5 is low, with scatterings of wood anemone, wild oats, Canada mayflower, trout lily, and occasional cinnamon and interrupted ferns, as well as seedling canopy trees. Regenerating red oak, black birch, sugar maple, basswood, white ash, hickory, and yellow birch, dominate the shrub and sapling layer. Japanese barberry, shrub honeysuckle, and winged euonymus, all non-native invasive species, are also scattered about the understory. Portions of the stand closer to the stream course are dominated by wetland shrubs such as silky dogwood and speckled alder.

Field

Located on Route 121, a roughly 3-acre field is frequently mowed and is absent of trees and shrubs except along the edges. The area is dominated by old field species, with plants such as poverty grass, little blue stem, Pennsylvania sedge, goldenrods, and milkweeds.

WP 7

This forest stand just under 11 acres, and similar in size to stand to WP1:as such, it is one of the largest forest stands on the property. The understory is similar in structure and composition to that of stand WP 3. Canopy trees such as red maple, black cherry, black birch, and white ash are regenerating in the shrub and sapling layer. Other plants in the shrub layer include the non-native Oriental bittersweet, glossy buckthorn, and shrub honeysuckle. The herbaceous layer is dominated by Canada mayflower, which grows as single broad leaf blades scattered over the

forest floor. Hay-scented and sensitive fern are also present in small patches. Star flower, poison ivy, lady fern, wild oats, and doll's eyes are present but uncommon.

HH 8

This picturesque stand is found along the steeper, western section of the stream running through the central portion of the property. The canopy is dominated by eastern hemlock, which generally limits growth in the understory to regenerating saplings of the hemlock and occasional white pine. However, small patches of ferns, including Christmas fern and hay-scented fern can be found, as well as scatterings of Canada mayflower. The banks of the stream are rocky and subject to erosion. The sparse vegetation here plays the important role of reducing erosion of the bank and preventing sedimentation of aquatic resources downstream.

MH 9

Stand MH9 is located in the southeast corner of the property, and features a wet swale feeding the Little River. Both the herbaceous and shrub/sapling layers are tall and lush, with dense vegetative cover. Herbaceous plants found here include spotted touch-me-not, wild geranium, Jack-in-the-Pulpit, sensitive fern, wood anemone, cinnamon fern, and Virginia creeper. Shrubs and saplings include sugar maple, black birch, and red maple. Non-native invasive shrub honeysuckle, Japanese barberry, and winged euonymus are also found here, especially in areas with wetter soils adjacent to the stream and subject to seasonal flooding.

MS 10

This stand is located in the bordering vegetated wetland adjacent to the Little River. It is a densely vegetated hardwood forest, with a robust herbaceous and shrub layer similar to that found in stand MH 9, though with a slightly higher species diversity – especially in the shrub/sapling layer. Plants in the herbaceous layer include hay-scented, sensitive and interrupted fern, grasses, sedges, and spotted touch-me-not. Speckled alder, silky dogwood, arrow-wood, choke-cherry, and invasive shrub honeysuckle and multiflora rose dominate the shrub/sapling layer.

Wildlife Sightings

We visited Clement Farm on two occasions to conduct wildlife surveys and bird inventories. A survey in winter was conducted to determine the presence of mammals, and a late spring visit was conducted to survey breeding birds. During our site visits, we noted all direct sightings of wildlife, as well as tracks and signs. In addition to our direct sightings, we also provide a list of species likely to be present at the Clement Farm property.

The winter of 2011-2012 had very little snow fall, and we waited and waited for the right conditions: 24 hours after a snowfall of ideally 2-4 inches. This allows ample time for animals to move through the landscape, and allows for clear reading of tracks. We had the good fortune to arrive at Clement Farm the morning of March 3rd, roughly 24-hours after 4-inches of new, wet snow had fallen: perfect conditions.

