HAMPDEN MEADOWS
CONSERVATION AREA
MANAGEMENT PLAN

Prepared by:
Barrington Conservation Commission
June 7, 2010

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1.0 INTRODUCTION

This document presents a conservation management plan for the Hampden Meadows Conservation Area (HMCA) in Barrington, Rhode Island. The management plan was prepared by the Barrington Conservation Commission, with input from Town departments, commissions, and committees, and citizens of Barrington (collectively, stakeholders). The management plan is based upon the environmental characteristics of the conservation area and its desired level of protection and use. The management plan outlines the stakeholder's goals and objectives for the conservation area, identifies the management and improvement needs of the conservation area; and identifies the individuals, departments, and/or organizations charged with specific management activities for the conservation area.

1.1 General Description of Resource

The HMCA comprises ~140 acres of land containing a 113-acre forested swamp, 12.5+ acres of forested upland, and 3 acres of recreationally-managed land. HMCA extends 1.2 miles north to south between Christine Drive at its northern boundary and past Linden Road to as south as the adjoining Orchard Street at its southern boundary. The primary features of the HMCA are a walking trail extending nearly the entire length of the conservation area, a series of ditches draining the area that were created (or expanded from natural features) in the early 1900s, a man-made pond, a subsurface sewer main, and two active recreational areas (tennis courts and a sports practice field). The HMCA is open to the public, is used primarily for passive recreation, and is adjoined by residential development on all sides.

Figure 1 illustrates the features of the HMCA. The conservation area is not entirely contiguous, but is intersected by two paved roads (Kent Street and Linden Road) and includes two additional non-contiguous parcels in its southern extent. Parcels contained within the conservation area and their current zoning designations are presented in Figure 2.

1.2 History of Conservation Area

A specific history of the HMCA is not available, but a general history of the Hampden Meadows area is provided by Thomas Bicknell in his "History of Barrington" (Bicknell, 1898).

The land between the two branches of the Sowams River (now known as the Palmer and Barrington rivers), was known as Chachacust by the Native Americans and New Meadow Neck by the European settlers. This latter name it received as early as 1653.

Massassoit was the chief sachem or leader of the Wampanoag tribe at the time of the arrival of the Plymouth settlers. Massasoit is believed to have had his residence on the south end of New Meadow Neck. A friendly alliance existed between the Plymouth settlers and Massassoit in 1621, which brought about the purchase by the settlers of much land in eastern Rhode Island and southeastern Massachusetts. After the purchase of "Sowams and Parts Adjacent" (the larger area in which current day Barrington was located) from Massassoit in 1653, the lands were divided and sold to European settlers. New Meadow Neck settlers included John Brown, Thomas Cushman, Thomas Willett, Governor Prince, Josiah and John Winslow, Joseph Peck, John Allen, and Governor Bradford. It appears that most of this land has remained in private ownership since that time. The first public burial place of European settlers on Barrington soil was located at the head of Hundred Acre Cove. The oldest graves are poorly, if at all, marked, but the earliest dated tombstone is marked 1703.

In the formation of the new town of Barrington in 1747, New Meadow Neck was the central part of town and was then called the "Place of Trade," with ship-building as the main activity. The appendage of "Hampden" to the New Meadow Neck area was given by the Rhode Island Historical society, in honor of John Hampden, who visited Massassoit with Edward Winslow in 1623. At the request of the Historical Society, the Providence, Warren & Bristol Railroad Directors changed the name of the railroad station at New Meadow Neck in 1890 to Hampden Meadows.

1.3 Primary Features of Conservation Area

Further information on the primary features of the HMCA is presented in this section.

Main Trail This north/south trending trail begins on Kent Street at the north and terminates on Linden road at the south. While the Main Trail is not paved (except for a small portion adjoining Kent Street), it is well-established and cleared of vegetative growth. It is primarily used for passive recreational activities, such as walking, along the Main Trail. This Main Trail is located west of, and parallels, the eastern-most drainage ditch throughout most of southern portion of the HMCA.

Northern Trail This secondary walking path, which is less developed than the Main Trail, follows the eastern bank of the ditch and extends from Kent Street north to Christine Drive. However, at its northern terminus at Christine Drive, the upland portion narrows into private land and is not readily accessible from the street.

Drainage Ditches Drainage ditches were dug through the HMCA in the early part of the 1900s, most likely for mosquito control. Two north/south trending ditches, one along the central/eastern portion of the HMCA and the other on the western side of the HMCA, both originating from areas north of the conservation area, are the main ditches. These ditches currently flow south to the Barrington River throughout the year. Several smaller ditches that trend east/westerly are present in the interior of the conservation area and flow from/to these two main ditches. The drainage ditches are dredged on an as-needed basis by the Barrington Department of Public Works (DPW).

Subsurface Sewer Line A buried sewer pipeline was installed parallel to the eastern main ditch in the 1970s from Kent Street. The Main Trail is built atop this buried pipeline.

Kent Street Pond A one-acre pond was dug along Kent Street west of the entrance to the Main Trail and is occasionally used for skating in winter. Periodic dredging of the pond by DPW to support its use as a skating rink results in a minimum of vegetation within the pond. The pond was last dredged in 2005 and is anticipated to require additional maintenance not more than once every ten years. Some emergent vegetation grows within its boundaries during the growing season.

Tennis Courts Two public tennis courts are located on the northern side of Kent Street adjoining the entrance to the Northern trail. The courts are managed by the Barrington Recreation Department. Parking for several cars is provided on the south side of the tennis courts adjoining Kent Street, and can also be used for general access to the conservation area trails.

Hampden Meadows Land The conservation area adjoins a parcel of land behind (east) of Hampden Meadows School, which contains several marked walking paths between the conservation area and the school believed to have been marked and maintained by the school.

Southern Parcels

Two parcels that are considered part of the conservation area are located along or south of Linden Road. These are Lot 29 Parcel 209 and Lot 28 Parcel 014. Parcel 209 is continuous with parcels located north of Linden Road; however, the walking trail does not extend into this parcel. Currently Parcel 209 is heavily vegetated and difficult to access most of the year.

Parcel 014 is a 5.9 acre site that was recently acquired by the town through a Rhode Island Open Space Recreation Acquisition and Development grant. Dubbed the "Sowams Road parcel", its eastern portion is occupied by a practice (non-regulation sized) field and a gravel-covered parking area. The western portion is undeveloped and heavily vegetated. The plan is to connect the western, undeveloped portion of the parcel with other portions of the HMCA.

Figure 2 identifies the plat map and lot designation of each parcel contained within the conservation area, as well as the current zoning of the parcels and identified any easements or use restrictions presently placed on the lots.

2.0 DESCRIPTION OF CONSERVATION AREA

The majority of information on the characteristics and existing conditions of the HMCA was obtained from the *Hampden Meadows Conservation Area Natural Resources Management Plan (March 4, 2009),* performed and prepared by the Rhode Island Natural History Survey (RINHS). This plan is presented in Appendix A.

2.1 Topography, Geology, and Soils

The HMCA is a 1.2-mile linear wooded area that covers 132 acres comprising a ditched and drained, 113-acre red maple swamp and bordering wetlands. Approximately 12.5 acres (9.4 percent) of the conservation area are upland areas consisting primarily (10 acres) of an oak-maple forest in the southern portion of the conservation area and a 2.5-acre former hay meadow along Sowams Road, now developed as the Sowams Road recreational field. The topography of the conservation area is flat, with an elevation of 10 feet mean sea level or less (Rhode Island Office of State Planning 1983).

The HMCA is contained within the Narragansett Till Plain formed during Wisconsin glaciations that occurred 10,000 to 12,000 years ago. Most soil within the conservation area is classified as Sb (Scarboro mucky sandy loam). Walpole sandy loam soils (Wa) are found along the eastern center portions and Windsor loamy sand (WgB) occurs along the southern portions near Linden Road. Sb and Wa soils are characterized as very poorly drained soils in sandy or glaciofluvial deposits derived mainly from schist, gneiss, shale, and granite. WgB soils are characterized by excessively drained soils in glaciofluvial deposits derived mainly from schist, gneiss, and phyllite [Soil Conservation Service (1981) Soil Survey of Rhode Island].

Bedrock within Barrington is from the Carboniferous period, deposited as sedimentary layers of sandstone, coal, and shale about 300 million years ago that was subsequently buried, folded, and fractured. Within the HMCA, bedrock is located at a depth of between 25 and 75 feet below grade, trending downwards towards the west to a depth of 100 feet within a deep north/south channel that intersects Hundred Acre Cove, the Barrington River, Tiffany Pond (aka Prince's Pond), and Brickyard Pond [Rhode Island Office of State Planning (1983) The Hydrogeology of Barrington, Rhode Island; Technical Paper No. 105].

2.2 Water Resources

The HMCA is contained within the Narragansett Bay drainage basin. The majority of the conservation area is located within a 100-year floodplain (A9), with areas along roadways and isolated areas within the conservation area within the 500-year floodplain (FEMA 1992). Groundwater occurs in the unconsolidated deposits at shallow depths within the HMCA (0-5 feet bgs). The saturated thickness of the uppermost aquifer ranges from 20 feet in the south portions of the HMCA to 80 feet in the northern portions (Rhode Island Office of State Planning 1983).

Water within the conservation area flows through a man-made ditch covering two acres that runs the extent of the HMCA, from its northern extent at Christine Drive to its outflow into the Barrington River/Narragansett Bay. These ditches were most likely constructed for mosquito control or to drain the area for development. The main ditch drains areas east and west through additional smaller ditches.

A one-acre shallow man-made pond is present along Kent Street near the primary entrance to the Main Trail. This semi-permanently flooded pond is used as a skating pond in winter months and is occasionally dredged to control vegetative growth and sedimentation.

Ninety-eight (98) percent of the wetland areas in the HMCA are red maple/shrub swamps and the remaining two percent are vernal pools within glacial depressions scattered in the southwestern corner of the conservation area.

2.3 Vegetation Habitat

RINHS conducted a vegetation communities inventory that characterized and classified the dominance of vegetation and a survey of invasive plant species.

2.3.1 Upland Areas

Approximately 9.4 percent of the HMCA is occupied by upland areas consisting of a 10-acre oak-maple forest in the southern portion of the conservation area and a 2.5-acre former hay meadow along Sowams Road (this area is now a recreational field) The canopy of the oak-maple forest is split between mixed oaks and red maple. Oak-maple forest shrubs include sassafras, red maple saplings, blueberry, and greenbrier.

Invasive plant species occur along the trail edges of the oak-maple forest and include Oriental bittersweet, multiflora rose, autumn olive, and Morrow's honeysuckle. Descriptions of these invasive plant species are presented in Appendix B.

During the summer of 2008, some areas of the oak-maple forest were suffering from insect damage that affected up to 50 percent of the leaf area of broadleaf deciduous tree and shrub species. This is believed to be caused by the winter moth, an exotic invasive pest.

2.3.2 Wetlands

Approximately 84 percent of the conservation area is occupied by a red maple/shrub swamp. The canopy of this habitat type is dominated by red maple with scattered pin oak and birch. In the shrub layer, sweet pepperbush and greenbrier are common. Cinnamon fern is common in the herbaceous layer. Invasive plant species occurring along access trails include bittersweet and multiflora rose.

2.3.3 Vernal Pools

The vegetative canopy within the vernal pools is dominated by red maple and the shrub layer is scattered sweet pepperbush. Ground cover is generally lacking in the pools, likely due to a long hydroperiod and thick leaf litter. No invasive species were noted in the vernal pools.

2.4 Avian Habitat

RINHS conducted a breeding songbird study of the conservation area on June 25, 2008, as well as opportunistic surveys during field visits conducted in June, September, and November 2008. The *Natural Resources Management Plan* (RINHS, May 2009) describes the survey methodology and results in depth. The findings and conclusions of the avian studies area summarized below:

- A total of 17 bird species were observed during RINHS fieldwork
- Four of the species observed are defined as Species of Greatest Conservation Need (GCN) by the Rhode Island Department of Environmental Management. These are:
  - Great-crested Flycatcher (*Myiarchus critinus*) (3 observed)
  - Rufous-sided Towhee (*Piplio maculatus/erythr*) (1 observed)
  - Scarlet Tanager (*Piranga olivacea*) (2 observed)
  - Wood Thrush (*Hylocichia mustelina*) (4 observed)

  Information on these birds is presented in Appendix C.

- The current avian species are dependent on current habitat types. Fragmentation of habitat type can change species interaction dynamics and can impact or preclude certain species, such as the Scarlet Tanager and the Wood Thrush, both of which are interior forest dwellers.

2.5 Aquatic Habitat

2.5.1 Amphibians and Reptiles

Dip net surveys conducted in the skating pond identified the presence of common bullfrogs and spring peepers. According to RIDEM, the East Bay peninsulas are severely lacking in amphibians, most likely because of past mosquito spraying with DDT and similar chemicals in the 1970s. Therefore, the presence of amphibian species in the skating pond is unexpected. All herptiles receive protected conservation status in Rhode Island.

2.5.2 Fish

Dip net surveys in the skating pond identified the presence of the estuarine fish species fourspine stickleback and juvenile American eels. It is hypothesized that these fish species reach the pond through the drainage ditch.

3.0 DESIRED USES AND NEEDS OF THE CONSERVATION AREA

3.1 Comprehensive Community Plan Goals

The 2009 Comprehensive Community Plan (CCP) identified general and specific goals applicable to the HMCA. The following goals and associated actions are included in the Natural and Cultural Resources element of the CCP.

Goal No. 1 Protect important natural areas, including wetlands, wildlife habitats, groundwater aquifers and the salt marshes around Hundred Acre Cove and the Barrington and Palmer Rivers.

Actions:
- Develop and implement Management Plans for priority sites, including Hampden Meadows "Greenbelt."
- Annually review status of Management Plan implementation for all conservation areas.

3.2 Natural Resources Management Plan Recommendations

Recommendations from the RINHS *Natural Resources Management Plan* can be broadly grouped into the following categories:

- Strengthen the protected status of the HMCA.
- Protect, preserve, or improve the habitat integrity for wildlife
- Manage access and public use of the HMCA
- Manage invasive plant species
- Enhance the ecological uses of the Kent Street skating pond

Many of the detailed recommendations in the *Natural Resources Management Plan* are adopted in the recommended actions discussed in Section 4.0.

3.3 Other Needs

Other needs that are applicable to HMCA include the following:

- Enforcement of easements
- Prevention of encroachments from neighboring parcels

4.0 RECOMMENDED MANAGEMENT ACTIONS

The following objectives and activities are adopted to attain the goals for the HMCA.

4.1 Objective 1 - Consolidate and Strengthen the Protected Status of the HMCA

The majority of the HMCA is zoned as conservation land. However, the Main Trail and adjoining land behind Hampden Meadows School is zoned as open space-passive (OS-P), the Kent Street Pond and tennis courts are zoned as open space-active (OS-A) and three other parcels (31-412, 31-013, and 32-028) are zoned residential (R-25). These zoning designations are subject to change through administrative procedures and, as such, place the HMCA at risk for re-designation and possible fragmentation. While much of the conservation area is designated as wetlands, providing some protection through state and town wetland regulations, wetland regulations can change over time, also making the conservation area susceptible to alteration.

Consistent with goals stated in the CCP and recommendations made in the NRMP, the following actions are to be taken, assuming that the Town of Barrington will retain ownership of the conservation area.

