Champlain Valley
Clayplain Forest Restoration:
A Landowner’s Guide

Middlebury College
Environmental Studies Senior Seminar
Spring 2003
Champlain Valley Clayplain Forest Restoration: A Landowner’s Guide

Michela Adrian
Nora Greenglass
Kelsey Ingmundson
Alex Kinsey
Brian McCurdy
Daniela Salaverry
Sarah Twichell
Rita Vincello
Martin Whyte

Program in Environmental Studies
Middlebury College
Middlebury, VT
Spring 2003

Please do not cite or reproduce without permission of the
Middlebury College Environmental Studies Program
Table of Contents

Introduction .................................................................................................................. 2
Geologic History of the Southern Champlain Valley.............................................. 4
Natural History of Clayplain Forest in Vermont.................................................... 5
Restoration Site History and Description ............................................................... 6
Restoration Planning ............................................................................................... 9
Restoration Supplies and Costs ..............................................................................12
Planting Techniques ...............................................................................................14
Future Management of Restored Plot .................................................................16
Summary ..................................................................................................................18
Acknowledgements ...............................................................................................19
Works Cited .............................................................................................................20
Appendices .............................................................................................................21

Cover photograph © 2000 Heather Karlson
Introduction

Imagine a landscape cleared of forest—where once stood imposing oaks and stately pines, there are instead ragged stumps and gullies raging with murky brown runoff. Now envision hills blanketed by beech, birch, maple, and spruce, where deer and fisher are dappled by sun and shade within the shelter of thick forest. Both these past and present landscapes define the character of Vermont. The experiment of farming on the rocky, sloping soils of the region largely ended a century ago, leaving in its wake a landscape stripped, to a large degree, of its precious natural resources. However, with the cessation of this use and the emigration of human settlers has come the relatively rapid return of the forests. Year by year, species by species, much of the anthropogenic landscape of Vermont was reclaimed by the wild.

However, the “rewilding” of Vermont is not complete. While most of the hill farms are abandoned, the fertile clay soils of the Champlain Valley remain in agricultural production today. Here, the native clayplain forest, which includes oak, hickory, maple, elm, beech, hemlock, and white pine, as well as native shrubs and herbs, has been replaced by corn, hay, and cattle in all but a few scattered patches. This species-rich ecosystem is distinct to the Champlain Valley region of Vermont, and its future existence depends on the fate of a handful of forest fragments that persist.

The Environmental Studies Program of Middlebury College in Middlebury, Vermont received permission from the College to restore a deforested clayplain fragment that, until recently, had been in agricultural use. Working in cooperation with the Champlain Valley Clayplain Forest Project (CVCFP), a group of students from the Environmental Studies Senior Seminar in the spring of 2003 undertook the task of restoring native clayplain forest to the site.

The CVCFP is a local organization that is involved in promoting stewardship, conservation, and research of the Champlain Valley’s clayplain forest natural community. CVCFP is also working with willing landowners to restore clayplain forest to parts of its native range. To this end, the CVCFP works collaboratively with landowners, foresters, land trusts, and local, state, and regional agencies to “identify and champion the best stewardship, management, and conservation strategies” (Karlson and Lapin, 2001).

The students involved in this restoration worked intensively with the CVCFP in order to encourage the establishment of clayplain forest on former agricultural land. We worked to restore the field by planting native species of trees and shrubs. As this is one of the first efforts of its kind, we endeavored to create a replicable model of restoration for landowners who wish to reestablish a
native community on clayplain land that was formerly farmed. It is important to remember that each ecosystem is unique in terms of both its natural history and history of land use, as well as its physical, biological, and geochemical characteristics. Therefore, each piece of land and its associated assemblage of species may respond differently under the varying starting conditions from which a restoration begins. It is also important to remember that restoration is a process, and that a successful process will work to perpetuate and/or restore the productivity, fertility, genetic diversity, ecological functions, and general health of clayplain ecosystems (Lapin, 2003b).

This Landowner Guide was written to supplement the CVCFP’s “Champlain Valley Clayplain Forest: Natural History and Stewardship” booklet. It is an effort to document the planning, supplies, costs, and processes associated with a specific restoration project. The remainder of the Guide will address the following:

- Clayplain forest and its history in Vermont
- Descriptions of the parcel of land that was restored by the Environmental Studies Senior Seminar in the Spring of 2003
- Step-by-step documentation of the process of planning and implementing this project, including chronology, species, supplies, costs, planting techniques, and difficulties encountered
- An outline for future management of the process of restoration on this site

Clayplain forest was once the dominant land cover in Vermont’s southern Champlain Valley. Through this restoration project and others like it, portions of the landscape may return to a state of natural health and equilibrium with respect to its native species and processes. We hope that this project, as well as the Landowner Guide, will serve as an inspiration and a model to those who wish to participate in the restoration and “rewilding” of Vermont.
Geologic History of the Southern Champlain Valley

“Clayplain” is an abbreviated name for “clay-soil lake plain,” the landform type that describes the region and its geologic history. The bedrock of the Champlain Valley consists mostly of limestones, dolomites, and calcareous (calcium-rich) shales. This bedrock sequence formed in a near-shore, shallow marine environment approximately 540-440 million years ago (mya). Over geologic time, the area was uplifted by a series of mountain building events, including the Taconic and Acadian Orogenies (440-430 mya and 400-350 mya, respectively). In more recent geologic time, the Champlain Valley was first glaciated, then inundated by water from melting ice as the glaciers retreated, resulting in the formation of proglacial Lake Vermont approximately 15,000 years ago. By 13,000 years ago, the combination of retreating ice, rising sea level, and depression of the crust from glaciers caused the lake basin to fill with marine water, forming the Champlain Sea. By 11,000 years ago, however, the inlet of marine water was closed, and precipitation and melting of snow filled the Champlain Sea with freshwater to create the present-day Lake Champlain. Clay and silt sediments that were deposited at the bottom of Lake Vermont and the Champlain Sea form the dominant parent material of the southern Champlain Valley soils. These soils are nutrient-rich because of the chemical composition of both the calcium-rich bedrock and the lake and marine deposits. The soils are predominantly somewhat poorly to well-drained clays; however, in some locations an overburden of sand exists where deltas or beach ridges may have formed in Lake Vermont or the Champlain Sea (Lapin, 2003a).
Natural History of Clayplain Forest in Vermont

Today, the Champlain Valley is dominated by agricultural lands supporting dairy cattle, corn, and hay. It is difficult to imagine what was here before European settlers began taking advantage of the fertile clay soils and working the land. But if we look closely at some of the remaining forest fragments among the fields and meadows, we can begin to piece together an idea of what Vermont’s natural landscape looked like.

Small remnants of clayplain forest are all that remain throughout the entire Champlain Valley of New York, Vermont, and Quebec. Clayplain forest is distinct from the forests of the Green, Taconic, or Adirondack Mountains due to the warm valley climate, very high fertility of the clay soil, and moderate to poor soil drainage (Karlson and Lapin, 2001). The clayplain forest also serves as habitat for animal species, such as bobcat, wild turkey, deer, and gray squirrels; it once provided the Native Americans of this region with an abundant source of animal protein (Lapin, 2003a). The warmer climate, relative to the northern New England region, and the fertile, heavy clay soils set the stage for a forest ecosystem in the southern Champlain Valley that is more typical of lands to the south and midwest. The differences between the clayplain forest and surrounding forests are also the primary reason why clayplain forest has been so dramatically reduced relative to total forest area, for the qualities of the clayplain forest that make it unique also make it highly attractive for farming and settlement. “The allure of the fertile southern Champlain Valley lands for early settlers,” writes Jan Albers, “can be seen in the fact that in 1820 Middlebury, located near the center of the region, was the largest settlement in Vermont, with a population of 3,170” (quoted in Lapin, 2003a).

Clayplain forest once covered over 220,000 acres in Vermont; however, it currently exists only in small parcels, often 20-30 acres in size (Karlson and Lapin, 2001). Although the parcels of clayplain forest are small they can still provide good examples of the species composition of the former, more extensive, clayplain forest. Oaks, hickory, maples, elm, ashes, beech, hemlock, and white pine still persist in remaining fragments, as well as a variety of small trees and shrubs (Karlson and Lapin, 2001). Additional information on species composition may be found in the “Restoration Planning” section of this guide; also, see the CVCFP’s “Natural History and Stewardship” guide for further details.
Restoration Site History and Description

The parcel of land chosen for this restoration project is owned by Middlebury College. It is located on the west side of campus, just south of the Recycling Center and modular homes along Route 125. The site is approximately 10 acres, and, at the start of the project, had a dense growth of grasses, sedges, and broad-leaved herbs. The field is bounded by forest on the east, south, and half of the west sides. There is also a wet, swampy area along a portion of the south side, drained by a wet swale that extends north and runs off the west side of the site.

![Site map](image)

Figure 1: Site map showing the boundaries of the planting area. Route 125 and the modular homes are located off the map, to the north.

The site has gently undulating topography with a high point in the southeast corner. The northwest corner is the lowest point. The woods along the east side of the parcel have a high prevalence of white pine, interspersed with other species, such as birch, maple, and red oak. The southern border is dominated by willow shrubs and the western side is bordered by a narrow finger of white pine woods.
Photograph of the planting area prior to restoration. Note the topographic variation, as well as the existing grassy vegetation. View is to the southeast.

Photograph of a planting area prior to restoration. Note the standing water. View is to the east.
The land has been leased out for farming by Middlebury College since 1965, when it was acquired from H. Blakely Harris, Jr. Harris, as well as his father before him, most likely used the land as a hayfield, after finding soils too wet for corn. The College then proceeded to lease out the parcel of land to a variety of people for agricultural use and kept it in the State Use Value Program from 1965 through 1997. After that it was removed from use value designation in order to be incorporated into Middlebury College’s development plans.

Despite its agricultural history, the land was not considered very valuable for farming because it was so wet. A diversion ditch was dug in 1991 along the west side of the property to facilitate drainage; however, this did not help the drainage problem enough to make the land valuable to the lessees (Figure 2). Prior to the restoration, the land had been brush-hogged every fall, which prevented trees or shrubs from establishing.

![Soil Attributes](image)

**Figure 2:** Soil map of the Harris Farm tree planting site. Diversion ditch highlighted by dark blue line.


**Restoration Planning**

**Choosing which species to plant**

The number and species of trees and shrubs planted in the project were based on clayplain forest species composition research by Marc Lapin, a forest ecologist and the CVCFP coordinator. From his data on the relative abundance of each species, we determined the number of trees of each species required to stock to a target density of 250-280 trees and shrubs per acre (see Appendix A for species abundance and composition data). Some of the common clayplain species were unavailable in area nurseries and were therefore not able to be planted. We attempted to obtain local stock to the greatest extent possible, but we did use sources from New York, New Hampshire, Maine, and Pennsylvania due to limited availability of native Vermont stock. If time had allowed, we could have gathered seeds from existing clayplain fragments for the species we were unable to order (see Appendix B for a list of nurseries utilized and the species obtained from each).

![Newly arrived trees and planting supplies.](image)

**Site mapping and planting decisions**

Our planting process began with a simple survey of our restoration area. We made a rough map of the ten-acre area, to show wetter and drier parts of the field. Initial surveys also included reference to the county soil survey. We mapped the site based on moisture regime according to the following three planting zones:

<table>
<thead>
<tr>
<th>Wet</th>
<th>Intermediate</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site #</td>
<td>Approx. Acres</td>
<td>Site #</td>
</tr>
<tr>
<td>1</td>
<td>0.35</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.35</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0.6</td>
<td>3</td>
</tr>
</tbody>
</table>
In determining the placement of species, we also noted existing individuals of species we were trying to restore; for example dry site 2 had a high density of young white pine, so we chose to plant white pines in other areas of the plot. Once we had determined the basic moisture regime and topography of our plots, we could plan where to plant individual species (see Appendix C for a list of trees and shrubs planted). We focused on three main growth factors:

- **Moisture**
  - Clayplain species have varying moisture tolerances, ranging from those that grow only in well drained, sloping areas to species that can grow in almost perpetually flooded areas.
  - Often, the wettest areas are dominated by shrub species, although swamp white oak can also tolerate very wet areas.
- **Light**
  - Certain clayplain species are very shade tolerant, while others prefer bright sunlight. In general, early successional species are less shade tolerant than later successional species. Given the time constraints of the project, both early and late successional species were planted together even though it was an open field planting. The only species known to have poor shade-tolerant survivorship in open-field plantings is beech, so we did not include it in the plans.

