

# Otter Creek Gorge Preserve Management Plan



Middlebury Area Land Trust  
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Maps were prepared by the above as well as the USDA Farm Service Agency of Addison County.

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This report was assembled by the Middlebury Area Land Trust in 2009.

## Plan Summary

The New Haven and Weybridge parcels of the Otter Creek Gorge Preserve will be managed to allow natural progression of the ecosystems, as well as to protect uncommon plant species and prevent invasive exotic species from becoming established. Agricultural use of a portion of the land will continue as part of the traditional Vermont landscape. Recreation management will provide hikers and bikers access on the Trail Around Middlebury and side trails. No new trails will be created, and the existing trails will be maintained and monitored to have the minimum possible impact on surrounding ecosystems. Neglected trails will be allowed to naturally become reforested.

## Weybridge Parcel

### Overview

The Weybridge Parcel of the Otter Creek Gorge landholdings is a 300-acre tract in the northeast corner of Weybridge, between Morgan Horse Farm Road and Otter Creek in the area of Beldens Falls. The site is one of the premier, low-elevation natural areas in the Champlain Valley and is highly significant for populations of rare plants, as well as relatively intact natural communities. The site also includes a winter deeryard and was recognized by Andrews (1990) as an integral part of the "Otter Creek Corridor." Andrews describes the area as "a largely intact undeveloped corridor along Otter Creek," where there is high-quality habitat for wood duck, common merganser, mallard, osprey, beaver, mink, muskrat, green-backed heron, great blue heron, and numerous other vertebrate species. Rare and uncommon plants occur in the wetlands and uplands within the "creek corridor."

The bedrock of the parcel is principally of the Beldens Formation, which consists of limestone, dolomite and marble; the marble was historically a valuable dimension stone, as evidenced by the quarry across the creek in New Haven. There may also be portions of the property with a bedrock of Middlebury Formation limestone and dolomite. Thus all of the bedrock has high concentrations of calcium- and magnesium-carbonates, and the soils are rich in lime.

Natural communities of the site are representative of the nutrient rich soils--both shallow, stony loams and deep lacustrine clays--of the southern Champlain Valley. The predominant natural community types are Valley Clayplain Forest and Transition Hardwoods Limestone Forest. The steep, ledgy slope that forms the western wall of the gorge is the third major natural community at the site, perhaps best called Limestone Bluff Cedar-Pine Forest; a very small sliver of that natural community lies within the landholding. Both the Transition Hardwoods Limestone Forest and the Limestone Bluff Cedar-Pine Forest are exemplary of their respective natural community types, and the northern portion of Valley Clayplain Forest is high quality also. In Vermont, these three types are quite restricted geographically: Transition Hardwoods Limestone Forest occurs in the Champlain Valley, Vermont Valley and Taconic Mountain biophysical regions; Valley Clayplain Forest occurs only in the Champlain Valley biophysical region, and Limestone Bluff Cedar-Pine Forest occurs in the Champlain Valley biophysical region and on bluffs adjacent to Lake Memphremagog. Please refer to Wetland, Woodland, Wildland: A guide to the natural communities of Vermont (Thompson and Sorenson 2000) for general natural community descriptions and occurrence information.

Although former land use is representative of the dominant pattern in the Champlain Valley--agricultural fields on more level, deeper-soil terrain and woodlots on the ledgy, shallow-soil terrain--the gorge parcel was perhaps left somewhat more forested than the norm. The presence of several deeply incised, but short, streams on the moderate slopes adjacent to the gorge may have discouraged the creation or maintenance of fields on the northern third of the parcel. Portions of clayplain and limestone forest indicate a history of clearing, but have now regrown to forestland.

Current uses of the property include agriculture and recreation, but the principal use and management objective is natural community and rare plant conservation. Hikers, walkers and mountain-bikers utilize the Trail Around Middlebury, which travels through

the parcel and crosses Otter Creek via a footbridge constructed at the top of Beldens Falls. Current agricultural use consists of sheep and cattle pasturing and hay production.

### **General Management Objectives**

The Otter Creek Gorge Preserve is an extremely important natural heritage site of statewide and even regional significance. The gorge itself and the surrounding forest and wetland natural communities, along with the numerous rare and uncommon plants known to occur on the preserve and adjacent lands, combine to form a natural showcase for the characteristic ecosystems of the Champlain Valley. The importance of the gorge area has been recognized since the early days of botanical exploration in the Champlain Valley.

As such, the management goal of the Preserve is to allow the natural ecosystem to function with minimum impact from human activities. Forest and wetland natural communities will be allowed to develop under a regime of natural dynamics so that the preserve can become an even more exemplary mosaic of upland, wetland, riparian and aquatic ecosystems.

Although the ecological integrity of the land and water is the primary management objective, the site can also provide environmental education and outdoor recreation opportunities. Guided natural history walks are conducted on the property nearly every year, and the Trail Around Middlebury provides easy access with, under appropriate management, relatively little adverse impact. Thus, the Otter Creek Gorge Preserve is a place where not only can local residents visit a breath-taking natural area, but also where they can gain a deeper understanding of the local ecosystems and natural communities in one of the Champlain Valley's finest ecological treasures.

To adequately and most effectively achieve these goals will require joint management of the gorge area among the several landowners, who include Middlebury Area Land Trust, Middlebury College, University of Vermont, Town of Middlebury, OMYA, Incorporated, and private individuals.

### **Management Area Descriptions and Management Recommendations**

#### Management Area 1: Transition Hardwoods Limestone Forest

Area 1 is not only a high-quality example of Transition Hardwoods Limestone Forest, but also is the site of one of the rarest vascular plants in Vermont, goldenseal (*Hydrastis canadensis*) which is currently known from only one other location and is protected with state-threatened status under the Vermont Endangered Species Law (10 V.S.A. Chap. 123). ***The presence of this highly vulnerable, medicinal native herb must not be made public.*** An additional rare plant, Allegheny crowfoot (*Ranunculus alleghaniensis*), was reported from the site in 1992, but has not been relocated by searches in 1999 and 2000. The uncommon herb, Allegheny-vine (*Adlumia fungosa*), grows on some ledges in the northern quarter of Area 1. The Transition Hardwoods Limestone Forest natural community is ranked S3 (uncommon) by the Nongame and Natural Heritage Program.

The limestone forest natural community is not uniform throughout. The southern third or so is divided from the northern portion by an old, woven-wire fence. Both subsections of the management area are above-average examples of the natural community type, even though the forest composition and structure of vertical layers and dead wood differ. The differences can be attributed both to management history and to differences in the

physical landscape (e.g. ledginess, slope degree).

The southern area is dominated by red oak (*Quercus rubra*) with diameters (diameter at breast height, dbh) from 10-18"; associate species include shagbark hickory (*Carya ovata*), white ash (*Fraxinus americana*), white oak (*Quercus alba*), sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*). The understory is comprised mostly of 1-6" dbh sugar maple saplings and small poles. The herbaceous flora of this subsection is very diverse and exceptionally beautiful; it is an excellent display of the limestone-flora characteristic of the natural community type. In all likelihood, part of this subsection was cleared in the early European settlement period, for possibly a short interval only, then regrew and was woodland pasture that was occasionally logged. A 16.5" dbh red oak had approximately 55 annual growth rings.

The northern subsection has an overstory dominated by 10-14" dbh sugar maple and white ash, with 14-20" shagbark hickory and white pine (*Pinus strobus*). Hophornbeam (*Ostrya virginiana*) dominates the understory. Within several hundred meters adjacent to the woven-wire fence, the forest has a "more used" appearance than the southern subsection—there are more openings from more recent logging, some "weedier" herbs (mullein (*Verbascum thapsus*) and thistle (*Cirsium* sp.)), and a moderate cover of European buckthorn (*Rhamnus cathartica*). The northern part of the subsection, however, is where there are the best examples of the classic Champlain Valley shelf-sequence limestone/dolomite ledges. The herb flora is exceptionally rich in species and includes the uncommon Allegheny-vine, as well as lopseed (*Phryma leptostachya*), which is quite uncommon in Addison County and northward in Vermont, bulblet-bladder fern (*Cystopteris bulbifera*) and white snakeroot (*Eupatorium rugosum*). Some large white oak divide this area from the adjacent clayplain forest to the east. The wonderful, ledgy terrain continues north where it interfingers with the clayplain forest.