We were rewarded with tracks of Eastern coyote, fisher, white-tailed deer, and mink, including dramatic scenes of predation captured in the snow. Coyote tracks were found on most main trails throughout the property (Photo 1). Tracks occasionally wandered into the woods, and at times we saw areas where coyotes left a urine scent marker at the base of trees.

The blow down in stand MH 2 featured fisher tracks along the large, downed trunks and at the base of white pines (photos 2-5). Fishers are arboreal members of the weasel family, wandering the forest for prey such as squirrels and small birds. They prefer to ambulate via trees, leaping to the base of large trees which they clamber up, or lumbering along large downed logs on the ground. Fisher nest in large tree cavities, and may nest in one of the large dead trees left standing in stand MH 2.

Mink tracks ran along the banks of the Little River (photo 6), and lead to kill sites, where it appears the stealthy hunter enjoyed tasty snacks of vole heads (photo 7). We observed another kill site under the canopy of eastern hemlock in stand WP 1, where foot prints and feathers in the snow told a story of predator and prey (photo 8).

The tracks of white-tailed deer wandered through the woods, as did grey squirrel and white-footed mice. And as noted above, our tracking survey showed that large, downed logs across the Little River serve as bridges and connect the property to the larger landscape.

I visited the property for a second time early on the morning of May 22nd. The Spring survey was timed to maximize encounters with breeding birds and after full leaf-out of the forest understory. I noted the songs and calls of all birds during my walk, and we can assume that these birds all breed at Clement Farm due to the timing of our survey at the height of breeding season. I heard a full suite of birds, including year-round residents (American crow, downy wood-pecker, and blue jay); interior forest species (pine warbler, ovenbird, red-eyed vireo,

scarlet tanager and broad-winged hawk); and wetland associated species (song sparrow, common grackle, and gray catbird). I also heard American goldfinch and American robin which are migratory birds. Other birds that are likely to breed at Clement Farm include Eastern kingbird, red-winged blackbird, Eastern phoebe, Eastern wood pee-wee, Baltimore Oriole, and Northern cardinal. In addition to breeding habitat, the forest and wetlands at Clement Farm also likely provide important habitat for migratory birds, especially because it is located along a water way.

Photo 1. Coyote tracks in trail through woods.

Photos 2,3,& 4. Fisher tracks, leading to base of White pine and across logs in woods and over Little River.

Photo 6. Mink tracks along bank of Little River.

Photo 7. Decapitated vole, and remains of birds – both victims of a mink.

Photo 9. Insect damage on dead hop hornbeam, which will attract birds. Photo 10. Pileated woodpecker excavation in white pine trees. Photo 11.Standing dead pine tree, which provides food for insects, feeding opportunities for birds, and cavities for nest sites.

Important Natural Resources at Clement Farm

The Little River and Adjacent Wetlands

The Little River is an outstanding feature of the Clement Farm property. Winding its way south along the western margin of the property, the river and its adjacent wetlands provide important habitat for aquatic, semi-aquatic, as well as terrestrial species. Rivers and their adjacent wetlands are often less developed than the surrounding landscape, which greatly amplifies the importance of their ecological function. Because of their linear nature, rivers also serve as wildlife corridors, facilitating the movement of wildlife in the water column, in the air space over the water, and along the banks. The habitat found along the Little River at the Clement Farm property likely provides breeding and feeding habitat for many resident species, as well as a stop-over point for animals using the river as a corridor between other patches of open space found in the greater landscape.

Eastern hemlock stands

Eastern hemlocks are evergreen trees and provide dense cover in which wildlife find refuge. Such areas can be especially important in winters with a heavy snow fall, as the snow depth on the ground under the canopy of hemlocks is much less than that of the surrounding woods, facilitating movement and allowing animals to conserve energy. Deer yards (areas where groups of deer congregate, stomp down snow and bed) are often found under stands of eastern hemlock.