- **Herbivory**
  - Certain species are more susceptible to deer and small mammal browse than others. Trees are often particularly susceptible when they are young, as deer can reach all of their branches. Protection from browse has been shown to greatly increase survival and growth of seedlings.
  - Tree shelters were placed around species we determined were most susceptible to browse. These shelters can be purchased from various nursery and environmental companies and can effectively prevent herbivory on very small trees. We targeted all oak species, as well as the hemlocks. Larger fenced-in deer exclosures can also be constructed, but exclosures are both more labor intensive and very expensive.

---

**Figure 4:** Representative cross-section of a moisture gradient (modified from New England Wetland Plants, Inc. website: [www.newp.com](http://www.newp.com)) showing the associated original soil types and species of the planting site, as well as native species planted.
**Restoration Supplies and Costs**

Active restoration of a field or meadow to clayplain forest involves an initial purchase of trees and shrubs with which to revegetate your plot of land. The number of stems you will want to procure should be calculated on a per-acre basis (see Appendix A). Beyond the cost of the actual plants, it is possible to spend as much or as little on the process of restoration as you wish. Our restoration project was designed to be as cost-effective as possible, while promoting the health and survival of our plants. Presented here are lists of plants and planting supplies and their associated costs (see Appendix B for a list of species and the nurseries from which they were obtained).

**Plants**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cost per Tree</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shagbark Hickory*</td>
<td>$7.00</td>
<td>30</td>
<td>$210.00</td>
</tr>
<tr>
<td>Nannyberry*</td>
<td>$6.50</td>
<td>25</td>
<td>$162.50</td>
</tr>
<tr>
<td>Wild Chokecherry*</td>
<td>$5.00</td>
<td>25</td>
<td>$125.00</td>
</tr>
<tr>
<td>Canadian Hemlock</td>
<td>$0.57</td>
<td>200</td>
<td>$114.57</td>
</tr>
<tr>
<td>Downy Arrowwood</td>
<td>$0.80</td>
<td>50</td>
<td>$40.00</td>
</tr>
<tr>
<td>Red Osier Dogwood</td>
<td>$0.80</td>
<td>50</td>
<td>$40.00</td>
</tr>
<tr>
<td>Silky Dogwood</td>
<td>$0.80</td>
<td>50</td>
<td>$40.00</td>
</tr>
<tr>
<td>Gray Dogwood</td>
<td>$0.80</td>
<td>50</td>
<td>$40.00</td>
</tr>
<tr>
<td>White Ash</td>
<td>$0.45</td>
<td>200</td>
<td>$90.00</td>
</tr>
<tr>
<td>Red Oak</td>
<td>$0.60</td>
<td>200</td>
<td>$120.00</td>
</tr>
<tr>
<td>White Oak</td>
<td>$0.60</td>
<td>200</td>
<td>$120.00</td>
</tr>
<tr>
<td>Sugar Maple</td>
<td>$0.60</td>
<td>100</td>
<td>$60.00</td>
</tr>
<tr>
<td>Red Maple</td>
<td>$0.60</td>
<td>300</td>
<td>$180.00</td>
</tr>
<tr>
<td>White Pine</td>
<td>$0.16</td>
<td>250</td>
<td>$40.00</td>
</tr>
<tr>
<td>Swamp White Oak</td>
<td>$0.39</td>
<td>200</td>
<td>$78.00</td>
</tr>
<tr>
<td>Witch-Hazel</td>
<td>$0.42</td>
<td>100</td>
<td>$42.00</td>
</tr>
<tr>
<td>Bur Oak</td>
<td>$2.00</td>
<td>150</td>
<td>$300.00</td>
</tr>
<tr>
<td>American Hornbeam</td>
<td>$0.95</td>
<td>150</td>
<td>$142.50</td>
</tr>
</tbody>
</table>

*prices were greater for these species—seedlings received were of an older age class

Total Plant Cost (including shipping) $2,178.32

Note: Shipping costs will vary depending on shipping distance and quantity of plants ordered.
### Planting Supplies

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost per Item</th>
<th>Quantity</th>
<th>Total Cost (including shipping)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspaper Mulch*</td>
<td>no cost</td>
<td>no cost</td>
<td>no cost</td>
</tr>
<tr>
<td>Compost*</td>
<td>no cost</td>
<td>no cost</td>
<td>no cost</td>
</tr>
<tr>
<td>Tree Shelters**</td>
<td>$1.25</td>
<td>750</td>
<td>$962.50</td>
</tr>
<tr>
<td>Hardwood Stakes**</td>
<td>$0.39</td>
<td>850</td>
<td>$356.50</td>
</tr>
<tr>
<td>Flagging</td>
<td>$1.00</td>
<td>6</td>
<td>$6.00</td>
</tr>
<tr>
<td>Planting Flats &amp; Soil*</td>
<td>no cost</td>
<td>no cost</td>
<td>no cost</td>
</tr>
<tr>
<td><strong>Total Supply Cost (including shipping)</strong></td>
<td></td>
<td></td>
<td><strong>$1,325.00</strong></td>
</tr>
</tbody>
</table>

* Newspaper, compost, planting flats, and soil were supplied free of charge by the Middlebury College Recycling Center, Facilities Management, and Biology Department, respectively.

** We used 2’ shelters; 3’ and 4’ shelters are also available at a slightly higher cost and afford longer protection to trees. Tree shelters and stakes were obtained from A.M. Leonard.

### Items Supplied by Planters

- Shovels
- Wheelbarrows
- 5 gallon buckets (for watering)

View of tree shelters in site Wet 1.
Planting Techniques

When to Plant

The ideal time for planting trees is early in the spring, when the ground is very moist, such as April to mid-May. Earlier planting is preferred because it allows the trees to become established more quickly and avoids handling of plants during the sensitive stage of leaf flush (St. Lawrence Nurseries Planting Guide).

Site Preparation

Although no formal site preparation was undertaken in this project, it is worth considering in order to enhance survivorship and growth in initial years. Site preparation may include mowing or brush-hogging and diskng to reduce competing vegetation. If exotic species are prevalent, it is advisable that they are cleared from the area as much as possible. Exotics control can be an intensive process – both The Nature Conservancy and the US Fish and Wildlife Service have much experience in this area and should be consulted (see Appendix D for contact information).

Digging the Hole and Planting

Trees should be left in the shade with their roots moistened and wrapped for protection from wind and sunlight while holes are being dug. A shovel or planting bar can be used to dig holes, which will vary in size and shape to accommodate the different sizes and shapes of the roots of the seedlings. The hole should be sufficiently large so that the entire root system is buried up to the ‘root collar’—the point on the stem up to which the soil had been when the trees were previously planted at the nursery—without having to bend the roots to fit them in the hole. When refilling the hole around the roots of the tree, the soil should be broken up of any clods (which are typical in a clay soil) and firmly packed around the roots (Derleth, 2003; Hartline, 2003; St. Lawrence Nurseries Planting Guide). The most important thing is to ensure complete contact

Swamp white oak being inserted into a freshly dug hole.
of the soil with the roots. Planting techniques will vary with the restoration scale (size of area and number of stems planted) and the size of the nursery stock. When digging in clays, often the shovel can create flat, compressed, or ‘shiny’ surfaces as it cuts down through the soil. If this happens, these smoothed surfaces should be roughened or broken up. The rest of the hole can then be filled with the subsoil until the edges of the hole are even with the ground, and the seedling is at the center of a slight depression which will serve to help catch water for the tree (St. Lawrence Nurseries Planting Guide).

**Preparing the Tree for Success**

Once the tree is planted, one can lay a thick layer of newspaper around the stem of the seedling as “mulch.” This will reduce competition for light and moisture with other plants (Hartline, 2003). Other materials, such as burlap or specialized bio- or photo-degradable brush mats, may also be used. Soil and/or compost can be put on top of the edges of the newspaper to keep it weighted to the ground. In larger scale plantings, this mulching process may not be practicable.

One can water the seedlings after they are planted, in order to hydrate the tree, compact the soil, and remove any air pockets (St. Lawrence Nurseries Planting Guide). This may also be impractical for a large planting. For species that are known to be grazed upon, bio-degradable tree shelters can be used to protect against herbivory, as well as sun-scalding. These shelters can be installed right over the planted seedlings and should be buried slightly into the soil and anchored with a stake (Hartline, 2003).

Installing a tree shelter over a seedling. Tree shelters are anchored into the ground with stakes. Newspaper and compost can be used in conjunction with tree shelters.
Future Management of Restored Plot

The key to plans for future management lies in the ability of the managers to maximize the potential for tree survival. This necessitates 1) ending any destructive practices, 2) restoring natural forces and processes, 3) controlling or limiting the influx of invasive exotic species into the restoration site, and 4) maximizing the success of reintroduced native species.

In order to maximize success we feel that the below actions should be carried out within the restoration site for at least the first three years after planting:

- **Keep vegetation down within a 2-5 foot diameter of trees in order to minimize competition from other species.** The utilization of brush mats can increase this success. One can purchase porous brush mats – which are expensive – or use organic mats of mulch, straw, and/or newspaper as suitable and economic replacements. One can also promote active measures for reducing competing vegetation in the form of brush hogging, weed whacking, raking, or other active weed control methods. Selective application of chemical herbicides can be effective, but the chemicals’ possible impacts and side effects can be damaging and are therefore discouraged for the restoration site.

- **Identify threats to restoration and minimize impact.** These impacts can come in many forms ranging from natural to artificial. Only a few will be discussed, but these range from site to site and should be identified prior to the restoration project. Excessive herbivory, generally from the deer populations within Vermont, can cause severe problems for forest regeneration. Some steps can be taken to minimize this impact: 1) use tree shelters around susceptible seedlings, 2) plant the most prone trees away from areas bordered by woods, or 3) use deer fences to protect sprouting sites or the entire restoration area. Other threats can come from environmental/climate conditions such as drought, heat stress, and pestilence.

In addition to maximizing success, one must ensure that the trees are growing adequately by monitoring the site for changes. This can be done by:

- **Documenting initial plantings with a tree census and a detailed site map.** Recording the list of species and number planted is basic – a more detailed report could include the existing preconditions of the site and should include features such as soil maps and land-use history.

- **Monitor plantings by periodically checking growth, predation, and survivorship, noting the success of species within microhabitats of each plot.** It is here that one can decide if additional plantings are necessary through the analysis and determination of changes
and/or problems that have arisen in the years following the initial planting. This will be carried out on our site through the analysis of sample plots.

Future management of the clayplain forest restoration site should be a dynamic and inventive process that should expand from these guidelines. It is impossible to predict all of the possible problems or successes of our proposed management; therefore, the future management of the site should be considered an interactive experiment requiring the input of future generations of Middlebury College students and other community members. As problems arise, continued work will further knowledge for landowners concerning clayplain forest restoration. For the Middlebury College restoration site, cooperation between the College, campus groups (e.g. the Keepers and the Volunteer Services Organization) and academic departments (specifically Environmental Studies and Biology) will allow for the resolution of these future problems.
Summary

Though originally proposed as an experimental case study, the Middlebury College and ES 401 clayplain forest restoration project is now largely concerned with success of planted species. This success is dependent on a knowledge of the terrain, species viability within microhabitats, correct planting practices, and continued management to enhance survivorship and growth. Though we attempt to address all four of these ideas in our Landowner Guide, the process is ever changing and will require unique action and management based on unforeseen and uncommon problems. In order to maximize the success of planted trees, future manipulation must occur in as limited and low-impact a manner as possible, allowing natural processes to become established on the site.

Top: Site flagging. Bottom: View to southeast of partially completed planting.
Acknowledgements

The Environmental Studies Senior Seminar would like to thank several people, without whom this project would not have been conceived, planned, or implemented. First, to Marc Lapin of the Champlain Valley Clayplain Forest Project, thank you for the invaluable knowledge, many hours, immeasurable patience, and abundant enthusiasm you have given us throughout this process. Also, thank you to Steve Weber, whose knowledge of the forest and the land helped us at every stage of the process, as well as to David Cunningham, Keith Hartline, and Eric Derleth for volunteering their planting knowledge and expertise. Thank you also to Professor Christopher McGrory Klyza, who helped to conceive and direct this effort, and especially to Diane Munroe, for the incredible time and effort put forth in planning this project, as well as the months of patience and direction she brought to us throughout its implementation.

