

# Wagon Hill Farm

## Stewardship Plan



Prepared for the  
Durham Conservation Commission

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# Wagon Hill Farm Stewardship Plan

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---Ellen Snyder, Ibis Wildlife Consulting

# Chapter 1 Property Description

## Location and General Description

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The 139-acre Wagon Hill Farm is located on Route 4 in Durham, New Hampshire, three miles east of the center of town. The property consists of 99 acres on the south side of Route 4 and 40 acres on the north side of the highway. The town-owned properties is named for the old wooden wagon that sits atop the hill, a prominent focal point for travelers along Route 4. South of Route 4 the land slopes down to the shores of Great Bay and includes 6,800 feet of frontage along this estuary (Map 1). The parcels are identified on the Durham Town Tax Maps as Map 12, Lots 8-1 and 8-2.

The southern 99-acre parcel has an extensive and well used trail network (Map 2). Access to the property is via a gravel driveway off Route 4 that ends in a gravel parking area with space for about two dozen cars near the historic Chesley farmhouse. The gravel access road continues beyond a locked gate and leads down to a grassy, mowed area near the shore of Great Bay. Along the main access road you will pass an apple orchard, an overgrown spruce and pine plantation, and the historic Davis cemetery. The hill sporting the wagon, first placed there by the Tirrell family, is popular for sledding in winter and kite flying in summer. This year a community garden was started southwest of the farmhouse. The trails are immensely popular among walkers with and without dogs and families regularly picnic by the shore.

As you follow the trail along the shore you can see a remnant of the forests that are native to this region – the Appalachian oak-hickory forest where tall red oaks dominant the forest canopy, along with shagbark hickory and white oak. Sassafras, huckleberry, ferns, and woodland wildflowers grow in the understory. Much of the forest was cleared and has changed over time. An old gravel pit, a stand of young, scrappy white pine, a planting of spruce and pine, and the fields are all evidence of this change.

As you emerge back out into the sunshine and wander among the fields and along shrub edges, you will see other changes. Invasive plants have seeped into spaces once occupied by native shrubs or have emerged in the midst of the fields. Along the shore you will see the erosive power of waves combined with heavy use by humans on the landward side, causing loss of land and salt marsh. Your feet may be wet or muddy walking some of the trails, an indication of the marine sediments that underlie some of Wagon Hill Farm.

The north 40 acres is accessed off Watson Road (crossing Route 4 is deemed too dangerous and there is no parking on the north side of Route 4) (Map 2). No parking is available at this entry point, although there is enough space to pull alongside the road. One trail leads from Watson Road through the property in a southeasterly direction before exiting onto a neighboring property. A large (approximately 20 acres) grassy, scrub-shrub, and forested wetland is located in the southern portion of this parcel. According to the tax map, the frontage along Watson Road is 80 feet and both parcels have approximately 1,460 feet of frontage along Route 4.

A survey was not recorded for either parcel, however much of the boundary is marked either by stone walls or the shoreline of Great Bay. Route 4 forms a boundary for each of the two parcels. The maps in this Stewardship Plan were created using existing GIS layers from the NH GRANIT database. Since a boundary survey does not exist for Wagon Hill Farm, the GIS overlays generate different acreages for each parcel than is described in the property deeds and related documents. Hence, you will notice that the total acreage generated by the GIS mapping is approximately 127 acres (93 acres south of Route 4; 34 acres north of Route 4).

## Recent History of Wagon Hill Farm

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The Town of Durham acquired the Chesley Homestead Farm on September 15, 1989 from the Estate of Mary H. Tirrell. This followed a public hearing, special town warrant, and Council approval in the summer of 1989. The Town purchased the property for \$3.1 million dollars in bond funds “*to preserve its scenic vistas, provide for future municipal purposes and preserve open space in order to provide for healthful and attractive outdoor environment for work and recreation, and to conserve land, water, forest and wildlife resources*” (see Appendix A for the language of the 1989 town ballot that approved the acquisition). The Town officially named the property Wagon Hill Farm. The 20-year bond will be paid off in December 2009.

In July 1990, the Town Council created a Wagon Hill Farm Advisory Committee that included 36 members with varying ideas on how the property should be used. Given a lack of consensus on how to proceed, the Committee disbanded after a few years. In 1995 the Town and the Strafford Regional Planning Commission received a grant from the New Hampshire Coastal Program to prepare a Master Plan for the property. The Cavendish Partnership, Inc., working with the Durham Recreation Committee, was hired to prepare the Plan along with input from many Durham residents (The Cavendish Partnership, Inc. 1995).

The 1995 Master Plan recommended that the “north forty” acres be sold, with funds from the sale to be used to improve the “Farm.” The Plan further recommended that the Farm be used for passive recreation, and that active recreation, such as playing fields, were not economically or environmentally feasible and would be in conflict with the Town’s goals for the property. It was recommended that stewardship should focus on shoreline stabilization, trail improvements, and grass and wildflower seeding. The buildings, that include the farmhouse and barn, were in need of repair or restoration for some public use related to the surrounding land. This Plan also sat on the shelf for many years as there was still not a consensus on what to do. About five years ago, the Public Works Department, under the leadership of Mike Lynch, finally garnered enough community support to move forward on many much-needed maintenance and stewardship activities, many of which were recommended in the Master Plan

The Public Works Department has implemented several management activities that include trail mowing, annual field mowing, posting signs about dogs, maintaining a picnic pavilion, picnic tables, trash cans and portable toilet, shoreline stabilization, maintaining and enhancing parking areas and road access, overseeing installation of memorials, repair and replacement of the “wagon,” coordinating special events, and periodic maintenance of the buildings.

### ***History Prior to Town Ownership***

This land was first settled by European immigrants in the 1650s and farmed continuously for the next 300 years. The 1804 Federal-style farmhouse, mid-19<sup>th</sup> century ell, stable, and open fields are reminders of this agricultural past. The old wagon that was first placed at the top of the hill in the 1960s serves as a key feature and well-known landmark in Durham (Federer 1991). According to Mike Lynch, the Durham Public Works Director, the wagon has since been replaced four times. The Tirrell family donated \$500 for replacement of the first wagon that was in disrepair. A replacement was found for \$100, and the Town placed a granite marker near the wagon in memory of Loring and Mary Tirrell who placed the first wagon on the hill.

John Davis moved to the north side of the Oyster River in the 1650s, buying land that is now part of Wagon Hill Farm. This was at a time when the Durham area was part of the township of Dover. Davis and his descendants are buried in the “Davis cemetery” which remains and is visible along the access road that leads down to the picnic/beach area. Around 1655, John Davis and his wife Jane Peasley Davis constructed a house and farm buildings on a knoll overlooking the Oyster River; the location is believed

to be where a gravel pit was excavated in the early 1900s, removing any evidence of the foundation. This house was called a “garrison,” although it is unclear if the house was fortified (Federer 1991).

The youngest son of John Davis inherited the land and was active in defending the English settlement along the Oyster River from Indians and the French. James Davis became the moderator of the first town meeting in the newly independent town of Durham in 1732. In the late 1790s the lands were transferred to the Bickford family. It is thought that Captain Bickford built the existing farmhouse sometime between 1802 and 1806. By 1829, the Bickfords transferred the farm to the Chesley family (Federer 1991).

The Chesleys actively farmed the land. Historical records indicate that they raised some dairy and beef cows, pigs, chickens, and an array of vegetables as well as harvested hay, silage, wood products, apples, and sand and gravel. From the early 1900s until at least 1930 when Route 4 was upgraded, the Chesley brothers sold and hauled away sand and gravel from the river bank and the gravel pit. You can see where they removed material from the river bank in the southwest corner of Wagon Hill; presumably they hauled it off by boat. The Chesleys also pastured the land north of Route 4. Elizabeth Chesley continued to farm the land until 1960 when she sold it to Loring and Mary Tirrell (Federer 1991).

The Tirrells kept the fields open through annual mowing, although did not use it for hay. The apple trees remained, but were not pruned. The Tirrells planted evergreens around the house as a windbreak and between the orchard and the gravel pit, many of which are now tall, dense spruce and pine. Otherwise, it appears that active agricultural use of these lands ended with the Chesley family. The 40 acres north of Route 4 began to reforest after decades of pasturing. The Tirrells were the first to place a wagon at the crest of the hill, and thereafter the place became locally recognized as “Wagon Hill Farm.” Loring Tirrell passed away in 1975, followed by Mary in 1988. Their son Theron and his wife Alma lived there until it was sold to the town in 1989 (Federer 1991).

In the 1950s, a water supply line was installed across the property; the water line still transports public water from the Bellamy Reservoir in Madbury to the City of Portsmouth treatment plant.

## **Stewardship Responsibilities**

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The Durham Town Council has the ultimate decision-making authority for Wagon Hill Farm. The Town Council has authorized the Durham Parks and Recreation Committee to provide guidance on how to use the property. All of the maintenance, management, and oversight of activities at Wagon Hill Farm have come under the auspices of the Public Works Department, led by the Director Mike Lynch. The Durham Conservation Commission is coordinating and providing some funding for the development of this Stewardship Plan for Wagon Hill Farm and for several other town-owned conservation areas.

The Town Council provides funding in the general fund budget for the annual maintenance of Wagon Hill Farm. These funds are requested by the Public Works Department to cover staff time and materials for such activities as mowing trails and fields, maintaining signs, picnic tables and other infrastructure, maintaining parking areas, and winter plowing. The Lori E. Brown Trust Fund was established in 1997 through a bequest to the town for “the care and preservation of Wagon Hill Farm as a public park.” Another source of funds for Wagon Hill was established by a member of the Tirrell family for the upkeep of the wagon. These latter two funding sources are administered by the Trustees of the Trust Funds.

## Purpose of the Stewardship Plan

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As a community resource Wagon Hill Farm offers many benefits and values to residents and visitors. Wagon Hill is located in the northeast corner of Durham and serves as the gateway to the town along Route 4, a heavily traveled thoroughfare. The property offers scenic views of fields and waters, clean air and cool breezes, walking trails, space for sledding, kite flying, birding and dog-walking, wildlife habitat, swimming and picnicking, a place for peaceful reflection and remembrance, protection of the waters and habitat along Great Bay, and a community garden.

