Bradford Natural Resources:

Prepared for the Bradford Conservation Commission

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Table of Contents

1. Introduction....1

2. Upland Natural Communities....1

2.1 Overview....1

2.2 Bradford's Upland Natural Communities....2

2.3 Significant Upland Natural Communities of Bradford....4

2.3.1 Hackett Hill Hemlock....6

2.3.2 Roaring Brook Forests....6

2.3.3 Wright's Mountain Forests....8

2.3.4 Potentially Significant Sites....11

2.4 Management Recommendations for Significant Upland Communities....12

2.4.1 Matrix Communities....12

2.4.2 Patch Communities....13

3. Wildlife Habitat....13

3.1 CHU Wildlife Habitat Components....14

3.1.1 Core Area....14

3.1.2 Ledge, Talus and Cliff Habitat....17

3.1.3 Bear Wetlands....19

3.1.4 Early Successional Habitat (ESH)....21

3.1.5 Forested Riparian Habitat....23

3.1.6 Mast Stands....25

3.1.7 Deer Winter Habitat....27

3.1.8 Grassland Bird Habitats....30

3.2 Contiguous Habitat Units (CHUs) Analysis....34

3.2.1 River Hill CHU....37

3.2.2 Spaulding Hill CHU....37
3.2.3 Rowell Brook CHU....38
3.2.4 South Bradford CHU....38
3.2.5 West Fairlee CHU....39
3.2.6 Ira's Pinnacle CHU....39
3.2.7 West Bradford CHU....40
3.2.8 Waits River CHU....40
3.2.9 Low-St. John CHU....41
3.2.10 Bradford Center CHU....41
3.2.11 Chase Hollow CHU....42
3.2.12 Taplin Hill CHU....42
3.2.13 Roaring Brook CHU....43
3.2.14 Newbury CHU....43
3.2.15 Goshen CHU....44
3.2.16 Wrights Mountain CHU....44
3.2.17 Meadow Brook CHU....45
3.2.18 Travel Corridors....45
3.3 Wildlife Habitat Overview for Bradford....48
3.4 Management Recommendations for Wildlife Habitat....50
3.4.1 Large Contiguous Habitat Units....50
3.4.2 Grassland Bird Habitat....51
3.4.3 Bear Habitat....51
3.4.4 Ledge, Talus, and Cliff Habitats....52
3.4.5 Deer Winter Habitat....52
3.4.6 Forested Riparian Communities....53
3.4.7 Travel Corridors....53
4: Conclusions....54

List of Figures and Tables

Table 1. Summary of Upland Natural Community Types in Bradford 3

Figure 1. Significant Upland Natural Communities Map 4

Table 2. Significant Upland Natural Communities in Bradford 5

Figure 2. The Hackett Hill Hemlock Forest contains numerous rock outcrops. 6

Figure 3. Roaring Brook Hemlock-Northern Hardwood Forest 6

Figure 4. Hemlock Forests occupy the banks of Roaring Brook 7

Figure 5.Mesic Red Oak-Northern Hardwood Forest at the Roaring Brook Site 8

Figure 6. Dry Red Oak-White Pine Community at Wright's Mountain 8

Figure 7. The Hemlock-Northern Hardwood Forest at Wright's Mountain contains a mix of hardwoods and hemlock. 9

Figure 8. The Wright's Mountain Hemlock forests contain bedrock outcrops and a dense conifer canopy 9

Figure 9. The Devil's Den site is surrounded by Mesic Red Oak-Northern Hardwood Forest 10

Figure 10. Potentially Significant Natural Communities 11

Figure 11. Woodpecker snag tree 15

Figure 12: Core Forest Map 16

Figure 13. Black bear 17

Figure 14. Talus slope 18

Figure 15: Potential Ledge, Cliff and Talus Habitats 19

Figure 16. Potential bear wetland 20

Figure 17: Map of Potential Bear Wetlands 21

Figure 18. Hare 22

Figure 19. Bobcat 22

Figure 20: Early Successional Forest Habitat Map 23

Figure 21. Waits River forested riparian area 24

Figure 22: Forested Riparian Habitat Map 25
Figure 23. Bear scarred beech tree 26
Figure 24: Hard Mast Stands Map 27
Figure 25: Deer Winter Habitat Map 29
Figure 26. Eastern hemlock deer winter habitat 30
Figure 27: Grassland Habitats Map 31
Figure 28 Scarlet tanager, an interior forest bird 32
Figure 29: Audubon Vermont- Responsibility Species 33
Figure 30. Contiguous Habitat Units Map 34
Table 3. CHU Summary Data 35
Figure 31: Potential Wildlife Corridors Map 46
Figure 32. Road Tracking Map 47
Figure 33. Moose 48
Figure 34. Mallard Duck 49

List of Appendices

Appendix 1. Methodology

Appendix 2. Wildlife Habitat Summary Data for Contiguous Habitat Units

Appendix 3. Attribute Tables

1. Introduction

In 2014, Arrowwood Environmental conducted a natural resources inventory in the town of Bradford. The purpose of the inventory was to map and assess the wildlife habitat and upland natural communities that are important to the natural heritage of the town. This inventory built upon a previously conducted wetland inventory (Arrowwood Environmental, 2005). The information in these inventories can be used to inform town planning decisions, further develop the town's sense of community and establish priorities for natural resource conservation.

The scope of the 2014 inventory involved three phases: 1) a remote landscape analysis; 2) field assessments; and 3) final resource ranking and map creation. The methodology used in mapping and assessing these resources is presented in Appendix 1. The results of the inventory are presented below and divided into Upland Natural Communities and Wildlife Habitat sections.

2. Upland Natural Communities

2.1 Overview

The town of Bradford sits along the banks of the Connecticut River in the "Upper Valley" of Vermont. Topographically, the town can be divided into two broad areas: the relatively flat lowlands along the Connecticut River, and the rolling hills west of the River. These two areas correspond to the two different biophysical regions in the town, the Southern Vermont Piedmont (along the River) and the Northern Vermont Piedmont. Both of these regions are warmer and drier than the adjacent Green Mountain regions and this is reflected in the composition of the natural communities found here.

The town is also bisected by the Waits River, which flows into the Connecticut River near Bradford village. Along both the Connecticut and Waits Rivers, the soils and surficial geology of the town are dominated by sediments from glacial Connecticut Valley Lake. These are mostly lake shore sediments such as sand and gravel, though some areas contain finer lake bottom sediments such as silt and clay. Some areas along the Connecticut River also have more recent river sediments (sands and gravels) overtopping the sediments lain down by the glacial lake. The remaining parts of the town consist mostly of unsorted glacial till derived soils. These different geologic histories manifest in different land-

uses and natural communities. The flat, rich river bottom areas were typically the first to be converted to agriculture, and most remain in agriculture today. Those that have been abandoned are slowly reverting to forest. Since white pine typically becomes established on abandoned pasture, it is a common component of these recovering forests. Areas along the rivers that typically experience flooding may revert to floodplain forest communities.

The bedrock underlying the surficial geology in the town is largely composed of quartzite and phyllite from the Gile Mountain Formation. Lesser amounts of quartzite, limestone and schists from the Waits River and Albee Formations exist in the northeastern and northwestern parts of town. Both the Waits River and Gile Mountain formations often give rise to calcium rich ("sweet") soils due to their calcareous nature. This can result in enriched natural communities such as Rich Northern Hardwood Forests or Mesic Maple-Ash-Hickory-Oak Forests.

2.2 Bradford's Upland Natural Communities

The natural communities of Bradford are the product of the land, climate and history of the area. The geologic history outlined above gives rise to 20 different types of soils in the town. This geology and soils, combined with elevation, slope, aspect, landscape position and land-use history result in a diverse set of upland natural communities in the town. Hemlock Forests and Hemlock-Northern Hardwood Forests dominate the low, rolling hills in most of the town. Northern Hardwood Forests and White Pine-Northern Hardwood Forests are also common, especially on more gentle slopes or in areas reverting from agriculture. Because of the relatively warmer climate (compared to the spine of the Green Mountains) red oak community types are also very common. This includes large acreages of Mesic Red Oak-Northern Hardwood Forest and a few small areas of Dry Red Oak-Pine Forests.

A summary of the upland natural communities is presented in Table 1. The most abundant natural community type, in both number of occurrences and total acreage is the Hemlock-Northern Hardwood Forest. Combined with the Hemlock Forests, these communities comprise 2/3's of the forest types in the town.

Table 1. Summary of Upland Natural Community Types in Bradford		
Community Name	**Number of Occurrences**	**Total Acreage**
Dry Red Oak-Pine Forest	3	20.7
Hemlock Forest	38	1068.6
Hemlock-Northern Hardwood Forest	172	8861.1
Northern Hardwood Forest	151	1144.5
Plantations	10	70.8
Mesic Red Oak-Northern Hardwood Forest	45	1031.3
Red Spruce-Northern Hardwood Forest	15	428.2
White Pine-Northern Hardwood Forest	121	1843.9
Total Acreage of Forested Communities		**14752.5**

2.3 Significant Upland Natural Communities of Bradford

The methodology for determining state significance of natural communities is based on the Vermont NonGame and Natural Heritage Program guidelines and is detailed in Appendix 1. The significant upland communities identified in Bradford are summarized in Table 2 and shown in Figure 1. A description of each significant community is included below.

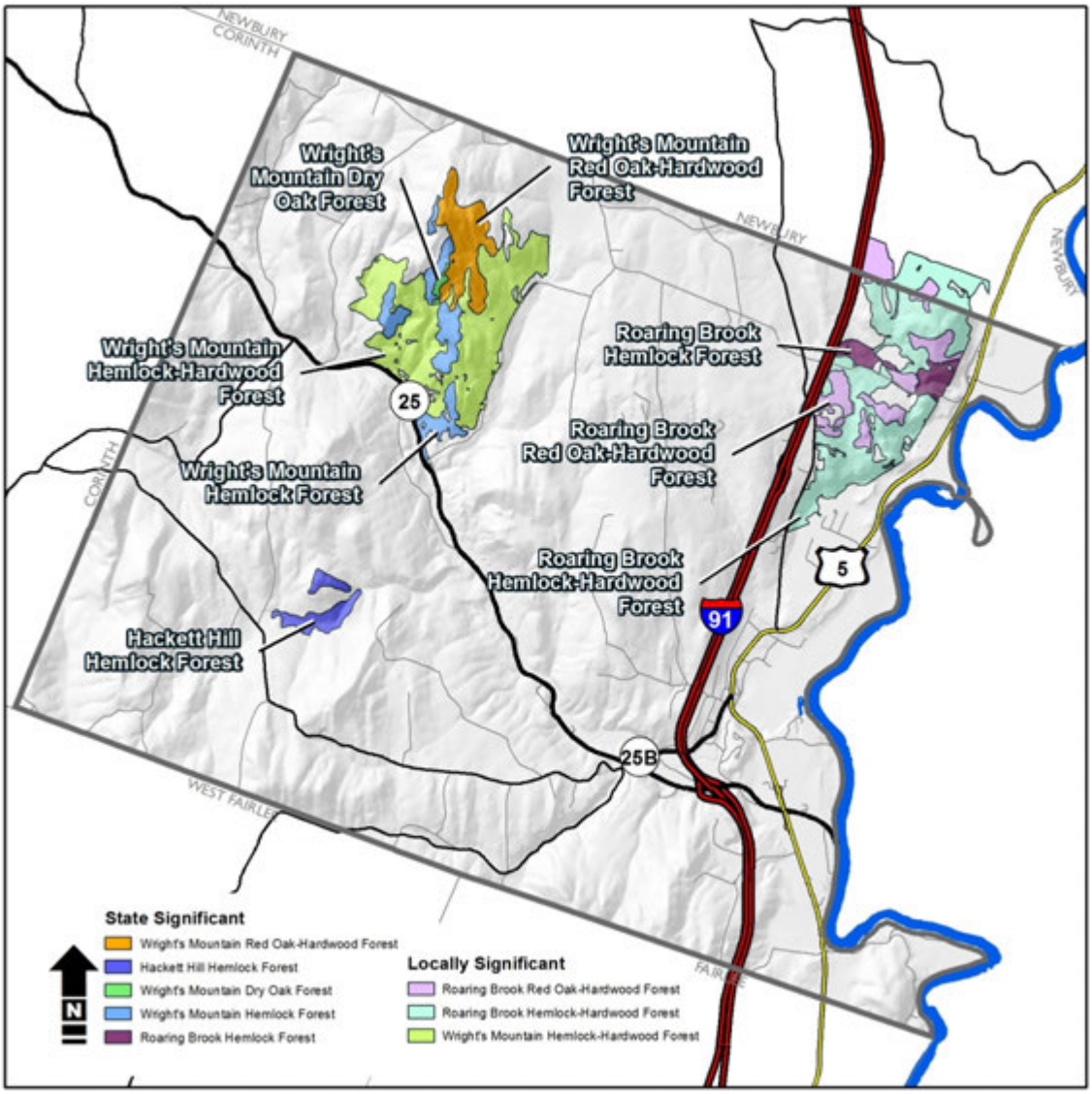

Figure 1. Significant Upland Natural Communities Map

Table 2. Significant Upland Natural Communities in Bradford

Site Name	Natural Community	Size (acres)	Locally Significant	State Significant
Hackett Hill Hemlock	Hemlock Forest	61	Yes	Yes
Roaring Brook Forests	Hemlock-Northern Hardwood Forest	520	Yes	No
	Hemlock Forest	64	Yes	Yes
	Mesic Red Oak-Northern Hardwood Forest	178	Yes	No
Wright's Mountain Forests	Dry Red Oak-Pine Forest	8	Yes	Yes
	Hemlock Forest	150	Yes	Yes
	Hemlock-Northern Hardwood Forest	531	Yes	No
	Mesic Red Oak-Northern Hardwood Forest	144	Yes	Yes

2.3.1 Hackett Hill Hemlock

The Hackett Hill Hemlock forests consist of two stands of hemlock near the West Bradford cemetery. One of the stands occupies the slopes above a tributary of the Waits River, the other occupies the summit and eastern slope of a small hill. Both sites are typical of the Hemlock forest community in that hemlock trees dominate the canopy to the near exclusion of other species. Red spruce, red maple and sugar maple are found in smaller amounts, but not enough to provide extensive canopy openings. Understory vegetation is sparse in these stands, largely due to the dense conifer canopy. Bedrock outcrops and scattered surficial rock are common in these sloped forests.

Figure 2. The Hackett Hill Hemlock Forest contains numerous rock outcrops.

The Hemlock Forest community is relatively common in the state, but large examples in good condition are infrequent. The Hackett Hill forest shows very little sign of human disturbance. Indeed, the northern stand may have areas of old growth hemlock. The size, community condition and landscape position combine to make these forests state significant examples of the Hemlock Forest natural community.

2.3.2 Roaring Brook Forests

Figure 3. Roaring Brook Hemlock-Northern Hardwood Forest

The Roaring Brook Forests sit in the northeast corner of the town and contain some extensive hemlock and red oak forest communities. The matrix, or background, forests at this site are Hemlock-Northern Hardwood Forests. Taken together, these forests comprise 520 acres. The canopy is largely a mixture of hemlock and red oak with lesser amounts of paper birch, white ash, beech and hop-hornbeam. The shrub layers consist mostly of red oak, hemlock and beech

regeneration. The understory is variable but often includes bracken fern, hay-scented fern, sword fern and intermediate fern.

This is a variable site, in terms of canopy cover and species dominance, but clearly has a history of responsible forest management. Areas of younger forest are intermixed with older forests where red oak reach 18-20" DBH. There are no signs of invasive species or other human impacts to most of these forests, though the two major stands are separated by the infrequently used Roaring Brook Road. Overall, this is a very nice forest; its size, community condition and landscape position combine to make it a state significant natural community.

Though smaller than the mixed type, the Hemlock Forests in this area are much more distinctive. Located on the banks and slopes above Roaring Brook, these forests are characterized by a dense hemlock canopy, accompanied by occasional red oak, white pine, and red spruce. The dense conifers cast deep shade and create a forest with virtually no understory. Occasional intermediate and marginal wood ferns and bunchberry herbs are found, but only where some scattered light reaches the forest floor. Bedrock outcrops are common, colonized by sparse lichens and polypoid ferns. The stand to the west also contains some flatter areas that appear to have been pasture in the past. These sites contain more open grown trees and grade into the White Pine-Northern Hardwood Forest to the north. Though common in the state, the Hemlock Forest community does not typically occupy large areas. This 150 acre forest is exceptional in that regard. This, combined with the community condition and landscape result in a state significant designation.

Figure 4. Hemlock Forests occupy the banks of Roaring Brook

Figure 5.Mesic Red Oak-Northern Hardwood Forest at the Roaring Brook Site

The Mesic Red Oak-Northern Hardwood Forests in this area are scattered throughout the site in 7 different stands. These have much in common with the surrounding mixed types and the lack of conifers may be the result of forest management. The canopy consists of a mixture of red oak, red maple, white birch, beech and occasional white pine. They differ from the mixed types by lacking a significant conifer component in the canopy. The shrub layers consist of regenerating canopy species as well as witch hazel shrubs. The herbaceous layer is variable but often includes bracken fern, club-mosses, sword fern and Pennsylvania sedge. Aside from forest management, there is no sign of invasive species or other human disturbance. These sites meet the criteria as a locally significant natural community.

2.3.3 Wright's Mountain Forests

The forests in the Wright's Mountain area are the crown jewel of natural communities in Bradford. They are one of the largest blocks of forest and contiguous habitat blocks and contain a wide diversity of natural community types. Particularly unique is the example of Dry Red Oak-Pine Forest. This is an uncommon natural community in the state and is restricted to dry ridges and summits on south-facing slopes. The southern exposure coupled with shallow, droughty soils results in conditions where the maples and ashes cannot compete with red oak. In some cases, like the example at Wright's mountain, the conditions are severe enough that even the red oak trees are stunted, giving the community an elven woodland appearance. In addition to red oak, the canopy also contains

Figure 6. Dry Red Oak-White Pine Community at Wright's Mountain

scattered white and red pine trees. All of these species have evolved to flourish at sites that routinely burn.