*All photographs were taken by members of ES 401, except where noted.
Works Cited


Lapin, M., 2003b, Ecological Restoration: Notes to Ponder, Question, Understand.


Additional References


Appendix A: Species Abundance and Composition

The table below shows the target density per acre of individuals of each species based on population research performed in multiple forest stands, and the resulting number of stems that were ordered for the restoration of a 10-acre plot.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Target #/acre*</th>
<th>Actual #/acre*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer rubrum</td>
<td>Red maple</td>
<td>26.5</td>
<td>30</td>
</tr>
<tr>
<td>Pinus strobus</td>
<td>White pine</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Quercus alba</td>
<td>White oak</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Quercus bicolor</td>
<td>Swamp white oak</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Tsuga canadensis</td>
<td>Canadian hemlock</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Quercus rubra</td>
<td>Red oak</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Carya ovata</td>
<td>Shagbark hickory</td>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>Sugar maple</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Quercus macrocarpa</td>
<td>Bur oak</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Fraxinus americana</td>
<td>White ash</td>
<td>16.5</td>
<td>20</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>American hornbeam</td>
<td>3.5</td>
<td>15</td>
</tr>
<tr>
<td>Shrubs**</td>
<td></td>
<td>38</td>
<td>35</td>
</tr>
</tbody>
</table>

*Density of stems per acre. The “target” number is based on research values obtained by Marc Lapin. Actual numbers refer to the number of individuals we ordered.

**The number of shrubs ordered was determined by taking 15% of the total number of trees.
## Appendix B: Nursery Information

<table>
<thead>
<tr>
<th>Nursery</th>
<th>Address</th>
<th>Order</th>
<th>Latin Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Lawrence Nurseries</td>
<td>Route 345, Potsdam, NY 13676</td>
<td>Shagbark Hickory</td>
<td>Carya ovata</td>
</tr>
<tr>
<td></td>
<td>(315) 265-6739</td>
<td>Nannyberry</td>
<td>Viburnum lentago</td>
</tr>
<tr>
<td>Western Maine Nurseries</td>
<td>1 Evergreen Drive - P.O.BOX 250, Fryeburg, ME 04037</td>
<td>Wild Chokecherry</td>
<td>Prunus virginiana</td>
</tr>
<tr>
<td></td>
<td>1-800-447-4745</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.sln.potsdam.ny.us">http://www.sln.potsdam.ny.us</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Hampshire State Forest Nursery</td>
<td>Route 3, Boscawen, NH</td>
<td>Downy Arrowood</td>
<td>Viburnum recognitum</td>
</tr>
<tr>
<td></td>
<td>(603) 796-2323 (Nursery Office)</td>
<td>Red Osier Dogwood</td>
<td>Cornus stolonifera</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.nhnursery.com/">http://www.nhnursery.com/</a></td>
<td>Silky Dogwood</td>
<td>Cornus amomum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gray Dogwood</td>
<td>Cornus racemosa</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White Ash</td>
<td>Fraxinus americana</td>
</tr>
<tr>
<td>NY Saratoga Tree Nursery</td>
<td>2369 Route 50, Saratoga Springs, NY 12866-4738</td>
<td>Red Oak</td>
<td>Quercus rubra</td>
</tr>
<tr>
<td></td>
<td>(518) 587-1120</td>
<td>White Oak</td>
<td>Quercus alba</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.dec.state.ny.us/website/dlf/privland/nursery/treeshrub.html">http://www.dec.state.ny.us/website/dlf/privland/nursery/treeshrub.html</a></td>
<td>Sugar Maple</td>
<td>Acer saccharum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red Maple</td>
<td>Acer rubrum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White Pine</td>
<td>Pinus strobus</td>
</tr>
<tr>
<td>Meadowview Nursery</td>
<td>5994 Byron-Holley Road, Byron, NY 14422</td>
<td>Swamp White Oak</td>
<td>Quercus bicolor</td>
</tr>
<tr>
<td></td>
<td>(585) 548-9014</td>
<td>Witch Hazel</td>
<td>Hamamelis virginiana</td>
</tr>
<tr>
<td>Poultny-Mettowee / TNC</td>
<td>PMNRCD, Poultny, VT 05764</td>
<td>Bur Oak</td>
<td>Quercus macrocarpa</td>
</tr>
<tr>
<td></td>
<td>Box 209</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.vacd.org/pmnrcd/index.html">www.vacd.org/pmnrcd/index.html</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musser Forests, Inc.</td>
<td>PO Box 340, Indiana, PA 15701-0340</td>
<td>American Hornbeam</td>
<td>Carpinus caroliniana</td>
</tr>
<tr>
<td></td>
<td>(724) 465-5685</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.musserforests.com">www.musserforests.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.M. Leonard</td>
<td><a href="http://www.amleo.com">www.amleo.com</a></td>
<td>Tree Shelters and Stakes</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix C: List of Trees and Shrubs Planted and their Growth Factors

<table>
<thead>
<tr>
<th>Common name</th>
<th>Latin name</th>
<th>Type</th>
<th>Soil type</th>
</tr>
</thead>
<tbody>
<tr>
<td>American hornbeam</td>
<td>Carpinus caroliniana</td>
<td>Tree</td>
<td>Acidic</td>
</tr>
<tr>
<td>Bur oak</td>
<td>Quercus macrocarpa</td>
<td>Tree</td>
<td></td>
</tr>
<tr>
<td>Canadian/Eastern hemlock</td>
<td>Tsuga canadensis</td>
<td>Tree</td>
<td>Highly acidic, coarse soils</td>
</tr>
<tr>
<td>Downy arrowwood</td>
<td>Viburnum recognitum</td>
<td>Shrub</td>
<td></td>
</tr>
<tr>
<td>Gray dogwood</td>
<td>Cornus racemosa</td>
<td>Shrub</td>
<td></td>
</tr>
<tr>
<td>Nannyberry</td>
<td>Viburnum lentago</td>
<td>Shrub</td>
<td>Acidic/Neutral</td>
</tr>
<tr>
<td>Red maple</td>
<td>Acer rubrum</td>
<td>Tree</td>
<td>Tolerant of most soil types</td>
</tr>
<tr>
<td>Red oak</td>
<td>Quercus rubra</td>
<td>Tree</td>
<td>Well drained clayey or loamy soils</td>
</tr>
<tr>
<td>Red osier dogwood</td>
<td>Cornus stolonifera</td>
<td>Shrub</td>
<td></td>
</tr>
<tr>
<td>Shagbark hickory</td>
<td>Carya ovata</td>
<td>Tree</td>
<td>Tolerant of most soil types</td>
</tr>
<tr>
<td>Silky dogwood</td>
<td>Cornus amomum</td>
<td>Shrub</td>
<td></td>
</tr>
<tr>
<td>Sugar maple</td>
<td>Acer saccharum</td>
<td>Tree</td>
<td>Acidic</td>
</tr>
<tr>
<td>Swamp white oak</td>
<td>Quercus bicolor</td>
<td>Tree</td>
<td>Organic</td>
</tr>
<tr>
<td>White ash</td>
<td>Fraxinus americana</td>
<td>Tree</td>
<td>Acidic/Neutral, rich soil (high N)</td>
</tr>
<tr>
<td>White pine</td>
<td>Pinus strobus</td>
<td>Tree</td>
<td>Neutral sandy soil/low-mid site quality</td>
</tr>
<tr>
<td>White oak</td>
<td>Quercus alba</td>
<td>Tree</td>
<td>Tolerant of most soil types</td>
</tr>
<tr>
<td>Wild chokecherry</td>
<td>Prunus virginiana</td>
<td>Shrub</td>
<td>Acidic, sandy, grainy</td>
</tr>
<tr>
<td>Witch hazel</td>
<td>Hamamelis virginiana</td>
<td>Shrub</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common name</th>
<th>Soil moisture index</th>
<th>Herbivory</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>American hornbeam</td>
<td>Intermediate/Wet, good drainage</td>
<td>Beaver</td>
<td>High shade tolerance</td>
</tr>
<tr>
<td>Bur oak</td>
<td>Wide range/not flooded</td>
<td>On acorns</td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>Canadian/Eastern hemlock</td>
<td>Intermediate/Wet, good drainage</td>
<td>Deer browse</td>
<td>High shade tolerance</td>
</tr>
<tr>
<td>Downy arrowwood</td>
<td>Intermediate, good drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray dogwood</td>
<td>Wet</td>
<td></td>
<td>Shade tolerant</td>
</tr>
<tr>
<td>Nannyberry</td>
<td>Wide range/not flooded</td>
<td></td>
<td>Shade tolerant</td>
</tr>
<tr>
<td>Red maple</td>
<td>Wide range/likes extreme conditions</td>
<td>Deer browse</td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>Red oak</td>
<td>Wet but well drained</td>
<td>Gypsy moth</td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>Red osier dogwood</td>
<td>Wet</td>
<td>Deer browse</td>
<td>Full sunlight</td>
</tr>
<tr>
<td>Shagbark hickory</td>
<td>Wide range</td>
<td></td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>Silky dogwood</td>
<td>Wet/will grow in poorly drained soil</td>
<td>Deer/rabbit</td>
<td></td>
</tr>
<tr>
<td>Sugar maple</td>
<td>Intermediate/well drained</td>
<td>Deer browse/sensitive to salt</td>
<td>Very shade tolerant</td>
</tr>
<tr>
<td>Swamp white oak</td>
<td>Wet/poorly drained but not flooded</td>
<td>On acorns</td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>White ash</td>
<td>Intermediate, good drainage</td>
<td>Deer browse/ ash yellows</td>
<td>Full sunlight</td>
</tr>
<tr>
<td>White pine</td>
<td>Dry/well drained</td>
<td>Deer browse/sensitive to salt</td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>White oak</td>
<td>Intermediate</td>
<td></td>
<td>Intermediate shade tolerance</td>
</tr>
<tr>
<td>Wild chokecherry</td>
<td>Wet/well drained</td>
<td>Deer browse/tent caterpillar</td>
<td></td>
</tr>
<tr>
<td>Witch hazel</td>
<td>Intermediate, good drainage</td>
<td></td>
<td>Intermediate shade tolerance</td>
</tr>
</tbody>
</table>
**Appendix D: Restoration Resources**

*For a list of plant nurseries and contact information, please see Appendix B.*

**Funding**

<table>
<thead>
<tr>
<th>Natural Resource Conservation Service</th>
<th>Partners for Fish and Wildlife Program</th>
<th>Urban and Community Forestry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middlebury Service Center</td>
<td>U.S. Fish and Wildlife Service</td>
<td>Vermont Department of Forests,</td>
</tr>
<tr>
<td>68 Catamount Park, Suite B</td>
<td>11 Lincoln St</td>
<td>Parks &amp; Recreation</td>
</tr>
<tr>
<td>Middlebury, VT 05753</td>
<td>Essex Junction, VT 05452</td>
<td>Steve Sinclair</td>
</tr>
<tr>
<td>(802) 388-6748</td>
<td>(802) 872-0629</td>
<td>(802) 241-3673</td>
</tr>
</tbody>
</table>

Williston Service Center
600 Blair Park Rd, Suite 800
Williston, VT 05495

Rutland Service Center
170 South Main St
Rutland, VT 05701
(802) 775-8034
www.nrcs.usda.gov

**Conservation Easements**

<table>
<thead>
<tr>
<th>The Nature Conservancy</th>
<th>Middlebury Area Land Trust</th>
<th>Vermont Forest Legacy Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermont Field Office</td>
<td>P.O. Box 804</td>
<td>Land Acquisition Program</td>
</tr>
<tr>
<td>27 State St</td>
<td>Middlebury, VT 05753</td>
<td>Agency of Natural Resources</td>
</tr>
<tr>
<td>Montpelier, VT 05602</td>
<td>(802) 388-1007</td>
<td>103 South Main St</td>
</tr>
<tr>
<td>(802) 229-4425</td>
<td></td>
<td>Waterbury, VT 05761</td>
</tr>
</tbody>
</table>

**Natural Communities/Rare & Threatened Species**

<table>
<thead>
<tr>
<th>Nongame and Natural Heritage Program</th>
<th>Vermont Land Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermont Department of Fish and Wildlife</td>
<td>8 Bailey Ave.</td>
</tr>
<tr>
<td>Contact: Eric Sorenson</td>
<td>Montpelier, VT 05602</td>
</tr>
<tr>
<td>103 South Main St</td>
<td>(802) 434-3079</td>
</tr>
<tr>
<td>Waterbury, VT 05671-0501</td>
<td><a href="http://www.vlt.org">www.vlt.org</a></td>
</tr>
<tr>
<td>(802) 241-3700</td>
<td></td>
</tr>
</tbody>
</table>

VGS012735
Forestry

David Brynn
Addison County Forester
68 Catamount Park, Suite C
Middlebury, VT 05753
(802) 388-4969
david.brynn@anr.state.vt.us

Michael Snyder
Chittenden County Forester
111 West Street
Essex Junction, VT 05452
(802) 879-5694
michael.snyder@anrmail.anr.state.vt.us

Nate Fice
Rutland County Forester
317 Sanitorium Rd, W. Wing
Pittsford, VT 05763
(802) 483-2730
nate.fice@anrmail.anr.state.vt.us

Vermont Family Forests
P.O. Box 254
Bristol, VT 05443
(802) 543-7728
Fax: (802) 453-7729
www.familyforests.org

Champlain Valley Clayplain Forest Project
Marc Lapin, Coordinator
239 Cider Mill Rd
Cornwall, VT 05753
(802) 462-2514
www.clayplain.org
Champlain Valley
Clayplain Forest
Natural History and Stewardship
Photos above and inside back cover:

*From the top of Snake Mountain, clayplain forest fragments intermingle with agricultural fields, fencerows and houses in Addison, Vermont.*

Cover photo:

*Clayplain forest near Dead Creek Wildlife Management Area in winter.*
What is clayplain forest?

