

# Moose Brook Valley Ecological Inventory

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February to May, 2008



Funding provided by:



**Water & Land Stewardship Fund**

Prepared for:



Prepared by:



## Introduction

From February to May, 2008, in partnership with the East Quabbin Land Trust (EQLT), Mass Audubon's Ecological Extension Service (EES) conducted a wildlife survey targeting mammals, reptiles, amphibians, and birds, on mainly private property in the lower Moose Brook valley in Barre and Hardwick, Massachusetts (Figure 1). Funding for the project was provided by the Riverways Program of the Massachusetts Department of Fish and Game, and the Water and Land Stewardship Fund and the Greater Worcester Community Foundation. The purpose of this survey was to document the presence of wildlife and their patterns of use in the landscape, to identify important wildlife corridors and habitats, and to help educate the property owners about their non-human neighbors. More than 110 wildlife species or their tracks or signs were observed in the area over the course of 6 field visits, including 24 mammals, 3 reptiles, 9 amphibians, and 77 birds. These species range from among the smallest and most secretive up to the largest in New England, and similarly span a diversity of habitats, home range sizes, and life strategies. That so many species of such differing needs occur in this valley indicates that the Moose Brook watershed functions largely as an intact ecosystem up through the landscape scale. Thoughtful conservation and compatible land use can ensure that this area retains its high value for wildlife into the future.

## Overview

The Moose Brook valley is part of an increasingly uncommon kind of landscape close to the urban center of Worcester. In the valley, a mixture of agricultural, low-density residential, and forested lands are linked together by the threads of Moose Brook and its associated wetlands and tributaries. The configuration of the valley—a north-south trough, with sometimes steep slopes rising to rolling ridges to the east and west—seems to have limited the number of major roads cutting across it. Land division patterns in the area reinforce the intact nature of the valley, with most landowners occupying relatively large parcels, which consist of pasture, cropland, and hay fields in the highlands, and forests and wetlands on the slopes and lowlands. A few key properties are owned by state conservation agencies (Department of Conservation and Recreation and the Division of Fisheries and Wildlife), the EQLT, or otherwise protected from development through conservation restrictions. This intersection of land cover, ownership, and configuration has created a distinctive atmosphere of naturalness unexpected in such a small area. And though the valley is settled and used by people, it supports a thriving community of wildlife of all kinds, from modest, small amphibians to top predatory mammals. Not to disappoint, the Moose Brook valley even supports moose to some degree.

This report summarizes the results of a wildlife inventory conducted largely on private lands in the winter and spring of 2008 by EES. EES was contracted by the EQLT to conduct this inventory around three main periods, each with different targets: winter mammal surveys, spring amphibian/vernal pool surveys, and late spring bird surveys. These surveys were

supplemented and informed by natural community/land cover mapping and classification using aerial photographs and field inventory.

