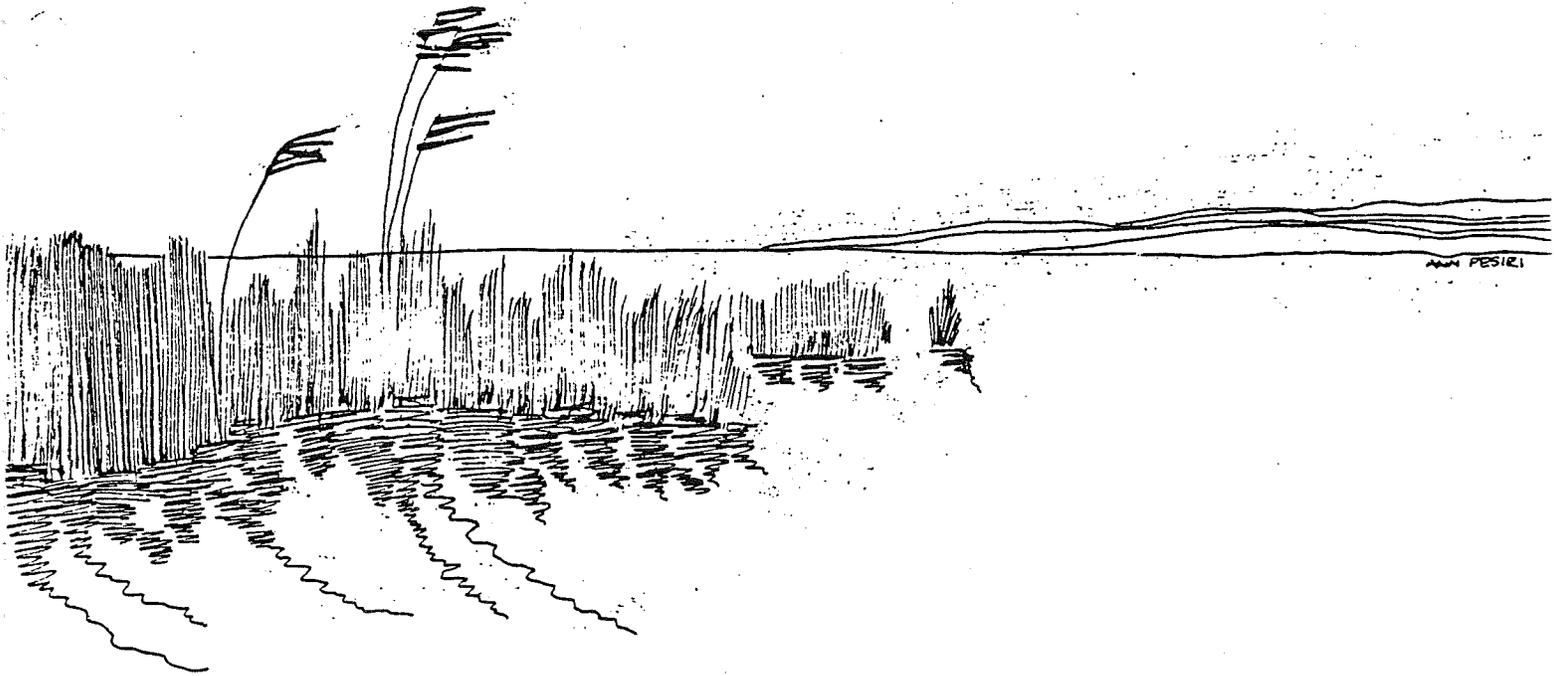


# Vermont Fragile Areas Registry



State of Vermont

Agency of Environmental Conservation





# State of Vermont

## AGENCY OF ENVIRONMENTAL CONSERVATION

Montpelier, Vermont 05602

OFFICE OF THE SECRETARY

Department of Fish and Game  
Department of Forests, Parks, and Recreation  
Department of Water Resources and Environmental Engineering  
Division of Protection  
Natural Resources Conservation Council

Fragile Areas are irreplaceable components of Vermont's natural heritage. They are valuable for many reasons, such as maintaining a diversity of natural communities, providing refuges for rare and endangered plants and animals, and giving us standards by which to judge the health of our environment. In other words, they are of great biological, educational, and social value.

The Fragile Areas Registry has been promulgated by Vermont law (10 V.S.A. Chapter 158, 1977) as a means of protecting significant natural areas through documentation and education. We hope that such non-regulatory approaches will encourage people -- of their own free will -- to protect and manage these critical areas.

The Agency of Environmental Conservation, as the administering agent of the Register, is committed to ensuring perpetuation of the State's Fragile Areas. It will manage appropriately areas under its jurisdiction and, upon request, assist landowners in protecting their own sites.

Provisions of the law having been followed, the areas herein described are designated as Vermont Fragile Areas. The general public may have access to this document at any office of the Agency of Environmental Conservation, regional planning offices, and the Vermont State Planning Office.

Date January 1, 1982

Signed Brendan J. Whittaker  
Brendan J. Whittaker  
Secretary



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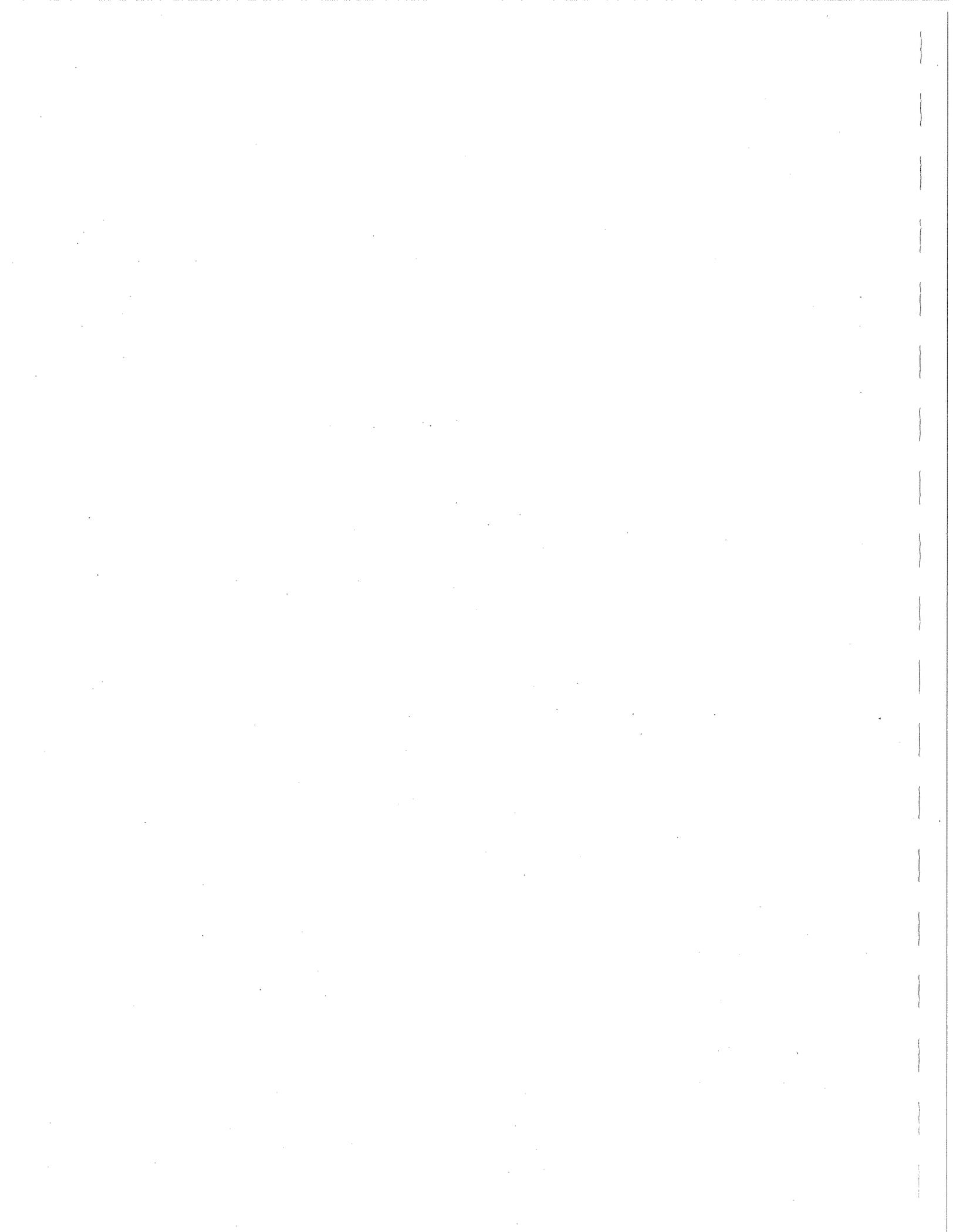
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### INTRODUCTION

10 VSA Chapter 158 authorizes the Secretary of the Vermont Agency of Environmental Conservation to create a Fragile Areas Registry. In the word of the law, "'Fragile Area' means an area of land or water which has unusual or significant flora, fauna, geological or similar features of scientific, ecological or educational interest".

Expanding, "the Secretary shall consider for designation...only a site which:

- (1) is of significant statewide scientific, ecological or educational value, or
- (2) is exemplary for the purposes of education or research in the natural sciences; or
- (3) has rare, remnant or other unusual plants or animals, or contains endangered species as determined by the Secretary under Chapter 79 of Title 13; or
- (4) contains a necessary wildlife habitat as that term is defined in Section 6001 (12) of Title 10."

These specifications require two important considerations: one, that the process of registering fragile areas be a selection of those areas that are truly "fragile" and two, that registration includes not only areas that are types of landscapes (e.g., alpine areas, marshes, etc.) but also habitats for certain critical species of plants and animals. Further, words such as "significant", "exemplary" and "unusual" mean judgements must be made as to the inherent value of an area to the state's natural history, in comparison to other similar areas.

Several inventories and lists of state natural areas have been made, and their information will be invaluable in the creation of the Register. However, the Register cannot adopt the contents of these lists wholesale; all areas must first be subjected to the processes which will classify them and

assess their importance to Vermont's total natural heritage. Only having been so processed can they acquire Fragile Area status. By way of illustration: Molly Bog, Peacham Bog and Franklin Bog are on most lists of important state natural areas, as bogs. But they have not arrived on the lists as the result of a systematic and standard method of selection which defines their actual character. Rather, they have been selected largely on their traditional reputations as fine bogs. That is not in and of itself bad but leaves many questions unanswered. In what precise ways are these areas indeed fragile? Do they have comparable fragileness or does one have some special merit beyond being a "bog" -- such as being the nesting site for an endangered species of bird?

The Fragile Areas Registry proposed here must start from a new base and incorporate existing information and data into a new structure that will categorize Vermont's natural diversity. And for it to reflect that diversity and be complete, standardized and operational, it should contain the following:

- (1) CLASSIFICATION SYSTEM. This is the creation of categories of fragile areas, both the physical and biological. It is the first step in processing an area for registration: all potential areas must meet the criteria defined in the system even before their relative value or significance is considered. Classification categories should

-- include all reasonable components of Vermont's natural and geologic history, since fragile areas may belong to or represent any facet of the natural world.

-- be organized into legitimate natural groupings, associations or entities that facilitate classification.

-- be constructed to accommodate revisions and adaptations without forcing the entire system to be revamped.

- (2) EVALUATION SYSTEM. This is the means by which candidate areas having satisfied the criteria of the classification system can be processed for inclusion on the Register. It is the way of sifting the best areas from those that are average or poor or simply do not merit recognition in the State Registry. Through the series of evaluation steps, an area will acquire "significance" and emerge as truly fragile or not.
- (3) DOCUMENTATION. Scientific evidence must substantiate the claim that an area is what it is purported to be. All areas must be researched by competent authorities and the findings recorded in writing. Areas already researched will be cited by references. Documentation will be on file at the Agency of Environmental Conservation, Montpelier, Vermont.
- (4) MANAGEMENT PLANS. Land and water-use plans are to be drawn up, directed toward protecting and enhancing those components which make an area fragile. Plans are to be mandatory for activities on state-owned lands, but only guidelines for private landowners and organizations. Included will be precautions against over-visitation of especially sensitive areas.