Fertile clay soils dominate the gently undulating fields of the southern Champlain Valley. Before European settlers began producing wheat, hay, corn, sheep and milk here, forest clothed the land. Oak, hickory, maple, elm, ash, beech, hemlock, and white pine grew in a diverse forest ecosystem.

The small parcels of hardwood, pine or mixed forest amidst today’s agricultural fields are the fragmented remains of the natural forest cover. Because of the warm valley climate, very high fertility of the clay soil, and moderate to poor soil drainage, clayplain forests are strikingly different from the forests in the Green, Taconic and Adirondack mountains. Agriculture is very different in the clayplain ecosystem also. It has been much more successful, and although most of the hill farms were abandoned a century ago, farming continues to be the dominant land use in the Champlain Valley.

Today, remaining fragments of clayplain forest provide a vital link to history. Many of the largest trees are well over 200 years old. Such giant oaks stood when Abenaki hunted and gathered in the Champlain Valley. The trees and the forest persisted through ice storms and hurricanes, and nourished black bear and now extinct passenger pigeons. Certainly, some of the trees in the remaining forest fragments started as sprouts from the stumps of the old-growth forests the settlers encountered. We’ll never know exactly what those former forests looked like, but from studying the remaining woods and early survey records we can surmise. The dense tree canopy was composed of the same species we see today, but in different proportions within a varied tapestry of wetter and drier forest. Here and there, tall above the canopy of oaks, maples, ashes, hickory and beech, one would likely have seen towering white pine and elegant elms.

About 11,000 years ago, the connection with the ocean was cut off and the present day Lake Champlain took shape. The lake bottom, for thousands of years beneath water, became an exposed lake plain and passed through a succession of vegetation types before the present clayplain forest natural community developed. The word “clayplain” is shortened from clay-soil lake plain—the landform on which the forest grows.

Although it has at times been called oak-hickory forest, many species of trees grow in the clayplain forest—more species than in any other forest type in northern New England. The hickory is shagbark, for bitternut hickory is almost always on the rocky hills and extremely rarely grows on the deep clay. The oaks of the clayplain are white, bur, swamp white and red; both swamp white and bur oak display northeastern range extensions into the clayplain. Sugar, red and silver maples, and all three of our ashes (white, black and green) grow in the forest, as well as American elm, basswood, beech, hemlock and white pine.

Clayplain forest is also home to a great diversity of shrubs and herbs, a number of which are rare or uncommon and some that occur in Vermont only in the clayplain forest. The great diversity is due to high fertility, a moderate climate and a patchy mosaic of wet depressions—small and large—scattered within the forest. These characteristics also account for the presence of a number of species with more southern affinities.

Clayplain forest is great wildlife habitat too. The plentiful food, including large nut crops, the proximity to water and wetlands, the moderate climate, and the landscape diversity featuring rocky hills such as Snake and Buck mountains, provide abundance for mammals, amphibians, reptiles, birds and insects. Bobcat, white-tailed deer, beaver, gray squirrel, and red and gray foxes are some of the larger mammals. Among the many bird species are wild turkey, cardinal, tufted titmouse, hermit thrush and blue jay. Salamanders include Jefferson, blue-spotted, spotted and redback. Gray treefrog, wood
Before the forest, however, the history of the land goes back millions of years. The limestone, dolomite and shale that the glaciers pulverized into clay formed in an ancient sea between 430 and 520 million years ago. Twenty thousand years ago glacial ice covered the region, and as it melted and retreated, a series of huge lakes filled the Champlain Valley. First, Lake Vermont, with its flotilla of icebergs, flooded most of the valley for one or two thousand years, and then, with an influx of marine waters, the smaller Champlain Sea covered lower parts of the valley for approximately 2,000 years. The clay that southern Champlain Valley residents know so well settled out in the deep, still waters of Lake Vermont and the Champlain Sea.

frog, spring peeper, northern leopard frog, green frog and bullfrog are some of the frog species. Worthy of particular mention is the red-headed woodpecker, a bird rare in Vermont where it is present only in the Champlain Valley lake plain ecosystem.

While many animals do spend all or part of their annual cycles on the clayplain, because of the small size of the remaining forest fragments many species that likely once thrived are rare visitors or breed unsuccessfully. For example, black bear surely could have put on much winter fat with a feast of clayplain acorns and beechnuts. Also, a number of migratory songbirds do not nest near forest edge and certainly now avoid breeding in the forest fragments.

Where is the clayplain forest?
Why is clayplain forest important?

A rich diversity of species and ecosystems forms the interconnected
web of life. In the southern Champlain Valley, clayplain forest is a major part of the native ecosystem—it is the principal fabric of the web. From the forest floor to the crowns of emergent white pines and American elms, hundreds of species of plants, animals—including humans—and microorganisms are part of the clayplain forest ecosystem.

Prior to European settlement, the eastern deciduous forest spread from the Atlantic coast to the Midwestern prairies. The landscape—from mountain summits to valley bottomlands; steep, rocky terrain to undulating, stone-free lands; sterile, dry soils to fertile, moist soils—was a pattern of many forest types. Human survival and food production are easier in the gentle, fertile valley lands, so the natural systems in those areas have been most disrupted. The Champlain Valley clayplain forest is one such fragmented ecosystem, and the remaining fragments may be under further threat. Only a few large patches of the forest remain; most fragments are well under 100 acres; many are only 20 or 30 acres. Once the dominant land cover in the southern Champlain Valley, clayplain forest, which formerly extended over 220,000+ acres, is now very rare.

The integrity of an ecosystem depends on its natural functioning, natural nutrient and water cycles, and native species diversity. The integrity of remaining forest patches is under pressure, especially from construction of homes within the fragments, removal of naturally vegetated corridors, and even from excessive deer browsing. As the Champlain Valley human population continues to increase, the disruption will continue unless we make conscious choices now about the stewardship of our home ecosystem. As landowners and stewards, our choices can help conserve the diversity of life and ecological functions of clayplain forest—an ecosystem that sustains us by providing clean water, clean air, pest predation, and outstanding natural beauty.
What can **WE** do?

Many stewardship opportunities exist for landowners and residents of clayplain forest. Whether you own 10 or 1,000 acres, your activities on the land can help maintain what is left of the forest and even promote growth of new forest. The Champlain Valley Clayplain Forest Project is dedicated to working with all interested people to promote stewardship of the threatened clayplain forest ecosystem.

The Champlain Valley Clayplain Forest Project is involved in research, conservation and restoration of clayplain forest. Because we believe that the best future for clayplain forest will result from collaboration, we work with landowners, local governments, state agencies, natural resource conservation districts, county and consulting foresters, and land trusts to identify and champion the best stewardship, management and conservation strategies.

Oppportunities of all sorts are available. Look for the bur oak leaves below to read about ways you can be involved in stewardship of "our" clayplain forest ecosystem.
Listening to the thoughts and addressing the concerns of landowners and community members are crucial to the future of the clayplain forest. Because the sum of all of our individual actions is critical to the health of the ecosystem, sharing ideas with one another and taking whatever small steps we can builds a strong, local conservation effort.

Wildflowers with cookie-cutter shaped leaves like this wood anemone blanket the clayplain forest floor in spring.

Ways you can help with **stewardship and conservation**:

- Let us know your vision for the future of the southern Champlain Valley and its forest ecosystem. Whether your interests are hunting, wildlife habitat, timber harvesting, water quality, using the forest as a windbreak for crop land and livestock pasture, or simply taking an occasional walk in the nearby woods, we can work with you to help achieve your objectives and protect the health of the forest for future generations.

- Share your thoughts and experiences of living with and working in the clayplain forest with your community.
Learn about the clayplain ecosystem. Contact us for more information or attend one of our natural history walks.

Protect your woods from conversion to non-forest land use. Only a tiny fraction of the original clayplain forest cover in the southern Champlain Valley is still forested. If you own a piece of this unique ecosystem, share your pride of it. Encourage neighbors and friends to retain their forest parcels.

If you are building a home, select a house site outside of existing woods.

Leave as many trees, shrubs and wildflowers on your lot as possible, and plant additional native species to landscape your home among the nearby forests, fencerows and fields.

Learn about rare, threatened and endangered species of the clayplain forest and help to conserve those that may be on your lands.

When landscaping, avoid planting non-native species, and help control the spread of invasive species such as honeysuckle, common buckthorn and purple loosestrife, which can displace native species.

Consider the ecological, financial and tax benefits of donating or selling the development rights on a parcel of clayplain forest. (See the "Conservation Easements" section.)

Encourage your planning commission to support conservation of clayplain forest fragments and to include ecosystem considerations in zoning ordinances and town plans.

Support the acquisition of public lands that are managed for ecological function and wildlife habitat.

---

Restoration

Because of the fragmented condition of the forest, restoration efforts are focused on encouraging buffers to existing forest cores, enhancing connections between forest tracts, and revegetating riparian zones. Restoration encompasses many activities including planting native trees and shrubs, stopping mowing and patiently allowing natural succession to occur, fencing, and controlling invasive exotics.
Ecosystem restoration provides conditions for:

- larger populations of area-sensitive wildlife species such as bobcat, bear and interior-forest birds,
- forest resilience to invasion by exotic species and edge-dependent nest parasites and egg-predators, and
- cleaner water and healthier stream and lake ecosystems.

The silky buds of the shagbark hickory unfold in the clayplain forest in early May to reveal large, compound leaves.

Ways to assist with clayplain forest restoration:

Are you tired of mowing your lawn? Consider letting part of it grow back into old-field and, eventually, forest. You will enjoy a unique opportunity to watch the process of succession as wildflowers, shrubs, and trees slowly emerge from your former lawn. In addition, butterflies, birds, deer, and other wildlife will visit your yard for food and shelter. Many species of birds and insects that eat insect pests will also be attracted to your yard and may help reduce pest problems in your garden.

Allow trees and shrubs to grow in field borders and wet swales. This will allow some species of wildlife to move between nearby patches of forest and will invite birds and insects that can help reduce agricultural and garden pests. It will also help protect soil by reducing wind erosion when plowing must occur during dry periods.
More ways to help with clayplain forest restoration:

- Help to control the impact of grazing and browsing on forest regeneration. While many of the fragments are still recovering from livestock grazing, deer browsing is becoming a major impact to tree and herb regeneration. Deer fencing in some areas may be necessary to restore natural vegetation processes in clayplain forest parcels.

- If you are harvesting trees from a clayplain woodlot, plan your rotations and silvicultural techniques to ensure a healthy forest for the future. Use the services of your county forester or a private consulting forester.

- Leave buffers of trees and natural vegetation along streams and wetlands to reduce nutrient- and pesticide-loaded runoff, benefit wildlife populations, and reduce soil erosion. Buffers of even 50-100 feet can be very effective.