- The current open space-passive designation overlaying the Main Trail should be defined (and surveyed) to contain only the Main Trail and the western portion of Plat/Lot 31-172 that currently contains marked walking paths and the area around the Kent Street Pond. This allows sufficient space for people to explore areas off of the Main Trail without impinging on ecological habitat.
- All of the areas east and west of the Main Trail (except the western portion of Plat/Lot 31-172) should be consolidated into one lot and zoned as conservation land.
- This new consolidated conservation lot should have a conservation easement placed on it, prohibiting development of the lot into the future.
- All land north of Kent Street along the Northern Trail should be consolidated into one lot and zoned as conservation land.
- This new consolidated conservation lot should have a conservation easement placed on it, prohibiting development of the lot into the future.
- If the Northern Trail is included in a future *Safe Routes to School* program (which is being considered, pending funding), an open-space passive designation should be overlaid on the Northern Trail from Kent Street to Sowams School.

An alternative to this zoning/conservation easement approach is to sell or transfer the land to an appropriate conservation group for management. Based on the goals set in the CCP, it is anticipated that retention of the land by the Town of Barrington is desirable.

Responsible Party: ***Town Planner/Planning Board/Town Council***

Target Completion Date: ***December 2010***

4.2 Objective 2 - Protect and Preserve Habitat Integrity for Wildlife

The HMCA is home to at least 17 bird species, four of which are defined as Species of Greatest Conservation Need (GCN) by the Rhode Island Department of Environmental Management. In addition, common bullfrogs and spring peepers were observed in the Kent Street pond, which, as herptiles, have protected conservation status in Rhode Island. Furthermore, estuarine fish species were detected in the Kent Street pond, apparently gaining access through the drainage ditch. These wildlife species, in addition to the more common bird and mammalian wildlife that reside in the conservation area, attest to the richness and diversity of wildlife that is one of the main features of the conservation area. Preservation of the conservation area's integrity as a wildlife habitat is a primary goal of the management plan.

Consistent with goals stated in the CCP and recommendations made in the NRMP to protect and enhance natural areas and wildlife habitat, the following actions are to be taken:

- Areas on either side of the main and north trails will be fully designated as conservation land with the explicit goal of preserving this land for wildlife only.
- All existing habitats will be retained in their entirety. No additional trails will be developed and use of informally blazed trails will be discouraged.
- Regular maintenance of vegetation will be limited to areas along the main and Northern Trails to maintain safe access by users of the trails and for gaining access to utilities.

- Vegetation in the interior of the conservation area will not be cleared or cut unless that vegetation poses a public safety risk or when removal is necessary as part of an invasive species management program (discussed in a separate section). The use of pesticides (including insecticides, herbicides, rodenticides, and fungicides) shall be prohibited in wildlife portions of the conservation area.
- No hunting or taking of wildlife species (animal or plant) will be allowed in the HMCA.

Educational material that communicates the objective of the HMCA management plan and identifies permitted and prohibited activities is needed. A discussion on public communication is presented separately.

Responsible Party: ***Department of Public Works/Conservation Commission***

Target Completion Date: ***December 2010 (for communication; activities ongoing)***

In addition, surveys in the general area of the HMCA conducted in the early 1900s identified the presence of a state-threatened plant, the white-fringed orchid. While the habitat most suitable for this plant has been altered since the plant was last observed (1921), the following action will be undertaken, as recommended by RINHS:

- The town will work with the New England Wildflower Society's Plant Conservation Volunteer (PCV) program to update the status of historic rare species and develop management plans regarding current occurrences of rare plants.

Responsible Party: ***Conservation Commission***

Target Completion Date: ***December 2012 (two growing seasons)***

4.3 Objective 3 - Manage Access to the HMCA

To attain the level of protection provided by Objectives 1 and 2, management of access to the HMCA is required. The following three locations are adopted as approved access points:

- Central access point: Kent Street at the intersection of the Main Trail. Access to the Main Trail and the northern extension is provided from this location. Parking is available for several cars immediately near the Main Trail entrance; additional parking is available west of the entrance at Hampden Meadows School.
- Southern access point: Linden Road. This location provides access to the southern end of the Main Trail, as well as to one of the two detached parcels in the southern portion of the conservation area. No parking is available immediately at the southern entrance; it is recommended that this area be retained as a pedestrian only access point.
- Northern access point: Rear of Sowams School. The middle section of the Northern Trail can be accessed at the rear of Sowams School.

Use of other access points is discouraged in order to prevent entry into the wildlife sections of the conservation area. Of note, access through a secondary trail branching west off of the Main Trail about midway between Kent Street and Linden Road and exiting at New Meadow Road is to be discouraged. This secondary trail passes near vernal pools and areas where interior-dwelling birds were identified, and has apparently been used as a social trail to locations in the interior of the conservation area. To

discourage use of this trail, the small footbridge over the western ditch will be removed and the New Meadow Road entrance will be obstructed with boulders, thorny native vegetation, or in some other acceptable manner.

Signage and communication to the public about the formalization of HMCA access is presented separately.

Responsible Party: ***Department of Public Works/Conservation Commission***

Target Completion Date: ***December 2010 for closing of secondary trail entrance on New Meadow Road and removal of the footbridge across the western ditch.***

4.4 Objective 4 - Establish Permitted Uses of the HMCA

To attain the level of protection required by Objectives 1 and 2, identification of permitted and unpermitted uses of the HMCA is needed. Many of these permitted and unpermitted uses are currently established through town ordinances or are understood to apply to HMCA; however, formalization is expected to result in a higher level of compliance.

4.4.1 Main and Northern Trails

The Main Trail will continue to be used for passive recreation (and similar activities) only. No improvements or expanded uses are planned. It is anticipated that the current condition of the Main Trail is suitable for this use, and no modification will be needed except for ongoing maintenance for safety/access.

Use of the Northern Trail for the *Safe Routes to School* program, if implemented, will require upgrading of the trail. The Northern Trail is largely undeveloped at the present time, with the trail formed mainly from foot traffic. The trail passes very close to the drainage ditch in some locations, and areas of eroding soil and exposed tree roots are plentiful. During development of plans for upgrading the Northern Trail in the *Safe Routes to School* program, safety and habitat preservation will need to be balanced to ensure that upgrades do not conflict with the needs of the conservation area.

Accepted uses along the Main and Northern Trails, consistent with its current/intended designation for open space-passive recreation, include the following:

- Walking; running
- Bike-riding
- Cross-country skiing; snowshoeing
- Dog-walking when dogs are leashed in accordance with the town ordinance.

Implementation of these uses requires only public communication and signage, discussed in a subsequent section.

4.4.2 Conservation Area Interior

As established in Objective 2, preservation of the conservation area as a wildlife habitat, with the exception of the Main and Northern Trails, is a primary goal of the management plan. Therefore,

accepted human uses of the conservation area outside of the trails are limited to the following, to be performed only by authorized town personnel or their designees:

- Management of invasive plant species
- Management of falling limbs or dead trees for safety concerns
- Response to emergency conditions (fires, utility line ruptures, etc.)

Implementation of these uses requires only public communication and signage, as well as communication with Town officials, discussed in a subsequent section.

4.4.3 Unpermitted uses

While the list of unpermitted activities within the HMCA could potentially be extensive (to an unnecessary degree, e.g., no opening of sewer manholes), the following are deemed sufficient to remind visitors of the permitted uses of the conservation area, and should be posted using approved signage:

- Stay on the marked trails; off-trail areas are off-limits.
- Observe day use restriction. Area closes at sunset.
- Leash your dog and remove waste.
- Do not disturb vegetation or wildlife.
- No littering. Carry out what you carry in.
- No disposing of yard waste or foreign plant material.
- No motorized vehicles of any type are allowed on trails.
- No setting of fires.
- No hunting or firearms.
- No alcoholic beverages.

Public communication regarding permitted and unpermitted uses of the HMCA will be performed initially through the following activities:

- As part of the development and acceptance of this management plan, a series of public meetings and/or site visits will be held. These will be advertised in the local newspaper (The Barrington Times), and posted on the town's website and at Town Hall.
- Signage describing permitted and unpermitted activities will be developed in an acceptable format to Town officials and posted at agreed upon locations at the entries of and within the HMCA.
- A listing of permitted and unpermitted activities, as well as an overview of the HMCA management plan will be posted on the Town's website.

With time, other forms of communication or "reminders" may be appropriate. The need for and form of such communication will be identified as part of the yearly assessment of the management plan.

Responsible Party: ***Conservation Commission/Planning Department***

Target Completion Date: ***Two public meetings/site visits by December 2010***
March 2011 for all signage

4.4.4 Encroachments

Encroachment on the HMCA by adjoining land owners will be managed by the following activities:

- Marking of the property boundaries of the HMCA using permanent granite markers or similar method.
- Periodic (yearly) inspection of the HMCA perimeter to identify possible encroachment
- Communication with adjoining land owners to advise against encroachment and/or correct existing encroachment
- If needed, enhancement of town ordinances prohibiting encroachment, with imposition of fines for offenses.

Responsible Party: ***Town Planner/Conservation Commission***

Target Completion Date: ***Marking of HMCA boundaries by June 2011***
Inspection of HMCA by June 2011 (in coordination with marking)
Communication with adjoining property owners by September 2011
Enhancement of Town ordinances (if needed) by September 2011

4.5 Objective 5 - Management of Invasive Plant Species

Invasive plant species occur along the trail edges of the oak-maple forest and include Oriental bittersweet, multiflora rose, autumn olive, and Morrow's honeysuckle. During the summer of 2008, some areas of the oak-maple forest were suffering from insect damage that affected up to 50 percent of the leaf area of broadleaf deciduous tree and shrub species. This is believed to be caused by the winter moth, an exotic invasive pest.

Based on the recommendations made by RINHS, the following are recommended:

Develop an invasive species management plan for the HMCA that includes the following components:

- Inclusion of an invasive species monitoring program to detect the introduction and spread of non-native species.
- Removal or treatment of invasive plants in a manner that does not adversely affect the conservation area or its wildlife inhabitants.
- Prohibition on the cutting, removal, or introduction of live or dead vegetation to the conservation area.
- Prohibition on the planting of non-native vegetation within or adjacent to the HMCA.
- Requirement to clean landscaping equipment prior to use in the conservation area to prevent the transfer of invasive species through equipment.
- Prohibition on the disturbance of soil, as this will increase the likelihood of invasive species establishment.
- Maintain or increase measures to thwart illegal dumping (e.g. yard waste) within the HMCA, including assessing fines for non-compliance.

- Require the development of a project-specific invasive species control plan as a formal component of any public development or activity planning in or adjacent to the conservation area (including the *Safe Routes to School* program and any redevelopment of Hampden Meadows School).
- Communication with adjacent landowners, RIDEM, and other stakeholders in the East Bay to develop an integrated, regional winter moth control strategy.

Possible control options for invasive plant species identified within HMCA is presented in Appendix B

Responsible Party: ***Department of Public Works (Tree Warden)/Planning Department (ordinance)***

Target Completion Date: ***Changes to work habits - upon adoption of this management plan***
Plan development - December 2010
Adoption of ordinances banning plant introduction/removal and requirement for invasive species control plan - March 2011

4.6 Objective 6 - Enhancement to the Uses of the Kent Street Skating Pond

The one-acre, man-made skating pond located along Kent Street near the Main Trail entrance functions as a long-hydroperiod vernal pool, providing semi-permanently flooded habitat for breeding amphibians and macroinvertebrates, such as dragonflies. Surveys conducted by RINHS revealed that common bullfrogs and spring peepers, both having protected conservation status in Rhode Island, are breeding in the pond. RIDEM Department of Fish and Wildlife has reportedly indicated that the East Bay peninsulas are severely lacking in amphibians, most likely due to intensive mosquito spraying in the early 1970s. As such, the ability to support breeding of amphibians and macroinvertebrates is a valuable attribute of the pond that warrants special protection.

To protect the unique habitat offered by the pond while still maintaining use of the pond as a skating rink in winter, the following actions will be taken:

- Maintenance of the pond will occur only after October 1 (to maximize time available for amphibians and odonates to emerge) and without draining the pond, if possible. If the pond needs to be drained, disturbance of the bottom substrate (where first year amphibians hibernate) will be minimized, and maintenance will be limited to once every ten years.
- Pond levels will be maintained through the use of flap gates to keep the pond flooded throughout the year in most years.
- A 10-foot wide fringe of woody wetland shrubs will be allowed to grow along at least one wooded (west or south) shore of the pond to enhance attachment, cover, and emerging habitat for larval fauna.

Responsible Party: ***Department of Public Works***

Target Completion Date: ***Adoption of maintenance practices - upon adoption of this management plan***
Erection of water level flap gates - June 2011

4.7 Objective 7 - Evaluation of Safety Concerns

Miscellaneous recommendations were made by RINHS concerning public safety and development issues. These recommendations included:

- Assess and mitigate hazards associated with forest fires.
- Assess and mitigate hazards associated with snags and falling limbs.
- Consult an attorney to see if an assessment and mitigation of drowning and pathogen transmission hazards associated with the drainage ditch and Skating Pond is necessary.
- Relocate large-scale recreational development to another municipal property.
- In any planning to install parking facilities, consider using permeable surfaces such as gravel or semi-pervious pavers to minimize the runoff of automotive fluids into surface waters and wetlands.

Specific recommendations for actions, if needed, will be considered during subsequent revisions of this management plan.

TABLE 1

HMCA Parcel Information

TABLE 1
Summary of Hampden Meadows Conservation Area Parcel Information

Plat	Lot	Acreage	Zoning [1]	Address/Other Comment	Year Acquired by Town	Prior Owner
28	14	5.9	R-25	Sowams Road (new practice field)	12/29/1995	Toolin Cynthia & Perna Michael
29	209	3.2	Conservation	Linden Road	--[2]	--[2]
31	13	13.6	R-25	324 Sowams Rd	9/19/2002?	John A. DeSano & Anthony R DeSano Sr. Trusts
31	172	13.6	OS-P	Includes Kent St Pond and part of drainage ditch. Owner: Hampden Meadows School	--[2]	--[2]
31	315	18.2	OS-A/OS-P	Sowams School	--[2]	--[2]
31	316	1.1	OS-A	Tennis Courts	--[2]	--[2]
31	315	18.2	OS-A/OS-P	Sowams School	--[2]	--[2]
31	321	0.3	Conservation	Briarwood Drive; owner: Sowams School	--[2]	--[2]
31	332	4.3	Conservation/OS-P	Oak Manor Drive (Sowams Rd Rear)	9/7/1967	A.J. Vander Woude, inc.
31	333	2.2	Conservation	Rear of Sowams Rd	unknown	No prior owner identified
31	351	1.8	Conservation	Rear Sowams Rd	8/25/1967	Created out of Lot 70
31	352	3.7	Conservation	Rear Sowams Rd	8/28/1967	Created out of Lot 12
31	412	?	R-25	Sowams Road Rear (rear of 31-013)	--[2]	--[2]
32	524	7.0	Conservation/OS-P	Rear Sowams Rd	8/25/1967	No prior owner identified
32	525	16.6	Conservation	Rear New Meadow Rd	12/31/1995	No prior owner identified
32	51	9.0	Conservation/OS-P	Rear Sowams Rd	6/9/1967	John H and Irene M McCann
32	29	2.0	Conservation	Rear New Meadow Rd	unknown	No prior owner identified
32	30	4.3	Conservation	Rear New Meadow Rd	1/27/1969	Margaret Adams Estate
32	28	3.1	R-25	Rear Sowams Road.	8/28/1967 (part)	Part of original Natale family plot
32	47	16.0	Conservation/OS-P	Linden Road Rear	unknown	No prior owner identified
32	48	2.1	Conservation/OS-P	Linden Road	6/6/1967	Alice Reynolds Estate
32	46	7.7	OS-P/Conservation	Linden Road	11/30/1967	Ruth Lindsley
32	45	5.5	Conservation/OS-P	Linden Road	7/3/1975	Marian McCann
Total		**141.1**				