People value Wagon Hill for many different reasons. Most of these are complimentary benefits, although more intensive human uses will coincide with diminished habitat values. A thoughtful and careful approach is needed to managing the resources and public uses at Wagon Hill given the soils, slopes, habitats, level of use, and proximity to Great Bay. Several management issues have surfaced since the town acquired the property, such as managing dogs and their waste, erosion along Great Bay, mowing fields, and trail maintenance. New issues emerge as the level of use increases, invasive species expand, wildlife concerns change or emerge, and the public desires change or expanded.

The goal of this Stewardship Plan is to understand and appreciate the values of Wagon Hill Farm and to guide the use and management of these resources over time. This is achieved by identifying the soils, topography, plants, animals, habitats, waters and wetlands, historical features, and public uses that occur on the property. An assessment of the environmental health – the extent of invasive species, water quality and erosion along Great Bay, trail erosion – is included since this affects a lot of the management decisions at Wagon Hill.

The Piscataqua Region Estuaries Partnership (PREP) Community Technical Assistance Program (CTAP) provided a grant to complete this Stewardship Plan. This funding, through PREP, is from the Otto Haas Charitable Trust 2 Fund of the New Hampshire Charitable Foundation. This grant, with additional funding from the Conservation Commission, is supporting the development of stewardship plans on four town-owned properties – Wagon Hill Farm, Doe Farm, Longmarsh Preserve, and Weeks Lot. PREP and the Conservation Commission contracted with Ibis Wildlife Consulting to prepare the Stewardship Plan.

The Stewardship Plan includes the following chapters and materials:

- ❖ **Chapter 2 -- Ecological Features** describes the landscape setting, soils, wetlands, habitats, plant communities, and environmental health of Wagon Hill Farm..
- ❖ **Chapter 3 – Public Access and Uses and Other Resources** describes the trails, allowed and prohibited uses, and other features of the property.
- ❖ **Chapter 4 – Stewardship Recommendations** presents potential management actions that can be implemented on Wagon Hill Farm to sustain and enhance its ecological features, environmental health, and the public benefits. Some of these actions are a continuation of current management, others include suggested changes to existing management, and some are new actions. Appendix D includes a list of resource people and agencies that can provide further technical assistance or potential grant funding to help implement these actions.
- ❖ **A set of maps** is included in the plan to further illustrate the ecological, recreation, and cultural features of Wagon Hill Farm.
- ❖ **Appendices A-E** provides additional background material and documents associated with Wagon Hill Farm.



## Chapter 2 Ecological Features

### Landscape Setting

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Sitting on the bench atop “wagon hill” is a great place to see and imagine the past and present. At 60 feet above sea level it is the highest point on Wagon Hill Farm. This is clearly not the high elevations of interior New Hampshire, for here you sit in the coastal plain. Highlights of this region--the southeastern corner of the state--include low, gently rolling topography; a moderate climate; marine sediments; tidal rivers and marshes; and bedrock of gneiss and schist (not granite).

Thinking back in time, imagine the English settlement in the 1600s when garrison houses lined the shores of the Oyster River. The Davis garrison stood on the knob in the southwest corner of Wagon Hill Farm, overlooking the Oyster River as it flowed into Little Bay. The house lasted through several generations and a few skirmishes. The land passed on through other families, and was likely farmed continuously for 300 years until about 1960.

Today, sitting with your back to Route 4, you can look south at the gently rolling fields of wildflowers and grasses, thickets of shrubs, forests of oak, hickory, and pine, down to the shore of the Great Bay Estuary. You can imagine the Oyster River flowing over the Mill Pond Dam in downtown Durham, three miles upstream. Walk down to the shore and watch tidal waters that push inland more than 10 miles from the seacoast flow up the Oyster River to the dam and down again, twice a day. Feel the breeze and smell the salt air. Watch for harbor seals bobbing in the water or basking on rocks. This is the quiet coast, away from the summer crowds that visit the coastal beaches.

The fields at Wagon Hill are a remnant of the agricultural past and remain one of its signature features. The wide expanse of open country with views to the Bay is unique today, as farming declined and forests reclaimed much of the rest of the state. Wildlife, such as nesting bobolinks and migrating monarchs, depend on these fields, as much as we enjoy walking the meandering meadow paths. This popularity by people also causes some negative impacts to the integrity of the land and water; issues that need to be addressed. Some management concerns such as removing and controlling invasive plant species extend beyond the boundaries of Wagon Hill and call for working with others.

The Great Bay Resource Protection Partnership, Strafford Rivers Conservancy, Towns, and other partners have conserved thousands of acres around the Great Bay Estuary. A few of the largest protected parcels in proximity to Wagon Hill Farm include the Town of Newington’s 119-acre Fox Point, the 1,000+ acre Great Bay National Wildlife Refuge, and the 70+ acre Adam’s Point. The portion of the Emery Farm that abuts Wagon Hill’s north forty to the west is permanently conserved through a conservation easement held by the Society for the Protection of New Hampshire Forests (Map 2).

Other conserved lands lie not far from Wagon Hill. Of particular note is a large block of land that is protected along the Bellamy River. The New Hampshire Fish and Game Department considers these lands and others extending west through Wagon Hill to Bunker Creek as critical to an existing New England cottontail population. This species is rare and declining. Wagon Hill Farm, although town-owned, is not permanently conserved; however the intent of the community at the time of purchase seemed to reflect a desire to maintain, at least the southern 99 acres, as public open space in perpetuity.

## Topography and Soils

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Set in the coastal plain on the shores of Great Bay, Wagon Hill Farm rises only to 60 feet above sea level. The wagon sits at the highest point; the former site of the Davis garrison on the knoll rises only to 20 feet. Despite the low elevation gain, Wagon Hill Farm is surprisingly “hilly” with the trails winding up and down and around rolling hills.

Wagon Hill Farm has a variety of soil types (see Table 1 and Map 3). Most of the poorly drained soils are beneath the wetland on the north forty acres or are associated with the marshes along the shores of Great Bay, the Oyster River and its creeks. More than 70% of Wagon Hill Farm supports farmland soils, including 60 acres of prime farmland soils, 10 acres of soils of statewide importance, and 18 acres of farm soils of local importance. The new community garden is located in prime farmland soils; however, local topography and past land may impact the feasibility of growing crops than the broad soil mapping would indicate.

Pockets of wet soils or marine sediments, the undulating topography, and the sensitivity of the water features (e.g., Great Bay, Smith Creek), dictate the types of land uses that could or should occur on Wagon Hill Farm. As described further on pages 14 and 19, the impacts of high public use in some areas (such as along Great Bay) reveals the land use limitations presented by these site characteristics.

**Table 1. Soil types on Wagon Hill Farm** (from NRCS Strafford County Soil Survey Data, 2001)

Soil #	Soil Name	Acres	Drainage	Parent Material
BzB	Buxton silt loam, 3 to 8 % slope	60.7	moderately well-drained; prime farmland soils	marine
ScA	Scantic silt loam, 0 to 3 % slope	27.8	poorly drained; farmland soils of local importance	marine
HcB	Hollis-Charlton fine sandy loams, 3 to 8 % slope	11.6	well-drained; soils of local importance	glacial till
SfC	Suffield silt loam, 8 to 15 % slope	10.2	well-drained; soils of statewide importance	marine
HcC	Hollis-Charlton fine sandy loams, 8 to 15 % slope	6.6	well-drained; soils of local importance	glacial till
Ta	Tidal marsh	5.5	very poorly drained	organic
Be	Biddeford silty clay loam	2.0	very poorly drained	marine
Gv	Gravel and borrow pit	1.5	-----	-----
HgC	Hollis-Gloucester very rocky fine sandy loams, 8 to 15 % slopes	0.5	well-drained	glacial till
HfC	Hollis-Gloucester fine sandy loams, 8 to 15 % slopes	0.4	well-drained	glacial till

## Watersheds, Wetlands, and Water Features

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### The Great Bay Estuary

At the coastal boundary between the states of New Hampshire and Maine, Gulf of Maine tidal waters flow twice a day up the Piscataqua River through Little Bay and then into Great Bay proper at Furber Strait. Collectively these water bodies are described as the Great Bay estuary system, one of the most productive ecosystems on the East coast (Odell et al. 2006). Beginning in the days of European settlement this area was known as “the Piscataqua region” and people said they were “of Piscataqua” (Bolster 2002).

The Great Bay estuary is approximately 10 miles inland from New Hampshire’s seacoast and adds more than 130 miles of tidal shoreline to the 18 miles of shoreline along the state’s coast. Seven major rivers – Winnicut, Squamscot, Lamprey, Oyster, Bellamy, Cochecho, and Salmon Falls -- flow into the Great Bay system draining nearly 1,000 square miles. The major habitats in Great Bay are eelgrass meadows, mudflats, saltmarsh, channel bottoms, and rocky intertidal. These habitats support 162 bird, fish, and plant species (23 of which are threatened or endangered) ([www.greatbay.org/index.html](http://www.greatbay.org/index.html)). In the estuary people harvest oysters and clams; fishing enthusiasts pursue striped bass, bluefish, herring, or smelt; lobstering is a commercial and recreational activity; and eels are trapped for bait and for export. Birders from all over the country and the world come to view migratory birds on Great Bay (NHEP 2000).

Wildlife that is regularly seen on or over the water from the shores of Wagon Hill Farm include double-crested cormorant, herring gull, common tern, great blue heron, and in winter many ducks, geese, and loons. Harbor seals can be seen at low tide basking on off-shore rocks or bobbing in deeper waters.

### Oyster River Sub-Watershed

Wagon Hill Farm lies within the Great Bay drainage, part of New Hampshire’s coastal watershed. More specifically, Wagon Hill is within the Oyster River sub-watershed. The property has more than 6,000 feet of frontage on the tidal portion of the Oyster River and sits at the mouth of the river as it flows into Little Bay. The Oyster River is one of seven major rivers that flow into the larger Great Bay estuary. At 19,828 acres, the Oyster River watershed is one of the smallest watersheds in the entire coastal region. Portions of six towns occur within the watershed including 38% of Durham, 24% of Lee, 17% of Madbury, 15% of Barrington, 5% of Dover, and 2% of Nottingham.

