Natural Heritage Element Inventory and Assessment for Warren, Vermont

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1.0 Introduction

The purpose of this inventory was to map and assess the natural heritage elements that are important to the preservation of biological diversity in the Town of Warren. This information will be used to inform town planning decisions, further define the town's sense of community, and to establish priorities for preserving significant resources.

The scope of the project included the identification, inventory, assessment and ranking of five resource elements: wetlands, vernal pools, upland natural communities, wildlife habitat and connecting lands and rare elements. The inventory process involved three phases: 1) remote landscape analysis; 2) field work and public input; and 3) final ranking and map creation. The methodology used in mapping and assessing these resources is presented in Appendix 1. The results of the inventory are divided into the five resource areas and presented below.

2.0 Wetlands

As is typical for areas in the heart of the Green Mountains, wetlands in the town of Warren are relatively small. Mountain slopes, rather than valley bottoms, dominated the landscape limiting the development of large expanses of wetlands. The wetlands in Warren tend to be smaller sites occupying the benches of mountain slopes, stream side areas, narrow valley bottoms and the few flatter areas. A total of 273 wetlands were mapped and classified during the wetland inventory process totaling approximately 631 acres in the town. These wetlands range in size from 0.01 acres to 46 acres. The National Wetlands Inventory (NWI) had previously recorded 80 wetlands comprising 158 total acres in the town. As discussed in the methodology (Appendix 1), some of the wetlands in the present inventory are considered "potential" wetlands. These are sites that need to be field verified to determine if a wetland actually exists on the site.

Figure a. Softwood swamp in the Alpine Village Complex

Table A shows the wetland resources in the town organized by natural community type with information on the different natural community types and acreages within the town. The agricultural fields, old fields and ponds are not considered natural communities but were included because of their

wetland regulatory status and their ability to perform wetland functions and values. The Beaver Wetland type is a mapping unit which likely contains a mixture of plant communities depending on the nature of the site.

Table A. Summary of Wetland Natural Communities in Warren

Natural Community	# of Occurrences	Average Acres	Total Acres
Agricultural Field	17	3.5	58.7
Alder Swamp	19	4.5	85.3
Beaver Wetland	13	4.5	59.1
Cattail Marsh	1	0.1	0.1
Erosional River Bluff	4	1.2	4.7
Floodplain Forest	1	2.2	2.2
Old Field	39	4.3	166.0
Pond	108	0.8	82.8
Red Maple-Black Ash Swamp	1	2.0	2.0
Seep	19	0.5	10.4
Seepage Forest	18	2.7	49.4
Shallow Emergent Marsh	23	1.9	44.4
Spruce-Fir Tamarack Swamp	10	6.6	65.9
Agricultural Field	17	3.5	58.7
Alder Swamp	19	4.5	85.3
TOTALS	**273**	**-**	**631**

While many wetlands and potential wetlands were mapped during this inventory process, it is likely that more wetlands remain to be mapped. This is especially true of types such as seeps, seepage forests and vernal pools. These sites are usually small and surrounded by a forested matrix, making them difficult to identify and map remotely. Further field work by ecologists or towns-people would likely result in the identification of more of these wetland types in town.

In order to help prioritize the importance of the many wetlands in the town, an assessment of the significance of the wetlands was performed. When determining the "significance" of a wetland, two different sets of criteria were used. A wetland was considered significant because of 1) the functions and values that it performs on the landscape, or 2) the natural community ranking of the wetland. (Refer to section C of Appendix 1 for a full explanation of the ranking procedure). Table B lists the wetlands in the town that have been deemed significant for either of these criteria. Table B also shows two wetlands that are 'Potentially significant". These are sites that, from remote sources, appear to be highly functioning wetlands. Lack of landowner permission, however, precluded a field visit. These sites should be visited to confirm these preliminary findings and more fully assess the wetlands.

As can be seen in Table B, most of the significant wetlands are grouped into "wetland complexes" which are an assemblage of interconnected wetlands of various community types. Because these wetlands are interconnected, it is useful to think of them as a unit, or a "wetland complex". Therefore, while only four

wetlands are listed in the table as significant, this includes a total of 23 different wetland sites.

Table B. Summary of Locally and State Significant Wetlands

Site Name	Natural Communities	Locally Significant	State Significant
Significant Sites			
Stetson Brook Seepages	Seep Forested Seep	Y	Y
Double Top Shrub Swamp	Shrub Swamp	Y	N
Blueberry Lake Wetland Complex	Pond (Blueberry Lake proper) Shallow Emergent Marsh Beaver Wetland Spruce-Fir-Tamarack Swamp Shrub Swamp	Y	N
Alpine Village Wetland Complex	Beaver Wetland Spruce-Fir-Tamarack Swamp Red Maple-Black Ash Swamp	Y	N
Potentially Significant Sites			
Mad River Beaver Wetland	Beaver Wetland	Unknown	Unknown
Warren Flats Marsh	Shallow Emergent Marsh	Unknown	Unknown

Not shown in Table B are the numerous small wetlands that occur throughout the town. These small beaver wetlands, seeps and emergent marshes may not be deemed significant individually but taken together, they offer extremely important wildlife habitat, water storage capacity, erosion control, water quality protection and perform many other functions. The lack of a "significant" ranking for a particular wetland in town does not, therefore, imply that the site is not important on the landscape. Rather, the significance ranking presented here is the first step towards recognizing those wetlands that stand out from an ecological perspective.

The significant wetland sites shown in Table B are each described below. Management recommendations are included for each site. The Wetland Inventory Map is included in the appendix and a summary data table in Appendix 2.

Stetson Brook Seepages

As can be seen from Table B, the only wetlands that were considered significant as natural communities (Criteria 1 discussed above) are a set of seeps in the Stetson Brook area. Seeps are small wetlands that typically occur within a forested matrix. They are sites of ground water discharge and usually form the headwaters of our mountain streams. Depending on the nature of the seep, the canopy may be open (termed a "Seep") or forested (termed a "Seepage Forest"). Because of their similarities, both of these types are considered together.

The group of five seeps in the Stetson Brook area are scattered throughout the basin and occur as headwaters of small brooks. These sites were considered state significant because of their collective size, the fact that they were in very good condition, and the pristine nature of the landscape in which they are found. Many of them form the headwaters of small drainages, while a few are stream-side seeps which feed existing drainages.

The largest of these wetlands (wetland # 842 on attached map) is a 4 acre seep that forms the headwaters of a small stream. Seeps of this size and condition are somewhat uncommon. It sits on a flat bench and in some regards resembles a conifer swamp. Scattered trees and areas of open water make this site unique and valuable for wildlife habitat. The rest of the seeps in this group are similar to Northern Hardwood forests in composition but contain an understory of wetland vegetation like sensitive fern and spotted touch-me-not. They also offer important wildlife habitat and water quality functions within a large forest matrix.

Seep Management Recommendations

The greatest threat to these particular communities is improper forest management. Encouraging foresters and loggers to avoid seeps (even in winter) can prevent damage to these wetlands. Seeps that are found on private land may be threatened by development. Since many of these wetlands are not mapped, they often go unnoticed by regulators and town officials. Local regulations protecting these small wetlands can prevent damage to these sites from development.

Figure b. Seepage Forest in the Stetson Brook Area

<u>Double Top Shrub Swamp</u>

This shrub swamp is situated along Rte 100 at the base of Double Top Mountain. Due to limited landowner permission, only the southern tip of this site was visited during this inventory. From the accessible area, however, it appears that this swamp is in very good condition and is functioning well on the landscape. This is one of the largest shrub swamps in the town. It is dominated by speckled alder (*Alnus incana*) in the shrub layer but has a scattered canopy of red spruce (*Picea*

rubens), red maple (*Acer rubrum*) and balsam fir (*Abies balsamea*). Because of this scattered canopy, it appears to be at a transitional state in between a shrub swamp and a red spruce-hardwood swamp, at least in the southern tip that was visited. The herbaceous layer is dominated by blue-joint grass (*Calamagrostis canadensis*), dewberry (*Rubus pubescens*) and various other wetland herbs. There are a lot of blown-down trees, and a poorly developed hummock and hollow complex. The soils are deep mucks and there is a fair amount of standing water present.

Figure c. The Double Top Shrub Swamp is a tangle of alder shrubs and fallen trees.

This wetland appears to be significant for wildlife habitat. The abundance of standing water likely makes it valuable for many species of amphibians. Deer use the wetland for browse and cover. Bear may also use the wetland for browse, especially in the early spring. This wetland is significant for water quality. The structure of the vegetation and the hydrology of the wetland permit it to filter out excessive nutrients or sediment from surface waters.

Management Recommendations

Because only a small portion of this site was visited, the nature and condition of the majority of the wetland is unknown. If landowner permission is obtained, it is recommended that an ecologist visit this wetland to confirm these preliminary findings.

If these preliminary findings are accurate, development within 50' of this wetland should be prohibited. Within 100' of this wetland, any activity that disrupts the local hydrology of the site or degrades the natural community should also be prohibited. It is recommended that logging not occur within the swamp or within a 50' buffer of the swamp edge.

Blueberry Lake Wetland Complex

As the name implies, the Blueberry Lake wetland complex is situated around Blueberry Lake. Not including the lake itself, this wetland complex consists of 11 different wetlands made up of 4 different natural communities and comprises approximately 90 acres. Blueberry Lake proper is not only at

the center of this wetland complex, it also is one of the most visible and widely used public resources in the town. For this reason, this site is considered significant for recreation and open space. In addition to the lake, this wetland complex contains 5 separate beaver wetlands, all of which feed into the lake. These wetlands are a diverse mixture of open water, shallow emergent marshes and shrub swamps. They offer a wide variety of wildlife habitats and perform multiple functions and values. In addition to these beaver wetlands, there is a fairly extensive, seven acre Shallow Emergent Marsh to the north east of the lake. This marsh is dominated by sedges (*Carex spp.*) and other wetland herbs and is mixed with areas of open water.

A few of the wetlands within this wetland complex have the distinction of providing habitat to two of the three rare plant species in the town, making this complex significant for wetland vegetation (see Section 5 on Rare Elements).

To the north of the lake, there is a long narrow shrub swamp that sits along Plunkton Road. This site was only viewed from the road, but appears to be somewhat intermediate between a shrub swamp and a hardwood dominated swamp.

Finally, this wetland complex also has two conifer swamps associated with it. These two large swamps sit along the eastern edge of the lake. A field visit was not conducted to these sites to fully asses the nature of these communities. From remote sources, however, these wetlands appear to be interesting sites.

Overall, wetlands that comprise the Blueberry Lake Wetland Complex are extremely diverse communities that provide important wildlife habitat in the town. They are also significant for providing recreation, open space, erosion control, nutrient and sediment retention, fisheries and rare plant habitat. Taken together, these sites make up the most diverse and significant wetland complex in the town.

Figure d. A beaver influenced wetland in the Blueberry Lake Wetland Complex

Management Recommendations

While this wetland complex is unique and diverse, it is also one of the most widely used public recreation sites in the town. The current use of the lake does not appear to be harming the surrounding wetlands. In addition, since the lake is on public land, the threat of development is minimal. For the sites in this wetland complex that are on private land, care should be taken with any kind of development or human activity near them. Any development within 100' of these wetlands should be avoided. This buffer zone will help to ensure that the natural communities present retain their undisturbed state and that the functions and values that these wetlands perform are maintained. In the case of the conifer swamps, logging should not occur due to the presence of fragile soils. Disturbing the soils in these sites can disrupt local hydrology of the wetland and open the site up to invasion by non-native plant species.