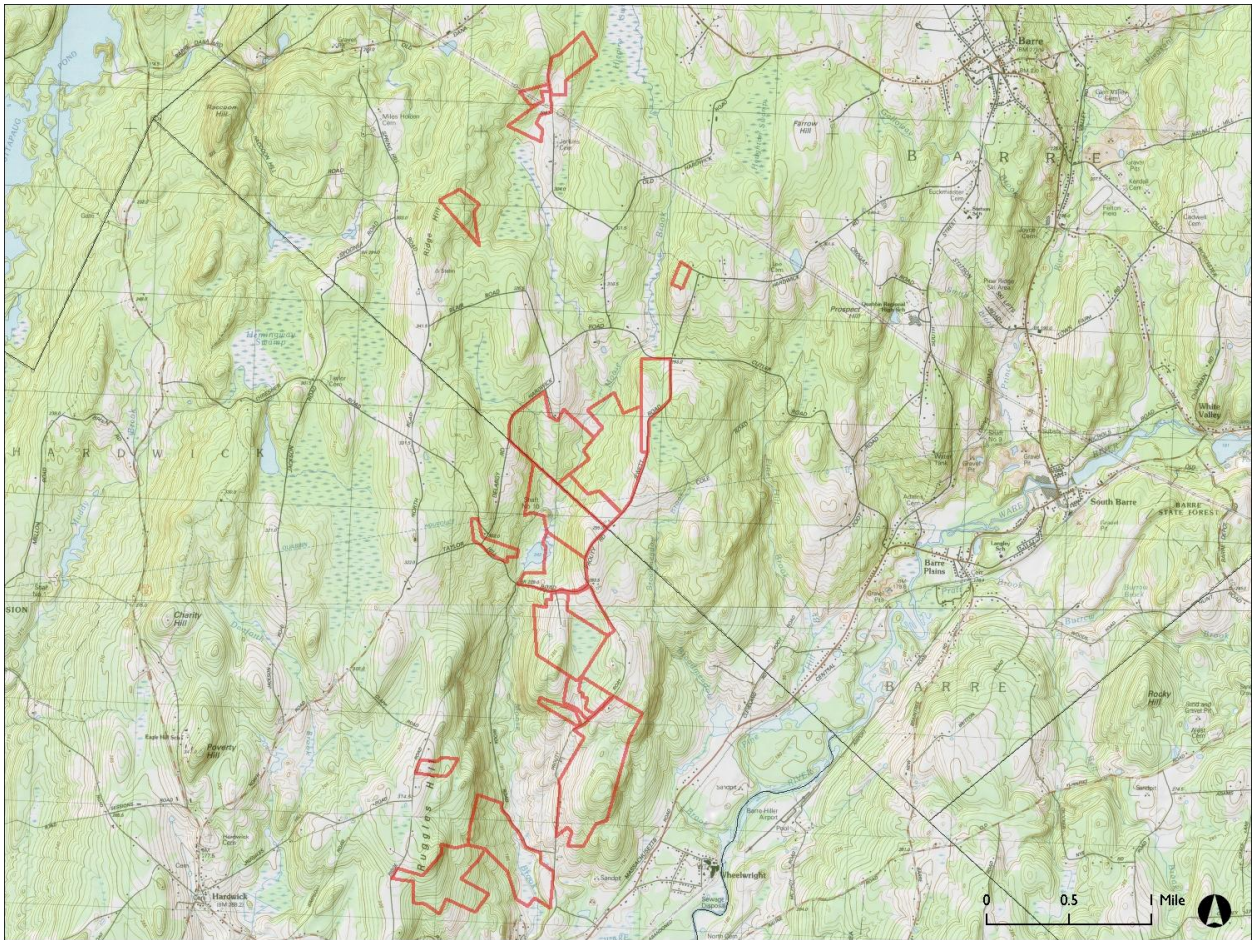


Figure 1. USGS topographical map of the lower Moose Brook Valley, Hardwick and Barre, Massachusetts. Subject parcels are outlined in red. Base map, town boundaries, and hillshade from MassGIS.

## Survey Site

The lower Moose Brook valley consists of approximately 3,500 acres of land, of which twenty-one parcels, totaling approximately 1,040 acres, were included in this survey. The surveyed parcels range from just north of Barre Road in Old Furnace on the south, to north of the powerline crossing on Sheldon Road in Barre, and from the Ruggles Hill/Ridge Hill ridge on the west, to the ridge east of Prouty Road on the east (Figure 2). Most of the surveyed parcels are entirely within the Moose Brook valley, though sections of a few of the parcels cover land in the valleys to the east or west. The entire study area is within the Ware River watershed; the confluence of Moose Brook with the Ware River is approximately 0.4 miles south of the southernmost parcel.



Figure 2. Google Earth image of the lower Moose Brook valley, looking north from near Old Furnace. Prouty Road is the straight north/south road in the lower right section of the image; Brook Road curves west and north from Prouty Road in the lower center section. Vertical dimension is exaggerated to emphasize relief. Note that much of the valley is forested, with agriculture along Prouty Road.

## Methods

One of the most important phases of the inventory occurred even before EES set foot in the Moose Brook valley: we gathered existing information about the area, mainly map-based data from the state's Office of Geographic and Environmental Information (MassGIS). We reviewed aerial photography, USGS topographical maps, wetland datalayers, and other information, targeting particular areas for field visits on account of their likelihood for observing specific wildlife or wildlife signs. We visited other areas on a more random, walkthrough basis, ensuring that most high wildlife value locations on the properties were visited at least once.