In 2000, local volunteers formed the Oyster River Watershed Association to protect the ecological integrity and environmental quality of the Oyster River watershed. The Association is now nominating the river for designation in the state rivers program, including the stretch of river from the headwaters in Barrington to the Mill Pond Dam in Durham. The tidal portion (including the stretch along Wagon Hill Farm) is not part of this nomination. For a map of the Oyster River to be included in the state rivers nomination see [http://www.trafford.org/cmsAdmin/uploads/OysterMap\\_mailout8\\_5x11.pdf](http://www.trafford.org/cmsAdmin/uploads/OysterMap_mailout8_5x11.pdf). The watershed association drafted a watershed management plan in 2001 that is available at <http://www.lefh.net/orwa/>.

According to Ted Diers (New Hampshire Coastal Program), the Oyster River carries the highest sediment load of any river in the seacoast. The reason for the high sediment load is not yet known.

### Oysters

The Oyster River is named for the American oyster (*Crassostrea virginica*). A unique conservation effort is underway to restore oysters to the Great Bay estuary, their populations decimated by over-harvest, pollution, and disease. Oysters are critical to water quality as they filter huge volumes of water each day when their populations are healthy. The University of New Hampshire, The Nature Conservancy, and

volunteers are restoring oysters by creating new nursery reefs in the Bay and by raising young oysters that are then released at the reef sites.

Volunteers with docks on Great Bay are raising young oysters in “oyster cages” for several months during the summer. New reefs are created by dropping tons of empty clam shells into estuarine waters around existing oyster beds. The newly raised oysters are then released at the reef, which provides a nursery for them to attach to and grow. The Oyster River is critical to this restoration effort as it appears to be one of the best sites in the Great Bay Estuary, which probably explains how the river got its name. A new oyster reef was created just upstream of Wagon Hill Farm on Bunker Creek. For more information on oyster restoration see <http://www.oyster.unh.edu/index.html> or <http://www.nature.org/wherewework/northamerica/states/newhampshire/projects/art28868.html>.

Small colonies of oysters are present on rocks off-shore from Wagon Hill Farm. As discussed in Chapter 4 – Stewardship Recommendations, the town could consider a long-term project to enhance these oyster populations, which in turn might help to mitigate the erosive active of waves in this part of the Bay.

### **Smith Creek**

Smith Creek forms the western boundary of Wagon Hill Farm, draining into the Oyster River at Stoney Brook Cove. The headwaters of Smith Creek begin on the north side of Route 4, flow southwest under the highway across the northwest corner of Wagon Hill Farm and into the tidal portion of the creek.

### **Davis Creek**

As “wagon hill” slopes south toward Great Bay, water seeps out of the hillside forming several drainages that come together in the center of Wagon Hill Farm. This fresh water stream meets tidal water as it flows up into a channel known as Davis Creek (see Federer 1991) (Map 2). This central wetland drainage has several fingers that drain off the fields; some may be a result of drainage tiles installed during active farming days. The wet seeps make mowing difficult and these swaths are left unmowed in wet years. Where trails cross streams, the town has installed bridges.

### **Freshwater Wetlands**

The 40 acres north of Route 4 has roughly 20 acres of wetland habitat and poorly drained soils (Maps 3 and 4). In August 2009, Bill Nichols of the New Hampshire Natural Heritage Bureau (NHNHB) evaluated this wetland as part of an Environmental Protection Agency-funded project to study freshwater wetlands in the coastal watershed. This freshwater wetland consists of a tall graminoid (grasses and sedges) marsh in the center, edged by a scrub-shrub community, with an outer, narrow band of red maple – elm – lady fern silt forest. The wetland native shrub community includes winterberry, meadowsweet, silky dogwood, arrowwood, highbush blueberry, and speckled alder. The upland surrounding the wetland and extending north on the rest of the 40-acre parcel is a white pine successional forest.

A wetland assessment by the Natural Heritage Bureau includes a measure of the site’s ecological integrity. Site conditions indicate that this wetland (and the entire 40 acres) was used as pasture until about 1960. Invasive plant species, such as common buckthorn and Japanese barberry, are present throughout the wetland and upland. A drainage channel, now filled with herbaceous growth, leads from the wetland down slope to the south, toward Route 4. Poison ivy is present throughout the understory and, although native, is also an indicator of past human disturbance. Given these conditions, the Natural Heritage Bureau characterized this wetland as having relatively low ecological integrity. In other words, the drainage channel, presence of invasive species, past land uses, all contribute to the degradation of this wetland. However, the wetland still provides some value for wildlife as New England cottontails may use this wetland, particularly for winter cover (see discussion on pages 15-16).

Bill Nichols also evaluated a forested wetland in the southern region of Wagon Hill Farm near the shores of Great Bay. This wetland is described as a red maple – red oak – cinnamon fern forest with vernal pools in the lowest areas. Winterberry and cinnamon and sensitive ferns are moderately common in this wetland. In his assessment, Nichols rated this wetland as having relatively high ecological integrity—with natural hydrology patterns, diverse vegetation structure (both live and dead), presence of native plants, and lack of invasive plants. This wetland is surrounded by an equally good example of a mesic Appalachian oak-hickory forest, with many large oaks and hickories. The main stressor (potential negative impacts) is the proximity to the walking path and the mowed picnic area to the east (Bill Nichols, NHHNB, personal communication).

## Salt Marsh

Salt marshes are wetlands along the coast or inland estuaries that are flooded regularly by tides. They range in size from narrow shoreline fringes to vast meadows. Wagon Hill Farm supports salt marsh in narrow fringes along the mouth of Smith and Davis Creeks and along the Oyster River/Little Bay shoreline. Salt marshes are considered one of the most productive ecosystems in the world. They produce a large amount of biomass (plant growth) that is important to shellfish, birds, fish, and other wildlife. Salt marshes perform many functions, such as shoreline protection, wildlife habitat, and nutrient cycling. Birds breed in salt marsh habitat and many crustaceans and fish feed in these wetlands.

Salt marsh is rare in New Hampshire, accounting for only 0.1% of the land. Much of the salt marsh habitat in New England has been altered or destroyed. Historically, salt marshes were first ditched and drained for salt marsh hay farms and later for mosquito control. Coastal development has caused extensive dredging and filling of salt marshes. Current threats to salt marshes include reduced tidal flow due to undersized culverts under roadways and train beds, loss of the upland buffer due to coastal development, excess nutrient inputs from stormwater runoff, and colonization by invasive species (Odell et al. 2006).

Although Wagon Hill has a fraction of the salt marsh that is found around Great Bay, it is important given the overall lack of such habitat left in the region. The dominant plants that grow in the salt marsh along Wagon Hill's shoreline include saltwater cordgrass (*Spartina alterniflora*), salt meadow grass (*Spartina patens*), sea lavender (*Limonium nashii*), common glasswort (*Salicornia europaea*), seaside goldenrod (*Solidago sempervirens*), among others. One of the significant management issues at Wagon Hill Farm is the ongoing erosion that continues to degrade existing salt marsh and destabilize the shoreline. The town has implemented several actions to stem the erosion, including fencing to keep the public off sensitive areas, focusing public use on a beach area, and riprap to manage runoff from upland areas. It is not clear if continued intensive public use of the shoreline or wave action from storms and boats is causing the continued erosion problems, or both.

As part of the preparation of this Stewardship Plan, we organized a site walk at Wagon Hill Farm in August 2009, to discuss the ongoing shoreline erosion and loss of salt marsh along Great Bay and to elicit potential management solutions that could mediate or reverse the trend. Ted Diers (New Hampshire Coastal Program), Ray Konisky (The Nature Conservancy), and Dave Burdick (University of New Hampshire Jackson Lab) attended the site walk; all three have extensive knowledge of salt marsh communities and of Great Bay. We walked most of the shore frontage and/or trail from the beach/picnic area to the mouth of Smith Creek.

The overall consensus from this site walk was that shoreline erosion and salt marsh loss is occurring rapidly along the shores of Wagon Hill Farm and the major cause was likely human induced. The mowed picnic area, beach, and shoreline trails receive intensive human use, often with dogs along. Soil compaction of the large mowed area that slopes to the beach has created more severe runoff into the Bay.

Rainfall runs off mowed areas much more quickly than in forested areas or in unmowed fields, almost equaling the runoff characteristics of a paved parking lot (Ted Diers, NH Coastal Program, personal communication).

A few years ago in an effort to prevent further erosion, the town re-designed the beach and installed riprap, flexible drainage pipe, permanent wooden fencing parallel to the shore, and lighter fencing perpendicular to the water to discourage people from walking along the shoreline. The goal was to focus human use within the sandy beach. However, the combination of increased runoff from the compacted, mowed picnic area, drainage directed to the shore, hard structures (riprap and fencing) that once exposed actually increase erosion, and continued human activity within the shoreline, is causing erosion to continue unabated and perhaps even intensifying.

The woodland trails that follow the shoreline are also showing signs of compaction and erosion. At various points along the trail, people and their dogs have ventured out and down the bank, causing compaction, bank erosion, tree falls, and sloughing off of salt marsh. Dave Burdick noted that freshwater freezes harder than saltwater and with increased freshwater runoff into the Bay, freezing and subsequent ice damage is occurring higher in the salt marsh. Chunks of ice (from freshwater) that form high in the salt marsh take longer to melt in the spring and through storm action chunks of frozen salt marsh are being yanked away from the shore.

To prevent further loss of shoreline and salt marsh at Wagon Hill Farm, the salt marsh experts offered several creative ideas to reverse these trends. These are discussed in more detail in Chapter 4. In general, the group concurred that moving people farther back from the shore, reducing compaction in the mowed picnic area, and upgrading trails (including boardwalks, overlooks, and re-routes) is essential to preventing further degradation of this area.