1. Zoning as of June 2009.
2. Information needed

FIGURE 1

Hampden Meadows Conservation Area

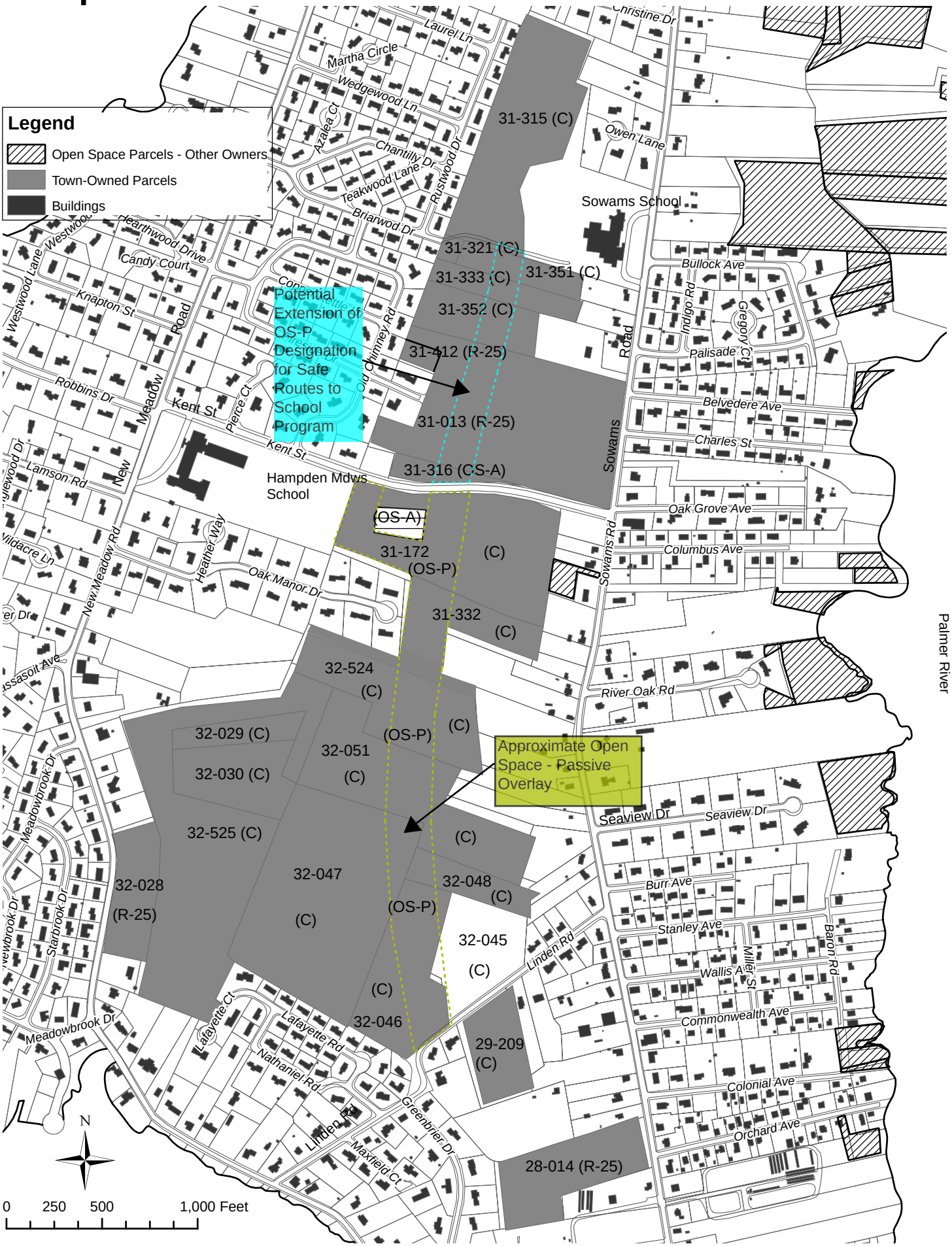
Figures

Figure 1 HMCA points of reference.

FIGURE 2

Plat and Lot Identification

Hampden Meadows Greenbelt



APPENDIX A

Rhode Island Natural History Survey Report

HAMPDEN MEADOWS CONSERVATION AREA

NATURAL RESOURCES MANAGEMENT PLAN

FINAL

Prepared for the
Barrington Conservation Commission
By
Rhode Island Natural History Survey
July 20, 2009

RHODE ISLAND
NATURAL HISTORY SURVEY
Providing Ecosystem Science and Information

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1. Introduction

This Natural Resource Management Plan is intended to guide the Town of Barrington in creating a comprehensive management plan for the Hampden Meadows Conservation Area (HMCA or Conservation Area) in Barrington, RI. This Plan relies on ecological information, gathered from research and in the field, to guide the development of recommendations for actions and policies that address Barrington's objectives for HMCA management regarding natural resources.

This report includes a rapid ecological assessment (REA) of the Hampden Meadows Conservation Area conducted from June to November, 2008. The structure and content of the REA generally follows the guidelines of an assessment protocol developed by Sayre *et al*. (2000). The protocol is based on the identification, characterization, classification, and mapping of vegetation communities, followed by research, inventories, and field surveys of flora and fauna. The intent is to reveal associations between habitat types, flora, and fauna, to identify species and habitats of conservation concern, and to identify anthropogenic stressors and the threats they pose to ecological integrity. This information is applied to the recommendations for natural resource management.

The REA protocol focuses on the spatial distributions of ecological and anthropogenic features to facilitate management decision-making. Wherever appropriate, maps are used to display data in a geospatial format.

2. Study Area

The Hampden Meadows Conservation Area is located in eastern Barrington, RI and is managed by the Barrington Conservation Commission under the ownership of the Town Of Barrington. The conservation area is a 1.2-mile-long linear greenbelt that covers 132 acres comprising a ditched and drained, 113-acre red maple swamp and bordering uplands. The properties are not entirely continuous, intersected by two paved roads, and are surrounded by residential development (Fig 1). The public can access the HMCA from Kent Road which bisects the properties latitudinally. A skating pond and tennis courts are at the access area. From there, a walking trail runs north and south along a wide, deep drainage ditch and atop a raised bed that covers a sewer line; these features run north-south through the entire run of the property, with the drainage ditch eventually entering Narragansett Bay through a pair of culverts with one-way scuppers.

2.1 History

The Hampden Meadows Conservation Area was designated to open space as a Greenbelt. The property conserves primarily a historically natural red maple swamp that grows on soils unsuitable for conventional agriculture or other development. A ditching program dug nearly two miles of deep and wide drainage ditches, likely for mosquito control, in the early part of the 1900s. The main ditch may have been originally dug (or widened) for transport of bricks during a short period of clay mining that also took place on the property during that time period. Currently, these ditches remain and continue to flow south to the Barrington River (Narragansett Bay) throughout the year, lowering the groundwater table, shortening the hydroperiod of wetlands, and affecting the habitats of the HMCA. The installation of a buried pipeline in the 1970s caused further disturbance to the wetland by raising the soil level, clearing a path of existing vegetation, and facilitating the introduction of upland and invasive species.

2.2 Current Use

The Conservation Area is open to the public and the trail is used primarily for passive recreation and commuting by local school children. The pipeline is maintained as a municipal facility. The skating pond and tennis courts on Kent Street are maintained by the Town of Barrington and used by the public.

3. Rapid Ecological Assessment

The goal of this section is to characterize and locate the ecological functions and values of, and threats to, the Hampden Meadows Conservation Area in order to provide a baseline for natural resource management recommendations, which follow.

The objectives of the REA are as follows:

- Create a baseline inventory of habitat types and characteristic flora
- Collect and generate ecological information about flora and fauna
- Identify ecologically sensitive, valuable, and otherwise important natural resources and sites
- Produce maps, tables, and other products to inform management decision-making
- Identify species and areas of special conservation concern

3.1 REA Methods

3.1.1 Mapping and Inventory of Vegetation Communities

The vegetation surveys consisted of a geospatial inventory of habitat types characterized and classified by dominance of vegetation and a survey of invasive plant species. Plant species diversity data were not collected due to inherent resource constraints.

Habitat Inventory

Vegetation communities were characterized by habitat type according to the NERRS Classification Scheme (Kutcher *et al*. 2007). The classification is hierarchical; it is based on broad ecological classes at the upper levels, and by the dominant vegetation type or man-made ground cover at the lower levels. This classification scheme was chosen because it integrates upland, wetland, and cultural land cover into a common format and it is compatible with the National Wetlands Inventory (NWI). The inventory involved a combination of remote sensing and field surveys.

Habitat types were heads-up (on screen) delineated in a geographic information system (GIS) using true color, leaf-off digital imagery based on aerial photography collected in 2003 and 2004 (RIGIS 2008). Polygons were created by photo-interpretation of the color and texture of the land cover at a digital scale of approximately 1:5000 and a targeted minimum mapping unit of 0.25 acres (0.1 ha). Where necessary, true color leaf-on digital imagery collected in 2003 (RIGIS 2008) was used to facilitate interpretation.

A preliminary field map (both paper and digital), depicting the digital imagery, the polygons, and scale bars, was created and taken into the field for verification. A datasheet was allocated to each identified vegetation unit. As each unit was verified in the field, data were collected to identify characteristic and other important (rare or invasive) plant species within each stratum. Percent cover of each species was then estimated in the field. Boundary and classification interpretations were adjusted as well.

The data were entered into a GIS table for analysis, export, and to create maps and other products.

Invasive Plants

Invasive plant species were inventoried in two ways; first opportunistically during field work for habitat and fauna surveys, and second, during a survey targeting the locations and intensities of

exotic species incursions. During habitat surveys, percent cover of invasive species was estimated for each identified habitat unit. During all other field work, invasive plant species occurrences were documented.

3.1.2 Fauna Surveys

Three surveys of fauna were conducted; a breeding songbird survey, an amphibian larva survey, and an opportunistic fauna survey. These surveys were chosen for the efficiency of collection and the information that can be derived from the specific taxa. Mammals and reptiles, though certainly important components of the ecology, are difficult to detect and field work involves specialized equipment; these groups were not surveyed.

Breeding Songbird Survey

Birds were surveyed using a 10-minute point-count method (e.g. Enser 1992), which quickly identifies and quantifies songbirds breeding in or otherwise utilizing a given area. Six sampling stations were selected in targeted habitat types throughout the conservation area. Each station was comprised of a point of survey and the surrounding 100-meter area in all directions (the theoretical distance that a bird song or call can be heard). All individual birds heard or seen during a 10-minute time period were recorded and tallied. The point counts were conducted on June 25, 2008 between 0600 and 0930.

Amphibian Larva Survey

Amphibian larvae were surveyed with a dip net. Survey stations were selected by using aerial photography and site reconnaissance to identify likely breeding areas. To survey the population, a dip net was swept a full arms length a total of 15 times per site. All amphibians captured were identified, counted, and documented (e.g. P. Paton personal communication).

Opportunistic Fauna Survey

During all aspects of field work, opportunistic fauna data sheets were on-hand to allow the documentation of incidental fauna. Any animal seen or heard during any field investigation was documented. Survey dates fell within June, September, and November, 2008.

3.1.3 Surrounding Landscape Assessment

GIS was utilized to characterize the intensity of land use surrounding the Conservation Area. A 1-Km buffer donut polygon was produced from an outline of the Conservation Area. This was used to clip RIGIS 2003-2004 land use / land cover data (RIGIS 2008) to represent the surrounding landscape only. The resulting clipped data were used to quantify the intensity of development in the surrounding 1 km by percentage of various land use and land cover types.

3.2 REA Results and Discussion

3.2.1 Flora

Habitat Inventory

The Hampden Meadows Conservation Area covers 132 acres comprising a 113-acre forested swamp, 12.5 acres of forested upland, and 3 acres of managed property. Forested lands cover 95% of the area total. A drainage ditch covers 2 acres total, while a skating pond covers 1 acre.

Six habitat types were identified in the Conservation Area; these are described below. Refer to Table 1 and Fig. 2 for areas and spatial orientation.

Uplands

1. Oak-maple Forest
An Oak-maple Forests grows on mesic Winsor loamy sand (WgB) soils occurring on the south end of the Conservation Area (Fig 3). The canopy is split between mixed oaks (*Quercus* sp.) and red maple (*Acer rubrum*) in these areas. Oak-maple Forest shrubs in the HMCA include sassafras (*Sassafras albidum*), red maple saplings, blueberry (*Vaccinnium corymbosum*), and greenbrier (*Smilax rotundifolia*). Invasive species occur along trail edges and include Oriental bittersweet (*Celastrus orbiculatus*; uncommon), multiflora rose (*Rosa miltiflora*; uncommon), autumn olive (*Elaeagnus umbellate,* scarce), and Morrow's honeysuckle (*Lonicera morrowii*; scarce).

In the summer of 2008, some of these areas were suffering from insect damage; the leaf area of broadleaf deciduous tree and shrub species was diminished by as much as 50% in areas. This appears to be caused by the exotic invasive pest the winter moth (*Operophtera brumata*) according to RIDEM (L. Lopes-Duguay, personal communication).

2. Hay Meadow
A 2.5-acre hay meadow lies along Sowams Road. This early successional habitat type is upland grassland containing native and agricultural grasses and forbs. This small area was not accessible for plant surveys. Expected characteristic species include switchgrass (*Panicum virgatum*), timothy (*Phleum pretense*), and hay (e.g. orchardgrass: *Dactylis glomerata*). Invasive plant species noted in this area were scattered tree of heaven (*Ailanthus altissima*) and the thorny shrub multiflora rose.

Wetlands
3. Red Maple/shrub Swamp
Occurring throughout the HMCA, Red Maple/shrub Swamps comprise 98% of wetlands and 84% of all lands within the Conservation Area. This is the most common wetland habitat type in the State. These areas are temporarily to seasonally flood during the growing season and fall primarily on Scarboro muck soils (Fig 3). The canopy of this habitat type in the HMCA is dominated by red maple with scattered pin oak (*Quercus palustris*) and birch (*Betula* sp.). Sweet pepperbush (*Clethra alnifolia*) is abundant in the shrub layer, while greenbrier is also common. Cinnamon fern (*Osmunda cinnamomea*) is common in the herbaceous layer. The property contains invasive species along access trails including bittersweet and multiflora rose.

4. Vernal Pools
This habitat type falls within glacial depressions scattered in the southwestern corner of the Conservation Area. Seasonally flooded, Vernal Pools have a longer hydroperiod than the Red Maple/shrub Swamp habitats because they occur in depressions that intersect the water table for a longer period and they contain poorly-drained muck soils. The canopy is dominated by red maple and the shrub layer is scattered sweet pepperbush. The pools in the HMCA generally lack ground cover vegetation, likely due to a long hydroperiod and thick leaf litter. No invasive species were noted in HMCA Vernal Pools.

Waters
5. Manmade Drainage Ditches

These features were constructed to drain the swamp waters of the HMCA into the Narragansett Bay. These features are of significant ecological consequence to the habitats on these properties because they continually maintain an artificially low water table in the swamps. This directly affects vegetation structure and species composition. The ditches themselves contain little vegetation.

6. Shallow Manmade Pond
A 1-acre manmade skating pond along Kent Street provides semi-permanently flooded habitat for breeding amphibians and macroinvertebrates such as dragonflies (*Odonates*). The pond has a sand bottom covered by a thin layer of detritus and is managed to keep vegetation to a minimum. Some emergent vegetation grows within its boundaries during the growing season.