- (5) PROCEDURE FOR NOMINATION OF NEW AREAS. Our knowledge of the state's fragile areas is not complete. Also, natural environments are always changing. In order that new areas be processed or areas already registered be reevaluated, a system will be devised whereby individuals can propose candidates for registration.

A few additional points should be made here.

The Register is nonregulatory. It is intended to identify and document critical areas, provide information and assistance to people and organizations owning them, heighten public awareness of the areas so that they will not be destroyed inadvertently and aid in local or state planning. Great care must be taken lest areas suffer under pressures due to increased visibility, however. Registration of areas wholly or partly in private ownership, will, by itself, impose no restrictions or controls beyond those already in existence.

The Register is to be ongoing and open-ended. That is, it must be flexible enough to incorporate refinements in the classification and assessment schemes, process newly-discovered areas and react to changes in species/area status. An important part of the Register will be a mechanism for regular review, revision, addition or removal of areas from the Register. Essential work for the future will be outlined and recommended.

The Register should appeal to the general public (through whose will the law was enacted) and not just to scientists. Thus, it will be published as an easily read, visually appealing document that will encourage people to participate further, but under proper guidance and procedures. The \$5,000 appropriated for the Register will be used for its publication and distribution.

### CLASSIFICATION SYSTEM

The system described here employs both an areas and species approach to the organization of our knowledge of Vermont's fragile areas. That is, an area may be deemed fragile for any number of reasons, but reasons which fall into two major categories: landscapes (areas) (e.g., bogs, cliffs, virgin forests) or habitats for critical species of plants and animals (e.g., sites of colonial nesting birds, habitats for endangered plants). Of course, many areas qualify as both. This combined approach emphasizes the need to look at whole systems as well as critical components within systems: an entire community or a single member of a community may be fragile. The intent of the Register, whether in regard to a rare landscape, ecosystem or habitat for an endangered plant or animal, is the same -- to identify and protect areas in Vermont which are in some way vital to the state's natural systems.

Therefore, the classification system must cover as many contingencies as possible. In other words, it must account for situations in which "fragileness" may occur, even if to our present knowledge such situations do not exist in the state. It must also organize these categories into comparable units so that like-areas may be assessed by the same set of criteria; it is obvious that an area being considered as habitat for the Indiana Bat (an endangered species) should not be judged by the same criteria as an area being considered as a virgin hardwood forest.

The outline below is followed by an explanation of the categories and the rationale for using them. The categories are narrow enough to cover the array of the state's natural systems, but broad enough to avoid the endless

subdivisions which would make the classification process tedious, cumbersome, and virtually unmanageable for the scope of this work.

### PHYSICAL FEATURES

#### Bedrock Features

- A. Significant structures: based on either (with examples)
  - 1. Shape: thrust-faults, cliffs, notches.
  - 2. Content: unusual mineral deposits; examples of igneous, metamorphic or sedimentary actions.
- B. Caves.
- C. Fossil sites.

#### Surficial Features

- A. Features due to glaciation (with examples).
  - 1. Mountain glaciation.
    - a) erosional: cirques, hanging valleys.
    - b) depositional: terminal moraines, deltas.
  - 2. Continental glaciation.
    - a) erosional: overdeepened valleys, striae.
    - b) depositional: eskers, erratics, kame terraces.
- B. Significant post-glacial features: unusual soils, dunes.

#### Marine Features

- A. Erosional: sea caves, gravel beaches.
- B. Depositional: sand dunes (from ancient deltas).

#### Aquatic Features

- A. Exceptionally natural streams, rivers and waterfalls.
- B. Exceptionally natural ponds and lakes.

BIOLOGICAL FEATURES

Flora

- A. Significant natural communities/ecosystems.
  - 1. Alpine communities.
  - 2. Forest communities (including swamps).
    - a) Boreal forest region.
    - b) Northern forest region.
    - c) Central forest region.
    - d) Southern forest region.
  - 3. Marshes.
  - 4. Peatlands.
- B. Habitats for endangered and threatened plant species.
- C. Sites of individual specimens of unusual significance.

Fauna: mammals, birds, reptiles, amphibians, fish, invertebrates

- A. Habitats for endangered and threatened species.
- B. Critical habitats for other species.
  - a) Breeding grounds for restricted colonial species.
  - b) Restricted wintering grounds.
  - c) Concentrated feeding and resting areas for migratory birds.
  - d) Routes, spawning areas and nursery areas for anadromous and adfluvial fish.
  - e) Spawning and nursery areas for other restricted fish.

This outline is a synthesis of systems used in other states and in the federal government, modified for Vermont's specific and present capabilities. Some states have quite elaborate systems, stemming from substantial funding and long existence, and we may profit from their experiences. The following programs have been most consulted.

Maine Critical Areas Program

Natural Areas Criteria Committee of the New England  
Botanical Club, Inc.

Vermont Natural Areas Project

National Heritage Program

The Nature Conservancy

Illinois Nature Preserves Commission

New England Natural Resources Center

Society of American Foresters (Research Natural Areas)

Specific references to their reports are cited at the end of this section.

The entirety of Vermont's natural and geologic history falls into one of two major subdivisions: physical and biological components. For our purposes, the important constituents of the two subdivisions are shown in the outline and elaborated here.

#### PHYSICAL FEATURES

The physical landscape of Vermont includes bedrock features, surficial deposits due to glaciation, wind or other force, and aquatic features such as lakes, ponds and rivers. Out of the vast array of physical formations in the state, relatively few would be considered "fragile" in a structural sense, but many are excellent representatives of a geologic-type or are exemplary or important for educational purposes. Many could be adversely affected by development or other disturbance. The fragility of physical features, therefore, are judged differently from biological features in their subsequent evaluation.

Bedrock Features. Those significant features in Vermont which are due to igneous, metamorphic or sedimentary geological processes. Included in such a category are outcroppings, mineral deposits, caves and sites with fossils. Sites may be important for their shape or content, or both.

Surficial Features. Any significant depositional or erosional formation due to ice, wind or water action during the Pleistocene or Post-Pleistocene period. Examples:

- continental glaciation: erratics, kames, striae, moraines.
- valley glaciation: cirques, deltas, kame terraces, terminal moraines.
- significant post-glacial features: sand dunes, special soil-types.

Marine Features. Significant features due to forces of marine origin during the glacial or peri-glacial time, mostly associated with the Champlain Sea or Lake Hitchcock. Included are erosional (gravel beaches, sea caves) and depositional (ancient delta dunes) features.

Aquatic Features. In the physical context here, these are bodies of water with unusual natural (undisturbed) qualities and exhibiting exceptional features of their type (e.g., river with features illustrating youth, maturity and old age). Such hydrologically-influenced plant communities as peatlands, marshes and swamps are dealt with later in separate categories. Bodies of water do not merit registration solely on the basis of wild, scenic or remote attributes.

#### BIOLOGICAL FEATURES

Biological features may be initially identified as either plant (flora) or animal (fauna). By direction of the Vermont law, areas here are to be designated fragile which are (1) significant in their own right or (2) critical

habitat for "rare, remnant or other unusual plants or animals" or "necessary wildlife habitat". Therefore, whether for flora or fauna, we have three distinct kinds of areas to consider:

- Representatives of significant plant ecosystems/communities.
- Essential habitats for endangered or threatened species.
- Habitats for species (not endangered) that have special habitat requirements (usually seasonal) without which they, as species, would not survive.

#### Flora

Many systems have been devised to identify and classify natural plant communities from the world-wide down to the local (microenvironmental) view. In this classification, we have drawn on several sources for those communities which either exist in Vermont or have the possibility of existing here, though we may not have discovered them as yet.

The basic approach is to consider climax communities (formations and associations as defined by Clements (1916)) since they tend to be the most stable and persistent. However, some important components of the state's natural systems are not climax; several are long-term seral stages (pre-, post- and sub-climaxes) and yet merit preservation and recognition for a number of reasons. Also, it may be that certain critical species (either plant or animal) depend upon habitats in an early stage of succession and, therefore, man must actively manage the areas to maintain the species.

Thus, for purposes of classifications, no attempt has been made to exclude any community type, regardless of the degree of stability or promise of persistence. Determination of an area's appropriateness to registration is part of the evaluation process later.

A. Significant Natural Plant Communities/Ecosystems.

1. Alpine Communities. (Vogelmann, 1969) These are special communities above treeline or on treeless cliffs which have some arctic-like environmental conditions and plant species assemblages. In Vermont, they generally fall into two categories:

- a. Tundra. Sedge/heath meadows above treeline with such species as Bigelow's Sedge, Alpine Bilberry, Highland Rush and Three-toothed Cinquefoil prevalent.
- b. Cliff Flora. On exposed, wet, calcareous cliffs. Species differ from those in tundra: Purple Mountain-saxifrage, Yellow Mountain-saxifrage, Live-long Saxifrage, Butterwort and others are part of this flora.

2. Forest Communities.

- a. Boreal Forest Region. (Oosting, 1954; Society of American Foresters (SAF), 1975). Includes distinctive coniferous and mixed cover types of considerable geographic and elevational range. Forest may be montane (alpine boreal forest) above 2,500' or low elevation as seen in the Northeast Highlands of Vermont. Several cover types are recognized along various moisture gradients. For example:

Jack Pine - Paper Birch (dry)

Black Spruce - Balsam Fir (fresh to moist)

Black Spruce - Tamarack (wet)

The SAF publication lists 13 possible cover types.

- b. Northern Forest Region. (SAF, 1975) Includes coniferous, mixed and deciduous forest types. The Northern Hardwoods-Hemlock-White Pine association (Oosting, 1954; Westveld, 1956) is the predominant climax type, with all its various expressions -- Sugar Maple-Beech-Yellow Birch being the most common in the state. Other communities in this category are Swamps, such as Northern White Cedar Swamp, American Elm-Red Maple Swamp and others. The SAF lists 39 possible cover types.
- c. Central Forest Region. (SAF, 1975) Called Transition Forest by Westveld (1956). This includes the classic Oak-Hickory association (Oosting, 1954). Other types are:
- Pitch Pine-Oak (dry)
  - Eastern Red Cedar (dry)
  - Cottonwood (fresh to moist)
- d. Southern Forest Region. (SAF, 1975) The presence of any southern forest cover types in Vermont are as relict communities from the Climatic Optimum (VNRC 1976) and usually occur in wet bottomlands in the Champlain or Connecticut River Valleys. To date, the only cover type recognized has been the Black Gum (Tupelo).
3. Marshes. (Cowardin et al, 1979) Marshes are wetlands which are usually water-saturated most of the year and typically have zones of floating-leaved, submersed and emergent vegetation predominantly herbaceous. Either deep-water marshes (average water depth = 6" to 3') with such species as Buttonbush, Bulrush and Pickerelweed

or shallow water marshes (average depth = less than 6", often with periods of dryness in late summer) dominated by Cattails and Burreed. Many subtypes exist (see Jeglum et al, 1974; Cowardin et al, 1979).

4. Peatlands. Various definitions of peatlands have been proposed, some rather general, others more technical. In that we wish to include many peatland types in this category, we employ the more general definition offered by Ford-Robertson (1971) and Heinselman (1963): "A general term for any tract covered with a layer (at least 30 cm deep) of soil containing a high percentage of peat." Peat is an organic soil with characteristics described by the U. S. Soil Conservation Service (1975). Two basic peatland formations exist -- bogs and fens (see Jeglum et al, 1974; Worley and Sullivan, 1978). Many subdivisions and classes of bogs and fens exist, many of which occur in Vermont. Due to the complexity of peatland systems, however, individual areas must be considered on a site-by-site basis within the broad category of peatland.
- B. Any habitat that is considered essential for the protection of endangered or threatened species of plants will be registered as a Fragile Area. The authority for designating endangered or threatened species is the State Endangered and Threatened Species List.
- C. On occasions, a site will contain species which have significance other than for the above reasons. It may contain an important tree (e.g., formerly, the Vermont Seal Pine) or other unusual individuals of historical, social or natural significances. These will be considered on a site-by-site basis.

Fauna

"Fauna" encompasses all members of the animal kingdom, vertebrates and invertebrates alike. For purposes of this Register, the major classes of vertebrates are considered: mammals, birds, reptiles, amphibians and fish. Invertebrates are considered as a group. Included are species which are year-round, permanent residents of the state (nonmigratory) and those that are transitory migrants which spent only part of their lives here.