## **Upland Habitats**

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### **Grasslands**

The dominant upland habitat on Wagon Hill Farm is the approximately 60 acres of grasslands; the signature feature of this property (Map 4). In addition to the critical wildlife habitat benefits, the extensive fields at Wagon Hill offer enormous scenic qualities and benefits to visitors and travelers. Large grasslands (those greater than 25 acres in size) are becoming rare in New Hampshire as development and natural forest succession have reduced this habitat throughout the state. Grassland-dependent birds (and their associated habitat) have declined faster than any other group of birds in New England (UNH Cooperative Extension 2008).

Wagon Hill Farm supports two grassland nesting birds—bobolink and eastern meadowlark. More than one dozen pairs of nesting bobolinks were observed in the summer of 2009 in the fields south of Route 4. The male bobolink is a blackish bird with a white back and straw-colored head, its bubbly song seen and heard as it flutters over its territory defending the ground-nesting female from other male bobolinks. A singing male eastern meadowlark was observed in the summer of 2009 in the field between the wagon and Route 4 (“the sledding hill”). The meadowlark is a medium-sized stocky bird, noted for its bright yellow throat, chest, and belly and a black “v” across its chest. This bird is listed as a “species of greatest conservation concern” by the New Hampshire Fish and Game Department (NHFG).

Grasslands are important for other wildlife including snakes, deer, wild turkeys, red-tailed hawks, and many beneficial insects such as pollinating bees and migrating butterflies, as well as spiders. The Town of Durham has been a great steward of these grasslands by mowing once a year in late summer or early fall.

This maximizes the benefit to all grassland-dependent species by allowing the nesting season to progress undisturbed and enabling late season flowers and grasses to provide food and cover.

## **Shrublands**

Shrublands are a transition between fields and forests that contain a mix of berry-producing shrubs and small trees important to many wildlife species. Some shrub habitats are dense and perhaps better known as “thickets,” while other shrublands are more open with a mix of shrubs, grasses, sedges, and wildflowers. Shrubs grow under many different habitat conditions. A field left unmowed will *succeed* naturally to a shrub stage and eventually to a forest. Shrubs often grow naturally around the edges of wetlands or along stream drainages. Burning or cutting of forests, creates new habitat for shrubs and young trees.

Wagon Hill Farm has ribbons of shrubland habitat around the edges of the fields and along the wetland and stream drainages. Some of the native shrubs growing in these places include speckled alder, silky and gray dogwoods, elderberry, northern arrowwood, sumac, bayberry, meadowsweet, raspberry, and winterberry. Sprinkled among the shrubs are other fruit-producing trees such as pin and black cherry and wild apples. These same habitats also create ideal conditions for some of our worst invasive plant species including autumn olive, bush honeysuckles, common and glossy buckthorn, and oriental bittersweet. Although these non-native shrubs also bear fruit, they are believed to be less nutritious for wildlife than the native shrub community.

Like grasslands, shrub habitats are declining due to development and natural succession; their habitat quality is declining with the invasion of non-native plants and, in some places, intensive recreational uses. Shrub habitats provide critical cover as well as important food sources for wildlife. Larger or wider shrub patches are more beneficial than small patches or narrow strips. Given the extensive grasslands and the existing shrub thickets at Wagon Hill Farm, there is an opportunity to enhance the shrub habitat to increase its benefit to wildlife, while still maintaining suitable grassland habitat.

Migrating songbirds are particularly dependent on berry-producing shrubs and trees, shifting from a diet of mostly insects in summer to one of mostly fruits during fall migration. This shift is particularly noticeable in thrushes, vireos, warblers, and mockingbirds (Parrish 2000). At Wagon Hill Farm look for the gray catbird, eastern bluebird, robins, and cedar waxwings in the shrub habitats. The only wildlife species prefaced with the name “New England” is one that is dependent on shrubland habitat—the New England cottontail, described in more detail below.

### ***New England cottontail***

The New England cottontail (*Sylvilagus transitionalis*) is a native rabbit that has declined significantly throughout its range. This species depends on dense, woody cover such as is found in shrub thickets, shrub swamps, brushy areas near wetlands, utility and railroad corridors that are shrubby, and young regenerating forests. Unlike eastern cottontails they do not occur on lawns, golf courses, or active farmland. Mature forests also do not provide suitable habitat as it lacks a dense understory. If you can't walk through it then it is probably good New England cottontail habitat! Wagon Hill Farm is within the historic range of the New England cottontail and there is an historical record on the 40 acres north of Route 4 (Steve Fuller, NHFG, personal communication).

The cottontail's food includes bark, twigs, leaves, fresh fruits, buds, flowers, grasses, rushes, and sedges. In spring and early summer they eat the tender shoots of grasses and herbs; later they shift to fruits, and then to a winter diet of bark, twigs, and buds. Some of their preferred foods include raspberry, blackberry, highbush blueberry, and willow (see Table 2 for a complete list). Often these plants provide both food and cover (Arbuthnot 2008). A full color copy of the publication by Margaret Arbuthnot, *A Landowner's Guide to New England Cottontail Habitat Management* is included as Appendix E.

**Table 2. Preferred foods of the New England cottontail.**

<b>Preferred Foods of the New England Cottontail</b> (from Arbuthnot 2008)		
<u>Shrubs &amp; Vines</u>	<u>Herbs &amp; Grasses</u>	<u>Trees</u>
raspberry	goldenrod	red maple
blackberry	rushes	aspen
dewberry	clovers	gray birch
winterberry	lance leaf plantain	apple
willow	chickweed	choke cherry
maleberry	sheep sorrel	black cherry
highbush blueberry	wintergreen	sugar maple
lowbush blueberry	buttercup	oaks
silky dogwood	wild strawberry	white birch
native roses	cinquefoil	yellow birch
spiraea	violet	black birch
chokeberry		beech
sumac		striped maple
greenbriar		

In addition to having an historical occurrence and located within a larger conservation focus area for an existing population, Wagon Hill Farm has most of the preferred foods for cottontails. Through active management on both the north and south side of Route 4, the town could enhance the habitat for New England cottontail, by managing for more native shrubs. This will benefit many other wildlife species, especially birds, which depend on this same habitat. These include eastern towhee, American woodcock, chestnut-sided warbler, prairie warbler, blue-winged warbler, black racers, and many pollinating bees and other insects.

New England cottontails are extremely susceptible to predation from coyotes and foxes, as well as fisher, weasel, domestic cats, owls, and hawks. The cottontail does not survive well in small patches of habitat (less than 6 acres) and does much better in patches of 25 acres or larger (Arbuthnot 2008). Given the size of Wagon Hill Farm and the existing habitat conditions, the town is in a unique position to provide quality habitat to this native New England rabbit. A proposed management strategy to achieve this goal is described in more detail in Chapter 4.

### **The Orchard**

A stand of old apple trees remains at Wagon Hill Farm within a mowed lawn that has hosted overflow parking in the past and is the site of a memorial chair and plaque. The apple trees are now overgrown with invasive plants that will topple them in the near future if not released from these competitors and then pruned. Wild apple trees are ideal natural cavity nest sites for trees swallows and eastern bluebirds, two birds that are beautiful to watch. Apple trees also offer excellent homes and foraging sites for woodpeckers and nuthatches.

### **Upland Forest**

#### ***Appalachian Oak-Pine Forest***

One of the dominant forest types across southeastern New Hampshire (below 900 feet in elevation) is called Appalachian oak-pine forest. Since this coincides with some of the state's densest human



development, this forest type is greatly diminished in size and distribution. Wagon Hill Farm has a few pockets of this forest, and although small, they are important remnants of this forest around Great Bay. As the name implies, these forests include some species more typical of southern (Appalachian) states such as white oak, shagbark hickory, and sassafras, in addition to red oak and white pine.

The best example of Appalachian oak-pine forest on Wagon Hill Farm is the forested area west of the mowed picnic area, extending approximately from the gravel pit area to the shores of Great Bay (see Map 4). From the walking trail you can see large red oaks (approximately 75 years old) along with scattered shagbark hickory, white oak, and red maple. The understory vegetation includes hornbeam (musclewood), winterberry, huckleberry, and sassafras, among other species. This forest surrounds the red maple – red oak – cinnamon fern forest described by Bill Nichols (see page 13).

Another pocket of mature red oak-white pine forest is located in the southeast corner of Wagon Hill Farm, also along the shore of Great Bay, and around the Davis cemetery. This forest patch has fewer southern species and may have seen more recent human disturbance than the larger, more diverse Appalachian oak-pine forest described above. The eastern boundary of Wagon Hill Farm is bordered by a stonewall and a row of mature red oak and shagbark hickory, with a mix of native and non-native shrubs. A similar forest surrounds the Davis cemetery.

These mature oak-pine forests provide habitat for gray squirrels, wild turkey, red-tailed hawks, and many songbirds such as scarlet tanager, eastern wood pewee, great-crested flycatcher, downy woodpecker, blue jay, among others. Some of the large oaks and pines are being lost along the shore, a result of soil compaction and erosion.

### ***Pine Forests and Plantations***

The rest of the forest on Wagon Hill Farm includes a mix of native pines and plantation pines and spruces. A pocket of pitch pine and red pine grows on the rocky point along the western shore near the mouth of Smith Creek. This unique rocky headland offers a nice view of Great Bay, but is succumbing rapidly to overuse and resulting erosion (The erosion here was also noted in the 1195 Master Plan for Wagon Hill Farm). Extending north along the shore and inland from this point is a mix of scrappy white pine and a plantation of pines and spruces. The latter appears to be the result of a Christmas tree plantation that was left to grow tall and dense. In the center of this forested area, just east of the knoll is the site of an old sand and gravel operation. This disturbed area supports a mix of pine and hardwoods of various ages.

### ***The North Forty***

As described under the wetlands section on page 12, about 20-acres of the “The North Forty” (the 40 acres north of Route 4) is wetlands (Map 4). The remaining 20 acres of upland can be generally described as a white pine successional forest. The dominant tree is white pine that became established after the use of this parcel as pasture ceased around 1960. Therefore, much of the white pine is about 50 years old with poor form and therefore little timber value. Pockets of low, wet soils extend up into the white pine uplands.