The Trail Around Middlebury has two sections routed through the southern portion of Area 1. The main trail goes east-west from the open pasture of Area 4 to the bridge at Beldens Falls. Another part of the trail, which forms something of an inner loop through the Preserve, utilizes the tractor road that connects the open land of Areas 4 and 5.

## Management Recommendations

### Sensitive species management

***As stressed above, the presence of rare plants, especially goldenseal, on the gorge property should not be made public.*** The greatest threats to the integrity of the state-threatened goldenseal population are trampling and other potential disturbance from the cattle that have been allowed to graze in the woods and possible disturbance from plant gatherers. As of this writing, the cattle will no longer be permitted to enter the woods. Restricting the livestock from access to Area 1 should be continued in perpetuity so that the goldenseal population can grow without any interference from non-native animals. As for direct human disturbance of the plants or population, there is no evidence of its occurrence to-date, but the plants are visible from a tractor road and the potential of two types of disturbance is not insignificant. Direct collecting of the plants could severely alter the population size and also the age-structure. Additionally, some well-intending "plant-savers" may think it a good idea to augment the population by planting more goldenseal in a nearby or adjacent area. This could introduce non-native genotypes into the existing population and has the potential to genetically compromise the population so

that it may no longer be well adapted to these particular site conditions, including climate and soil factors. **NO MANIPULATION OF THE GOLDENSEAL POPULATION SHOULD BE PERMITTED**, with the exception of seed collection by representatives of the Nongame and Natural Heritage Program or the New England Plant Conservation Project. This latter activity would require a written permit from the Agency of Natural Resources. Any other activity related to the goldenseal population should be undertaken only in consultation with the Nongame and Natural Heritage Program. The program may decide in the future that active conservation measures, such as population augmentation by planting seeds collected from this site or vegetation management such as control of exotic species, are recommended as a best practice for the long-term persistence of the population. A well conceived adaptive management plan should be developed before any such actions are undertaken.

#### Natural community management

The management objective for Area 1 is maintenance of a natural forest ecosystem with a long-term goal of old-growth forest conditions. Therefore, active forest management of Area 1 is not recommended since native forest is well developed and there is no need for restoration action. Natural ecosystem dynamic processes should be allowed to operate unhindered by direct manipulations by people; indirect disturbances from anthropogenic atmospheric pollution and climate change obviously cannot be controlled at the level of this management plan. The forest ecosystem is in a period of recovery from past human management that has altered the natural forest structure of live and dead wood, and perhaps has also altered the forest composition. As the forest matures, single-tree death and small-scale disturbances are likely to form a more heterogeneous horizontal structure to the forest, as well as allow for the development of an uneven-age overstory and an abundance of standing and prone large woody debris.

Current population levels of exotic invasive plants, particularly European buckthorn, do not require active management, and it is likely that under a natural dynamics regime the buckthorn will not spread and will eventually die out as the existing cohort senesces. In the event of a severe, stand-initiating natural disturbance, however, the forest may become quite open and thus lead to establishment of another and more widespread cohort of buckthorn. In such an event, it may be desirable to control the buckthorn before it becomes well established.

Additional high-quality areas of Transition Hardwoods Limestone Forest occur in the New Haven parcel of the Otter Creek Gorge Preserve, Wright Park south of the New Haven piece, and on private lands on the west side of Morgan Horse Farm Road adjacent to the parcel which is the subject of this management plan. The former piece will be managed in conjunction with the Weybridge parcel. To increase the functional size of the conserved Transition Hardwoods Limestone Forest natural community, it is recommended that MALT, if possible, develop with the landowners of these other two high-quality pieces, management agreements that aim toward a management regime of natural dynamics. Doing so will help to assure that a high-level of integrity of the limestone-forest ecosystem will be maintained in the gorge area and that these landholdings together will continue to serve as a very important ecosystem conservation area.

## Recreation Management

Trail management in Area 1 should be very conservative. No additional trails or roads should be constructed and management of existing thoroughfares should aim to re-establish or maintain a closed forest canopy overtopping all trails. The tractor road at the south end that provides access to the inner meadow (Area 5) should be allowed to re-vegetate naturally along the edges so that the road closes in and becomes narrower. It may even be beneficial in the long-term to allow full re-vegetation of this road, although severe compaction would make that process very slow. Control of buckthorn or honeysuckle (*Lonicera morrowii*, *L. tartarica*) may be desirable, depending on the levels of colonization that occur along this rather wide opening.

## Management Area 2: Valley Clayplain Forest

Valley Clayplain Forest, in various successional stages and cover-types, is demarcated as Area 2. The area is divided into sections 2a, 2b and 2c, which are differentiated by land-use history and, thus, current vegetative cover. The clayplain forest natural community covers the most acreage in the parcel, but some of it has been and remains cleared for agriculture. Nearly all of the existing clayplain forest at the site is the drier-type, Vergennes-soil forest; the wetter, Covington-soil portion of the clayplain mosaic does exist on the property but is currently in pasture and meadow. The cleared fields are treated as separate management areas.

### Area 2a: South of the inner meadow

Clayplain forest south of the inner meadow is dominated by white pine, with an understory of sugar maple. The pine domination is the result of previous agricultural management of the land; the forest ecosystem is recovering well from the historical clearing. The age of the pine overstory was not determined, but the trees are mature and natural individual-tree-death dynamics are beginning to make the area more heterogeneous and structurally diverse. A substantial amount of large woody debris is accumulating on the forest floor, and among the standing pines is a minimal to moderate amount of wood decay. The dead wood provides niche space for numerous insects, fungi, birds and small and medium mammals.

A portion of the white pine overstory was either uprooted or partially de-limbed during the 1998 ice storm. A small patch of ice-damaged pine at the south end of the meadow was harvested in 1998. Other than that "salvage" operation there has been no recent logging. The date of the previous pine sawtimber harvest is not known. It appears that as the pines continue to die slowly, canopy gaps will form that will allow a number of the established sugar maple poles and saplings to be recruited into the canopy. Other hardwoods such as red maple (*Acer rubrum*) and white ash will also be recruited, and the future species composition will depend on the size of canopy gaps, the soil substrates available for germination and the available seed source. Also present in the understory and sapling layers is a component of hemlock (*Tsuga canadensis*). Because of faster growth rates of hardwood saplings and poles, it is unlikely that many hemlock will be recruited to the canopy, but they will persist for a hundred years or more in the subcanopy and understory and will thus remain an important structural and compositional component of the forest. The herb flora beneath the pine canopy is substantially less



diverse than in hardwood-dominated portions of the clayplain forest. This can perhaps be attributed to both the past land use and the deep shade and deep pine litter of the forest floor. Where the pine canopy adjoins the hardwood-dominated ledges of the Transition Hardwoods Limestone Forest in Management Area 3, the herb composition is significantly more diverse. It is likely that as the forest succeeds to hardwood domination, many herb species now present will be able to germinate and establish in the area. Of course, if a major disturbance happens to create a large forest opening, the area may see a re-establishment of white pine.

Within the nearly level clayplain forest of Area 2a, a deeply incised stream flows south from the meadow and is surrounded by hemlock-dominated slopes. In the narrow valley bottom are seepage areas with an herb flora indicative of the continuous supply of aerated water both flowing in the stream channel and seeping from the banks. This riparian area is surely of importance to many species of amphibians, small mammals and invertebrates that favor forest areas with an ecotone of dry and moist microsites and natural communities.

The Trail Around Middlebury runs east-west through this management area.

## Management Recommendations

### Natural Community Management

No active forest management is recommended for Area 2a. Natural forest dynamics will continue to occur and will enhance the ecological integrity of this area, which is in the beginning stages of conversion from white pine dominance to, probably, a more mixed forest canopy.