Areas deemed essential for the protection and enhancement of endangered and threatened species or for species with special habitat needs (without which they, as species, would be extirpated in Vermont) will be registered.

Categories for all Classes

1. Habitats for endangered and threatened species may be very small for organisms which have small home ranges or area-requirements or may be very large for those with large home ranges. Many encompass several different types of landscapes. Thus, it may not be feasible to designate habitats for the latter group as "fragile". However, determining such feasibility takes place with the evaluation process later.
2. Breeding grounds for colonial species. Some birds, mammals and other animals congregate in confined areas for breeding and raising young. The sites are usually chosen to satisfy specific needs of the species at a certain time in their life cycle. Though colonial species are not necessarily endangered or threatened, their existence in the state could be put in jeopardy quickly should these sites be disturbed or lost.
3. Designated wintering grounds. On the other end of the seasonal scale, several species exhibit colonial behavior in winter when they either hibernate (e.g., some bats) or confine their activities to a small area (e.g., "yards" for White-tailed Deer). Again, not all such areas will be suitable for Fragile Area Status. (See Evaluation.)

Specific groups of animals require special considerations:

Birds

- a) Concentrated feeding and resting areas for migratory species.

Most waterfowl migrate in flocks and stop over in special areas on their routes, especially in marshes that provide food and cover for resting. The Lake Champlain and Connecticut River Valleys are two important branches in the Atlantic Flyway, and the wetlands associated with them harbor great numbers of migratory waterfowl in spring and fall.

- b) Nesting habitats for endangered or threatened species are especially critical.

Fish

- a) Many species of restricted range and/or numbers have special area needs for their perpetuation, especially spawning and nursery areas.

- b) In order to complete their life cycles, anadromous and adfluvial fish must be able to migrate along established routes, to and from their spawning and nursery areas. All steps in this migration are critical to species' survival. Adfluvial = species that migrate upstream from ponds and lakes to spawn. Anadromous = species that migrate upstream from the ocean.

Amphibians & Reptiles

- a) In general, amphibians and reptiles depend heavily on specific sites for breeding.

- b) At this time, little information is available on the distribution and area requirements of many amphibians and reptiles in Vermont, especially concerning potential endangered or threatened species.

Invertebrates

Little information available, especially related to potential endangered or threatened species.

EVALUATION SYSTEM

Once an area has been classified as a potential fragile area, it may then be processed for final designation on the Register or dropped from consideration. That is, it must be determined to be truly "fragile"; also, it may be that an area, even though fragile, is not suitable for inclusion in this Register -- for example:

-- an area may qualify initially under the category of Boreal Forest, but may actually be a mediocre example of that forest type.

-- a habitat for an endangered species may not be appropriate for registration if either the species or the area it occupies cannot be protected or managed (such as the great tracts of forest required for the territory of the Catamount).

Adamus & Clough (1978), when discussing areas for critical species, suggest considering the suitability and desirability of such species for selection: suitability means "species amenable to protection and management by a natural areas program", and desirability means "those species which deserve or need additional protection". By their definitions, not all species desirable for protection are suitable for protection via a natural areas program. We suggest employing these concepts by combining them into one of appropriateness, applying it to all area categories by means of the scheme outlined below.

Therefore, an area processed through this system, if characterized as both fragile and able to be managed or protected to preserve the entity or character in question, it will finally be placed on the Register. Essential for this last step will be confirmation of an area's attributes through citation of existing literature or through new field research.

The Evaluation System is comprised of 11 categories, each of which is a distinct measure of an area's feasibility for registration. The characteristics of each category are outlined only enough to guide the scientific advisors in their deliberations on the specific merits of each area.

Numerical ratings have been used in some natural area programs. Such a system is not used for any part of this assessment, however, since they tend to:

"...assume constants among areas when, in fact, every area is unique in its combination of elements and factors.

Cumulative value systems also risk the underrating of areas that may have one single but important attribute...  
By the same token, an area with a large number of factors -- none significant -- may achieve an unwarranted high rating."  
-- VNRC (no date)

All 11 categories do not apply to all fragile area types, and some will carry different meanings for different types, e.g., "persistence" means one thing for an endangered species and quite another for a bedrock formation. Therefore, two provisos should be kept in mind:

- (1) The evaluation criteria should be applied consistently only within a fragile area type and not cross boundaries to other area types.
- (2) The criteria should be applied in a step-by-step way, so that all categories are considered.

NOTE: Sites representing the only known station of an endangered or threatened species will automatically be registered regardless of the results of evaluation, since for their individual categories they are ultimately fragile.

- Peripherality: a species or community which is on the edge of its natural range in Vermont may exhibit erratic or cyclic population numbers in the state and thus may not be truly scarce.
- The factors which contribute to endangered or threatened species' scarcity (e.g., failure to reproduce, lack of adaptability, pesticides, etc.) need be considered only for purposes of management, since such species are by definition scarce and will be accepted for registration in this category.

#### 5. Status of Area

Areas that exhibit the least human disturbance to the natural conditions generally will receive the highest consideration. However, in some cases where recommended by the advisory panels, even much-disturbed areas may have value to the Register, especially if active management is required to maintain the character of the area (or fragile component of it) or if it can be readily restored. Susceptibility to disturbance will also be considered: areas/species more susceptible to disturbance will mean higher consideration than one less so.

#### 6. Persistence

- (1) Areas: Areas that are ecologically stable and likely to be self-perpetrating over a long period of time (climax communities) generally will receive greater consideration than areas that are unstable and more ephemeral (seral stages).
- (2) Species: Species that occupy the same site from year to year, over an extended period, will receive greater consideration than those which do not. To "occupy" may mean to spend the entire life cycle, just the breeding season, just the winter, periods in migration, or any combinations thereof.

### Evaluation Categories

#### 1. Knowledge of the Area

Areas which have been thoroughly or well studied/researched will receive more consideration for registration than those which have been little or not at all studied. The better our knowledge of an area, the more basis we have to judge its true nature.

#### 2. Representatives on the Register

Area types (e.g., marsh, critical habitat for a bird) that are not on the Register will receive more consideration than those which are already. This will insure that the Register will cover the whole scope of fragile areas in the state and will not become overloaded with one type or another.

#### 3. Diversity

Areas that contain the greatest number of fragile area classification categories (see page 6) will receive the highest consideration. For example, an area that is being considered as a peatland, as a habitat for an endangered species of plant and contains a site of geologic significance, will merit greater consideration than if it were being considered for only one of those categories.

#### 4. Scarcity

Only areas that are truly scarce or areas containing truly rare species/features will be registered. In evaluating scarcity, the following should be kept in mind:

-- A common area-type may be scarce if it is an outstanding example of that area (e.g., virgin northern hardwood forest, as opposed to second growth northern hardwood forest).

-- A scarce endemic species warrants higher consideration than one which is alien or newly-arrived to the state.

Adamus & Clough (1978) use the term "site tenacity" to evaluate "the probability a species will occur at the same general site or natural area for a specified period of time (arbitrarily 25 years)". Species with high site tenacity merit greater consideration than those with low. The characteristics Adamus & Clough ascribe to each are as follows:

Lower Site Tenacity

1. Inhabits earlier successional stages, or an otherwise more ephemeral site (e.g., floodplain).
2. Feeds closer to the breeding site (at least seabirds) in relatively homogeneous habitat.
3. Reproduces in a few large aggregations.
4. Individuals with shorter lifespan (e.g., annuals).
5. Individual or group in question near the periphery of its range.
6. Cyclic population.

Higher Site Tenacity

1. Inhabits more mature vegetation successional stages or an otherwise more permanent site (e.g., rock edge).
2. Feeds at greater distance from the breeding site (seabirds) in relatively homogeneous habitat.
3. Reproduces in pairs or many small groups.
4. Individuals with longer lifespan (e.g., perennials).
5. Individual or group in question well within range.
6. Noncyclic population.

7. Geographic Distribution

- (1) Areas: Fragile areas should be as widely distributed throughout the state as possible. Therefore, similar sites that are well-represented in one area of Vermont will generally receive less consideration than comparable sites in areas poorly represented.
- (2) Species: The geographic location and distribution of sites for critical species may be highly important. The only known station for an endangered or threatened species will automatically be registered; a few stations or many stations in a few locales will be more highly considered than a few well-distributed over many locales.

8. Protection/Manageability

Areas that are capable of being managed and/or protected to maintain the desired natural feature(s) will receive higher consideration than those that are not. Determination of this capability includes whether or not the areas/species are:

- (a) Discreet and identifiable management units or encompass too much territory or community types.
- (b) Accessible for scientific study, education and, if necessary, management activities.
- (c) Insulated from outside influences by buffer zones or distance from any conflicting land uses.

9. Area Size Needs

- (1) Areas: The areas must be of sufficient size to offer protection for either (a) all phases or the critical phase(s) of the community, or (b) unmodified natural conditions throughout most of the area(s). In general, larger areas are favored over smaller ones of similar nature.
- (2) Species: Species having large territories, covering many habitat types, are usually less feasible for registration than those having smaller, more restricted territorial requirement.

10. Habitat Specificity

A species restricted to a single habitat for any part of its life cycle will receive higher consideration than one that is either:

- (a) not so restricted, or
- (b) adaptable to changes in habitats or able to shift to new habitats.

11. Seasonal Mobility

Species that are nonmigratory or have restricted seasonal mobility are usually more feasible for registration than those that are migratory or seasonal "wanderers", if those species do not have high site tenacity (persistence) and do not congregate in large flocks during migration (e.g., waterfowl). Adamus & Clough (1978), in deciding priority order, listed degrees of mobility as:

- (a) confined mobility
- (b) local mobility
- (c) regional mobility
- (d) migratory

with decreasing suitability for registration from (a) to (d).

REFERENCES

- Adamus, Paul R. and Garrett C. Clough. 1978. Evaluating species for protection in natural areas. Biol. Conserv. (13): 165-178.
- Center for Natural Areas (Paul R. Adamus and Garrett C. Clough, Principal Investigators). 1976. A preliminary listing of noteworthy natural features in Maine. Prepared for the Maine Critical Areas Program, Maine State Planning Office. 397 pp.
- Clements, F.E. 1916. Plant succession. An analysis of the development of vegetation. Carnegie Inst., Washington, D.C. No. 242.
- Ford-Robertson, F.C. (Ed.) 1971. Terminology of forest science, technology, practice and products. Soc. Am. For., Washington, D.C. 349 pp.
- Heinselman, M.L. 1963. Forest sites, bog processes, and peatland types in the glacial Lake Agassiz region, Minnesota. Ecol. Monogr. 33:327-374.
- Illinois Nature Preserves Commission. 1972. Comprehensive plan for the Illinois nature preserves system. Part 1. Guidelines. Illinois Nature Preserves Commission, Rockford, Ill. 13 pp.
- . 1975. Illinois nature preserves. Two-year report, 1973-1974. Illinois Nature Preserves Commission, Rockford, Ill. 76 pp.
- Jeglum, et al. 1974. Toward a wetland classification for Ontario. Can. For. Serv. Rep. O-X-215. 54 pp.
- National Heritage Program. 1978. Ecological classification in the National Heritage Program. (First working draft.) HCRS, Washington, D.C.
- New England Botanical Club. 1972. Guidelines and criteria for the evaluation of natural areas. 1 p.
- Oosting, H.J. 1956. The study of plant communities: An introduction to plant communities. W. H. Freeman & Co., San Francisco, CA. 440 pp.
- Sargent, Fredric O. and Justin H. Brande. 1975. Natural area classification. Research Report 87, Agricultural Experiment Station, University of Vermont, Burlington, VT. 14 pp.
- Society of American Forests. 1954. (Reprinted 1975). Forest cover types of North America. Society of American Forests, Bethesda, MD. 67 pp.
- . (no date) Research natural areas. SAF, Bethesda, MD. 18 pp.
- The Nature Conservancy. 1975. Preserving our natural heritage. Vol. I. federal activities. Prepared for the U. S. Dept. of Interior, National Park Service. U. S. Govt. Printing Office, Washington, D.C. 323 pp.
- . 1976. Preserving our natural heritage. Vol. II. state activities. U.S. Govt. Printing Office, Washington, D.C. 671 pp.