Scattered among the overstory are a few large trees of other species, including white ash, shagbark hickory, black cherry, red oak, and sugar maple. The understory has a smattering of seedlings of the same suite of tree species. However, invasive plant species are the dominant understory vegetation throughout much of this parcel. The most common invasive plants on the north forty include Japanese barberry, oriental bittersweet, glossy and common buckthorns, winged euonymus, and multiflora rose. Once established invasive plants are difficult to remove and control, since they are well-adapted to disturbance and out-compete native plants.

The combination of invasive plants, poor timber value of existing trees, extensive wetlands, and remote access presents some management challenges. However, some management options exist, particularly in collaboration with state and federal partners that steward nearby lands. During the course of preparing this Stewardship Plan we met on site with a licensed forester to discuss potential forest management options and with experts from the NHFG and U.S. Fish and Wildlife Service to discuss potential habitat management options to benefit New England cottontail. Their input is incorporated into the Stewardship Recommendations in Chapter 4. With active forest management this stand could be restored to a healthier, more diverse forest, although it will take time. Forest management could be combined with habitat management for cottontails.

## **Rare Plants and Animals and Exemplary Natural Communities**

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The New Hampshire Natural Heritage Bureau (NHNHB) finds, tracks, and facilitates the protection of rare plants and exemplary natural communities. They also maintain information on rare wildlife in cooperation with the NH Fish and Game Department (NHFG). Natural Heritage defines a natural community as “recurring assemblages of plants and animals found in particular physical environments.” Each type of natural community has a unique set of environmental conditions that support certain species adapted to those conditions. Exemplary natural communities include nearly all examples of rare types and high-quality examples of common types (Sperduto and Nichols 2004).

Landowners can request from the NHNHB a list of known rare species and exemplary natural communities for their property. However, unless a property has been specifically surveyed for rare and exemplary elements, then such a list may be incomplete. There are currently no known records of rare elements in the Natural Heritage database for Wagon Hill Farm. However, within one mile of the property several rare plants, animals, and exemplary communities are known to occur (see Appendix B for NHNHB Report).

Although no species are listed in the Natural Heritage database, several wildlife species documented on Wagon Hill Farm are considered “species of greatest conservation concern” by NHFG as described in the NH Wildlife Action Plan (WAP) (NHFG 2006). The Fish and Game Department identified 123 wildlife species and 27 habitats in the WAP that deserved special management attention given risks to their populations and/or habitats. Several species on this list spend their winter in open water on Great Bay, including just offshore of Wagon Hill. These include American black duck and common loon. Bald eagles roost along Great Bay shores in winter. Osprey and great blue herons forage among the shoreline. The eastern meadowlark nests in the grasslands of Wagon Hill Farm. New England cottontails were documented historically on Wagon Hill Farm, and may still occur here. These species are all included in the WAP as “species of greatest conservation concern.”

### *Unfragmented Habitats*

Although Wagon Hill Farm has few documented rare species or exemplary natural communities, its location on Great Bay and within a larger swath of undeveloped land are important ecological features.

Unfragmented lands are areas of habitat with no roads, houses, or other development (such as intensive recreational uses). In coastal New Hampshire, blocks of 1,000 acres or more are rare and blocks of 500 to 1,000 acres, especially around Great Bay, are locally significant. Wagon Hill Farm is one of the biggest blocks of undeveloped land along the tidal portion of the Oyster River. The north forty abuts other conserved lands and is within a larger regional block of conserved land.

The New Hampshire Fish and Game Department identified development (residential, commercial, or industrial) as one of the most significant risk factors to the State’s wildlife and habitats (NHFG 2006). Development causes the fragmentation of habitat into small, unconnected parcels. Songbirds, small mammals, and other wildlife species are more susceptible to mid-sized predators such as fox, raccoon, and skunk in small blocks of habitat. These “generalist” predators adapt better than other species to a fragmented landscape. Habitat blocks crisscrossed with residential roads and houses expose wildlife to high rates of road mortality, increase conflicts with humans and pets, result in increased contaminated runoff, and offer more opportunities for invasive plants to spread to natural areas.

A large unfragmented block typically supports more interior forest species (e.g., scarlet tanager, wood thrush) or grassland-dependent birds, is better at sustaining natural processes (such as nutrient cycling, water cycles, clean air), is more resilient to natural disturbances, and often supports a diversity of large and small habitat patches in close proximity to each other. Large unfragmented lands also allow plants and animals to adapt to changing environmental conditions, giving them space to shift their territories or populations.

## **Environmental Health**

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Environmental health, or *ecological integrity*, can be measured in several ways, such as the quality and quantity of surface waters, degree of erosion and runoff, amount of impervious surface, quality of air, presence of forest pests or invasive species, presence of native species and associated habitat elements. Some environmental stressors, such as mercury deposition, air pollution, extreme weather events and climate change, are large in geographic scope and largely outside the influence of land stewardship decisions on individual ownerships.

The environmental health of Wagon Hill Farm is decidedly mixed. While the property remains largely undeveloped with little impervious surface, the intensive public use especially along the shores of Great Bay and desires of the town to expand public uses is causing some degradation in environmental health.

The two greatest impacts to environmental health on Wagon Hill Farm are soil compaction and erosion from human activity that is deteriorating the shoreline and causing loss of salt marsh, and the presence of invasive plant species that degrades native habitats. On the positive side, the fields, forests, and wetlands support many wildlife habitat elements and native plant species important to maintaining ecological integrity. These elements also offer scenic vistas and places for quiet contemplation and reflection, features that are important to human health and well-being.

### **Soil Compaction and Erosion**

Wagon Hill Farm was purchased by the townspeople of Durham “to preserve its scenic vistas, provide for future municipal purposes and preserve open space in order to provide for healthful and attractive outdoor environment for work and recreation, and to conserve land, water, forest and wildlife resources.” This mix of public values and benefits is feasible on Wagon Hill Farm, but not without careful planning and some compromises. However, some uses have greater impacts than others, and currently, the intensive public use along the shores of the Oyster River (and Great Bay) are resulting in serious degradation. This is compromising all three of the proclaimed purposes for Wagon Hill – the scenic vista, the healthful and attractive outdoor environment, and the land, water, forest and wildlife resources are all compromised by the eroding shorelines.

Almost every visitor to Wagon Hill Farm ventures down to the shores of Great Bay, to soak up the view, to enjoy a family picnic, to dip into the cool water, to exercise their dog. Periodically the town has also permitted vehicles and camps to be set-up in the large mowed area near the shore. To accommodate these activities, the town has provided a beach, picnic tables and shelter, trash cans, and maintains a large mowed "lawn." These are wonderful community benefits, but without some changes in the management of the shorefront, the resulting soil compaction and loss of shoreline and salt marsh will continue to degrade the environmental health and the experience of Wagon Hill Farm.

Several factors have created the current conditions. The clayey soils and sloping topography on land, the runoff directed at the shoreline, a large mowed area that acts like impervious surface, heavy wave action especially during storms (Wagon Hill sits at the mouth of the Oyster River where it opens out broadly into Little Bay), and fringes of sensitive salt marsh habitat along the shore create conditions that are especially susceptible to compaction and erosion. See the discussion under Salt Marsh on pages 13-14 for more details on the impacts to salt marsh habitat.

People want to get to the water and explore the shore. Unfortunately the attempts thus far to keep visitors to specific areas, have either been insufficient or have exacerbated the problem. Much of the continued erosion results from people wandering off trail or around fencing designed to keep them out. Worn paths down steep banks to the marsh, toppled trees, undercut banks, and chunks of salt marsh cut loose are all visible, extending from the beach along the wooded shoreline to the rocky headland.

The salt marsh experts provided several concrete suggestions both immediate and long-term that could help minimize and prevent further erosion, and then begin the process of restoring the shoreline and associated habitats. The most immediate step is to move people farther away from the shore, create limited access points to the shore, enhance trails with boardwalks and overlooks, improve fencing, and install interpretive signs that educate people on why these steps are taken and how they can help protect and better enjoy their public resource. These recommendations are detailed in Chapter 4.

## **Invasive Species**

An "invasive species" is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (National Invasive Species Council 2001). One report estimates the economic cost of invasive species in the U.S. at \$137 billion every year (Pimentel et al. 2000). Up to 46% of the plants and animals federally listed as endangered species have been negatively impacted by invasive species (Wilcove et al. 1998, National Invasive Species Council 2001).

Invasive species typically have certain traits that give them an advantage over most native species. These traits include producing many offspring, early and rapid development, and being adaptable and highly tolerant of many environmental conditions. Such traits give them an edge over native species. Studies show that invasives can reduce natural diversity, impact endangered or threatened species, diminish wildlife habitat, affect water quality, stress and reduce forest and crop production, damage personal property, and cause health problems.

The New Hampshire Invasive Species Act states that "*no person shall knowingly collect, transport, sell, distribute, propagate or transplant any living or viable portion of any listed prohibited invasive plant species including all of their cultivars, varieties, and specified hybrids.*" Appendix C includes the list of prohibited species referenced in this Act. For more information on New Hampshire's invasive species program see [http://www.nh.gov/agric/divisions/plant\\_industry/plants\\_insects.htm](http://www.nh.gov/agric/divisions/plant_industry/plants_insects.htm) and [http://www.nh.gov/agric/divisions/plant\\_industry/documents/booklet.pdf](http://www.nh.gov/agric/divisions/plant_industry/documents/booklet.pdf).

Invasive plant species are transported by humans and wildlife; many were planted purposefully in the past for wildlife, erosion control, or as landscape plantings. Others came in via international commerce. Many invasive plants appear first in disturbed areas such as along roadsides and trails, in gravel pits, or edges of fields. They can be moved along roadways by plowing, mowing or other roadwork.

Wagon Hill Farm has several invasive plant species (see Table 3). These are most abundant on the north 40 acres, along stream drainages and in the shrub thickets on the property south of Route 4. Pockets of invasive shrubs also grow in scattered clumps throughout the fields.