### Recreation Management

Trail management may be necessary. Trail issues that should be monitored and may require attention include 1) impact of hikers and bikers on exposed roots, 2) trail erosion in the short, steep stream valley, and 3) trail conditions where travelers cross the stream. Shallow rooting in the heavy clay soil is normal for many tree species, but physical damage and compaction from heavy recreation travel is not. There is thus a potential for unacceptable levels of damage to the trees that have roots crossing the trail. Erosion on the stream-valley slopes, and especially around tree roots on the trail, may rise to unacceptable levels that could impact either stream and riparian zone integrity or tree health, or both. Similarly, compaction, erosion or other physical disturbance to the soil in the narrow riparian area has the potential to create an undesirable amount of impact on the ecosystem; this can be largely controlled by maintaining two solid planks as a crossing point.

Consultation with a professional trails designer and manager would be useful to avoid unnecessary harm to the forest and stream ecosystems. Design planning should evaluate routing objectives, possible relocation, educational potential and construction specifications with respect to drainage, erosion, and crossing of wet areas and streams.

Since ecosystem integrity is a primary management objective for the preserve, tolerance levels of adverse impact from recreation should be rather low. To put that into action will require regular monitoring of recreation types, levels and impacts. Monitoring is especially important on and near to the trails and roads, where one would expect recreation use to be concentrated. Developing a monitoring system with quarterly or

twice-annual reports to be filed would be useful to assess long-term strategies for ecosystem protection and recreation management.

#### Area 2b: Middle section of clayplain forest north and northeast of the inner meadow

The middle section of clayplain forest is delineated more-or-less from the northerly end of the inner meadow to the well-defined east-west woods road. This section is quite different from that discussed above (Area 2a). This subsection includes areas of moister clayplain and is characterized by a younger tree canopy. The area due north of the meadow features a young forest of numerous hardwood species and is very flat and moist. A moderate to high amount of European buckthorn occurs there. A spur of the Trail Around Middlebury travels through this part of Area 2b. The trail connects the main east-west portion that follows an old woods road with the inner meadow (Area 5).

The easterly portion of the subsection is less wet and features a mixed canopy of hardwoods and white pine. Some portions on the periphery of the meadow have been the scene of previous pine blowdowns and/or small patch tree harvest. Such areas may have more gray and paper birch (*Betula populifolia*, *B. papyrifera*, respectively) than is seen on the rest of the parcel. This eastern area was not visited during the management plan preparation.

### Management Recommendations

#### Natural Community Management

Active forest management is not a priority activity, but European buckthorn control measures could be employed in the area. Mechanical control by cutting stems is likely to be effective at reducing the buckthorn understory in areas where it is common. In the absence of active control measures, which can be very time and resource intensive, natural forest succession will likely lead to eventual shading out of the buckthorn.

#### Recreation Management

The Trail Around Middlebury spur that connects the east-west woods road [North Gorge Trail] with the north end of the inner meadow runs through a very wet piece of clayplain forest. Nor is this piece of forest particularly pleasing aesthetically, as it features small, young trees and much buckthorn.

Serious consideration should be given to the utility of this trail spur. With regard to rare plant conservation, it is undesirable to lead people through the inner meadow to the tractor road. If trail considerations dictate that it is desirable to have a northern access to the inner meadow, it would be better to relocate this trail to the west. A drier location near the boundary between Area 1 and Area 2b would make trail impact lighter and maintenance easier, as well as provide a more scenic route through more mature trees or even along the base of floristically rich ledges.

Consultation with a professional trails designer and manager would be useful to avoid unnecessary harm to the forest ecosystem. Design planning should evaluate routing objectives, possible relocation, educational potential and construction specifications with respect to drainage, erosion, and crossing of wet areas and streams.

### Area 2c: Northern section of clayplain forest

The northern section of clayplain forest is north of the east-west woods road and south of the property boundary. The terrain is level to moderately sloping and includes a well-incised, intermittent stream whose source is a springhead within the management unit. The forest canopy is comprised of white pine, hemlock, red maple, sweet birch (*Betula lenta*), sugar maple, red oak, white oak and shagbark hickory. Small-patch logging has created a mosaic of older and younger forest, with the younger patches featuring an overstory of 6" dbh paper birch, white ash and red maple, and larger, remnant white pine. Patches of white pine that blew down and/or were girdled have also created openings of younger forest. Additionally, a bigtooth aspen (*Populus grandidentata*) grove occurs in the southern part of Area 2c. An apparently small population of the rare/uncommon sedge, loose sedge (*Carex laxiculmis*), which is most commonly found in clayplain forest in Vermont, occurs in this area; a larger population may exist there, but a search to the northeast was not conducted.

Northward Area 2c interfingers with the limestone forest of Area 1. Natural forest structure in the northern quarter of the property in both natural communities appears to be uniformly intact, with an overstory of 12-16" dbh sugar maple, beech, red oak and shagbark hickory, along with an associate component of white pine and hemlock. An understory of sugar maple, beech and hophornbeam, ranging from 4-8" dbh, is well developed. Northwest of the northernmost field, the overstory is pine-dominated.

The Trail Around Middlebury does not go through Area 2c. The trail utilizes the woods road that is the southern boundary of Area 2c.

### Management Recommendations

#### Natural Community Management

Area 2c is relatively well-structured, "mid-successional" clayplain forest. Natural ecosystem dynamics will continue to diversify the forest structure. The openings at the south end were likely created for "wildlife habitat diversity." Such practices are not recommended for natural community management. Single-tree death and small-patch disturbance will naturally create both vertical and horizontal structural diversity. Thus, no active management is recommended.

#### Recreation Management

Area 2c is more remote from the trail system and has a relatively complex undulating topography with drainages on a moderate slope. The area has the most intact, most diverse clayplain forest in the parcel and it is thus recommended that no recreation facilities be developed there. Off-trail hiking and hunting are appropriate activities, whereas trail access is discouraged. Even small trails can fragment the forest ecosystem, as it is perceived by small, soil-dwelling animals.

### Management Area 3: Transition Hardwood Limestone Forest and Limestone Bluff Cedar-Pine Forest

Limestone Bluff Cedar-Pine Forest is a natural community that is recognized in the state classification as occurring primarily on rocky headlands of Lake Champlain, but occasionally occurs away from the lake on calcareous ridges or cliff tops. At Otter Creek

Gorge there is a fairly extensive example of limestone bluff forest on the cliff top; a bit of this natural community occurs on the MALT-owned parcel, but there is none of the associated Temperate Calcareous Cliff within the landholding. Thompson and Sorenson (2000) describe accurately that Limestone Bluff Cedar-Pine Forest is often adjacent to Transition Hardwood Limestone Forest. This is evident in the Otter Creek Gorge, where one can see the dense growth of the limestone bluff dominants—northern white cedar (*Thuja occidentalis*), eastern red-cedar (*Juniperus virginiana*) and white pine—beginning where the more level terrain meets the topslopes of the gorge.

The forests of Area 3 are quite natural; the vegetation has not been subject to much human manipulation. Nevertheless, in the ledgy terrain where blowdown and tree-death occur at a high rate, there are often openings large enough for the establishment of buckthorn and honeysuckle. Hence, there are small patches where these invasive exotic shrubs are established in the forest.

Most of Area 3 is Transition Hardwoods Limestone Forest, but a narrow strip of bluff forest occurs on the property at the southeast extremity. The hardwood forest is at least equally intact as that of Area 1. One will notice quite a bit of pine and some white-cedar in the hardwood forest of Area 3; the amount of ledginess, landscape position in a more exposed location close to the gorge, and seed source from the adjacent bluff forest and pine-dominated clayplain forest contribute to the higher abundance of these species.

The Trail Around Middlebury goes through the management area from east to west in the southern portion. Most of the trail section that parallels Otter Creek is on adjacent ownerships.

## Management Recommendations

### Natural Community Management

No active management is recommended in Area 3. The forest ecosystems are quite intact and are surrounded by forest and gorge on all sides. Natural dynamics are apparent in the form of blowdown of shallowly rooted trees growing on ledge and single-tree death. As these dynamics, along with the potential larger-scale disturbance, continue to function, the forest ecosystem will accumulate more dead wood and will become more structurally diverse. Exotic shrub control is not expected to be necessary, although monitoring conditions along the trail that parallels Otter Creek is suggested.

### Recreation Management

This discussion includes trail management considerations for the section of trail that parallels Otter Creek. The trail travels across the land of OMYA, Inc. and Middlebury College, but is managed by MALT, so a general consideration regarding the section of trail that parallels the gorge is offered.