- Eliminate the use of chemical pesticides and fertilizers. Instead, use organic supplements, such as careful applications of manure or compost to fields, or grass clippings left on lawns. Chemicals can wash off fields and lawns to neighboring forests and streams, and can threaten the health of the forest and the fish and other organisms in nearby streams and Lake Champlain. They can also enter your drinking water and impact human health.

- Plant trees around your house for shade, for protection from the wind, to help cool and clean the air, and to encourage wildlife. Connect nearby fragments of forest by planting trees or allowing natural old-field succession.

- When planting trees and shrubs on your property, plant native species that have grown from local seeds. Clayplain forests are very diverse and offer many native species of trees and shrubs that will succeed on the clay soils. Contact us for sources of seeds and plants of native species. If you have a landscaping or nursery business, consider growing and selling native clayplain species.

- Invasive exotic species like common buckthorn and the Eurasian honeysuckles can slow the process of native tree and herb regeneration in an old-field or hedgerow. Mechanical control of young buckthorn and honeysuckle involves uprooting or clipping stems. Learn to identify these.
widespread pests and try to remove them before they root deeply and grow vigorously. Larger plants in fields or hedgerows can be cut back year after year to give native species an advantage.

Join us for restoration work projects throughout the year. Help with seed collection, tree and seed planting and exotics control in the spring and fall.

Marc Lapin, left, discusses clayplain forest ecology on a springtime walk in Dead Creek Wildlife Management Area. The walk was sponsored by Otter Creek Audubon Society and the Middlebury Area Land Trust.

Research

The Champlain Valley Clayplain Forest Project was started in 1996 to gather and analyze data about plants, soils and wildlife in clayplain forest parcels on private and state lands. These data help us to understand the components and dynamics of a little-known ecological system. We also have prepared maps to look at patterns on the landscape, in order to assess research and conservation opportunities and alternatives that may arise.
Ways to become involved in clayplain forest research:

- Learn about clayplain forest ecology during one of our natural history walks.

- Offer researchers access to clayplain forest lands that you own or manage to help us learn more about the characteristics of clayplain forest.

- Help us gather data in some of the permanent sample plots in clayplain forest near your home.

- Tell us about your observations of the less common wildlife.

Sources of technical assistance and funding ...
The Champlain Valley Clayplain Forest Project can connect you with a variety of organizations that will help you with conservation and restoration. Funding is available for many conservation projects on private lands.

**Funding**

Explore funding opportunities to help with clayplain forest conservation and restoration projects.

The Partners for Fish and Wildlife Program can help with funding for fencing and water supplies for your livestock to protect nearby areas of clayplain forest. The program can also provide technical and financial assistance for restoring clayplain forest on lands that were formerly cleared.

**Partners for Fish and Wildlife Program**

of the U.S. Fish and Wildlife Service

Contact: Eric Derleth or Chris Smith

11 Lincoln Street
Essex Junction, VT 05452
(802) 872-0629


The Natural Resources Conservation Service of the U.S. Department of Agriculture has several landowner assistance programs, including Conservation Technical Assistance and the Wildlife Habitat Incentives Program, which may be available to help with clayplain forest conservation projects.

**Natural Resources Conservation Service**

Middlebury Service Center (802) 388-6748
1590 Route 7, Suite 1, Middlebury, VT 05753-8997

Williston Service Center (802) 879-4785
600 Blair Park Rd, Ste 280, Williston, VT 05495

Rutland Service Center (802) 775-8034
170 South Main Street, Rutland, VT 05701


Seek grant money to help with tree planting and forest maintenance projects:

**Urban and Community Forestry**

Vermont Department of Forests, Parks and Recreation
Steve Sinclair 241-3673
Swamp white oak leaves in clayplain forest in Charlotte.

Conservation Easements

Land trusts and other land conservation organizations can assist you with the process of selling or donating development rights on your land. While protecting
the ecological values of your land, conservation easements also often provide tax breaks and income.

Consider selling or donating the development rights on your clayplain forest. With a conservation easement in place on your land, you will continue to own and use the land, but future development will be restricted. Some of the organizations listed below may also be interested in purchasing clayplain forest land.

**The Nature Conservancy**

Vermont Field Office
27 State Street
Montpelier, VT 05602-2934
(802) 229-4429
http://www.tnc.org/

**Middlebury Area Land Trust**

P.O. Box 804
Middlebury, VT 05753
(802) 388-1007
email: malt@middlebury.edu

**Vermont Forest Legacy Program**

(Funding currently available for fee purchase or easement purchase in several Addison County towns)

Land Acquisition Program
Agency of Natural Resources
103 South Main St.
Waterbury, VT 05761
(802) 241-3697 or (802) 241-3682

www.state.vt.us/anr/fpr/lands/acquis.htm

**Vermont Land Trust**

8 Bailey Ave.
Montpelier, VT 05602
(802) 434-3079
http://www.vlt.org/
Snakeroot sprouts among the many herbaceous plants of the clayplain forest floor.

Oaks and shagbark hickories are prevalent in many clayplain forest sites.

Natural Communities and Rare and Threatened Species
The Nongame and Natural Heritage Program of the Vermont Department of Fish and Wildlife studies and provides management information for natural communities, threatened and endangered species, and other nongame wildlife species in Vermont.

For more information about the clayplain forest natural community and the many other natural communities in Vermont, contact:

Nongame and Natural Heritage Program
Vermont Department of Fish and Wildlife
Contact: Eric Sorenson
103 South Main St.
Waterbury, VT 05671-0501
(802) 241-3700
www.anr.state.vt.us/fw/fwhome/nnhp/index.html

Forestry

The forest ecosystem does not need to have timber harvested to be healthy and productive. If you do choose to harvest timber or firewood from a clayplain forest parcel, plan operations to maintain long-term sustainability of not only trees or game animals but all ecosystem components, including soil, herbaceous plants and water quality. Even if a woodlot is only a few acres, forest management information and planning provided by a county forester or a knowledgeable consulting forester are likely to improve both ecological sustainability of the parcel and long-term economic returns.
If you decide to harvest trees from a clayplain parcel, utilize silvicultural methods that ensure a healthy, diverse, uneven-age forest for the future. In most cases for clayplain forest, to promote diverse, more natural stand structure and age-classes, single-tree selection would be the recommended silvicultural technique.

It is best to harvest only during frozen, winter conditions. Even then, or especially if you harvest in dry, summer conditions, plan logging operations carefully in and around wet areas. The wet soils are easily disturbed, and there may be sensitive wildlife species, like salamanders and frogs, present. Never take machinery into the woods when soils are wet.

Use the services of your county forester or a knowledgeable consulting forester.
Think about how you would like your woods to be in the future. The most important part of managing land is to have a clear set of goals and objectives for the land. Management plans and activities, whether they are involved or brief, can then be designed to meet your vision.

Leave dead wood, large and small, standing and down, in the forest. Large woody debris is important for sustaining natural nutrient cycles and the full diversity of life in a forest.

For more information about ways you can manage your clayplain woodlot for a wide variety of functions and values, contact:

**David Brynn**  
**Addison County Forester**  
1590 Rt 7 South,  
Middlebury, VT 05753  
(802) 388-4969  
david.brynn@anr.state.vt.us

**Michael Snyder**  
**Chittenden County Forester**  
111 West Street  
Essex Junction, VT 05452  
(802) 879-5699  
michael.snyder@anrmail.anr.state.vt.us

**Nate Fice**  
**Rutland County Forester**  
317 Sanitorium Rd, W. Wing  
Pittsford, VT 05763  
(802) 483-2730  
nate.fice@anrmail.anr.state.vt.us

Vermont Family Forests (VFF) is a nonprofit forest conservation organization.

VFF promotes the cultivation of local family forests for economic and social benefits while protecting the ecological integrity of the forest community. VFF offers hands-on workshops on all elements of ecologically sustainable forest management. VFF provides family forest owners with affordable access to independent "green" certification by the Forest Stewardship Council. VFF currently has 34 parcels and over 5,000 acres in its certified forest land-base. VFF also assists family forest owners in local value-adding and marketing for their forest products under the "Family Forest" registered trademark.

In addition to ecological and social benefits, clayplain forests can also produce high-quality forest products. Using ecologically sustainable forest management, these forests can grow more than 100 board feet per acre per year in species such as white and red oak, shagbark hickory, basswood, and sugar maple.

VFF has developed a "Voluntary Timber Management Checklist" for landowners interested in ecologically sustainable forestry. The checklist includes 36 ways to protect water quality, site productivity, and native biological diversity in forests managed for timber products.

Many of these practices are ideally suited for use in clayplain forest communities. For example, careful design and winter use of access will help avoid soil erosion, rutting, and compaction. Undisturbed buffers along streams and wetlands will improve soil quality.
health and water quality. By discouraging invasive exotics such as common buckthorn and by retaining snags and downed wood, landowners can provide wildlife habitat and help to ensure a healthy and diverse forest and high quality timber for the future.

To obtain a copy of the VFF Timber Management Checklist or additional information, contact:

Vermont Family Forests  
http://www.familyforests.org/  
PO Box 254, Bristol, VT 05443  
email: vff@together.net  
(802) 543-7728  
Fax: (802) 453-7729

The Champlain Valley Clayplain Forest Project is generously funded by:

South Lake Champlain Trust, Inc.  
Lake Champlain Basin Program  
The Sustainable Future Fund  
Teresa Heinz Scholars for Environmental Research

Additional assistance and support have been provided by:

Vermont Department of Fish and Wildlife—
Dead Creek Wildlife Management Area &
Nongame and Natural Heritage Program

Staff of the Addison County Regional Planning Commission

Middlebury Area Land Trust

Otter Creek Audubon Society
Landowners and other community members are joining together to explore, support, and restore clayplain forests in the Champlain Valley.

Your concerns and ideas are crucial to the future of the clayplain forest. Let us hear from you!

Champlain Valley Clayplain Forest Project

Marc Lapin, Coordinator
239 Cider Mill Rd.
Cornwall, VT 05753
(802) 462-2514
info@clayplain.org

Visit us on the web:
http://www.clayplain.org/

Natural history and conservation presentations are available free of charge!

Publication design and layout by Heather Karlson
Text © 2000-2001 Heather Karlson and Marc Lapin
All photographs © 1999-2000 Heather Karlson. All rights reserved.
Printed on recycled, processed-chlorine-free paper with soy-based inks.
Clayplain forest floor in January with leaves of swamp white oak, American elm, white oak, and white pine.

Mission

The Champlain Valley Clayplain Forest Project coordinates research, conservation and restoration, and promotes stewardship of the threatened clayplain forest natural community. Through its work, the Project increases awareness, provides education, and encourages local pride in the unique clayplain ecosystem.

for more information, contact:

Marc Lapin, Coordinator
Champlain Valley Clayplain Forest Project
239 Cider Mill Rd.
Cornwall, VT 05753
(802) 462-2514
mlapin@clayplain.org

http://www.clayplain.org/

This publication was made possible with grants from the South Lake Champlain Trust, the Lake Champlain Basin Program and The Sustainable Future Fund.

Printed by Queen City Printers Inc.

Page last updated: July 16, 2002
For your free printed copy of this booklet, contact the Champlain Valley Clayplain Forest Project.

Return to the clayplain home page
Summer 2011

The Oak Log
News From Vermont

REBIRTH AND RESTORATION

Inside:
- Bringing back native plants, pg. 4
- WOW! blossoms and grows, pg. 6
Healing the Earth

We sometimes joke about Vermont’s fifth season, that time of year when our otherwise tame backroads become obstacle courses of mud, ruts and puddles. Remember that? Influriting though this can be, our experience of Vermont itself hinges on our experience of the seasons unfolding here, including that mud-luscious time between winter and spring. We key on subsidiary events too — sugarings, for example, and the return of phoebes, the opening day of trout season, and the reappearance of farmers markets.

A time of renewal in nature, spring jumps starts the year for many of us. When Robert Browning wrote “God’s in His Heaven, all’s right with the world,” surely he was thinking of spring. There’s something profoundly comforting in the solid predictability of nature’s norms and cycles. Partly, it’s because we humans are innately attuned to our environment, as all animals are. Also, we’re hard-wired to seek patterns in everything, and in reliable seasonal patterns we envision a world that’s safe and understandable.

Spring also jumpstarts our “field season” here at the Vermont Chapter. At our Native Plant Nursery in the Champlain Valley, the seeds we collected last summer and fall (from 22 species of trees and shrubs) have been “stratifying” in a refrigerator all winter long. Now it’s time to germinate them in pots. Seedlings from two years ago have grown large enough to survive on their own, so until the heat of summer stops us, we’ll be busy planting them out at clayplain forest restoration sites.