The understory consists of hop-horn beam, canopy species and a dwarf shrub layer of blueberries. The herbaceous layer consists mostly of sedges and grasses, giving a lawn appearance. This "lawn" however, is frequently interrupted by bedrock outcrops and surficial rocks. Mosses and lichens can be found on these rock outcrops and dry soil margins. This natural community appears to be in very good shape, showing no signs of recent logging or other human disturbance and no occurrences of invasive species. The condition, size and landscape of this forest combine to make this a state significant example of this natural community.

Figure 8. The Wright's Mountain Hemlock forests contain bedrock outcrops and a dense conifer canopy

Equally impressive in this forest are the Hemlock Forests that surround the Dry Red-Oak Pine Forests. These are sites of steep, east and west facing slopes with shallow soils and frequent bedrock ledges and outcrops. The dense conifers give the forests a dark and secluded feel. Hemlock, the main canopy species, can form nearly 90% cover in some places. Typically, hemlock shares the canopy with scattered red oak and an occasional red pine. The red pine is especially interesting in that it shows signs of historic fire in these communities. Because of the dense conifers, the understory is sparse. There are a few scattered seedlings of the canopy species but virtually no herbaceous layer. This is a common community type in Vermont (S4-ranked) but large examples like the ones found in the Wright's Mountain are uncommon. The size, condition and landscape

Figure 7. The Hemlock-Northern Hardwood Forest at Wright's Mountain contains a mix of hardwoods and hemlock.

together warrant a state significance designation for these forests.

In the southern half of the Wright's Mountain land, the matrix, or background forest is a large Hemlock-Northern Hardwood Forest. This forest is a mixture of hemlock, red and sugar maple, red oak, and white pine. The understory is highly variable depending on local conditions, but typically includes shrubs of beech, balsam fir and other canopy species. The herbaceous layer is dominated by ferns such as bracken fern and hay-scented fern and sedges such as graceful sedge and Pennsylvania sedge. Various parts of this forest have more recent signs of logging, but the forest appears to be regenerating well. These areas are much younger than others and contain more canopy openings. Given the variations in topography, aspect, soils and human management, this is a highly variable forest. This is a common natural community in the state, and this site falls short of the state significance standards. However, because of its size and condition, it should be considered locally significant.

Figure 9. The Devil's Den site is surrounded by Mesic Red Oak-Northern Hardwood Forest

Devil's Den, the centerpiece of the Wright's Mountain forests, is part of a 144 acre Mesic Red Oak-Northern Hardwood Forest. This forest occupies the north central portion of the Wright's Mountain forests and contains inclusions of Northern Hardwood Talus Woodland and Rich Northern Hardwood Forest as well as areas that tend toward Dry Red Oak-Pine forest. This variation is the result of variable topography, aspect and soil conditions that exist throughout this site. A common theme in the canopy is red oak, but this can be accompanied by sugar maple, ash, paper and yellow birches, and red and white pine depending on the microsite. The understory is likewise variable and can contain richer herbs such as bellwort and geranium or species indicating more "standard" conditions such as wild sarsaparilla, lycopodiums and Canada may-flower. There is sign of logging in some areas from about 20+ years ago, but the community seems otherwise free from human-caused disturbance. The combination of community condition, size and landscape position make this a state significant natural community.

2.3.4 Potentially Significant Sites

In addition to these significant communities, there are a number of communities that may be significant but could not be visited during this inventory due to time constraints. These potentially significant sites were identified during the remote mapping and based on size, landscape position and community type. A final determination of significance, however, can only be made after a site visit. So these sites were identified as "Potentially" significant in the attached GIS layers.

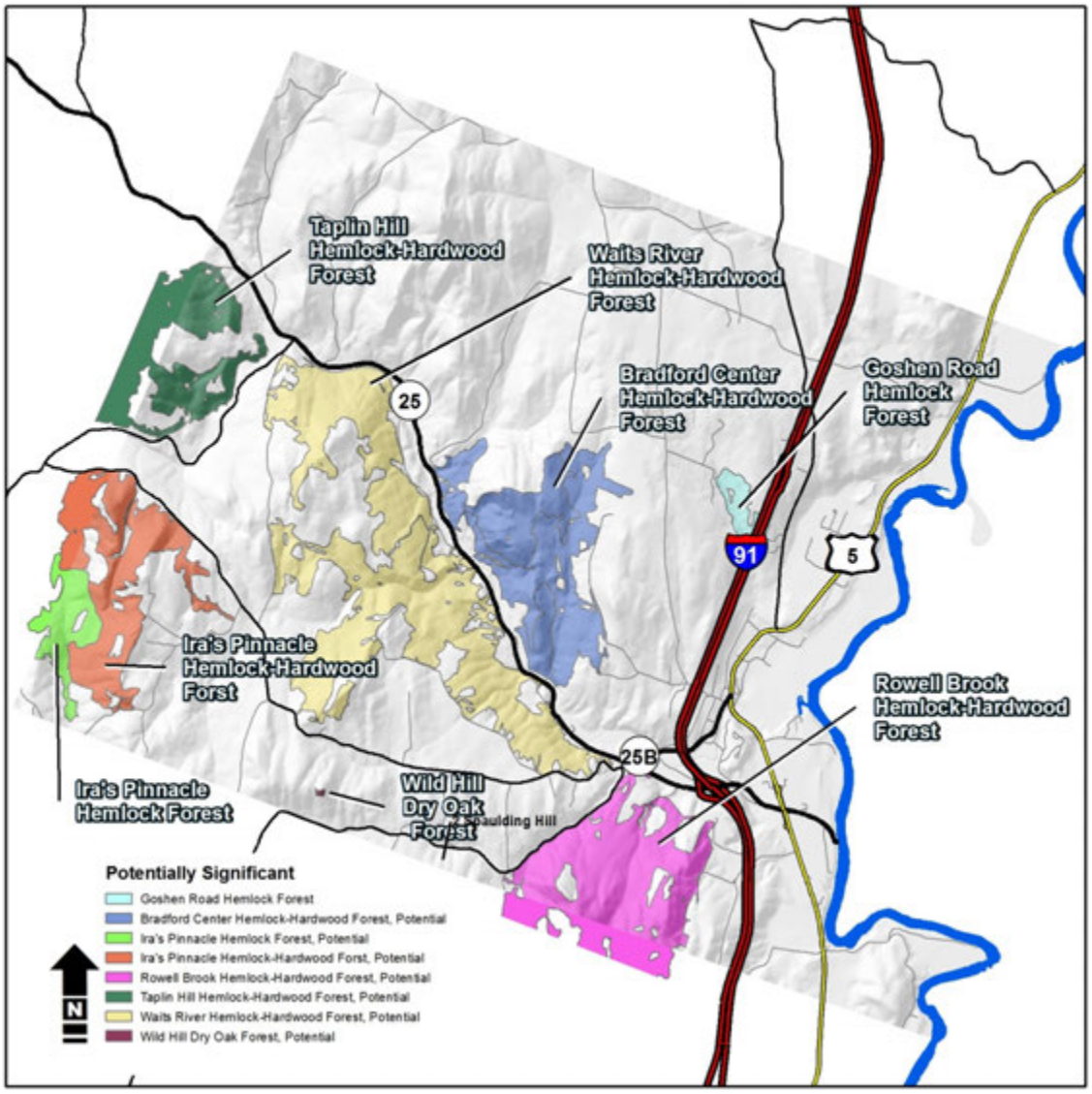

Figure 10. Potentially Significant Natural Communities

Of particular interest is the very large Waits River Hemlock-Northern Hardwood Forest. This forest consists of two nearby stands together comprising 1345 acres. A stand of this size typically has a lot of variation in terms of forest composition, land-use history and condition, but from remote sources, this large forest appears to be intact.

Other mixed hemlock forests such as the Pond Brook, Bradford Center and Ira's Pinnacle sites may be significant communities given their size. There is also a very small site, the Wild Hill Dry Oak forest that warrants investigation. From remote sources, it appears that this may be a dry oak type similar to the one found on Wright's Mountain. As such, even small acreages of this uncommon community could be significant. Future inventory work is warranted to determine the significance of these sites.

2.4 Management Recommendations for Significant Upland Communities

Management recommendations for upland communities that are considered significant depend largely on the type of forest, how rare the community is, and how large of an area it typically occupies on the landscape. Communities are broken up into rarity ranks (S-ranks, see Appendix 1) as well as typical patch size. Large types like the Northern Hardwood Forest occur as matrix-forming forests. Forests like Hemlock-Northern Hardwood Forest occur in large to medium patches and forests like the Dry Red Oak-Pine communities occur in small patches.

2.4.1 Matrix Communities

Large, common, matrix-forming communities such as Northern Hardwood Forests are much more resilient to small perturbations than rarer communities that occur in small patches. Activities such as well-planned logging operations would not likely have a detrimental effect on the overall community. Indeed, a forest management plan that incorporates wildlife habitat and mimics natural disturbance regimes can increase diversity on the landscape and ensure long-term regeneration of the stand. Because they are larger and more resilient, these forests can readily "recover" from most logging operations if the managers adhere to the Best Management Practices. Maintaining the integrity of these communities is more an issue of limiting the overall fragmenting development that would break up the forests and degrade their condition. For this reason, infringement by residential development on the edges of these communities is not a cause for concern as much as the development of large fragmenting features into the heart of the community.

2.4.2 Patch Communities

The recommended management for large-medium patch communities (such as Hemlock Forests and Rich Northern Hardwood Forests) is similar to that presented above for the matrix communities. It differs primarily in the matter of scale. Large fragmenting developments that cut across or reach into the center of these sites should be discouraged. Some degree of encroachment around the margins of these sites is tolerable as long as it does not impact or degrade a significant section (>20%) of the community. If some impact to these communities is inevitable, development that is clustered near the edges is preferable to those that are scattered over a wider area. Logging operations in medium-patch communities can also occur and not degrade the condition of the stand. However, large clear cuts that may be appropriate in matrix communities are not typically appropriate in these sites. Smaller patch cuts and thinning operations are generally recommended.

Communities that occur in smaller patches such as Dry Red Oak-Pine Forests are generally more sensitive to disturbance than larger patch communities. The site conditions that give rise to these communities (geology, soils, slope, aspect etc.) are typically localized. This, coupled with the fact that they are small, means that any development in part of the community could have a detrimental effect on the entire stand. Responsible forest management operations in these sites can also be a challenge. If any cutting is to occur, only light selective logging is recommended. Fortunately, the trees in many of these sites are short, stunted and have very little marketable value. Because of their uncommon or rare status, excluding these sites from forest harvest operations is sometimes recommended.

3. Wildlife Habitat

The wildlife habitat in this study is defined by Contiguous Habitat Units (CHU). Each CHU is an assemblage of wildlife habitat features such as forested riparian buffers, ledges, deer wintering areas, wetlands, mast stands and early successional habitats which function together as a unit of diverse and relatively continuous wildlife habitat. The largest forested area, often the most valuable wildlife habitat, is the core area (largely free from most human activities). CHUs are largely a human-derived construct (as they are bound by our roads), but they represent the largest contiguous wild areas in the study area. The CHUs can be the basis of wildlife management and planning for wildlife in the town of Bradford.

3.1 CHU Wildlife Habitat Components

In constructing CHUs, core forest areas are combined with early succession habitats, forested riparian habitats, wetlands, deer wintering habitat, mast stands, and ledge or cliff habitats. In some cases these specific wildlife habitat features (like riparian areas) may not add new area to the already mapped central core as they are often already subsumed within the core area boundary. In other cases (when they are tangential but not within the mapped core area) they add new area and additional acreage to the CHU. Each of the following habitat components can serve as a source of food or water, seasonal or year-round habitat, escape cover, breeding and rearing habitat, movement habitat or all of the above for one or more species of wildlife. Each of the CHU component features is discussed in detail below.

3.1.1 Core Area

Core habitat is forested wildlife habitat that is far removed from human activities and their artifacts such as roads, houses, and active farmlands. For the purposes of this analysis, it is defined as forested land 100 meters or more from regular human disturbance such as development, open fields and roads. This remote wildlife habitat is qualitatively distinct from small, fragmented habitats, in that it provides important mating, nesting, feeding, and denning habitats for species that cannot survive in these human-dominated landscapes. These animals typically require travel corridors between various landscape patches that provide other distinct habitat elements.

Core habitat is generally characterized as having a lower amount of forest edge habitat. Also in core areas, edge habitat is often "soft" and the result of differences in ecological conditions such as a variable site aspect. In contrast, our human-caused "abrupt or hard" edges, occur where different land-uses have created different cover types or ages of communities. Edge habitat, and especially abrupt edge habitat, is characterized by extremes in climatic variables such as temperature and wind speed. Bird species composition and behavior is often different in edge habitat.

Figure 11. Woodpecker snag tree

A wide-variety of birdlife in the northeast utilizes the larger contiguous forests available only in core areas. These birds include species such as the broad-winged and red-shouldered hawks, owls, and forest songbirds like the ovenbird, wood thrush, scarlet tanager, pileated woodpecker, and the Canada and black and white warblers. Several of these species suffer from greater nest predation (by animals such as squirrels, raccoons, snakes and other birds) and nest parasitism (by other birds such as the brown-headed cowbird) where nesting grounds are near human disturbance and the habitat edges it creates. Bird populations throughout Bradford and the region, therefore, benefit from the deep forest "interior" habitat provided by core areas See Figure 12 for core forested habitat locations in Bradford.

Figure 12: Core Forest Map

Remote wildlife habitat found in core areas can provide the various habitat elements for wide-ranging species such as fisher, bobcat, and black bear. Core areas are often hilly or mountainous, without easy access, and only rarely or seasonally visited by landowners, hunters, and loggers. Wide ranging species thrive in the remote habitat of the core areas.

Core areas are often the most important "source areas" where reproductively active female bear, bobcat, fisher, and coyote can defend territories, have their young and contribute to the overall population of these species. In general, the larger the core area size, the greater the population (and territories) of individual species it can support. Larger populations are generally more stable over

Figure 13. Black bear

longer periods. Core areas often provide the breeding grounds and nurseries that support relatively high populations of these deep forest species. Although most human wildlife observations may be near town, within our small woodlots and crossing roads, it is these core areas that produce a surplus of young and without them many populations would likely decline.

The smaller more fragmented wildlife habitats throughout Bradford, are dependent upon these large core habitats, for maintaining stable, self-sustaining populations of species that have relatively large home ranges (such as bear, bobcat and fisher). Animals living near humans, roads, pets, hunters, and trappers suffer higher rates of mortality than do animals deep in core wildlife habitats. The long-term maintenance of wildlife populations in Bradford may be dependent on keeping these core habitats biologically meaningful and free from deleterious fragmentation.

3.1.2 Ledge, Talus and Cliff Habitat

Ledge habitat is generally associated with steep land and vertical rock structure. Vertical rock structure itself is only valued by a limited number of species such as nesting peregrine falcon, common ravens, and the small-footed bat. If the ledge is broken, that is, with crevices, hollows and caves, it becomes important habitat for a wider variety of animals.

Figure 14. Talus slope

In many areas throughout the northeast, bobcats use ledges for courting and breeding grounds and the broken ledge (often at the foot of a ledge) for birthing and rearing of their young. Broken ledge is considered defendable from predators like the coyote that may try to kill and eat bobcat young. Bobcats (and other animals) are reported to also utilize broken ledge (similar to coyote and fisher) when it's cold and snowy as well as when it's hot (for relief from the heat). There is some evidence that ledges facing south and west (areas that generally are more exposed to the sun) may receive higher use by certain species and are more valuable to wildlife.

Porcupines and raccoons also live in ledge hollows, under larger rocks, and in deeper cave-like structures in ledge and talus environments. Fisher and coyote often use these sites for protection from the weather while moving throughout their home ranges. Ruffed grouse and small rodents often utilize these areas for varying periods of time. Figure 15 shows the likely ledge and talus areas that were identified in Bradford, and more are assumed to exist.