Plant Species of Conservation Concern

The habitats of the HMCA have changed dramatically over the last century. The habitats that have supported rare species in the past are no longer represented and no rare species were noted during our vegetation community surveys. Although it is not likely that documented historic occurrences remain, RINHS recommends that Barrington work with available resources to investigate this further. Rare plant species surveys require time and resources not available in this project. Refer to Section 4.2.5 for more information on rare species monitoring and to Appendix 1 for descriptions of historic element occurrences.

Invasive Plant Species

Invasive plant species tend to become established in highly disturbed areas. This is the case in the habitats within the HMCA. Invasive species are mainly present along open habitat edges (e.g. along roads) and along trails in interior areas. The trail lies on a raised pipeline that was installed during the late1970s. The disturbance of vegetation and soils from that project and since (Fig 4), including the raising of ground level, removal of canopy vegetation, and the use of trails by humans, likely were and are the main contributors to the establishment of invasive species. Refer to Table 2 for a list of invasive plant species inventoried during this work.

3.2.2 Fauna

Birds

Birds are effective indicators of environmental status because they are omnipresent, sensitive to environmental structure and change, and they can be monitored efficiently. Species assemblages can give managers information about how habitats are functioning, since certain species are habitat-specific. Rhode Island Natural History Survey (August *et al*. 2008) has compiled abundance and breeding status of RI birds, RIDEM (2005) has compiled a list of species of greatest conservation need (GCN), and the Nature Conservancy (2008) has compiled a database of the conservation status of bird species in North America. This information for each species listed is presented below and in subsequent tables. A total of 17 bird species were observed during RINHS fieldwork, of which 4 were GCN species.

<u>Bird Point Count Survey</u>
Breeding songbird point count surveys were conducted to provide current information on bird species and habitat function. Fourteen species total, including four GCN species, were identified during breeding bird surveys at HMCA. Refer to Table 3 and Figure 5 for tallies and locations of species and for habitat associations.

Opportunistic Fauna Surveys

Opportunistic fauna surveys were also conducted during all field work. Four avian species were identified during these surveys, three of which were not found during the breeding bird survey. Refer to Table 4 for tallies of these species.

Other Bird Data

In a study conducted from 1981 to 2000, Starring (2008) found that the community composition of bird species shifted in response to natural succession in the HMCA and adjoining areas (App. 2). This corroborates with numerous studies and theories on bird habitat selection. The current species inhabiting the HMCA are indeed dependant upon current habitat types; this is very important to consider during any activities that affect habitats in the Conservation Area., especially where interior species are concerned.

Amphibians and Reptiles

Amphibians are good indicators of the environmental health of seasonally flooded wetlands and surrounding uplands because they are extremely sensitive to environmental stressors and can be efficiently surveyed. RIDEM DFW identified species of greatest conservation need (GCN) and the RINHS has compiled a database of the conservation status of all amphibians known to occur in Rhode Island. This information for each species listed here is presented in subsequent tables.

Dip Net Surveys

Dip net surveys were conducted in the skating pond only, since vernal pools of the HMCA were already dry during the sampling period. The surveys revealed that common bullfrogs (*Rana catesbeiana*) and spring peepers (*Pseudacris crucifer*) are breeding in the pond. RIDEM DFW notes that the East Bay peninsulas are severely lacking in amphibians. They theorize that intensive mosquito spraying in the early 1970s may have caused a decline of amphibians in the area and the population has not yet fully recovered (C. Raithel, personal communication).

Opportunistic Fauna Surveys

During all field work, only the call of a single green frog (*Rana clamitans*) was observed in the Skating Pond area.

Other Amphibian and Reptile Data

RIDEM DFW has been conducting statewide surveys of amphibians and reptiles in Barrington for decades. Table 5 shows species tallies from those data and state abundance status. All herptiles receive *protected* conservation status in RI. The lack of expected species is not thought to be from deficient effort (C. Raithel, personal communication).

Fish

Dip net surveys revealed that the estuarine fish species fourspine stickleback (*Apeltes quadracus*) and juvenile American eels (*Anguilla rostrata*) were utilizing the skating pond. Apparently, fish species are able to utilize the drainage ditch as a riverine connection inland. The American eel's conservation status is in flux, as populations are recently rapidly decreasing. Sticklebacks are thought to be secure.

Macroinvertebrates

Sampling for dragonflies and damselflies (Odonates) was conducted at HMCA between May 1998 and June 2004 as part of the Odonata Atlas of Rhode Island. Over 30 separate sampling events, a total of 66 voucher specimens of 26 species were collected. This represents 53% of the total odonate species that have been recorded in Barrington. Refer to Table 6 for results.

3.2.3 Surrounding Landscape

The surrounding landscape can have a strong effect on the ecological functions of a conservation area. This is because the surrounding landscape can influence habitat connectivity, migration patterns, water quality, species dispersion, edge effects, metapopulations, direct disturbances, the introduction of invasive species, and a host of other factors. An analysis of the land use and land cover (LU/LC) surrounding the Area revealed that 66% of the land surrounding the HMCA is developed, while 4% is agricultural and 30% is natural. Refer to Table 7 and Figure 6 for areas and locations.

3.3 Areas of Special Consideration

One area of special concern is identified here. The area requires special management consideration because it is regionally unique, supports species of concern, and is particularly vulnerable to human impacts.

3.3.1 Kent Street Skating Pond

Although the Kent Street Skating Pond is a manmade and regularly maintained feature, it functions as a long-hydroperiod vernal pool. It is a breeding haven for amphibians, which are regionally scarce, and supports juveniles of the declining American eel population and diverse macroinvertebrates. With careful timing of maintenance, the pond may serve the dual purpose of wildlife habitat and recreational activity area. In fact, its utility to the public could be enhanced by the aesthetic benefits of managing wildlife uses during the warm seasons and recreation during the winter. Recommendations for management are offered in Section 4.2.3.

3.4 REA Conclusion

The Hampden Meadows Conservation Area is an important natural feature occurring within a highly developed landscape matrix. The main feature, a 113-acre Red Maple Swamp, has long been drained and is likely a considerably drier swamp than the original. But the wetland vegetation has adjusted to this persistent stress for close to a century, and has largely adjusted, now containing vegetation structure and composition that is more characteristic of a temporarily to seasonally flooded natural swamp. A slightly species poor understory and the occurrence of greenbrier may further indicate this disturbed hydrology. Invasive plants are abundant at the street edges and along stretches of the raised trail. Humans are likely the cause and custodians of this problem. While invasive species are difficult to control, small incursions can be mitigated before further damage is done to native habitats.

The skating pond is an unexpected ecological feature, acting as a breeding haven for amphibians, which are regionally scarce, likely due to historic mosquito spraying and limited immigration opportunity. It also may function in supporting juveniles of the declining American eel population and in supporting diverse macroinvertebrates. The swamp itself supports both edge- and interior-dwelling breeding songbirds, including four species identified as those of greatest conservation need in RI. The composition of songbird species has shifted since the development of the pipeline, but

this will likely stabilize as the vegetation reaches climax. Mammal data are unavailable for the HMCA, but the Area likely acts as best available habitat for a host of expected species.

4. Management Objectives and Actions

Management objectives for the HMCA have been identified by the Barrington Conservation Commission (BCC) and the Draft Comprehensive Community Plan. The goal of this section is to inform management planning for these objectives in relation to natural resources.

4.1 Overarching Actions for Resource Management

Three overarching recommendations for natural resource management are offered here. These actions have broad applications that address multiple objectives. Applicability of these and other actions regarding specific objectives is offered in Section 4.2.

4.1.1 Preserve or Strengthen the Property Designation as a Conserved Area

The objectives identified in Barrington's Draft Comprehensive Plan regarding the HMCA require its continued and strong designation as conserved land. Conservation of the properties contributes to the integrity of wildlife habitat and the recreational enjoyment of the land. It appears that the status of HMCA as conservation land is based on town policy. This is not considered a particularly secure form of conservation by the Rhode Island Land Trust Council (R. Friday, personal communication). Contingency planning to protect the status of conservation land should the owner fall on hard times is also a best practice recommended by the Land Trust Alliance (Land Trust Alliance 2004). It is recommended that Barrington consider steps to reinforce HMCA's conservation status.

There are many ways to improve the security of a parcel's conservation status and they represent trade-offs between security and acceptability or feasibility. The use of various types of conservation easement to protect land in public ownership is anticipated in the Land Trust Alliance's Conservation Easement Handbook (Byers and Ponte 2005), and the Audubon Society of Rhode Island and a number of Rhode Island land trusts now regularly buttress conservation status of land by distributing ownership interests—separating development rights or other interests from fee ownership (L. Taft, personal communication). Barrington should consider whether a transfer to another party such as a land trust, statewide conservation group, or the state of Rhode Island of certain use rights to HMCA in the form of a conservation restriction is desirable and feasible. Other approaches to strengthening conservation status could include by-law or zoning modifications.

4.1.2 Manage Property Access and Use

Providing liberal access and use of the HMCA enhances the public's feeling of ownership and investment in the Conservation Area. However, uncontrolled misuse of the properties will have negative impacts on the resources and ultimately on public support for leaving undeveloped space for recreation. For example, dumping of trash or organic materials can introduce toxins, nutrients and pathogens to the surface waters and wetlands; trailblazing can directly impact habitats, cause fragmentation, and spread invasive species; and partying by teenagers causes litter, erosion, fire threats, and direct health hazards. An access and use management plan needs to be incorporated into the management plan for the properties to protect the resources and public support for this type of open space. The plan needs to include usage policies and rules and a feasible plan for maintenance and enforcement.

4.1.3 Manage Invasive Species

The establishment and spread of invasive species are directly related to human use, but they can be minimized through proper management. Terrestrial invasive plant species are often dispersed by

dumping yard waste and by lawn care equipment. Municipalities often infest their roadsides by carrying seeds and viable plant fragments from one mowing site to the next. Invasive plants can establish and thrive anywhere vegetation had been removed or substrate has been disturbed. Aquatic invasive plant and animal species are often carried from one water body to the next attached to the boots and boats of fishermen. Like plants, invasive animal species can impact native species through competition for resources. The introduction of invasive species to an ecosystem can have widespread and significant effects on the system.

Invasive species must, then, be considered in many management actions and activities, especially grounds maintenance, development, and other activities involving the clearing or cutting of vegetation. RINHS recommends the development of an overarching invasive species management plan, as well as the incorporation of targeted invasive species planning into all project and activity planning. The overarching plan should utilize all available resources including volunteers, community organizations, and State and Federal funding. It should include language that lays out monitoring methods, identification of responsible parties, and response protocols. It should also identify specific activities in the HMCA that facilitate invasive species introduction and spread. Finally, it should mandate that as part of planning, all management activities include a targeted invasive species management plan specific to the site and the activity.

Recommendations toward the management of invasive species, as it relates to HMCA management objectives, are offered throughout section 4.2. A summary of general guidelines for invasive species management are offered in Section 4.2.6:

4.2 Objectives and Actions for Resource Management

The following is an outline of objectives identified by the BCC and in the Draft Barrington Comprehensive Community Plan, followed by recommendations for actions regarding each objective. Recommendations are given in approximate order of importance. Natural resource management is complex in that it relies on predicting intricate interactions of the physical and biological world that cannot be easily generalized. Management planning for any specific project will require an equally specific degree of natural resource planning that is well beyond the scope of this effort.

4.2.1 Protection, Preservation, or Improvement of Habitat Integrity for Wildlife

As detailed in Section 3, the HMCA is an important haven for wildlife and passive recreation within a heavily developed landscape matrix. Four bird and one fish species of greatest conservation need utilize the habitats within the properties. Protection, preservation, and enhancement of the integrity of these habitats are critical to the preservation of the wildlife species that depend on them. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the protection of habitat integrity for wildlife:

- Preserve or strengthen the property designation as a Conservation Area. Minimize development of the properties and further fragmentation by roads, and trails. Even non-raised trails can introduce and facilitate invasive plant species. Fragmentation changes species interaction dynamics and can impact or preclude certain species, such as the Scarlet Tanager and the Wood Thrush; both are interior forest dwellers and GCN listed species inhabiting the HMCA.

- Control the spread of invasive plant species by following recommendations given in this document. Invasive species can degrade habitat integrity by changing the structure and composition of vegetation.
- Clearing and cutting of vegetation should be eliminated or minimized in the interior of the properties. Clearing and cutting of vegetation directly impacts habitats and can facilitate the establishment of invasive plant species. Removal of vegetation also contributes to erosion and sedimentation in wetlands through debilitating the binding function of root systems in the soil and facilitating sheet runoff. Where cutting is considered absolutely necessary, it should be limited to selective cutting of vegetation directly addressing the task at hand; all other vegetation should be left intact.
- Work with adjacent landowners, DEM, and other stakeholders in the East Bay to develop an integrated, regional winter moth control strategy. The non-native winter moth was observed on the properties in 2008 (Section 3) and their presence may pose a threat to broad-leaved deciduous vegetation because they browse on foliage and are difficult to control. Among some trees in the HMCA, leaf area was diminished by approximately 50% during the 2008 growing season. RIDEM has suggested that the introduction of a biological control agent may be effective at reducing their effects.
- Minimize impacts to areas of special concern. Specifically, develop maintenance protocols that enhance a dual use of the Kent Street Skating Pond by the public and wildlife (see Section 4.2.3).
- Minimize the use of pesticides in the area. Diverse odonate (dragonfly and damselfly) fauna have been inventoried at the Kent Street Skating Pond; some of these may be rare and further investigation may be needed. Many bird and bat species depend on flying insects for forage. It has been suggested that former mosquito spraying practices may be in part responsible for the local decline of expected amphibian species (Section 3). Removal of any trophic level (insects being toward the base of the food chain) may have unforeseen consequences on the environment.
- Maintain and enforce the *no hunting* policies in the HMCA. Hunting can directly impact regionally scarce resources and poses a threat to other uses of the Conservation Area. In many forested areas in Rhode Island, hunting is needed to replace top predators in controlling white-tailed deer overpopulation that can overwhelm vegetation. HMCA habitats show no indications of over-browsing and hunting is not necessary.

4.2.2 Management of Public Uses

The HMCA contains two activity areas and a linear foot trail running atop a buried sewer pipeline. The trail provides access for the public to enjoy the natural environs, a pathway for commuting school children, and access for pipeline maintenance. A managed skating pond and tennis court facilities at Kent Street provide public recreation opportunities. Recreational uses enhance public enjoyment and their appreciation and support for open space conservation. However, public use can directly and indirectly compromise the natural integrity of the conservation area. Thus, public use must be balanced against objectives that incorporate conservation. Best management practices can help minimize compromising effects. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding public uses as they relate to natural resources:

- Protect public safety by following recommendations offered in Section 4.2.5.
- Control the spread of invasive plant species associated with public use by following recommendations given in this document. Develop an invasive species management plan

that identifies specific regulations regarding activities conducted on the properties. The plan should include, for example, such requirements: a ban on cutting, removing, or introducing live or dead vegetation in the area; regulation of mowing and brush-cutting protocols to include the cleaning of equipment between sites; discouraging trailblazing; etc.

- Preserve or strengthen the property designation as a Conservation Area. Avoid the development of new activity areas and rather focus on the maintenance and stewardship of low-impact uses. Minimize trailblazing by designating and clearly marking hiking trails; post signage discouraging trailblazing. Even non-raised trails can introduce and facilitate invasive plant species and increase erosion and surface runoff into surface waters and wetlands. Furthermore, fragmentation of continuous habitats changes species interaction dynamics and can impact or preclude important species.
- Manage activities that may impact areas of special concern. Specifically, develop public use policies that enhance a dual use of the Kent Street Skating Pond by the public and wildlife (see Section 4.2.3).
- Maintain or increase measures to thwart illegal dumping within the HMCA to minimize erosion, the spread of invasive species, and the introduction of nutrients and other pollutants to the wetlands and surface waters. Dumping of yard waste into wetlands is illegal and it is destructive to wetlands because it introduces excess nutrients and affects substrates.
- Minimize the use of fertilizers in the HMCA. Best management practices (BMPs) should be applied in the maintenance of mowed areas, particularly in the application of fertilizers and schedule of watering. Contact the Cooperative Extension Education Center, URI for information on BMPs.
- Impose and enforce a pet waste policy that requires owners to remove any pet waste introduced to the property to ensure that nutrients and pathogens will not be carried into surface waters and to increase the quality of passive recreation.