Eastern hemlock also provides good cover in which predators can conceal themselves while stalking unsuspecting prey. Accipiters, members of the true hawk family (as opposed to Buteos which are hawks that soar high in the sky on broad, outstretched wings), are forest specialists, with short, rounded wings and long tails to help them maneuver through dense forest cover. Sharp-shinned hawk, Coopers hawk, and perhaps Northern goshawk, are all likely hunters in the Hemlock stands at Clement Farm.

Forest Opening in Blow Down

Blow downs in mixed hardwoods stands are also an important feature of the Clement Farm property. Disturbances such as these create openings in the forest canopy. Increased sunlight reaching the forest floor promotes the growth of understory species that previously would have

been suppressed by the shade of the canopy overhead. Seeds lying dormant in the soil, waiting for their day in the sun, soon germinate in response to the increased sunlight and space provided by the open patch. This loss of mature canopy trees, and the subsequent growth of the understory trees, saplings, and newly sprouted plants, introduces structural and compositional diversity to forest stands. Structural diversity includes physical parameters such as height, density, and "openness" of herbaceous, shrub and tree layers within the forest, while compositional diversity is the overall richness or sheer number of species in a stand. Mature forests are often less structurally and compositionally diverse than their younger counterparts, and the blow down at stand MH 2 greatly increases the overall biological diversity of the Clement Farm forest.

As the transition from young to old takes place over time through the process known as forest succession, the changing plant community attracts a different suite of wildlife, which further increases the overall biological diversity of the forest. Several bird species prefer these early successional areas, or young forests including chestnut-sided warbler, Eastern towhee, and blue-winged warbler. Although we did not observe these species here, in time they may be found in the blow down area. Other species, including wood thrush, ovenbird, and scarlet tanager, prefer mature forests. Maintaining patches of both young and mature forest at the Clement Farm property will promote biological diversity of the property, and offer greater resilience to natural disturbances.

Recommendations to Protect and Enhance Wildlife Habitat

Protect the Banks of the Little River.

We strongly recommend some trail alterations to protect the Little River and its bordering vegetated wetlands.

- One of the forks from the main trail leading down to the trail in the floodplain located in stand MS 10 should be closed. Currently the two forks are roughly 20 feet apart. Closing one will help minimize disturbance in sensitive wetland areas. The access trail leading down to the floodplain should be monitored for erosion if trail use increases substantially in the future. Improvements such as water bars to direct surface flow would help maintain the trail and reduce sedimentation of the wetland areas.
- The lower trail through the eastern hemlock stand (WP 1) should be closed to protect sensitive habitat adjacent to the river. Two trails run through the hemlock grove in the northern portion of stand WP 1, essentially a "high road" and a "low road". Both offer excellent views of the river, however the lower trail is situated on steep slopes that are

unstable and subject to erosion. We strongly recommend closing this lower trail to protect the hemlock gorge, minimize disturbance to wildlife, and prevent injuries to hikers. Since the upper trail also offers views of the river, we believe that the visitor experience will not be diminished by closing the lower trail.

- We also recommend improving the crossing where the stream through the hemlock grove enters the bordering vegetated wetlands in stand MH 10. Currently, the trail crosses directly through the stream bed which increases erosion and sedimentation downstream, and at times potentially leaves visitors with wet feet. We suggest the installation of a small, simple foot bridge which could be a good project for a school group or scouts.
- Maintaining a vegetated buffer along the stream will help to reduce erosion of the bank, and subsequent sedimentation of aquatic resources downstream.

The Forest Management Plan indicates that canoe and kayak access at the river is desired. Our initial assessment is that Clement Farm is not a good candidate for canoe/kayak access to Little River. Although surveying the entire bank for a suitable launch site was beyond the scope of this project, we noted some thoughts during our inventory. It is possible that a suitable area to locate a take-out can be found, but it would likely be a temporary haul-out point rather than a car-top put-in, as the rather long walk (roughly 1/10th of a mile) from the parking lot to the river would discourage most boaters. We are aware of discussions to improve the dirt road leading through the property to reduce this distance but feel that this change would introduce more disruption to the forest interior, and degrade the quality of the wildlife habitat there. We searched for locations that would be suitable for such a launch as we conducted the botanical inventory but we did not locate any. The right bank of the river (which is on the side of the Clement Farm property) is steep and undercut and is therefore highly susceptible to erosion. Ideally, a take-out would be located in an area that has stable banks, gentle slopes and stable soils (such as gravel or sand), qualities that would minimize erosion and provide sure footing. Finally, from our observations, this stretch of Little River appeared to be regularly subject to trees falling across the river channel, making navigation with a canoe or kayak difficult, at best, and potentially dangerous.

