

Beaver Brook Watershed
Cornwall, Vermont
Conservation Plan
July, 2010





 <p>Landslide Natural Resource Planning <small>Linking people to their landscape</small></p>	 <p>MIDDLEBURY AREA LAND TRUST</p>
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1. Introduction – See map 1, Appendix A

The Beaver Brook Watershed is typical of small tributary watersheds throughout the Champlain Valley of Vermont. Land use is a mix of agriculture, residential, woodlands, roads and waterways. Much of the native vegetation was cleared when Europeans settled during the 19th century, with remnants of Clay Plain Forest still present. There are development pressures that come mostly in the form of single houses being built over time, but much of the land remains open and increasingly it is hospitable to wildlife.

As agricultural land is converted to rural house lots, wildlife populations have rebounded – including species like coyote, beaver, mink and bobcat. Every day we are learning more about how much human encroachment wildlife will tolerate as our landscape grows more trees and more houses simultaneously. In the Beaver Brook Watershed, there is an opportunity to conserve a working agricultural landscape that also provides habitat for self sustaining populations of wildlife and supports rural housing close to Middlebury. Parcel sizes are relatively large, providing an opportunity for landowners who choose to, to conserve important areas for wildlife.

This conservation plan was motivated by Mary Dodge and Michael Katz, who are donating a conservation easement on their property because they realize that the potential is here for a working landscape that provides habitat for people and wildlife if we are able to conserve the most critical pieces of the landscape today. These property owners are doing something new to conservation in Vermont by way of donating an easement on their lands and then reaching out to their neighbors with a plan and a hope that they will work together to conserve important plant and animal habitat in the watershed.

Mary Dodge and Michael Katz own 58 acres in the northwest portion of the Beaver Brook Watershed. Fifty-three of these acres are forested and enrolled in the current use program and they are donating a conservation easement to the Middlebury Area Land Trust (MALT) to permanently conserve these forest lands. As part of the donation of this conservation easement, they have asked MALT to develop a watershed-wide conservation plan that will identify other lands that are important to the ecological function of the watershed. Ecological function refers to inter-and intra-specific interactions among different life forms within the watershed as well as the interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting and flammability (www.biology-online.org).

This conservation plan focuses on identifying areas for conservation of wildlife habitat and connectivity. Many of these areas are important for water quality protection and improvement as well.

2. Background

When European settlers arrived in the Champlain Valley, there was a mature forested landscape primarily composed of climax species – white pine, spruce and hemlock, interrupted by some wetlands and bogs that would not sustain large trees and by openings created when these large trees fell down.

By 1890, the Vermont landscape had been largely cleared for timber, agriculture and charcoal, creating a ratio of agriculture and wooded lands roughly the opposite of that which we experience today: 25% forested and 75% open versus 75% forested and 25% open now. Arguably, it is the increase of forested lands and decrease in active farming that has brought about a rebound to many of the areas wildlife species. Due to the existence of productive soils, the Champlain Valley continues to have more land managed for agriculture than other areas of Vermont. In the Beaver Brook Watershed, approximately 43% of the land area is forested and/or not managed for agriculture today.

Over the past 50 years the Vermont landscape, in particular the Champlain Valley, has experienced a decline in the amount of land cultivated for agriculture. At the same time, there has been a dramatic increase in the number of rural residences fragmenting the undeveloped landscape. Conventional wisdom among conservation biologists says that larger, less fragmented forested areas provide necessary habitat for many native species. The re-vegetation of the Vermont landscape corroborates this in the big picture, but at the smaller scale, the increase in diversity has gone hand in hand with an increase in fragmentation due to rural residential development. If we consider that from the perspective of a bobcat, increased areas of native vegetation have been beneficial and the development of rural residences on relatively large lots, has improved habitat by taking land out of agriculture and maintaining most of it as open space that has been allowed to revert back to woodland. The Beaver Brook watershed is a prime example of what has become the quintessential Champlain Valley landscape, with wildlife populations rebounding with the decline of agricultural cultivation.

When planning for wildlife conservation, it is typical to select an “indicator” species – a species that has needs that encompass many of the needs of other species as well. In the case of the Champlain Valley and the Beaver Brook Watershed, the bobcat provides the best umbrella for planning purposes. It is adaptable and utilizes hardwood and softwood forests and scrub/shrub and wetland land use types. It is also known to avoid roads and agricultural fields (Royar). Planning for bobcat will also be good for gray foxes as they have similar habitat needs. Finally, the home range of a female bobcat is between eight and ten square miles and the Beaver Brook Watershed is 7.5 square miles. In Vermont, only black bear and fisher are thought to have greater habitat needs than the bobcat and there have been reports of them in the watershed as well.