No major trail issues were noted in the area. This section of the trail is very scenic as it provides views of the creek and the gorge, as well as including an east-west section that cuts across some beautiful limy ledges. There are moist spots below some sections of ledge, but the trail placement has avoided any of the more serious seeps. It could be beneficial to use the technique of “armoring” (lining low areas with large native rocks) where the trail crosses wet areas.

Limestone Bluff Cedar-Pine Forest can be quite flammable, and may even in some instances be an ecosystem that burns relatively frequently. Therefore, the threat of

human-caused fires must be recognized. I am unaware of the fire history of the site, but would not be surprised if it has burned within the last several hundred years. A naturally ignited fire would fall within the realm of natural forest dynamics, whereas one ignited by careless hikers would not. It may be advantageous to post fire-warning signs along this portion of the trail, if there is evidence of ad-hoc campfire pits.

#### Management Area 4: Fields adjacent to Morgan Horse Farm Road

The long-range management of the agricultural portions of the parcel has been a topic of discussion for several years now. The several fields bring different management concerns.

Of greatest concern is the irregularly shaped middle pasture. This area has been used as cattle pasture, but cows pastured there have also been allowed to forage in the woods of Management Area 1.

The southern rectangular field has been used as sheep pasture and the northernmost fields are hay meadow.

The Trail Around Middlebury follows the fence that separates the southern rectangular pasture from the larger middle pasture. The trail also goes through the northern portion of Area 4, along the old woods road.

#### Management Recommendations

##### Agricultural Management

As has been the custom in recent times, cattle-pasturing in the middle field has been apparently strongly related to woodland grazing, for reasons of shelter and water supply. Livestock access, however, to the woods in Area 1 poses a threat to a state-threatened plant species and, to a lesser extent, to the integrity of the Transition Hardwoods Limestone Forest. Therefore, pasturing in the field must not be accompanied by access to the woods.

Most of the field acreage is on clay soil, and the fields are relatively small. If agriculture is abandoned at the site, these fields could present an opportunity for active clayplain forest restoration, or for monitoring clayplain forest succession. Being mostly surrounded by clayplain and limestone forest, there is ample seed source for a diversity of trees native to the ecosystem. The invasion of honeysuckle and buckthorn into abandoned fields, however, necessitates a thought out forest restoration plan; this does not suggest that the threat of invasive exotic shrubs should preclude the commencement of natural succession in the fields. There are, however, various alternative strategies that could be employed and should be considered if old-field succession is allowed to proceed. Experiences at Dead Creek Wildlife Management Area may inform the discussion of old-field succession and forest restoration. Selective mowing, direct seed and seedling plantings, and exotics control are the principal issues that would need to be considered.

The agricultural management of the pastures and meadows needs to be considered by a committee. Advantages and disadvantages of continuing the current regime should be evaluated and the long-range goals should be determined.

#### Management Area 5: Inner meadow

The inner meadow is fully surrounded by forest and is accessed by a short tractor road that connects it with the south end of Area 4. The natural community of the site is Valley Clayplain Forest, as determined by soils and physiography.

A spur of the Trail Around Middlebury is routed through the meadow, from the tractor road to the north end of Area 5.

## Management Recommendations

### Agricultural Management

The inner meadow is currently mown once a year, after which time cattle have been allowed access. As it would be costly to contain the cattle in the inner meadow to prevent them from wandering into the adjacent woods, it is recommended that cattle, or any livestock, be prohibited access to the inner meadow.

The mowing regime and the future management of the inner meadow needs to be considered by a committee. Advantages and disadvantages of continuing the current regime should be evaluated and the long-range goals for the meadow should be determined.

Presently the inner meadow provides a minimal amount of probably low-quality hay and a verdant, grassy opening from which to view the surrounding woods and mountains. It also functions as a portion of the desirable wildlife habitat for numerous species of birds, mammals and insects. If allowed to succeed to forest, the meadow would provide old-field habitat useful to numerous wildlife species before succeeding to a closed-canopy clayplain forest. Another option is to maintain the meadow as "old-field" by mowing infrequently.

Since it is a meadow surrounded by relatively high-quality forest ecosystems, and since the tractor access to the meadow is through a very sensitive part of the preserve, the wisdom of maintaining both the meadow and the road to it must be fully considered.

## Literature Cited

Andrews, J. 1990. Areas of biological significance, Weybridge, Vermont. Town of Weybridge, Vermont.

Thompson, E. H. and E. R. Sorenson. 2000. Wetland, Woodland, Wildland: A guide to the natural communities of Vermont. Vermont Department of Fish and Wildlife, and The Nature Conservancy. University Press of New England, Hanover, N.H.

### **Recreation Management Conclusions**

Based on the recommendations of Marc Lapin and field observations, the following decisions were made concerning the management of trails in the Weybridge parcel. The current cross trail is split by the inner meadow into a southern and northern portion. The southern portion is a wide woods road providing tractor access to the meadow and would be difficult to close off. The northern portion is a narrow footpath running parallel (slightly to the east) to the woods road. Neither portion is currently signed except for a sign on each side of the meadow directing hikers. The intention is that neither the woods road nor the footpath will be actively maintained by the Land Trust, but hikers may continue to use them if they wish. Natural growth will be allowed to narrow the woods roads, including the North Gorge Trail. Erosion due to bikes on the TAM (southern trail) will be monitored. The North Gorge Trail is closed to bikes, and closing the TAM in the Weybridge parcel to bikes has not yet been deemed necessary, but remains an option if erosion worsens.

### **Agricultural Management Conclusions**

In accordance with plan recommendations, cattle should be fenced off from woodland areas, especially near sensitive ecological areas. Should agriculture be abandoned in the pasture, the fields could present an opportunity for clayplain forest to be reestablished by natural succession. Principal issues to consider in this scenario are selective mowing, direct seeding and seedling plantings, and invasive species control. As of 2009, the Middlebury Area Land Trust anticipates no change in the current agricultural use.

## Acreage Chart

1. Total acres in parcel according to town records	300
2. Actual number of acres to be excluded	0
3. Acres to be enrolled in program	300
4. Acres to be enrolled as measured on orthophotos	310
5. Factor to prorate map acres	0.967

<b>Management Area</b>	<b>Natural Community</b>	<b>Map Acres</b>	<b>x Factor</b>	<b>= Prorated Acres</b>
1	Transition Hardwoods Limestone Forest	72	0.967	69.670
2	Valley Clayplain Forest	141	0.967	136.393
3	Transition Hardwoods Limestone Forest & Limestone Bluff Cedar-Pine Forest	18	0.967	17.452
4	Valley Clayplain Forest and Transition Hardwoods Limestone Forest currently in Pasture and Meadow cover	54	0.967	52.264
5	Valley Clayplain Forest currently in Meadow cover	25	0.967	24.221
<b>Total</b>		309		300



## Action Summary

<b>Area</b>	<b>Management Activities</b>	<b>Time Period</b>	<b>Action Taken</b>
Area 1	Protect state-threatened goldenseal population and continue annual monitoring program in consultation with the state botanist, Bob Popp. Protection is closely related to agricultural management of Areas 4 & 5.	Ongoing	
	Allow commencement of natural revegetation of margins of woods road that connects Areas 4 & 5, with the goal of creating a narrower travel corridor.	Ongoing	
	Monitor composition of road-margin revegetation to determine an appropriate buckthorn and honeysuckle management strategy.	2002 and henceforth	
	Monitor trail conditions on Trail Around Middlebury.	Ongoing	
Area 2a	Monitor trail conditions on Trail Around Middlebury, with especial regard for wet spots and the incised stream area.	Ongoing	
Area 2b	Close or redesign spur of Trail Around Middlebury that connects the east-west woods road with the north end of the inner meadow (Area 5). Consider the desirability of and need for such a connecting trail.	2001	
	Assess buckthorn population, especially in area north of the inner meadow. Consider various management alternatives regarding buckthorn control.	2001-2003	
Area 2c	No action. In the event of medium- to large-scale disturbance, monitor exotic invasive shrub abundance and develop an appropriate management strategy.		
Area 3	Monitor trail conditions on Trail Around Middlebury	Ongoing	
	Assess trail use types to consider necessity of installing fire-caution signs.	2001-2003	
Area 4	Continue conversations with agricultural lessee to determine how fields may be used in the near future.	2001	
	Develop long-range plans for management of agricultural fields.	2001-2002	
Area 5	Continue conversations with agricultural lessee to determine how meadow may be used in the near future.	2001	
	Develop long-range plans for management of inner meadow.	2001-2002	