### Winter Mammal Tracking

Winter is the time to see recent signs of most mammals in New England, with a few notable exceptions (black bear, for example), as fresh snow cover provides a blank slate for wildlife to mark. Field visits to the area during marginal to decent tracking conditions occurred on February 12, 24, and 25, 2008.

For efficiency, we reviewed topographic maps and aerial photos of the Moose Brook valley to direct search efforts to areas most likely to contain mammal signs. These areas included steep slopes/ledges, ridgelines (top and bottom), wetland/upland edges, extensive wetland

complexes, topographic or forest cover “pinch points,” stream corridors, and early-successional areas—in fact, most of the Moose Brook valley could fall into one of these categories. Within these categories, however, very often there are particular habitat features that animals need to survive in a landscape, such as appropriate den sites (e.g. cavity trees, talus slopes, or ledges) or stands of favored food-producing trees (mast stands) such as beech or oak. Additional examples of critical habitat features for mammals include old apple orchards/wild apple groves, hemlock stands (deer overwintering areas, porcupine food source), downed logs, and water supplies. Many of these habitat features are visible on aerial photos, or their locations can be inferred by looking at topographical maps.

In the field, we visited the areas previously identified on maps to determine the presence of mammals. When encountered, we identified tracks if possible to species, and backtracked trails of some of the larger mammals to get a sense of their use of the habitat. We collected GPS waypoints of features important for mammal habitat, including den sites and other points of interest.

After snowmelt, mammal sightings were opportunistic, though we looked for tracks in mud or sand when encountered. In one case, we observed a flying squirrel gliding from a nearby tree to another, but most species were noted only based on secondary evidence.

### Vernal Pools

Vernal pools are particularly important habitat for several amphibian and reptile species, and their influence on the diversity of animals in the forest is enormous. Because vernal pools are the only or most important breeding habitat for mole salamanders and wood frogs, and also provide breeding and other habitat values for several, more generalist species, they are focal areas for these species during the breeding season. As many vernal pool-related species are dispersed and uncommonly encountered during the non-breeding season, surveying vernal pools in the spring is one of the most efficient means of identifying many of the amphibian and reptile species that may be using an area.

We identified potential vernal pools by checking aerial photographs of the area, and by reviewing the state’s Potential Vernal Pool and Certified Vernal Pool GIS datalayers. We then visited each of these potential vernal pools, and meandered through other areas likely to contain vernal pool habitat. Vernal pool-related field visits occurred on April 17 and 21, 2008. When we approached a probable vernal pool during this time, we listened for any calling amphibians (wood frogs or spring peepers) in the area. Then we either waded through the pool or viewed into the pool from its perimeter to determine whether vernal pool obligate amphibian breeding had occurred in the pool: we looked for mole salamander and/or wood frog egg masses. If egg masses were present, if possible we made a rough count of the egg masses of each species.

Encounters with reptiles and non-vernal pool obligate amphibians were more opportunistic, and included looking under logs or stones for fossorial (living underground) species, or happening across individuals in or near vernal pools or other wetlands.

## Birds

During the winter and early spring field visits, we noted the presence of birds opportunistically as they were encountered in various natural communities. However, on May 14, 2008, we undertook walk through surveys to identify breeding birds or potential breeding birds in areas likely to provide habitat for different groups of birds: wetlands, early-successional areas, and various types of forest. During these surveys, we walked through or moved along the edge of habitat long enough to record most, if not all, of the species present in the area during the survey. We did not use recordings to elicit responses for more secretive birds such as owls or marsh birds, but noted their presence if we heard or observed them. The mid-May date is somewhat early for breeding bird surveys, and while many species have settled into their breeding season by that time, other species are still only passing through or have not yet arrived. Additional field work should be conducted (perhaps in cooperation with the East Quabbin Bird Club) to generate a breeding bird list for the area.

## **Survey Results**

### Winter Tracking

Over the course of the survey, twenty-four mammal taxa were directly observed, or were identified in the area by tracks or sign (Table 1).