Any improvements of this type will require consultation and permitting from the Haverhill Conservation Commission, and perhaps other regulatory authorities. Should this type of project be pursued, we recommend choosing a design and materials that will not impair the functions and values of the wetlands, and that can withstand periodic flooding.

Maintain Blow Downs

The blow-down in stand MH 2 is one of the most important wildlife habitat features at the Clement Farm property. The gap resulting from the opening in the canopy introduces structural and compositional diversity to the forest, and creates a habitat type that exists nowhere else on the property. Although the forest management plan suggests removing the fallen trunks if a harvest is conducted in stand WP 1, we strongly advise against this. The large, downed, coarse woody debris – including large diameter tree trunks - and tip up mounds, provide den sites for wildlife such as coyote, raccoon and fisher. Furthermore, standing dead wood attracts insects which in turn attract birds, such as pileated woodpecker and great horned owl. In time, the coarse woody debris will decay and "feed" the soil, promoting the growth of a new generation of forest.

If a salvage operation is planned, we strongly recommend maintaining some of the downed limbs and trunks to promote structural and biological diversity of the forest. Additionally, we recommend that salvage or extraction operations be conducted as selective cuts, or in small patches within stand WP 1. This will further enhance wildlife habitat by creating larger areas of young forest contained within the property. The size of open patches within a forest influences their function in the ecosystem. A single large patch often has greater ecological value than several small patches. Therefore, we suggest that forest extraction in stand WP 1 be conducted adjacent to the blow down in stand MH 2. This will increase the size of the opening and promote greater biological diversity within the Clement Farm property.

Manage Invasive Species

Non-native invasive species are severely impacting the wildlife value of the Clement Farm property and disrupting ecological processes at the landscape scale. Plants such as shrub honeysuckle (Morrow's or Tartarian), multiflora rose, glossy buckthorn, Japanese barberry, and oriental bittersweet are all present. In some patches, these plants dominate the forest understory, especially in wet areas which are prone to infestation.

Plants are not the only non-native threat to the property, wooly adelgid, an insect native to Japan, threatens the stand of eastern hemlock trees. Similar to aphids, adelgids suck sap from trees, and can cause wide-spread mortality in eastern hemlock stands. At Clement Farm, eastern hemlocks are found most often on steeper slopes adjacent to wetlands and waterways, and the loss of a mature canopy of hemlock threatens aquatic as well as forest resources.

We highly recommend conducting a more thorough invasive species inventory to locate the worst infestations, developing a strategy to reduce the cover of invasives, and conducting continual monitoring to locate and eradicate new infestations. Even though no wooly adelgid was found during our survey, nor during the development of the forest management plan, we strongly recommend conducting annual monitoring in May or June to assess its presence at the site. We also recommend that, as much as possible, forestry operations maintain an undisturbed buffer around the hemlock stands to help prevent introduction of wooly adelgid.

We also recommend that forestry operations include plans to manage invasive species. Forestry operations could unintentionally increase the spread of invasive plants through the property. To help prevent this, we recommend that invasive plants be suppressed to the greatest extent possible before forestry operations take place. We also recommend that skidder roads, log landings, and other areas of exposed soils be over seeded with a conservation seed mix to discourage the growth of non-native, invasive species, and promote the growth of native plants. These seeded areas should be monitored regularly during the first three growing seasons to ensure the growth of native plants, and to eradicate any invasive plants that take a foot-hold there.