How much habitat is necessary to maintain healthy populations of wildlife? It is generally accepted that the hydrology of a watershed is altered when it is 10% developed. The Department of Fish and Wildlife, with UVM, has recently completed a study of bobcat habitat utilization that indicates the home range for a female bobcat is 8-10 square miles and that within that range, 67% of the land needs to be useful habitat (Royar). In the Beaver Brook watershed, which is 7.5 square miles, 43% of the land base is currently acceptable bobcat habitat.

There are multiple land uses competing within any given land area. The case of the Beaver Brook is no different. There are pressures from human habitation and land use, there are valuable, even rare, natural communities and wildlife and plant habitat types present, there are significant agricultural lands and wetlands, transportation needs, flood attenuation and water quality concerns. This management plan seeks to identify the important characteristics of the Beaver Brook watershed and identify those features that are most important for conservation in order to assist the residents of the watershed in implementing sound management practices into the future.

3. Vision

The Beaver Brook watershed in Cornwall, Vermont is a model of sustainability. It provides necessary habitat for people and native plants and animals by balancing agriculture, rural residential and ecologically sustaining land uses that establish core areas of habitat and travel corridors for plant and animal migration.

4. Goal

The goal of the Beaver Brook Watershed Conservation Plan is to identify and prioritize land areas that are important to the ecological health of the watershed and the region so that interested landowners may work toward long term conservation and improved management of these resources. The plan:

- Compiles existing natural resource information into a watershed-based structure that is accessible to watershed residents;
- Places the watershed in the larger context of Vermont and the Champlain Valley; and
- Prioritizes conservation areas to assist the Middlebury Area Land Trust with outreach efforts in the watershed.

5. Conservation Biology Basics – See Map 2, Appendix A

Conservation biology seeks to apply scientific knowledge to the conservation of life on the planet. At the watershed or landscape scale, conservation biologists generally agree on some

fundamental principles that have been developing since Darwin studied song bird evolution on isolated islands. These principles include:

- Larger, undeveloped tracts of land are more likely to have greater species diversity;
- Larger conserved areas are more beneficial to more species than smaller conserved parcels;
- Closer patches of undeveloped land in its natural vegetative cover are more likely to sustain plant and animal populations than are patches that are farther away;
- Interconnected large patches of conserved lands are the most likely to mimic an undeveloped landscape and to sustain healthy populations of native plants and animals.

The Conservation Fund has developed a “Green Infrastructure” approach to conservation planning that seeks to preserve important functions within the landscape that will ensure the preservation of ecosystem functions even as land is developed. The Green Infrastructure (GI) approach can be used for planning for all ecosystem services – from wildlife habitat to wetlands and waterways including human land uses such as agriculture. The Beaver Brook Conservation Plan is focused on planning for wildlife and water quality. The GI approach hinges on identification of hub areas as well as smaller blocks of land called “core” areas that are connected by corridors. Depending upon the species being considered, hubs, cores and corridors will provide for different life history needs. In some cases, a plant or animal may spend its entire life cycle in the corridor, but in other cases the corridor will provide a way for an animal to move safely from one hub area to another.

The Beaver Brook Watershed is a relatively undeveloped land area that currently functions as both a wildlife corridor – connecting the larger “hub” areas of the Cornwall Swamp and Snake Mountain Wildlife Management Areas, as well as providing “core” areas that sustain populations of many native plants and animals.

6. Existing Land Use

The Beaver Brook Watershed (BBW) is 4,822 acres or approximately 7.5 square miles. The top three land uses in the watershed are: hay (34%), crop land (27.5%) and all forest types added together (25.2%). Water is the next highest land use (5%) with the other land uses being considerably less. There are approximately 151 residential structures in the watershed and approximately 20 other buildings in the watershed. There are 16.2 miles of roads in the watershed and the watershed is approximately 5.7% developed.