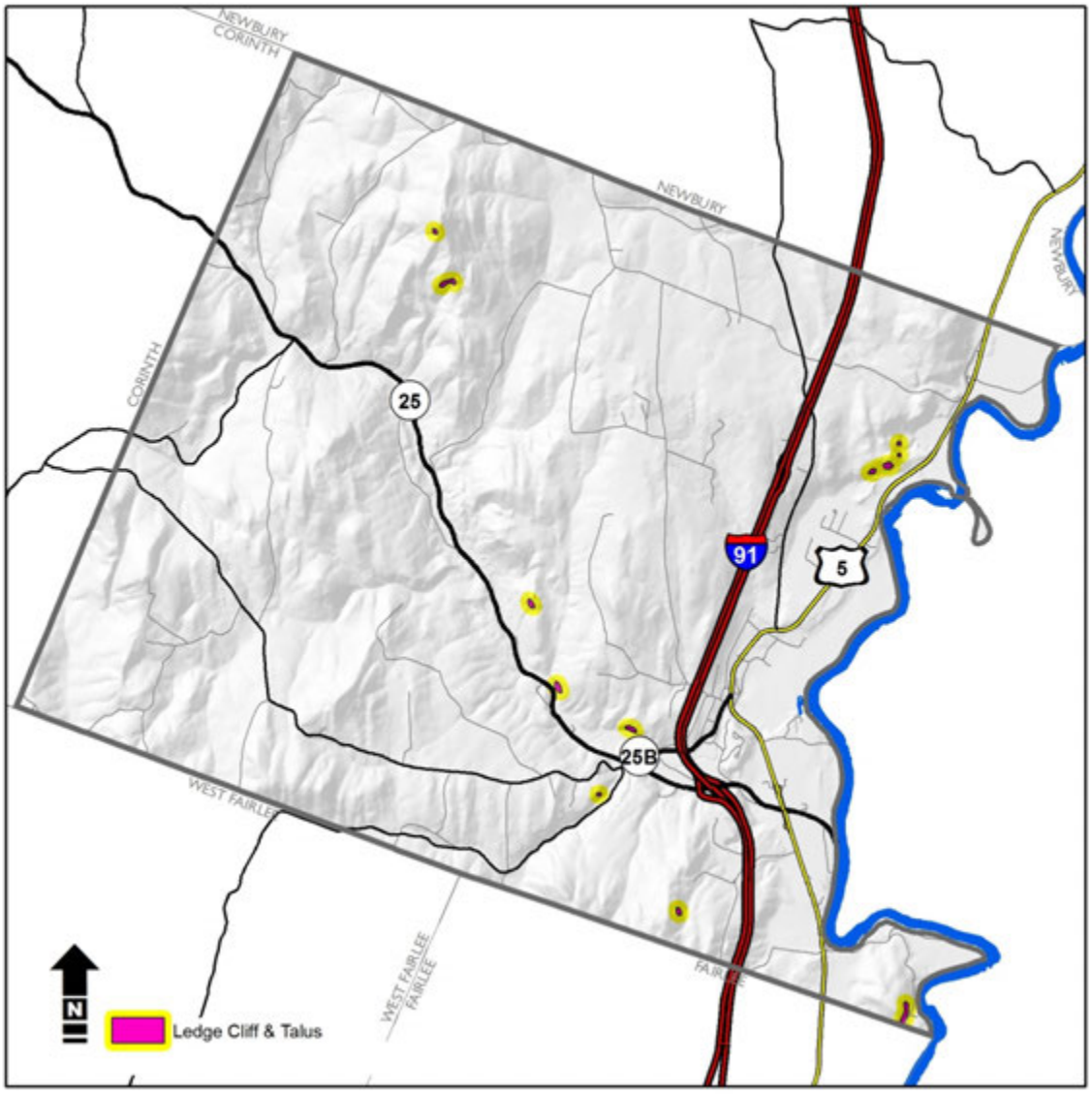

Figure 15: Potential Ledge, Cliff and Talus Habitats

3.1.3 Bear Wetlands

Black bear utilize a wide variety of wetlands during the spring and summer months. Forested, shrubby, beaver-flow wetlands, and forested seeps are sought out for the flush of early vegetation that often grows in these environments. In the early spring, wetlands with ground-water discharge promote an early growth of leafy green vegetation at a time when the trees are still barren of nutritious buds and new leaves. Black bears (as well as deer and turkeys among other animals) will utilize this food source and also search out plant roots, grasses, sedges and ants in these environments. Free flowing water is

also available at many of these wetlands. Bear wetlands typically have shrubs or tree vegetation nearby which provide concealment.

Figure 16. Potential bear wetland

Throughout the Bradford area forested seeps are probably the most heavily utilized wetlands by bear. In many locations these seep wetlands are located in remote areas relatively close to bear denning areas far away from humans. As such, they warrant special protection for their wildlife value.

The wetlands identified as preferential bear habitat in this study represent a mix of wetlands that were either observed in the field to have sign of bear use or were determined to be potential candidates to fulfill bear wetland habitat requirement (i.e. sufficient cover for bear use and potential food resources) based on their community type and cover characteristics.

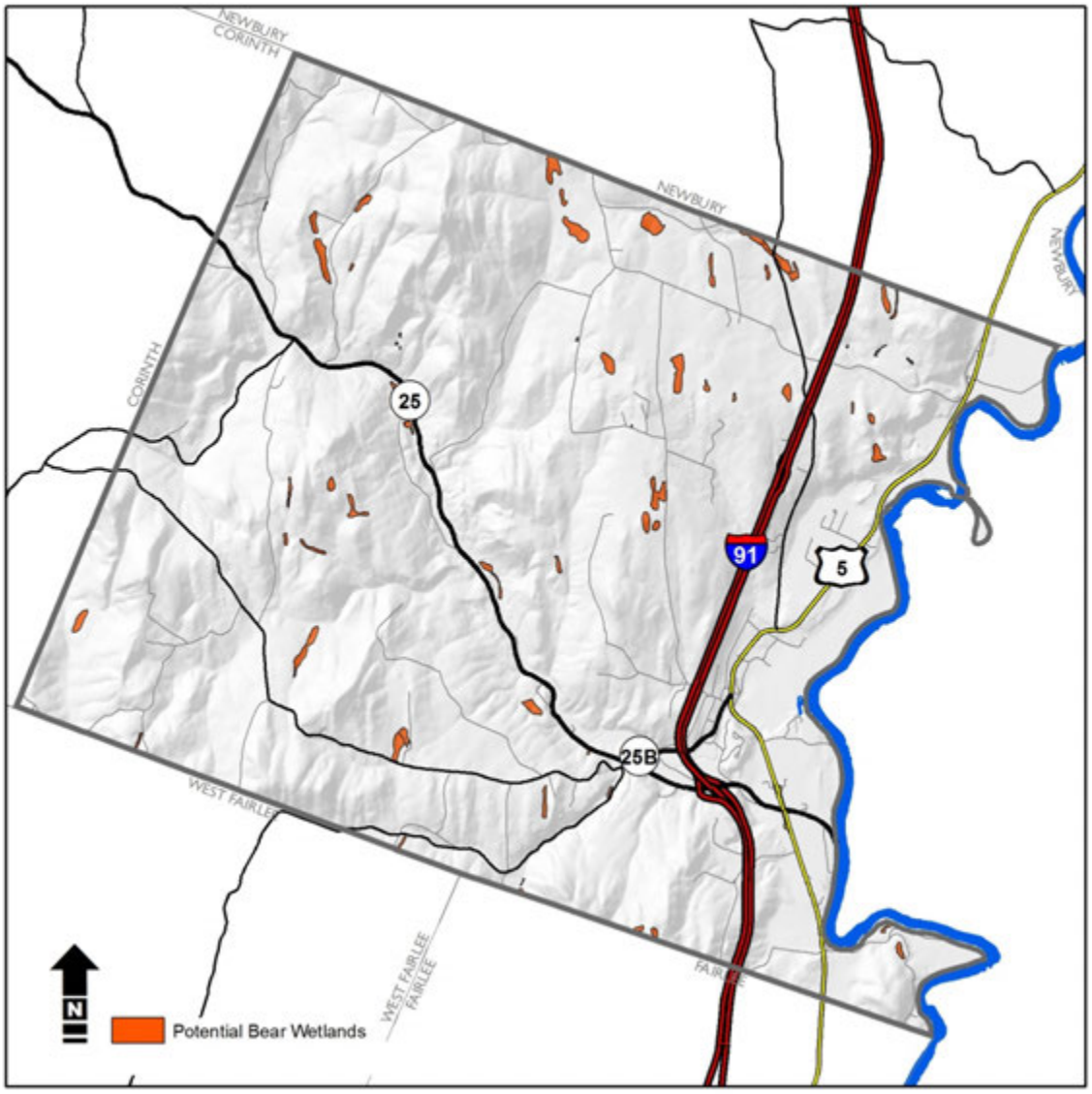

Figure 17: Map of Potential Bear Wetlands

3.1.4 Early Successional Habitat (ESH)

ESH is forested habitat that is characterized by regenerating young, often dense shrubs, saplings or trees. Active forest management or natural disturbances such as disease infestation, ice storms, or wind blow can sufficiently open the forest canopy to sunlight and encourage a new growth of woody vegetation. Old fields and power line ROWs with a substantial shrub component were also identified as ESH in this study. ESHs are important for many species of birds and mammals. Bird species that thrive in areas with tree saplings and shrubs include: the song sparrow and field sparrow, chestnut-sided and

golden-winged warbler (rare), common yellowthroat, gray catbird, indigo bunting, brown thrasher, American woodcock, and ruffed grouse.

Figure 19. Bobcat

ESH that is interspersed with older forestland, old fields, and wetlands harbors many small mammals that are prey for predators. Snowshoe hare, woodchucks, white-footed and woodland jumping mice, and shrews are often found in high densities in areas of successional patches on the landscape. Red and gray fox, coyote, ermine, skunk, raccoon, and bobcat will search these patches for food. Black bears and other animals will utilize these areas extensively in years when berry-producing shrubs are thick with fruit.

Figure 18. Hare

Recently, early succession patches within an otherwise forested matrix have been shown to provide feeding habitat to bird species that were otherwise thought to be forest "interior" specialist. These birds visit the fruit and insect rich openings between the end of the breeding season and beginning of migration to bulk up on the copious foods in preparation for the long migratory flights.

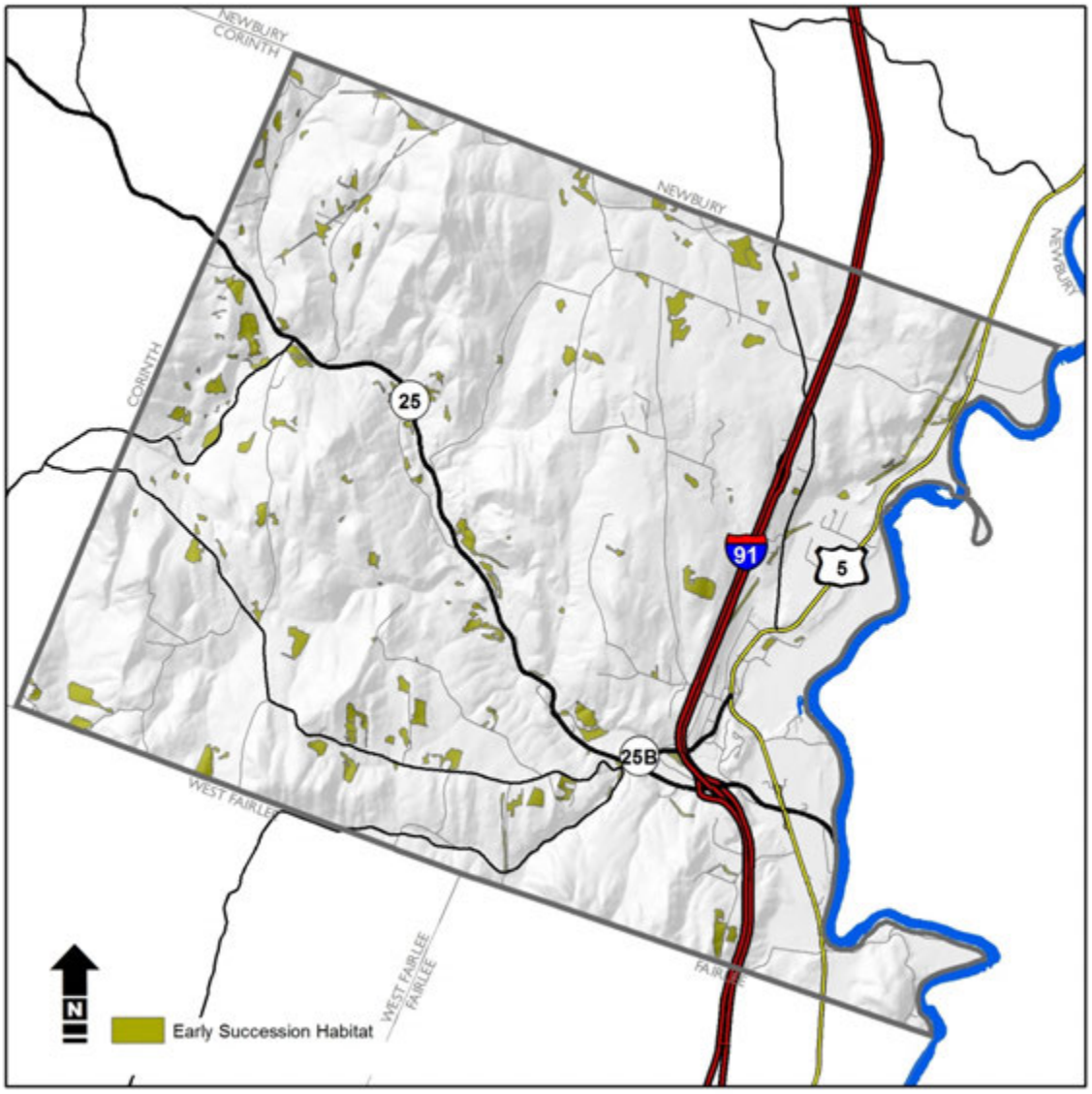

Figure 20: Early Successional Forest Habitat Map

3.1.5 Forested Riparian Habitat

Forested streamside riparian habitats are important for species that utilize the aquatic habitats, terrestrial vegetation and cover that are provided. Riparian forested vegetation anchors the stream shoreline and limits streambank erosion. It also provides coarse woody debris to streams which adds to the stream structural and substrate diversity as well as provides food that fuels stream food chains. In addition, the tree canopy provides critical shade important for maintaining cooler water temperatures necessary for fish survival. The contribution of coarse woody debris (especially during leaf-fall on low order streams) to energy budgets of shady headwaters streams is pronounced.

Figure 21. Waits River forested riparian area

Amphibians such as the green frog and the Northern dusky and two-lined salamanders live along streams in forested habitat and utilize the adjacent riparian environment. The raccoon and long-tailed weasel use streamside forested habitats to hunt for food and for denning habitat. The moose and white-tailed deer use streams and streamside forested habitats for cover and water. Aquatic animals such as the river otter, mink, muskrat, and beaver use streamside vegetation for cover, denning and food. Several species of bats such as the little brown myotis and the big brown bat use these environments to hunt for insects. Birds such as the belted kingfisher, wood duck, red-shouldered hawk, snipe, Eastern screech and barred owl, the wood pee-wee and alder flycatcher, American gold finch, tufted titmouse, and the yellow, Canada, and cerulean warblers make extensive use of forested riparian habitats.

Forested riparian areas also function as important travel corridors for a variety of wildlife species. Often these zones are the only treed route affording cover and facilitating movement.

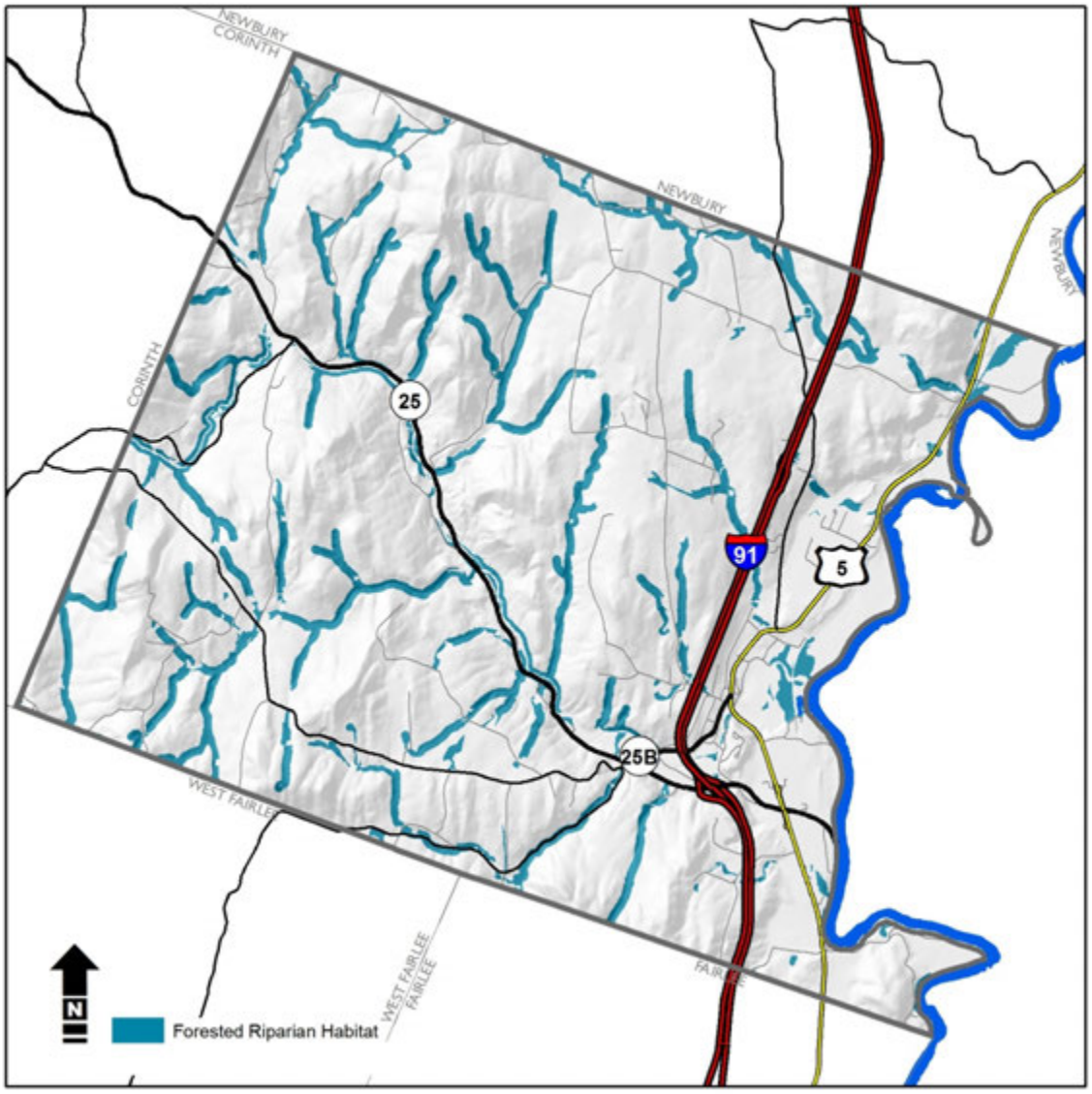

Figure 22: Forested Riparian Habitat Map

3.1.6 Mast Stands

Masting trees are those which synchronize fruit production in an area. Within Bradford "hard mast" trees are Northern red oak and American beech trees. These trees, when found clumped into stands, are regularly frequented by many species of wildlife.

Various sized beech and oak stands have been identified within Bradford. When beech and oak stands are remote, use by black bear is generally higher than stands near human activities. Wildlife attracted

to the fruits of American beech (beechnuts) and oak trees (acorns) include squirrels, wild turkey, deer, and bear.