4.2.3 Enhancement to the Uses of the Kent Street Skating Pond

Kent Street Skating Pond is a manmade and regularly maintained feature used for public ice skating during the winter. It is drained during the growing season to allow the town to remove vegetation from the substrate to maintain a clear surface for skating the following season. However, the pond functionally acts as a long-hydroperiod vernal pool; it is a breeding haven for amphibians and supports American eels and diverse odonate macroinvertebrates. With careful timing of maintenance, the pond may serve the dual purpose of wildlife habitat and recreational activity area. The pond's utility to the public could be enhanced by managing wildlife uses during the warm seasons. Enhancing wildlife use of the pond could encourage public appreciation, raise awareness, and increase support for the conservation of the HMCA.

Bull frogs and spring peepers breed in the pond and green frogs may as well (Section 3). Bull frogs and green frogs generally require two full seasons of flooding before emerging as adults, and semi-permanent to permanent flooding is considered obligate to their breeding success. Paton and Crouch (2000) found that in Southern RI, these species may adapt to shorter hydroperiods by undergoing metamorphosis earlier, but still require two seasons of flooding. American eels require permanent flooding as well. Ideally, the pond should never be fully drained to maintain its habitat viability for these species. If maintenance cannot be accomplished without draining, draining every two years would allow a portion of breeders to be successful.

Odonates vary in life history, but many rely upon emergent or woody wetland vegetation to complete their lifecycles, as aquatic larvae emerge to perch and metamorphose into winged adults. Allowing emergent vegetation to grow throughout the growing season will enhance the productivity of the pond for these species. A permanent fringe of wetland shrubs would further enhance the pond's quality as habitat for odonates and amphibians.

Considering the benefits of dual use and the life history factors for dependant species, RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the use of Kent Street Skating Pond:

- Revise or establish maintenance schedules to minimize impacts to wildlife using the pond as detailed below.
- All maintenance should be conducted after October 1 to maximize time available for amphibians and odonates to emerge.
- Maintenance should be conducted without draining the pond, if possible. If the pond needs to be drained, limit maintenance to every other year to allow a portion of amphibians to successfully emerge.
- Maintain pond levels so that the pond is flooded throughout the year in most years.
- Minimize disturbance of the substrate during maintenance activities, especially in deeper sections of the pond where first-year amphibians hibernate, to minimize mortality.
- Maintain a 10' wide fringe of woody wetland shrubs along at least one wooded (west or south) shore of the pond to enhance attachment, cover, and emerging habitat for larval fauna without greatly decreasing skating area.
- Develop and distribute informational literature highlighting the dual use of the facility to enhance public enjoyment and support.

4.2.4 Development of New Activity Areas

While it can enhance public enjoyment and use, development can potentially directly and indirectly compromise the natural integrity of the conservation area and must be balanced against objectives that incorporate conservation. The development of recreational facilities within the properties is contradictory to conservation and to objectives that require conservation. Thus, development should be minimized within the HMCA. If development is planned, every effort should be made to minimize impacts to wildlife, critical habitats, surface waters, and wetlands. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding the development of new active use areas as it relates to natural resources:

- Preserve or strengthen the property designation as a Conservation Area. Preserve all existing habitats in their entirety. Relocate large-scale recreational development to another municipal property. Because it is comprised primarily of wetlands, there are limited sections within the HMCA that could support conventional development without impacting the wetlands. Wetlands are protected by state law; according to RIDEM and RICRMC, development should specifically not be located within 50 feet of any wetland. Town laws may require additional setbacks from these features. These laws were put in place to reduce additional impacts to surface waters and wetlands; deviation from these setbacks will require special permitting and lead to degradation of the resources.
- Develop an invasive species control plan as a formal component of any development planning. Invasive species are facilitated by several activities associated with development, including removal of vegetation, introduction of soils and fill, disturbance of substrate, fertilization, mowing and brush-cutting, and foot traffic.

- In any planning to install parking facilities, consider using permeable surfaces such as gravel or semi-pervious pavers to minimize the runoff of automotive fluids into surface waters and wetlands.

4.2.5 Consideration of Public Safety

Public safety will likely be a key consideration in management planning for the HMCA. RINHS recommends that the following policies be incorporated into Barrington's Management Plan regarding public safety as it relates to natural resources:

- Assess and mitigate hazards associated with forest fires. Consult with RIDEM Division of Forest Environment for regulations and risk assessment. While red maple swamps are generally considered low risk habitats, oak forest habitats are particularly susceptible to forest fire, especially in the summer and fall seasons (B. Payton, personal communication).
- Assess and mitigate hazards associated with snags and falling limbs. This should be done by a trained expert. While incidence of tree and branch deaths is generally considered low, falling woody debris does pose a real risk to people. Quickly remove any snags that appear to pose a danger to humans using the HMCA, especially large debris that is leaning or hung on other trees. Standing dead snags are valuable wildlife habitat for avian and mammalian cavity nesters, including the resident GCN species Great Crested Flycatcher and resident woodpeckers. These should be preserved when they pose no threats to humans.
- Consult an attorney to see if an assessment and mitigation of drowning and pathogen transmission hazards associated with the drainage ditch and Skating Pond is necessary.

4.2.6 Management of Invasive Species

The effects of invasive species have been discussed in Sections 3, 4.1, and throughout 4.2. Removal of invasive vegetation is not recommended without further work in determining its utility. Removal of invasive vegetation is often not a high priority in forested areas due to excessive costs, unintentional impacts to habitats and wildlife, and low effectiveness. The following is a summary of policies that RINHS recommends be incorporated into Barrington's management plan regarding management of invasive species in the HMCA:

- Develop an overarching invasive species management plan for the HMCA.
- Regulate mowing and brush-cutting protocols to include the cleaning of equipment between sites.
- Discourage trailblazing.
- Ban the cutting, removal or introduction of live or dead vegetation to the conservation area. Clearing and cutting of vegetation should be avoided or minimized. Clearing and cutting of vegetation can facilitate the establishment of invasive plant species.
- Develop a project-specific invasive species control plan as a formal component of any development or activity planning. Invasive species are facilitated by several activities associated with development, including removal of vegetation, introduction of soils and fill, disturbance of substrate, fertilization, mowing and brush-cutting, and heavy foot traffic.
- Minimize development of the properties and fragmentation by roads, and trails. Even non-raised trails can introduce and facilitate invasive plant species.
- Avoid disturbing the substrate or exposing it to light, as this will increase the likelihood of invasive species establishment.
- Apply BMPs to minimize nutrient inputs into HMCA habitats. Invasive species thrive on increased nutrients.

- Work with adjacent landowners, DEM, and other stakeholders in the East Bay to develop an integrated, regional winter moth control strategy.
- Do not plant non-native vegetation within the HMCA.
- Maintain or increase measures to thwart illegal dumping within the HMCA to minimize the spread of invasive species.
- Develop an invasive species monitoring program to rapidly detect the introduction and spread of non-native species.

4.2.7 Preservation of Native Vegetation

Native vegetation provides necessary cover, structure, and forage to wildlife and maintains biological diversity. Because Hampden Meadows has been heavily modified by historic activities, the habitats have been changing over time through natural succession. With succession comes a change in vegetation composition. Restoring conditions to support historic rare species that relied on historic habitats may not be practicable due to the threats of invasive species establishment, erosion, and other consequences of land clearing. RINHS recommends that the following policies be incorporated into Barrington's Management Plan: regarding the preservation of native vegetation as it relates to natural resources:

- Control the spread of invasive plant species by following recommendations given in this document. Invasive species pose a serious threat to native flora.
- Ban the cutting or removal of vegetation in the conservation area.
- Work with the New England Wildflower Society's Plant Conservation Volunteer (PCV) program to update the status of historic rare species and develop management plans regarding current element occurrences of rare plants.

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Tables and Figures

Tables

Table 1 Areas of habitat systems and habitat types occurring within the HMCA in 2008.

Habitat Type	Area (acres)		Area (acres)
Uplands		***Cultural Cover***	
Oak-Maple Forest	12.5	Mowed Park	0.9
Hay Meadow	2.5	Tennis Court	0.3
Total Uplands	**14.9**	**Total Cultural**	**1.3**
Wetlands		**Total HMCA**	**131.9**
Red Maple / Shrub Swamp	110.2		
Vernal Pool	2.6		
Total Wetlands	**112.8**		
Waters			
Drainage Ditch	1.8		
Shallow Man-made Pond	1.1		
Total Waters	**3.0**		

Table 2 List of invasive plant species observed at the HMCA and associated habitats.

Ailanthus altissima (tree of heaven)
- Hay Meadow

Celastrus orbiculatus (Oriental bittersweet)
- Oak-maple Forest
- Red Maple / shrub Swamp

Eleaegnus umbellata (autumn olive)
- Oak-maple Forest

Lonicera morrowii (Morrow's honeysuckle)
- Oak-maple Forest

Rosa multiflora (multiflora rose)
- Oak-maple Forest
- Red Maple/shrub Swamp
- Hay Meadow

Table 3 Bird species tallies from a breeding bird point count conducted in the HMCA in June, 2008.

Bird Code	Location						Bird Species Name
	GB1	GB2	GB3	GB4	GB5	Total	
AMRO		1	1		1	3	American Robin (*Turdus migratorius*)
BCCH	3	2	4	1	3	13	Black-capped Chickadee (*Poecile atricapillus*)
BLJA	2					2	Blue Jay (*Cyanocitta cristata*)
CAWR		1		3		4	Carolina Wren (*Thryothorus ludovicianus*)
DOWO		1	1			2	Downy Woodpecker (*Picoides pubescens*)
GCFL*	1		1	1		3	Great Crested Flycatcher (*Myiarchus crinitus*)
GRCA			2	3	3	8	Gray Catbird (*Dumetella carolinensis*)
HOFI		1				1	House Finch (*Carpodacus mexicanus*)
NOCA	1	1	2		1	5	Northern Cardinal (*Cardinalis cardinalis*)
RBWO			1			1	Red-bellied Woodpecker (*Melanerpes carolinus*)
RSTO*	1					1	Rufous-sided Towhee (*Pipilo maculatus/erythr*)
SCTA*		1	1			2	Scarlet Tanager (*Piranga olivacea*)
TUTI	2	2		1		5	Tufted Titmouse (*Baeolophus bicolor*)
WOTH*	1		1	2		4	Wood Thrush (*Hylocichla mustelina*)
Richness	7	8	9	6	4	14	
Tally	11	10	14	11	8	54	

*Identified as species of greatest conservation need (GCN) by RIDEM (2005).

Table 4 Bird tallies from opportunistic surveys conducted at the HMCA in June 2008.

Common Name	Scientific Name	Count
American Robin	*Turdus migratorius*	5
Barn Swallow	*Hirundo rustica*	1
Brown-headded Cowbird	*Molothrus ater*	1
Mallard	*Anas platyrhynchos*	3

Table 5 Amphibian* and reptile* species observed in Barrington RI by RIDEM DFW.

Genus	species	Common Name	Year	Status	location	age/sex
Bufo	*fowleri*	Fowler's toad	1985	Uncommon	Nockum Hill	adult
Bufo	*americanus*	American toad	1990	Common	0.6 SW Prince Pond	adult male
Bufo	*americanus*	American toad	1990	Common	0.6 SW Prince Pond	adult male
Bufo	*americanus*	American toad	1990	Common	Echo Lake	adult male
Chelydra	*serpentina*	common snapping turtle	1982	Common		
Chelydra	*serpentina*	common snapping turtle	1991	Common	Brickyard Pond	
Chelydra	*serpentina*	common snapping turtle	1991	Common	Runnins River	
Chelydra	*serpentina*	common snapping turtle	2002	Common	vic Brickyard Pond	
Chrysemys	*picta*	painted turtle	1983	Common	41	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Chrysemys	*picta*	painted turtle	1991	Common	Brickyard Pond	
Clemmys	*guttata*	spotted turtle	1982	Common	Hunderd Acre Cove	
Clemmys	*guttata*	spotted turtle	2003	Common	Lincoln Ave @ Peck Ave.	male
Lampropeltis	*triangulum*	Eastern milk snake	1990	Common	New Meadow Neck 0.3 SW Sowams School	juvenile male
Malaclemys	*terrapin*	Northern Diamondback Terrepin	0	Rare	vic Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	0	Rare	vic Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1993	Rare	Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1993	Rare	Nockum Hill	
Malaclemys	*terrapin*	Northern Diamondback Terrepin	1997	Rare	Hundred Acre Cove	adult male
Malaclemys	*terrapin*	Northern Diamondback Terrepin	2005	Rare	Mouth of Warren River	juvenile
Nerodia	*sipedon*	Northern Watersnake	1991	Common	Runnins River	
Nerodia	*sipedon*	Northern Watersnake	1992	Common	Haines Park Road at Annawomscutt Road	
Opheodrys	*vernalis*	Smooth Greensnake	2002	Common	Haines State Park	
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	Brickyard Pond	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	New Meadow Neck	adult
Plethodon	*cinereus*	Northern Redback Salamander	1987	Common	New Meadow Neck	adult
Plethodon	*cinereus*	Northern Redback Salamander	1990	Common	Echo lake	adult
Plethodon	*cinereus*	Northern Redback Salamander	1990	Common	Kent Street	adult
Pseudacris	*crucifer*	spring peeper	1990	Common	Echo Lake	adult
Pseudacris	*crucifer*	spring peeper	1990	Common	Haines State Park	adult
Rana	*clamitans*	Green Frog	1987	Common	New Meadow Neck	
Rana	*catesbeiana*	Common Bullfrog	1990	Common	Haines State Park	juveniles
Rana	*catesbeiana*	Common Bullfrog	1990	Common	Haines State Park	juveniles
Rana	*clamitans*	Green Frog	1991	Common	Runnins River	adult
Rana	*palustris*	Pickerel Frog	1991	Common	Runnins River	adult
Rana	*sylvatica*	Wood Frog	2006	Common	near East Providence border	adult
Storeria	*dekayi*	Northern Brown Snake	1983	Common	41	
Trachemys	*scripta*	red-eared slider	2000	Rare	Brickyard Pond	juvenile

*These are state protected species; please do not distribute these data.

Table 6 Odonate data collected between May 1998 and June 2004 by the Odonate Atlas of RI.