Table 1. List of mammal species observed (directly or through tracks or sign) in the lower Moose Brook Valley, February to May, 2008

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Virginia Opossum  
Mole (at least two species)  
Eastern Cottontail  
Eastern Chipmunk  
Woodchuck  
Eastern Gray Squirrel  
Red Squirrel  
Flying Squirrel (uncertain species)  
American Beaver  
White-footed Mouse  
Vole (uncertain species)  
Porcupine  
Coyote  
Red Fox  
Gray Fox

Raccoon  
Fisher  
Ermine  
Long-tailed Weasel  
American Mink  
Northern River Otter  
Bobcat  
White-tailed Deer  
Moose

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With the exception of many of the rodents, which were directly observed, the presence of these animals in the Moose Brook valley was indicated by their tracks or other signs left in snow or mud (for example, Figure 3). Specific inventory techniques, such as bat surveys and small mammal trapping, would certainly uncover additional species not on this list.



Figure 3. Bobcat track in the lower Moose Brook valley, 2/25/08. Photo by TEL.

### Vernal Pools

Nine vernal pools on the project site that were identified from the Potential Vernal Pool datalayer or aerial photos, or encountered during fieldwork, function as vernal pool habitat for

wood frogs and/or spotted salamanders. Four other pools either were previously certified on a property or occur adjacent to the surveyed parcels, for a total of 13 functional vernal pools in or immediately adjacent to the survey area (Table 2). (A qualification: the large red maple swamp east of Prouty Road and south of Taylor Hill Road has numerous areas that provide vernal pool habitat, some of which are high quality vernal pools in and of themselves, and others which are not much more than pits remaining from tree throws. Although not classic, isolated pools, these areas are important to the biodiversity of the swamp. We made no attempt to locate every tip-up or deeper hollow that could potentially serve as vernal pool obligate species breeding habitat; if these were counted as individual pools, one could say that there are more than 20 vernal pools in the survey area, a somewhat misleading tally.)

Table 2. Locations of vernal pools on or near the subject parcels in the Moose Brook valley. (Pools labeled CVP are from the NHESP Certified Vernal Pool datalayer; those labeled PVP are from the NHESP Potential Vernal Pool datalayer. The remaining pools were located by Mass Audubon staff during field work, April and May, 2008.

<u>Pool</u>	<u>Latitude</u>	<u>Longitude</u>
CVP4216	42.350039	-72.160526
CVP4219	42.354892	-72.160445
CVP4220	42.365067	-72.161957
PVP1738	42.410707	-72.16983
PVP10059	42.37728	-72.157466
PVP10061	42.371227	-72.15457
PVP10062	42.366967	-72.147061
PVP10063	42.364997	-72.147626
PVP10064	42.366028	72.148086
VP1	42.376997	-72.160711
VP2	42.372838	-72.153009
VP3	42.37331	-72.1527
VP4	42.361778	-72.150198

In addition to the wood frogs and spotted salamander egg masses found at the vernal pools, several other species of reptile or amphibian were observed in or near the pools, or in various other wetlands elsewhere in the survey area. Additional species were searched for directly or encountered while simply walking through a site. Through eggs, calls, or direct observation, 12 reptile and amphibian species were observed over the course of the survey (Table 3).



Table 3. List of amphibian and reptile species observed in the lower Moose Brook Valley, April to May, 2008

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Spotted Salamander
Eastern Newt
Eastern Red-backed Salamander
Four-toed Salamander*
Snapping Turtle
Spotted Turtle
American Toad
Spring Peeper
Gray Treefrog
Green Frog
Wood Frog
Common Gartersnake

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\* A Species of Special Concern in Massachusetts

Additional snake, turtle, frog, and salamander species would be expected to occur in the area, especially in the beaver pond and adjacent wetlands north of Taylor Hill Road, as well as in the Moose Brook channel and its tributaries. Of particular note, the river and adjacent fields and forest in the vicinity of the Brook Road bridge over Moose Brook matches our search image for high-quality wood turtle habitat. We would encourage searches in this area for this species, a state-listed Species of Special Concern; if found, these turtles would provide another strong reason to support the long-term protection of this area.



Figure 4. Section of PVP1738, Barre. Photo by TEL, 5/14/08.

## Birds

Over the course of the survey, 77 species of birds were observed in the lower Moose Brook valley (Table 4). Many of these species were heard or seen throughout the study area (for example, Black-capped Chickadee), while others were only observed in one location (for example, Eastern Meadowlark, in the fields on the corner of Prouty and Taylor Hill Roads).