Figure 23. Bear scarred beech tree

Bear will climb the beech trees in fall to gather beechnuts, leaving scars from their climbing activities. They often return in spring and scavenge beechnuts from the ground under the beech trees. Bears act in a similar fashion in search of acorns, however, their climbing activities do not usually leave persistent scars and their use is therefore difficult to detect on the tree itself.

This study compiled known mast resources, field identified stands and utilized natural community designations to identify probable stands of mast trees. Additional mast stands, especially American beech stands are likely present on the landscape.

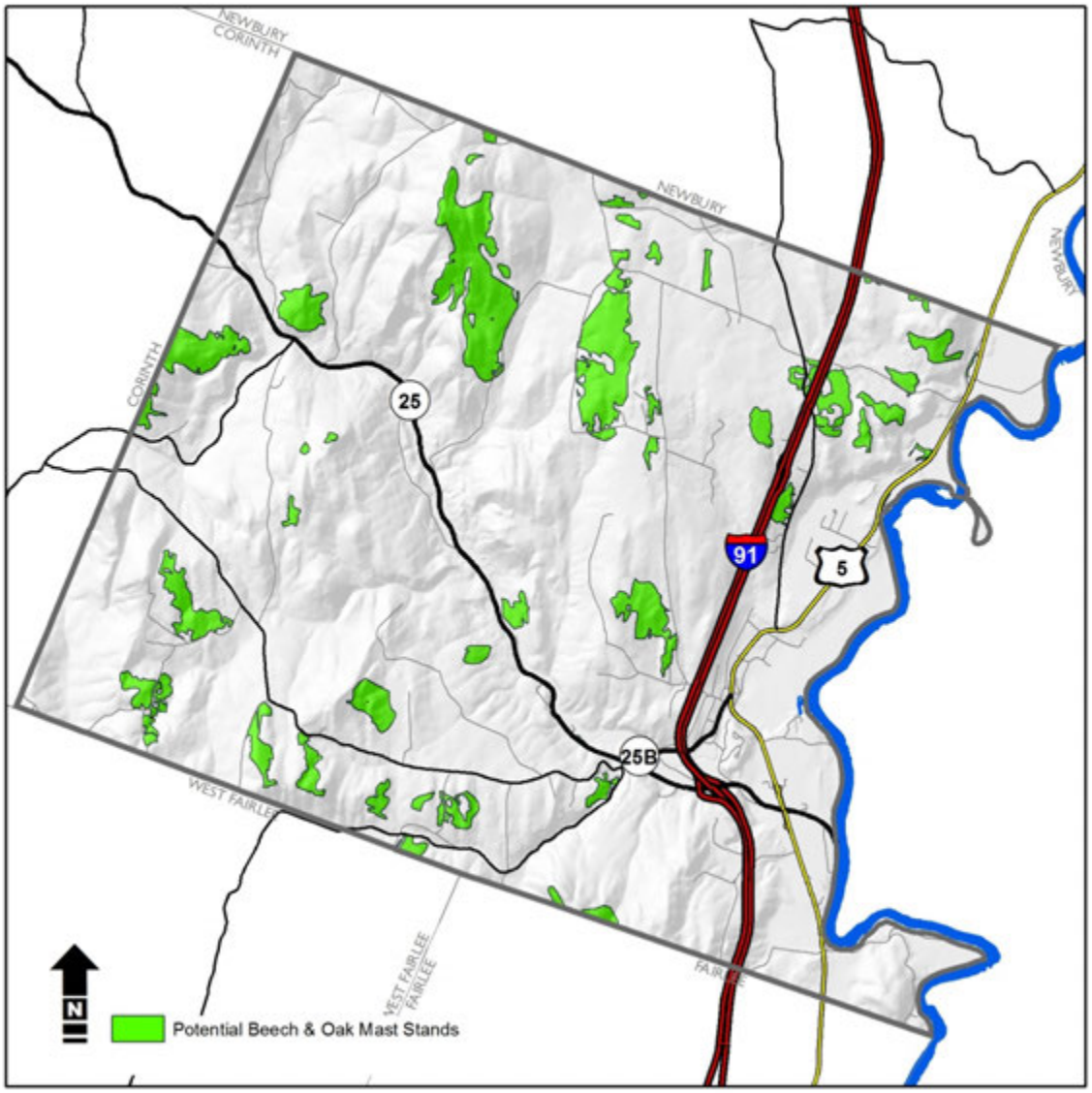

Figure 24: Hard Mast Stands Map

3.1.7 Deer Winter Habitat

In years where significant amounts of snow accumulate in the woods, white-tailed deer utilize evergreen forests for winter habitat. Evergreen trees intercept snow as it falls to the ground generally resulting in shallower snow depths. These habitats offer an overhead canopy of needles that shield deer from the cold. Deer congregate in these areas when snow depths exceed about 15 inches and often remain until the snow melts in spring. These winter habitats can be critical in limiting the energy expenditures of deer and supporting the overall survival of this species in the north.

Deep snow can occur anywhere within Bradford, but probably lasts longer into spring in the higher elevation areas within town. Years with significant snow cover mixed with cold temperatures tax the deer population. In these years, or over multiple years with several harsh snow winters, the cumulative drain on deer energy resources can take its toll. For this reason deer wintering habitats are seen as crucially important to the long-term maintenance of deer populations in the Bradford region.

Deer winter habitat that faces into the sun (either west or south) is often more valuable than east or north facing areas. Eastern hemlock, balsam fir, and Northern white-cedar stands provide the best cover and food value to deer, but pine and spruce will sometimes be utilized. These deer winter habitats are also home to bobcat, fisher, coyote, and scavenging bears that come looking for live deer to eat during the winter or carrion to scavenge in spring. Other animals such as conifer-nesting birds, porcupines and fox utilize these habitats during other seasons.

Figure 25: Deer Winter Habitat Map

For this study, potential deer winter habitat was divided into either "likely" or "potential" categories (see Figure 25 above). Likely deer winter habitats are comprised of evergreen dominated forests such as Hemlock Forests and Hemlock-Northern Hardwood forests that have a west, south, or southwest aspect. These natural communities often receive the heaviest deer use and the most consistent from year to year. These "likely" deer winter habitats are those generally sought out in the longest, coldest, and snowiest winters. The strong spring sun in these communities melts snow early and warms cold bodies.

Figure 26. Eastern hemlock deer winter habitat

Potential deer winter habitats may be less likely to be used by deer each year-particularly in the coldest and snowiest of years. Some of these communities may not offer the most protection from the cold resulting from a less complete evergreen canopy, the dominance of tree species that do not form a closed protective treed canopy, or even from having a cold northern aspect. Some of these deer winter habitats may be abandoned in early or mid-winter for other more protective overwinter habitats and some may function in varying capacity throughout the winter.

All winter deer habitats provide some thermal benefits and aid deer in fending off starvation, cold and a continually declining energy budget during the harsh winter and spring months. Energy loss during the winter and spring is cumulative, that is, whatever fat and energy are lost by deer during the early winter months are not available for deer metabolism during late winter and spring. For the most part, it is not until plants produce green leafy material or ripen buds in spring that deer climb out of their energetic downhill spiral.

3.1.8 Grassland Bird Habitats

There is a whole suite of bird species that do not utilize forested (or early successional forest) environments to fulfil their breeding requirements. In the Bradford area, grassland birds are the largest non-forest dwelling group, and perhaps the assemblage of species most at risk. Grassland bird species utilize open field grasslands, typically of at least 10 acres or larger for their breeding, nesting and feeding. Many of these species are historically more associated with mid-western prairie habitats, but have established a foothold in the open agricultural fields throughout the northeast. These species, such as bobolink, savannah sparrow and grassland sparrow are seeing drastic population declines attributed to a variety of factors. As agricultural practices become more and more mechanized and new genetic modification and nutrient application technologies allow far more frequent grass harvesting, many young fledglings are destroyed while still in the nest from contact with haying equipment. Add to

that the conversion of hayfields to row crops such as corn and soybeans and extensive deforestation of winter habitats in South and Central America, and these species are losing ground quickly.

Grassland habitats were mapped in this study based on remote review of cover conditions as apparent in aerial photographs. Since grass conditions are highly temporal and very dependent on current management practices, this is only a snapshot of potential grassland that may be providing habitat for this group of species.

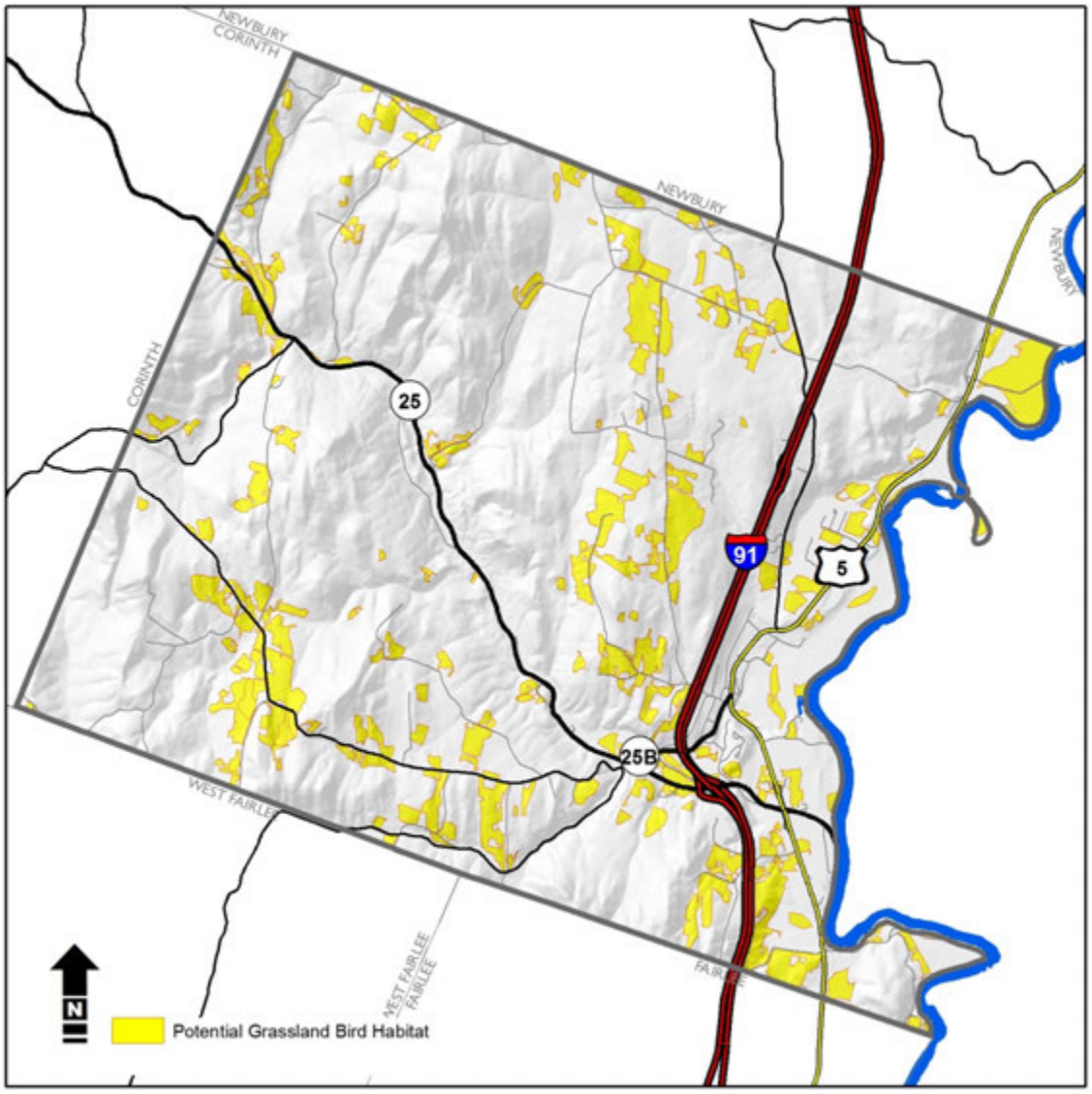

Figure 27: Grassland Habitats Map

There is a whole suite of bird species that do not utilize grassland environments to fulfil their breeding requirements. According to the current tally from the 2003-2007 breeding bird atlas there are over 200 bird species that breed in the State of Vermont. In fact, the northern New-England region is referred to as a "veritable breeding factory" by the Partners in Flight Land Bird Conservation Plan (Rich et al, 2004) for its abundance of breeding neo-tropical migrating bird species.

Due to this extensive list of breeding bird species, discussion of breeding birds in the Bradford is focused primarily on a set of 40 "Responsibility Species" as developed by Audubon Vermont. This list covers a range of species that have a high proportion of their breeding population within our Atlantic Northern Forest region.

Figure 28 Scarlet tanager, an interior forest bird

Many of these species are experiencing global declines in population, sometimes severe. However many of these are fairly familiar to anyone who spends a bit of time in the forests and fields of central Vermont. Focus on these species, and their habitat requirements will help insure that these birds, ubiquitous to our region, remain common and that those experiencing sharp declines may be stabilized or restored before being lost for good.

Figure 29: Audubon Vermont- Responsibility Species

Birds of early-succession and old fields	**Birds of mature forests**
Chestnut-sided Warbler	Ovenbird
Mourning Warbler	Wood Thrush
White-throated Sparrow	Veery
Ruffed Grouse	Eastern Wood-Pewee
American Woodcock	Yellow-bellied Sapsucker
Nashville Warbler	Black-throated Blue Warbler
Canada Warbler	Blackburnian Warbler
Magnolia Warbler	Black-throated Green Warbler
Northern Flicker	Scarlet Tanager
Birds of high elevation and boreal forest	American Redstart
Spruce Grouse	Chimney Swift
Black-backed Woodpecker	Northern Parula
Olive-sided Flycatcher	Purple Finch
Yellow-bellied Flycatcher	Blue-headed Vireo
Gray Jay	
Cape May Warbler	
Tennessee Warbler	**Birds of wetlands and riparian areas**
Blackpoll Warbler	Swamp Sparrow
Bay-breasted Warbler	Lincoln's Sparrow
Palm Warbler	Rusty Blackbird
Boreal Chickadee	Alder Flycatcher
Bicknell's Thrush	Louisiana Waterthrush

3.2 Contiguous Habitat Units (CHUs) Analysis

Figure 30. Contiguous Habitat Units Map

A total of seventeen contiguous wildlife habitat units (CHUs) were identified in Bradford. The following table provides summary data for specific habitat components within the CHUs for the town. A summary data table is provided in Appendix 3 detailing the individual habitat elements within all the CHUs.

Table 3. CHU Summary Data		
Habitat Feature	**Total Amount in All CHUs in Bradford**	
Core Habitat	7109	Acres
Deer Winter Habitat	8223	Acres
Streams	50	Miles
Wetland	302	Acres
Early Succession	455	Acres
Forested Riparian	1596	Acres
Vernal Pools	25	Count
Conserved Land	948	Acres

For each CHU presented below a list of habitat features is provided. Features in black are present within the unit, and those in grey are absent.

Each CHU is also assigned a "Habitat Block" ranking. In 2012, the Vt. Dept. of Fish and Wildlife completed a project to map and quantify large blocks of wildlife habitat throughout the State of Vermont. The inputs used in the project were of a courser scale than applied in the development of Bradford's CHUs, but the habitat blocks identified by Vt. F&W cover the entire state and are ranked relative to habitat areas statewide. Each CHU in Bradford has been assigned the priority ranking value of the underlying Habitat Block. The Vt. Habitat Block scale runs from 0 to 10, with 0 being the lowest priority ranking and 10 the highest. The Bradford CHUs all participate in habitat blocks ranging from 3-7 on the statewide scale. For more information on the Vt. F&W Habitat Block project see: http://tinyurl.com/VtFWHabitatBlocks.

Accompanying the list of habitat features is a discussion of each of the CHUs. Included in that discussion is an assessment of horizontal diversity. Horizontal diversity is a measure of the change in vegetative types, ages, and conditions across an area of undeveloped land. These patterns or changes can result from differing bedrock and soil types, or past land use or management activities.

In general, the greater the change in vegetative diversity across an area, the greater the overall species diversity of animals within that area. This applies most directly to mammals, such as fox, coyote, deer, moose and black bear, but horizontal diversity is also applicable to bird species. Mammals and birds often need different vegetative structure and species composition to fulfill various habitat needs throughout a life cycle or season. For instance taller trees may be utilized for singing and the feeding activity of a bird while the nesting activities may be focused low in the canopy on smaller saplings or shrubs. Black bear may utilize mid to older American beech trees for fall feeding and then travel to beaver-complex wetlands for spring and summer feeding and utilize areas of dense cover for travel corridors. A wide variety of habitat types can translate into more prey opportunities for predators. In general, when prey populations are higher -- predators respond with greater reproduction and are more numerous as well. When species specific habitat features, and on-going human disturbances on the landscape are not otherwise limiting, an increase in horizontal diversity usually produces an increase in mammalian and bird species diversity. The site context, i.e. the surrounding land-uses, plays an important role in determining the influence of horizontal vegetative diversity on animal species richness (diversity of species) as well.

3.2.1 River Hill CHU

River Hill
171.3 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 1

River Hill CHU is located at a fairly low elevation site along the Connecticut River in the extreme southeastern corner of Bradford. This CHU is somewhat isolated and contained within a largely agricultural landscape. This relatively small 171 acre CHU consists of forested and wetland wildlife habitat. The forest is a mix of Eastern hemlock, northern hardwood species, white pine, and red oak and provides conifer cover and potential deer winter habitat. The unit's wetland marsh, may be used by Connecticut River aquatic species such as mink, river otter, and numerous bird species. The site may contain potential ledge habitat as well. The River Hill CHU exhibits low horizontal diversity.

3.2.2 Spaulding Hill CHU

Spaulding Hill
148.9 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 7

The Spaulding Hill area is a 149 acre CHU located between an elevation of 800-1285 feet along the southern edge of Bradford. It is small at 149 acres, however the Spaulding Hill forest is part of the northern edge of a much larger 10,000 acre contiguous forest block that is mainly in the Town of Fairlee. The area has over 50 acres of potential deer winter habitat as well as forested riparian wildlife habitat. Deer winter use was evident in both 2014 and 2015. The Spaulding Hill CHU has a high horizontal diversity containing many different vegetative types.