On the other hand, spring activates garlic mustard, an aggressive, non-native invader that’s taking over Vermont’s woodlands. In response, we mobilize staff and volunteer crews to hand-pull the banks of garlic mustard that encroach on our properties. This is only the beginning, since later we’ll battle a host of other invasives — Japanese honeysuckle, buckthorn and barberry, for example. During the summer, we organize volunteers to pull water chestnut from the shallows of Lake Champlain by the ton. Going beyond this site-by-site work, our Wise on Weeds program reaches out and encourages others to join the overall effort — landowners, foresters, NGO partners, and communities. ‘Together, we are healing the Earth.’

Just letting “unmanaged” forests grow on our lands is a deliberate act of renewal and restoration. Vermont’s forests are recovering from a history of disturbance, timber management, and harvest — and few “wild” forests actually exist here. But northern hardwood forests are resilient, and if left alone they’ll regain structural complexity, develop deeper soils, provide habitat for cavity nesters, and sequester even more carbon. It only takes time and patience.

“Conservation” encompasses many things. The Conservancy’s original strategy was to conserve land by acquiring title, but ecological restoration is a growing part of our toolkit. This is a good thing, because that’s the future of conservation.

Bob Klein

© Jon Vachon
South Stream Wildlife Management Area addition
Pownal

Located in the extreme southwest corner of Vermont, Pownal holds some of the state’s most rare botanical treasures. The wetland complex at the South Stream Wildlife Management Area in Pownal provides habitat for such rarities as Hill’s pondweed, bog bedstraw and wild azalea. A combination of sinuous hills and depressions at the base of the Green Mountains, where glacial ice slowly melted away, creates these ideal growing conditions.

The Nature Conservancy and the Vermont Fish and Wildlife Department closed on a collaborative project in February to add 17.4 acres to the 130-acre South Stream wildlife area. It will be managed for wildlife and wildlife-based recreation.

Part of the parcel had once been an automobile salvage yard, and many tires and other junk had been left onsite after the business closed. The Conservancy contracted for the removal of the materials to restore the site and prevent future contamination of the calcareous red maple-tamarack swamp on the parcel.

Silvio O. Conte National Fish and Wildlife Refuge,
Nulhegan Basin Division
Ferdinand

At the request of the U.S. Fish and Wildlife Service, the Conservancy acquired 73 acres of spruce-fir forest as part of the Silvio O. Conte Wildlife Refuge. This tract of land is on a south-facing low hill that forms the northern valley wall of the Nulhegan River.

“The views of the surrounding hills and basin are gorgeous,” says Jon Binhammer, the Conservancy’s Director of Land Protection, noting that the land would have been an attractive candidate for development. By conserving this parcel along Vermont Route 105, the Conservancy is ensuring there is a buffer for the wildlife refuge as well as access to the Nulhegan Basin.

Dominated by the basin, covering 55 square miles, the area contains natural communities that have affinities further north in Canada and in northern Maine, such as boreal flora and fauna, bogs, northern wetlands, and mountains with red spruce-northern hardwood forests.

Bomoseen State Park and Old Marsh Pond Natural Area addition
Fair Haven

Two parcels of land, each just under 100 acres, have been added to the Conservancy’s ownership in the Great Ledge area, one an addition to the Conservancy’s Old Marsh Pond Natural Area, and the other an inholding in Bomoseen State Park. Over the years, the Conservancy was instrumental in protecting more than half of the 3,549-acre Bomoseen State Park and now owns nearly 830 acres adjoining the park.

The recent additions host a multitude of species. But their key ecological significance lies in their location as critical timber rattlesnake habitat. The timber rattlesnake is a state-listed endangered species in Vermont, and is the focus of active conservation work. The Conservancy and our partners, the Orianne Society, Vermont Fish and Wildlife Department, and the Vermont Reptile and Amphibian Atlas, are studying the behavior and movements of these snakes in western Rutland County over the next two years.

The Old Marsh Pond addition came to the Conservancy through the generous donation of two brothers, whose forebears had homesteaded on the property. This property was logged recently, says Associate Director of Land Protection Joan Allen, and “all the downed woody material makes great foraging habitat for the rattlesnakes.” The Bomoseen State Park inholding has been owned by the same family since the late 1700s, and the current generation wanted to make sure it stayed undeveloped and wild. A state park road bisects this parcel, and the Conservancy’s ownership helps the park manage access to the remote sections of the park, Allen says.

Equinox Highlands Natural Area addition
Dorset/Rupert

Through the gift of a generous landowner, The Nature Conservancy has added 19 acres of land in an ecologically significant hollow to holdings on Mother Myrick Mountain. Steep and remote, the property climbs to about 2,150 feet in elevation, and as such, it has seen minimal human activity over the years with the exception of periodic forest management.

The Conservancy has assembled almost 2,400 acres in the vicinity that protect the natural values of the mountain while maintaining appropriate public access.

“It’s beautiful land — a rich northern hardwood forest in a hollow and a great v-shaped valley that just opens up to the Nichols Hill valley,” says Director of Land Protection Jon Binhammer.
Rebirth and Restoration

From nursery to clayplain, the Conservancy cultivates native trees

It’s been almost 10 years since the first seed was planted at the Champlain Valley Native Plant Restoration Nursery just over the Vermont line in Whitehall, N.Y. Today, thousands of native seedlings later, the nursery continues to fulfill its role as the primary supplier for local restoration projects by The Nature Conservancy and the Poultney Mettowee Conservation District.

In 2002, Mary Droege, now the Vermont Chapter’s Director of Ecological Management and Restoration, along with then Conservancy trustee David Fedor-Cunningham and the Poultney Mettowee’s district manager Marli Rupe, pooled their knowledge and resources to prioritize ecological restoration of the Champlain Valley. To do it, they wanted to use plant materials that would be as authentic as possible. That meant literally starting from scratch, growing local native trees from local native seeds.

At the time, most native plant seedlings available for restoration came from nurseries in the Midwest, and the trio was doubtful that the seedlings would do well in southern Vermont.

As AmeriCorps member Joseph Forsyth’s story outlines on the following page, the nonprofit nursery continues to flourish on a former dairy farm on a quiet country road in New York. It’s simple, low-cost and effective.

Drawing on the nursery stock, Droege hopes to plant 10,000 trees by June toward the goal of almost 76,000 trees by 2014 at the Conservancy’s Hubbardton River Clayplain Forest Natural Area and the Helen W. Buckner Memorial Preserve. This project, started in 2004 and now standing at 43,672 trees planted, puts the Conservancy and its partners at the nexus of a resurgence of valley clayplain forests in Vermont.

Driving along Route 22A near the Vermont Chapter’s West Haven office, the Hubbardton Clayplain site is clearly visible — a large, open field dotted with blue tubes. These protective tubes contain the fledgling trees that will one day mature into a diverse forest. For now, the field is a bit of a local curiosity. Passersby sometimes stop and ask about it.

What isn’t obvious from either the simple nursery or the young Hubbardton replanting site is the potential for magnificence, based on the rich history of this distinctive area of Vermont.

Here in the low-lying Champlain Valley, the clay-rich soils from the valley’s glacial past and the state’s warmest climate created ideal growing conditions for clayplain forests. These majestic forests, supporting more tree species than any other forest type in northern New England, once dominated the valley. But the fertile soils were also prized as agricultural lands by European settlers, and by 1850, the grand clayplain forests were largely cleared. The loss of the forests contributes to poorer water quality, accelerated stream bank erosion and the decline of rare species, such as leafy bulrush, broad-flowered sandwort and loose sedge. Wildlife, including black bear, and a wide array of birds once depended on these forests for their abundant nuts and broad canopy of trees.

When the Hubbardton project is complete, the Conservancy would like the nursery to continue to support other forest restoration projects as well as become more of an educational resource. It might remain under the Conservancy’s wing, or it might be transferred to another organization. At least one area college has expressed interest in setting up the nursery on campus for hands-on learning.

Ecological restoration is labor-intensive work with a time-line that stretches far into the future. But picture this: One day there will be a mature forest of white and red oak, shagbark hickory, white pine and sugar maple with an understory of hophornbeam and a forest floor covered in barren-strawberry and wild geranium — prime habitat for abundant wildlife.

“I like to tell our volunteers, especially the students, that they should come back in 50 or 60 years with their grandchildren to show them the forest they helped plant,” Droege says.

From the tiny seed in the nursery, giants will grow.

Interested in Volunteering?

We have opportunities in the nursery and on the clayplain. Check the Volunteer page at nature.org/Vermont for details.
Caring for a Special Place

By Joseph Forsyth, AmeriCorps 2011

Murray McHugh unlocks the entrance to the plant restoration nursery and leads me to a worn refrigerator filled with plastic bags bursting with seeds. He stands back, admiring the bounty, then retrieves a bag and holds it up for inspection: white oak acorns, all of them gathered from local trees. A few of the acorns have already begun to swell and split. The hope of restoring the Southern Lake Champlain Valley’s clayplain forests sprouts from these seeds.

McHugh, who grew up in the Bronx but is most at home in the rolling hills around the nursery in Whitehall, N.Y., makes his way toward the back of the barn on this late winter’s day, forcing open doors swollen from the cold and switching on bulbs hanging from the ceiling.

“I like to keep things as simple as possible,” McHugh explains.

When the nursery was first established in 2002, the Eastern New York Chapter of The Nature Conservancy already owned this retired dairy farm, and McHugh has kept costs down by using found equipment. The potting soil is mixed in a cast-off whirlpool bathtub. The refrigerator was donated, the sink was found on the roadside on the Conservancy’s nearby Buckner preserve, and the counter and cabinets he inherited from his mother’s farm in nearby Granville, N.Y. The seedlings are grown in pots on the farm’s former manure pad. They’re dormant on this late winter visit, and covered up in low greenhouses for protection. In the spring, they jump into action when they are planted for forest restoration.

When The Nature Conservancy and partners envisioned starting a nursery, their first task was to figure out a way to fund it. In January 2002, they were able to pair a grant from the National Fish and Wildlife Foundation with a private science grant from New York. They then turned to their next challenge: finding someone to run the nursery.

“Kudos to Murray,” says Mary Droge, who was then the Director of Science and Stewardship for the Southern Lake Champlain Valley office. “He was the right guy at the right time.” McHugh approached Droge after she spoke about the nursery at a conservation district meeting in the winter of 2002.

At the time, McHugh was living in nearby Granville. His experience with horticulture began with a high school job at a nursery in Westchester, N.Y., but he’d spent his summers on his mother’s farm outside of Granville and he loved the area, moving back to it after receiving his M.S. in Ecology from Rutgers University.

When McHugh approached Droge, he was already employed by a commercial nursery. He was receiving a salary and benefits, and, with his son Ben less than a year old, McHugh was reluctant to accept a part-time, short-term position.

“But I always wanted to work for an organization like The Nature Conservancy,” McHugh says. In March of 2002, the nursery began growing local, native seedlings for the Conservancy and the Poultney-Mettowee Natural Resources Conservation District, which began planting trees and shrubs in abandoned agricultural fields and along eroding stream banks.

McHugh’s position has broadened — he is now the Southern Lake Champlain Valley Stewardship Program Coordinator — but it still includes overseeing the nursery and supervising the seasonal grower, AmeriCorps member Keith Roberts. One of McHugh’s favorite “chores” is hopping in the truck with ladders and buckets and heading out on the road to collect native seeds for the nursery, asking permission from landowners along the way. “I’ve only had one person say no,” he says. “Sometimes I get funny looks. ‘You want to do what?’ ”

McHugh also enjoys his time at the nursery on the peaceful old Ward farmstead. Looking west from the nursery, the land drops away to fields of grasses down to the Poultney River, gathering into the great mass of Bald Mountain, and on to the mountains of New York.

“Only spot in New York where you can look west into Vermont. Pretty spectacular place to work.”

About the author: Joseph Forsyth, AmeriCorps Stewardship Assistant, is responsible for field and office support of stewardship in Montpelier.
THE OAK LOG / SUMMER 2011

**A Friend to the Vermont Chapter**

The Nature Conservancy has lost a good friend in long-time volunteer Marge Norton, who passed away in April. Marge, a former Stowe motel owner, logged more than 120 hours of volunteering in six years.