## VERMONT RARE AND ENDANGERED PLANTS

Nongame and Natural Heritage Program  
Vermont Fish and Wildlife Department  
103 South Main Street  
Waterbury, VT 05676  
(802) 244-7340

### NORTHERN STICKSEED

*Hackelia americana*

Borage Family



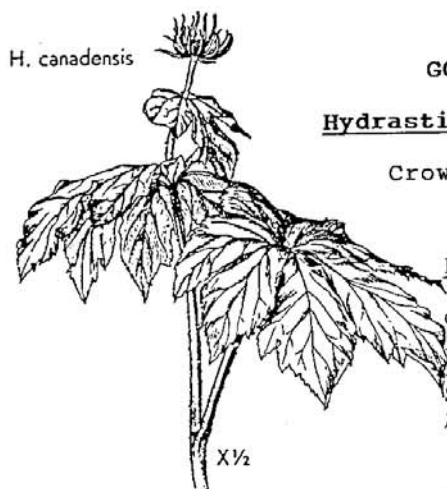
Description: A plant with tiny whitish flowers in a one-sided arrangement on the flower stalk. Lance-shaped leaves are arranged alternately on the stem; basal leaves are larger and usually shriveled by flowering time. The fruit is a prickly bur; prickles being uneven in size or even absent compared with the similar Hackelia virginiana which has uniform prickles.

Habitat: Calcareous, rocky or gravelly woods, bluffs, talus slopes, and cliffs.

Range and Vermont Status: Range extends from Quebec across the northern part of the United States to Minnesota and west to Washington. This species is listed as a threatened species in Vermont. It is currently known to occur exclusively in the Champlain Lowlands at 12 known locations.

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## GOLDENSEAL

Hydrastis canadensis L.

Crowfoot Family

Description: Perennial 8-15 in. high with a single terminal flower 1/2 in. wide composed of numerous greenish-white stamens. The 3 leaves are deeply lobed, the single basal leaf being larger than the two stem leaves. Stems arise from a thick, knotted yellow root. April-May.

Habitat: Rich hardwood forests.

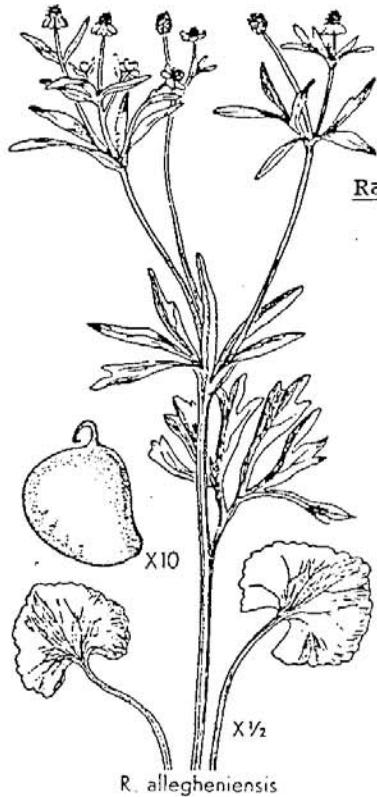
Chester, R.S. The New Edition and Some  
Illustrated Flora of the Northeastern U.S.  
and Adjacent Canada. New York Botanical Garden,  
1952.

Range and Vermont Status: Vermont to Minnesota and Nebraska; south to Georgia, Alabama and Arkansas. Largely exterminated due to over-collection. Endangered in Vermont and known to occur at two sites.



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## ALLEGHENY CROWFOOT

Ranunculus allegheniensis Britt.

Crowfoot Family

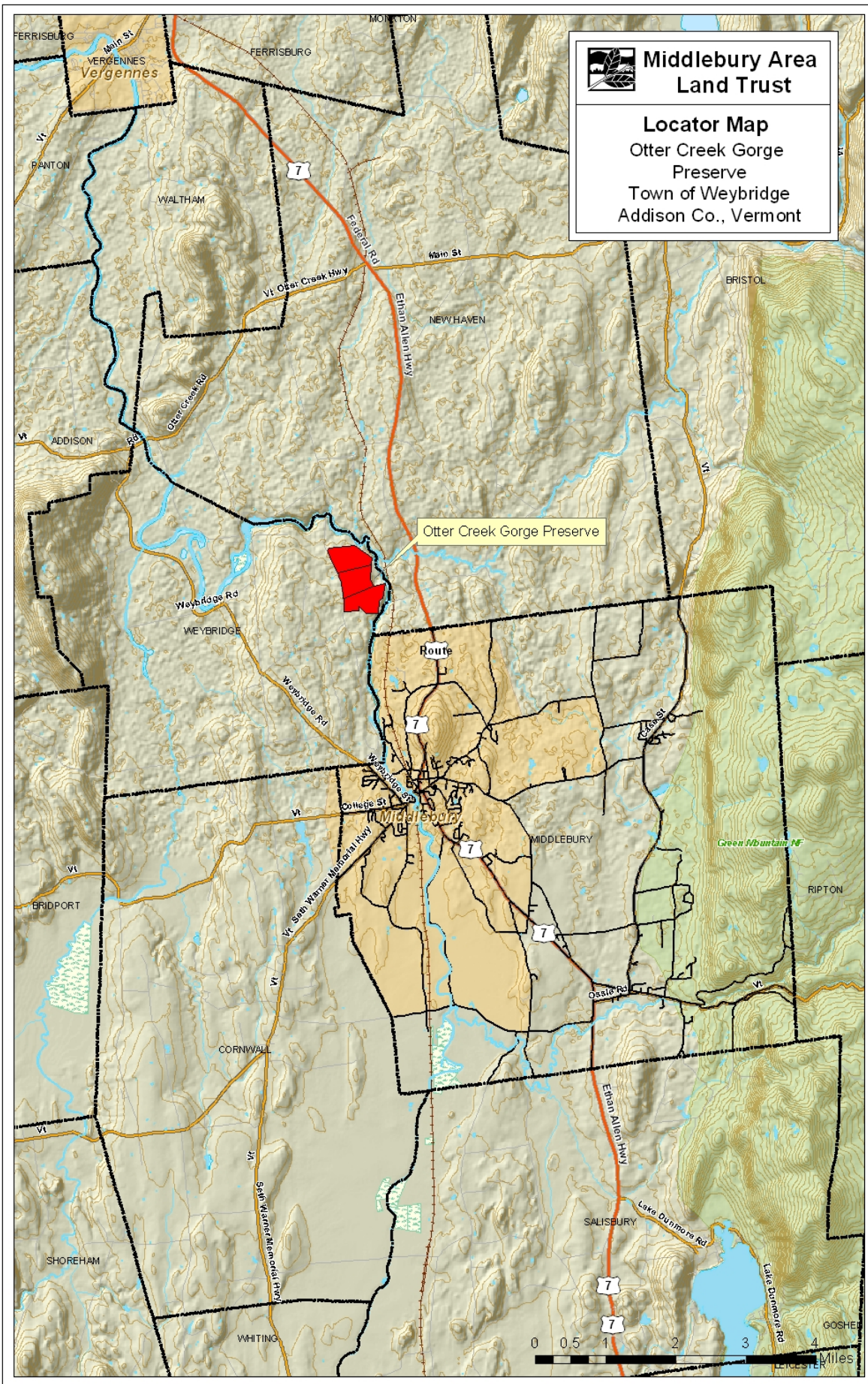
Description: Many small, pale yellow flowers with reflexed sepals longer than the flower rays. Firm, erect stems 6-24 in. high. Some basal leaves are rounded, toothed and heart-shaped at the base. Seeds have a pronounced, curved hook. April-July.