U. S. Soil Conservation Service, Soil Survey Staff. 1975. Soil Taxonomy: a basic system of soil classification for making and interpreting soil surveys. Preliminary abridged text. U. S. Soil Conserv., Washington, D.C. 330 pp. (Cited in Cowardin, et al, 1977)

Vermont Natural Resources Council. (Robert Klein, Project Director) 1976. Technical report: Vermont natural areas project (phase 2). VNRC, Montpelier, VT. 112 pp.

----- (no date) Protection of natural areas in Vermont. Report of the Vermont Cooperator in the New England Natural Areas Project. 26 pp.

Vogelmann, H.W. 1964. (Reprinted 1971) Natural areas in Vermont, Report 1. Vermont Agricultural Experiment Station, University of Vermont, Burlington, VT. 29 pp.

----- 1969. Vermont natural areas, Report 2. Central Planning Office and Interagency Committee on Natural Resources, Montpelier, VT. 30 pp.

Westveld, et al. 1956. Natural forest vegetation zones of New England. Journ. Forestry (54): 332-338.

Worley & Sullivan. 1978. A classification scheme for the peatlands of Maine. Draft of a report for the State Planning Office, State of Maine. 154 pp.

ADDENDUM

Cowardin, Lewis M., Virginia Carter, Francis C. Golet and Edward T. Laroe. 1979. Classification of wetlands and deepwater habitats of the United States. Office of Biological Services, Fish and Wildlife Service, USDI, Washington, D.C.

VERMONT FRAGILE AREAS

AREAS WITH COMBINED FEATURES

(see site description for classification categories)

A. Combined Features

1. Mt. Mansfield Alpine Area
2. Camel's Hump Natural Area
3. Lake Willoughby Natural Area
4. Smugglers Notch
5. Missisquoi River Delta
6. Moose Bog

PHYSICAL FEATURES

B. Bedrock Features

1. Lone Rock Point
2. Chazyan Coral Reef
3. Quechee Gorge
4. Texas Falls
5. Weybridge Cave

C. Surficial Features

1. Miller Brook Cirque

D. Aquatic Features

1. Shelburne Pond

BIOLOGICAL FEATURES

Flora

E. Alpine Communities

1. Mt. Mansfield Alpine Area (A1)
2. Camel's Hump Natural Area (A2)
3. Lake Willoughby Natural Area (A3)
4. Smugglers Notch (A4)

F. Forest Communities

1. Cambridge Pines
2. Canfield-Fisher Memorial Pines
3. Lord's Hill Northern Hardwoods
4. Gifford Woods
5. Maynard Miller (Vernon) Black Gum Swamps

G. Marshes

1. Little Otter Creek Marsh
2. Barton River Marsh

H. Peatlands

1. Franklin Bog
2. Molly Bog
3. Colchester Bog

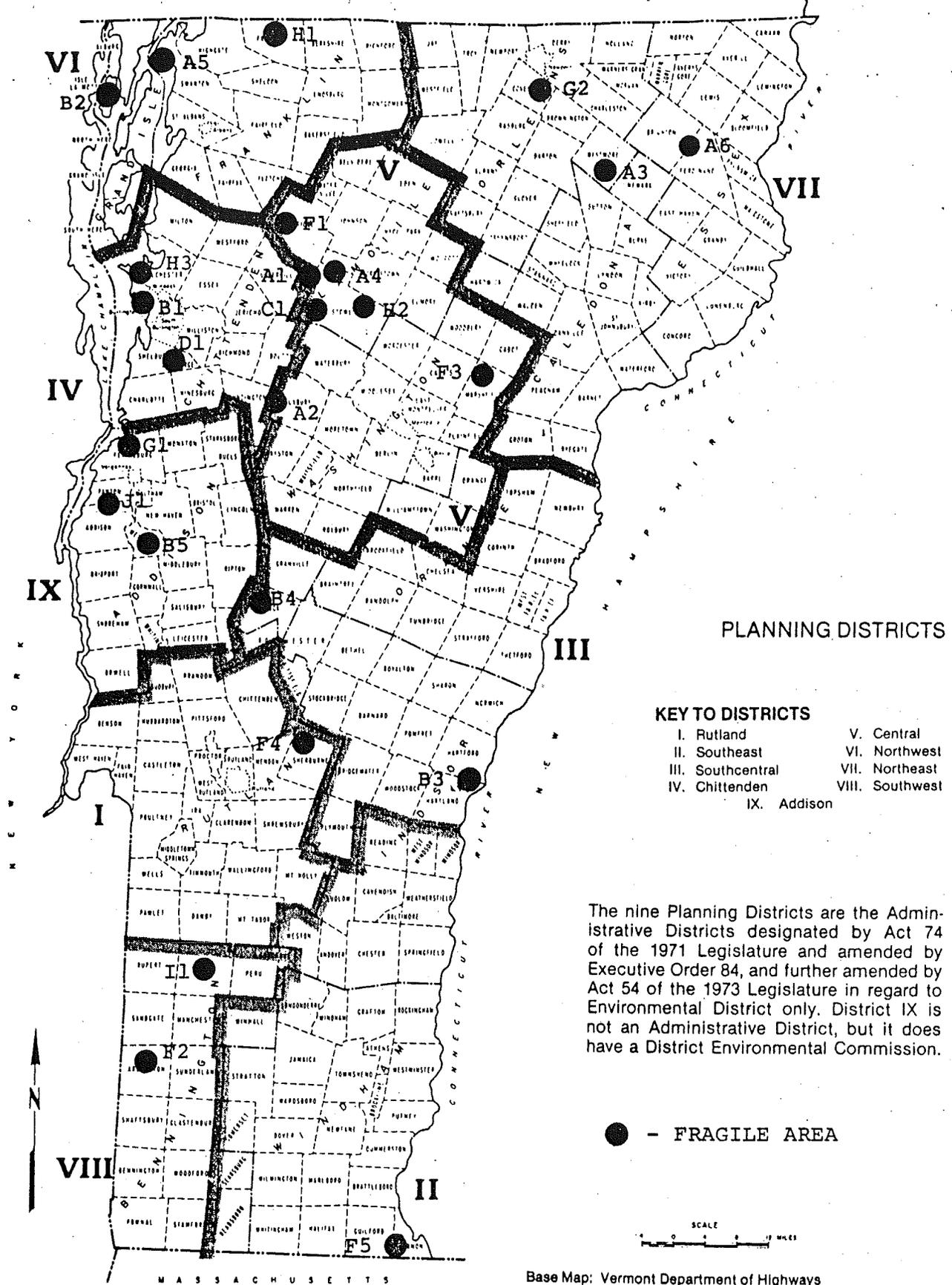
Fauna

I. Habitats for Endangered Species

1. Dorset Bat Cave (Green Peak Cave)

J. Critical Habitats for Restricted Species

1. Dead Creek Waterfowl Area



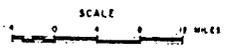
PLANNING DISTRICTS

KEY TO DISTRICTS

- I. Rutland
- II. Southeast
- III. Southcentral
- IV. Chittenden
- V. Central
- VI. Northwest
- VII. Northeast
- VIII. Southwest
- IX. Addison

The nine Planning Districts are the Administrative Districts designated by Act 74 of the 1971 Legislature and amended by Executive Order 84, and further amended by Act 54 of the 1973 Legislature in regard to Environmental District only. District IX is not an Administrative District, but it does have a District Environmental Commission.

● - FRAGILE AREA



Base Map: Vermont Department of Highways

AREA DESCRIPTIONS

NOTE: Page numbers correspond to outline  
on pages 26 and 27.



## MT. MANSFIELD ALPINE AREA

### Location

Lat. 44° 32' 0" N, 72° 49' 0" W, Lamoille County (Town of Stowe) and Chittenden County (Town of Underhill). See accompanying map.

### Site Description

Mount Mansfield, rising to 4393' from a base level of approximately 1500', is one of the most striking landscape features of Vermont. Its long summit ridge, resembling to some the profile of a man's face, lies mostly above altitudinal tree line and possesses the largest single expanse of alpine vegetation in the state. At various times in its recent history the summit ridge has been the site of a hotel, a post office, radio and television towers, and transmitter houses. Since 1941 the Mt. Mansfield Company has operated a ski area on the slopes beneath the summit on the northeast side of the mountain. Despite the scope of these human activities, however, the summit ridge of Mt. Mansfield (a 200-acre area, owned largely by the University of Vermont) remains one of the most outstanding natural areas in the state. There are excellent exposures of bedrock which display evidence of the tectonic and metamorphic history of the Green Mountain anticlinorium. Many rare and endangered plant species are numbered among the mountain's tundra population, including *Diapensia* (*Diapensia lapponica*), bearberry willow (*Salix Uva-ursi*), Boott's rattlesnake root (*Prenanthes Boottii*), alpine knotweed (*Polygonum viviparum*), alpine bilberry (*Vaccinium uliginosum* var. *alpinum*), black crowberry (*Empetrum nigrum*), mountain cranberry (*Vaccinium vitis-idaea*), mountain sandwort (*Arenaria groenlandica*), Bigelow's sedge (*Carex Bigelowii*), highland rush (*Juncus trifidus*) and seven species of grass. Altogether about 40 species of plants on or near the summit ridge are of special ecological interest. Of additional interest are several small peat bogs located in wet depressions along the ridge. The bogs add still further to the habitat and floristic diversity of the area. Lake of the Clouds on Mt. Mansfield is the highest permanent body of water in the state. Bear Pond is almost as high. Both contain boreal insects not known elsewhere in the state (Bell 1980).

### Critical Features

This is one of only two areas in the state in which alpine tundra can be found, and the only one of significant extent. The tundra contains many species on the Vermont rare and endangered species list, as well as other unusual alpine species. Heavy foot traffic in the summer and fall requires constant monitoring by ranger-naturalists. The alpine bog areas are particularly fragile and require monitoring and protection.

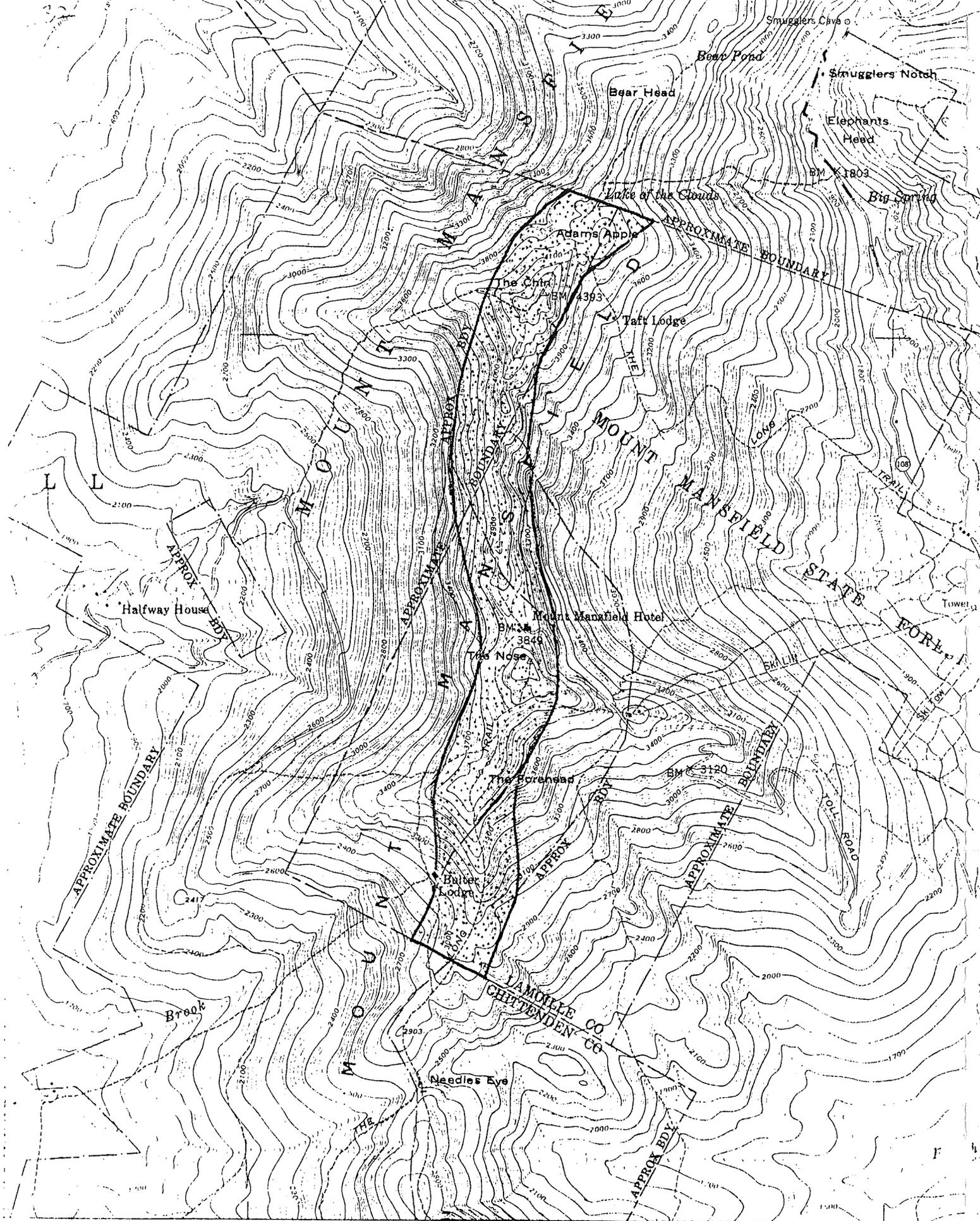
### Rare and Endangered Species (Existing and/or recorded historically)