**Table 3. Invasive plant species on Wagon Hill Farm.**

Common Name	Scientific Name
Autumn olive	<i>Elaeagnus umbellata</i>
Bush honeysuckles	<i>Lonicera spp.</i>
Common barberry	<i>Berberis vulgaris</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common reed	<i>Phragmites australis</i>
Glossy buckthorn	<i>Frangula alnus</i>
Japanese barberry	<i>Berberis thunbergii</i>
Multiflora rose	<i>Rosa multiflora</i>
Oriental bittersweet	<i>Celastrus orbiculata</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Winged euonymous	<i>Euonymous alata</i>

### Wildlife Habitat Features

Wildlife need food, water, cover, and space to live and reproduce--collectively known as their *habitat*. Each species has unique habitat requirements, and the presence of a given species in an area varies depending on the availability of the habitat features that they depend on. Wildlife food resources include aquatic and upland plants, fruits, seeds and nuts, insects and other animals, and nectar. All wildlife require water, almost daily, yet aquatic organisms clearly depend on it more than upland species. Cover provides protection from weather and predators and sites for nesting, resting, travel, and other activities. The juxtaposition of food, water, and cover determines the wildlife community that occurs in a given area.

An area with many different kinds of food, water, and cover typically supports a greater diversity of wildlife. This reflects *habitat structure*, an important concept in understanding the distribution and abundance of wildlife. Habitat structure is measured in several ways:

- *Horizontal vegetation diversity*—the mix of different plant communities in a given area. At Wagon Hill Farm this includes the grasslands, shrubs, forests, wetlands, and salt marsh.
- *Vertical vegetation diversity*—the extent of layering within a forest or other habitat. Layering within a forest includes ground cover (fungi, mosses, ferns, woodland wildflowers), vines and shrubs, and trees (including sizes and ages). Because the forests of Wagon Hill Farm were cleared for fields or pasture, harvested for wood, or disturbed for gravel extraction, the vertical vegetation diversity is relatively low. The intact Appalachian oak-pine forest west of the picnic area has the more diverse vegetation layers.

- *Food resources*—this often varies seasonally and includes insects, berries, nuts, seeds, nectar, other animals. The extensive grasslands offer an abundance of insects and nectar in summer and seeds in the fall. The oak and pine forests offer a ready supply of acorns, hickory nuts, cones, and other seeds. The shrub community includes berry-producing dogwoods, winterberry, blueberries, viburnums, cherries, grapes. The apple trees add their fruit to the mix of food resources.
- *Cavity and other nest trees*—nearly two dozen birds and mammals depend on tree cavities for nesting, roosting, or denning, such as bats, woodpeckers, chickadees, nuthatches, squirrels, raccoons. These species rely on a range of cavity tree sizes and on a mix of dead or partially dead standing trees (called “snags”) as well as live trees with cavities. Wagon Hill Farm has a limited supply of large dead or dying cavity trees, partly because of past lands uses that cleared much of the forest. Over time cavity trees will be created through natural processes, except for trees removed for human safety or through logging or other management.
- *Dead and down woody material*—also called “coarse woody debris,” this includes fallen logs and trees, stumps, and upturned roots in various stages of decay on the forest floor. This material provides homes for salamanders, snakes and invertebrates, hiding or hunting grounds for mice, voles, chipmunks, squirrels, coyotes, foxes and weasels, and nutrients for lichens, fungi, and other plants. Similar to cavity trees as noted above, coarse woody debris is limited in these forests due to past land uses. Again, the area with the most material is the Appalachian oak-pine forest.

These habitat features are also a measure of ecological integrity as their presence contributes to the overall biological diversity of a place. For example, dead and dying trees and fallen logs are not only important to wildlife, but are critical components of nutrient cycling and serve as *nurse logs* for regenerating plants. In contrast, the presence of invasive shrubs is detrimental to wildlife and also degrades natural communities by out-competing native plants.

## **Chapter 3                    Public Access and Uses and Other Resources**

Wagon Hill Farm is a popular destination in Durham. As one of the largest town-owned properties, it receives dozens of visitors daily and hundreds of visitors on busy summer weekends or on snowy weekdays that are ideal for sledding. Not only does Wagon Hill offer a beautiful setting for outdoor activities, it is easily accessible off Route 4. The town, mainly through the efforts of the Public Works Department, has maintained the access, parking, trails, and other amenities to accommodate visitors and to provide a safe and enjoyable experience. Wagon Hill Farm is open from 8:00 am to dusk.

The most popular activities at Wagon Hill Farm appear to be walking (especially with dogs), picnicking, sledding, kite-flying, photography and nature observation, x-country skiing and snowshoeing, and some swimming and boat landing, especially kayaks. As on all Durham-owned lands, hunting is prohibited. Use of town properties, including Wagon Hill Farm, for larger events is allowed with approval from the Town Council; a permit application with a refundable deposit is required, but no fee is charged. Large events have included weddings, reunions, educational programs and celebrations, reenactments, among others. Some of these events include driving and parking vehicles within the mowed lawn near the beach. A major issue at Wagon Hill Farm since the start of town ownership has been the issue of dogs, as it is a popular destination for dog owners.

### **Access and Parking**

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The entrance to Wagon Hill Farm is via a gravel driveway on the south side of Route 4, just east of the Emery Farm (see Map 2). Route 4 is a heavily traveled road; people exiting and entering the property must be cautious. The driveway ends at the historic Bickford-Chesley House and associated buildings. An upper and lower gravel parking lot each accommodate about 12 vehicles.

An iron gate at the entrance from Route 4, which can be closed, is intended to allow public access only from 8:00 am to dusk. A second iron gate, located at the end of the gravel driveway, controls access to the management road/trail that leads down to the picnic/beach area. This gate is typically open only for special events to allow overflow parking in the orchard or for vehicle access to the picnic area.

The Public Works Department is preparing to create a new, and likely final, gravel parking area to accommodate 79 cars. The proposed location is on the west side of the existing gravel access road just past the gate, between the farmhouse and the orchard (Map 2). Such a parking lot was one of the recommendations in the 1995 Master Plan.

Access to the north forty acres is via Watson Road, off of Back River Road. No parking is available, although there is space along the road shoulder for a few cars. Watson Road becomes class VI starting at this location. Historically there was a trail and probably an old woods road from Route 4 onto the north forty. However, these trails have become overgrown and Route 4 has become too busy to allow a safe access. A trail leads from Watson Road in a southeasterly direction through the northern half of this parcel, before exiting on the abutting property to the east. There are no structures or other public amenities on the north forty acres.

## Trails and Public Uses

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The gravel management access road that leads from the parking lot to the mowed picnic area also serves as the main pedestrian trail down to the shores of Great Bay. Several loop trails lead from the parking lot as well as off the access road, through fields and forest.

The network of trails that meanders through and along the edges of the fields is mowed regularly by the Public Works Department (Map 2). Wooden bridges are located at several wetland crossings. Some low sections of the trail can be wet in spring or during rainy periods. The main woodland trail follows the shoreline of Great Bay, with several spurs that lead back to the management access road. Almost all of the woodland trails show signs of compaction and erosion.

Wagon Hill Farm has become an important site for memorials, given its scenic vistas, peaceful settings, and network of walking trails. Memorial benches are located at several places along the trail network – atop wagon hill, at the west end of the orchard, and at the old boating landing west of the picnic area.

Wagon Hill Farm is a perfect place for a picnic. The town has provided numerous picnic tables with one set under a shelter near the beach. Trash cans and a portable toilet at the parking lot are also available for public use.

## Dogs

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Since its inception as a town-owned open space in 1989, Wagon Hill Farm has drawn visitors and their dogs. As the site became more widely known among dog-owners, its popularity grew until it seemed like an informal “dog-park.” This led to overuse and resulting impacts to natural resources, bad behavior by some dogs and their owners, and conflicts between people with and without dogs. To resolve these problems, the town debated and then instituted a set of rules governing dogs at Wagon Hill Farm.

Although some people in the community wanted dogs prohibited from Wagon Hill Farm, the compromise was to have owners control their dogs at all times and to pick up their dog waste. The town erected signs (see below) near the parking lot listing the rules and provided bags and trash cans for the dog waste. These steps seemed to have helped control the number and actions of dogs visiting Wagon Hill.

<p style="text-align: center;">Attention: Dog Owners</p> <ul style="list-style-type: none"><li>• Dogs must be on leash at all times.</li><li>• Fines of up to \$150 may be charged for violating ordinance 2001-10 <i>“All dogs shall be restrained by a leash not exceeding eight (8) feet in length or a retractable leash with stop control.”</i></li><li>• Owners are responsible for proper removal of dog droppings.</li></ul> <p style="text-align: center;">Thank you for your cooperation.</p>
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People and their dogs still visit Wagon Hill in high numbers, but most seem to follow the rules. However, the lack of signage near the beach, picnic area, and along the wooded shoreline trail may be a cause of continued erosion and heavy human and dog traffic in sensitive areas that are meant to be off-limits.



## **Community Garden**

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A community garden was started in the summer of 2009, with a pilot of twelve 10'x10' plots cultivated and planted (Map 2). The Public Works Department is researching a potential source of freshwater for the garden, which is situated between the existing buildings and the apple orchard. The full size of the community garden is proposed to be 195 feet by 195 feet with 256 10x10 plots. The proposed layout leaves a 250 foot buffer along Smith Creek. Anyone in the community can apply to use one of the garden plots. A community garden was recommended in the 1995 Master Plan; the Plan suggested reserving 5 acres in this area for agriculture.

## **Historical Resources**

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Two documents provide an excellent discussion of the historic resources on Wagon Hill Farm. Boston University graduate student Kari Ann Federer produced a detailed description of the property in 1991 titled, "Wagon Hill Farm – Past, Present, and Future." Her thesis included a history of the land back to the colonial period and recommendations for using the historic buildings (Federer 1991). The 1995 Wagon Hill Farm Master & Management Plan also provided an assessment of the historic resources and recommendations on their use (The Cavendish Partnership, Inc. 1995).