Consider Cutting Spruce/Pine Plantation

From a purely ecological standpoint, the stand WP 4 can be considered a monoculture, and as such has little wildlife habitat value, and is prone to disturbance such as wind throw or insect damage. We recommend cutting this forest stand to encourage the development of another patch of young forest, or to even "convert" the forest habitat to expand the amount of open field habitat on the property. These actions would greatly enhance the wildlife habitat and ecological values of the property. We acknowledge that the stand is currently serving a specific, non-habitat purpose, and at a minimum would suggest removing non-native invasive species scattered along the edges.

Delay Field Mowing

Old field habitats are important for birds such as tree swallows, American goldfinch, and Eastern kingbird, and to a wide variety of insects as well. To enhance the wildlife habitat values of the old field along Main Street for birds and invertebrates, we recommend delaying the first cut until late October. If an earlier mow is required, we would recommend postponing until after August 15th to limit disturbance to breeding birds. This later mow will allow birds nesting

in the grassland to successfully rear and fledge their young. We recommend a high cut (6 inches), and maintaining a layer of cut stems and vegetative debris in which overwintering insects, including butterflies, can seek shelter. The field would also benefit from the placement of several nest boxes. Cavities can be a limiting factor in the landscape, and the addition of two or three nest boxes to the old field will likely increase the diversity and abundance of birds at the site. The construction and placement of nest boxes could also be a potential project for a scout group.

Maintain Portions of Mature Canopy

We recommend maintaining legacy trees, older trees which have endured natural disturbances or remain after previous forest cutting operations. These trees are much larger than surrounding trees in the forest, and as such provide critical elements of structural diversity. Additionally, legacy trees are tremendously valuable to wildlife as a source of food, such as mature oaks that produce a bumper crop during mast years, or as denning sites in the cavities that often develop in older trees.

Conduct Forestry Operations in Late Fall or Winter

The Clement Farm property was formerly designated as Priority Habitat by the Mass Natural Heritage & Endangered Species program for wood turtle, a Species of Special Concern in Massachusetts. The records are considered historic and therefore the property is no longer designated as Priority Habitat. However, this does not mean that wood turtles are no longer present; rather it means that there is no record of wood turtles having been found at the property within the past 20 years. Since it is possible that wood turtles are still present at Clement Farm, we believe it would be prudent for the City of Haverhill Conservation Department to delay forestry operations until after the ground is frozen, generally around October 15th, when turtles will be over-wintering and out of harm's way. It would also be beneficial to conduct forestry operations within a short time frame, rather than as a phased project, to limit disturbance to wildlife.

Scientific Name	Common Name	Also in shrub layer
Stand WP1		
Toxicodendon radicans	poison ivy	
Maianthemum canadense	Canada mayflower	
Tiarella cordifolia	starflower	
Acer saccharum	sugar maple	
Prunus serotina	black cherry	
Aster spp.	aster species	
Vaccinium angustifolium	low-bush blueberry	
Sedge spp.	sedge species	
Tsuga canadense	eastern hemlock	
Smilacina racemosa	false solomon's seal	
Viburnum acerfolium	maple-leaved viburnum	
Polystichum acrostichoides	Christmas fern	
Corylus cornuta	beaked hazelnut	
Acer pensylvanicum	striped maple	
Mitchella repens	partidge berry	
Quercus alba	white oak	
Carya ovalis	pignut hickory	
Dennstaedium punctilobula	hay-scented fern	
Pinus strobus	white pine	
Cypripedium acuale	pink lady-slipper	
Polystichum acrostichoides	Christmas fern	
Dennstaedium punctilobula	hay-scented fern	
Athyrium filix-femina (cf)	lady fern	
Maianthemum canadense	Canada mayflower	
Tsuga canadense	eastern hemlock	x
Stand OH 5		
Anemone quinquefolia	wind flower	
Uvularia sessilifolia	wild oats	
Acer saccharum	sugar maple	
Osmunda cinnamomea	cinnamon fern	
Erythronium americanum	trout lily	
Osmunda claytoniana	interupted fern	
Maianthemum canadense	Canada mayflower	
Arisaema triphyllum	Jack in-the-pulpit	
Smilacina racemosa	false solomon's seal	
Tsuga canadense	eastern hemlock	x
Acer saccharum	sugar maple	x