Table 1. Land Use

Land Use	Acres	Percentage
Hay	1670.4	34.6
Crop	1327.6	27.5
Broadleaf forest	761.9	15.8
Water	241.6	5.0
Mixed Forest	178.9	3.7
Residential	170.8	3.5
Coniferous forest	161.7	3.4
Forested Wetland	112.9	2.3
Transportation	104.3	2.2
Wetland	91.0	1.9
Commercial	1.0	0.0
Urban/built up	0.4	0.0
Total	4822.4	100.0

7. Soils – Agricultural Value – See Map 3, Appendix A.

Current land use in the Beaver Brook watershed is driven by agriculture, which is a direct result of the quality of the underlying soils to support productive agriculture. The majority of the soils rated nationally prime and most of the statewide prime soils are currently utilized for active agriculture or maintained as hay fields. As of 2006, there were 29 parcels enrolled in the State’s Current Use tax program, totaling 2,547 acres, or 53 percent of the watershed. Of those acres enrolled in the program, 298 are forest land and 2,249 are agricultural land. While enrollment in Current Use does not preclude development of land, it can be considered an indicator of the long-term commitment of landowners to maintaining the land for active agriculture or managed forestry and does represent some level of commitment to not develop the land.

While lands managed for agriculture are not considered prime habitat for native wildlife or plant species, they are also not considered developed from a hydrologic perspective nor are they as inhospitable to wildlife as developed lands or areas near houses. There are grassland bird species that can benefit from hay field habitat if a specific cutting schedule is maintained. For this plan, however, species indigenous to Vermont are of primary concern.

Table 2. Prime Agricultural Soils

Type	Acres	Percent
Not rated	1439.4	29.8
Prime	712.4	14.8
Prime (b)	107.7	2.2
Statewide	1881.0	39.0
Statewide (a)	19.4	0.4
Statewide (b)	662.8	13.7
Total	4822.8	100.0

- a) Limited by slope
- b) Limited by wetness

8. Natural Communities – See Maps 4 & 5, Appendix A

Of the 4,823 acres in the Beaver Brook Watershed, approximately 2,082 acres, or 43%, is currently not mowed or cropped and considered in this plan to be “natural vegetation”. Without doing extensive field work, it is not possible to say what natural communities currently exist on all of these vegetated lands, however, the assumption is that they are more likely to have or evolve toward pre-settlement natural communities than are lands cultivated for agriculture.

The existing natural community maps were created by digitizing the natural vegetation lands that are forest lands and un-mowed wet grasslands at a 1:5,000 scale from the 2008 National Agricultural Inventory Program (NAIP) color aerial photos. These naturally vegetated lands were then joined to the soils map and linked to the Natural Community Types as defined in Wetland, Woodland Wildland (Thompson & Sorenson). The map of pre-settlement community types was made by joining the soils data with the natural community data. For a detailed description of each natural community type, please refer to Wetland, Woodland, Wildland (Thompson & Sorenson).

Natural communities are critical to maintaining healthy populations of indigenous plants and animals. They provide a generalized measure of how the current landscape compares to that of pre-European settlement. Conservation biologists agree that conserving biodiversity can be best achieved by conserving all of the different types of natural communities. What is striking about the following tables and charts of pre-settlement and post-settlement natural community distribution is how similar the percentages of each community type are between the two landscapes. When prioritizing future areas for restoration and possible conservation, it is recommended that community types that currently are at a lower percentage of the landscape than before settlement are prioritized. For example, Valley Clayplain forest type was 43% of the landscape but today it is 35% of it.

Table 3. Pre-Settlement Natural Community

Natural Community Type	Acres
Hemlock/Hemlock White Pine	19.406
Mesic Maple-Ash-Hickory-Oak	449.217
Mesic Maple-Ash-Hickory-Oak/Rich NH	602.513
Mesic Maple-Ash-Hickory-Oak/Transition Hardwood Limestone	423.046
Red Cedar Woodland/Mesic Maple-Ash-Hickory-Oak Forest	50.559
Red Maple-Black Ash Swamp/Calcareous Red Maple Tamarack Swamp	118.322
Spruce-Fir-Tamarack Swamp	84.794
Valley Clay Plain/Mesic Red Oak	138.442
Valley Clay Plain/NH Forest	74.54
Valley Clayplain Forest	2088.54
Water	4.513
Wet Clayplain Forest	662.832
Wet Clayplain Forest/Alder Swamp	106.047
Total	4822.771