Alpine Village Wetland Complex

The Alpine Village Wetland complex consists of a large beaver wetland with surrounding conifer and hardwood swamps. Taken together, this wetland comprises nearly 40 acres. The central beaver wetland is dominated by a wide variety of wetland vegetation including tussock sedge (*Carex stricta*), bulrush (*Scirpus spp.*), manna grass (*Glyceria spp.*), sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*) and spotted touch-me-not (*Impatiens capensis*). The vegetation is mixed with areas of open water and deep marsh. This beaver wetland is very diverse in terms of microhabitat for both wildlife and plants. The mixture of open water, islands of vegetation, occasional shrubs and the surrounding uplands create ideal habitat for a wide array of wildlife including mink, otter, deer, moose, beaver, as well as many species of water fowl, raptors and songbirds.

Figure e. A large Beaver Wetland is at the center of the Alpine Village Wetland Complex

The Spruce-Fir-Tamarack Swamp that surrounds this beaver wetland is dominated by a mixture of red spruce, hemlock (*Tsuga canadensis*) and occasional red maple (*Acer rubrum*). It has been influenced by the nearby beaver wetland and is flooded in many places, creating an open canopy. Hummocks and hollows are well developed and standing water is common

in the hollows. Herbaceous vegetation is similar to that of the beaver wetland.

Taken together, the wetlands of the Alpine Village wetland complex are a diverse and very interesting set of wetlands. They offer valuable wildlife habitat in a matrix of upland forests. They perform multiple functions and values including, floodwater storage, nutrient and sediment retention, wildlife habitat, open space, and erosion control.

Management Recommendations

It is recommended that a minimum 100' buffer zone around the wetland margin be maintained in a natural condition. This buffer can help to ensure that the natural communities present retain their undisturbed state and that the functions and values that these wetlands perform are maintained. In the case of the forested swamps, logging should not occur due to the presence of fragile soils. Disturbing the soils in these sites can disrupt local hydrology of the wetland and open the site up to invasion by non-native plant species.

Mad River Beaver Wetland

This wetland sits at the base of the Warren Pinnacle along the Mad River. It was not visited during this inventory due to lack of landowner permission. From remote sources, however, this site appears to be significant for many functions and values. It likely provides floodwater attenuation by storing flood waters from the drainages upslope as well as from the Mad River. The mixture of open water, herbaceous vegetation and scattered shrubs likely make this wetland valuable habitat for a wide variety of wildlife. This wetland may also perform other functions such as erosion control and sediment and nutrient retention. Without a field visit, however, this data is considered preliminary and the wetland "potentially" significant.

Warren Flats Marsh

Just to the north and east of the Warren Airport is a relatively flat landscape. This is the site of the Warren Flats Marsh. This Shallow Emergent Marsh community sits along the banks of a tributary of Folsom Brook, which flows north into Waitsfield. This is an 8.5 acre wetland that appears to be dominated by herbaceous wetland vegetation with small pockets of open water. There is also a small area with scattered conifer trees in the southern part of the wetland, which may be an incipient conifer swamp or shrub swamp. This site is likely significant for erosion control, wildlife habitat, floodwater storage and water quality. Without a field visit, however, this data is considered preliminary and the wetland "potentially" significant.

3.0 Vernal Pools

Vernal pools are seasonal wetlands that typically contain water during the wet spring months but become dry as the summer progresses. These isolated wetlands usually occur under a forest canopy, lack fish, and provide habitat to a wide variety of wildlife.

Figure f. During the summer months, vernal pools dry up and look like small depressions in the forest.

The initial remote inventory for vernal pools in Warren yielded a total of 19 potential vernal pool sites. A combination of field work and public input was used to confirm or deny the presence of these sites. During the field work, many of these sites were not deemed to be vernal pools, but were reclassified to wetlands and added to the wetlands database. Some of these sites were seepage wetlands or small conifer dominated swamps. The final vernal pool map for Warren consists of 13 potential vernal pool sites. Four of these sites have been confirmed in the field, though some of these four still need a field visit in the spring in order to confirm use by amphibians. A map of the vernal pool locations is included with the Wetland Inventory Map included in the appendices. An attribute table for these vernal pools is included in Appendix 3.

Vernal Pool Management Recommendations

As can be seen on the attached Wetlands Inventory Map and Figure (g) below, there are two buffer areas around each vernal pool. These buffer distances are based on the work of Semlitsch (1998), Calhoun and Klemens (2002), Calhoun and deMayandier (2004). The first buffer distance is 100' in diameter and is important because the density of amphibians within this area is very high both during the spring breeding period and the fall juvenile dispersal period. The nature of the forest immediately around the vernal pool has a tangible affect on the nature of the pool itself. Shading from surrounding trees can drastically prolong the hydroperiod of a pool. In addition, leaf litter that enters the pool from the surrounding trees forms

the basis for the food chain in the vernal pool ecosystem.

The condition of the forest in this 100' buffer zone is therefore strongly linked to the condition of the vernal pool itself. For this reason, it is recommended that the vernal pool envelope be managed in a way that will not interfere with the functioning of the vernal pool. This includes maintaining a complete forested cover within this envelope. Light thinning of forest trees is, in most cases, acceptable but should come no closer than 25' to the pool's edge. Since many amphibians require a dense leaf litter on the forest floor with un-compacted soils, logging should occur when the soils are frozen and there is adequate snow cover. The creation of ruts in this area can often disrupt the hydrology of the nearby vernal pool. Development and other barriers to amphibian movement should be avoided within this buffer zone.

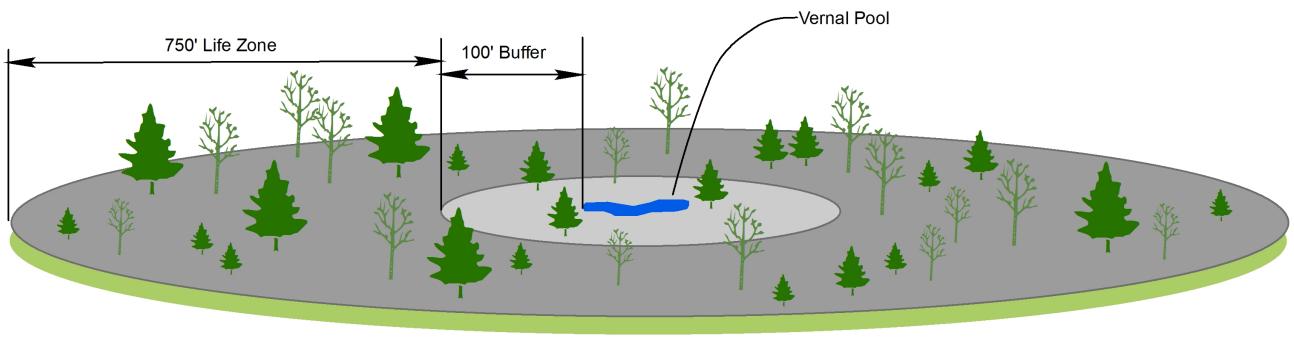

Figure g. Vernal Pool Buffer Zones

The next buffer shown on the attached map is calculated at 750' from the vernal pool habitat. This is termed the "amphibian life zone" or the "critical terrestrial habitat". Amphibians that breed in vernal pools spend most of their adult lives in the forests surrounding their natal pools. These amphibians require a forest with dense leaf litter, decomposing woody debris, un-compacted soils, and adequate canopy cover. Calhoun and Klemens (2002) recommend maintaining 75% forested cover within this life zone to retain adequate habitat for forest dwelling amphibians. If logging is to occur in this area, it should occur in the winter when the ground in frozen and there is adequate snow cover. Ruts that occur in the life zone can fill with water and create population sinks as amphibians lay eggs in the ruts and never reach the more reliable vernal pool.

Compaction of the soil can also result in direct loss of habitat for mole salamanders.

Since many of the potential vernal pool sites on the attached map have not been field confirmed, it is recommended that additional field work be conducted. With a little training, this can be done by interested towns-people and landowners. This can take place in conjunction with identifying amphibian road crossings. In addition, field work is the best way to discover new pools that could not be detected during the remote inventory.

4.0 Upland Natural Communities

The upland natural communities in the town of Warren were mapped as part of this inventory process. A summary of the upland natural communities in the town is presented in Table C. With the exception of the Plantations and the White Pine Forests, all of the communities listed in Table C are recognized as natural communities in Thompson and Sorenson (2000). As can be seen from this table, there are 12 different "recognized" upland communities mapped comprising a total of 20,499 acres. With the exception of the Cliff and Outcrop communities, these are all forested types and exclude any agricultural fields or openings from development. The Upland Natural Communities Inventory Map is included in the appendices.

Table C. Summary of Upland Communities in Warren

Natural Community	# of Occurrences	Average Acres	Total Acres
Boreal Acidic Cliff	1	0.5	0.5
Boreal Outcrop	1	1.4	1.4
Hemlock Forest	52	28.7	1494.9
Hemlock-Northern Hardwood Forest	68	64.2	4366.0
Lowland Spruce-Fir Forest	15	39.0	585.6
Montane Spruce-Fir Forest	16	81.4	1302.0
Montane Yellow Birch-Red Spruce Forest	16	98.0	1567.5
Northern Hardwood Forest	77	114.8	8841.7
Plantation	13	9.7	126.0
Red Oak-Northern Hardwood Forest	1	2.2	2.2
Red Spruce-Northern Hardwood Forest	56	34.2	1912.9
Rich Northern Hardwood Forest	5	28.4	142.0
White Pine Forest	4	8.0	32.1
White Pine-Northern Hardwood Forest	3	41.3	123.8
TOTALS	328	-	20,499

Many of these sites were at least partially visited during the field inventory, resulting in more detailed information about the communities and a more accurate inventory map. For the sites that were not visited, the naming of the natural community was done based solely on remote sources. In some cases, these sites need to be field verified to confirm the classification. This is especially true of the conifer and mixed hardwood-conifer types where it is difficult to determine conifer species from remote sources alone. It should also be noted that the boundaries between the different upland natural communities are often gradual or indistinct in the field. The boundaries drawn on the map are therefore somewhat artificial and represent gradual transitions between types.

Because only a small portion of the overall town received a field visit to confirm and assess these natural communities, the Upland Natural Communities Inventory Map should be considered a preliminary map. Further field work will undoubtedly lead to the discovery of more natural communities, a refining of the map and a better picture of the state and locally significant sites in the town. A detailed data summary table is presented in Appendix 2.

State and Locally Significant Upland Communities

The methodology for determining state significance is based on the Vermont NonGame and Natural Heritage guidelines and is detailed in Section F of Appendix 1. Each of the state or locally significant communities is summarized in Table D and briefly described below. All of these determinations were based on field work conducted as part of this inventory. If a field visit was not made to a particular community, that community was not ranked, even though remote sources may suggest that the site may be significant. For most of the larger communities, assessments were made only on a portion of the community for which landowner permission was obtained.

Table D. Summary of Locally and State Significant Upland Natural Communities

Natural Community	Site Name	Total Acreage	Locally Significant	State Significant
Hemlock Forest	Bradley Brook	136	Y	N
Hemlock-Northern Hardwood Forests	Stetson Hollow	481	Y	Y
	Warren Pinnacle	675	Y	N
	Mad River	915	Y	N
Montane Spruce-Fir Forest	Mt Ellen	1077	Y	Y
Northern Hardwood Forests	Stetson Hollow	2377	Y	Y
Rich Northern Hardwood Forest	Northfield Mtns	3006	Y	Y
	Stetson Brook	20	Y	Y
Red Oak-Northern Hardwood Forest	Eurich Pond	2	Y	N
Red Spruce-Northern Hardwood Forests	Lower Lincoln	914	Y	Y
	Stetson Hollow	59	Y	Y

As can be seen from Table D, there are seven different natural community types from 42 different sites that have been deemed significant. Each of these significant sites is described briefly below.