#### Plants:

Agrostis borealis

Arenaria groenlandica

Arnica mollis



672 50' 673 (BOLTON MOUNTAIN) 675 47 30' 67

Asplenium viride  
Calamagrostis Fernaldii \  
Calamagrostis inexpansa var. novae-angliae \  
Calamagrostis inexpansa var. brevior \  
Callitriche anceps \  
Carex Bigelowii .  
Chamaedaphne calyculata var. latifolia  
Deschampsia atropurpurea \  
Diapensia lapponica E  
Dryopteris fragrans \  
Empetrum nigrum \  
Carex atratifomis T  
Festuca ovina var. saximontana  
Geocaulon lividum  
Hierochloë alpina  
Juncus trifidus  
Luzula spicata  
Osmorhiza obtusa  
Poa Fernaldiana  
Polygonum viviparum  
Prenanthes Bootii  
Salix uva-ursi  
Vaccinium uliginosum var. alpinum  
Vaccinium vitis-idaea  
Viburnum edule

Rare Insects

Ground Beetles:

Nebria suturalis \*  
Notiophilus aquaticus \*  
Notiophilus borealis \*  
Notiophilus nemoralis \*  
Blethisa quadricollis #  
Trechus crassiscapus  
Bembidion grapii %  
Bembidion mutatum %

Patrobus foveocollis

Pterostichus punctatissimus

Pterostichus pinguedineus

Pterostichus brevicornis

\* denotes true tundra species found only at this site in Vermont.

# only Vermont record from Bear Pond

% species of bare mountain ridges, but not quite confined to Mt. Mansfield (also on Camel's Hump, Killington, Lincoln Mtn., etc.)

Zubovskya glacialis - the "Glacier Grasshopper" is found in openings of the spruce-fir forest and at timberline.

Other rare species:

Rana septentrionalis - the mink frog is rare in Vermont, but breeds in Bear Pond.

Evaluation Categories

- (1) Knowledge: probably no natural area in the state has been more thoroughly studied or more carefully documented, botanically, zoologically and geologically. The mountain's alpine area continues to be a focal point for ecological research. Among invertebrates, the ground beetles have been rather thoroughly studied, and the list of tundra species is probably nearly complete (although a few may be added in difficult groups not yet adequately studied). There is much Mount Mansfield material in the UVM collection in other invertebrate groups, but it hasn't yet been identified. Butterflies, crane flies, and spiders are three groups liable to be represented by true tundra species limited to this site in Vermont, and are groups particularly in need of further study.
- (2) Representation: one of only two alpine tundra areas in the state; the larger and more complex of these. This is the only Vermont site with a partial alpine fauna. Camel's Hump has small areas of alpine flora, but the alpine insects either never reached it, or have been eliminated by alteration of the site (complete removal of loose stones).
- (3) Diversity: classified as a significant alpine ecosystem with several communities, each with a distinctive flora and fauna; a significant bedrock feature; and as a habitat for endangered plant species.
- (4) Scarcity: one of only two alpine tundra areas in Vermont and one of few in New England. Many rare and endangered plant species. This is the only Vermont site with a partial alpine fauna.

- (5) Status: even with marked trails the tundra is subjected to intensive visitation in the summer and fall. Because of the fragile nature of this environment/vegetation complex the tundra must be actively protected. The situation is handled by ranger/naturalist protection/education program.
- (6) Persistence: tundra in climax condition and appears stable as long as protection is available.
- (7) Distribution: not applicable.
- (8) Manageability: capable of protection through existing programs and laws.
- (9) Area Size Needs: sufficient to include the significant portion of the tundra environment.
- (10) Habitat Specificity: endangered plants of this community are restricted to this site type.
- (11) Seasonal Mobility: not applicable.

#### Ownership

The University of Vermont. Burlington, Vt. 05401

#### Recognition

University of Vermont Natural Area

State of Vermont Natural Area (Vt. Dept. of Forests, Parks and Recreation)

Primary Natural Area (Vt. Natural Resources Council)

National Natural Landmark (U.S. Dept. of the Interior)

#### Management/Protection Strategy

- (1) Continued protection through Ranger/Naturalist Program
- (2) Continued monitoring through Act 250 and University regulations
- (3) No further development (television, visitor facilities, etc.) along the summit ridge, and a gradual phasing out of those facilities that do exist at present, or limiting facilities to a very specific area.

#### References

- |            |  |
|------------|--|
| Bearse, R. | 1968. Geology of Vermont (in Vermont: a Guide to the Green Mountain State). Houghton, Mifflin Co.: Boston. |
| Bell, R.T. | 1978. The habitat of <u>Nebria suturalis</u> in Vermont. Cordulia 4:82.                                    |
| Bell, R.T. | 1980. Suggestions for the initial registry of fragile areas (personal communication).                      |

- Borie, Louis 1977. University of Vermont Natural Areas. Environmental Program. University of Vermont. Burlington.
- Bowley, D.R. 1967. Characterization and comparison of two alpine bogs (Mt. Mansfield, Vt.). MA Thesis. Boston Univ. Boston, Mass.
- Bowley, D.R. 1978. Contributions to the flora of Mt. Mansfield and Smuggler's Notch, Vermont: the lichens. PhD. Thesis. Boston Univ. Boston, Mass.
- Christman, Robert A. 1956. Geology of Mt. Mansfield State Forest. Vt. Geol. Survey. Montpelier, Vt.
- Christman, Robert A. 1959. Geology of the Mt. Mansfield Quadrangle. Vt. Geol. Survey. Bull. 12.
- Christman, Robert A. and Donald T. Secor, Jr. 1961. Geology of the Camel's Hump Quadrangle. Vt. Geol. Survey Bull. 15.
- Connally, G.G. 1968. Surficial geology of the Mt. Mansfield fifteen minute quadrangle: A report to the state geologist. Open file at Vt. Geol. Survey. Montpelier, Vt.
- Connally, G.G. 1967. Glacial geology of the Mt. Mansfield Quadrangle, Vermont (abstract): Geol. Soc. Amer. Boston, Mass.
- Countryman, W.D. 1978. Rare and Endangered Vascular Plant Species in Vermont. New England Botan. Club and U.S. Fish and Wildlife Service.
- Evans, Llew 1944. Mount Mansfield: Capstone of Vermont. Appalachia (June).
- Fernald, M.L. 1933. Callitriche anceps in New England. Rhodora 35:185-186.
- Fernald, M.L. and K.M. Wiegand. 1913. The genus Empetrum in North America. Rhodora 15:211-217.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine - Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Goldthwait, J.W. 1916. Evidence for and against the former existence of local glaciers in Vermont. Vt. State Geologist 10th Report.
- Hagerman, Robert L. 1971. Mansfield - The Story of Vermont's Loftiest Mountain. Essex Publ. Co: Essex Jct., Vt.
- Hancock, William et al 1978. The Vermont Atlas and Gazetteer. David DeLornie Co: Yarmouth, Me.
- Harris, S.K. 1965. Geocaulon lividum in New England. Rhodora 67:407-409
- Hitchcock, Edward 1861. Report on the Geology of Vermont. Vol 2. Montpelier, Vt.

- Hitchcock, C.H. 1884. Geological Sections across New Hampshire and Vermont. Amer. Mus. Nat. Hist. Bull Vol 1. No. 5.
- Hitchcock, C.H. 1904. Glaciation of the Green Mountain Range. Vt. State Geol. 4<sup>th</sup> Rept.
- Hungerford, E. 1868. Evidences of glacial action on the Green Mountain summits. Amer. Jour. Science 45:1-5.
- Indridason, Ottar 1973. Natural Areas - Mt. Mansfield. Vermont Life 27(4) : 10-15
- Jacobs, E.C. 1936. Report of the State Geologist. No. 20. Montpelier, Vt.
- Jacobs, E.C. 1938. The geology of the Green Mountains of northern Vermont. Vt. State Geol. 21<sup>st</sup> Rept. Montpelier, Vt.
- Jacobs, E.C. 1942. The Great Ice Age in Vermont. Vt. State Geol. 23<sup>rd</sup> Rept. Montpelier, VT.
- Jacobs, E.C. 1950. The physical features of Vermont. Vermont State Development Dept: Montpelier.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England: Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Koneg, R.H. 1956. Geology of the northwest flank of Mt. Mansfield, Vermont. Master's Thesis (unpubl.) Cornell Univ. Ithaca, N.Y.
- Lee, William S. 1955. The Green Mountains of Vermont Henry Holt: N.Y.
- Moore, H.P. 1961. Mount Mansfield and its environs. Moore's New England: Concord, N.H.
- Sargent, F.O., H.W. Vogelmann, and R.S. Stanley 1970. Natural Areas in Chittenden County. Lake Champlain Basin Studies. No. 6. Burlington, Vt.
- Stebbins, G.L. Jr. 1930. A revision of some North American species of Calamagrostis. Rhodora 32:35-57
- Stephens, R. 1967. The Green Mountains. Vermont Life 21(4): 34-45.
- Stewart, David P. 1961. The glacial geology of Vermont. Vt. Geol. Survey. Bull. 19. Montpelier.
- Stewart, David P. and Paul MacClintock 1969. The surficial geology and Pleistocene history of Vermont. Vt. Geol. Survey Bull. 31. Montpelier, Vt.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Nat. Resources Project. Montpelier, Vt.

- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta., Univ. of Vermont. Burlington.
- Watts, R.B. 1957. Garnet as an indication of degree of metamorphism with application to Mt. Mansfield, Vt. Senior Thesis (unpubl.). Cornell Univ. Ithaca, N.Y.
- White, W.S. and R.H. Jahns 1950. Structure of central and east-central Vermont. Jour. Geol. 58:179-220.

## CAMEL'S HUMP NATURAL AREA

### Location

Lat. 44° 19' 0" N, Long. 72° 53' 0" W. Washington County (Town of North Duxbury) and Chittenden County (Town of Huntington). See accompanying map.

### Site Description

This area includes a 10-acre alpine tundra community (approx. 3800'-4803' elev) and the spruce-fir forest between approx. 2800'-3800' elevation. Other than Mt. Mansfield, it possesses only alpine tundra ecosystem in the state. The spruce-fir forest is in virgin or near-virgin condition and is a prime example of a montane boreal forest ecosystem.

### Critical Features

The tundra contains eight species on the Vermont rare and endangered species. The 10-acre summit is subjected to heavy foot traffic in summer, and the entire plant community could be irreparably damaged without proper management and protection. The spruce-fir forest is an outstanding example of its type and one of few large unspoiled stands in the state.