Scientific Name	Common Name	BP	KS	Total
Aeshna tuberculifera	Black-tipped Darner		2	2
Anax junius	Common Green Darner	1	1	2
Arigomphus villosipes	Unicorn Clubtail		1	1
Celithemis elisa	Calico Pennant		1	1
Celithemis martha	Martha's Pennant		2	2
Enallagma aspersum	Azure Bluet		5	5
Enallagma civile	Familiar Bluet	7	4	11
Enallagma durum	Big Bluet	1		1
Enallagma geminatum	Skimming Bluet	2		2
Enallagma signatum	Orange Bluet	2		2
Enallagma traviatum	Slender Bluet	1		1
Epitheca princeps	Prince Baskettail	2		2
Erythemis simplicicollis	Eastern Pondhawk		1	1
Erythrodiplax berenice	Seaside Dragonlet	1	3	4
Ischnura hastata	Citrine Forktail	1	4	5
Ischnura posita	Fragile Forktail	4		4
Ischnura ramburii	Rambur's Forktail		1	1
Ischnura verticalis	Eastern Forktail	1	1	2
Lestes congener	Spotted Spreadwing		7	7
Lestes forcipatus	Sweetflag Spreadwing		6	6
Lestes rectangularis	Slender Spreadwing	2		2
Leucorrhinia intacta	Dot-tailed Whiteface		2	2
Libellula cyanea	Spangled Skimmer		1	1
Libellula incesta	Slaty Skimmer		3	3
Libellula lydia	Common Whitetail		2	2
Libellula needhami	Needham's Skimmer		2	2
Libellula pulchella	Twelve-spotted Skimmer		2	2
Libellula quadrimaculata	Four-spotted Skimmer		2	2
Pantala flavescens	Wandering Glider		1	1
Sympetrum internum	Cherry-faced Meadowhawk		2	2
Sympetrum vicinum	Yellow-legged Meadowhawk		7	7
Tramea carolina	Carolina Saddlebags		1	1
Tramea lacerata	Black Saddlebags		2	2
	Number of individuals	***25***	***66***	***91***
	Species Richness	***12***	***26***	***33***

BP: Brickyard Pond
KS: Kent Street Skating Pond

Table 7 Land use and land cover occurring within 1.0 Km of the HMCA in 2004. Data derived from RIGIS 2003-04 LCLU (2008).

Land Use / Land Cover	Area (acres)	% of Total	Land Use / Land Cover	Area (acres)	% of Total
Developed Land			***Agricultural Land***		
Medium Density Residential	611.1	52.5	Orchards, Groves, Nurseries	20.3	1.7
Medium High Density Residential	111.5	9.6	Cropland	19.5	1.7
Developed Recreation	14.4	1.2	Pasture	4.0	0.3
Institutional	11.8	1.0	**Agricultural Total**	**43.8**	**3.8**
Commercial	10.3	0.9			
Power Lines	7.7	0.7	***Natural Land***		
Low Density Residential	3.0	0.3	Wetland	162.3	13.9
Medium Low Density Residential	0.8	0.1	Deciduous Forest	139.1	11.9
Developed Total	**770.6**	**66.2**	Mixed Forest	43.1	3.7
			Water	2.2	0.2
			Beaches	1.9	0.2
			Brushland	1.2	0.1
			Natural Total	**349.7**	**30.0**

Figures

Figure 1 HMCA points of reference.

Figure 2 Habitat types and cultural land cover occurring within the HMCA in 2008.

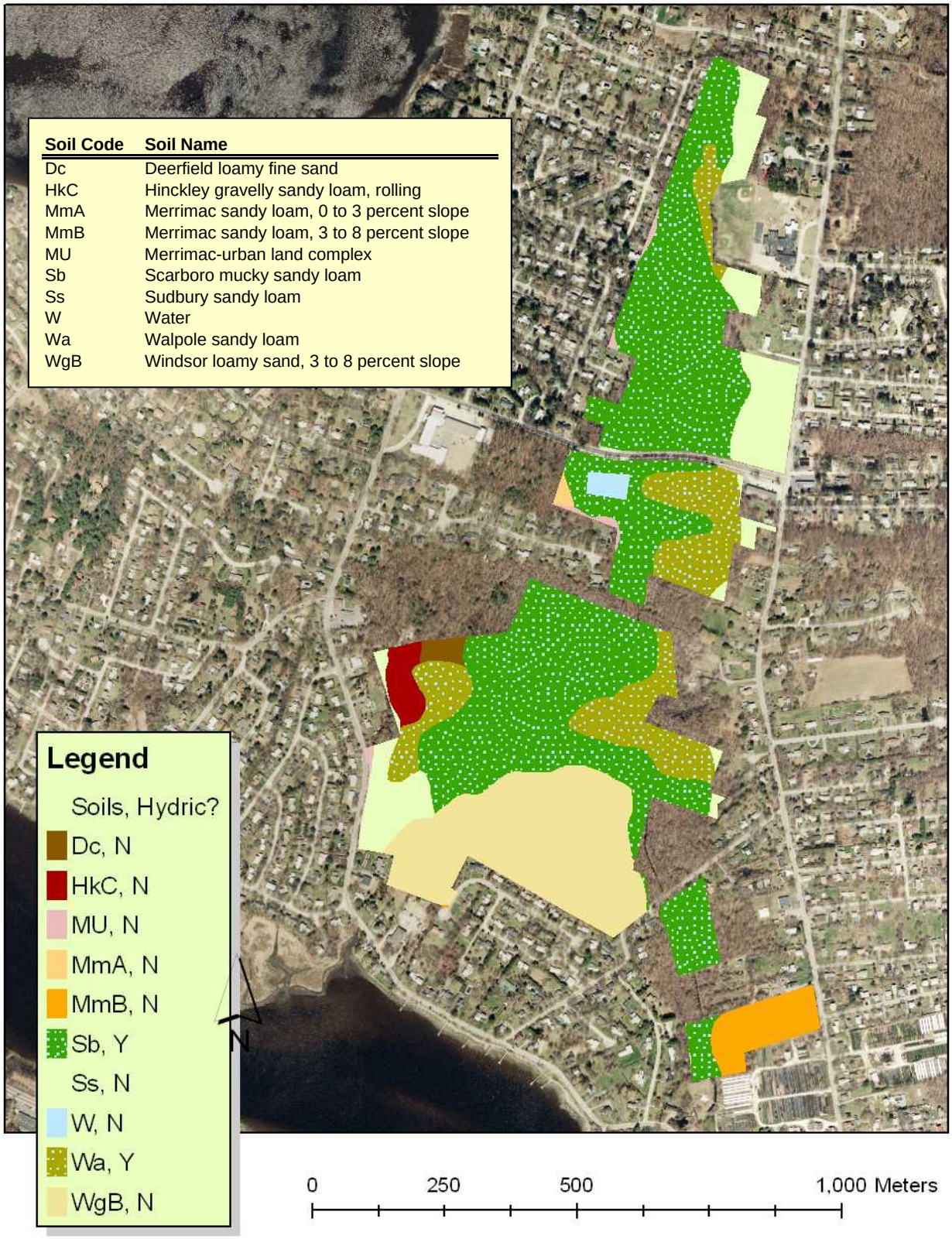

Figure 3 Soils of the HMCA (RIGIS 2008).

Figure 4 1981 aerial photo depicting sites of relatively recent habitat disturbance at HMCA.

Figure 5 HMCA 2008 breeding songbird point count sample stations and habitat associations.

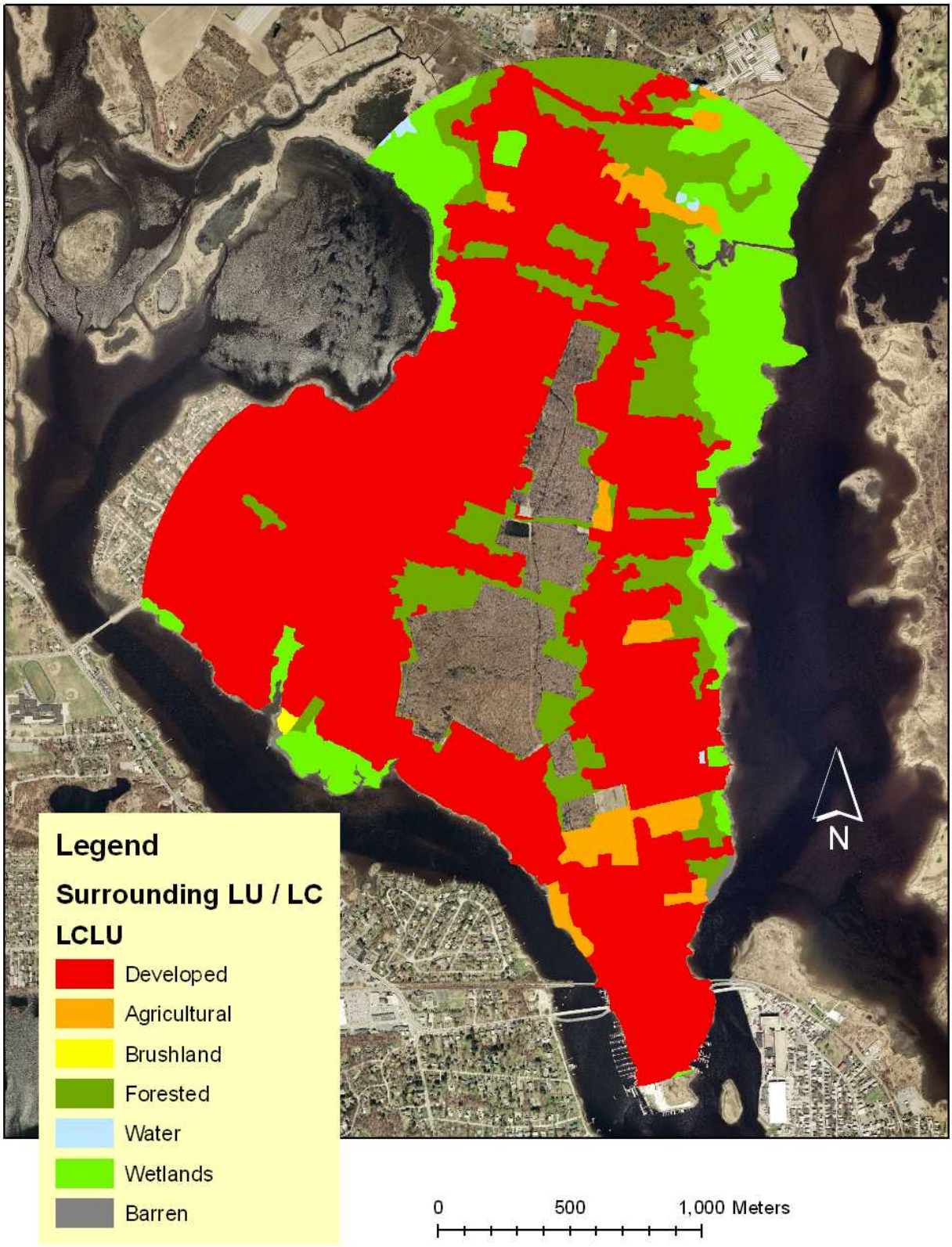

Figure 6 Land use and land cover occurring within 1.0 Km of the HMCA in 2004. Data derived from RIGIS 2003-04 LCLU (2008).

Appendices

Appendix 1. Historic Rare Plant Species of HMCA

Platanthera blephariglottis (White-fringed Orchid)

Species Status	Population Status	Last Observed	Last Survey
State Threatened	Historical	07-1921	07-2005

History:
Plant was initially collected by R. Sweet (specimen deposited in Brown Herbarium), in 1921, in New Meadow Neck area of Hampden Meadows, approximately ½ mile north of Rt. 114 on land between Palmer and Barrington Meadows. Since then it has been unsuccessfully searched for on three occasions (8-2001, 7-2004, and 7-2005).

This population is listed as historic because the population, or preferred habitat for this population, has not been discovered despite repeated surveys. This area has undergone considerable change since the population was initially observed, and the most suitable extant habitat for this species is the pond which is dug out intermittently to promote its use as an ice-skating area.

Preferred habitat: In full sun or semi-shade in damp acidic situations, especially sphagnum, cranberry or tamarack bogs (NatureServe 2008).

Threats: Somewhat threatened by land-use conversion, habitat fragmentation, and forest management practices (Southern Appalachian Species Viability Project 2002). Other threats include alteration of water supply, over-shading by woody growth, horticultural collection (NatureServe 2008).

Appendix 2 Historic trends in Barrington avifauna from 1981-2000 (Starring 2008).

Non-Migratory Species
Increasing / Decreasing
(1981-2000)

INCREASING SPECIES	NAI	DECREASING SPECIES	NAD
GREAT HORNED OWL	1	AMERICAN KESTREL	1
RED-BREASTED NUTHATCH	1	BOBWHITE	1
RED-TAILED HAWK	2	CANADA GOOSE	1
BLUE-JAY	3	CHICKADEE	1
CANADA GOOSE	4	DOWNY WOODPECKER	1
HOUSE FINCH	4	FLICKER	1
MOCKINGBIRD	4	MARSH HAWK	1
MOURNING DOVE	4	RED-TAILED HAWK	1
MUTE SWAN	4	FIELD SPARROW	2
STARLING	4	PURPLE FINCH	2
FLICKER	5	RB NUTHATCH	2
SONG SPARROW	5	TUFTED TITMOUSE	2
DOWNY WOODPECKER	6	BLACK-BACKED GULL	3
RED-BELLIED WOODPECKER	6	SONG SPARROW	3
TUFTED TITMOUSE	6	BLUE-JAY	4
CHICKADEE	7	HOUSE FINCH	4
HOUSE SPARROW	7	MOCKINGBIRD	4
MALLARD	7	MOURNING DOVE	4
WHITE-BREASTED NUTHATCH	7	STARLING	4
CARDINAL	8	BLACK DUCK	5
CAROLINA WREN	8	HAIRY WOODPECKER	8
CROW	8	HERRING GULL	8
GOLDFINCH	8	RN PHEASANT	8
		ROCK DOVE	8

LEGEND: NAI=Number areas increasing; NAD=Number of areas Decreasing. (SEE TABLES 12,15,18,21,24,27,30 AND 33 FOR MORE SPECIFIC DATA ON IDENTIFIED NON-MIGRATORY SPECIES AND THEIR COUNTS)

North American Migrants
Increasing / Decreasing
(1981-2000)

INCREASING SPECIES	NAI	DECREASING SPECIES	NAD
AMERICAN BITTERN	1	AMERICAN WIDGEON	1
AMERICAN COOT	1	BLACK-HEADED GULL	1
AMERICAN WIDGEON	1	BROWN CREEPER	1
CEDAR WAXWING	1	EASTERN PHOEBE	1
DOUBLE-CRESTED CORMORANT	1	EVENING GROSBEAK	1
GADWALL	1	GREATER YELLOWLEGS	1
GRACKLE	1	GREEN WINGED TEAL	1
GREATER YELLOWLEGS	1	IBIS	1
GREEN HERON	1	KING RAIL	1
JUNCO	1	LEAST BITTERN	1
LESSER SCAUP	1	LESSER YELLOWLEGS	1
LESSER YELLOWLEGS	1	LITTLE BLUE HERON	1
RED-BREASTED MERGANSER	1	MARSH WREN	1
RED-WINGED BLACKBIRD	1	RB MERGANSER	1
SHOVLER	1	RUDDY DUCK	1
SNOWY EGRET	1	SHORT BILLED DOWITCHER	1
SPOTTED SANDPIPER	1	SNOW GOOSE	1
WHITE-EYED VIREO	1	WHITE-EYED VIREO	1
WOOD THRUSH	1	BLUE-WINGED TEAL	2
YELLOW WARBLER	1	BROWN THRASHER	2
COMMON MERGANSER	2	CANVASBACK	2
GREAT BLUE HERON	2	CAPE MAY WARBLER	2
IBIS	2	CATTLE EGRET	2
KILLDEER	2	CLAPPER RAIL	2
ROBIN	2	COMMON MERGANSER	2
TOWHEE	2	COWBIRD	2
WOOD DUCK	2	GADWALL	2
BUFFLEHEAD	3	GREATER SCAUP	2
KINGFISHER	3	GREEN HERON	2
GREAT EGRET	4	LESSER SCAUP	2
PINE WARBLER	4	PINE WARBLER	2
COWBIRD	5	REDHEAD DUCK	2
OSPREY	5	SEASIDE SPARROW	2
		SHARP-TAILED SPARROW	2
		B-C NIGHT HERON	3
		BLACKPOLL WARBLER	3
		GREAT BLUE HERON	3
		JUNCO	3
		LAUGHING GULL	3
		SNOWY EGRET	3
		TREE SPARROW	3
		WOOD THRUSH	3
		TOWHEE	4
		KILLDEER	5
		RING-BILLED GULL	5
		CEDAR WAXWING	6
		RED-WINGED BLACKBIRD	6
		ROBIN	6
		SAVANAH SPARROW	6
		D-C CORMORANT	7
		GRACKLE	7
		YELLOW WARBLER	7