Table 4. Existing Natural Communities

Natural Community Type	Acres
Hemlock/Hemlock White Pine	5.4
Mesic Maple-Ash-Hickory-Oak	175.1
Mesic Maple-Ash-Hickory-Oak/Rich NH	213.6
Mesic Maple-Ash-Hickory-Oak/Transition Hardwood Limestone	358.3
Red Cedar Woodland/Mesic Maple-Ash-Hickory-Oak Forest	27.4
Red Maple-Black Ash Swamp/Calcareous Red Maple Tamarack Swamp	108.6
Spruce-Fir-Tamarack Swamp	43.5
Valley Clay Plain/Mesic Red Oak	37.5
Valley Clay Plain/NH Forest	34.7
Valley Clayplain Forest	716.7
Water	0.4
Wet Clayplain Forest	290.1
Wet Clayplain Forest/Alder Swamp	70.4
Total	2081.7

Chart 1. Pre-settlement Natural Communities

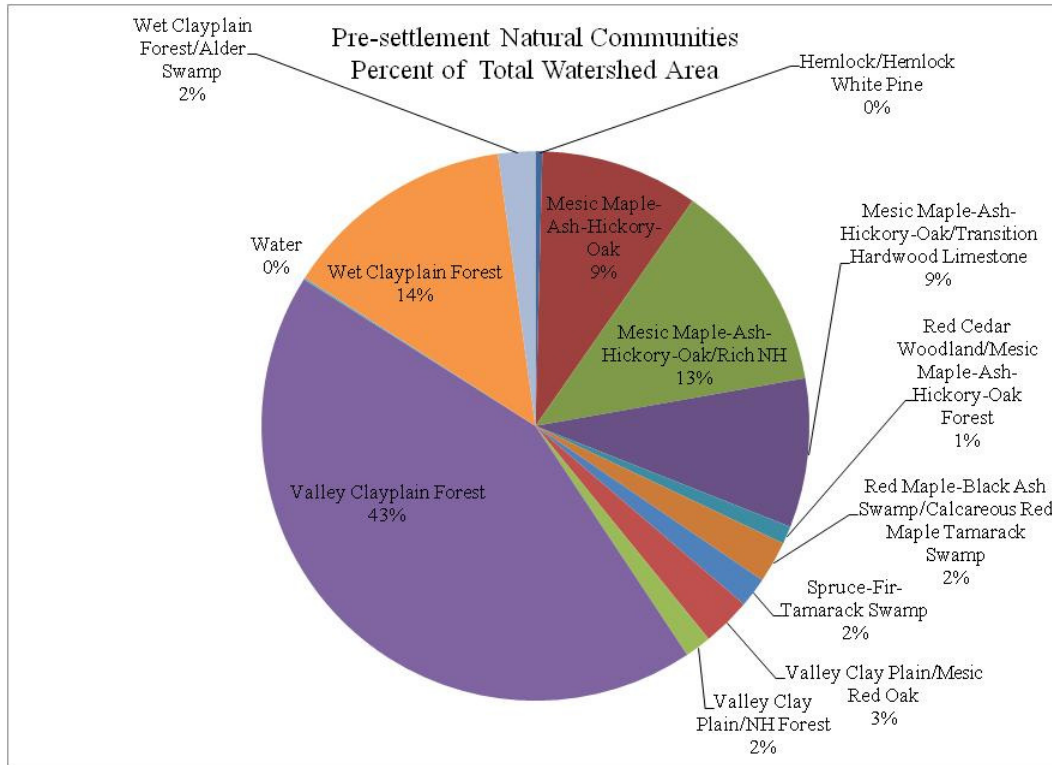
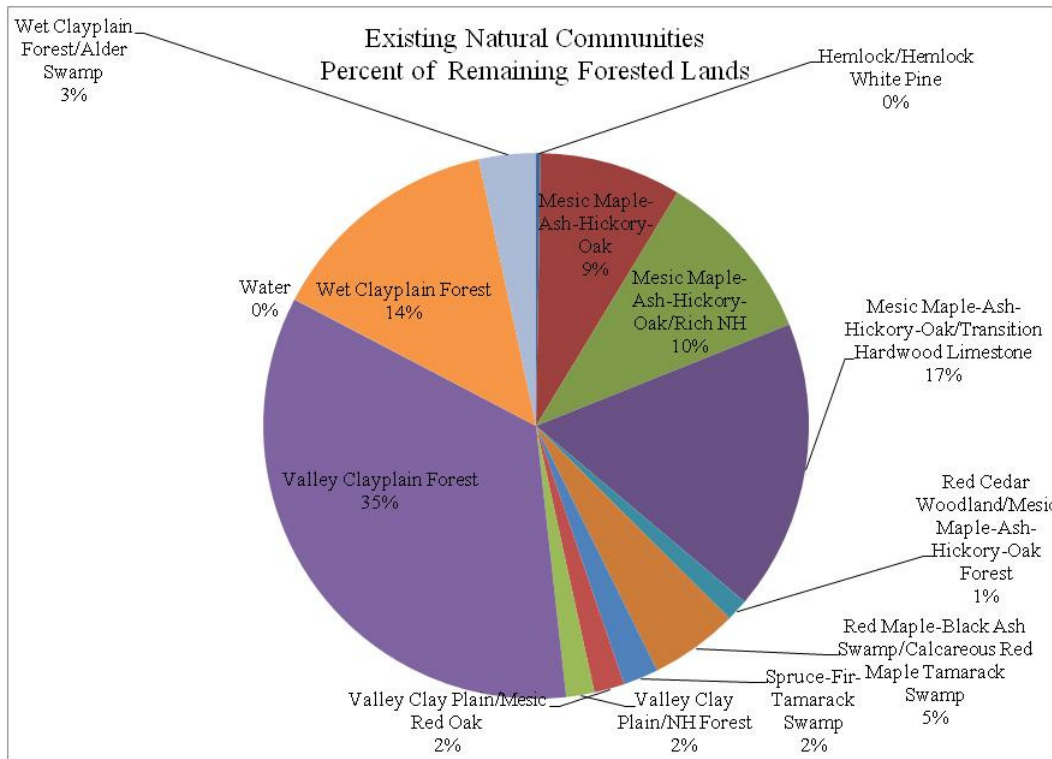