Appendix A – Understory Plants in Forest Stands, Clement Farm, Haverhill MA

Scientific Name	Common Name	Also in shrub layer
Berberis thurnbergii	Japanese barberry	x
Stand WP 7		
Tiarella cordifolia	starflower	
Toxicodendon radicans	poison ivy	
Rhus hispidus	dewberry	
Maianthemum canadense	Canada mayflower	
Lonicera sp.	shrub honeysuckle	x
Acer saccharum	sugar maple	x
Viburnum dentatum	arrowood	x
Athyrium filix-femina (cf)	lady fern	
Uvularia sessilifolia	wild oats	
Celastrus orbiculatus	oriental bittersweet	
Actaea pachypoda	doll's eyes	
Euonymus alatus	winged euonymus	x
Berberis thurnbergii	Japanese barberry	x
Stand MH 9		
Acer rubrum	red maple	
Fraxinus americana	white ash	
Impatiens capensis	spotted touch-me-not	
Geranium maculatum	spottted geranium	
Sedge spp.	sedges	
Lonicera sp.	shrub honeysuckle	x
Arisaema triphyllum	Jack in-the-pulpit	
Athyrium filix-femina (cf)	lady fern	
Onoclea sensibilis	sensitive fern	
Smilacina racemosa	false solomon's seal	
Anemone quinquefolia	wind flower	
Osmunda cinnamomea	cinnamon fern	
Acer saccharum	sugar maple	
Parthenocissus quinquefolia	Virginia creeper	
Aster sp.	aster species	
Acer saccharum	sugar maple	x
Berberis thurnbergii	Japanese barberry	x
Tilia americana	basswood	x
Betula nigra	black birch	x
Stand MS 10		
Berberis thurnbergii	Japanese barberry	x
Dennstaedium punctilobula	hay-scented fern	
Solidago sp.	goldenrod species	
Carex sp.	sedge species	

Appendix A – Understory Plants in Forest Stands, Clement Farm, Haverhill MA

Scientific Name	Common Name	Also in shrub layer
Onoclea sensibilis	sensitve fern	
Impatiens capensis	spotted touch-me-not	
Osmunda cinnamomea	cinnamon fern	
Grasses	grass species	
Lonicera sp.	shrub honeysuckle	x
Rosa multiflora	multiflora rose	x
Alnus rugosa	speckled alder	x
Cornus amomum	silky dogwood	x
Prunus virginiana	choke cherry	x
Viburnum dentatum	arrowood	x
Osmunda regalis	royal fern	
Arisaema triphyllum	Jack in-the-pulpit	
Cephalanthus occidentalis	oriental bittersweet	x
Aster divaricatus	white wood aster	
Stand WH 3		
Pinus strobus	white pine	
Carya ovalis	pignut hickory	
Viburnum acerfolium	maple-leaved viburnum	
Sassafrass albidum	sassafrass	x
Erythronium americanum	trout lily	
Maianthemum canadense	Canada mayflower	
Quercus alba	white oak	x
Smilacina racemosa	false solomon's seal	
Berberis thurnbergii	Japanese barberry	
Onoclea sensibilis	sensitve fern	
Impatiens capensis	spotted touch-me-not	
Arisaema triphyllum	Jack in-the-pulpit	
Toxicodendon radicans	poison ivy	
Frageria virginiana	wild strawberry	
Gallium asprellum	rough bedstraw	
Betula nigra	black birch	x
Ostrya virginiana	ironwood	x
Tilia americana	basswood	x
Thalictrum thalictroides	tall meadow rue	