Hemlock Forests

Hemlock Forests are patch-type communities in Vermont, which means that they do not usually occur as a background or "matrix" natural community. Rather, they occur in small to medium sized patches surrounded by matrix forest types. While hemlock is often found mixed with other hardwoods in a wide variety of situations, forests comprised almost exclusively of hemlock are less common. They typically occur on steep sites with shallow soils often along the banks of streams.

Bradley Brook Hemlock Forest

Such is the case with this hemlock forest that sits along the steep banks of Bradley Brook. This occurrence consists of two nearly connected stands; only the eastern end of the largest stand was visited. The forest in this location is fairly typical for this community type: hemlock trees dominate the canopy, with occasional yellow (*Betula alleghaniensis*) or white birch (*B. papyrifera*) trees interspersed. There is only a sparse shrub layer of moosewood (*Acer pensylvanicum*) and canopy species and a sparse herbaceous layer dominated by intermediate wood fern. The soils are shallow and the topography is fairly steep, sloping down to the brook. The site appears to be in good condition, there were no signs of invasive species and no recent logging. The size of this site, approximately 136 acres coupled with its condition make this a locally significant site.

Management Recommendations

Sitting along the banks of Bradley Brook, this community acts as a forested riparian buffer. It provides good cover and habitat for wildlife and prevents erosion along the shores of the brook. Any activity that degrades these functions should be avoided. Selective logging can be an allowed use as long as a 50' buffer is maintained along the brook. Clear cutting or logging to the brook's edge should be avoided.

Hemlock-Northern Hardwood Forest

There are 3 different occurrences of this community type that have been identified as locally and state significant in the town of Warren. Each is described separately below.

Stetson Hollow Hemlock-Northern Hardwood Forest

The Stetson Hollow site is a series of large patches of hemlock-northern hardwood forest surrounded by the larger Northern Hardwood Forest matrix. They occur in microhabitats where the soils are a little shallower and nutrient poor than the surrounding hardwood forests. Three of the most prominent stands in this group are situated along the banks of Stetson Brook and can be easily seen from the hiking trail that follows the brook. The structure and composition of this forest is very similar to the others in this group. The canopy is a mixture of

hemlock and other hardwoods such as yellow and white birch, red maple (*Acer rubrum*), sugar maple (*A. saccharum*) and American beech (*Fagus grandifolia*). The understory and shrub layers are sparse and composed of the same species that are found in the canopy as well as an occasional moosewood. The herbaceous layer is likewise sparse. Intermediate wood fern, marginal wood fern (*D. marginalis*), wood sorrel (*Oxalis acetosella*) and Canada mayflower (*Maiathemum canadense*) are the common herb species.

Figure h. A Large Hemlock tree in the Stetson Hollow Hemlock-Northern Hardwood Forest

The Hemlock-Northern Hardwood stand along Rte 100 (Unique ID # 157 on attached map) differs from the above description in being mixed with white pine in the canopy. This may reflect past land use of this site. The other stand that warrants note is Unique ID # 170. In the northern end of this forest is a small stand of old growth hemlock. The trees in this area are very large, approximately 3 feet in diameter, with impressive canopies. Standing dead trees and multi-aged structure give this small stand an "old growth" feel that is not common in the region.

Mad River Hemlock-Northern Hardwood Forest

Directly across Rte 100 from the Stetson Hollow site is a large Hemlock-Northern Hardwood Forest that has been named the "Mad River" stand. Though close in proximity, the landscape condition of this stand is very different than the Stetson Hollow site. While large, this forest is often slightly fragmented and interrupted by development and some agricultural fields. This slightly fragmented nature is largely responsible for this site not being deemed state significant. Despite this, this appears to be a forest in very nice condition and has some more "remote" areas within it, especially in the southern part of the stand. It is therefore considered of local significance.

Warren Pinnacle Hemlock-Northern Hardwood Forest

The Warren Pinnacle Hemlock-Northern Hardwood Forest is very similar to the Mad River stand in that it is a series of large

forests in fairly good condition but exists within a somewhat fragmented landscape. Bounded on all sides by roads, and containing some fragmenting features, these stands are nonetheless interesting and in fairly good condition. They include areas of town-owned land and have a trail system that is regularly used by the public. Within these forests are a scattering of wetlands and vernal pools which offer valuable wildlife habitat. Like the Mad River stand, there are also some fairly remote areas within this forest. These forests are considered locally significant.

Montane Spruce Fir-Forests

Unlike the Hemlock types described above, the Montane Spruce-Fir Forest community is considered a matrix community. A matrix community is a community that is dominant on the landscape and is often found in large stands as a background forest (rather than patches). The Montane forests are high elevation, conifer dominated stands that cover the summits of the Green Mountains. They are dominated by Red Spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyerifera*). Mountain ash (*Sorbus spp.*) and mountain maple (*Acer spicatum*) are common in the shrub layer. The herbaceous layer is typically dominated by boreal herbs such as bunchberry (*Cornus canadensis*), Canada lily (*Maiathemum canadense*) and goldthread (*Coptis groenlandica*). These communities are characterized by steep slopes, shallow soils and frequent outcroppings of bedrock

Mt. Ellen Montane Spruce-Fir Forest

There is one large occurrence of this community type in the town that is considered significant. This occurrence consists of two stands along the spine of the Green Mountains and makes up the majority of the acreage of this type in the town. It is part of a much larger Montane forest that was mapped and assessed in Fayston. This is an A-ranked stand and is recognized as state significant. The ski slopes on the slopes of Mt. Ellen create minor fragmentation, but most of the forest is in good condition.

Northern Hardwood Forests

Like the Montane Spruce-Fir Forests, the Northern Hardwood Forest is considered a matrix natural community type. These are the quintessential Vermont forests and can be found on a wide variety of sites with the vegetation varying according to the particular site. The canopy is typically dominated by hardwood species such as sugar maple, white ash (*Fraxinus americana*), American beech, yellow birch, and black cherry (*Prunus serotina*), among others. Hobblebush (*Viburnum alnifolium*), moosewood and any of the canopy species can be found in the understory. A wide variety of herbs may be found, depending on the site. Wild sarsaparilla (*Aralia nudacaulis*), Canada mayflower (*Maianthemum canadense*), intermediate woodfern, and acuminate aster (*Aster acuminatus*) are common.

Figure i. A typical Northern Hardwood Forest in Warren.

Stetson Hollow Northern Hardwood Forest

The Stetson Hollow Northern Hardwood Forest is a large forest which straddles Stetson Brook in the southwest corner of the town. It sits mostly on U.S. Forest Service land and continues south into Granville. There are approximately 2377 acres of this forest within the town and just as much to the south in Granville. This forest is highly variable both in structure and composition. This is a result of the many microhabitats and landscape variability that is found throughout this large area. The areas of this forest that were visited appeared to be in good condition. The size, community condition and landscape condition together make this a state significant Northern Hardwood Forest.

Northfield Mountains Northern Hardwood Forest

This large Northern Hardwood Forest is found on the eastern side of town and sits along the base of the Northfield Mountains. It runs north and south along the entire length of the town. It also includes two stands east of Alpine Village (Unique ID# 252 and 225); further development south of Alpine village, however, may fragment these stands from the rest of the occurrence resulting in a loss of state significance for these stands.

This is the largest Northern Hardwood Forest in the town. The areas that were visited appear to be in good condition. Like the Stetson Hollow site, there is likely a lot of variation in structure and composition of this forest. There are also likely areas that have seen significant logging activity as well. As long as this activity is not extensive or conducted improperly, this should not negatively affect the overall community ranking (see Management Recommendations below). Because of its size, condition and landscape context, this large community is considered state significant.

Rich Northern Hardwood Forest

Rich Northern Hardwood Forests are similar to the more widespread Northern Hardwood Forest in over-story

composition and structure. They differ in being sites where the soils are slightly nutrient enriched. These sites typically support a diverse array of understory vegetation including the spring ephemerals. Species such as common maidenhair (*Adiantum pedatum*), trout lily (*Erythronium americanum*), Virginia spring beauty (*Claytonia virginica*), and blue cohosh (*Caulophyllum thalictroides*) are common in the sites. The enriched soils also favor the growth of sugar maple, white ash and black cherry. These trees grow very well on these sites and can reach impressive size if not taken for lumber.

Stetson Brook Rich Northern Hardwood Forest

The largest and most diverse Rich Northern Hardwood Forests in the state occur in the Taconic Mountains and the Champlain Valley. Some smaller and slightly less enriched sites, however, can also be found in the Green Mountains. The Stetson Brook site is a good example of a Rich Northern Hardwood Forest in the Green Mountains. While the herbaceous flora may not be as diverse, this site is decidedly different than the surrounding Northern Hardwood Forest. The trees grow straight and tall, averaging around 22" in diameter (though some are much larger). There is an open understory with herbs such as maidenhair fern, blue cohosh, and wild sarsaparilla dominating. Localized, wet seepy areas are commonly scattered throughout this forest. This site is fairly steep and bedrock outcrops and tip and mound microtopography is common. The size, condition and landscape context make this site a state significant example of this community.

Eurich Pond Red Oak-Northern Hardwood Forest

On a steep slope above Eurich Pond, there is a community that is uncommon in the heart of the Green Mountains. While common in the warmer regions of the state, the Red Oak-Northern Hardwood Forest is only found in isolated pockets and small stands in the Green Mountains. The Eurich Pond Red Oak-Northern Hardwood forest is a mere 2 acres, but the presence of older, knarled red oak mixed with hardwoods sets it apart from the surrounding Northern Hardwood Forest. The soils are droughty and relatively thin. This coupled with steep slopes creates a habitat that red oak and drier species such as hop-hornbeam (*Ostrya virginiana*) can compete in. Other plants such as northern oat-grass (*Danthonia compressa*) and blue-stemmed goldenrod (*Solidago caesia*) also grow here. Although this site cannot compete with the much larger and well developed stands throughout the state, its uniqueness in the area and good condition warrant its rank as locally significant.

Red Spruce Northern Hardwood Forests

The Red Spruce Northern Hardwood Forest community is similar to the Hemlock-Northern Hardwood Forest in that it occurs in medium to large patches on the landscape. It is characterized by a mixture of red spruce trees and various hardwood species, depending on the nature of the site. Hardwood species typical of the matrix Northern Hardwood Forest such as sugar maple, white ash, and beech are common in some areas. In other examples of Red Spruce Northern Hardwood Forest, especially those on steep knolls and ridges,

the red spruce is more commonly mixed with red maple and yellow and white birch. There are two Red Spruce Northern Hardwood Forests in the town that have been assessed as state significant sites. Each of these is described briefly below.

Lower Lincoln Red Spruce-Northern Hardwood Forest

The Lower Lincoln Red Spruce-Northern Hardwood Forest is a large forest on the lower slopes of Lincoln peak along the Lincoln Gap road and Hill road. Only the area on the National Forest was assessed. This area is a fairly consistent mixture of red spruce and various hardwoods such as sugar maple, beech, yellow and white birch and red maple. Red spruce is present in the canopy and in the understory as a shrub layer, suggesting that this species will persist at the site. There is a fair amount of active forest management at this site. Selective cutting has created canopy openings and dense understory growth in some places. This has resulted in favorable habitat for species such as moose and snowshoe hare. Though this site has been temporarily impacted by logging activity, the size of this site coupled with the landscape condition ranks it as state significant.