She started out pulling water chestnut with staff and volunteers at the Vermont Chapter’s West Haven office, and devoted more than 90 hours to the task.

After being diagnosed with cancer in 2004, Marge continued to volunteer, and helped with anything from stuffing envelopes to completing a garlic mustard roadside survey.

“There was so much to learn that I didn’t know,” she once said. “Volunteering with TNC gave me the opportunity to learn new things and see new things.”

Marge’s companionship and generous spirit of giving will be greatly missed.

---

**Counting tree rings**

Rose Paul, the Vermont Chapter’s Director of Science and Stewardship, loves to be out in the field exploring. Even better, she loves to explore with other curious minds. Last fall, Paul was joined by students from the University of Vermont who set out to study the floodplain forest at the Conservancy’s LaPlatte River Marsh Natural Area. 

This experiential, service learning class with UVM Professor Shelly Rayback received practical lessons in “dendrochronology”—the study of tree rings and what they can tell us about the past—and the Conservancy received a report from the students that helps reconstruct the past and present of the floodplain forest at LaPlatte. To read the students’ report and see their video, go to nature.org/Vermont and click on the Explore page.

---

**WOW! Grows to Meet Demand**

By Sharon Plumb, Invasive Species Coordinator

Seeing the first white trillium, Dutchman’s breeches and Jack in the pulpit has always reassured me that no matter how uncertain this world can be, each spring the earth softens and new life emerges.

In recent years, my enjoyment of spring has been tainted by my growing awareness of the presence of invasive terrestrial plants—barberry, honeysuckle, burning bush, and other non-native invasives shade the forest floor, crowding out spring ephemerals and native tree and shrub seedlings.

This spring, however, I enjoyed the woods knowing that thanks to the efforts of the Conservancy, volunteers, our partners, state and federal agencies, and professional foresters, much work is being done to raise awareness, and to establish on-the-ground management projects. Here’s a snapshot:

**New invasives web site:** The Nature Conservancy, University of Vermont Extension and Vermont Department of Forests, Parks and Recreation have teamed up to develop a new web site, vtinvasives.org. This will be the go-to source for information on invasive terrestrial plants and invasive insects and will be available this summer.

**iMap it!** The Nature Conservancy has subscribed to iMap-invasives, a web-based, geo-referenced database that allows anyone in Vermont to document the presence of invasive terrestrial plants. The Conservancy will provide on-line and in-person trainings, beginning in the summer. Community groups, professional land managers, and schools are excited about using this tool. It will be accessible via vtinvasives.org.

**PlantWise! in action:** This is the first growing season that nurseries and other horticultural professionals who have joined PlantWise! Vermont will have voluntarily ceased the sale of invasive barberry, burning bush, Norway maple, yellow iris and Amur maple. Please thank them for joining and encourage those who haven’t signed on yet to join the cause!

**Map and manage invasives:** Thanks to a grant from the Northeast Integrated Pest Management Center, The Nature Conservancy will be partnering with Green Mountain College and UVM to support local community efforts to map and manage invasives.

**Community guide published:** The Vermont Chapter has just completed a community guide on invasive plants, “Developing Invasive Plant Outreach and Management Projects.” You can download a copy from nature.org/Vermont.
Conservation Tools Guide Restoration

The Nature Conservancy has developed a cutting-edge tool to help identify the most important land areas to protect and restore for the purpose of aquatic conservation. The Active River Area (ARA) framework, which includes areas beyond the riverbank as part of a dynamic river system, is being used by the Vermont Chapter to prioritize protection and restoration efforts in two Lake Champlain tributaries.

In 2008, the Conservancy’s eastern region combined river ecology knowledge with GIS (Geographic Information System) software to identify active river areas, land areas that are ecologically linked most strongly with rivers. The following year, the Vermont Chapter’s Conservation Ecologist Paul Marangelo and partner organizations used the ARA-GIS tool along with extensive research by the Vermont Department of Environmental Conservation (VTDEC) to determine where to best focus efforts to protect the aquatic ecosystem of Lewis Creek and the Poultney River.

This map, by Dan Farrell, the chapter’s Conservation Information Manager, shows one of the products of the ARA analysis, the flood zone in the Lewis Creek watershed.

Based on their research, the Conservancy and partners — VTDEC, the Lewis Creek Association and the Poultney-Mettowee Watershed Partnership — created “conservation blueprints” for Lewis Creek and the Poultney. The blueprints are now available to anyone interested in helping to conserve these significant river systems.

Marangelo says the ARA approach is proving to be a helpful tool in conservation. “We are able to target where to work to protect or restore processes that shape and maintain natural habitats in river systems,” he says.

Legacy Club: John and Jane Ewing

From their home along the Winooski River in Burlington, Legacy Club members John and Jane Ewing look out to conserved lands that The Nature Conservancy helped to protect. The Ewings’ connection to the Conservancy goes back many years before they discovered their paradise near Derway Island and the Halfmoon Cove Wildlife Management Area. As a lawyer, John Ewing worked with Vermont Chapter co-founder Hub Vogelmann and State Director Bob Klein doing title searches. He also served as a Vermont Chapter trustee and was chairman of the board in the 1970s.

John’s background is in banking and law — he practiced law in Vermont from 1957 until joining the Bank of Vermont in 1972 as general counsel and later president — but his real passion is conservation and land use planning. “Conserving natural areas, particularly those that are fragile and threatened by development, is so vital to keep that special quality of Vermont,” John says. “The Nature Conservancy does a superb job of targeting areas and finding out how to acquire the lands to protect them.”

Both community-minded, John and Jane are engaged in many pursuits. John, the founder of Smart Growth Vermont, still serves on its board as well as the Vermont Housing and Conservation Board, the Burlington Parks and Recreation Commission and the board of Blue Cross and Blue Shield. He also served as chairman of the Vermont Environmental Board from 1995 to 1998. Jane’s main volunteer focus is the preservation of the historic Lakeview Cemetery on the shores of Lake Champlain. The Ewings are also busy with a large family. The couple married in 1975, a second marriage for both, and, combined, they have eight children and eight grandchildren.

But these long-time Legacy Club members always reserve a special place for conservation, and what it will mean to their children, grandchildren and future generations.

“What better legacy is there to leave than your commitment to protecting the Earth for generations to come? Find out more about The Nature Conservancy’s Legacy Club. Contact Emily Boedecker at (802) 229-4425, ext. 112; eboedecker@tnc.org.
Save the Date!

Come to Camp with the Vermont Chapter
We’re holding our 2011 Annual Gathering at Hosmer Point Camp in Craftsbury, Vermont on Saturday, Sept. 10. There will be field trips, delicious local food—and cabins if you want to stay the night! We hope you’ll join us. Watch nature.org/Vermont for more details.

Field Trips:
June 18 at Black Mountain Natural Area, Dummerston
July 9 at White River Ledges Natural Area, Sharon
Go to nature.org/Vermont for information.

Elizabeth Collins / TNC
FOR IMMEDIATE RELEASE

2400 SEEDLINGS, 8.5 ACRES, 2 YEARS
Willowell Foundation to restore valley clayplain forest in Monkton with students and community members to benefit water quality and wildlife

How many people does it take to raise a forest? David Schein, Executive Director of the Willowell Foundation, claims that it will take a village. Schein is calling on local community members to join elementary, middle and high school students from Monkton, Bristol, New Haven, Starksboro, Lincoln and Vergennes to take the Clayplain Restoration Challenge. Participants will pick up planting bars and find a home for silver maples, swamp white oaks, and red-osier dogwoods in the rich clay soil of the Willowell property in Monkton. The ultimate goal is to plant 2400 seedlings on 8.5 acres in 2 years and learn about this valuable natural resource in the Champlain Valley.

On Green Up Day, Saturday, May 7th, Willowell is co-sponsoring a workshop with Vermont Coverts: Woodlands for Wildlife, Inc. for community members interested in learning about clayplain forests and restoration techniques. “This is a great opportunity for landowners to learn about and implement clayplain forest restoration” notes Coverts Executive Director Lisa Sausville. Vermont Coverts mission is to encourage the enhancement and/or creation of sustainable forest ecosystems for wildlife and other benefits on private lands.

The workshop will run from 9-11:30am at the Monkton Methodist Church (78 Monkton-Bristol Rd, Monkton). Marc Lapin, Ecologist, Middlebury College Professor and Director of the Champlain Valley Clayplain Forest Project, launches the morning with a discussion of natural history and stewardship concerns. Mary Droege, Conservation Ecologist with The Nature Conservancy, will discuss TNC’s clayplain forest restoration efforts in the Hubbarton/West Haven area. She will share lessons learned from their seven-year restoration project. A representative from the Natural Resources Conservation Service will wrap up the morning talking about wildlife of the clayplain and funding programs for landowners interested in forest restoration and stewardship. A field planting session will follow from 1-3pm at the Willowell property. Chili, cornbread and cider will be provided for lunch but participants are also welcome to bring their own. After lunch folks will have an opportunity to get their hands dirty learning proper planting techniques and putting their own seedlings in the ground. Space is limited to 20 participants so RSVP to Kelsey Haigh of the Willowell Foundation at kelsey@willowell.org or 802-349-2077. The restoration is supported by funding through the Natural Resources Conservation Service (NRCS) and the Lake Champlain Basin Program.
Of the wetland restoration, Willowell’s founder Matt Schlein says: “Since its inception The Willowell Foundation has offered programs that dynamically integrate the arts, education, and the environment. In that spirit, this restoration project will allow a diverse community of learners to engage in their local ecosystem and transform it for future generations. We feel like it is one thing to talk about the importance of conservation in a climate-controlled building, it is another thing to learn about it when you have dirt under your fingernails.”

The 8.5 acres to be restored are part of 109 acres owned by the Foundation that were conserved by The Nature Conservancy (TNC) in 2009. The majority of the conserved property is a high quality Northern white cedar wetland; a habitat that is more typical of the Northeast Kingdom. The restoration area was retired from agricultural production to provide a buffer to the cedar wetland and Pond Brook, a stream that flows out of Bristol Pond into the Lewis Creek. Unlike the cedar wetland, the soils of the restoration area are typical Champlain Valley clay and silt. These soils were the foundation of the valley clayplain forest; a forest common to the Champlain Valley prior to European settlement but which has been subsequently converted to agricultural land. A few small disconnected patches remain. When this area is restored it will also provide an important wildlife corridor connecting the Little Hogback and Hogback forest blocks.

The Foundation owns a total of 230 acres just east of Bristol Road in Monkton. The rest of the property is used for Willowell’s famous collaboration with Vergennes High School—the Walden Project, one of the nation’s only outdoor public high schools; the Farm to School Community Garden, where students grow food for their own school lunches; Sue Morse’s Keeping Track program, a large mammal tracking and citizen monitoring project; a medicinal herb garden; and workshops in aspects of “learning from the land” and nature-based arts.

###
In the spring of 2007, the Willowell Foundation hopes to begin a Valley Clayplain reforestation initiative that will eventually return more than twenty acres of wet, difficult farmland to its natural state as endangered Valley Clayplain forest.

When the Willowell Foundation purchased what is now the Willowell Land in the summer of 2005, it was roughly 50% forest and 50% field. For the last 5-10 years, the fields had be hayed by neighboring farmers to keep them clear of brush and to take advantage of their incredible fertility. Willowell is committed to preserving the agricultural heritage of the property, and plans to keep much of this acreage open for vegetable farming, haying, and a potential pasturing operation. We hope to preserve and enhance our soils and use our land sustainably for many generations to come.

In keeping with our commitment to sustainable ecological land use, we at Willowell are also committed to preserving endangered habitat so that the plants and animals that enrich our lives and share our space in the world may continue to flourish as our most treasured neighbors. During our time at the Willowell Land, we have recognized its importance as both a wildlife “corridor” that allows movement from place to place for large animals, and as an intrinsically rich home for many animals, birds, insects, reptiles, amphibians and plants. We believe that our own health is inextricably linked to the health of the ecosystem around us, and strive to improve its health in as many ways as we can.

One means that we will use to improve the health of the Willowell Land is our Valley Clayplain Reforestation Initiative. Set to begin in the spring of 2007 with a small, pilot reforestation project on one acre of open field and along our eastern border with Pond Brook, this initiative will be the start of a long-term stewardship project that will aid in the comeback of Vermont’s rare Valley Clayplain forest. Willowell is already home to a small pocket of Valley Clayplain that will be expanded and enriched by this project.