3.2.3 Rowell Brook CHU

Rowell Brook
891.3 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 7

Rowell Brook CHU is located at a mean elevation of 870 feet along Bradford's southern border. The Rowell Brook CHU consists of an 891 acre largely forested parcel that is part of the much larger forest block extending south into Fairlee, actually connecting to the Spaulding Hill CHU outside Bradford. This area contains over 620 acres of potential deer winter habitat and provides over 640 acres of deep woods core wildlife habitat in Bradford. Winter road tracking exercises revealed extensive deer winter use during both 2014 and 2015. This CHU has extensive forested riparian habitat, streams and a few wetlands. The Mill Pond and Rowell Brooks flow through the CHU. The site also contains mast trees, potential bear wetlands, ledge habitat, and small amounts of early succession shrubland wildlife habitat. Overall however, the Rowell Brook site is fairly uniform in vegetative types and exhibits a low horizontal diversity.

3.2.4 South Bradford CHU

South Bradford
309.9 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 4

The South Bradford CHU is a relatively high (mean elevation of 1212 feet) forested area along Bradford's southern boundary with West Fairlee. This 310 acre area is adjacent to a larger forest habitat block to the south in West Fairlee and bounded by roads and agricultural land uses to the north. The South Bradford CHU contains moderate amounts of deer winter habitat, stream and forested riparian habitat, and lesser amounts of wetland area. The site contains over 15 acres of early succession habitat and 2 vernal pools have been identified. This small CHU is quite diverse in vegetative types and has a high horizontal diversity.

3.2.5 West Fairlee CHU

West Fairlee

442.3 Acres

Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 7

This CHU is 442 acres with 256 acres of core wildlife habitat. The West Fairlee CHU is located high on the landscape along the town's southwestern edge. Much of the West Fairlee CHU forest is coniferous, with much hemlock potentially providing deer winter habitat. Over 3.5 miles of streams and forested riparian habitat provide aquatic wildlife and fish with a place to live. This relatively small unit has a low horizontal diversity.

3.2.6 Ira's Pinnacle CHU

Ira's Pinnacle

803.3 Acres

Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 7

Ira's Pinnacle is a relatively high CHU (mean elevation of 1114 feet) located in the southwestern corner of Bradford. Ira's Pinnacle forms the northern boundary in Bradford of a 13,000 acre forest block located in Corinth, West Fairlee and Vershire. Ira's Pinnacle is over 800 acres in size providing 529 acres of deep woods core wildlife habitat. With over 615 acres of potential deer winter habitat, much of it dominated by hemlock, deer in the region seek out this forest during cold, snowy winters. The CHU also provides mast trees, 39 acres of early succession habitat, and over 3 miles of stream and forested riparian wildlife habitat. Bear wetlands are located within the CHU, and 1 vernal pool has been identified. Over the entire unit however, this CHU exhibits a low horizontal diversity.

3.2.7 West Bradford CHU

West Bradford
309.9 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 4

The West Bradford CHU is a small 310 acre habitat on the town's western border adjacent to the Town of Corinth. The area is bordered by residential development and roads but provides 185 acres of core wildlife habitat. Potential deer winter habitats including some with hemlock forests are found here. Some deer winter use of these conifer forests was suggested by winter road tracking exercises. The West Bradford CHU exhibits a moderate horizontal diversity.

3.2.8 Waits River CHU

Waits River
2097.8 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
4% Conserved
ANR Block Priority: 5

The Waits River CHU is large wildlife habitat located in central Bradford across a broad range of elevations from under 500 feet to over 1400 feet. It is adjacent to the Bradford Center and Wright's Mountain CHUs which taken together make up the largest area of forestland in Bradford. This CHU is over 2000 acres in size and contains 1177 acres of core wildlife habitat.

This site contains 1638 acres of potential deer winter habitat, including extensive areas dominated by Eastern hemlock. In both 2014 and 2015, winter tracking exercises revealed winter deer use of these areas. Waits River CHU has over 7 miles of streams and rivers, including the Wait's River and extensive forested riparian habitat. This CHU contains 55 acres of swamp and marsh wetland wildlife habitat, 102 acres of early succession habitat, and potential bear wetlands. The site contains small areas of mast bearing forests and 4 vernal pools have been identified. Waits River provides extensive habitat for deep forest species such as bear, bobcat, fisher, songbirds, raptors and owls, as well as aquatic habitat for species such as shorebirds, mink, otter, and fish. This large CHU has a moderate horizontal diversity.

3.2.9 Low-St. John CHU

Low-St.John
717.6 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
7% Conserved
ANR Block Priority: 4

The Low-St. John CHU is 718 acres in size located along I-91 at a mean elevation of 924 feet and is bound to the east by a well-travelled paved road. Only 357 acres of this CHU is core wildlife habitat, but it does provide 576 acres of potential deer winter habitat including some areas dominated by Eastern hemlock. The Low-St. John contains 34 acres of wetlands, 42 acres of early succession habitat, and a potential bear wetland. Four vernal pools have been identified in the area and 2.5 miles of stream provide 88 acres of forested riparian wildlife habitat. The Low-St. John CHU has a moderate horizontal diversity.

3.2.10 Bradford Center CHU

Bradford Center
1419.6 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
2% Conserved
ANR Block Priority: 6

The Bradford Center CHU is a 1420 acre area in the center of town and bordered to the south by the Wait's River at a mean elevation of 805 feet. This extensive CHU provides 907 acres of core wildlife habitat and contains over 1200 acres of potential deer winter habitat. The road tracking surveys of both 2014 and 2015 reveal extensive deer use of the area's winter habitat, much of which has an Eastern hemlock component. The Wait's River itself provides extensive fish habitat as well as shoreline habitat for birds, mink, river otter and other water-loving species. The Bradford Center CHU has over 7 miles of stream and rivers and over 240 acres of forested riparian habitat. This CHU also has smaller amounts of early succession, and wetland habitat and potential bear wetlands as well as 30 acres of conserved land. Overall, this large CHU exhibits a low horizontal diversity.

3.2.11 Chase Hollow CHU

Chase Hollow
228.4 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 3

Chase Hollow is located in northcentral Bradford at a mean elevation of 1130 feet. The 228 acre CHU provides 82 acres of core wildlife habitat and 217 acres of potential deer winter habitat. Some use of this winter habitat by deer was observed during road tracking exercises. Chase Hollow is close to the Bradford Center and Wright's Mountain CHU's and may benefit from its proximity to these wild areas. The site does have 1.8 miles of stream and small amounts of forested riparian, early succession habitat, and wetland wildlife habitat. Chase Hollow has a potential bear wetland. This fairly small CHU has a high horizontal diversity.

3.2.12 Taplin Hill CHU

Taplin Hill
546.7 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 5

Taplin Hill is located along the western edge of Bradford at a mean elevation of 942 feet and is part of a 1000 acre wildlife habitat mostly found in Corinth. The 547 acre CHU provides 355 acres of core wildlife habitat and 265 acres of potential deer winter habitat. Taplin Hill contains 1.6 stream miles and provides 71 acres of forested riparian wildlife habitat. The South Branch of the Wait's River crosses this CHU. The site also has 49 acres of early succession wildlife habitat. This relatively large CHU is quite diverse and has a high horizontal diversity.

3.2.13 Roaring Brook CHU

Roaring Brook CHU
813.6 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
25% Conserved
ANR Block Priority: 5

Roaring Brook CHU is located in the northeastern section of Bradford at a mean elevation of 697 feet. This CHU is 814 acres is size and contains 560 acres of core wildlife habitat. The site provides 532 acres of deer winter habitat some of which is dominated by Eastern hemlock cover. Roaring Brook CHU contains the Roaring Brook watercourse and 1.8 miles of total stream habitat and 56 acres of forested riparian wildlife habitat. Roaring Brook has over 28 acres of wetland, including a potential bear wetland, ledge and mast-bearing trees. The site contains 45 acres of early succession habitat and 2 vernal pools have been identified within the CHU. 203 acres of this CHU are conserved. Roaring Brook has a moderate horizontal diversity.

3.2.14 Newbury CHU

Newbury
223.4 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 4

The Newbury CHU is located at a mean elevation of 806 feet elevation along the town's northern border. I-91 borders this 223 acre CHU to the east. The Newbury CHU provides 147 acres of core habitat, and 149 acres of potential deer winter habitat. The results of the road tracking survey found use of this area by deer during one winter. The Newbury CHU has over 1.5 stream miles and 38 acres of forested riparian habitat.

3.2.15 Goshen CHU

Goshen

101.3 Acres

Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 4

The Goshen CHU is a 101 acre area surrounded by grasslands in northcentral Bradford. With a mean elevation of 993 feet, this site contains no core wildlife habitat, but does provide 71 acres of potential deer winter habitat at least some of which has an Eastern hemlock forest component. Associated with its 1.7 miles of stream are 27 acres of marsh and beaver-influenced wetlands and 47 acres of forested riparian wildlife habitat. The small Goshen CHU is quite diverse and exhibits a high horizontal diversity.

3.2.16 Wrights Mountain CHU

Wrights Mountain

1633.6 Acres

Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
36% Conserved
ANR Block Priority: 7

The Wrights Mountain CHU is a large 1634 acre forested area that provides 1280 acres of core wildlife habitat in the northwest section of Bradford at a mean elevation of 1141 feet. This wild forested area continues north into Newbury and comprises over 5000 acres of contiguous wildlife habitat. This CHU has 1041 acres of potential deer winter habitat which based on road tracking exercises was used by deer in both 2014 and 2015. Wrights Mountain contains 7.8 miles of stream and rivers, including the Wait's River and contains over 230 acres of forested riparian wildlife habitat. The Wait's River provides habitat for a cold-water fishery and habitat for water birds and aquatic mammals such as otter and mink. The forest contains ledge habitat as well as early succession habitat, and 35 acres of swamp and marsh wetland. The CHU has potential bear wetlands and extensive areas of mast trees which when combined with its remoteness provides suitable black bear habitat. Wrights Mountain contains 590 acres of conserved land and 10 vernal pools have been identified within this CHU. The Wrights Mountain CHU is not only large but also exhibits a high horizontal diversity.

3.2.17 Meadow Brook CHU

Meadow Brook
541.6 Acres
Core Forest
Deer Winter Habitat
Streams
Wetlands
Early Succession
Forested Riparian
Mast Stands
Ledge/Cliff/Talus
Bear Wetlands
Vernal Pools
Sig. Nat Comm
0% Conserved
ANR Block Priority: 4

The Meadow Brook CHU is located in the northwestern corner of Bradford at mean elevation of 917 feet. This 542 acre CHU provides 248 acres of core wildlife habitat. This site offers 418 acres of potential deer winter habitat and road tracking surveys found Meadow Brook to be used by over-wintering deer in 2014 and 2015. Eastern hemlock and spruce are common deer winter habitat species in this CHU. Meadow Brook CHU includes areas of the Wait's River and Meadow Brook, providing 4.5 miles of fisheries and aquatic mammal and bird habitat. There are 28 acres of wetlands, including potential bear wetlands, 107 acres of forested riparian habitat, and 27 acres of early succession wildlife habitat within the Meadow Brook CHU. The Meadow Brook CHU has a low horizontal diversity.

3.2.18 Travel Corridors

Travel corridors are places where landscape and land use characteristics combine to form an area where wildlife can move across roads to and from different habitat areas. Many species of wildlife utilize a diversity of different habitat and plant community types within their home ranges (or territories). Wildlife move across the landscape for a variety of reasons, most often in search of new territories, food resources, or potential mates.

A good example to illustrate seasonal wildlife movements is that of the black bear in Vermont. The black bear typically moves in spring from its high, remote denning areas to wetlands (often forested seeps) lower on the landscape. In summer, bear will seek berry patches (soft mast) in openings and along old logging roads within the forest. In fall, bears will move to beech stands, orchards, or corn fields depending on the availability of natural foods in the forest.

Many of the wide ranging wildlife corridors identified in Bradford are located within areas of limited development and contain large, significant habitat features in close proximity to the corridors. As would be expected, wide ranging mammals are likely to find these areas most preferential as movement zones due to the relative lack of human disturbance and the necessities of moving between critical

food, cover and/or other habitats. General wildlife corridors for wide ranging species are shown on Figure 31.

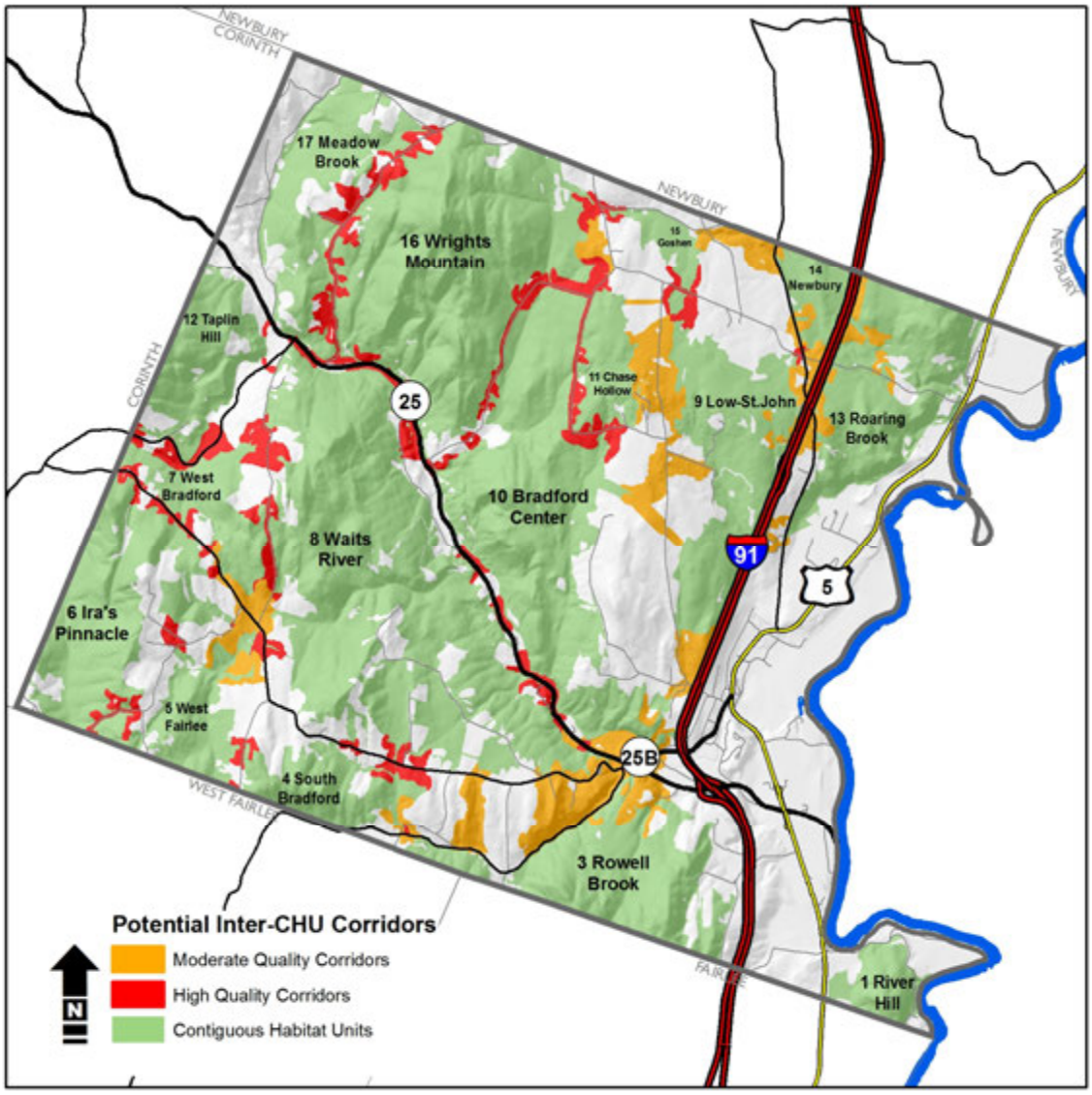

Figure 31: Potential Wildlife Corridors Map

Improvement and expansion of the vegetated buffer conditions of the Connecticut River and the tributaries feeding it would greatly assist in providing travel corridors throughout the Bradford area without putting undue burden on agricultural or development activities.

These probable corridors should be field verified and, if used by wildlife, should be considered as high conservation and protection priorities. Additional corridor areas may also be discovered in the course of additional field and more detailed, site-specific remote evaluation.

As part of the field assessment, winter road tracking was conducted with the goal of documenting road crossings and travel corridors currently being used by wildlife in Bradford. The Road Tracking Map, Figure 32 below, presents the summary of this data. Tracking data is discussed in greater detail for CHUs in the previous section.