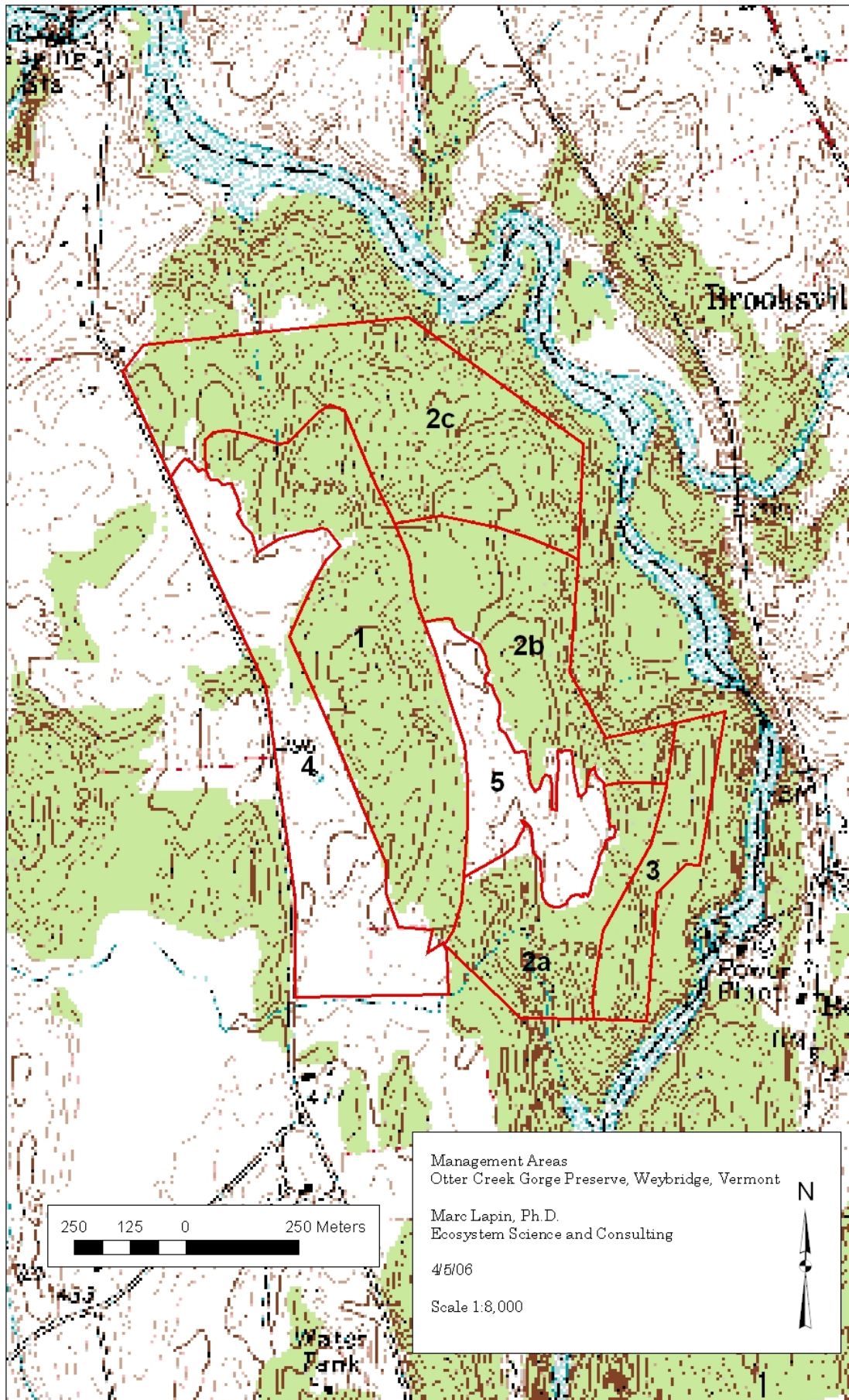
Habitat: Dry, calcareous woods and rocky slopes.

Clemens, R.A. The New Britton and Brown  
Illustrated Flora of the Northeastern U.S.  
and Adjacent Canada. New York Botanical Garden,  
1979.

Range and Vermont Status: Eastern Massachusetts and Vermont to southeastern Ohio; south to South Carolina and Tennessee uplands. Proposed endangered in Vermont, known to occur at fewer than ten current sites.







## New Haven Parcel

### Overview

The New Haven Parcel of the Otter Creek Gorge landholdings is a 38.7-acre tract in the southwest corner of New Haven. The parcel is adjacent to Otter Creek to the west and to the Beldens Falls damsite to the north. Bedrock at the site is Beldens Formation limestone, dolomite and marble; the marble was historically a valuable dimension stone, as evidenced by the quarry at Beldens Falls. A portion of the historic quarry extends south along the railroad tracks onto either the MALT parcel or the railroad right-of-way.

Natural communities at the site are characteristic of the southern Champlain Valley and are largely controlled by a relatively warm climate, calcareous bedrock, and post-glacial lacustrine clay and silt deposits. The parcel contains natural communities strongly influenced by shallow soils on ledgy terrain, as well as those influenced by clay soils, and those influenced by recent sand and silt alluvium along Otter Creek. The shallow-soil, calcareous-bedrock natural community, Transition Hardwood Limestone Forest, is an exemplary gem of a Champlain Valley forest remnant.

Former land use is typical of the region. Shallow and steeply sloping areas were managed woodlands, utilized for both timber resources and woodland pasture, whereas deeper soil and more level areas were cleared for crops and improved pasture.

The Trail Around Middlebury crosses this parcel, joining Wright Park on the south with the bridge at Beldens Falls on the north. Over the past ten years since the trail was developed, it has primarily been used as a footpath, although horseback riders and mountain bikers occasionally use the easterly trail. A small portion of the northeast section of trail may have been used by all-terrain-vehicles in the past without the permission of the landowners.

### Management Area Descriptions and Management Recommendations

#### Management Area 1: Transition Hardwoods Limestone Forest

Area 1 is a very high quality example of Transition Hardwoods Limestone Forest. The natural community is of statewide significance due to its reasonably natural forest structure and characteristic floristic composition. The significant transition hardwoods limestone forest natural community extends to the north and south on adjacent parcels and in total may cover as much as 30 acres. The natural community type is ranked S3 by the Vermont Nongame and Natural Heritage Program, an indication that it is an uncommon type.

This example features a classic component of warm, rich forest herbs and trees on a landform that typifies the thrust-fault geology of the Champlain Valley. The upper/eastern portion is relatively level to moderately sloping and contains a diverse canopy of hardwoods and a very lush and species-rich herb flora; limestone pavement outcrops are intermixed among areas of deeper soil. Canopy trees include sugar maple (*Acer saccharum*), hemlock (*Tsuga canadensis*), red oak (*Quercus rubra*), basswood (*Tilia americana*), shagbark and bitternut hickories (*Carya ovata*, *C. cordiformis*, respectively), sweet and paper birches (*Betula lenta*, *B. papyrifera*, respectively), and

butternut (*Juglans cinerea*). Hophornbeam (*Ostrya virginiana*) is an abundant small tree. The general diameter range of overstory trees is 10-20 inches diameter at breast height (dbh). Characteristic and dominant herbs in the natural community are black-seeded ricegrass (*Oryzopsis racemosa*), large-leaved and heart-leaved asters (*Aster macrophyllus*, *A. cordifolius*, respectively), bottlebrush grass (*Elymus hystrix*), blue-stemmed goldenrod (*Solidago caesia*), herb-robert (*Geranium robertianum*), blue cohosh (*Caulophyllum thalictroides*), sharp-leaved hepatica (*Hepatica acutiloba*), bulblet-bladder fern (*Cystopteris bulbifera*), clearweed (*Pilea pumila*), marginal and intermediate wood-ferns (*Dryopteris marginalis*, *D. intermedia*, respectively), maidenhair fern (*Adiantum pedatum*), white snakeroot (*Eupatorium rugosum*), white avens (*Geum canadense*), jack-in-the-pulpit (*Arisaema triphyllum*), and plaintain-like, broad-leaved and Pennsylvania sedges (*Carex plantaginea*, *C. platyphylla*, *C. pensylvanica*). Over 50 herb and fern species occur in the natural community. Limestone ledges and boulders are mossy and relatively moist, for they are deeply shaded by the tree canopy and are subject to a microclimate somewhat modified by the moister, shadier conditions of the gorge. As one often finds on the calcareous ledges and boulders of the Champlain Valley, walking fern (*Asplenium rhizophyllum*) and maidenhair-spleenwort (*Asplenium trichomanes*) abound.