Table 4. List of birds observed in the lower Moose Brook valley, February to May, 2008.

Great Blue Heron	Red-eyed Vireo	Pine Warbler
Turkey Vulture	Blue Jay	Prairie Warbler
Canada Goose	American Crow	Palm Warbler
Wood Duck	Common Raven	Black-and-white Warbler
American Black Duck	Barn Swallow	American Redstart
Mallard	Black-capped Chickadee	Ovenbird
Red-tailed Hawk	Tufted Titmouse	Northern Waterthrush
Ruffed Grouse	White-breasted Nuthatch	Common Yellowthroat
Wild Turkey	Winter Wren	Scarlet Tanager
Killdeer	Golden-crowned Kinglet	Eastern Towhee
American Woodcock	Eastern Bluebird	Chipping Sparrow
Herring Gull	Veery	Field Sparrow
Rock Pigeon	Hermit Thrush	Song Sparrow
Mourning Dove	Wood Thrush	White-throated Sparrow
Barred Owl	American Robin	Dark-eyed Junco
Ruby-throated Hummingbird	Gray Catbird	Northern Cardinal
Belted Kingfisher	Northern Mockingbird	Rose-breasted Grosbeak
Red-bellied Woodpecker	Brown Thrasher	Bobolink
Yellow-bellied Sapsucker	European Starling	Red-winged Blackbird
Downy Woodpecker	Cedar Waxwing	Eastern Meadowlark
Hairy Woodpecker	Blue-winged Warbler	Common Grackle
Northern Flicker	Tennessee Warbler	Brown-headed Cowbird
Pileated Woodpecker	Yellow Warbler	Baltimore Oriole
Least Flycatcher	Chestnut-sided Warbler	American Goldfinch
Eastern Phoebe	Black-throated Blue Warbler	House Sparrow
Eastern Kingbird	Black-throated Green Warbler	

We are certain that additional bird surveys covering later May through June would add many species to this list, as well as allow observers to confidently document breeding activity.

Appendix 1 is an expanded list of birds including all birds expected to occur in the lower Moose Brook valley based on experience with similar habitats and direct observation.

## **Land Cover/Natural Community Mapping**

We maintained a running list of dominant species and landforms as we explored the lower Moose Brook valley. These data, in conjunction with 2005 aerial photos and the state's GIS wetland layer, allowed us to compile a rough land cover/natural community map of the subject

properties. While the classification and delineation of the land cover units could be refined with additional field and office work, the level of detail in the current effort is adequate to provide a general picture of the lower Moose Brook valley's lands (Table 5). The land cover map is attached as Appendix 2.

Table 5. General land cover/natural community types of the participating landowners in the lower Moose Brook valley, 2008.

<b>Cover</b>	<b>Area (Acres)</b>
<u>Uplands</u>	
<i>Forest</i>	
Mixed Hardwood-Hemlock-White Pine Forest	360
Mixed Hardwood Forest	300
Hemlock-White Pine Forest	14
Mixed Hardwood-White Pine Forest	12
Hemlock Forest	2
Pine Plantation	1
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	689
<i>Agricultural/Early Successional</i>	
Meadow	180
Shrubland	54
Cropland	3
Pasture	3
	<hr/>
	240
<i>Developed</i>	
Residential	17
Roads	9
<u>Wetlands</u>	
Red Maple/Softwood Swamp	19
Red Maple Swamp	15
Shrub Swamp	17
Shallow/Deep Marsh	28
Open Water	6
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	85
	<hr/>
Total:	1,04

## Macro-invertebrate Sampling

On May 16, 2008, staff from the Department of Fish and Game and others conducted a qualitative macro-invertebrate sampling effort where Moose Brook passes under Brook Road in

Hardwick. Preliminary identification determined that dobsonfly, caddisfly, dragonfly, stonefly, dipteran, water penny, and mayfly larvae were found in this area. This suite of species indicates relatively high water quality, as stoneflies, mayflies, and water pennies tend to be absent where water quality is impaired. In the context of the Moose Brook watershed, these results corroborate the intact nature of the valley, with many human activities buffered from the brook and its tributaries by forest, and much of the water filtered through the area's extensive wetland systems.