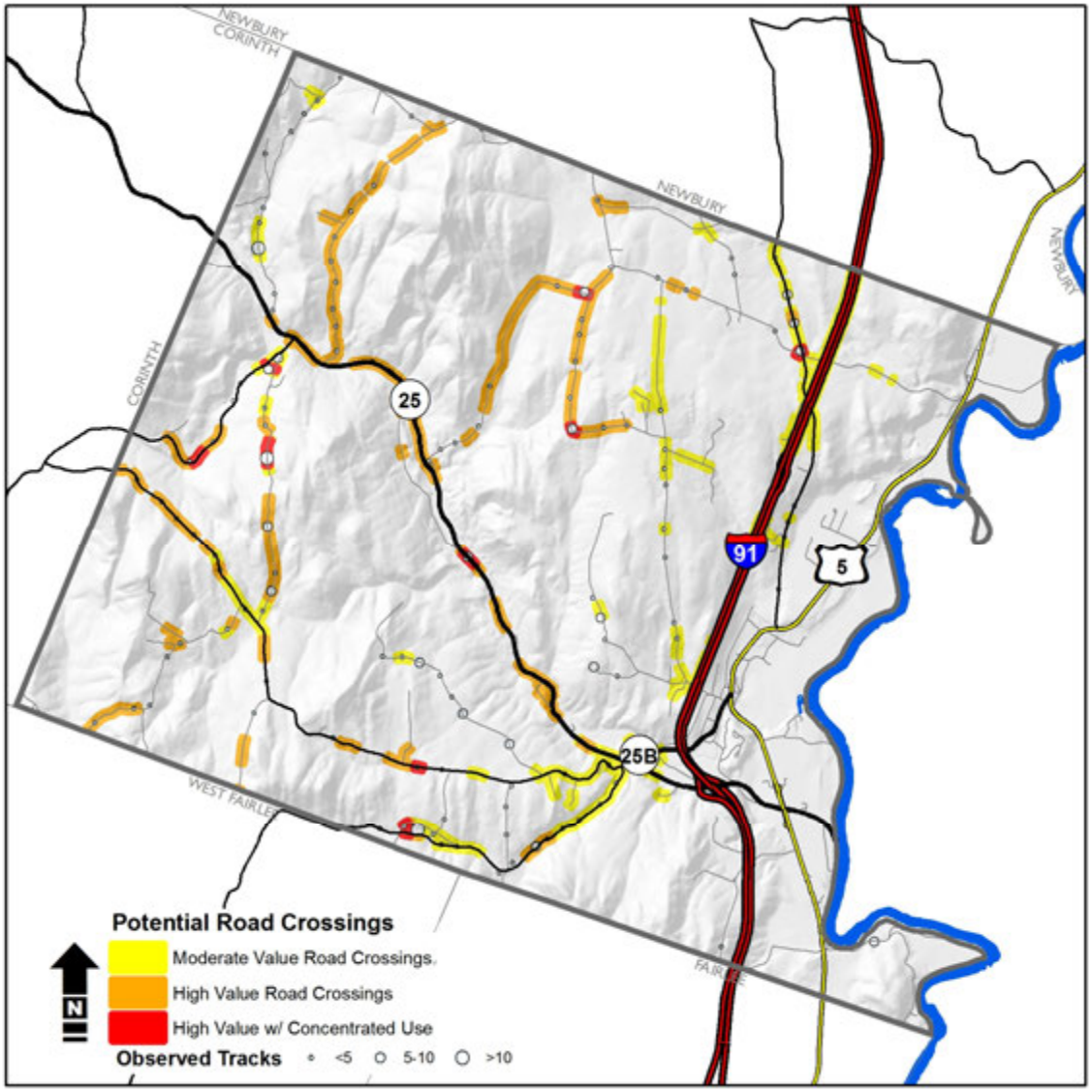

Figure 32. Road Tracking Map

3.3 Wildlife Habitat Overview for Bradford

Typical of much of hilly Vermont countryside, paved and non-paved roads sub-divide the town of Bradford into smaller and smaller functional wildlife habitat units. The South, Fairground, Wait's River, Goshen and Tarbox Roads act as partial barriers to wildlife and wildlife movements around Bradford. I-91 is a more complete barrier for most wildlife. Bradford's Contiguous Habitat Units (CHUs) vary in size from the large 2100 acre Waits River CHU down to the 100 acre Goshen CHU, and of course there are even smaller areas of wildlife habitat in Bradford--down to the individual trees in Bradford Village--that provide sustenance and nesting habitat for squirrels.

The largest un-fragmented wildlife habitats are the Bradford Center, Waits River, and Wright's Mountain CHUs. These three large CHU's combined provide over 5100 acres of un-fragmented, wild, largely undisturbed wildlife habitat. These CHUs provide extensive areas of core wildlife habitat largely free from edge habitat where predator and prey alike live far away from the artifacts of human existence. The Wright's Mountain area is also adjacent to large wild forests in Newberry north of Bradford and wildlife likely moves between the two areas.

Figure 33. Moose

These large CHUs provide extensive habitat for Bradford's deep forest species, many of which require large tracts of forestland with varied habitat features such as a mix of forest types, wetlands, ledge, mast-bearing trees, and early succession vegetative types. Dominant reproductively active females of species such as black bear, fisher, bobcat, and moose establish home ranges in the large CHUs incorporating the best of all their various habitat requirements. Moose inhabit the forests of Bradford and considerable moose sign was evident in the Wright's Mountain region. Many of these deep forest species also require access to varied and disparate habitat features, such as specific foods during defined times of the year, microhabitats such as ledge for breeding or relief from inclement weather, or access to the aquatic resources of streams, ponds, and wetlands. Different habitat features can be used

for breeding, rearing of young, refuge from weather, competitors, predators, as sources of food and/or water, or as refuge from humans, their pets, and their disturbances.

The core forests with less human disturbed forest edges provide excellent habitat for many species of birdlife. These large forests provide nesting habitat for species of hawk, owl, and songbirds such as the scarlet tanager and black-throated blue warbler that nest preferentially in Bradford's larger forest blocks. Core forests generally contain lesser amounts of edge habitat. For many songbirds, this is a bonus. Often with edge habitat comes an increase in nest predators, such as cats, snakes, and raccoons. In the northeast, the parasitic brown-headed cowbird lays its eggs in the nests of other unsuspecting songbirds-causing a decrease in the reproductive success of many of these host birds as the young cowbird grows rapidly and outcompetes the host birds own young.

It is these larger CHU's and their core forests that provide the greatest area and the greatest potential for the maintenance and expansion of many of Bradford's wildlife populations. These areas have the greatest number and density of breeding females of many of Bradford's more wary species, such as the black bear. Keeping these areas wild and un-fragmented is the most important and most effective means of maintaining Bradford's wildlife population and allowing its citizen's to continue to enjoy and coexist with wildlife.

Smaller, or less remote CHUs also provide important wildlife habitats in Bradford. The wildlife that the people of Bradford often see or otherwise interact with can be associated with these smaller wild or semi-wild areas where roads reach into the homes of wildlife. During the summer, people see white-tailed deer, raccoons, and fox in these more humanized landscapes. In addition, these smaller CHUs can function as stepping stones, facilitating travel between the larger forest blocks in the region. This facilitation of

Figure 34. Mallard Duck

wildlife movements can be crucial for some of the wider-ranging species and helps maintain continued genetic diversity so important in the maintenance of biological diversity.

Bradford's Connecticut River shoreline consists predominantly of cleared agricultural land, and the New Hampshire side of the river is similar in that forests rarely extend down to the river's edge. The broad reach of the Connecticut River provides extensive habitat for fisheries, both cold and warm water fisheries, i.e., trout, bass, and other panfish. The river otter, mink, and beaver live along the Connecticut's shorelines, oxbows, and wetlands. Herons, shorebirds, geese, and ducks utilize the banks and waters of the Connecticut to fish, nest, and raise their young. Osprey, belted kingfisher, and the occasional bald eagle fish along its shorelines.

Similar conclusions can be drawn concerning Bradford's other abundant waterways. The Wait's River is the largest of these, with the Wait's tributaries reaching deep into the majority of Bradford upland forests. In fact, because of the ubiquity of paved roads along the mainstem of the river, the Wait's River tributaries are more likely to flow through wild forests. However, even with paved roads following most of the Wait's River path it remains home to mink, river otter, cold water fish such as trout, and a host of bird life such as the belted kingfisher, ducks, geese, and shorebirds such as herons.

3.4 Management Recommendations for Wildlife Habitat

3.4.1 Large Contiguous Habitat Units

The large Contiguous Habitat Units described above are areas with large core size, substantial forest interior habitat and generally a wide-diversity of wildlife habitat elements. They provide important habitat for large, wide-ranging wildlife such as black bear, habitat for forest interior birds, as well as specific habitat features critical for a wide variety of other species.

Forest fragmentation in the larger CHUs should be discouraged. Roads, housing and most other human activities should be restricted to the periphery of these units.

Roads built to facilitate forest management activities should be allowed to revegetate when management activities are completed in an area.

Natural connections between the various wildlife habitats/elements within the units should be maintained.

To maintain deep forest habitat for many declining songbirds, forest clearing and land development should be managed to avoid the extension of edge conditions (a hard break between forested and unforested areas) into the interior of the core forest.

Forest management activities that support a diversity of forest types and early successional habitat are an appropriate use of these areas and consistent with all of the above recommendations.

3.4.2 Grassland Bird Habitat

As mentioned above, the presence of suitable habitat to support grassland bird species is in decline. The availability of this habitat is dependent upon proper land management. There are a number of resources available to assist landowners in developing management practices that not only provide for successful breeding by grassland species, but also allow continued agricultural use of the land.

Additional information about land management activities that can directly benefit grassland birds is available from Audubon Vermont at: http://vt.audubon.org. Communities should consider encouraging landowners to work with Audubon and other partners such as the USDA NRCS (Natural Resource Conservation Service) to provide and maintain grassland bird habitat. The Vermont Fish & Wildlife Department provides a number of management guidelines for grassland birds on the following webpage http://www.vtfishandwildlife.com/cwp_elem_spec_gbh.cfm.

3.4.3 Bear Habitat

Black bear require extensive remote areas to meet their yearly habitat requirements. Large areas without roads must be preserved to maintain sustainable populations within Bradford and the area. In addition, bears must continue to have access to mast stands and forested wetlands. Bear habitat management can focus on beech and oak stands that have documented bear use.

Mapped beech and oak stands and forested wetlands utilized by bear should be protected from development activities with buffers ¼ mile in extent. A professional biologist should address potential impacts to bear and their populations in these cases.

Harvesting of beech or oak that shows current or historic use by bear should be discouraged. Beech trees with Beech Bark Disease will continue to produce beechnuts and be visited regularly by bear.

Forest management activities are generally consistent with black bear habitat, and, at times, can enhance it by producing soft mast crops such as black and raspberries. However, the removal of important mast species such as American beech trees can have negative effects upon bear. Logging roads entering bear habitat no longer in use should be de-commissioned to prevent easy entry by humans into remote areas that bear's depend upon.

3.4.4 Ledge, Talus, and Cliff Habitats

Ledge, talus and cliff habitats are utilized by nesting birds, resting wildlife, and in some cases denning bobcats and porcupine.

Human development activities should be discouraged on and near ledges, talus, and cliffs. A minimal 100' buffer should be maintained between these habitats and human development activities.

Forest management activities are generally consistent with ledge, talus and cliff habitat protection.

3.4.5 Deer Winter Habitat

These habitats are critical to the survival and maintenance of deer populations in the Bradford region. Without deer winter habitat preservation, deer populations within the region could decline.

Deer winter habitats identified in this study should be protected from human activities by 300' buffers.

A professional biologist should assess potential impacts from human development activities (except forest management activities) proposed within 300' of deer winter habitats.

Some guidance to the protection of these deeryards is contained in the Vermont Fish and Wildlife Department's 1999 *Guidelines for the Review & Mitigation of Impacts to White-tailed Deer Winter Habitat in Vermont; and, Management Guide for Deer Wintering Areas in Vermont* which includes forest management guidelines.

3.4.6 Forested Riparian Communities

Forested riparian habitats offer important wildlife habitat and provide cover for wildlife movements. Wherever possible, forested riparian communities should not be fragmented by human activities.

Forest management activities in forested riparian communities should utilize selective harvesting techniques only and maintain a continual forest cover.

3.4.7 Travel Corridors

Functioning travel corridors allow for the movement of wildlife across the landscape. Conservation of wildlife travel corridors is often a difficult undertaking in that much of the negative impact to these features happens slowly over time. The effect on a particular corridor from one residential development, for example, may be small. Over the years, however, as more small development occurs, the once functioning travel corridor may receive less use and eventually be abandoned. Concrete management recommendations for the travel corridor presented here are, therefore, difficult to develop. The following steps, however, will increase the knowledge about the specific corridors in the town and enable planners to draw more specific conservation guidelines.

Conduct field verification studies to identify and characterize the important travel corridors within the Bradford region and especially those presented in this study.

Prioritize the importance of these travel corridors for conservation action.

Take steps to conserve the most important travel corridors by creating isolation buffers around them to maintain wildlife movement patterns.

Limit development to the outside edge of corridors and encourage screening, natural color schemes and other actions to limit negative effects of development in or near corridors.

Improve vegetated buffer conditions along rivers and streams to provide protected movement opportunities for wildlife.

4: Conclusions

As part of this inventory, seven different upland natural community types were mapped. These range from small, 1½ acre Dry Oak-Pine Forests containing stunted oak trees to large, 900 acre Hemlock-Northern Hardwood Forests with stately hemlock trees towering over the forest floor. Eight of these sites have been determined to be state or locally significant sites, most of these in the Wright's Mountain and Roaring Brook areas. Another eight sites have been flagged as potentially significant pending further field work.

Seventeen distinct contiguous wildlife habitat units were mapped in Bradford, which constitutes approximately 60% of the town's area. Contained within these CHU habitats are wetlands, talus and ledge, early succession forests and shrublands, and forested riparian wildlife habitats. These habitat elements are sought out by wildlife for the food, water and cover they provide seasonally or on a year-round basis. This diverse landscape provides sustenance to a wide variety of wildlife including: moose, deer, bear, fisher, weasels, bobcat, raccoon, porcupine, coyote, red and grey fox, snowshoe hare, rodents, and a wide variety of birdlife. The town's ponds, streams, and rivers such as the Waits and Connecticut Rivers provide habitat for a variety of aquatic and semi-aquatic life such as fish, mink, otter, muskrat, beaver, as well as waterfowl and shorebirds.

The larger forest blocks within Bradford including the Wright's Mountain, Waits River, and Bradford Center areas provide remote wildlife habitats inhabited by moose, bear and bobcat. And while Bradford citizens may seldom directly observe these animals within these haunts -- these areas remain vitally important to the persistence of deep forest wildlife in Bradford. The towns smaller, more human influenced forested areas, harbor the red fox, turkey, deer and other wildlife that we enjoy observing on a regular basis.

Maintaining these functioning ecosystems, however, is only possible with proper management and planning. It is our hope that this inventory will provide the necessary information to landowners and town planners to manage these resources in a way that is beneficial to both the humans and wildlife that share the town of Bradford.

Bradford Natural Resources: Upland Natural Communities and Wildlife Habitat

Appendix 1:

METHODOLOGY

May 1, 2015

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Methodology

The Bradford Natural Resources Inventory project included the identification, inventory and assessment of upland natural communities and wildlife habitat in the town of Bradford, Vermont. Existing digital and paper databases were used remotely mapping resources and determining areas of potential significance to identify sites for field assessments. These natural areas were evaluated by specific ecological and landscape criteria to determine the significance and value that these areas have to the natural heritage of the town. The methodology and findings of the inventory are documented in this appendix.

The methodology section is organized into four sections, A. Public Sightings Map, B. Landcover Delineation, C. Upland Natural Communities, and D. Wildlife Habitat.

A. Public Sightings Map

Arrowwood Environmental, through the Bradford Conservation Commission sought public comments from members of the professional natural resource management community with experience in the Town. An on-line mapping application was created whereby professionals and amateur naturalists could document and map known locations of specific natural communities, wildlife habitat, wildlife crossing areas, or actual sightings of wildlife, or their sign. Access to the application was distributed by the Bradford Conservation Commission. Only a limited amount of data was collected with this tool, but the online application can stay active if the Bradford Conservation Commission wishes to continue to solicit sightings from the community.

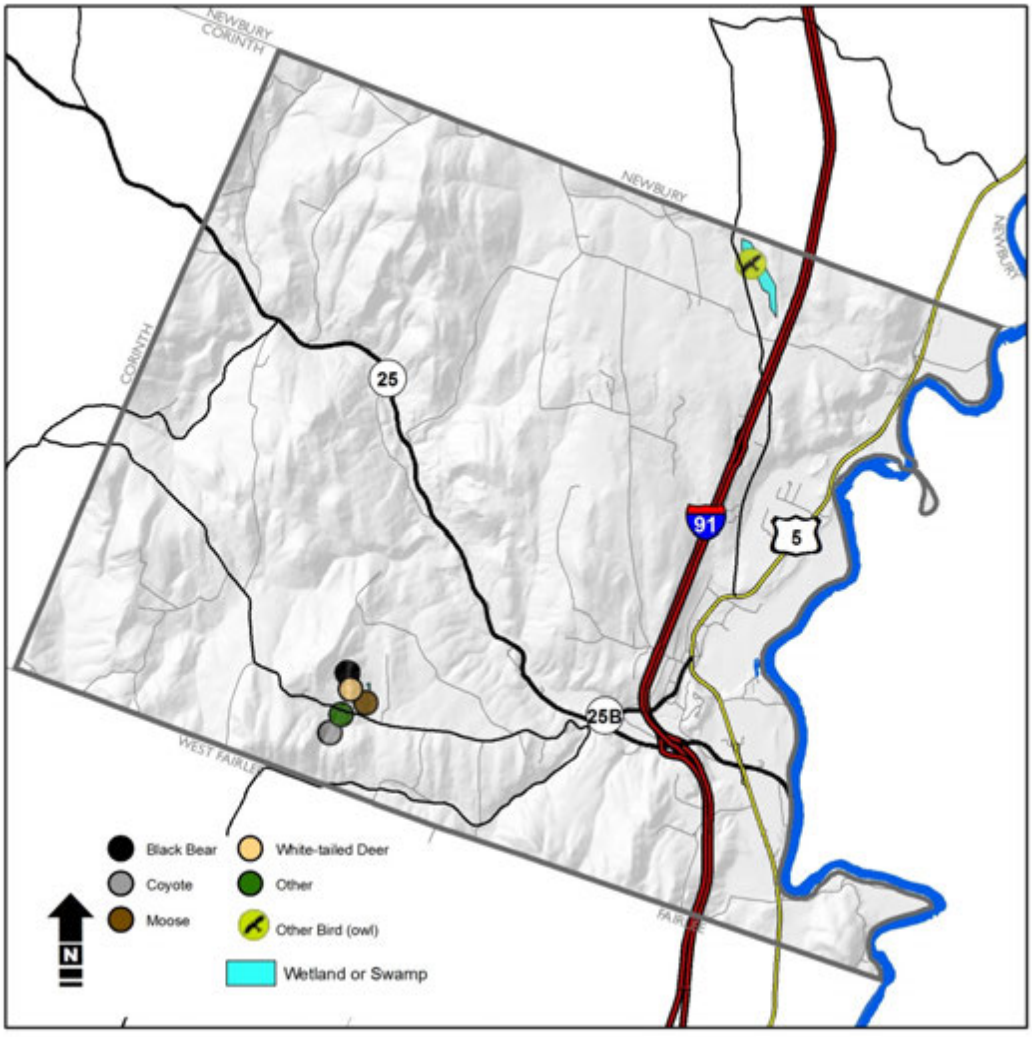

Figure 1. Local Habitat and Species Sightings Map

B. Landcover Delineation

Arrowwood Environmental (AE) built several of the GIS layers utilized in this project from a foundation of basic landcover analysis. This analysis was conducted by AE personnel, and is intended to replace the use of the statewide LCLU (landcover/landuse) dataset available from the Vermont Center for Geographic Information (VCGI). Although the VCGI LCLU data is available covering the entire state of Vermont, AE has found the level of detail too coarse (30 meter

resolution) to effectively assist on a town-scale analysis of natural heritage elements. For this inventory, AE conducted a combined automated and manual digitization of broad classifications of land cover types.