Since only the area on federal land was investigated, the areas on private land should be assessed to confirm the natural community and condition.

Stetson Hollow Red Spruce-Northern Hardwood Forest

Just south of the Lower Lincoln Red Spruce-Northern Hardwood Forest is a series of much smaller patches of this community type. These patches occur against the backdrop of the matrix Stetson Hollow Northern Hardwood Forest. They occupy steep ridges and knolls where the soil is shallow and more nutrient poor than the surrounding forest.

Figure j. White birch and red spruce share dominance in the Stetson Hollow Red Spruce-Northern Hardwood Forest.

These forests show no signs of logging or other human disturbance. There are a lot of downed trees and shrubs which has created canopy openings and spruce regeneration. Because of the relatively high elevation, some of these sites resemble the Montane Spruce-Fir forest. The dominant trees are red

spruce, red maple and white birch. The understory consists of moosewood and red spruce shrubs over a sparse herbaceous layer dominated by intermediate wood fern and shining clubmoss (*Lycopodium lucidulum*). Because of their undisturbed nature and landscape context, these sites are considered state significant natural communities.

Management Recommendations for Significant Upland Communities

Many of the natural communities described above occur as "matrix" communities on the landscape. This means that they can occur as very large examples that often form the background natural communities on the landscape. Therefore, in order for a particular site to be considered state significant it must represent some of the best examples in the state. The site must be a very large, un-fragmented example, be in overall good condition (lack of exotics/invasives or other major, human-caused disturbance) and be well buffered by other undisturbed natural communities.

Because of the large size of these communities, the management recommendations for maintaining their integrity are very different than those for smaller patch communities (see below). With matrix communities it is not an individual acre or parcel that is as important as the entire forest as a whole. Maintaining the integrity of these communities is more a matter of maintaining the un-fragmented nature of the community and limiting human encroachment into the interior of these sites. 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.

Unlike many wetland communities or smaller patch communities, matrix and larger patch communities tend to be more ecologically resilient. Active forest management including a wide variety of forestry practices generally does not threaten the ecological integrity of these sites. Many of these practices can mimic natural disturbance regimes and provide valuable wildlife habitat. Nearly all manners of recreation can be a part of the overall management plan for these sites.

The recommended management for 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 are preferable to those that are scattered over a wider area.

Because they are generally smaller than patch communities, active forest management can have greater impact on the overall condition rank of patch communities. Whereas in matrix communities, an area of clear-cut may not affect the overall rank of the community, patch communities may be significantly affected by these cuts. If logging is to occur in

these significant patch communities, selective logging is generally recommended over small clear-cuts.

5.0 Rare Elements

Historic and current locations of rare plants and animals in the town of Warren were obtained from the Vermont Non-Game and Natural Heritage Program (NNHP). There are currently three known sites for rare or uncommon plant species in the town. While available to town planners, the precise location of these populations is not public information and should not be distributed.

The auricled twayblade (*Listera auriculata*) is the rarest species known in the town and is listed as Endangered in the state. There are currently only 2 known occurrences for this species in Vermont. The Warren occurrence is located in the Blueberry Lake wetland complex. This elusive little orchid was first observed at this site in 1934. The approximately twenty five individuals, however, were last observed here in 1996. A thorough search in 2005 did not locate the plants. It is unknown if the population still exists at the site.

Also at the Blueberry Lake wetland complex is a rare sedge: Hayden's sedge (*Carex haydenii*). This species is listed as S1 which indicates that it is rare in the state. There are currently only 4 known populations in the state. These plants were discovered in 2005 during the survey for the auricled twayblade.

The third rare plant species currently known in Warren is found along the Long Trail on the spine of the Green Mountains. This small-flowered rush (*Luzula parviflora*) grows on the slightly disturbed habitat of high elevation trail-sides. It is "uncommon" in the state; there are currently 23 known locations for this species.

Management Recommendations

Managing for the continued survival of rare species, in most cases, means managing for the continuation of the habitat in which the species' resides. In the case of the small-flowered rush, the use of the trail by hikers actually encourages its growth. Little management other than maintaining the status quo is required for this species. The wetland habitats of the Blueberry Lake wetlands, however, may be slightly more fragile. The management guidelines described in the section on Blueberry Lake should be enough to ensure that these sites remain appropriate habitats for these species.

6.0 Wildlife Habitat

The contiguous wildlife habitat in Warren is largely divided by Route 100. To the west lie the Green Mountains, characterized by large, remote, un-fragmented wildlife habitat. Many of the town's ledge and talus communities are located in the west providing habitat for wildlife such as bobcat and porcupine. Large American beech stands providing fall and spring feeding areas for bear, deer and wild turkey are also located on the slopes of the Green Mountains. Forested riparian buffers provide habitat and potential wildlife corridors in the hills, mountains, and valleys of Warren. Much of Warren's high-elevation forested communities provide habitat for songbirds such as the endangered Bicknell's thrush. The extensive forests west of Route 100 also provide deep forest breeding habitat for many songbirds, hawks, owls as well as wide-ranging predators such as the coyote, bobcat, fisher, and black bear.

In Warren, the landscape east of Route 100 is more diverse, comprised of valleys, wetlands, hillsides, and the Northfield Mountains. While less of this forest is deep woods core wildlife habitat, this landscape diversity provides for excellent wildlife habitat and the opportunity for Warren's citizens to observe wildlife. Many areas provide winter cover and refuges for deer. The area's extensive wetlands and surface water systems provide plentiful habitat for amphibians, fish, waterfowl and other birdlife as well as species such as mink, muskrat and otter.

The wildlife habitat in the town was divided into 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. CHUs are largely a human-derived construct (as they are bound by our roads), but they represent the largest contiguous wild areas in Warren. The CHUs can be the basis of wildlife management and planning for wildlife in the town. Each of the CHUs in the town is described briefly below.

Description of Wildlife Habitat Features

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. This remote wildlife habitat is qualitatively distinct from small fragmented areas in that it provides important mating, nesting, feeding, and denning habitats for species that cannot survive in more fragmented landscapes. These animals also require travel corridors between various landscape patches that provide these elements.

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. Bird populations throughout the Mad River Valley, therefore, benefit from the deep forest "interior" habitat provided by core areas, see Figure (k) for core forested habitat locations.

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 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 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 populations would likely go into decline.

Approximately 25,500 acres of core forested habitat were identified within the study area.

Horizontal Diversity

Horizontal diversity is a measure of the change in vegetative types across an area of undeveloped land (i.e., core areas). These patterns or changes can result from differing bedrock and soil types, or past land use or management activities.

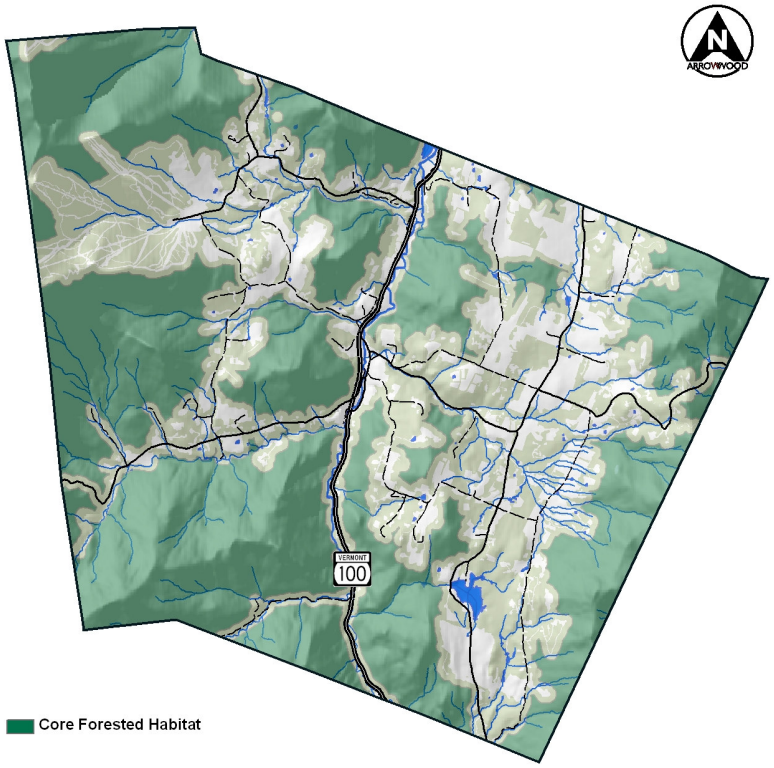

Figure k. Core Habitat Map

In general, the greater the change in vegetative diversity across a core 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. For instance taller trees may be needed for nesting activity of a bird while the preponderance of the feeding activities of this bird may be on smaller saplings or shrubs. Black bear may utilize mid to older American beech trees for fall feeding and then travel to beaver-dam 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. When species specific habitat features on the landscape are not otherwise limiting an increase in horizontal diversity usually produces an increase in mammalian and bird species diversity.

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 wide-variety of animals. Porcupines and raccoons live in 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. 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. 60 ledge or talus areas were identified, and more are likely to exist within the study area.

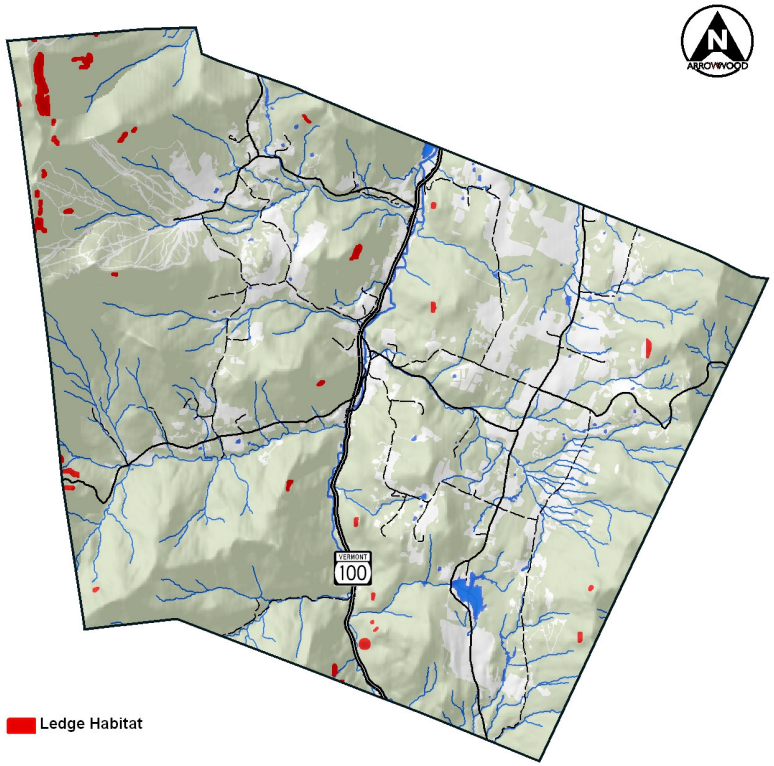

Figure l. Ledge Habitat Map

Broken ledge is considered defendable from predators like the coyote that may try to kill and eat bobcat young. Bobcats 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.

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 leafy 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 cover.

Throughout the study area remote forested seeps are probably the most heavily utilized wetlands by bear. As such, they warrant special protection for their wildlife value.

The 57 wetlands identified as preferential bear habitat in this study represent a mix of wetlands that were observed in the field to have either 1) sign of bear use or 2) fulfill bear wetland habitat requirement (i.e. sufficient cover for bear use and potential food resources). See Figure (m) for Bear Wetlands Map.