### Rare and Endangered Species

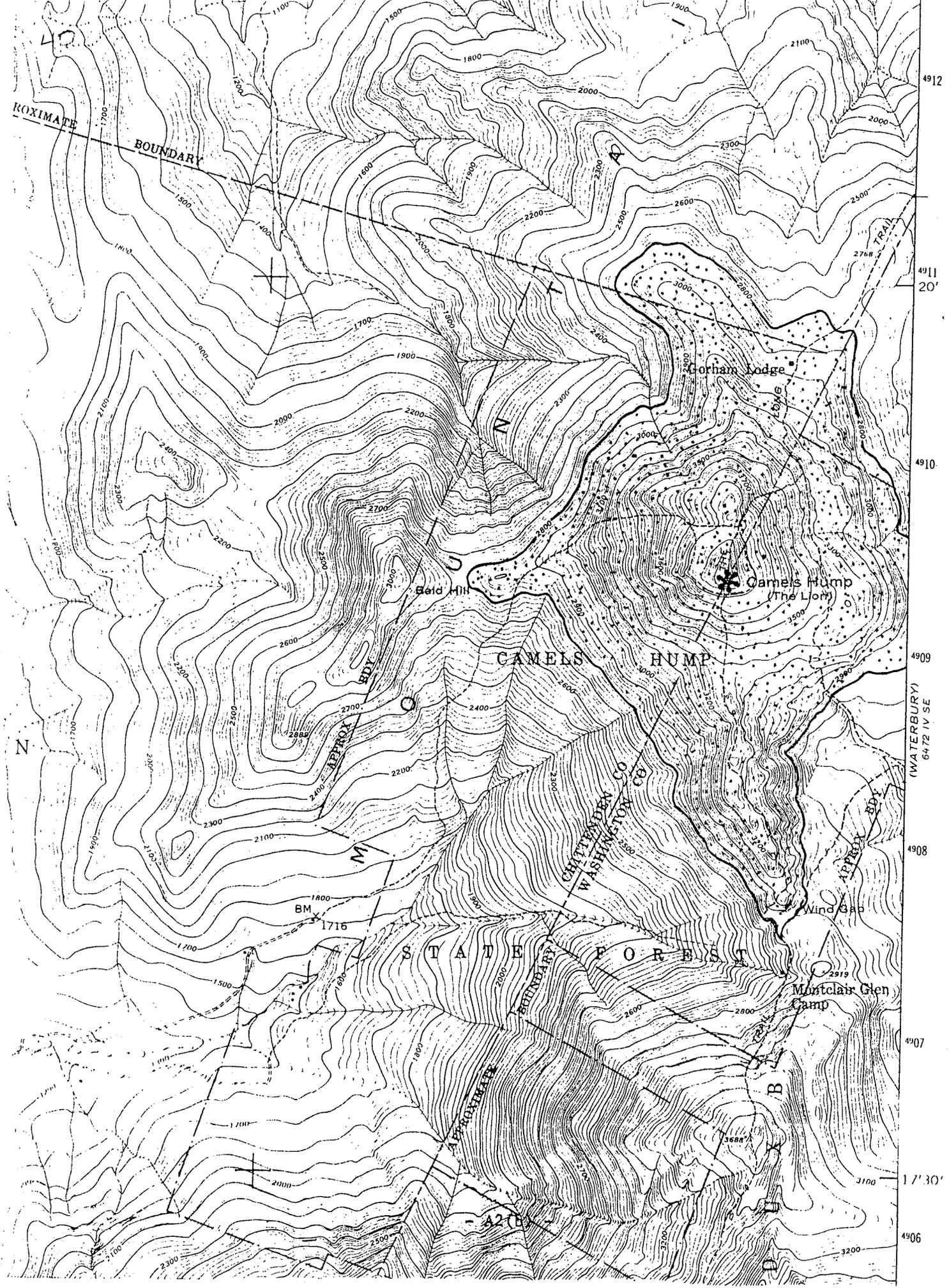
#### Plants:

Arenaria groenlandica X  
Carex Bigelowii X  
Dryopteris fragrans X  
Empetrum nigrum X  
Hierochloë<sup>"</sup> alpina X  
Juncus trifidus X  
Polygonum viviparum X  
Prenanthes Boottii E  
Salix Uva-ursi E  
Vaccinium uliginosum var. alpinum  
Vaccinium vitis-idaea

#### Insects:

##### Ground Beetles:

Notibphilus nemoralis  
Scaphinotus bilobus  
Scaphinotus viduus  
Spheroderus nitidicollis brevoorti



4912  
4911  
20'  
4910  
4909  
4908  
4907  
17' 30"  
4906

(WATERBURY)  
6472 IV SE

ROXIMATE  
BOUNDARY

N

CAMELS HUMP

STATE FOREST

CHITTENDEN CO  
WASHINGTON CO

Montclair Glen  
Camp

Gorham Lodge

Bald Hill

BM  
1716

APPROX  
EDG

Wind Gap

APPROX  
EDG

B

D

A

N

C

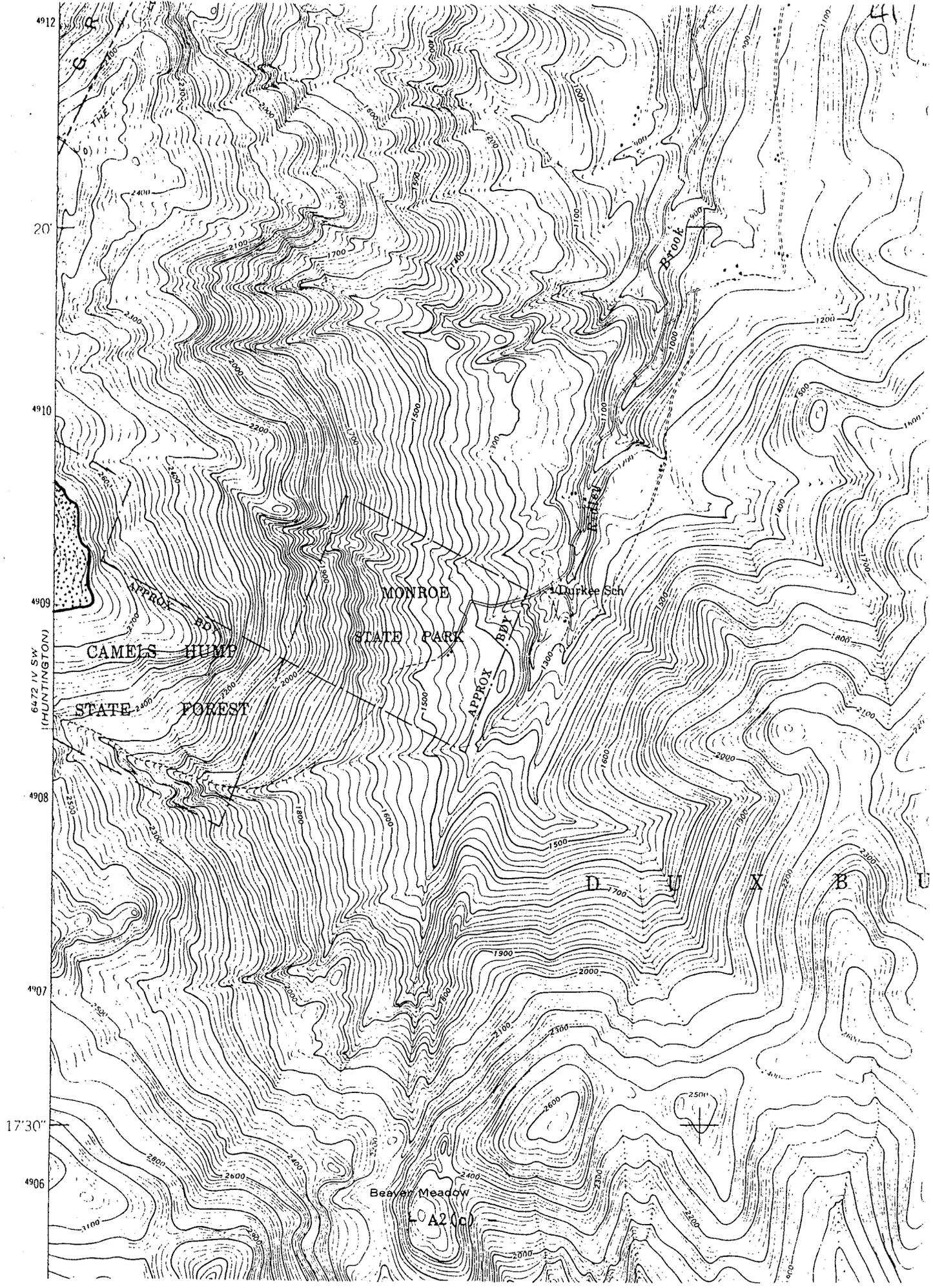
4200

3688

3026

3026

NOTE



Trechus crassiscapus

Bembidion grapii

Bembidion mutatum

Patrobus foveocollis

Pterostichus punctatissimus

Pterostichus pinguedineus

(all are characteristic of spruce-fir zone.)

Other rare boreal forest arthropods:

Mitopus morio -- Harvestman (Phalangida)

Zubovskya glacialis -- Glacier Grasshopper

Birds:

Parus hudsonicus -- Boreal Chickadee

### Evaluation Categories

- (1) Knowledge: documented and researched (see references) botanically, zoologically, and geologically. Continuing research in tundra and forest vegetation. A large collection of invertebrates from Camel's Hump is kept as a unit in the UVM Invertebrate Collection. The fauna of Gleason and Preston Brooks, on the north side of the mountain, have been studied in several theses in the Zoology Department.
- (2) Representation: one of only two alpine tundra areas in Vermont. Fine examples of large, untouched montane boreal forests uncommon in the state. The spruce-fir forests on the west slope are especially good because neither wind nor fire have destroyed the large trees. Additional rare invertebrates may be found there for that reason.
- (3) Diversity: classified as a significant alpine community, significant boreal forest region, and habitat for endangered plant species.
- (4) Scarcity: one of only two alpine tundra areas in the state and one of few in New England. Exemplary boreal forest. Possesses many rare and endangered plant species.
- (5) Status: tundra severely impacted by about 10,000 hikers each summer. Increased or uncontrolled visitation could threaten plant communities. Present situation is not adequately handled by ranger-naturalist program. Boreal forest faces no foreseeable threat.
- (6) Persistence: both tundra and boreal forest evidently climax communities and appear to be biologically stable over long periods of time, given protection.
- (7) Distribution: with only two such areas in state (alpine) both would be worthy of recognition regardless of their location.
- (8) Manageability: Significant visitation problems, even with existing programs, Act 250, and Forests, Parks and Recreation regulations. Trail access from all directions, excellent buffer zones of hardwood forests below.

- (9) Area Size Needs: Sufficient to include all tundra and boreal forest areas here.
- (10) Habitat Specificity: rare and endangered plants of this community are restricted to this site type.
- (11) Mobility: plants not seasonally mobile.

#### Ownership

Vermont Department of Forests, Parks and Recreation: Montpelier.

#### Recognition

Legislation (Creation of Camel's Hump State Park and Forest Reserve)

State Natural Area (Dept. of Forests, Parks and Recreation)

Primary Natural Area (Vt. Nat. Resources Council)

National Natural Landmark (U.S. Dept. of the Interior)

The mountain most subject to painting and photography of any in Vermont.

#### Management/Protection Strategy

- (1) Continued coverage through Ranger-Naturalist Program
- (2) Continued monitoring through Vermont Public Law 250, Forests, Parks and Recreation regulations, and by Camel's Hump Forest Reserve Commission.
- (3) Consideration of means of limiting numbers of visitors to proportions compatible with effective protection, should the time arise.

#### References

- Aubrey, W.M. 1977. The structure and stratigraphy of the northern ridges of Camel's Hump Mountain. Camel's Hump Quadrangle: North-central Vermont. Master's Thesis. Univ. of Vt., Burlington.
- Bertram, Paul G. 1976. Distribution and abundance of riffle fauna in a bifurcated mountain stream: Gleason Brook, Camel's Hump, Vermont. 124 pp., Master's Thesis, University of Vermont. Burlington.
- Cady, W.M. 1961. Excursion across the Green Mtns. - Hinesburg to Montpelier (in Guidebook, New England Geol. Conf. 53rd ann. mtg. New Haven, Ct.
- Camel's Hump Forest Reserve Commission. 1973. A Promise Was Made (pamphlet). State of Vt. Dept. of Forests, Parks and Recreation. Montpelier.