Plans are underway in this restoration and education effort. Our hope is to involve students of all ages from the many public schools that we work with in our restoration efforts in order to learn and teach together about the importance of the Valley Clayplain.

**About the Valley Clayplain**

Valley Clayplain forest, also known as oak-hickory forest, is a rare, endangered forest type found only in the Champlain Valley of Vermont. The name, “clayplain,” is actually short for clay-soil lake
alluding to the extremely fertile clay soils, warm valley climate, and poor drainage that characterize this forest type. Agriculture in Valley Clayplain soils is much more successful than in any other soil type in Vermont, which is why farming is still the most prevalent land use in the Champlain Valley.

Despite its alter ego as “oak-hickory forest,” more species of tree, shrub and vine grow naturally in the Clayplain forest than in any other forest type in New England, and many of them are found only in Clayplain forests. Tree varieties found here include: shagbark hickory; white, bur, and red oaks; red, silver and sugar maples; black, white and green ash; and American elm, beech, basswood, white pine and hemlock. In addition to its extensive variety of trees, the Clayplain forest is rich with a diverse variety of herbs and shrubs, some of which only occur in the Clayplain forest.

Valley Clayplain forest also provides excellent habitat for wildlife, including an abundance of insects, amphibians, reptiles, birds, and mammals, like the bobcat who left this track (left) in the Valley Clayplain forests at the Willowell Land. These creatures are drawn to the Clayplain forest by the abundant food, landscape diversity, warm climate, and the nearby water and wetlands that are most often found near the Clayplain. Of particular importance is the presence of the redheaded woodpecker, a bird rare to Vermont, in these forests.

Pictured at right is the Redheaded Woodpecker (Melanerpes erythrocephalus), denizen of the Valley Clayplain forest.

Why Preserve the Valley Clayplain

The Valley Clayplain forest is an incredibly rich ecosystem, including hundreds of species of plants and animals (humans included). It makes up a huge part of the native ecosystem of the southern Champlain Valley, and serves many functions including water and air purification and natural pest control. But the Valley Clayplain, which once extended over more than 220,000 acres, is now extremely rare here. Large patches of this forest type are even more rare, with most encompassing only 20 or 30 acres.

Though many animals do spend most or all of their annual cycles in the Clayplain, the relatively small size of the forest fragment on the Willowell land means that many species (especially larger animals such as moose and bear) are rare visitors here, merely passing through the forest to access neighboring properties or to feed seasonally. When corridors between pockets of Clayplain and larger habitat areas are destroyed, animals are unable to move safely through their former home ranges and are squeezed into smaller and smaller habitat areas. This leads to confrontations with humans, a weakened gene pool due to interbreeding, and a stressful quality of life that undermines breeding populations.

Development and town expansion are the greatest threat to these Clayplain patches, as the population of people in the Champlain Valley continues to
increase. The preservation of existing Valley Clayplain forest land and the reforestation of lands that have been damaged is crucial to the survival of the Clayplain and the many species that depend on it.

A snapshot of Willowell’s existing Valley Clayplain forest. Photo © EKWB (2005).

True to our commitment to educating the public about sustainable, ecologically sound land use practices, as well as to preserving our forested land for the future generations to enjoy, we at Willowell hope to return a percentage of our land to its native Valley Clayplain forest over the next several years as well as to sustainably steward our existing Valley Clayplain forest.

Getting Involved

There are several ways to get involved in the Valley Clayplain Forest Project at Willowell. These include:

* Volunteering to plan tree-planting events, and participating in preparing soils and planting trees.

* Donating Valley Clayplain forest tree species, tools, and funds to support the Valley Clayplain Forest Project.

If you are interested in any of these opportunities, or if you would like more information about the Valley Clayplain Forest Project, please Contact Us.
One day, a clayplain forest will rise up from these seedlings.

Visitors to the Hubbardton River Clayplain Forest will find no giant trees. Rather they will discover nearly 200 acres of wet meadow land that is being planted over a ten year period with a crop of foot-tall bur oak, green ash, red maple and other native Vermont tree seedlings.

It is the Conservancy’s hope that this Lilliputian forest will, in a few hundred years, grow up into a mature clayplain forest – recreating in a small way a natural community that once sprawled from the southernmost end of the Lake Champlain Valley north to the lowlands of Quebec, one that is now considered a rare natural community in the state.

This new forest will offer valuable ecosystem services to the human community. It will help conserve the Hubbardton River, which cuts through the preserve, and the mature clayplain forest with its abundant mast trees provide food and cover to many species of wildlife, such as deer and turkey. This growing educational resource will also serve as a classroom for high school and college classes experience firsthand the many varied restoration techniques and projects that have been implemented on the preserve.

**Size**

250 acres.

**Access**

Limited parking along Route 22A, no trails.

**Why the Conservancy Selected This Site**

“One of the reasons why the Conservancy was interested in this land is because there was already a large patch of existing clayplain forest at the edge of this property, actually one of the best remaining examples in the Champlain Valley, says Mary Droege the Conservancy’s director of ecological management and restoration. “Since 2004 we’ve been planting seedling trees in the adjacent fields with the intent of making this particular clayplain forest patch bigger. Bigger means stronger - and more viable in the long term. We are giving the forest a jump start, while also conducting a formal experiment to see how best to re-grow a clayplain forest.”

ECOSYSTEM RESTORATION PROGRAM PROJECT

PROJECT DESCRIPTION

Project Title: BENJAMIN/ WING WETLAND RESTORATION
Project ID: 74
ERP Program: Wetlands

Town(s) - County - Legislative District:
Benson - Rutland County - Addison-Rutland-1

Project Lead Organization(s) - either Government or Civic:
Lead: ANR-FPR  Program: Forestry - Wetlands
Lead: The Nature Conservancy

Project Contact: April Moulaert
Address: Dept. of Forests, Parks & Rec. 103 South Main Street, 10 South Waterbury, VT 05671-0601
Phone: 802-241-1054
Email: april.moulaert@state.vt.us

Project Description:

The Benjamin-Wing wetland restoration site in Benson is a model of cooperation between willing landowners, the state and conservation groups. Clean and Clear is providing $39,000 in funding to the Nature Conservancy which recently purchased a 65-acre parcel of agricultural (the Benjamin tract) property which borders the Hubbardton River in the Lake Champlain Basin. TNC then worked with the neighboring farmer (John Wing) to swap a portion of the property, securing 50 acres of low utility, wet agricultural land adjacent to the river. This low utility land will be retired from agriculture and will be restored to wet clayplain forest which is a significant natural community in Vermont.

The restoration of this formerly farmed site will eliminate an active source of phosphorus loading to surface waters. The farmer was able to trade low utility wet land for usable dry land for agricultural grazing. So, all parties benefit from the transaction. The Clean and Clear funding will help cover the costs of acquisition of the land, and will provide seed money for planning and monitoring the restoration, and for purchasing restoration materials.

Project Status: A grant agreement with The Nature Conservancy is being finalized, and a separate conservation agreement is being developed which will be recorded in the town land records to protect the state's interest in this property. Restoration at the project site has already started.
Hubbardton and Lower Poultney River Clayplain Forest Restoration Plan

Map 3. Thirty Largest Clayplain Forest Fragments

Notes:
Potential clayplain forest fragments are defined by the intersection of clay soils and forest layers. Field identified clayplain forests fragments are clayplain forest fragments that have been identified by TNC ecologists. The 30 largest clayplain forest fragments are a subset of the potential clayplain forest fragments layer and are ranked according to acreage (rivers were not considered a dividing feature).
Valley Clayplain Forest

ECOLOGY AND PHYSICAL SETTING
This is the forest that dominated the clay and silt soils of the Champlain Valley prior to European settlement and the subsequent conversion of forest to agricultural land. Today this forest community is extremely rare. The clay soils were deposited in the Champlain Valley during and following the Pleistocene glaciation, both when the valley was flooded by a large freshwater lake, and later when salt water invaded the basin from the north. The soils are deep and fertile, and make ideal agricultural soils, especially when drained. Moisture in these soils varies with soil texture and topographic position, and the most well-drained areas were the ones preferentially cleared for agriculture. The Valley Clayplain Forest remnants that are left are generally on the moister sites, though they typically contain a mosaic of wet and less-wet areas. In some areas, thin lenses of sand lie over the clay. It is unknown how these areas differ from places without sand. Lapin (1998) described Clayplain Forests and the variations within them, and much of this information is taken from his study.

This natural community is a mesic, or less wet, Clayplain forest. Wet Clayplain Forest is considered a variant and is typically a wetland community. These two variants are found together, however, and from a practical standpoint are difficult to separate. Mesic Clayplain Forest has moderately well drained to somewhat poorly drained soils but pools and wet hollows (Wet Clayplain Forest) are scattered throughout. In both, soil fertility is high. Because of the wet soils, trees are typically shallow-rooted and are easily blown over during heavy winds. Tip-up mounds are therefore a common sight in these forests.

VEGETATION
The canopy in Clayplain Forests is a diverse mixture of trees, including most commonly white oak, red oak, maple, white pine, shagbark hickory, and white ash. Associated species include hemlock, sugar maple, beech, swamp white oak, and bur oak. The shrub layer is typically well developed, and the herb layer can be quite dense and very diverse. Characteristic species include barren strawberry and grove sandwort. Slight changes in microtopography yield changes in species composition. Mounds within level sites may have dry-site species such as low sweet blueberry and woodland sedge, while hollows harbor wet site species such as winterberry holly and Bailey’s sedge.

ANIMALS
Characteristic mammals in this community are gray squirrel, eastern chipmunk, beaver (in wet areas), raccoon, and the ubiquitous white-tailed deer. Common birds are wood thrush, eastern wood pewee, ovenbird, northern oriole, and downy woodpecker. Typical amphibians are blue spotted salamander, American toad, wood frog, and grey treefrog. In the vernal pools within these forests, one can find caddis flies, predaceous diving beetles, and horsehair worms.

SUCCESSIONAL TRENDS
White pine seems to dominate some early-successional areas. Green ash and quaking aspen are also common early-successional species, along with eastern red cedar, red maple, bur oak, and white ash.

VARIANTS
Wet Clayplain Forest: This variant has soils that are somewhat poorly to poorly drained and is classified as a wetland. It is found as small to medium-sized inclusions within the Mesic Clayplain Forest and is very closely allied with it, hence its inclusion here. The canopy is dominated by swamp white oak, red maple, and green ash or white ash. White oak, shagbark hickory, white pine, American elm, and black ash are also present. Musclewood is the dominant small tree. The shrub layer is dense, and wetland plants such as sensitive fern, water hemlock, and water horehound are present along with the sedges listed above.

RELATED COMMUNITIES
Mesic Maple-Ash-Hickory-Oak Forest: This forest type is found on non-clay soils in the warm climate regions of the state and shares many species in common with the drier examples of Clayplain Forest.
CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS
This is certainly one of the most severely altered communities in Vermont. Its present size is a small fraction of its presettlement extent, and the exact nature and composition of the presettlement Clayplain Forest are not known. The remaining examples are all under one hundred acres and are separated from one another by large areas of agricultural land, making plant and animal dispersal between sites very difficult. A few good examples are protected on state and private conservation lands, but the remaining examples need protection badly. The long-term protection of the clayplain landscape will require not only protection of the remaining examples but also restoration of some agricultural land back to Clayplain Forest, an exciting and challenging proposition.

PLACES TO VISIT
Dead Creek Wildlife Management Area, Bridport, VT Department of Fish and Wildlife

CHARACTERISTIC PLANTS OF WET CLAYPLAIN FOREST

TREES – COMMON SPECIES
Swamp white oak – Quercus bicolor
American elm – Ulmus americana
Bur oak – Quercus macrocarpa

SHRUBS – COMMON SPECIES
Winterberry holly – Ilex verticillata
Northern arrowwood – Viburnum dentatum var. lucidulum

HERBS
Lakeshore sedge – Carex lacustris
Marsh fern – Thelypteris palustris

INVASIVE NON-NATIVE PLANTS
Morrow’s honeysuckle – Lonicera morrowii
Tartarian honeysuckle – Lonicera tatarica
Japanese barberry – Berberis thunbergii
Common buckthorn – Rhamnus cathartica
European buckthorn – Rhamnus frangula

RARE AND UNCOMMON PLANTS
Short-styled snakeroot – Sanicula canadensis
Harsh sunflower – Helianthus strumosus