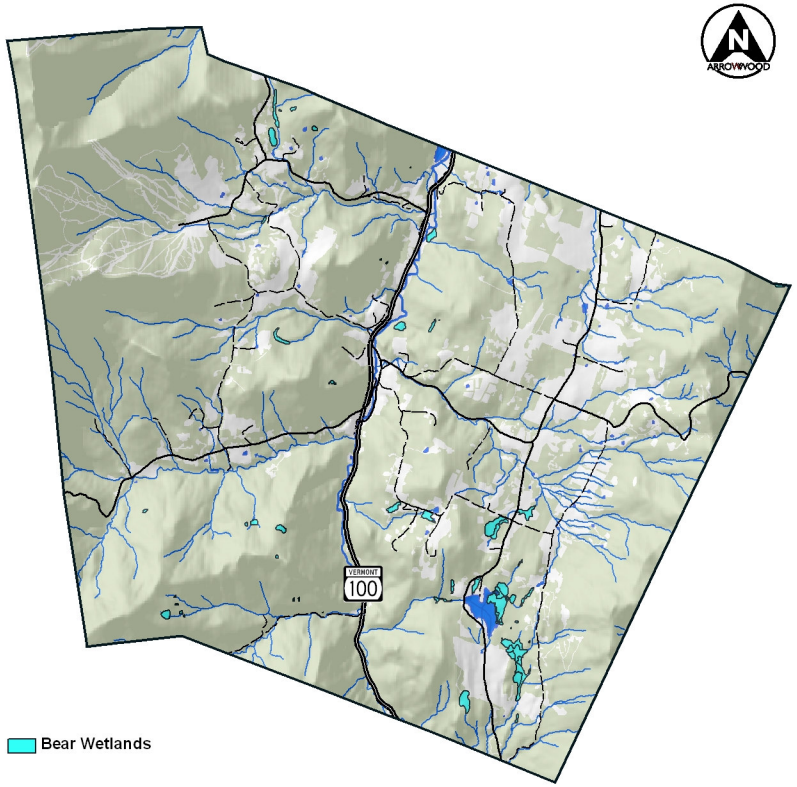

Figure m. Bear Wetlands Map

Early Successional Habitat (ESH)

ESH is forested habitat that is characterized by young, often dense shrubs, saplings or trees. Active forest management or natural disturbances such as disease infestation, ice storms, or wind blow can create a new growth of woody vegetation. Old fields 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 thrashers, veery, American woodcock, and ruffed grouse.

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 berries.

Approximately 630 acres of ESH were identified in the study area.

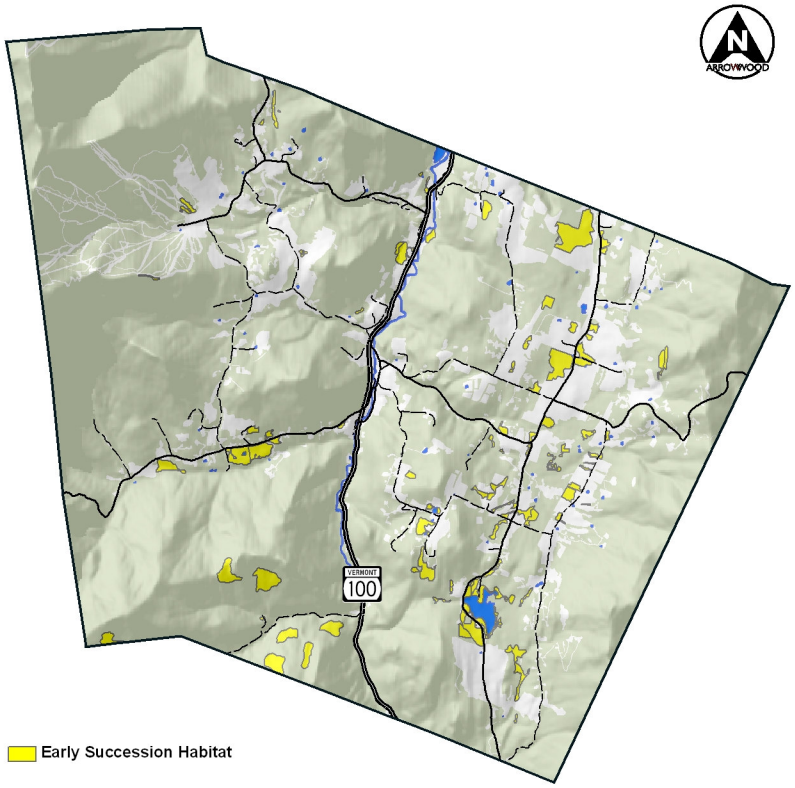

Figure n. Early Successional Habitat Map

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 shade and provides coarse woody debris to streams that adds to the stream structural and substrate diversity as well as provides food that fuels stream food chains.

Amphibians such as the green frog and the Northern dusky salamander 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 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.

There are approximately 250 kilometers of river and stream mapped in the town, and just over 3000 acres of forested riparian habitat was identified.

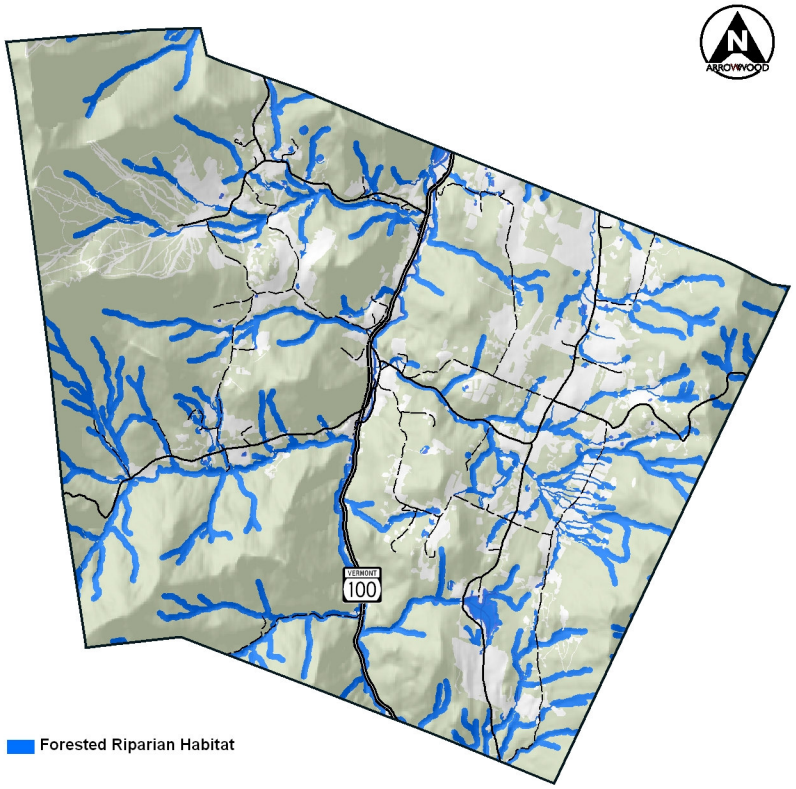

Figure o. Forested Riparian Habitat Map

Mast Stands

Masting trees are those which synchronize fruit production in an area. In the town of Warren, masting trees are Northern red oak and American beech trees. Both of these trees, when found clumped into stands are regularly visited by many species of wildlife.

Figure p. Bear clawed beech tree

Some of these stands are very large, such as the Slide Brook beech stand in Fayston and Warren which is several hundred acres in size and other areas are 20-30 trees in extent. 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 Northern red oak (acorns) include squirrels, wild turkey, deer, and bear.

Bear will climb the 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.

Eleven mast stands were identified in the study area, 6 of which were confirmed for bear use in the field.

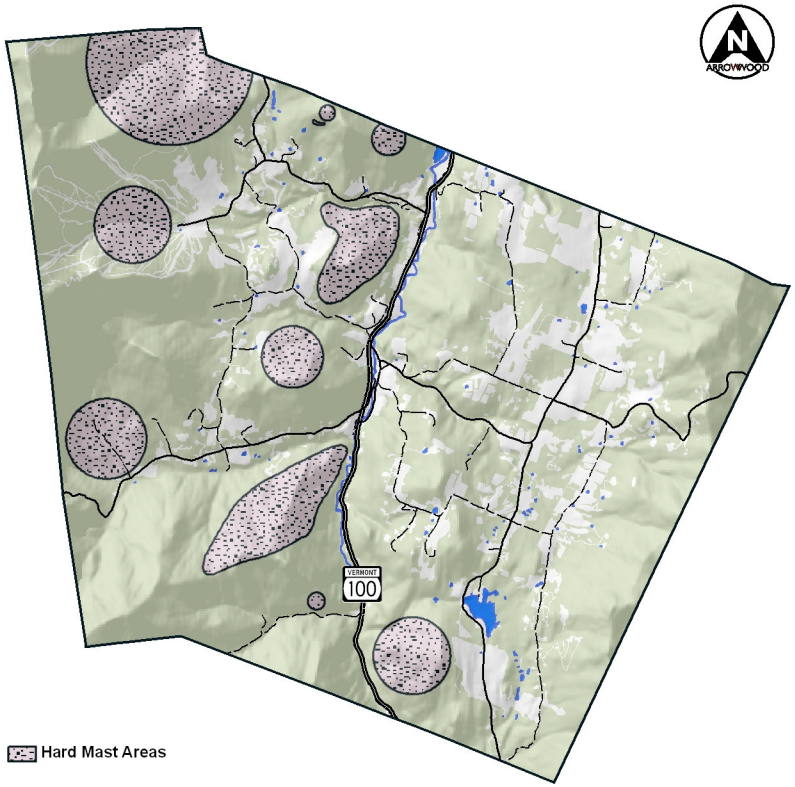

Figure q. Hard Mast Areas Map

Warren Deer Winter Habitat

In years where significant amounts of snow accumulate in the woods, white-tailed deer utilize evergreen forests for 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.

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, 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 evergreen-loving birds, porcupines and fox utilize these habitats during other seasons.

Potential deer winter habitat was divided into either "likely" or "potential" categories. Likely deer winter habitats are comprised of evergreen dominated forests, Eastern hemlock natural communities 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 (but not always) sought out in the longest, coldest, and snowiest winters. The strong spring sun in these communities melts snow early and warms cold bodies.

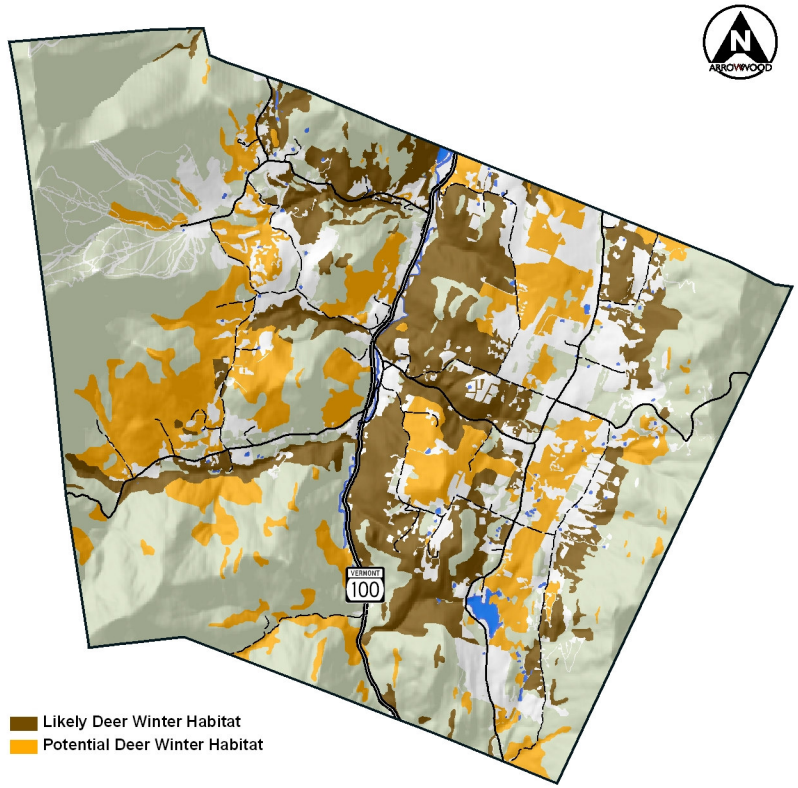

Figure r. Deer Winter Habitat Map

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 deer 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 Warren 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.