The historic resources on the property include:

- The Bickford-Chesley House and carriage barn; built in the early 1800s
- Davis Cemetery
- Davis Garrison; evidence of this homestead on the knoll was lost during the excavation of the gravel pit around the 1930s
- Wharf – the remains of the wharf located west of the beach are still evident; likely used to transport hay by gundalow
- Fields reflect the history of farming
- Other features include stonewalls, old well site, foundation of cider mill east of the house

## Chapter 4 Stewardship Recommendations

As a community resource Wagon Hill Farm offers many benefits and values including scenic beauty, walking trails, wildlife habitat, a sledding hill, picnic areas, protection of Great Bay, public space for photography, painting and nature observation, historic buildings, among others. It is worth revisiting the purposes, for which Wagon Hill was acquired by the people of Durham -- *“to preserve its scenic vistas, provide for future municipal purposes and preserve open space in order to provide for healthful and attractive outdoor environment for work and recreation, and to conserve land, water, forest and wildlife resources.”*

The stewardship of a community resource such as Wagon Hill Farm is a long-term commitment by dedicated community members working together. For Wagon Hill Farm this includes the Parks and Recreation Committee, Public Works Department, Conservation Commission, and others. The Stewardship Plan provides a foundation for moving forward on enhancing and maintaining this great public space. This Plan is a living document to be reviewed and updated as part of the long-term stewardship of Wagon Hill Farm.

The following stewardship recommendations were developed by conducting site assessments in summer 2009; consulting with several experts on shoreline erosion and salt marsh, wetlands, New England cottontails, and forest management; reviewing the purposes and historic documents related to the acquisition of Wagon Hill Farm, and discussions with the Conservation Commission and Public Works Director. The recommendations are not exhaustive but represent the author’s ideas for the most significant actions for the town to consider, given the existing site conditions and the capacity of the resources to provide the desired benefits.

Several of the recommended action items suggest further consultation with or assistance from other resource professionals and agencies or organizations. A detailed list of resource contacts is included as Appendix D.

### General Stewardship

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- **Boundary Survey and Monitoring**

Much of Wagon Hill Farm is bounded by stone walls, shorelines of Smith Creek, Oyster River and Great Bay, Route 4, and Watson Road. However, a boundary survey was never completed and recorded for the two parcels. A recorded survey offers an accurate determination of the acreage and provides a permanent record of the property boundaries.

**Action:** Hire a licensed surveyor to complete and record boundary survey for both parcels

**Action:** Annually or periodically walk the entire boundary to re-affirm boundaries and assess conditions

**Action:** Place small metal signs along the property boundary (on trees) indicating “Durham Conservation Land,” or “Durham Public Land,” or whatever is appropriate.

- **Land Conservation**

Neither the south nor north sections of Wagon Hill Farm are permanently conserved. Although publically owned and acquired for the above-stated purposes, future decision-makers and residents

could decide to sell the property. In addition, the complexity of the purposes for which the land was acquired creates uncertainty about the intended uses of Wagon Hill Farm. Conveying a conservation easement on all or part of Wagon Hill Farm to a third party would ensure that those purposes (as stated in a conservation deed) would be conserved in perpetuity.

The 1995 Master Plan suggested that the north 40-acres be sold and the funds from the sale be used to improve “the Farm.” The Plan authors recognized that the 40 acres north of Route 4 had limited development value given extensive wetlands. A site visit by NHFG and the U.S. Fish and Wildlife Service revealed that this parcel is within a larger block of land critical to the rare New England cottontail. The north forty is now within a larger block of conserved land; losing this parcel to development would diminish those efforts.

**Action:** Consider working with a third party, such as the Great Bay Resource Protection Partnership, Southeast Land Trust of New Hampshire, or Strafford Rivers Conservancy), to place a conservation easement on all or most of the south 99 acres (“The Farm”).

**Action:** Continue to consult with the NH Fish and Game Department and the U.S. Fish and Wildlife Service on managing the north 40 acres for New England cottontail—these agencies have funding pending to assist landowners with such management

**Action:** Consider placing a conservation easement on the north forty acres. If the town decides that selling the north 40 acres is in its best interest, as first option consult with the Great Bay Resource Protection Partnership to see if they have the ability to acquire the land for conservation purposes. This parcel should be considered for permanent conservation given its location within a larger block of conserved land and its potential importance to New England cottontail.

## Shoreline Protection and Restoration and Erosion Control

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Great Bay is a unique estuary system, noted for its relatively good condition compared to other estuaries along the east coast. Salt marsh and eelgrass in the Bay form the base of the food web that supports fish, birds, and invertebrates. Eelgrass and salt marsh also protect shoreline from erosion, trap sediment and nutrients, and filter pollutants. Salt marshes are considered one of the most productive ecosystems in the world (Odell et. al 2006).

The shoreline erosion and loss of salt marsh along the shores of Wagon Hill Farm was likely started by human activities and is exacerbated by ongoing human impacts and possibly increased storm/wave action. To prevent further loss and pursue restoration of these critical habitats, the town can implement several steps. Visitors can help by learning how to use and enjoy the views and habitats at Wagon Hill Farm in ways that protect its sensitive features.

- **Upgrades to Beach/Picnic Area**

The beach/picnic area receives some of the most intensive human uses at Wagon Hill Farm, and it is the area most sensitive to over-use. The Public Works Department has implemented several steps in the past to prevent further erosion. Although these steps have produced some positive results, the continued loss of shoreline and salt marsh demonstrates the need to do more. This requires cooperation among users, land managers, and decision-makers.

*These are likely the most important and highest priority stewardship actions for Wagon Hill Farm*

**Action:** Re-locate the fence farther inland. Due to ongoing erosion the fence, in places, is now close to or at the high tide line. The fence paralleling the shore needs to be moved inland at least 25 to 50 feet. The Department of Environmental Services calls the first 50 feet the “waterfront buffer,” indicating its particular importance in protecting shoreline.

**Action:** Maintain the webbed fencing parallel to the shore. This fencing is intended to keep people and their dogs off the shoreline except in designated beach area. The fence is either knocked down or is displaced during storms. Consider engaging volunteers to monitor and repair this fencing to ensure that it keeps people off. Erect interpretive signs near the beach to educate visitors on the purpose of the fence and why their help is needed.

**Action:** The mowed lawn area slopes to the shore and any precipitation is directed at the shore, causing erosion. The drainage pattern should be changed to prevent runoff from eroding the shoreline. To prevent further compaction of the mowed lawn, prevent any vehicles or structures from using this area (keep such intensive uses up near the orchard/community garden, and existing buildings/parking areas).

**Action:** Consider making the beach area smaller; encourage visitors to use/pay in the “sandy beach” away from the shore.

**Action:** Create a boardwalk and overlook to provide views of Great Bay, which will guide visitors to specific areas. Possible location(s) include the existing beach area or near the site of the historic wharf.

**Action:** Contact the NH Coastal Program (see Appendix D) for technical assistance and grant funding for upgrades to beach/picnic area.

- **Trail Improvements**

The existing trail network at Wagon Hill Farm is one of its most attractive features, offering views of fields and the Bay and peaceful paths through fields and mature woodlands. Some of the trails purposefully bring visitors close to the shores of Great Bay; other paths have been created by people making their way to the water. To protect shoreline and salt marsh these latter trails need to be closed, existing trails improved with boardwalk and/or relocated, and additional signage erected to inform visitors of these changes.

**Action:** The Appalachian Mountain Club (AMC) is experienced at designing, building, and maintaining trails. They offer a free consultation (and follow-up fee services if desired) to landowners and are especially helpful with trail design, including location and materials. Consult with AMC prior to changing, upgrading, or relocating trails. See Appendix D for contact information.

**Action:** Close the “unauthorized” trails that lead from the field and woodland trails to the water. These are located in the southeast corner (from the field to the water) and in various places off the woodland trail extending from the shores of Smith Creek through the woods to the beach/picnic area. Place brush and other material at entrance to these paths.

**Action:** Sections of the woodland trail should be shifted inland a bit to move away from the shore, but not so far as to impact the freshwater wetland area. This trail would likely benefit from boardwalk (see consult with AMC).

**Action:** Consider closing the woodland trail in the southeast corner (in the oak-pine forest) to allow this area to regenerate and to discourage people from walking down to the shore. Or erect signs along

the woods trail here to explain the sensitivity of the shoreline and ask people to help protect the shore by staying on higher ground.

**Action:** In the southeast section of the property consider moving the trails bordering the field into the field another 15 to 20 feet to allow creation of more shrub habitat (see discussion below under Habitat Management).

**Action:** The trail leading out to the rocky headland is deteriorating due to over-use and resulting erosion. Consider closing this section of trail or consult with AMC on buttressing the access to the point.

**Action:** Install a kiosk near parking area to inform visitors about the trail network, sensitivity of habitats, rules about dogs, and other interpretive material.

- **Oyster Reef Creation and Oyster Restoration**

Oysters are an important resource within the Oyster River and the larger Great Bay estuary. A major effort is underway to restore oysters into these systems, including at sites not far from Wagon Hill Farm. Oyster restoration off-shore from Wagon Hill Farm, might also help minimize the erosive action of waves at the mouth river. Such a large-scale effort requires partnership with others.

**Action:** Consult with The Nature Conservancy and the University of New Hampshire on the techniques and feasibility of oyster restoration off-shore from Wagon Hill Farm.

**Action:** Consult with the NH Coastal Program on potential funding sources and technical assistance on oyster reef creation and shoreline restoration.

- **Living Shoreline**

A relatively new approach to protecting and restoring coastal shoreline is to create a “living shoreline.” In the past, hard structures, such as rip-rap and seawalls, have been used to prevent coastal erosion. Research has shown however, that these structures often increase erosion and limit the ability of the shoreline to carry out natural processes. The “living shoreline” technique uses more natural materials or a mix of soft and hard materials. This approach may be suitable for the shores along Wagon Hill Farm to prevent further erosion and begin to restore the salt marsh.

**Action:** For more information on “living shorelines” see fact sheets at the website for the National Oceanic and Atmospheric Administration (NOAA) :  
[https://habitat.noaa.gov/restorationtechniques/public/shoreline\\_tab1.cfm](https://habitat.noaa.gov/restorationtechniques/public/shoreline_tab1.cfm).

**Action:** Consult with the NH Coastal Program on technical assistance and grant funding to explore feasibility of creating “living shoreline” at Wagon Hill Farm. This effort, combined with oyster reef restoration and creating new and better landward land uses could create a phenomenal demonstration area and educational site at Wagon Hill Farm.