The southwestern portion of Area 1 slopes steeply down to Otter Creek; hemlock, beech (*Fagus grandifolia*) and yellow birch (*Betula alleghaniensis*) predominate on the steeper slopes. The former two species, by way of deep shade and acidic leaf/needle litter, exert much control over the shrub and herb flora; hence, the herb richness apparent above the steeper terrain gives way to a more depauperate (less diverse) flora on the steep slopes. Near the southwest corner of the property, a lovely 25-30 foot limy ledge drops down to the creek-side terrace of Area 3. The northwest part of Area 1 is less steeply sloping and resembles more the eastern section.

Although the area has been utilized for log extraction and pasture, the age of the forest is indicated by a hemlock tree core of over 155 annual rings. Certainly the faster-growing hardwoods were preferably harvested and the age of the existing hardwood trees is estimated to average 80-100 years. No other trees were cored, however, and this estimate is based only on general observation of tree stature.

The common invasive exotic shrubs, European buckthorn (*Rhamnus cathartica*) and exotic honeysuckles (*Lonicera tartarica*, *L. morrowii*), are present in Area 1, but they are widely scattered and are of generally small size. The lack of a substantial exotic shrub flora is another reason for the statewide significance of the natural community.

#### Management Recommendations

Area 1 is a locally and regionally important natural area (B-ranked (good quality), S3 (uncommon) natural community) and should be managed for the long-term health of the ecosystem. Natural forest dynamics should be allowed to occur and tree-cutting of any sort is discouraged. Specific actions that could diminish the integrity of the area include creation of large canopy openings that permit establishment and recruitment of buckthorn and/or honeysuckle, removal of large woody debris and other forest “legacies,” and severe erosion due to improper trail construction and inappropriate trail uses (with reference to the type of construction of various trail sections). Of course, natural dynamics may cause large canopy openings from disturbance events, and the



establishment of invasive exotics may ensue. The protected landscape position of the gorge terrain suggests, however, that small-scale disturbance, rather than large-scale, catastrophic disturbance, is the natural regime. The age of the hemlocks and the existence of numerous partially rotted trees pocked with pileated woodpecker holes supports this observation (i.e. the old trees remained standing through the 1938 and 1950 hurricanes).

Trails in Area 1, especially those that traverse the steep western portion and those that may cross pavement outcrops, have the potential to degrade soil and flora of the natural community. To best manage for long-term ecological integrity and conservation of the significant natural community, trail placement and trail construction should minimize such potential detrimental impacts. Detailed on-site examination and planning are necessary prior to developing more specific trail recommendations.

The invasive species (buckthorn and honeysuckle) should be monitored, and if they begin to become more established due to openings in the forest canopy or other disturbance, small-scale removal efforts are recommended for these species. This work should not disrupt other elements of the ecosystem. Mechanical control methods should be utilized prior to resorting to herbicides. Herbicides should be used only if the invasive exotics become more widespread in Area 1 AND are not responding to mechanical control. If herbicides are utilized, the chemical(s) used and the application procedures should follow proven methods established and tested for buckthorn and honeysuckle by a conservation organization such as The Nature Conservancy.

#### Management Area 2: Otter Creek Terrace and Floodplain Natural Communities

Area 2 consists of riverine landforms adjacent to Otter Creek; the soils are creek-deposited sands and silts. The area is bounded on the east by slope breaks at the base of large ledges (at the southern end) or moderately sloping terrain (at the northern end). Upland forest dominated by hemlock, yellow birch, beech, and white ash covers most of the management area. Smaller percentages of the land are accounted for by very narrow strips of silver maple-ostrich fern floodplain forest, emergent wetlands on exposed creek silts and sands, and small wetland depressions within the upland forest. Mudbar wetlands are dominated by water-pepper (*Polygonum hydropiper*) and other smartweed species (*Polygonum lapathifolium*, *P. pennsylvanicum*), giant bur-reed (*Sparganium eurycarpum*), rice-cutgrass (*Leersia oryzoides*), common water-purslane (*Ludwigia palustris*) and nodding beggar-ticks (*Bidens cernua*). Purple loosestrife (*Lythrum salicaria*) is rare at the site.

#### Management Recommendations

Area 2 contains natural communities that have some areas sensitive to soil disturbances such as compaction and erosion. Although little of the forested area is on an active floodplain, the forest soils are post-glacial sandy alluvium from Otter Creek. It is primarily the numerous wet spots, both at the base of limy ledges and in the forest nearer to Otter Creek, that are sensitive to soil disturbance. Trails should avoid these areas so as to disturb neither their more fragile soils, nor potentially breeding amphibians and invertebrates. As with Area 1, natural dynamics should be permitted to prevail. To an extent that has not been investigated, the Beldens Falls dam has disrupted the natural hydrologic fluctuations; the forest on this small terrace, however, does not indicate that prolonged artificial flooding is a problem.

It is recommended that only a single trail, with one or two spur trails to creek-side locations, be placed within Area 2. Other trails, if they exist, should be closed and allowed to regenerate naturally.

### Management Area 3: Valley Clayplain Forest, currently Conifer Plantation

Area 3 was formerly cleared agricultural land and has been replanted to white pine (*Pinus strobus*) and Norway spruce (*Picea abies*). The natural community of the area is, however, Valley Clayplain Forest as indicated both by soils and by native flora that has re-established on the site. Although the Addison County Soil Survey has the land mapped as a combination of Farmington, Covington, Livingston and Vergennes soils series, brief field observation indicates that much of this area possesses soils of the Vergennes Series, Moderately Shallow Variant (VrB), a clay soil that is shallow to bedrock. The historic land-use closely follows the soil/natural community boundary; it is very characteristic in the Champlain Valley to find that Farmington soils areas (Transition Hardwoods Limestone Forest) were left forested and used principally as woodlot and woodland pasture, whereas the clay soil areas were cleared for crops and open pasture.

Norway spruce and white pine are intermixed in the plantation, although there are some areas that have only one species. It is apparent that the floristic composition is extremely sparse in both species numbers and plant coverage beneath areas where Norway spruce predominates. Under pines and mixed planting with a high percentage of white pine, there is substantial establishment of native clayplain forest species such as baneberry (*Actaea* sp.), white-grass (*Leersia virginica*), lady fern (*Athyrium filix-femina*), bottlebrush grass, bedstraw (*Galium triflorum*), barren-strawberry (*Waldsteinia fragarioides*), and bur-reed and loose sedges (*Carex sparganioides*, *C. laxiculmis*, respectively). Loose sedge is uncommon in the state and is mostly found on clay soils. Woody regeneration beneath the pines includes native hardwoods along with a substantial amount of European buckthorn.

### Management Recommendations

While it is tempting to suggest that the plantation overstory be removed and the area be managed for a future clayplain forest natural community, the abundance of European buckthorn and exotic honeysuckles suggests that there would be a long period (50-100 years or more?) of dominance by the exotics. A more prudent approach is, therefore, suggested. One may consider two different management strategies for Area 3. One is to manage the plantation for production of spruce and pine lumber; the other is to leave the plantings to natural processes and allow the forest to develop on its own. Although much of the pine is multi-stemmed due to weevil damage, there are numerous trees that would yield one to two sawlogs. The spruce is generally smaller diameter (maximum ~10 in. dbh) than the pine (maximum ~12-14 in. dbh) and not yet of sawlog size. If one were to harvest, thin, or silviculturally treat in any way the plantation, opening size should be carefully planned. Openings larger than two trees may be prone to dense regeneration of buckthorn. Thus, log harvest in the plantation should be by a single-tree selection method and logging equipment should be very small. The result of all these caveats may be that it is not economical to harvest in such a way. The advantages of single-tree harvest in the plantation, however, are that the effort that went into planting the trees would actually yield the initial desired result—timber—and that single- or two-tree-harvesting would

hasten the natural succession of the land back to deciduous-dominated, or mixed clayplain forest. Whether this area is managed for lumber or left to regenerate naturally, careful removal of buckthorn may speed the establishment of a healthy clayplain forest community in this area. Invasive exotics control methods should be the same as those recommended for Management Area 1.