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 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 but generally they move in search of new territories, food resources, and/or potential mates.

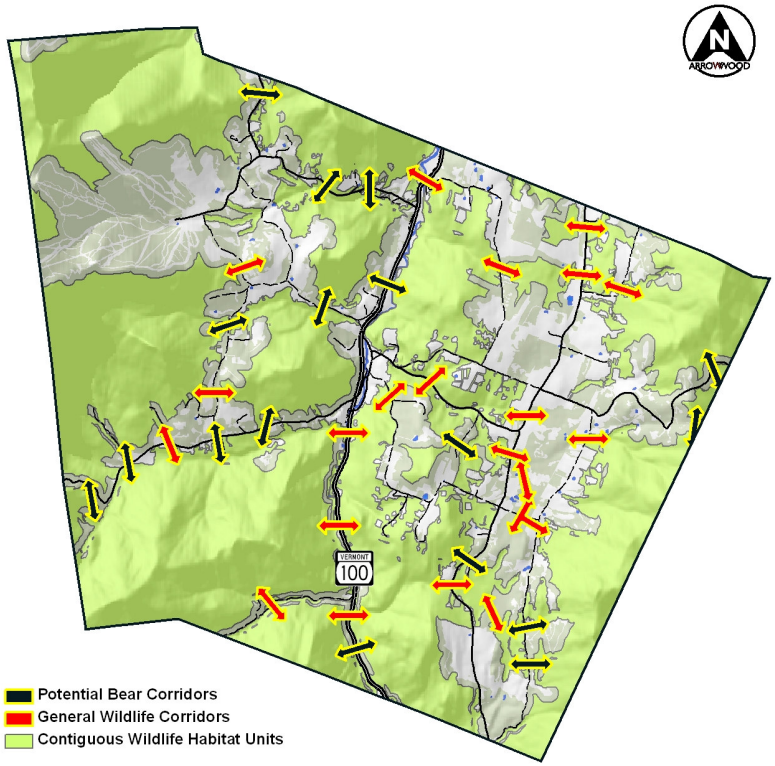

Figure s. Possible Wildlife Corridors Map

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 in openings and along old logging roads within the forest. In fall, bears will move to

beech stands, orchards, or possibly corn fields depending on the availability of natural foods in the forest.

General wildlife corridors for wide ranging species are shown on Figure (r). In addition to these general corridors, the presence of more specific habitat elements allowed for the mapping of potential species specific corridors for bear and deer. Finally, travel corridors for amphibians moving from upland to wetland habitats were determined based on location of roads and available habitats.

Detailed discussion of corridor assessment methodology is provided in Appendix 1, Section G. Discussed here are the results of the corridor assessment, focused on the three areas listed above.

General Wide Ranging Mammal & Species Specific Corridors

A total of 38 potential corridors were identified within the study area. Seventeen of these potential corridors are likely to be favored by bear, nineteen are likely to be favored by deer and all may provide travel opportunity to deer, bear, bobcat, moose and other wide ranging species. As mentioned in the methodology (Appendix 1, Section G) these corridors were not field verified or assessed.

Many of the wide ranging wildlife corridors identified in this project 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 lack of human disturbance and the necessities of moving between critical food, cover and/or other habitats.

There were relatively few probable corridors identified crossing the more developed areas of the study area such as the Village of Warren, Sugarbush Ski Area or the East Warren area. The limited opportunities for wildlife travel in these developed areas highlight the importance of maintaining and improving what already exists for movement corridors within these areas.

Given its relatively high traffic volume, there are quite a few crossing opportunities from one side of Route 100 to the other, mainly due to large areas of unfragmented forest in close proximity to the road, especially in the south end of town. These areas may merit additional attention in vehicle collision mitigation, and crossing structures and additional safety measures should be considered.

Improvement and expansion of the vegetated buffer conditions of both the Mad River and the tributaries feeding it would greatly assist in providing travel corridors throughout Warren without putting undue burden on agricultural or development activities. Additional focus on riparian buffers is especially important in the more developed valley bottom, Sugarbush village and the more agricultural East Warren areas.

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 remote evaluation.

Land conservation of connecting lands, in conjunction with improved riparian buffers and structures that provide wildlife safe travel, will aid in maintaining a healthy and diverse wildlife population throughout the area.

Amphibian Road Crossing Zones

Many busy roads bisect amphibian travel corridors and amphibians are forced to cross roads to get from their upland forest habitat to the breeding habitat in the vernal pools and wetlands. Fourteen (14) potential amphibian road crossings have been identified in the study area. None of these sites have been field verified. Field verification requires monitoring these road crossing sites during spring migration of the vernal pool amphibians. By knowing the location of the crossings, townspeople can be made aware that they should drive with care during the migration time. Some towns have organized volunteers to be out on nights of the migration to warn drivers and assist amphibians crossing the roads. Other towns have obtained signage to erect near the sites of the highest amphibian mortality.

Forested travel corridors between forest and vernal pool habitat should be maintained to facilitate migration of pool breeding amphibians. Barriers to amphibian movement such as busy roads, large clearings, or intensive development should be avoided or minimized within these amphibian travel corridors. Small developments (e.g. a single family house), yards, and infrequently traveled dirt roads are often not a major barrier to amphibian movement but may decrease migration success and habitat availability on a meta-population level.

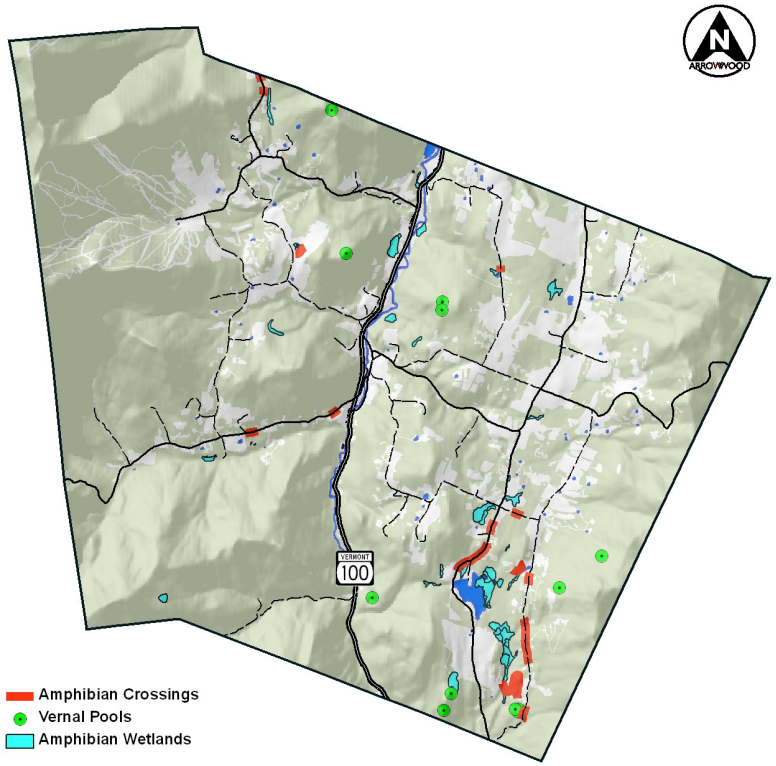

Figure t. Amphibian Crossings Map

Travel pathways that allow these movements are critical for animals that have habitat requirements in distant places and these pathways help maintain the genetic variability of various species of wildlife including: bear, bobcat, coyote and fox, fisher, deer and moose and some amphibians.

Contiguous Habitat Units (CHUs)

Contiguous Habitat Units are a combination of several different wildlife habitat types combined to form a unit of relatively continuous wildlife habitat. The largest forested area, often the most valuable wildlife habitat is the core area (largely free from most human activities). In constructing CHUs the core 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 (they are already subsumed within the core area boundary) to the already mapped central core, while in other cases (when they are tangential but not within the mapped core area) they add new area and additional acreage to the CHU.

Birds in CHUs

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. Over 100 of those species were recorded breeding in and around the town of Warren. 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 it's abundance of breeding neo-tropical migrating bird species.

Due to this extensive list of breeding bird species, discussion of breeding birds in CHUs is focused 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.

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.

Examples of responsibility species that are likely to prefer the mix of habitats within a given CHU are listed with each CHU description. These are meant to be representative examples, and are by no means a complete list of all birds, or even all responsibility species, that are likely to be found in the CHU.

Additional information about land management activities that can directly benefit these birds is available from Audubon Vermont at: http://vt.audubon.org.

Breeding Bird Atlas, data not yet finalized and published: http://www.pwrc.usgs.gov/bba/index.cfm?fa=explore.ProjectHome&BBA_ID=VT2003

Figure u. Scarlet Tanager- a core forest bird

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
	Chimney Swift
	Northern Parula
Spruce Grouse	Purple Finch
Black-backed Woodpecker	Blue-headed Vireo
Olive-sided Flycatcher	**Birds of wetlands and riparian areas**
Yellow-bellied Flycatcher	
Gray Jay	
Cape May Warbler	
Tennessee Warbler	
Blackpoll Warbler	Swamp Sparrow
Bay-breasted Warbler	Lincoln's Sparrow
Palm Warbler	Rusty Blackbird
Boreal Chickadee	Alder Flycatcher
Bicknell's Thrush	Louisiana Waterthrush

A total of 20 contiguous wildlife habitat units (CHUs) were identified in the study area, see Appendix 1, Section E for methodology. The 20 CHUs comprise a total land area of 23,811 acres, of which 20,387 acres is considered core habitat.

Over 9900 acres or 41% of the total CHU acreage has been conserved either privately or publicly.

Within the CHUs, approximately 6302 acres of Deer Winter Habitat has been identified and mapped. Mast stands were identified in 6 of the CHUs. A summary data table is provided in Appendix 2 detailing the individual habitat elements within all the CHUs. A discussion of the most significant CHUs is provided below.