- Chaucer-Halton, H.Y. 1976. Altitudinal distribution and ecotypic variation of dictyostelid cellular slime molds. Camel's Hump, Vermont. Univ. of Vt. M.S. Thesis (unpublished).
- Christman, R.A. and D.T. Secor, Jr. 1961. Geol. of the Camel's Hump Quadrangle, Vt. Geol. Survey Bull. 15. Montpelier.
- Countryman, W.D. 1978. Rare and Endangered Vascular Plant Species in Vermont. New England Botan. Club and U.S. Fish and Wildlife Service.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine - Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Hancock, William et al 1978. The Vermont Atlas and Gazetteer. David DeLorme Co: Yarmouth, Me.
- Jacobs, E.C. 1936. Report of the State Geologist. No. 20. Montpelier.
- Jacobs, E.C. 1938. The geology of the Green Mountains of northern Vermont. Vt. State Geologist. Report No. 21. Montpelier.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England: Hanover, N.H.
- Klein, Richard M., H.W. Vogelmann, Margaret Blies and R.W. Leonard 1980. Fog as a contributor to acid rain in the Green Mountains. (unpublished ms.)
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Lee, William S. 1955. The Green Mountains of Vermont. Henry Holt: N.Y.
- Leedy, Dwight A. 1972. Fog moisture interception in the Green Mountains of Vermont. Univ. of Vt. M.S. Thesis. (Botany).
- Matousek, John A. 1974. Distribution of Ephemeroptera, Plecoptera and Trichoptera in Preston Brook, Chittenden County, Vermont, . 107 pp.; Masters Thesis, University of Vermont.
- Sargent, F.O., H.W. Vogelmann, and R.S. Stanley 1970. Natural Areas in Chittenden County. Lake Champlain Basin Studies. No. 6. Burlington, Vt.
- Siccama, Thomas G. 1968. Altitudinal distribution of forest vegetation in relation to soil and climate on the slopes of the Green Mountains. Ph.D. Thesis. Univ. of Vt., Burlington.
- Siccama, Thomas G. 1971. Presettlement and present forest vegetation in northern Vermont, with special reference to Chittenden County. Amer. Midl. Nat. 85(1): 153-172.

- Siccama, Thomas G. 1974. Vegetation, soil, and climate on the Green Mountains of Vermont. *Ecol. Monogr.* 44: 325-349.
- Smith, Peter 1970. Seasonal distribution of several small species of mammals of Camel's Hump, Vermont. Ph.D. Thesis. Univ. of Vermont, Burlington.
- Society of American Foresters (Green Mountain Chapter) 1967. Natural Areas - Types and Definitions. (Jan.) Burlington, Vt.
- Spence, John R. 1974. Comparative Niche Ecology of Nebria lacustris Casey and Nebria pallipes Say in Vermont, 118 pp. Master's Thesis, Univ. of Vt.
- Spence, John R. 1979. Riparian Carabid Guilds, a Spontaneous Question Generator., in pp. 525-537. Erwin, T.L., G.E. Ball, and D.R. Whitehead: Carabid Beetles, their Evolution, Natural History and Classification: 635 pp., The Hague, Boston, London, 1979.
- Sprague, Philip S. 1871. Insect Fauna of Camel's Hump. Archives of Science and Transaction of the Orleans County Society of Natural Science 1:85-88. (Note: The Insects of this collection are still preserved in the Museum of Comparative Zoology at Harvard).
- Stephens, R. 1967. The Green Mountains. *Vermont Life* 21(4): 34-45.
- Teschner, Douglass P. 1978. Channelled foot traffic effects on boreal vegetation and soils. Camel's Hump, Vermont. Univ. of Vt. M.S. Thesis.
- Uphan, W. 1889. Ascents of Camel's Hump and Lincoln Mountain, Vt. *Appalachia* 5:319-326.
- Vermont Endangered Species Subcommittee 1978. Revised preliminary list of endangered, threatened, and rare species of birds in Vermont. Vt. Agency of Environmental Conservation. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Nat. Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta., Univ. of Vt., Burlington.
- Vogelmann, H.W., C.C. David Jr., and R.E. Leonard 1980. The effects of fertilizer on alpine vegetation in the Green Mountains of Vermont.
- Wimmer, H. Peter 1979. An Anatomical and Phylogenetic Study of Trichoptera, including a partial checklist of Vermont Species. 300 pp. Doctoral Thesis, University of Vermont.



## LAKE WILLOUGHBY NATURAL AREA

### Location

Lat. 44° 43' 0" N, Long. 72° 02' 0" W. Orleans County. Town of Westmore. See accompanying map.

### Site Description

The magnificent cliffs of Mt. Pisgah (on the east) and Mt. Hor (on the west) dropping almost vertically into the depths of Lake Willoughby, represent one of Vermont's most exciting landscapes. Both geologically and botanically this area is worthy of the wide recognition it has received. The valley was glacially carved and the combination of cliffs and lake displays classical glacial features. The cliffs of Mt. Pisgah contained one of the state's major historic peregrine falcon eyries (Stewart 1980). Presently, the state has no breeding population of this federally endangered species. The flora of these cliffs is very similar to that in Smuggler's Notch, where similar environmental conditions prevail. Some of Vermont's rarest plants grow on the wet ledges of the Willoughby Cliffs, and this area is probably the richest fern locality in Vermont, with rarities such as the wall rue (Asplenium cryptolepis), smooth and purple cliff-brakes (Pellaea glabella and P. atropurpurea), and smooth and northern woodsias (Woodsia glabella and W. alpina) all being found on the cliffs. Finally, the lake itself, 1692 acres in area, is one of the deepest in New England, and supports a large variety of cold water fish.

### Critical Features

One of only three areas in Vermont with an arctic cliff flora. Remarkable diversity of rare ferns and ferns in general. Many species from state's rare and endangered list.

### Rare and Endangered Species

#### Plants:

Calamagrostis inexpansa var. novae-angliae

Calamagrostis inexpansa var. brevior

Galium tinctorium var. subbiflorum

Hedysarum alpinum var. americanum

Pellaea glabella

Primula mistassinica

Saxifraga aizoides

Saxifraga aizoon var. neogaea

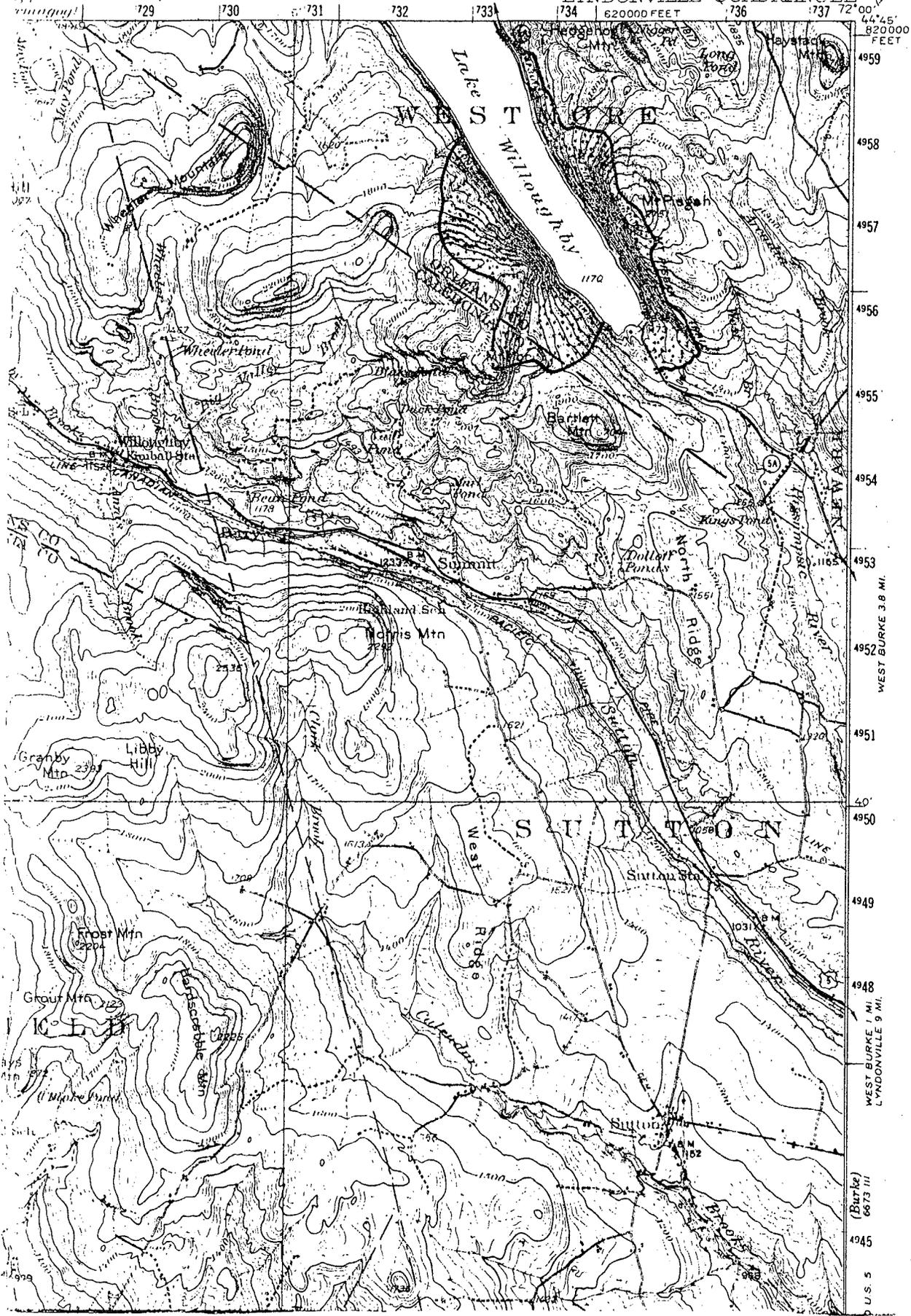
Saxifraga oppositifolia

Woodsia alpina

Woodsia glabella

WEST CHARLESTON 11 MI.  
WESTMORE 1.5 MI. VERMONT  
LYNDONVILLE QUADRANGLE

6673 IV  
(Burke Pond)



62000 FEET  
44°45' 82000 FEET  
4959  
4958  
4957  
4956  
4955  
4954  
4953  
4952 BURKE 3.8 MI.  
4951  
40° 4950  
4949  
4948  
WEST BURKE 1 MI.  
LYNDONVILLE 9 MI.  
(Burke)  
6673 III  
4945  
U.S. 5

### Evaluation Categories

- (1) Knowledge: a famous botanical landmark; well researched and documented (see references), botanically and geologically. Considered likely to have relict populations of arctic and subarctic invertebrates, but studies are lacking.
- (2) Representation: one of only three arctic tundra locations in Vermont; clearly one of the two best. The only lake ecosystem proposed for the Registry.
- (3) Diversity: classified as a significant arctic/alpine ecosystem, a significant aquatic ecosystem, a significant bed-rock landscape feature, and finally as a habitat for endangered species.
- (4) Scarcity: this kind of assemblage of plants is even more of a rarity outside of Vermont than within the state. The few sites in Vermont are all the more scarce when viewed in this context. There is no other lake in Vermont equivalent in depth and size to compare with Lake Willoughby.
- (5) Status: minimal human disturbance, partly because of relative inaccessibility of cliffs from road. Trails are steep and floristic study here is dangerous. The flora itself, though, is vulnerable because of thin substrate and should be protected. Over-collecting of rare plants is considered a definite threat.
- (6) Persistence: likely to remain stable over a reasonably long period of time.
- (7) Distribution: not applicable.
- (8) Manageability: capable of being protected through existing programs, Act 250, and Forests, Parks and Recreation regulations. Buffer zones of forest and talus slope surround the critical plant habitat. Lake presently showing little evidence of stress from presence of boaters, swimmers and fishermen.
- (9) Area Size Needs: sufficient to include cliff flora and the geologic and aquatic features of significance.
- (10) Habitat Specificity: endangered species of this community are restricted to this site type.
- (11) Mobility: not applicable.