Development- Developed areas were delineated using a collection of publicly available statewide data sources obtained from VCGI. Features in these source datasets were buffered to approximate an average development disturbance as detailed in the table below.

Selected Data	Data Source	Source Data Type	VCGI Layer Name	Source Data Date	Buffer Generated
Driveways	E-911 Driveway Centerlines	Polyline shapefile	EmergencyE911_DW	2013	12 feet both sides of line
Houses & Other Buildings	E-911 Site Location	Point shapefile	EmergencyE911_ESITE	2013	100 feet around point
Major Roads-Class 1,2, State	Vtrans Road Centerlines	Polyline shapefile	Trans_RDS	2013	30 feet both sides of line
Major Roads-US Routes	Vtrans Road Centerlines	Polyline shapefile	Trans_RDS	2013	50 feet both sides of line
Minor Roads- AOT Class 3,4, trail & Forest Roads	Vtrans Road Centerlines	Polyline shapefile	Trans_RDS	2013	20 feet both sides of line
Railroads	Vtrans_RR	Polyline shapefile	Trans_RR_Line	2005	50 feet both sides of line

Further modifications were made to the developed areas during the hand delineation process described below.

Open Land- open, non-forested land was delineated by hand from 2012 series Vermont Mapping Program 0.5 meter resolution black and white orthophotography. The orthophotography was visually analyzed at a scale of approximately 1:5000 or better on a computer monitor within a geographic information system (GIS) software platform. Non-forested agricultural, recreational, residential, commercial and industrial areas were digitized by hand in the GIS software.

Transitional areas were best fit by the assessor into "open land" or "developed land" categories.

Using GIS based geoprocessing tools, the buffered developed areas were erased from the hand digitized open areas. From these, wetland natural communities, as described in Section C of this report were also erased. At this point, anything not depicted as developed, open, or wetland was considered an upland natural community and mapped according to methodology explained in Section D. Boundaries were adjusted and classifications adjusted as appropriate through the remainder of the inventory and assessment project. A sample result of this process is shown in Figure 2.

While an effort was made to be relatively accurate at the working scale, the scope of this project did not include either the budget or time necessary to complete a highly accurate manual digitization of landcover classes. The intention of this exercise was to provide a more accurate depiction of landcover types within the towns than is currently available from remotely sensed sources in a rapid fashion. Other than visual review, no quality assurance was conducted, no tests of consistency were completed and no measure of expected accuracy was assessed.

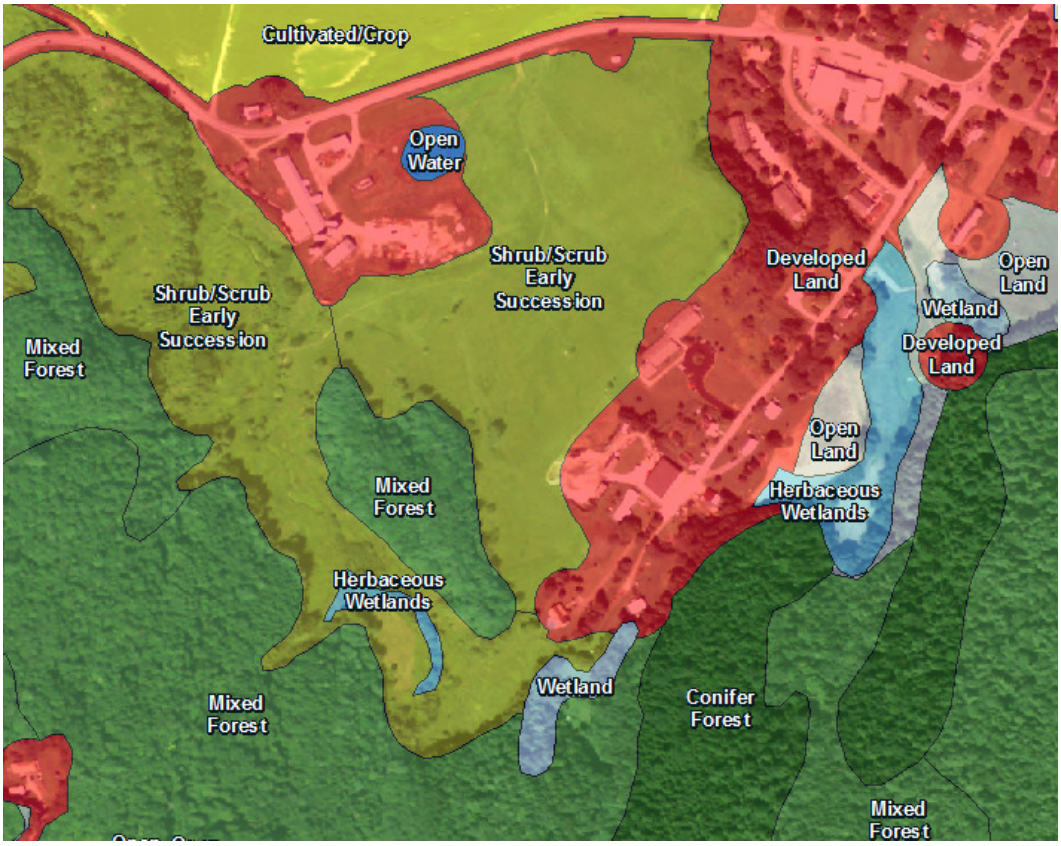

Figure 2. Sample Result of Land Cover Mapping

C. Upland Natural Community Mapping and Assessment

Upland natural communities were identified and mapped in Bradford during this inventory. The natural community assessment was conducted in two phases. The first phase was a remote landscape analysis of the study area and the second was field evaluations of selected sites. Results of each of the phases were brought together to create the final Natural Communities Inventory Map. The phases of the assessment are described in more detail below.

C.1. Remote Uplands Landscape Analysis

The remote landscape analysis consist of using existing remote data sources of natural resources in the town to develop a preliminary map of upland natural communities. Information sources that were reviewed during the landscape analysis process include: Natural Resources Conservation Service soil survey maps, Black and White Orthophotography, NAIP Color orthophotography, U.S. Geological Survey (USGS) topographic maps, and the Non-Game Natural Heritage Program (NNHP) database. The NNHP data base includes information on previously mapped and assessed significant natural communities in the town and area. These sites were incorporated into the natural community mapping and noted in the attribute data for each occurrence.

In addition to these sources, the Use Value Appraisal data was consulted. This publically available data includes forest management plans on lands enrolled in the Use Value program. This data aided in the remote mapping of forests by linking forest stand types to natural community names. In some cases, information on wildlife use was also obtained and incorporated into the map. Finally, forest community types in Bradford were discussed with county forester Dave Paganelli.

Preliminary boundaries of natural communities were drawn using various orthophotographs as a base map. Each site was given a preliminary natural community name based on Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont (Thompson and Sorenson, 2000) and the NNHP updated community classification (March 26, 2014).

C.2. Field Assessments

Field assessments of selected sites were conducted during the 2015 field season. Using the information from the remote analysis, the field inventory seeks to refine the base map and gain more in depth information not obtainable from remote sources. The field inventory focused on 1) classifying the natural communities mapped during the remote analysis and 2) assessing the current condition of those

natural communities. Landowner permission for conducting field visits was secured by the Bradford Conservation Commission before field visits were made. No parcels were visited without landowner permission.

For natural communities that received a site visit, an overall ecological inventory was conducted. This inventory included the identification of the dominant plant species by strata, information on soils, and an explanation of the development of the community, where appropriate. Notes on the current condition of the community were also taken. This brief assessment includes information on the degree of and time since major human disturbance and information on the presence or absence of non-native, invasive plant species.

C.3. Upland Natural Community Map Creation

Once fieldwork was concluded, field data was compiled and integrated into the Upland Natural Communities Inventory Map. This involved adding natural communities that were discovered during the field inventory, changing community boundaries on the map and removing sites that were determined not to be uplands. Due to the difficulty of mapping natural communities on a town-wide scale, some larger polygons contain small fields and areas of residential development. Some smaller forest patches (especially those surrounded by open land) did not get mapped. Data from the field visits were also incorporated into the attribute table which is linked to the map. Attribute information for the upland natural community map is presented in Appendix 3.

C.4. Natural Community Ranking and Significance Determination

Determining the local or state significance of natural features occurs after all of the field work is completed and the final maps are compiled. The local or state significance methodology is based on the system used by the Vermont NonGame and Natural Heritage Program. For natural communities this methodology takes into account the rarity, size and condition of the community as well as the quality of the landscape that the community exists in.

The state has a system of rarity rankings that are based on a numeric system of 1-5 (from rarest to most common). This rank is usually preceded by an "S" to indicate that the rank is on the state-wide scale. This ranking is assigned to each community type as a whole and does not refer to specific examples of the community. This rarity ranking is included in the database in the "State_Rank" field and is based on the following system:

- S1 Very Rare (1-5 occurrences)
- S2 Rare (6-20 occurrences)
- S3 Uncommon (> 20 occurrences)
- S4 Apparently Secure
- S5 Demonstrably Secure

Particular occurrences of communities are ranked based on the conditions present on the site. As mentioned above, the factors that determine the rank of a particular community include its condition, size and condition of the landscape. This alphabetic ranking (A-D) is included in the database in the "EO_Rank" (Element Occurrence) field. Sites that did not receive a field visit were not ranked.

For many natural communities, the ranking methodology allows for multiple communities to be grouped together and ranked as a single unit. Multiple communities of the same type which are separated by short distances on the landscape may be considered as one "element" when ranking. The grouping of some of these communities is shown in the "ElementGrp" field.

Once particular communities are ranked, the Element Occurrence ("EO_Rank" field) is compared to the State rarity rank ("State_Rank" field). A community would be considered state significant if the following criteria are met: S1 or S2 communities with an EO rank of A, B or C; S3 or S4 communities with an EO rank of A or B; S5 communities with an EO rank of A. These guidelines are considered in conjunction with professional judgment and knowledge about the site.

Local significance is determined following the methodology of determining state significance but puts the community in a local perspective. Local geology, biophysical region, size and condition of the community all play a role in determining local significance. All communities that were considered to be state significant are also considered locally significant. In addition, any community that doesn't meet the criteria for state significance but is considered to be significant on the town scale is also labeled as locally significant.

The reason for assigning significance to a community is listed in the "Justificat" (Justification) field of the attribute table.

D. Wildlife Habitat Mapping and Assessment

Wildlife habitat elements were identified within the Bradford study area utilizing Geographic Information Systems (GIS). All GIS data presented in this project should be considered approximate. The locations depicted are for planning and community level analysis purposes, and further field biological assessments should be considered a requirement for additional understanding of the function of the wildlife unit area on the landscape and its importance to any or all species that may utilize it. This section describes the derivation process for the individual habitat unit polygons, the attributes and assessment are discussed in the study report.

The following habitat elements were identified and mapped:

- Core forest units
- Deer winter habitat
- Mast stands
- Early succession areas
- Forested riparian corridors
- Wetlands
- Ledges, cliffs & talus

D.1. Core Forest

Core forest areas for the State of Vermont were originally developed by the UVM Spatial Analysis Lab (SAL) for inclusion in a region wide GAP analysis. AE utilized similar parameters as the original SAL project, but updated the inputs using landcover classifications from the land cover/natural community (NCLC) mapping efforts described above.

Developed and open land features from the NCLC were buffered by 100 meters and the remaining areas within the study area were considered Core Forest. For the purposes of this project, any Core Forest Units with an area of 20 acres or less were eliminated.

D.2. Deer Winter Habitat

Delineation of deer winter habitat, or deer wintering areas (DWA) began with review of the existing State of Vermont Deeryard data layer. Deer winter habitat was assessed remotely based on upland natural community descriptions discussed earlier in this report. Natural community polygons with an appropriate conifer component were assessed using GIS processing tools for their average aspect. Communities were then ranked using the following matrix where 1 is the highest value and 3 is the lowest and 0 denotes no value as a deer wintering area:

Natural Community	Deer Winter Rank
Dry Red Oak-Pine Forest	0
Hemlock Forest	1
Hemlock-Northern Hardwood Forest	2
Hemlock-Red Oak-White Pine Forest	2
Hemlock-Red Spruce Forest	1
Lowland Spruce-Fir Forest	1
Montane Spruce-Fir Forest	0
Montane Yellow Birch-Red Spruce Forest	3
Montane Yellow Birch-Sugar Maple-Red Spruce Forest	3
Plantation	3
Rich Northern Hardwood Forest	0
Mesic Red Oak-Northern Hardwood Forest	0
Red Pine Forest or Woodland	3
Red Spruce-Northern Hardwood Forest	3
Red Spruce-Heath Rocky Ridge Forest	2
Subalpine Krummholz	0
Temperate Hemlock Forest	1
White Pine-Northern Hardwood Forest	0
White Pine-Red Oak-Black Oak Forest	0
Spruce-Fir Tamarack Swamp	1

Average aspect was used to further refine the rankings as follows:

Rank	Aspect	Deer Winter Value
0	Any	None
1	Any	Likely
2	South or West	Likely
2	Other	Potential
3	Any	Potential

Following field evaluations, the polygons were modified to reflect conditions noted in the field, including current signs of use and habitat potential based on professional experience.

D.3. Mast Stands

Hard mast of importance to black bear within the study area is assumed to be American Beech and Red Oak tree species. Mast stands as identified for the purposes of this study originated from the following sources:

- Natural Communities mapped as a component of this project with a significant Oak component.
- Vermont Dept. of Fish and Wildlife bear points database (vector- point)
- Mast locations identified by the public on a project specific online mapping platform set up to collect local knowledge (none reported).
- Field visits by AE personnel
- Vermont Dept. of Forest Parks & Recreation, aerial forest health monitoring data- The VT Dept. FPR conducts annual aerial surveys throughout the State of Vermont in order to map forest health threats, insect attacks and tree disease. One disease identified and mapped by the aerial forestry team is Beech Bark Disease, a disease specific to American beech trees, and unfortunately quite prevalent in our region. AE utilized the FPR Beech Bark Disease data as provided in draft form by the VT Dept. FPR to identify areas where concentrations of American beech trees are likely to occur. As this data identifies areas of diseased beech trees, not necessarily those used by black bears, it was not utilized as a primary source for this project, but was referenced during secondary review.

Mast stands from all the above sources were confirmed or refined when visited in the field; however, no attempt was made to provide an accurate depiction of the extent or boundary of any American beech stand or concentration. Mast stands appearing in the data and maps accompanying this report are very general locations. Numerous possible mast areas were not evaluated in the field. This should NOT be construed as a complete accounting of all mast stand areas present within the project area. It is highly likely that unmapped mast stands exist in the town, and their identification should continue to be a conservation priority. Boundaries presented for this project are to be considered approximate, habitat quality and bear use were not methodically evaluated within the scope of this project.

D.4. Early Succession Habitat

Areas of early succession forest were delineated as a land cover component during the landcover analysis discussed above. Due to the limitation and resolution of the imagery, the areas defined as early succession were typically logging patch cuts, clear cuts or old fields. Small early succession patches in forested settings were not typically able to be seen, and therefore do not appear in the dataset. Wetlands identified as "old field" as well as beaver complexes and shrub community wetlands were added to the early succession habitat data, as many of these wetlands provide the vegetative structure and composition required by early succession obligate and facultative species. Any additional early succession areas discovered in the field were subsequently added to the dataset.

D.5. Forested Riparian Corridors

Identification of forested riparian corridors was completed through a remote GIS model with the following inputs:

- Vermont Hydrography Dataset stream layer (line)
- Vermont Hydrography Dataset waterbodies layer (polygon)
- AE Bradford Landcover analysis, described above

Streams were buffered at 50 meters, giving a 100 meter wide corridor. Areas within the corridor that were described in the AE landcover analysis as open, developed or misc, or were classified as agriculturally impacted wetlands in the natural community assessment were eliminated. Remaining forested areas within 50 meters of a stream, but separated from the stream by a road or not in contact with the stream centerline or waterbody edge were also eliminated using an automatic selection process.

All resulting corridor areas were merged to provide an approximation of intact riparian corridor areas.

D.6. Bear Wetlands

Wetlands more likely to be utilized by black bear for spring feeding activity were derived from the complete wetland inventory data described in the Wetland

Inventory study report (AE, 2005). The following wetland communities were included in this dataset:

Beaver wetlands, Seeps, Shallow Emergent Marsh, Cattail Marsh, Hemlock-Balsam Fir-Black Ash Seepage Swamp, Red Maple-Black Ash Seepage Swamp, Red/Silver Maple-Green Ash Swamp, Red Spruce Hardwood Swamp, Spruce-Fir-Tamarack Swamp, Alluvial Shrub Swamp, Northern White Cedar Swamp and Alder Swamp.