## Discussion

The wildlife community of the lower Moose Brook valley is impressive in its integrity. Except for extirpated top predators like mountain lions and wolves, the area appears to contribute to the success of populations of most mammal species native to inland Massachusetts, rich and abundant breeding, migrating, and overwintering birds, and a representative assortment of reptiles and amphibians, with some rare or uncommon species present or expected as well. This intact system is all the more remarkable because it occurs in an area where, based on the evidence of raceways and mill dams, stone walls, and old fields, the human presence on the landscape has been a dominant force in times past. For now, though, forests have grown or are reclaiming much of the landscape, and the juxtaposition of large patches of mature forest with extensive and varied wetlands, shrublands, and agricultural fields, combined with the relatively light present-day human use, forms an environment where many native species can meet their needs for space, food, and shelter, even if only passing through.

For example, of note among mammals in the lower Moose Brook valley is the presence of many weasel species, including fisher, ermine, long-tailed weasel, American mink, and northern river otter. Fisher have become more common throughout Massachusetts in recent decades, and also have seemed to become increasingly tolerant of living in close proximity with people. With many ledges and hemlock patches in the area supporting a healthy porcupine population, it is no surprise that fishers would also be in the valley. And otters, while requiring long sections of high-quality river or other large waterbodies, could be simply making excursions up Moose Brook from core habitat in the Ware River. However, mink, ermine, and long-tailed weasel are not always present in places where they would otherwise be expected. Over the course of the survey, during several visits to Moose Brook near the Brook Road bridge, we observed mink tracks and trails either in snow or in mud along the brook, indicating that a mink is resident in the area (see Figure 5). The significance of the resident mink is that, for an active carnivore like a mink to survive in the area, the brook must provide adequate food and other resources. The mink's food—crayfish, frogs, fish, and such—while having more modest needs, must also be finding adequate resources for their proliferation. Thus, the long-term presence of the mink (and its more terrestrial cousins the long-tailed weasel and ermine, which were also noted during most of our visits to the area through tracks or scat) indicates a robust food web, with a strong foundation in the aquatic ecosystem of Moose Brook.



Figure 5. A mink trail in snow near the abutment of the Brook Road bridge over Moose Brook, 2/24/08. Note paired, bounding impressions in lower right section of image, characteristic of weasel-family tracks. Photo by TEL.

Similarly, the presence of bobcat was documented in the valley on two of the winter tracking visits. Backtracking the bobcat's trail revealed that it passed through most of the habitats (and properties) around the large beaver pond north of Taylor Hill Road during a particular circuit following a snow storm. The bobcat patrolled several areas likely to be important habitats for small rodents, such as the marshy shore of the pond, where sedge tussocks were pocked with vole tunnels, and passed up through densely shrubby thickets on abandoned fields or pasture northeast of the pond, where cottontail rabbit tracks were common. (Along one section of its trail, likely to save energy, the bobcat walked in tracks previously left by coyotes in the same area; the coyotes were probably also on the lookout for deer and rabbits using the area—or bobcats.) The home range size for bobcat ranges from approximately 1 square mile to 80 square miles, with smaller values occurring in higher-quality habitat (DeGraaf and Yamasaki, 2001). As with the mink, repeated observations of bobcat sign indicate that at least one individual of this species is in residence in the area, again implying that the Moose Brook valley supports a diverse, relatively intact native ecosystem.

The lower Moose Brook valley hosts a rich diversity of habitats that, in turn, support abundant and diverse wildlife populations. The human hand on the landscape at this time is relatively light compared to areas close by to the east, and much of the human use of the valley is agricultural, providing a complementary, soft buffer between dense development eastward and wilder lands westward. Patches of abandoned pastures in various states of succession are interspersed on the slopes of the valley, further separating the valley's bottomland from the more settled ridges. In the lowlands, the evidently pure Moose Brook flows through ponds and extensive wetland systems on its way to the Ware River. The arrangement and extent of high-quality habitats, interconnected by the brook and flanking ridges, is a foundation for a full, intact ecosystem, where, among many other animals, bobcats, weasels, and coyote are resident, signifying the landscape's health. However, only a few careless changes could alter this situation, severing connections within the landscape, jeopardizing water quality, and isolating the valley from nearby conservation lands. Many land uses currently occurring in the valley, including farming and logging, are not necessarily in conflict, and if thoughtfully performed can support wildlife habitat; but the threat of dense residential, commercial, or other higher impact development will only grow in the coming decades. The time to act to conserve the ecosystem flourishing in the lower Moose Brook valley is now.