(SEE TABLES 13,16,19,22,25,28,31,AND 34 FOR MORE SPECIFIC DATA ON IDENTIFIED NORTH AMERICAN MIGRANT SPECIES AND THEIR COUNTS)

Neo-Tropical Migrants
Increasing / Decreasing
(1981-2000)

INCREASING SPECIES	NAI	DECREASING SPECIES	NAD
AMERICAN REDSTART	1	B-T BLUE WARBLER	1
B-T BLUE WARBLER	1	BLACKBURNIAN WARBLER	1
B-T GREEN WARBLER	1	BOBOLINK	1
INDIGO BUNTING	1	BROAD-WINGED HAWK	1
KINGBIRD	1	CANADA WARBLER	1
LEAST SANDPIPER	1	CATBIRD	1
MAGNOLIA WARBLER	1	CERULEAN WARBLER	1
NORTHERN PARULA	1	HOUSE WREN	1
ROSE-BREASTED GROSBEAK	1	LEAST SANDPIPER	1
RUBY-CROWNED KINGLET	1	LEAST TERN	1
SCARLET TANAGER	1	OVENBIRD	1
SEMI-PALMATED SANDPIPER	1	RED-EYED VIREO	1
WHITE-CROWNED SPARROW	1	ROSE-BREASTED GROSBEAK	1
WORM EATING WARBLER	1	SCARLET TANAGER	1
YELLOW-RUMPED WARBLER	1	SEMI-PALMATED SANDPIPER	1
BLACK-BILLED CUCKOO	2	VEERY	1
CHIPPING SPARROW	2	WARBLING VIREO	1
EASTERN WOOD PEWEE	2	BLACK-BILLED CUCKOO	2
TREE SWALLOW	2	B-T GREEN WARBLER	2
YELLOWTHROAT	2	GC FLYCATCHER	2
RED-EYED VIREO	3	ORCHARD ORIOLE	2
WARBLING VIREO	3	ROUGH-WINGED SWALLOW	2
BANK SWALLOW	4	W-T SPARROW	2
BLUE-WINGED WARBLER	4	TREE SWALLOW	3
GREAT CRESTED FLYCATCHER	4	AMERICAN REDSTART	4
NORTHERN ORIOLE	4	BANK SWALLOW	4
HOUSE WREN	6	B&W WARBLER	4
WHITE-THROATED SPARROW	6	MAGNOLIA WARBLER	4
CATBIRD	7	NORTHERN ORIOLE	4
		WHITE-CROWNED SPARROW	4
		BARN SWALLOW	5
		NORTHERN PARULA	5
		YELLOW-BILLED CUCKOO	5
		CHIPPING SPARROW	6
		KINGBIRD	6
		YELLOWTHROAT	6
		YELLOW-RUMPED WARBLER	7
		CHIMNEY SWIFT	8
		COMMON TERN	8

(SEE TABLES 14,17,20,23,26,29,32, AND 35 FOR MORE SPECIFIC DATA ON IDENTIFIED NEO-TROPICAL SPECIES AND THEIR COUNTS)

APPENDIX B

Invasive Plant Species of HMCA and Possible Invasive Plant Control Options

Morrow's Honeysuckle (*Lonicera morrowii*)

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Stacey Leicht, University of Connecticut, Bugwood.org

Morrow's honeysuckle (*Lonicera morrowii*) is an upright, dense deciduous shrub with white to yellow flowers and dark red berries. It is one of several honeysuckles commonly referred to as "bush honeysuckles" that were introduced from Asia and western Europe. The bush honeysuckles are tolerant of a wide range of conditions. Spread of these species is mainly by seed dispersal provided by birds who eat the berries. Seeds remain viable for 2 years and tend to germinate best in areas that have minimal herbaceous cover.

Management Options

A. Hand Pulling:

Seedlings can be removed by hand, particularly if done in early spring or late fall when other plants are dormant but honeysuckles have leaves to mark their seedlings. Care should be taken to minimize soil disturbance to prevent re-invasion.

B. Cutting:

Cutting of mature plants is not an effective means of control because re-sprouting will occur. However, it may temporarily reduce seed sources. If done in combination with seedling removal, population spread can be controlled.

C. Grubbing:

This method is appropriate for colonizing populations or plants in environmentally sensitive areas where herbicides cannot be used. A digging tool may be used to remove the entire plant, including all roots. Any portions of the root system not removed will potentially re-sprout. All plant parts, including fruits, should be bagged and removed from the site to prevent reestablishment.

D. Herbicides:
Spray bush honeysuckles with glyphosate or triclopyr in late summer to mid fall. Cut-stump treatments with glyphosate or triclopyr are effective throughout the year except early spring.

ROUNDUP [glyphosate (41%)]:
Foliar spray: 2 fl. oz./gal
Cut-stump treatment: Diluted with equal part water (1:1)

BRUSH-B-GON [triclopyr (8%)]:
Foliar spray: 4 fl. oz./gal
Cut-stump treatment: Undiluted

References

Converse, C.K. 1984. Element Stewardship Abstract for *Lonicera* spp. Bushy Honeysuckles. The Nature Conservancy.

Tennessee Exotic Plant Management Manual, April 1997.

From: http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

Multiflora Rose (*Rosa multiflora*)

Photos by Dr. John Meade, weed scientist emeritus
Rutgers NJAES Cooperative Extension

Multiflora rose is a large, dense shrub that has escaped from ornamental and conservation plantings to become a serious invasive plant problem across the eastern half of the U.S. It invades natural areas, pastures, and light gaps in forests. Multiflora rose produces abundant small white flowers in the spring. Birds and mammals consume the red fruits, called hips, and may disperse them long distances. The majority of plants develop from seeds in the soil, which may remain viable for 10 to 20 years. It may also spread vegetatively when tips of arching branches touch the ground and develop roots (called layering), and from plants that emerge from shallow roots. Plants grow slowly for the first one or two years followed by rapid expansion through layering and root sprouts. Multiflora rose spreads quickly and may grow 1 to 2 feet per week to form impenetrable thickets of thorny stems.

Management Options

A. Grubbing:

Pulling, grubbing, or removing individual plants is effective when plants are small. Use a digging tool to remove the entire plant. Special care should be taken to ensure that all roots are removed to prevent their resprouting. If plants develop from severed roots these should be removed as well.

B. Cutting:

This method is also appropriate for small initial populations and for environmentally sensitive areas where herbicides cannot be used. Repeated cutting will control the spread of multiflora rose, but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible. Hand cutting of established clumps is difficult and time consuming due to the long arching stems and prolific thorns.

C. Mowing:

For disturbed areas containing large populations of multiflora rose, mowing of large bushes can provide partial control, by restricting top growth and spread. Research indicates that mowing three to six times a year can be effective. The objective of a mowing program is to clear the existing vegetation and reduce the reproductive capability of the below ground portions of the shrubs. As such, this is only a practical option in infested areas such as pastures where mowing equipment can operate. Mowing can also be somewhat effective in protecting a field or pasture from encroaching infestations on adjoining properties. Repeatedly mowing the perimeter of a site to block this type of expansion can be somewhat effective in preventing the spread of multiflora rose. In many cases where this weed is present, mechanical methods will not be an option, and chemical control options should be considered.

D. Herbicides:

Multiflora rose is susceptible to both glyphosate and triclopyr. Triclopyr can be applied starting in spring before or during flowering. Glyphosate is most effective when applied after flowering (early summer) until early fall. Cut-stump treatments with both herbicides also provide control, but cutting stumps in established thickets is very difficult because of the numerous thorny branches.

ROUNDUP [glyphosate (41%)]:
Foliar spray: 1.5 fl. oz./gal
Cut-stump treatment: Diluted with equal part water (1:1)

BRUSH-B-GON [triclopyr (8%)]:
Foliar spray: 4 fl. oz./gal
Cut-stump treatment: Undiluted

References

Ahrens, J. F. 1979. Chemical control of multiflora rose. Proceedings, Northeastern Weed Sci. Soc. 33:213-217.

Kay, S. H., W. M. Lewis, and K. A. Langeland. 1995. Integrated management of multiflora rose in North Carolina. North Carolina Cooperative Extension Service. 17 p.

Noxious and Nuisance Plant Information System, Version 4.0.

Szafoni, R.E. 1991. Vegetation Management Guideline: Multiflora Rose (*Rosa multiflora* Thunb.). Natural Areas Journal 11(4): 215-216.

Tennessee Exotic Plant Management Manual, April 1997.

From: http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

Oriental Bittersweet (*Celastrus orbiculatus*)

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Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Oriental bittersweet is a deciduous woody vine that can reach 19 m (60 ft) in height, and can grow to 10 cm (4 in) in diameter. Its leaves are simple and alternate. It blooms in May with small yellow-green flowers, and its numerous green berries turn red in yellow capsules upon maturity. Oriental bittersweet is a serious threat to plant communities due to its high reproductive rate, long-range dispersal, ability to root sucker, and rapid growth rate. Climbing vines severely damage or kill trees and shrubs by constricting and girdling stems, and by blocking sunlight. Oriental bittersweet has a wide range of habitat preferences including roadsides, thickets, young forests and dunes. It is shade tolerant, readily germinating and growing under a closed forest canopy. Seeds are dispersed readily by birds and small mammals.

Management Options

A. Cutting:

Cut climbing or trailing vines as close to the root collar as possible. This technique is feasible on small populations; as a pretreatment on large impenetrable sites; and in areas where herbicide cannot be used. Cutting will reduce seed production and strangulation of surrounding woody vegetation. Oriental bittersweet will re-sprout unless cut so frequently that its root stock is exhausted. Treatment should begin early in the growing season and be repeated at 2-week intervals until autumn.

B. Grubbing:

This method is appropriate for small initial populations or environmentally sensitive areas where herbicides cannot be used. Using a "pulaski" or similar digging tool, remove the entire plant, including all roots and runners. Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially re-sprout. All plant parts, including mature fruit, should be bagged and disposed of in a trash dumpster to prevent reestablishment.

C. Herbicides:

Oriental bittersweet is fairly tolerant of glyphosate but is susceptible to triclopyr. Young vines or low-growing patches can be sprayed with triclopyr any time during active growth. Larger vines or vines that have climbed high into trees should be cut or girdled just above ground level in summer or early fall. Paint undiluted triclopyr into the freshly cut surfaces of the stump. Repeated applications may be necessary to eliminate re-sprouting.

BRUSH-B-GON [triclopyr (8%)]:
Foliar spray: 4 fl. oz./gal
Cut-stump treatment: Undiluted

References

Ahrens, J. F. 1987. Herbicides for control of oriental bittersweet. Proceedings, Northeastern Weed Sci. Soc. 41:167-170.

Dreyer, G. D. 1988. Efficacy of triclopyr in rootkilling oriental bittersweet (*Celastrus orbiculatus* Thunb.) and certain other woody weeds. Proceedings, Northeastern Weed Sci. Soc. 42:120-121.

Dreyer, G. D. 1994. Element Stewardship Abstract for *Celastrus orbiculata* (Oriental Bittersweet). The Nature Conservancy.

Mervosh, T. L. 1998. New England guide to chemical control of problem weeds and brush around homes and on non-cropland. Univ. of New Hampshire, Cooperative Extension. 7 p.

Tennessee Exotic Plant Management Manual, April 1997.

From: http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

Autumn Olive (*Elaeagnus umbellata*)

Chris Evans, River to River CWMA. Bugwood.org

Pennsylvania Department of Conservation and Natural Resources - Forestry Archive. Bugwood.org.

Nancy Loewenstein, Auburn University. Bugwood.org.

Introduced to the U.S. from Asia, autumn olive is a fast-growing woody shrub or tree that can attain 20 feet in height. It has simple, alternate oval leaves with silvery undersides (but not as silvery as Russian olive). The fragrant small white flowers reach peak bloom around mid-May. The fleshy fruits are brown at first but gradually turn red with silvery dots. Autumn olive has been planted extensively for wildlife

habitat, strip mine re-vegetation, and erosion control, and also has been marketed widely as an ornamental. It produces abundant fruits that are consumed and spread by birds and small mammals. Autumn olive grows well in disturbed areas, open fields, forest margins, roadsides, and clearings. While tolerant of drought, it does not grow well in wet sites. It is intolerant of shade and will not invade dense forests. However, because its fruits are eaten by a variety of wildlife, its seeds may be distributed into forest openings or open woodlands.

Management Options

A. Hand Pulling:

Autumn olive is effectively controlled by manual removal of young seedlings. Plants should be pulled as soon as they are large enough to grasp, but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may re-sprout.

B. Cutting:

Cut trees at ground level with power or manual saws. Cutting is most effective when trees have begun to flower to prevent seed production. Because autumn olive spreads by suckering, re-sprouts are common after cutting. Cutting is an initial control measure, and success will require either herbicide application or repeated cutting of re-sprouts.

C. Girdling:

Use this approach for large trees. Using a hand-axe, make a cut through the bark approximately 15 cm (6 in) above the ground, and cut completely around the trunk. Be sure that the cut goes well into or below the cambium layer. This method will kill the top of the tree but re-sprouts are common, and may require follow-up treatments for several years.

D. Herbicides:

Autumn olive tends to be more susceptible to triclopyr than to glyphosate, especially prior to late summer. Where possible, foliar sprays are effective once the leaves are fully expanded. For larger trees, three approaches are possible: 1) Girdle the tree (see description above) with an axe, and apply undiluted triclopyr in the cut around the trunk; 2) Cut down tree and apply undiluted triclopyr into the freshly cut surfaces of the stump to prevent re-sprouting, or 3) Cut down tree and spray re-sprouts before they get too tall to spray.

BRUSH-B-GON [triclopyr (8%)]:
Foliar spray: 4 fl. oz./gal
Cut-stump treatment: Undiluted

ROUNDUP [glyphosate (41%)]:
Foliar spray: 2.5 fl. oz./gal
Cut-stump treatment: Diluted with equal part water (1:1)

References

Sather, N. and N. Eckardt. 1987. Element Stewardship Abstract for *Elaeagnus umbellata* (Autumn olive). The Nature Conservancy.

Tennessee Exotic Plant Management Manual, April 1997.

From: http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

Tree-of-Heaven (*Ailanthus altissima*)

Photo by Gary Huntzinger
Rutgers NJAES Cooperative Extension

Photo by Gary Huntzinger
Rutgers NJAES Cooperative Extension

Ailanthus, also known as tree-of-heaven or Chinese sumac, is a persistent and aggressive weed throughout much of Europe and North America. *Ailanthus* grows quickly and can reach a height of 2.5 m (8 ft) in its first year; ultimately these trees are 25-30 m (80-100 ft). It flowers in late May through early June and may produce several hundred flowers each year, each of which forms clusters containing hundreds of seeds. Single trees may produce up to 350,000 seeds in one year. Seeds are small, easily dispersed by wind, and mostly viable. Trees also reproduce readily via root sprouts that can emerge up to 15 m (50 ft) from the nearest trunk. It is a ready colonizer of disturbed sites both in urban and natural areas but is intolerant of full shade. Once established, its primary mode of reproduction is through root suckers. The compound leaves of tree-of-heaven resemble those of staghorn sumac, but tree-of-heaven can be distinguished by its foul-smelling leaves.