## **Invasive Species Management**

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Non-native invasive plant species thrive in disturbed areas. Exposed soils offer prime sites for invasive species to colonize and spread. Trails, forest edges, and fields are often places where invasive plants first establish, either dispersed by animals and wind or carried unintentionally by people, pets, or vehicles.

Invasive species are one of the major threats to the integrity of natural communities, second only to direct habitat loss. Wagon Hill Farm on the south side of Route 4 has clumps of invasive shrubs in the fields and in the shrubby edges bordering the fields. The 40 acres north of Route 4 has invasive plant species throughout the understory.

Control and removal of invasive plant species is one of the most difficult management challenges and requires collaborating with others on technical and financial support. Mechanical, chemical, and biological techniques are effective depending on the specific invasive plant. The use of chemicals to control invasive plants requires a pesticide applicators license and requires careful consideration, especially in wetlands. Physical removal can be effective, but usually requires repeated cuttings. Volunteers are often eager to help with the latter.

- **Mapping Invasive Plant Species**

Eleven state and federal agencies and nonprofit organizations formed an alliance called the **Coastal Watershed Invasive Plant Partnership** to work collaboratively on invasive species control. The mission is *to protect the ecological integrity of natural habitats and economic vitality of managed lands in New Hampshire's coastal watershed through activities that reduce the threat of invasive plants*. As part of their effort they have developed methods for mapping the distribution of invasive plants on their respective lands. For more information see <http://des.nh.gov/organization/divisions/water/wmb/coastal/cwipp/index.htm>

**Action:** Consult with this Partnership on inventorying and mapping invasive plants. Partner with UNH students to complete the mapping as a student project.

- **Control and Removal of Invasive Plant Species**

**Action:** Contact UNH Cooperative Extension for financial assistance with removing and controlling invasive plant species. Removal of invasive shrubs can be coupled with planting of native shrubs. For more information on identifying invasive plant species in New Hampshire see the following publications and resources at <http://extension.unh.edu/forestry/Docs/invasive.pdf>; <http://www.nashuarpc.org/envplanning/documents/SoRLAC/invasiveplants.pdf>, and <http://nbii-nin.ciesin.columbia.edu/ipane/index.htm>. Grant sources are available (see Appendix D).

- **Restore/Replant with Native Species**

**Action:** Avoid introducing any non-native species onto Wagon Hill Farm when possible. Several local or regional sources of native plants are available if plantings are needed for any future restoration. Consult the New Hampshire State Forest Nursery (<http://www.dred.state.nh.us/nhnursery/>), New England Wildflower Society (<http://www.newfs.org/>), New England Wetland Plants Inc (<http://www.newp.com/>), or other sources of native plants.

## Habitat Management

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The fields and shrubs need active management to maintain as suitable habitat. The timing of mowing affects the capacity of a field to support grassland-nesting birds and other wildlife. The town has effectively maintained the fields at Wagon Hill Farm by mowing late in the growing season. The shrub habitat can be enhanced by removing invasive shrub species and by expanding the shrub habitat along the field edge. This will benefit the rare New England cottontail and many shrub-dependent birds. The mature

Appalachian oak-pine forest is best left to natural processes, as the town has done over the past 20 years. The area of scrappy pine and plantation pines could use some active management with consultation from a licensed forester. The goal should be to restore the forest over time to Appalachian oak-pine forest and create more diverse forest structure and composition.

- **Grassland Management**

The approximately 60 acres of grassland offers critical habitat and a scenic backdrop. The town is effectively managing this habitat, although new pressures to use portions of the fields for more intensive public uses will diminish the value as wildlife habitat.

**Action:** Continue to mow the fields late in the growing season. Delaying mowing until September or October is ideal; this allows late-flowering wildflowers such as asters and goldenrods to provide nectar for migrating butterflies.

**Action:** As part of invasive species management, remove the clumps of invasive shrubs scattered in the fields.

- **Shrub Management**

Larger patches of shrubs (greater than 5 acres) and wider swaths (at least 20 feet wide) provide more suitable habitat than smaller patches. At Wagon Hill Farm, the shrub community can be enhanced by allowing a wider swath of shrubs to grow into the field, particular in the southeast corner and along the shrubby shoreline of Davis Creek. This management option needs to be coupled with invasive species monitoring and control to allow the native shrub community to thrive.

**Action:** As part of invasive species management, remove invasive plants growing among the native shrubs.

**Action:** Expand the shrub habitat in the southeast corner of the property and along Davis Creek by shifting the trail 20 feet into the field and cease mowing the newly created shrub habitat.

**Action:** Consider creating more shrub habitat in the northwest corner of Wagon Hill Farm, south of Route 4. This area includes the stream drainage that flows into Smith Creek. This area, from the stream to Route 4 is another ideal location to create shrub habitat. It is too small to support grassland nesting birds and shrub habitat around wetlands and along streams is ideal for New England cottontail. This is also a difficult area to maintain as grassland given uneven ground and wet conditions for mowing.

**Action:** Contact UNH Cooperative Extension for further technical assistance on implementing these actions.

- **Forest Management**

Wagon Hill Farm supports pockets of relatively undisturbed, mature Appalachian oak-pine forest. These woodlands require little active management. The remaining forest of scrappy pine, plantation pine and spruce, and young forest within the sand and gravel extraction area offers opportunities for active management. This could be a longer term goal, as the other management actions (e.g., shoreline and salt marsh protection, invasive species control, field management) are higher priorities. The white pine successional forest on the north side of Route 4 could be managed in the near term. This could be combined with the creation of New England cottontail shrub habitat, control of invasive plant species, and long-term restoration of this forest to Appalachian oak-pine forest.

**Action:** Allow the undisturbed, mature Appalachian oak-pine forest to be managed through natural processes. Unless trees need to be removed for safety reasons along trails, allow trees to age naturally, leave dead trees and fallen logs, and monitor for invasive species (currently few invasive plants are growing in this woodland).

**Action:** Consult with licensed foresters on the feasibility of a forest management operation (i.e., logging) on the north 40 acres to enhance improve the health of the forest (removal of invasive species, promote diverse tree species and ages) and create habitat for New England cottontail.

**Action:** Consult with licensed foresters on the feasibility of long-term forest management of the young pines and pine/spruce plantations on the south parcel, with a goal of diversifying tree species ages, removal of non-native species, and improving forest health.

- **Wetland Management**

The freshwater wetlands on the north side of Route 4 and the wetland drainages on the south side of Route 4 have extensive populations of invasive plant species. Purple loosestrife and common reed grow in the mowed wetland drainage at the bottom of the sledding hill and on both sides of Route 4. Invasive shrubs grow throughout the wooded wetlands on both parcels. The health of these freshwater wetlands would be enhanced through invasive plant removal, although this is a significant management challenge. The protection and restoration of salt marsh habitats has been thoroughly discussed above. Salt marsh management is dependent on managing human uses along the shores of Great Bay.

**Action:** As one of the highest management priorities initiate changes to public access to and use of the shoreline and salt marsh, to allow these habitats to recover.

**Action:** As part of the overall invasive species management, consult with experts on removing invasive plants from freshwater wetland habitats.

**Action:** Locate any new intensive public uses such that water quality and drainage patterns are not degraded. For example, installation of a new parking lot and expansion of the community garden should be planned to avoid any negative impacts to water quality or creating runoff.

## **Managing Intensive Public Uses**

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Wagon Hill Farm was acquired “*to conserve land, water, forest and wildlife resources,*” as well as to “*provide for future municipal purposes and preserve open space in order to provide for healthful and attractive outdoor environment for work and recreation.*” To fulfill both goals, the location of more intensive “municipal purposes” requires careful consideration. Without a suitable balance, the land, water, forest, and wildlife resources may suffer. Some of this degradation is already occurring (see shoreline discussion above).

One effective way to balance the various goals of the acquisition is to identify the types and location of more intensive public uses. Since some of these already occur in the vicinity of the historic Chesley homestead it makes sense to focus future intensive uses in this area. The fields surrounding this area continue to provide habitat for bobolinks, meadowlarks, and migrating butterflies, therefore, decision-makers must recognize that any new public uses in the fields will diminish the habitat values (and



possibly some scenic vistas). The community and private events that are currently allowed by special use permit, should be contained within an “intensive use area” near the existing parking areas, and not be allowed within the mowed picnic area or anywhere south of the orchard.

- **Identify Intensive Use Areas**

***Action:*** Identify the types and location of more intensive public use areas. Consider restricting this to the area between the orchard and the entrance to Wagon Hill Farm. Discontinue the use of any area south of the orchard for intensive community or private events. Specifically, prevent any vehicles or structures that cause compaction.

***Action:*** Before any new infrastructure is built (such as a new parking lot or expanded community garden), evaluate the potential impacts on the other acquisition goals -- preserving scenic vistas and land, water, forest and wildlife resources.

- **Develop Interpretive Materials and Displays**

The success of any of the management actions proposed in this Stewardship Plan requires the help of visitors to Wagon Hill Farm. The town has developed and erected some very effective signs on the rules governing dogs and dog owners. These educational signs should be expanded to address the sensitive ecological features, wildlife habitats, historic features, and recreational opportunities, including a map of the trail network. The protection and restoration of the shoreline and salt marsh, especially needs public awareness and support.

***Action:*** On the Town of Durham website, add folders for each of the town-owned properties. For each property include a trail map, property description, history of acquisition, site-specific rules (such as dogs at Wagon Hill) and related documents such as management plans, master theses (e.g., Federer thesis on Wagon Hill Farm). Documents can be easily scanned as pdf files. The more information that people have about a property, the better they are able to help with its stewardship.

***Action:*** Erect an informational kiosk and the public lot near the Chesley homestead. Include a trail map, rules, description of the habitats and any ongoing management, history of the buildings and land.

***Action:*** At the site of any new management action -- such as closure or re-routing of trails, fencing to block shoreline access, invasive plant removal -- erect information signs explaining the purpose of the management action and requesting public support by abiding by the signs, fencing, etc.

***Action:*** Continue the current rules governing dogs and dog owners. Consider erecting a sign with the dog rules by the beach to reinforce need to stay off the sensitive shoreline.

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