### Public Use Recommendations for Management Areas 1, 2, and 3

All three management areas include portions of the Trail Around Middlebury. Historically, the trails on this property have been used primarily by non-motorized vehicles. Due to the fragile nature of the forest communities in this parcel (e.g., shallow, moist soils, very steep slopes), it is recommended that the trails be closed to all motorized vehicles. Mountain bikes have access to the easternmost north-south trail that runs through the property. It is recommended that this trail remain open to mountain bikes as long as erosion problems do not develop. Annual monitoring for erosion and off-trail use is strongly recommended.

Other trails on the parcel should remain closed to mountain bikes. Water bars should be constructed to reduce the risk of erosion on steeper sections of the trails. Further onsite-examination and ongoing surveillance should be done to determine other trail management requirements and to protect the natural communities.

For further information on trail and recreation management in the New Haven parcel, consult the Wright Park Management Plan, as all trails continue into the Town of Middlebury's Wright Park.

## Acreage Chart

1. Total acres in parcel according to town records	38.7
2. Actual number of acres to be excluded	0
3. Acres to be enrolled in program	38.7
4. Acres to be enrolled as measured on orthophotos	38.0
5. Factor to prorate map acres	1.02

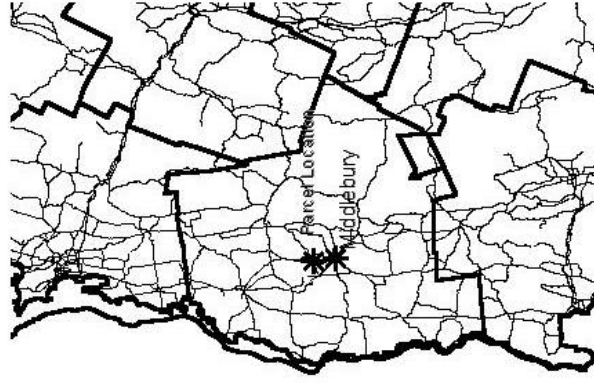
<b>Management Area</b>	<b>Natural Community</b>	<b>Map Acres</b>	<b>x Factor</b>	<b>= Prorated Acres</b>
1	Transition Hardwood Limestone Forest	15	1.02	15.3
2	Otter Creek Terrace and Floodplain Natural Communities	5	1.02	5.1
3	Valley Clayplain Forest	18	1.02	18.3
<b>Total</b>		38		38.7

## Action Summary

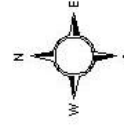
Action	Date	Action Taken
<i>Forest:</i>		
In all areas of forest except plantation in Area 3, allow natural forest dynamics; do not remove large woody debris; do not cut trees except where may be necessary along the trail corridor for safety and accessibility of trail users.	Ongoing	
Determine whether to allow natural forest regeneration in the plantation in Area 3 or to harvest trees from the plantation overstory using the single-tree-selection method. If trees will be harvested, plan the method and timing of harvest.	Summer 2001	No trees harvested
Monitor buckthorn, honeysuckle, and other invasive species.	Ongoing	
If invasive species become more prevalent, remove these species with small-scale mechanical control methods in accordance with the management plan.	If needed	
<i>Trails:</i>		
Examine trail layout, especially on steep sections in the western portion and those that cross pavement outcrops to assess whether trails may damage the soils and natural communities. Devise strategies to eliminate or greatly reduce the potential of damage. Determine future trail management requirements.	Summer 2001	
Implement strategies to protect soils and natural communities near trails (as determined above).	Ongoing	
Close trails in Area 2 with the exception of a single trail with one or two spur trails to creek-side locations. Allow closed trails to regenerate naturally.	Spring 2001	
Update/maintain signs indicating all trails are closed to motorized vehicles and all trails except the easternmost north-south trail are closed to mountain bikes.	Ongoing	
Annually monitor the trails for erosion and off-trail use.	Ongoing	
Construct water bars on steeper sections of the trails.	Ongoing	

**Otter Creek Gorge Preserve**  
**Owner: Middlebury Area Land Trust**  
**Town: New Haven, Vermont**

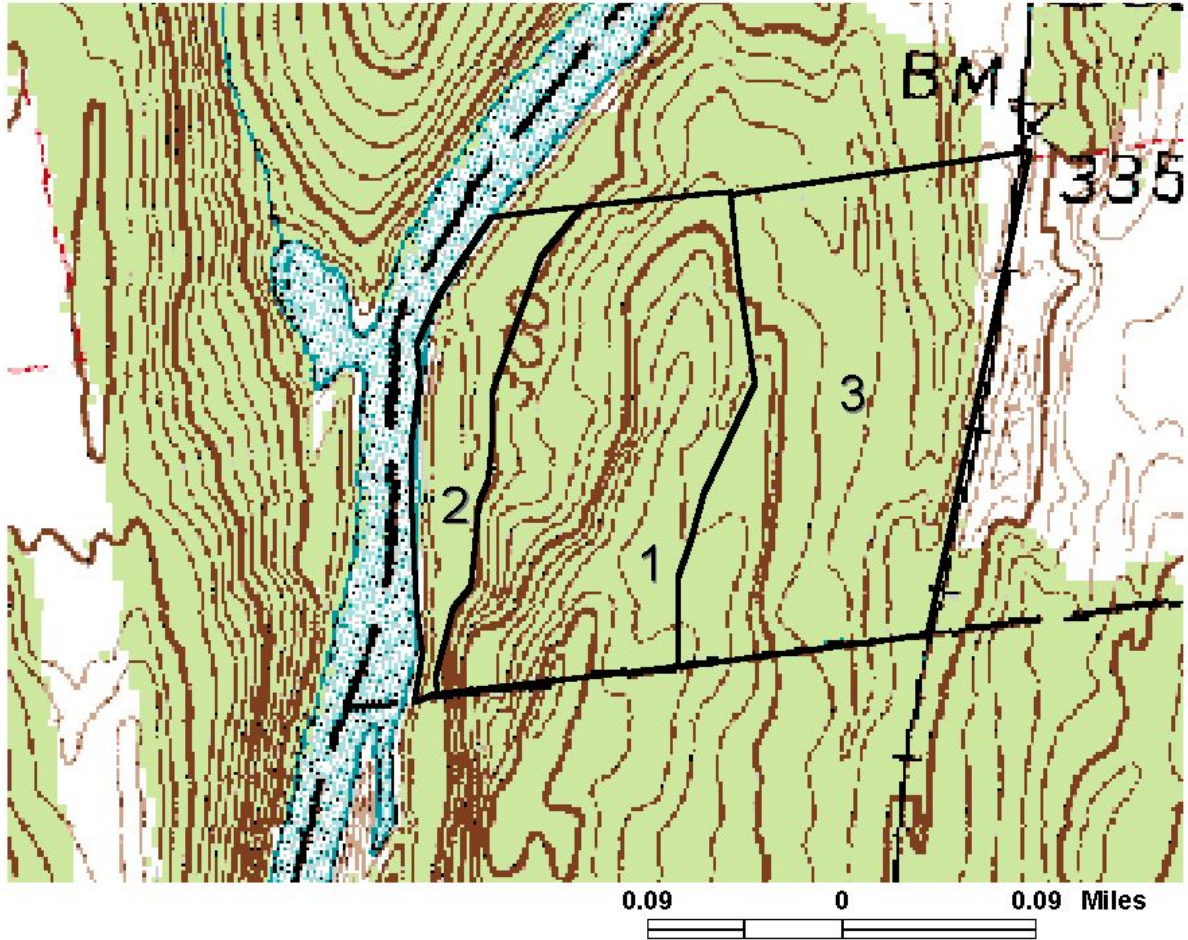
Base map: Vermont Digital Orthophoto Quadrangles  
#096168, 096172  
Scale 1:5,000  
Prepared by: Marc Lapin, 30 October 2000



Location Map of  
Addison County, Vermont



**Otter Creek Gorge, New Haven Parcel  
Management Area Map  
owner: Middlebury Area Land Trust  
size: 38.7 acres**



Location: Southwest corner of New Haven,  
adjacent to Otter Creek and Middlebury town-line

Area 1--Transition Hardwood Limestone Forest

Area 2--Otter Creek Terrace and Floodplain

Area 3--White Pine-Norway Spruce Plantation