Spotted turtle, near PVP10064, Hardwick. Photo by TEL, 4/21/08



# Appendix 1

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## Expanded Bird List

Species expected to occur in the Moose Brook Valley, with status in area based on observation and experience in similar habitats.

### Status Key

Y – present year round

B – Breeding confirmed or highly probable

b – Breeding possible

Vw – Visitor (winter resident)

Vm – Visitor (migrant)

O – Likely only overhead (e.g., migrant)

**Bold** – recorded at property during 6 visits (February to May, 2008)

Species	Status	Species	Status
Double-crested Cormorant	Vm	Peregrine Falcon	O
American Bittern	Vm	<b>Ruffed Grouse</b>	B, Y
<b>Great Blue Heron</b>	b	<b>Wild Turkey</b>	b, Y
Green Heron	b	<b>Killdeer</b>	B
<b>Turkey Vulture</b>	b	Solitary Sandpiper	Vm
<b>Canada Goose</b>	B	Spotted Sandpiper	b, Vm
<b>Wood Duck</b>	B	Least Sandpiper	Vm
<b>American Black Duck</b>	B	<b>American Woodcock</b>	B
<b>Mallard</b>	B	Ring-billed Gull	Vm
Blue-winged Teal	Vm	<b>Herring Gull</b>	Vm
Northern Pintail	Vm	Great Black-backed Gull	O
Green-winged Teal	Vm	<b>Rock Pigeon</b>	Y
Ring-necked Duck	Vm	<b>Mourning Dove</b>	B, Y
Bufflehead	Vm	Black-billed Cuckoo	b, Vm
Common Goldeneye	Vm	Yellow-billed Cuckoo	b, Vm
Hooded Merganser	b, Vm	Eastern Screech-Owl	b, Y
Common Merganser	Vm	Great Horned Owl	b, Y
Osprey	Vm	<b>Barred Owl</b>	B, Vm
Bald Eagle	O	Northern Saw-Whet Owl	Vm
Northern Harrier	O	Common Nighthawk	O
Sharp-shinned Hawk	Vm	Chimney Swift	O
Cooper's Hawk	b, Vm	<b>Ruby-throated Hummingbird</b>	b
Northern Goshawk	b, Vm	<b>Belted Kingfisher</b>	b, Vm
Red-shouldered Hawk	b, Vm	<b>Red-bellied Woodpecker</b>	B, Y
Broad-winged Hawk	b, Vm	<b>Yellow-bellied Sapsucker</b>	Vm
<b>Red-tailed Hawk</b>	B, Vm	<b>Downy Woodpecker</b>	B, Y
American Kestrel	Vm	<b>Hairy Woodpecker</b>	B, Y
Merlin	Vm	<b>Northern Flicker</b>	B