Chart 2. Existing Natural Communities



9. Waterways and Wetlands - See Map 6, Appendix A

The Beaver Brook is a tributary of the Lemon Fair River, which is a tributary of the Otter Creek. It is 4,823 acres in size or 7.5 square miles. There are two Beaver Brooks in close proximity to one another in the Lemon Fair Watershed: one enters the Lemon Fair in Weybridge and has its headwaters along Cider Mill Road in Cornwall. The other, the subject of this report, is entirely in the Town of Cornwall and is just downstream and west of the former Beaver Brook. On some maps, the latter is referred to as the Beaver Branch.

Wetlands are important for many reasons: They provide storage for flood waters, sediment and nutrients before they enter moving water and end up in Lake Champlain; they also provide necessary habitat for numerous amphibians and reptiles; they can provide connectivity and food sources for animals that do not live in them. There are 234 acres of Class II wetland in the BBW. Class II wetlands have been identified by the State as significant and are given increased protection as a result. State law requires a 50' buffer on all Class II wetlands – which encompasses an additional 112 acres of land adjacent to these important wetlands. Additionally, there are approximately 33 acres of other wetlands identified on the National Wetland inventory. The Town of Cornwall requires a 50' setback from all perennial streams and a 25' setback from all intermittent or seasonal streams. These buffers are shown on the SGA/wetlands map.

The Addison County River Watch Collaborative has monitoring data on the Lemon Fair River from 2003-2007 for E. Coli and Total Phosphorous for one site in the middle of the BBW (on Sperry Road) as well as at LFR3.7, the closest monitoring site downstream of the mouth of the Beaver Brook. Water quality in the Lemon Fair Watershed is negatively impacted by human land uses, in particular, runoff from agricultural practices in the upstream portions of the watershed.

In 2006 Addison County Regional Planning Commission completed a Phase 1 Stream Geomorphic Assessment of the Lemon Fair watershed, which includes the Beaver Brook. Primary impacts identified on the BB were straightening, eight undersized bridges and culverts, and four dams. Channel straightening is typically the result of agricultural practices, road and rail road development and road crossings. It increases both bed and bank erosion by increasing the velocity of the water in the channel, which leads to down cutting of the bed and collapsing banks. If left unmanaged, over time, a stream will naturally regain its sinuosity and re-establish an equilibrium condition.

Undersized bridges and culverts increase the velocity of the stream and can lead to bed erosion. They are also more prone to clogging and flooding during high water events, which can lead to road closures and/or washouts. The dams that were identified were all in the headwaters of the BB. Dams can disrupt the equilibrium of a stream by trapping sediment and causing increased erosion downstream of the structure as the stream seeks to regain equilibrium. Additionally, impoundments increase the temperature of the water in the channel which can adversely affect aquatic organisms.