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

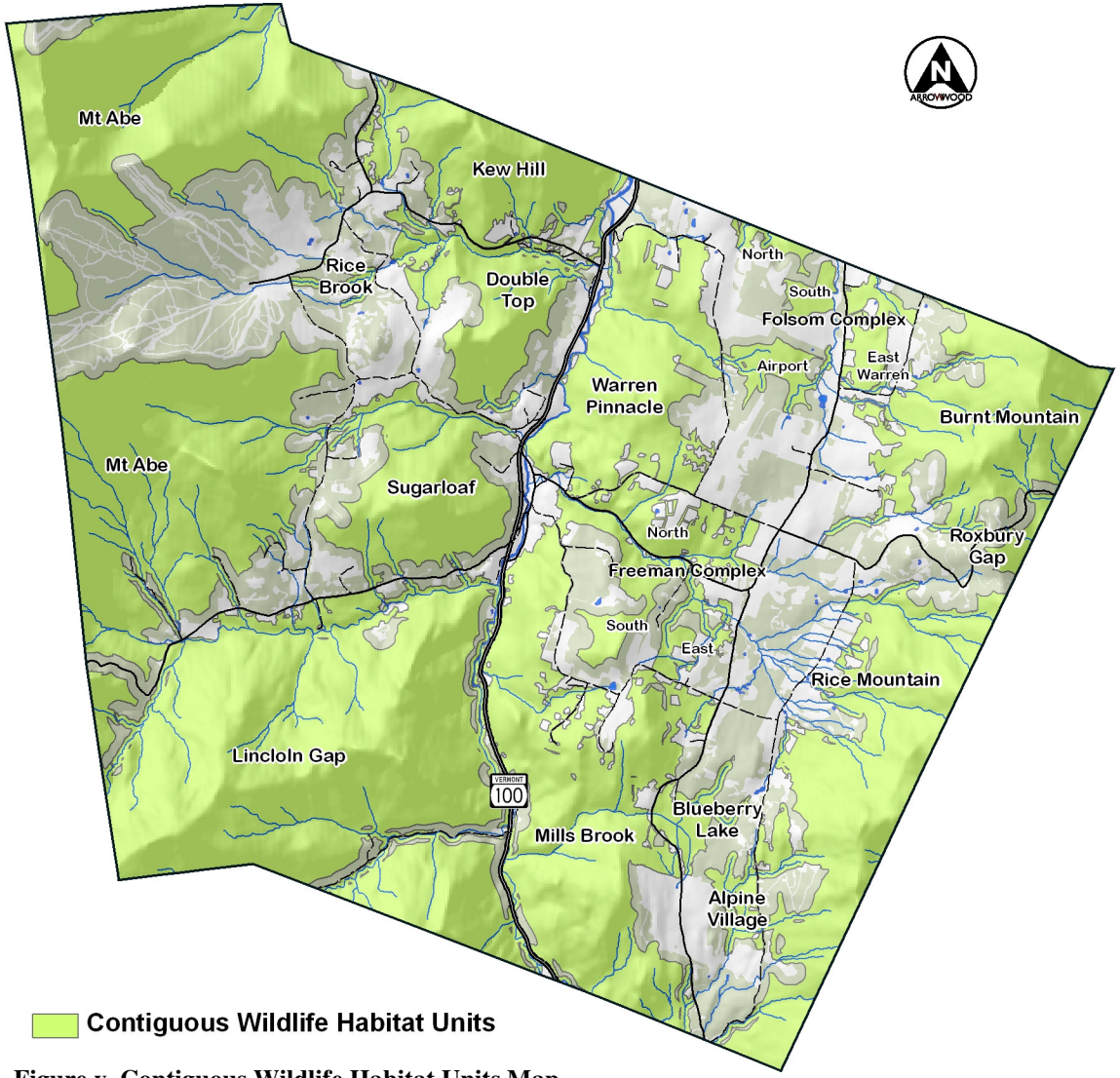

Figure v. Contiguous Wildlife Habitat Units Map

Small CHUs:

Rice Brook

Rice Brook
50.45 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
14% Conserved

The Rice Brook CHU, located to the east of the Sugarbush Ski-area, is a 50 acre swath of forested riparian corridor dominated by Hemlock-Northern Hardwood forest. This area may provide some deer wintering habitat, but certainly has value to riparian species such as the Louisiana waterthrush and northern parula. The Rice Brook CHU also contains a wetland that is suitable for black bear use during the spring and summer months. Other species such as mink, fisher and coyote may also use this area.

Alpine Village

Alpine Village
103.13 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
Conserved Land

The 103 acre Alpine Village CHU is centered on the Alpine Village Wetland Complex and provides a nice variety of habitat features including shrub, forested and open water wetlands, early successional habitat and west facing Hemlock-Northern Hardwood forest. Although only limited deer use was noted during the winter of 2007/08, this area may be used by white-tailed deer as wintering habitat. The wetlands have characteristics making them suitable for spring and summer bear feeding. The diversity of habitats makes this area particularly suitable to bird species such as the Canada warbler, ruffed grouse, American woodcock and American redstart. Additionally the wetlands are likely to provide considerable reptile and amphibian habitat, as well as opportunity for mink, otter, bobcat, moose, bear, and beaver. Waterfowl species and birds such as the alder flycatcher, swamp and Lincoln's sparrows and Louisiana waterthrush may also be found breeding here.

Blueberry Lake

Blueberry Lake
136.73 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
Conserved Land

The Blueberry Lake CHU consists of large and diverse wetlands centered on the lake. Shrub swamps and spruce-fir tamarack swamps as well as marsh and open water areas provide habitat for a variety of waterfowl, shorebirds, fish, and aquatic animals such as amphibians and reptiles, river otter, mink, muskrat, and likely black bear as well. The stream and forested riparian corridors provide habitat and landscape linkages for wildlife and their movements to and from other wild areas in Warren. Large areas of early

succession and edge habitat provide browse and nesting habitat.

Northeast of Blueberry Lake, are a Red Spruce-Northern Hardwood Forest and a Lowland Spruce-Fir Forest. These conifer dominated areas likely serve as deer winter habitat. Bobcat likely take advantage of ample prey drawn to the edge habitat along the wetland/forest boundary. Birds such as the swamp sparrow, Louisiana waterthrush, alder flycatcher, American redstart, chestnut-sided warbler and Nashville warbler, among many others, are likely to breed in this diverse CHU.

Roxbury Gap

The Roxbury Gap CHU is a relatively small (189 acres) wildlife block that connects with large wildlands in the Town of Roxbury. Part of this CHU is conserved within the Roxbury State Forest. This forest block is situated between the Old Warren and Warren Mountain Roads and is composed of Northern Hardwood and Montane Yellow Birch-Red Spruce forest. While this forest block contains no core forest it does contain forested riparian habitat, and streams.

Roxbury Gap
188.96 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
25% Conserved

Bear crossings have been observed in the vicinity. Wetlands are present to the East in Roxbury. Bird species likely to be found breeding here include the blue-headed vireo, scarlet tanager, ovenbird and black-throated green warbler.

<u>Complexes made up of small CHUs:</u>

Freeman Brook Complex: North, East & South

The 572 acre Freeman Brook complex includes three CHUs in proximity to Freeman Brook in the center of Warren. These CHUs together are comprised of Hemlock and Hemlock-Northern Hardwood forest that are likely to provide important deer wintering habitat. In addition there are pockets of early-succession forest, wetland and forested riparian corridor that contribute to the needs of a variety of wildlife species. Bird species found breeding here may include the northern parula, blackburnian warbler and purple finch.

Freeman East	Freeman South	Freeman North
113.75 Acres	*206.07 Acres*	*253.18 Acres*
Core	**Core**	Core
Deeryard	**Deeryard**	**Deeryard**
Streams	**Streams**	**Streams**
Wetland	**Wetland**	**Wetland**
Early Succession	Early Succession	**Early Succession**
Forested Riparian	**Forested Riparian**	**Forested Riparian**
Mast	Mast	Mast
Ledge/Cliff	Ledge/Cliff	Ledge/Cliff
Bear Wetland	Bear Wetland	**Bear Wetland**
Vernal Pools	Vernal Pools	Vernal Pools
Significant Community	Significant Community	Significant Community
49% Conserved	Conserved Land	Conserved Land

Folsom Brook Complex: North, South, Airport, East Warren

The Folsom Brook Complex includes four CHUs in the north-central part of Warren along the border with Waitsfield. This 570 acre complex includes the Folsom North (mostly in Waitsfield), Folsom South, Airport and East Warren CHUs. The Folsom Brook complex is focused along or in proximity to Folsom Brook which flows into the Mad River to the North. These four CHUs provide a somewhat similar set of habitat characteristics in relatively close proximity, and although each is larger than 50 acres, they are separated by roads, development and land use changes that may limit wildlife movement to some degree.

Folsom South	Airport	East Warren	Folsom North
64.38 Acres	*127.45 Acres*	*150.11 Acres*	*342.21 Acres*
Core	**Core**	Core	**Core**
Deeryard	**Deeryard**	**Deeryard**	**Deeryard**
Streams	**Streams**	**Streams**	**Streams**
Wetland	**Wetland**	**Wetland**	Wetland
Early Succession	Early Succession	**Early Succession**	Early Succession
	Forested Riparian	**Forested Riparian**	**Forested Riparian**
Mast	Mast	Mast	Mast
Ledge/Cliff	Ledge/Cliff	Ledge/Cliff	Ledge/Cliff
Bear Wetland	Bear Wetland	Bear Wetland	Bear Wetland
Vernal Pools	Vernal Pools	Vernal Pools	Vernal Pools
Significant Community	Significant Community	Significant Community	Significant Community
Conserved Land	Conserved Land	Conserved Land	**19% Conserved**

The Folsom North area is dominated by Hemlock and Spruce-Fir Forest and is almost entirely un-fragmented Core forest. Likewise, the Airport CHU to the south is also mostly coniferous Core forest consisting of a mix of Spruce-Fir and Red-spruce Northern Hardwood forests. The East Warren CHU, on the other side of East Warren Road, is largely comprised of a west facing Hemlock-Northern Hardwood forest that likely provides quality deer-wintering habitat. blackburnian warbler, purple finch and black-throated green warbler, among others likely use these coniferous forested CHUs.

In the middle of these is the Folsom South CHU which is dominated by an old-field. The old-field likely provides early-successional habitat that is used for nesting by many declining bird species such as the chestnut-sided warbler, white-throated sparrow, and as displaying and mating areas for other species such as the wild turkey and American woodcock.

Wildlife observed in and around the Folsom Brook complex includes bear and moose.

Large CHUs (greater than 500 acres)

Double Top

The Double Top CHU is nearly 600 acres of forested habitat surrounding Double Top Mountain. The area consists of Northern Hardwood, Hemlock-Northern Hardwood and Hemlock Forest communities. Most of the Double Top CHU has an east or northern aspect; the deer winter and ledge habitat values are therefore somewhat limited. Deer do utilize the south-facing slopes during the winter months. A good portion of the forest contains American beech trees and is likely utilized by bear and other wildlife for its beechnuts. Double Top provides over 400 acres of deep woods core habitat with high horizontal diversity. This CHU also borders Route 100 and provides potential connecting habitat to the Warren Pinnacle CHU. A variety of forest bird species can likely be found in this CHU including raptors, woodpeckers such as the yellow-bellied sapsucker and songbirds such as the black-throated blue warbler, blue-headed vireo, blackburnian warbler and wood thrush.

Double Top
596.19 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
16% Conserved

Wildlife and wildlife sign observed in this CHU or nearby include: bear, red fox, coyote, mink and deer.

Sugarloaf

The Sugarloaf CHU is part of the large, relatively un-fragmented forest in the south-west part of Warren. The 750 acre block has northern hardwood as well as conifer dominated forest. The area contains forest riparian corridors, stream habitats, winter deer habitat and over 650 acres of core forest habitat. The Sugarloaf CHU also is linked to other CHUs by potential wildlife corridors throughout the town. The presence of ledge, deer winter habitat, American beech and bear wetlands draw animals into this CHU. Many birds are likely drawn to breed in these habitats, including the Canada warbler, blackburnian warbler, veery and black-throated blue warbler.

Sugarloaf
756.13 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
7% Conserved

Observations of coyote, deer, moose, mink, and many bear over the years attest to its value as wildlife habitat.