Species	Status	Species	Status
<b>Pileated Woodpecker</b>	B, Y	<b>Yellow Warbler</b>	B
Eastern Wood-Pewee	b	<b>Chestnut-sided Warbler</b>	B
Alder/Willow Flycatcher	Vm	Magnolia Warbler	Vm
<b>Least Flycatcher</b>	b, Vm	<b>Black-throated Blue Warbler</b>	B
<b>Eastern Phoebe</b>	B	Yellow-rumped Warbler	Vm
Great Crested Flycatcher	b	<b>Black-throated Green Warbler</b>	B
<b>Eastern Kingbird</b>	B	Blackburnian Warbler	Vm
Northern Shrike	Vw	<b>Pine Warbler</b>	B
Yellow-throated Vireo	B	<b>Prairie Warbler</b>	B
Blue-headed Vireo	B	<b>Palm Warbler</b>	Vm
Warbling Vireo	b, Vm	Blackpoll Warbler	Vm
<b>Red-eyed Vireo</b>	B	<b>Black-and-white Warbler</b>	B
<b>Blue Jay</b>	B, Y	<b>American Redstart</b>	B
<b>American Crow</b>	B, Y	<b>Ovenbird</b>	B
<b>Common Raven</b>	b, Vm	<b>Northern Waterthrush</b>	B, Vm
Tree Swallow	B	Louisiana Waterthrush	b
Northern Rough-winged Swallow	Vm	<b>Common Yellowthroat</b>	B
Bank Swallow	Vm	Wilson's Warbler	Vm
Cliff Swallow	Vm	Canada Warbler	b, Vm
<b>Barn Swallow</b>	B, Vm	<b>Scarlet Tanager</b>	B
<b>Black-capped Chickadee</b>	B, Y	<b>Eastern Towhee</b>	B
<b>Tufted Titmouse</b>	B, Y	American Tree Sparrow	Vw
Red-breasted Nuthatch	b, Y	<b>Chipping Sparrow</b>	B
<b>White-breasted Nuthatch</b>	B, Y	<b>Field Sparrow</b>	B
Brown Creeper	b, Y	Savannah Sparrow	Vm
Carolina Wren	b, Y	Fox Sparrow	Vm
House Wren	b	<b>Song Sparrow</b>	B, Y
<b>Winter Wren</b>	Vm	Lincoln's Sparrow	Vm
<b>Golden-crowned Kinglet</b>	Vm	Swamp Sparrow	B
Ruby-crowned Kinglet	Vm	<b>White-throated Sparrow</b>	Vw
Blue-gray Gnatcatcher	B	White-crowned Sparrow	Vm
<b>Eastern Bluebird</b>	B	<b>Dark-eyed Junco</b>	Vw
<b>Veery</b>	B	<b>Northern Cardinal</b>	B, Y
<b>Hermit Thrush</b>	B	<b>Rose-breasted Grosbeak</b>	B
<b>Wood Thrush</b>	B	Indigo Bunting	B
<b>American Robin</b>	B, Y	<b>Red-winged Blackbird</b>	B
<b>Gray Catbird</b>	B	Rusty Blackbird	Vm
<b>Northern Mockingbird</b>	B, Y	<b>Common Grackle</b>	B
<b>Brown Thrasher</b>	B, Vm	<b>Brown-headed Cowbird</b>	B
<b>European Starling</b>	B, Y	<b>Baltimore Oriole</b>	B
<b>Cedar Waxwing</b>	b, Y	Purple Finch	Vm
<b>Blue-winged Warbler</b>	B	House Finch	b, Y
<b>Tennessee Warbler</b>	B	Pine Siskin	Vm
Nashville Warbler	Vm	<b>American Goldfinch</b>	B, Y
Northern Parula	Vm	<b>House Sparrow</b>	Y

## **Appendix 2**

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### **General Land Cover/Natural Community Map**

# General Land Cover/Natural Community Map of the lower Moose Brook valley, 2008

## Forest

- Mixed Hardwood Forest (300 ac)
- Mixed Hardwood-White Pine Forest (12 ac)
- Mixed Hardwood-Hemlock-White Pine Forest (360 ac)
- Hemlock-White Pine Forest (14 ac)
- Hemlock Forest (2 ac)
- Pine Plantation (1 ac)

## Agricultural/Early Successional

- Cropland (3 ac)
- Meadow (180 ac)
- Pasture (3 ac)
- Shrubland (54 ac)

## Wetland

- Red Maple Swamp (15 ac)
- Red Maple/Softwood Swamp (19 ac)
- Shrub Swamp (17 ac)
- Shallow/Deep Marsh (28 ac)
- Water (6 ac)

## Developed

- Residential (17 ac)

- Subject Parcels
- Vernal Pools

Notes: General land cover/natural communities generated from MassGIS 1999 land use/land cover, 1:12,000 DEP wetland datalayer, and 2005 color orthophotos, with revisions based on field work in February to May, 2008. Base map of hillshade, roads, streams and ponds, and watershed boundaries from MassGIS. Vernal pools from NHESP Potential and Certified Vernal Pool datalayers, supplemented by field work. Map produced by Mass Audubon Ecological Extension Service, May 2008.