10. Habitat Connectivity: Conserved Lands and Context – See Map 7, Appendix A

The BBW is a critical link between areas that are considered wildlife conservation priorities at the State level: Snake Mountain and Cornwall Swamp both have significant areas of state lands (wildlife management areas) as well as private conservation lands (The Nature Conservancy). As Addison County and Vermont continue to provide habitat for increasing numbers of people, the landscape risks becoming too fragmented to provide habitat and movement corridors for wildlife. The BBW currently provides important links between the Cornwall Swamp and Snake Mountain. Two corridor areas – one that follows the Beaver Brook and the other that follows a tributary of the Brook part of the way but is on the ledges in the eastern watershed have been identified as high priority areas for conservation in this plan.

11. Conservation Priorities – See Map 8, Appendix A

Conservation priorities were identified by mapping wildlife travel corridors, core areas, rare, threatened and endangered species and communities, Class II wetlands and perennial and intermittent streams. The mapping started with the creation of a GIS layer of existing natural vegetation – areas within the watershed that are not actively farmed or otherwise developed, that are more likely to host native natural communities and to provide important habitat for native species. Utilizing this natural vegetation layer, two potential wildlife corridors were identified as linear features running north/south that are a minimum of 600’ wide and are in a natural vegetation cover and connect with areas of natural vegetation outside of the watershed that are connected to Snake Mountain and the Cornwall Swamp. The width of a wildlife corridor is based on the “umbrella” species that is being planned for – in this case, the bobcat (Royar).

Areas of natural vegetation were used to locate existing core areas in the watershed. A core area was defined as any area with natural cover that was 100’ from an edge with a different land use. These core areas provide habitat cover for species that are not well adapted to the human altered, agricultural landscape. Rare, threatened and endangered species and communities were mapped as well as Class II wetlands with their required 50’ buffer. Finally, streams, which both provide important habitat and protect water quality were mapped with the Town of Cornwall’s required 50’ setback on perennial streams and 25’ setback on intermittent streams.

12. Management Recommendations

The conservation priorities mapped in this study allow individual landowners to understand how their property fits into the whole of the Beaver Brook watershed as well as the region. This study was completed to help inform private property owners as they development management plans for their property with the hope that it will motivate people over time, to explore placing conservation easements on lands valuable to wildlife. There are other actions that can be taken to make an area more hospitable to native plants and animals. These include:

- Maintenance and enhancement of hedgerows;
- Re-establishment of stream bank vegetation; and
- Removal of exotic invasive plants with cultivation of natives.

13. Conclusion

This study provides a new type of conservation planning in the State of Vermont – one that comes from landowners in the watershed who have conserved their land and are hoping their watershed neighbors will voluntarily conserve the significant areas of their properties to allow for the continued coexistence of people and wildlife in the watershed. Conservation planning and watershed science are just beginning to explore and understand thresholds for ecological function at the landscape level and the Beaver Brook Watershed is currently a model for the coexistence of people and wildlife. More people are realizing that their individual actions, when added to their neighbors, can have a great impact. If enough people chose to conserve important wildlife habitat, then this coexistence will continue for future generations.

14. Additional Future Refinement

In addition to the identification of important habitat areas done in this study, there are other refinements that could be done to improve the management plan:

- Core area size and natural community diversity are two characteristics that could help in prioritizing conservation areas further;
- Properties could be prioritized based on ecological function and landownership/size of parcel;
- The information on natural community distribution prior to European Settlement and in the current landscape could be used to identify areas could be restored to their pre-settlement natural community, allowing the current distribution of natural communities to more closely mimic the past;
- Identification of areas for future development; and
- Agricultural lands and scenic view shed analyses would compliment this conservation plan.

15. GIS Analysis

1. Digitize existing natural vegetation from the National Agricultural Inventory Program (NAIP) 2008 color aerial photos at a scale of 1:5,000. Natural vegetation is defined as not actively farmed or mowed, understanding that natural forest succession may not be

occurring on some of these properties as they have forest management plans, however, for this exercise, they are providing wildlife habitat.

2. Using Euclidean distance tool, identify forested areas that are 100 feet from the forest edge. Create core area shapefile.
3. Clip State of Vermont Significant Wetlands theme to watershed boundary to identify Class II wetlands in the watershed and apply required 50' buffer.
4. Clip National Wetlands Inventory GIS theme, to identify remaining inventoried wetlands in the watershed.
5. Clip existing State of Vermont Rare, Threatened and Endangered Species and Natural Communities theme to watershed boundary.
6. Clip surface waters to watershed boundary and buffer perennial stream 50' and intermittent streams to 25'.

15. References

- Addison County River Watch Collaborative, March 23, 2009, Draft Lemon Fair River Water Quality Report (Interpretation and Conclusions Based on Results: 2003-2008).
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