These wetland types were buffered by 500 feet and the composition of forested to non-forested area within each wetland buffer was derived based on the project land cover types. In addition, the perimeter of each wetland was evaluated for surrounding land cover types and the composition of the immediately surrounding landscape was determined. Because bears are more likely to visit and feed from wetlands in a landscape matrix that affords both thermal and visual cover, the following selection criteria were utilized to identify potential bear wetlands from the natural community group listed above:

Wetlands where: >50% of the surrounding landscape (500' buffer) is forested;

AND for forested wetland community types (ie. Hemlock-Balsam Fir-Black Ash Seepage Swamp, etc.) at least 50% of the wetland perimeter is adjacent to a forested area, OR, for non-forested wetland community types (ie. Shallow Emergent Marsh, etc.) where more than 60% of the wetland perimeter is adjacent to a forested area.

D.7. Ledges, Cliffs & Talus

Ledges, cliffs and talus areas were derived from the following sources:

- Slopes over 100% (45 degrees)- from an automated slope analysis conducted by AE using the VCGI 10 meter resolution "VT HYDRODEM" elevation data as input.
- Natural community units indicating ledge outcrops, cliffs or talus.
- Field identified ledges, cliffs or talus by AE ecologists.

D.8. Contiguous Habitat Units

Contiguous habitat units (CHUs) were derived from the above mentioned habitat elements. The contiguous units are patches of habitat that should be expected to provide a range of critical habitat function for a range of wildlife species including mammals, birds, reptiles and amphibians. CHUs were derived through combining the following previously described polygon layers:

- Core forest units
- Deer winter habitat
- Early succession areas
- Forested riparian corridors
- Wetlands
- Ledges, cliffs & talus

In many cases, there are forest zones adjacent to CHUs that likely function as secondary or possibly even primary habitat for some species but fall out of the definition used for development of the CHU layer.

Horizontal diversity was delineated within each CHU from 2006/2007 and 2011 orthophotography. Two separate axis were drawn (1) a north-south axis at the widest point of a core area, and (2) an east-west axis at the widest point of each CHU.

Along each transect a point was given for each natural community type, another point was given when a minor change in the community, such as a change in hardwood species dominance, or the additional of minor amounts of evergreen trees in an otherwise deciduous forest-- that was at least 100 meters, was encountered. A point was also recorded whenever a major physiognomic change was encountered along the transect and was at least 10 meters in extent. Major changes include a change in dominance from a deciduous to a conifer dominated forest, a change from forest to shrubland, or when a wetland was encountered.

All the changes along both transects were then totaled and divided by the length of the two lines (combined) to arrive at a measure of change per unit linear distance –

as a measure of overall horizontal diversity for the CHU. The number of changes divided by the total linear length of the axis yields a measure of the amount of vegetative change per unit length.

The more the vegetation changes along each axis-the greater the gross vegetative structural change within that CHU. By itself, and on a statewide basis, the amount of change per CHU is essentially meaningless (because we do not have this data over the range of the state). However, the high, medium, and low rankings provided in this study are a comparison of the relative diversity of the vegetative structure of CHU areas within the Bradford study area.

Each CHU was then described by a variety of statistics as presented in summary table format in Appendix 2 and listed below.

- Size of Contiguous Habitat (core habitat and overall)
- Horizontal Diversity of CHU
- Length of Streams
- Size of Deer Winter Habitat
- Area of Wetlands
- Presence (Count) of Vernal Pools
- Area of Early Succession Habitat
- Area of Riparian Corridor
- Presence of Mast Stands
- Presence of Ledge/Cliff/Talus
- Presence of Significant Natural Communities
- Elevation metrics
- Area of Conserved Land

D.9. Wildlife Travel Corridors

Travel corridors, also called connecting lands or connecting habitats are land areas that serve to link other patches of important wildlife habitats together. Some species of wildlife rely on a variety of habitat features that are often separated from each

other by roads, houses or other impediments to easy movement. Species in this category include many amphibians, bobcat, fisher, and river otter. Others species such as moose, deer and black bear require large tracts of similar landscape that are quite rare in the developed northeastern United States. In order to survive in this region, these wide ranging species must move between several habitat patches of similar makeup.

D.10. CHU Corridors and CHU Road Crossings

The process of identifying general wildlife travel corridors seeks to predict areas within a town or area that are most likely to provide safe and preferable passage to a wide range of non-specific wildlife from one large habitat patch (in this case: CHUs) to another. AE utilized three components in attempting to identify these locations. The components and their parameters all consider the landscape in somewhat general terms, at varying levels of resolution, with the intent of rapidly capturing a sense of potential habitat blocks and movement potential between them. The following steps were taken to identify potential wildlife travel corridors.

1. Road Track Value- road tracking points were counted based on a 150 meter square cell. Cells were assigned a ranking value based on the number of track points present:

# Track Pts	Rank
1-3	0
3+	1
0	NoData

2. CHU Corridor Rank- Corridor values were calculated and modeled in GIS as follows: Cost-Distance values were developed for each CHU within the study area. The result represented a combined distance and cost score for every 10 meter x 10 meter cell within the study area relative for each CHU. These maps used the combined Natural Community and landcover data to determine travel cost as

animals move across the landscape where lower cost represents a "safer" cover type for wildlife movement while numbers in the middle of the scale are considered "neutral" in the Land Cover/Cost table below:

Land Cover	Cost Score
Forested	1
Mixed Forest	1
Forested/Shrub Wetlands	1
Conifer Forest	2
Herbaceous Wetlands	2
Deciduous Forest	3
Open- Grassland	3
Agricultural	3
Pasture/Hay	3
Shrub/Scrub Early Succession	4
Unknown	5
Open Water	5
Barren- Rock/Sand/Clay	5
Wetland	5
Upland	5
Open Land	6
Developed- Open Space	7
Cultivated/Crop	7
Developed Land	10

The costs for each CHU and each of its adjacent CHUs in turn (1-3, 2-3, 2-3, 2-8 etc.) were then summed to provide a relative accumulated cost value for travel between each CHU and each of its neighbors.

The Cost Value between CHUs was reclassified and ranked based corridor potential using the following scale: (note corridor values are relative for the study area and are simply accumulative cost and distance measures, the breakout below was subjective based on professional judgment and local knowledge)

Corridor Value	Rank
1-500	High
500-1200	Low
>1200	None

If a CHU to CHU corridor had areas with values scoring 500 or below, those areas were ranked High. If however, a given CHU to CHU corridor score was higher than 500, the areas scoring less than 1200 were ranked Moderate. This procedure insures that in areas of high permeability between CHUs, only the best areas are flagged as potential corridors, while in areas of lower permeability, the threshold is lowered allowing for more compromised movement in these zones.

4. Potential Corridors: Potential corridors were hand placed using the Combined Corridor Value, public sighting input (from online map), CHU proximity to roads and professional judgment as a guides. The Bradford tracking points were used as a final check to cross reference corridor placement.

5. Combined Corridor Value and Road Tracking: The Corridor Rank and Road Track Value were added together and the results of this clipped to an area 200' on either side of roads. This results in the Road Crossings layer with high value corridor areas where concentrated tracks were found scoring highest as potential wildlife road crossing locations.

The CHU Corridor and CHU Road Crossing data are intended to represent LIKELY or POTENTIAL locations where wildlife move across the landscape and cross roads between contiguous habitat units. More field work and analysis would be required to develop an understanding of actual use and/or viability of these areas as effective and valuable corridors.

D.11. Road Tracking

Two road tracking assessments were conducted as part of the Bradford NRI. On March 25, 2014, and February 17, 2015 all of the public roads (with the exception of roads within the Village of Bradford) were driven and wildlife tracks that were observed within the road ROW were recorded.

Wildlife tracking assessments were timed to occur under the best available conditions, with no new snowfall within the previous 48 hours at a minimum. Snow and crust conditions varied between tracking dates. Snow depths in both years were above average and deep snow banks along roadsides made for challenging conditions. Because of this, it was often difficult to observe tracks from the road that were located within the ROW but behind the high snow banks.

All wildlife tracks which came into the ROW were recorded and the location mapped with a mapping grade GPS (assumed accuracy+/-30 feet). In general, tracks made by small animals such as rodents, squirrels and birds were not recorded, however larger birds that serve as significant prey species such as wild turkey were recorded when observed. An attempt was made to isolate tracks of animals that may have walked parallel to the road entering the ROW at more than one location. Tracking along the corridors was limited to the road ROW and because of this a positive identification of all wildlife tracks was not always possible. When a positive identification of a track to species was not possible, an educated guess was attempted wherever adequate features were available. If no educated guess could be made, an "unknown track" was recorded for that location.

Every attempt was made to distinguish between tracks that were comprised of singular or multiple individual animals leaving sign of their passing. Where a well-worn path was left as a result of multiple animal passings -- the location was recorded as a "multiple trail". This was common in areas where white-tailed deer utilized common trails to move on the landscape in the winters of 2014 and 2015 when deep snow cover was present.

Appendix 2
Wildlife Habitat Summary Data for Contiguous Habitat Units

CHU #	NAME	Size (acres)	Core Area (acres)	Deeryard Area (acres)	Stream Length (miles)	Wetland Area (acres)	Early Successional (acres)	Forested Riparian Corridor (acres)	Mast Present	Ledge Present	Bear Wetland Present	Vernal Pool Present (#of)	Significant Natural Community Present	Max Elevation (ft)	Min Elevation (ft)	Elevation (mean)	Elevation Range (ft)	CHU Horizontal Diversity Rank	Conserved Area	ANR Habitat Rank
1	River Hill	171.3	78	145	0.0	23.1	0	7		Y	Y	0		748	394	543	354	L	0	1
2	Spaulding Hill	148.9	116	57	0.3	0.0	1	10				0		1285	808	1015	477	H	0	7
3	Rowell Brook	891.3	644	622	2.6	9.2	14	68	Y	Y	Y	0	Potential	1326	510	877	816	L	0	7
4	South Bradford	309.9	188	183	1.5	8.0	15	46				2		1483	928	1212	555	H	0	4
5	West Fairlee	442.3	256	249	3.8	9.0	18	114	Y		Y	0		1491	967	1195	524	L	0	7
6	Ira's Pinnacle	803.3	529	617	3.0	5.3	39	104	Y		Y	1	Potential	1491	792	1114	699	L	0	7
7	West Bradford	309.9	185	242	1.7	7.7	17	67				2		1254	716	976	538	M	0	4
8	Waits River	2097.8	1177	1638	7.1	55.4	102	282	Y		Y	4	Yes	1473	495	915	978	M	74	5
9	Low-St.John	717.6	357	576	2.5	34.3	42	88			Y	4	Yes	1094	650	924	444	M	51	4
10	Bradford Center	1419.6	907	1201	7.1	13.9	48	244	Y	Y	Y	0	Potential	1112	471	805	641	L	30	6
11	Chase Hollow	228.4	82	217	1.8	6.2	5	15			Y	0		1187	1008	1130	179	H	0	3
12	Taplin Hill	546.7	355	265	1.6	0.7	49	71				0	Potential	1286	599	942	687	H	0	5
13	Roaring Brook	813.6	560	532	1.8	29.0	45	56	Y	Y	Y	2	Yes	890	400	697	490	M	203	5
14	Newbury	223.4	147	149	1.5	8.5	5	38			Y	0		909	719	806	190	H	0	4
15	Goshen	101.3	0	71	1.7	27.0	3	47			Y	0		1095	928	993	167	H	0	4
16	Wrights Mountain	1633.6	1280	1041	7.8	35.7	25	232	Y	Y	Y	10	Yes	1826	544	1141	1282	H	590	7
17	Meadow Brook	541.6	248	418	4.5	28.8	27	107			Y	0		1263	593	917	670	L	0	4

Table 1: Natural Community Attributes (Wetland and Upland Communities)

Field Name	Meaning	Responses	Description
FID	Feature Identification	Integer	Feature identification number, assigned by ArcGIS software
UniqueID	Unique Identification	Integer	Unique identification number
FieldID	Field Identification	Integer	Identification number that links to the field forms
Type	Type	Integer	Indicates upland or wetland community Upland, 2- Wetland or Open Water
NatCom	Natural Community	General Text	Lists the primary natural community present on the site
NatCom2	Natural Community 2	General Text	Lists an alternate or co-dominant natural community on site
Comments	Comments	General Text	Comments on the ecology, vegetation or mapping of the community
Source	Source	See Source table Above	Indicates who conducted the mapping of the site.
CONS_STATS	Conservation Status	Complete/Partial	Indicates whether the site exists on conserved land.
Acres	Acres	Integer	The size of the community in acres
Field_Visit	Field Visit	Y/N/WS: Yes/ No/ Windshield Survey (public access)	Indicates whether the site received a field visit. Drive-by denotes sites that were viewed from a public access site such as trails or roads. (STATE) denotes sites that were visited by state personnel.
State_Rank	State Rank	S1/S2/S3/S4/S5/NR S1 is rare, S5 is common. NR indicates sites that are not ranked	The state rarity rank of the natural community.
ElementGrp	Element Group	General Text	A grouping method used in determining local and state significance.
EO_Rank	Element Occurrence Rank	A/B/C/D/E A=Excellent, E=Poor	Rank of the particular natural community.
Local_Sig	Local significance	Y/N Yes/No	Indicates if the site is a locally significant site
State_Sig	State Significance	Y/N Yes/No	Indicates if the site is a state significant site
Justificat	Justification	General Text	Indicates the reason for assigning local or state significance
Landscape	Landscape Condition	A=surrounded by 1,000 acres of intact matrix of natural communities B=surrounded by forest or undisturbed communities but there may be developed land or clear cutting nearby C=surrounded by fragmented forest, agricultural land or rural development D=surrounding area intensely developed	Landscape quality of the natural community-
Condition	Site Condition	A=great-Pristine forest, areas of mature forest, no or minimal human disturbance B=Good-Some minor signs of human disturbance or exotic species C=Moderate-Significant logging, disturbance, or exotic species but site will recover D=Poor-Significant logging, disturbance, or exotic species; recovery unlikely	Current condition of the natural community
Size_Rank	Rank based on overall size of the natural community	A=larger…D=smaller	Ranking depends on community type, contact Vt. Fish and Wildlife Natural Heritage Program or Arrowwood Environmental for more information.
SiteName	Site Name	General Text	Name of site given for significant communities or wetlands. Some based on previously assigned NNHP site names. Other assigned based on location of site.

Table 1 (continued): Natural Community Attributes (Wetland and Upland Communities)

Field Name	Meaning	Responses	Description
Attributes present for wetland sites only			
Confidence	Confidence	L/M/H/C: Low/Moderate/High/Confirmed	Indicates the confidence that a wetland exists at the site based on the remote inventory. Sites that were field verified receive a "C"
VSWI	Vermont Significant Wetlands Inventory	Y/N Yes/No	Indicates if the site is on the VSWI map and is a Class II wetland.
Floodwater	Floodwater	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for floodwater retention
WQ	Water Quality	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for water quality
Fisheries	Fisheries	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for fisheries
Wildlife	Wildlife	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for wildlife habitat
Vegetation	Vegetation	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for significant vegetation
Recreation	Recreation	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for recreation
Open_Space	Open Space	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for open space
Erosion	Erosion	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for erosion control
Education	Education	L/M/H/N: Low/Moderate/High/No	Indicates if the site functions for education
FVSize	Complex Size	L/M/H/N: Low/Moderate/High/No	Size score for wetland and associated complex (defined as wetland natural communities within 100' of each other)
FXNVALSUM	Function and value summary	Integer	Summary weighted score of functions and values. Calculated as a sum of all Function/Value scores above using the following matrix: N=0, L=1, M=2, H=3. Provides comparative score for all wetland communities within the study area.

Table 2: Wildlife Contiguous Habitat Unit (CHU) Attributes

Field Name	Meaning	Responses	Description
Id	Arrowwood Environmental Identification	Integer	Unit identification number assigned by Arrowwood Environmental
Name	Name of unit	Text	Unit name designation, typ. based on nearby feature
ACRES	Acres	Integer	The size of the CHU
Core_acres	Core acres	Integer	The acres of core habitat within the CHU
Dryd_acres	Deeryard acres	Integer	The acres of deeryard within the CHU
Strm_mile	Stream miles	Integer	The length in miles of stream within the CHU
Wet_acres	Wetland acres	Integer	The area of wetlands within the CHU
ES_acres	Early Successional acres	Integer	The acres of early successional habitat within the CHU
FRC_acres	Forested riparian corridor acres	Integer	The acres of forested riparian corridor within the CHU
Mast_pres	Mast present	Yes/blank	Indicates if mast is present within the CHU
Ledge_pres	Ledge present	Yes/blank	Indicates if ledge is present within the CHU
BW_pres	Bear wetland present	Yes/blank	Indicates if bear wetland is present within the CHU
VP_count	Vernal Pool count	Integer	Indicates the number of vernal pools identified within the CHU
Sig_natcom	Significant natural community	State/local	Indicates the presence of locally or state significant natural communities within the CHU
Elev_min	Elevation minimum	Integer/Feet	Indicates the minimum elevation (in feet) within the CHU
Elev_max	Elevation maximum	Integer/Feet	Indicates the maximum elevation (in feet) within the CHU
Elev_range	Elevation range	Integer/Feet	Indicates the range of elevation (in feet) within the CHU
Elev_mean	Elevation mean	Integer/Feet	Indicates the mean elevation (in feet) within the CHU
C_hd_rank	CHU horizontal diversity rank	Low/moderate/high	Indicates the horizontal diversity rank measured and assigned by Arrowwood Environmental
Cons_acres	Conservation acres	Integer	Area of conserved land within the CHU

Table 3: NCLC Dataset Land Cover Classification Codes

Code	Land Cover Type
0	Unknown
11	Open Water
2	Developed Land
21	Developed- Open Space
22	Developed- Low Intensity
23	Developed- Medium Intensity
24	Developed- High Intensity
3	Upland-general
31	Barren- Rock/Sand/Clay
4	Forested
41	Deciduous Forest
42	Conifer Forest
43	Mixed Forest
52	Shrub/Scrub Early Succession
7	Open Land
71	Open- Grassland
8	Agricultural
81	Pasture/Hay
82	Cultivated/Crop
9	Wetland-general
90	Forested/Shrub Wetlands
95	Herbaceous Wetlands