Warren Pinnacle

The Warren Pinnacle CHU is a 1000 acre wildlife unit that is dominated by Northern Hardwood, Hemlock-Northern Hardwood and Hemlock Forest communities. This CHU has forested riparian habitat, early succession forest, over 30 acres of wetlands, seeps, 2 potential vernal pools, and likely provides important amphibian breeding habitat. Ledges and talus provide cover and shelter for porcupine, ruffed grouse, raccoon, bobcat and other wildlife. The ledge and deer wintering areas in the Warren Pinnacle are west-facing, providing important habitat for wildlife trying to stay warm during the winter. Site observations, however, suggest that winter deer use in this area is limited; further field work in needed to adequately assess this habitat. The Warren Pinnacle lands likely provide an important linkage across Route 100 toward the Double Top CHU and east to the Folsom Brook CHU Complex.

Warren Pinnacle
998.78 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
Conserved Land

Birds likely to be found breeding in this predominantly coniferous CHU include the blackburnian warbler, northern parula and black-throated green warbler.

Many species of wildlife have been observed in or near this CHU including deer, moose, red fox, wild turkey, bobcat, and several bear.

Kew Hill

The Kew Hill CHU is a 1230 acre CHU that straddles the towns of Waitsfield, Fayston and Warren. Much of this CHU is conserved by Camel's Hump State Forest or through privately conserved land. Over 1000 acres of this wild forest is core, deep woods habitat dominated by northern hardwoods with hemlock. These woods include bear wetlands, beech and red oak stands and at least 1 vernal pool. Deer winter habitat is provided by the over 200 acres of coniferous forest cover. Extensive forested riparian habitat, as well as ledge and talus add to the diversity of wildlife habitat in this CHU. Small areas of early succession forest and wetlands are present also.

Kew Hill
1229.61 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
35% Conserved

This CHU likely provides breeding conditions for ovenbird, yellow-bellied sapsucker, scarlet tanager and eastern wood-pewee among many others.

The wildlife and wildlife sign observed in and near this CHU includes: bear, moose, deer, red fox, coyote, bobcat, fisher, river otter, beaver, and frogs.

Mills Brook

The 1850 acre Mills Brook CHU sits just east of Route 100 in the southern part of Warren. Wildlife move from this parcel into others across the road. This contiguous habitat continues south into Granville. Over 620 acres of Mills Brook is conserved within Vermont Land Trust and Green Mountain Forest Lands. The 1244 acres of core forest with a high horizontal diversity, provides important habitat for wildlife. With a western aspect, the site's deer winter, ledge and cave habitat values are increased. The Mills Brook CHU contains American beech trees and wetlands providing black bear with year-round feeding opportunities. At least 4 potential vernal pools provide amphibian habitat and pockets of shrub wetland/early succession habitats are important feeding and breeding areas for some wildlife.

Mills Brook

1850.63 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
36% Conserved

Birds breeding in the Mills Brook CHU are likely to include Canada warbler, ruffed grouse, purple finch, blue-headed vireo, scarlet tanager and wood thrush.

Numerous moose, bear, and deer have been observed within or near this CHU.

Burnt Mountain

The Burnt Mountain CHU is part of the Northfield Mountain complex and continues into Northfield, Roxbury, and Waitsfield. The complex rises to over 2800 feet in elevation and provides potential Bicknell's thrush and other high-elevation songbird habitat. At lower elevations northern hardwood forests dominate the hillsides. Burnt Mountain provides over 1700 acres of remote core habitat for moose, bear and other predators. Wetlands, streams and their associated forested riparian habitats provide wildlife habitat for a variety of species. Bear likely utilize some of these wetlands during the spring and summer months.

Burnt Mountain

1920.29 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
Conserved Land

Besides Bicknell's thrush, other birds that may be found breeding in the high elevation areas of this CHU are the olive-sided flycatcher and blackpoll warbler. In the lower elevations, a variety of warblers such as the black-throated blue, thrushes like the wood thrush and veery and many other species are likely present.

A snowy owl and bear have been sited near this CHU, and extensive moose browse was observed.

Rice Mountain

The Rice Mountain CHU, also in the eastern Northfield Mountain Complex, is over 3400 acres of core forest habitat. Rice Mountain provides potential habitat for Bicknell's Thrush and other high-elevation songbirds. This CHU is large enough to provide space and habitat features for bears, including reproductive females. The area has 2 potential vernal pools that provide breeding habitat for amphibians. The area also contains several ledge habitats. This CHU continues in Roxbury, where large areas are conserved with the Roxbury State Forest. Lower down the slopes hemlock and other coniferous forest likely provide deer winter habitats. Both the ledge and deer winter habitats are west-facing and provide warmer, sunny habitats for wildlife.

Rice Mountain
3497.64 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
36% Conserved

A full suite of forest birds are likely to be found breeding in this CHU including scarlet tanager, ovenbird, blue-headed vireo, black-throated blue warbler and magnolia warbler.

Sign of bear, moose, and bobcat have been observed in this CHU.

Lincoln Gap

The Lincoln Gap CHU is a large habitat unit, stretching from just over 900 feet to over 3000 feet in elevation. It is dominated by extensive northern hardwood forests. Over 4000 acres of this area is conserved within the Green Mountain National Forest. The Lincoln Gap CHU has high elevation forests that are potential habitat for Bicknell's thrush. Extensive ledges provide habitat for porcupine, ruffed grouse, raccoon, and bobcats. Stands of American beech produce beechnuts eaten by deer, turkey, and black bear.

Lincoln Gap
5067.1 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
86% Conserved

The Lincoln Gap CHU also has early succession habitat, forested riparian areas, bear wetlands and a large core area distant from most human activities and development. Forest interior songbirds, owls, and raptors likely inhabit this area, as due coyote, fisher, bobcat, and bear. This CHU is large enough to contain habitats of these wide-ranging species including reproductive females.

The full suite of forest birds are likely to be found breeding in this CHU including scarlet tanager, wood thrush, blue-headed vireo, black-throated blue warbler. Of note are some large areas of managed patch and clear-cut early succession habitat in the central and southern portion of this CHU. These areas provide breeding habitat for species such as the magnolia

warbler, chestnut-sided warbler, mourning warbler and Nashville warbler.

Moose browse on woody plants and several black bear scat have been observed here.

Mt Abe

The Mount Abe CHU encompasses the heart of the Green Mountains and is the largest contiguous wildlife habitat in Warren. The Mount Abe forest extends up from 1348 feet to over 4000 feet in elevation. The wild forest here continues into Fayston and Lincoln. The upper elevation spruce-fir forests provide extensive habitat for Bicknell's thrush and other high elevation songbirds. The Mt Abe CHU contains several American beech stands including the large Slide Brook stand. The area also contains many ledges and small talus. Deer winter habitat and wetlands are located at lower elevations within this CHU. The Mount Abe core forest is over 6000 acres in size and provides breeding habitat for wide-ranging species such as bear, fisher and coyote.

Mt Abe
6158.66 Acres
Core
Deeryard
Streams
Wetland
Early Succession
Forested Riparian
Mast
Ledge/Cliff
Bear Wetland
Vernal Pools
Significant Community
48% Conserved

In addition to habitat for the endangered Bicknell's thrush, this CHU also provides important high-elevation habitat for species such as the olive-sided flycatcher and blackpoll warbler. Many forest nesters will be found in the mid-elevation areas such as the scarlet tanager and blackburnian warbler. The extensive edge and early succession habitat resulting from the cleared ski trails of the Sugarbush ski area will be preferred by species such as the chestnut-sided warbler, white-throated sparrow, Eastern wood-pewee and wood thrush.

Bear, moose, coyote, deer, and snowshoe hare have been observed in this CHU.

Figure w. Coyote Tracks

Management Recommendations for Wildlife Habitat

Large Contiguous Habitat Units: The Core 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 these larger CHUs should be discouraged. Roads, housing and most other human activities should be restricted to the periphery of these units.

- Forest management activities that support a diversity of forest and early succession natural communities are an appropriate use of these areas.

- 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, heavy forest cutting which promotes the development of edge conditions should be limited in these areas.

High Elevation Bird Habitat: High elevation songbird habitat is found in the Mt. Abe, Burnt and Rice Mountain areas, and the Lincoln Gap CHU. Bicknell's thrush and other high-elevation birdlife may nest in the higher elevations (generally above 2700 ft) within these units.

- Any forest removing activities proposed for areas above 2700 ft should be assessed by a professional biologist to ensure the minimization of impact to Bicknell's' thrush breeding habitat.

Bear Habitat: Black bear require extensive remote areas to meet their yearly habitat requirements. Large, non-road areas must be preserved to maintain sustainable populations within Warren. Bears must continue to have access to mast stands and forested wetlands. Bear habitat management can also focus on beech stands that have documented bear use (see Wildlife Habitat Elements Map included in the Appendix).

Figure x. Bear clawed beech tree

- Mapped beech 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 that shows current or historic use by bear should be discouraged.

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.

Figure y. An area of talus and boulders

Deer Winter Habitat: These habitats are critical to the survival and maintenance of deer populations in Warren and the broader Mad River Valley. Without deer winter habitat preservation, deer populations within the Valley could decline.

Figure z. Hemlock Forest deer winter habitat

- Deer winter habitats identified in this report 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.

Forested Riparian Communities:

Forested riparian habitats offer important wildlife habitat and provide cover for wildlife movement.

- 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.

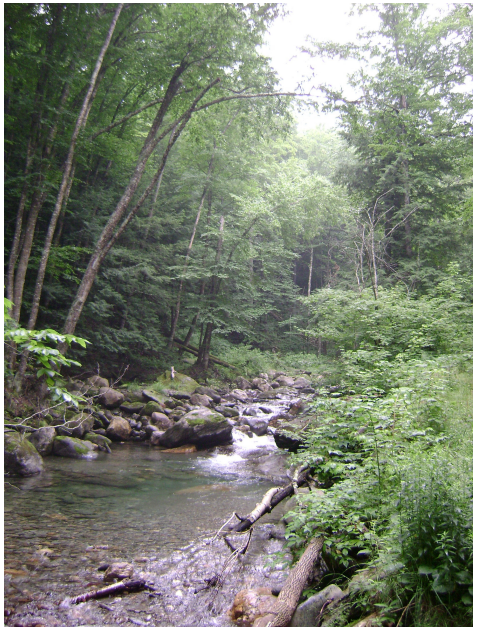

Figure aa. Riparian forest along Stetson Brook

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 affect 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 disappear. 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 towns and enable planners to draw more specific conservation guidelines.

- Conduct field verification studies to identify and characterize the important travel corridors within Warren and the broader Mad River Valley 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.

- Important black bear corridors are especially vulnerable and may require buffers of up to ¼ mile in extent.

- Improve vegetated buffer conditions along the Mad River and its tributaries to provide protected movement opportunities for wildlife.

7.0 Conclusions

The town of Warren is known throughout the region for the alpine skiing, which brings in thousands of people to the town every winter. Visitors and residents alike, however, also know Warren as a place of pristine forests and abundant wildlife. The habitats in the town range from low elevation riverside wetlands to high elevation conifer forests. This extreme diversity has created habitat for a wide variety of wildlife as well as areas of significant natural communities and rare species habitats. In many ways, it is this assemblage of natural features that defines the town. Maintaining this quality of wilderness, however, is only possible with proper town planning and resource management. It is our hope that this inventory will provide the information needed to protect the natural features of the town and maintain the quality of life for its visitors and residents.

8.0 References

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