Management Options

A. Hand Pulling:

Young seedlings of *Ailanthus* can be pulled by hand, but they will develop a significant taproot within 3 months and then will become very difficult to remove. Thus, plants should be pulled as soon as they are large enough to grasp. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may re-sprout.

B. Cutting:

Larger trees may be cut at ground level with power or manual saws. Cutting is most effective when trees have begun to flower to prevent seed production. Because *Ailanthus* spreads by suckering, re-sprouts are common after treatment. Two cuttings per year may be necessary, one early in the growing season and one late in the growing season. Although plants may not be killed after cutting, seed

production will be inhibited and vigor will be reduced. If continued for several years, plants will be severely stressed by cutting and will eventually be killed.

C. Girdling:
Use this approach for large trees. Using a hand-axe, make a cut through the bark approximately 15 cm (6 in) above the ground, and cut completely around the trunk. Be sure that the cut goes well into or below the cambium layer. This method will kill the top of the tree but re-sprouts are common, and may require follow-up treatments for several years.

D. Herbicides:
Tree-of-heaven tends to be more susceptible to triclopyr than to glyphosate, especially prior to late summer. Where possible, foliar sprays are effective once the leaves are fully expanded. For larger trees, three approaches are possible: 1) Girdle the tree (see description above) with an axe, and apply undiluted triclopyr in the cut around the trunk; 2) Cut down tree and apply undiluted triclopyr into the freshly cut surfaces of the stump to prevent re-sprouting, or 3) Cut down tree and spray re-sprouts before they get too tall to spray.

BRUSH-B-GON [triclopyr (8%)]:
Foliar spray: 4 fl. oz./gal
Cut-stump treatment: Undiluted

ROUNDUP [glyphosate (41%)]:
Foliar spray: 2.5 fl. oz./gal
Cut-stump treatment: Diluted with equal part water (1:1)

References

Invasive and Alien Plant Species of Virginia. Tree-of-Heaven (*Ailanthus altissima* (Miller) Swingle). http://www.state.va.us/%7Edcr/dnh/invlist.htm

Tennessee Exotic Plant Management Manual, April 1997.

From: http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

APPENDIX C

Bird Species of Greatest Conservation Need (GCN) at HMCA

Great Crested Flycatcher (*Myiarchus crinitus)*

Family: Tyrannidae, Tyrant

Description	9" (23 cm). Slightly crested. Brown above, with gray throat, yellow belly, rufous wings and tail, and pale brown at base of lower mandible.
Habitat	Open forests, orchards, and large trees in farm country.
Nesting	5 or 6 creamy-white, brown-spotted eggs in tree cavities or bird boxes. The bulky nest is lined with all sorts of trash--cellophane, snakeskins, string, rags.
Range	Breeds from south-central and southeastern Canada to Gulf Coast. Winters in southern Florida; also in tropics.
Voice	Loud, whistled, slightly buzzy wheep, sometimes repeated. Also a raucous whit-whit-whit-whit.
Discussion	This species is to woodlands what the Eastern Kingbird is to open country. It is noisy, aggressive, and even more colorful. Living mostly under the forest canopy, however, it is much more often heard than seen, and is much less in evidence than its black-and-white relative. A mystifying habit is its frequent use of shed snakeskins in its nest lining. Whether this is intended to frighten off predators or merely decorate the nest is not known. The Great Crested is the only eastern flycatcher that nests in holes.

http://www.enature.com/fieldguides/detail.asp?recNum=BD0284

Rufous-sided Towhee - Pipilo erythrophthalmus

Characteristics
The rufous-sided towhee is about seven inches in length. It has red-brown eyes, long black tail feathers and a small pointed black bill. The male rufous-sided towhee has a black head, neck and shoulders, a white chest and rust-red wings and sides. The female has the same color pattern as the male, but where he is black she is a dark brown.

Range
The rufous-sided towhee breeds from British Columbia east to Maine and south to California, Louisiana, Florida and Guatemala. It winters in the south from British Columbia, Nebraska and southern New England.

Habitat
The rufous-sided towhee lives in thickets and at the edges of brushy woodlands.

Diet
The rufous-sided towhee scratches under leaves looking for food. Nuts, seeds and fruits make up most of its diet. It also eats some insects.

Life Cycle
The female makes a nest of weeds, leaves, bark and stems on or near the ground in a well-covered area. Sometimes the males brings materials for the nest. The female lays two to six eggs. The male sometimes brings the female food during incubation. The female incubates the eggs. The chicks hatch in a little under two weeks and both parents feed them. The chicks fledge when they are 10 to 12 days old. The female usually has two broods a year.

Behavior
Rufous-sided towhees have regional accents! Depending on where they live, the towhee's call will vary. Birds in the east sound nothing like birds in the west.

http://www.nhptv.org/NatureWorks/rufoustowhee.htm
Image Credits: Clipart.com

Scarlet tanager (Piranga olivacea)

Geographic Range
Scarlet tanagers breed in eastern North America and winter in northern and western South America, from Panama in the north as far south as Bolivia. The breeding range is from southern Canada as far west as Manitoba and east to the Maritime provinces and south through the western Carolinas, northern Georgia, Alabama, and Mississippi, and much of Arkansas. The breeding range corresponds with the extent of the eastern deciduous forest biome.

Habitat
Scarlet tanagers are found mainly in mature deciduous forests or mixed deciduous forests with hemlock (*Tsuga*) and pine (*Pinus*). They can also be found in younger deciduous forests and sometimes in heavily wooded suburban areas. In the Smoky Mountains they are found from 425 to 1525 meters of elevation, in other mountainous parts of their range they are found at all elevations in suitable habitat. Habitat use in their winter range in South America is poorly known, but they are generally found in mid-elevation evergreen forests, from 100 and 1,300 meters on the eastern slope of the Andes.

Physical Description
Scarlet tanagers are 16 to 17 cm long with a wingspan of 25 to 29 cm. They weigh from 23.5 to 33 grams during the breeding season and from 32 to 38 grams during migration. Mature males in breeding season are bright red with black wings and tails, in the winter they resemble females except for their black wings and tail. Females and immature birds are dull, olive green above and straw-yellow below with dark wings and tail.)

Females, immature individuals, and males in winter plumage are sometimes confused with female and immature summer tanagers (*Piranga rubra*) or western tanagers (*Piranga ludoviciana*), with which they sometimes co-occur. Some details of plumage color help to distinguish these species, as do their distinctive calls. Scarlet tanagers use a hoarse "chip-churr" call, while western tanagers use a soft "pri-tic" call and summer tanagers use a staccato "pit-i-tuck" call.)

Reproduction
Scarlet tanagers form monogamous pairs for breeding each season. No studies of banded birds have confirmed that pair bonds last beyond the breeding season. Males use a silent courtship display in which they fly to exposed branches below a female and extend their wings and neck to expose their scarlet back. Females are apparently attracted to the male's scarlet color as well as their posture and movements.)

Breeding occurs from May to August. Females build shallow, saucer-shaped nests in a week or less from twigs, rootlets, coarse grass, and weed stems, and line them with fine grasses and pine needles. They are placed anywhere from 4-75 feet above ground. Four to 5, usually 4, pale blue-green eggs with brown

speckles are incubated for 13-14 days. Though they are brooded by females only, both parents bring food to the nest. The nest is kept clean and the droppings are swallowed or carried away in the bill. The young are able to leave the nest about 9-15 days after hatching.

Behavior

Males usually arrive from their winter stay in South America slightly before the females and stake out territories in choice tall trees. To warn the other males away, each sings frequently from his own spot with songs such as :"querit, queer, queery, querit, queer" along with the call note "CHIP-churr or CHICK-bur". Females are attracted to the singing males, who court potential mates by hopping about on low perches in woods near the ground, spreading their wings and displaying their scarlet backs. The males often feed their partners as the nesting season approaches.

Food Habits

Scarlet tanagers eat insects while foraging in treetops, in shrubs or on the ground. Preferred foods include aphids, nut weevils, wood borers, leaf beatles, cicadas, scale insects, dragonflies, ants, termites, caterpillars of gypsy moths, parasitic wasps, bees, mulberries, June-berries, huckleberries and other wild fruits.

Predation

Adult scarlet tanagers are eaten by birds of prey, including eastern screech owls, long-eared owls, short-eared owls and merlins. Eggs and nestling predators include blue jays, grackles, American crows, squirrels, chipmunks, and snakes.

Scarlet tanagers mob most predators, diving and swooping around them while calling at them. However, scarlet tanagers respond to American crows and merlins by becoming quiet and watchful, apparently in an attempt to be inconspicuous.

Dewey, T. and R. Street. 1999. "Piranga olivacea" (On-line), Animal Diversity Web. Accessed June 23, 2009 at http://animaldiversity.ummz.umich.edu/site/accounts/information/Piranga_olivacea.html

Wood thrush (*Hylocichla mustelina*)

Geographic Range

The breeding range of wood thrushes (*Hylocichla mustelina*) extends from southern Canada to northern Florida and from the Atlantic coast to the Missouri River and the eastern Great Plains. Wood thrushes spend winters in Mexico and Central America, mostly in the lowlands along the Atlantic and Pacific coasts.

The breeding range of wood thrushes is composed of deciduous and mixed forests. They prefer late-successional, upland mesic forests with a moderately-dense shrub layer. Other important elements of wood thrush breeding habitat include trees taller than 16 m, a fairly open forest floor, moist soil, and leaf litter. Bertin (1977) found that wood thrushes favor areas with running water, moist ground and high understory cover. Substrate moisture is more important than canopy cover or access to running water. Wood thrushes can breed in habitat patches as small as 1 acre, but those that breed in larger tracts of forest experience lower predation and lower nest parasitism, leading to higher reproductive success.

Wood thrushes winter primarily in the interior understory of tropical primary forests. However, they may also occur along forest edges and in second growth.

Wood thrushes are small songbirds, 19 to 21 cm long and weighing 40 to 50 g. They are warm cinnamon-brown on the crown and nape, with a slightly duller olive-brown on the back, wings and tail. The breast and belly are white with conspicuous large dark brown spots on the breast, sides and flanks. Wood thrushes have a dull white ring around their eye. Their bill is dark brown, and their legs are pinkish.

Male and female wood thrushes are similar in size and plumage. Juveniles look similar to adults, but have additional spots on their back, neck and wing coverts.

Wood thrushes can be easily confused with other similar-looking thrushes. They are distinguished by the rusty color on their head, and the white, rather than buffy, breast and belly.

Reproduction

Wood thrushes are monogamous. Breeding pairs form in mid-April and early-May, and usually last for the duration of the breeding season (through several nesting attempts or two complete broods). Most wood thrushes find a new mate each year. Mate guarding and extra-pair copulation have not been documented in this species.

Male wood thrushes begin to sing at dawn and dusk a few days after their arrival at breeding grounds. Some males arrive on the breeding grounds several days before the earliest females to establish territories, while other males arrive at the same time as the females. Behaviors such as circular flights led by the female interspersed with perching together are characteristic of wood thrush pair formation and/or pre-copulatory behaviors.

The female typically chooses the nest site and constructs the nest. The nest is located in a tree or shrub, and is constructed of dead grasses, stems or leaves, and lined with mud. The female lays 2 to 4 eggs (usually 4 for first clutch, 3 for later clutches) at a rate of one per day. The eggs are incubated for 11 to 14 days (average 13 days) by the female only. The chicks are altricial at hatching; they are mostly naked with closed eyes. The female broods the chicks during the first four days after hatching. Both parents feed the nestlings and remove fecal sacs from the nest. The chicks fledge from the nest 12 to 15 days after hatching. The parents continue to feed them until they become independent and leave the parents' territory at 21 to 31 days old. These chicks will be able to begin breeding the next summer.

The majority of females lay their first eggs in mid-May, with older females laying sooner. Most pairs attempt to rear a second brood usually no later than late July, with the last young fledging around mid-August.

Lifespan/Longevity

The oldest known wood thrush lived to be at least 8 years and 11 months old. Annual adult survival rates are estimated to be 70% for males and 75% for females.

Behavior

Wood thrushes migrate between breeding areas in Canada and the United States and wintering grounds in Mexico and Central America. The average distance wood thrushes migrate is 2,200 km. Wood thrushes usually arrive on the U.S. Gulf coast during the first week of April, with most birds arriving at their breeding grounds by mid-April. Fall migration begins in mid-August and continues through mid-September. Wood thrushes migrate at night.

Wood thrushes are generally solitary, though they occasionally form mixed-species flocks in the winter. They defend territories that range from 0.08 to 2.8 ha in size. Territories are used for nesting, gathering nest materials, and foraging, although movement is not restricted to territories. Some wood thrushes may also defend a feeding territory in winter. Territorial interactions are usually settled without physical contact, but physical contact with feet or bill occurs during high-intensity encounters or during nest defense. Flight is the usual method used in reducing threat. Defense behaviors in response to conspecifics and nest predators include wing flicks, tail flicks, and raising one's crest.

Communication and Perception

Wood thrushes communicate using song and physical displays. Male wood thrushes sing a very unique song that ends in a trill. They are able to sing two notes at once, giving their songs an ethereal, flute-like quality. Female wood-thrushes are not known to sing. Wood thrushes also use calls, such as "bup, bup" or "tut, tut" to signal agitation.

Food Habits

Wood thrushes are omnivorous; they feed preferentially on soil invertebrates and larvae, but will eat fruits in late summer, fall, and late winter. Occasionally they feed on arboreal insects, snails, and small salamanders. During the post-breeding and pre-migration time, wood thrushes switch from insects to fruits with high lipid levels. During the summer, low fruit consumption and lipid reserves require the birds to feed continuously on insects in order to meet their daily metabolic needs.

Wood thrushes feed primarily on the forest floor. They can be observed hopping around in leaf litter and on semi-bare ground under the forest canopy, gleaning insects and probing the soil. They use their bill to turn over leaves to reveal prey. Fruits are swallowed whole.

Predation

Eggs and chicks are vulnerable to predation by chipmunks, raccoons, blue jays, American crows, black rat snakes, brown-headed cowbirds, common grackles, southern flying squirrels, gray squirrels, least weasels, white-footed mice, domestic cats, great horned owls and sharp-shinned hawks. Adults are probably taken primarily by hawks and owls.

When predators are nearby, adult wood thrushes become alert and responsive to sounds. When their nests or young are threatened, adults respond with agitated calls and chases, escalating into dives and strikes.

Ecosystem Roles

Wood thrushes affect the populations of the insects and other animals they eat. They may help to disperse the seeds of the fruits they eat. They also provide food for their predators.

Conservation Status

Continent-wide wood thrush populations appear to have declined significantly over the past several decades. This decline can be attributed largely to habitat loss and habitat fragmentation. Wood thrushes are usually found in mature forests; nesting in residential areas and other disturbed sites is rare. They are significantly less abundant in fragmented areas bordered by roads and power lines compared to larger tracts of forest.

Brood parasitism by brown-headed cowbirds is more common in forested habitats with a high proportion of edge than in large tracts of forest. Brood parasitism leads to decreased reproductive success of wood thrushes. The rate of parasitism varies by region; rates are much higher in the Midwest than in the Northeast or Mid-Atlantic regions. Reproductive success is also affected by increased predation in smaller forest patches. A study conducted in Pennsylvania found that less than half (46%) of wood thrush nests were successful in forest patches less then 80 ha in size, while in large continuous forests, 86% of nests were successful. Rates of predation are higher in smaller forest patches with large edge areas, possibly because small patches cannot support large predators that regulate smaller nest predators and nest predators tend to be abundant in small patches, which they use for foraging.

Wood thrushes are protected under the U.S. Migratory Bird Act. There are about 14,000,000 wood thrushes throughout the geographic range.

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