### Ownership

Vermont Dept. of Forests, Parks and Recreation. Montpelier, Vt.  
(Willoughby State Forest). Lake shore is largely in private ownership, with some state-owned access points.

### Recognition

Primary Natural Area (Vt. Nat. Resources Council)  
National Natural Landmark (U.S. Dept. of the Interior.)

### Management/Protection Strategy

- (1) Continued monitoring through Vermont Public Law 250, and Forests, Parks and Recreation regulations.
- (2) Acquisition of as much lakeshore property as possible to protect the lake from development pressure.

### References

- Abbe, E.C. 1948. Braya in boreal eastern America. *Rhodora* 50:1-15.
- Barneby, R.C. 1964. Atlas of the North American *Astragalus*. *Memoir of the New York Bot. Garden.* 13:1-594; 597-1288.
- Bearse, R. 1968. Geology of Vermont (in Vermont: a Guide to the Green Mountain State). Houghton Mifflin Co.. Boston, Mass.
- Countryman, W.D. 1978. Rare and endangered vascular plant species in Vermont. New England Bot. Club and U.S. Fish and Wildlife Service.
- Dennis, John G. 1956. Geology of the Lyndonville area. *Vt. Geol. Survey. Bull. No. 8.*
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLornie Co.. Yarmouth, Me.
- Jacobs, E.C. 1921. The geology of Lake Willoughby. *Vt. State Geol. 12th Report.* Montpelier, Vt.
- Jacobs, E.C. 1936. Report of The State Geologist of Vermont. No. 20. Montpelier, Vt.
- Jacobs, E.C. 1942. Report of The State Geologist of Vermont. No. 23. Montpelier, Vt.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Kennedy, George G. 1904. Flora of Willoughby, Vermont. *Rhodora* 6(66):93-134.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). *Vt. Natural Resources Council.* Montpelier, Vt.
- Lee, William S. 1955. The Green Mountains of Vermont. Henry Holt. N.Y.
- Mills, John Ross. 1951. A Study of Lakes in Northeastern Vermont. *Vt. Geol. Survey Bull. #4.* Montpelier, Vt.
- Perkins, G.H. 1918. The physiography of Vermont. Report of the Vermont State Geologist. No. 11. Montpelier, Vt.
- Perkins, G.H. 1931. The physiography of Vermont. Report of the Vermont State Geologist. No. 17. Montpelier, Vt.

- Stewart, James 1980. Comments on fragile areas draft.  
(personal communication).
- Stewart, David P. 1961. The glacial geology of Vermont. Vt.  
Geol. Survey Bull. No. 19. Montpelier, Vt.
- Stewart, David P. and Paul MacClintock 1969. The surficial  
geology and Pleistocene history of Vermont. Vt. Geol.  
Survey Bull. No. 31. Montpelier, Vt.
- Tillon, George H. 1904. An addition to the fern flora of  
Vermont. Rhodora 6(72):235-236.
- Vermont Natural Resources Council 1972. Vermont Natural  
Areas Inventory: New England Natural Resources Project.  
Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural areas in Vermont. Report 1.  
Vt. Agric. Expt. Sta.. Univ. of Vt. Burlington, Vt.
- Walker, Lawrence R. 1977. Microenvironments of Saxifraga  
aizoon, S. oppositifolia, and S. aizoides in northern  
Vermont. University of Vt. M.S. Thesis (unpublished).



## SMUGGLER'S NOTCH

### Location

Lat. 44° 33' 0" N, Long. 72° 48' 0" W. Lamoille County.  
Town of Cambridge. See accompanying map.

### Site Description

Smuggler's Notch is a rocky gap between Mt. Mansfield on the southwest and Sterling Mountain on the northeast. Here, within The Mount Mansfield State Forest, is a preserve of 1424 acres whose cliffs and ledges (from Rt. 108 to over 3000' in elevation) contain a flora that is essentially arctic in character and quite unlike the alpine tundra to be found nearby on the Mt. Mansfield summit. Many of the species growing here are not found on the other higher mountains of the East, either. The best representation of arctic-alpine flora is found on the west side of the notch where the plants grow on open and often wet, dripping ledges. These species include a large number of rare arctic calciphiles, such as the live-long saxifrage (Saxifraga aizoon var. neogaea), yellow mountain saxifrage (S. aizoides), purple mountain saxifrage (S. oppositifolia), northern painted cup (Castilleja septentrionalis), grass-leaved fleabane (Erigeron hyssopifolius), butterwort (Pinguicula vulgaris), sweet broom (Hedysarum alpinum var. americanum), tufted bulrush (Scirpus caespitosus), bird's-eye primrose (Primula mistassinica), purple hairgrass (Deschampsia atropurpurea), and felwort (Gentiana amarella). The notch is the only known station of the early sandwort (Arenaria rubella), and of the moss, Plagiobryum zierii (Worley 1980), in the eastern United States. Smuggler's Notch is also known as a haven for ferns and several of its rare species are ferns. It is known (Stewart 1980) to have been the location for one of the state's peregrine falcon eyries. Presently, this endangered species is not known to breed in Vermont.

### Critical Features

A nearly unique habitat for New England with several arctic plant species at the southern limits of their ranges. An outstanding example of this kind of habitat, with a number of plants on the state's rare and endangered list.

### Rare and Endangered Species

#### Plants:

Arenaria rubella

Carex aratririformis

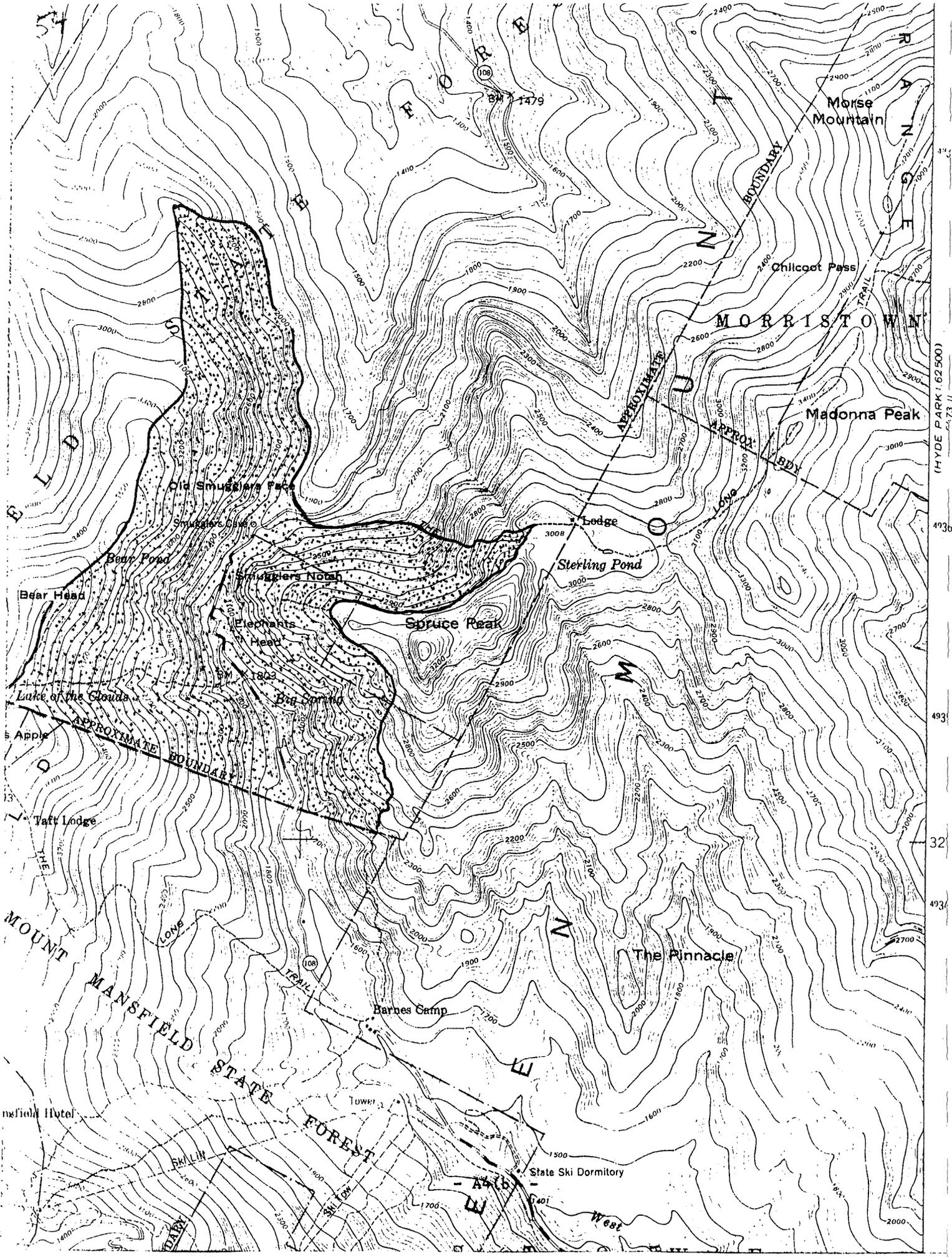
Castilleja septentrionalis

Gentiana amarella

Hedysarum alpinum var. americanum

Pinguicula vulgaris

Primula mistassinica



54

4936

(HYDE PARK 1:62500)  
5473 II

4936

4936

32

4936

Mansfield Hotel

State Ski Dormitory

West

Saxifraga aizoides

Saxifraga aizoon var. neogaea

Saxifraga oppositifolia

Trisetum spicatum var. pilosiglume

#### Evaluation Categories

- (1) Knowledge: researched and documented (see references) both botanically and geologically over a more-than-100-year span; this is one of the state's best-known sites. Considered likely (Bell 1980) to have relict populations of arctic and subarctic invertebrates, but studies are lacking.
- (2) Representation: one of only three areas in the state with an arctic cliff flora; clearly one of the two best.
- (3) Diversity: classified as a significant arctic/alpine community; as a significant bedrock feature of the landscape; and as a habitat for endangered plant species.
- (4) Scarcity: this kind of assemblage of plants is even more of a rarity outside of Vermont (east of the Rocky Mountains) than within the state. The few sites in Vermont take on added significance when viewed in this light.
- (5) Status: subject to visitation but as the vegetation is scattered over cliffs and ledges, the main impact of visitors is minor. Botanical over-collecting continues to be a threat, however.
- (6) Persistence: apparently not a successional community; likely to remain stable over a reasonably long period of time.
- (7) Distribution: the two areas proposed for the Registry are relatively widely spaced in their geographic locations.
- (8) Manageability: capable of being protected through existing programs, Act 250, and Forests, Parks and Recreation regulations.
- (9) Area Size Needs: sufficient to include most of the cliffs and ledges with rare plant species. Expansion of state's holding here would be desirable to provide a more substantial buffer zone.
- (10) Habitat Specificity: endangered species of this community are restricted to this site type.
- (11) Mobility: not applicable.

#### Ownership

Vt. Dept. of Forests, Parks and Recreation owns all the west side and some of the east (Mt. Mansfield State Forest); the Mt. Mansfield Company owns a parcel around Elephants Head.

#### Recognition

Primary Natural Area (Vt. Nat. Resources Council)

56

Management/Protection Strategy

- (1) Continued monitoring through Vermont Public Law 250, and Forests, Parks and Recreation regulations.
- (2) Purchase of or exchange for the private-in-holding around Elephants Head.
- (3) District prohibition of rock climbing within the entire natural area.

References

- Barneby, R.C. 1964. Atlas of the North American Astragalus. Memoir of the N.Y. Botanical Garden 13:1-594; 597-1288.
- Bearse, R. 1968. Geology of Vermont (in Vermont: a Guide to the Green Mountain State). Houghton Mifflin Co.: Boston.
- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Bowley, D.R. 1973. The environment of Schistostega pennati (Hedn.) Hook & Tayl.: New Vermont stations. Rhodora 74(801):149-153.
- Bowley, D.R. 1978. Contributions to the flora of Mt. Mansfield and Smuggler's Notch, Vermont: the lichens. Ph.D. Thesis. Boston, Univ., Boston, Mass.
- Christman, R.A. 1956. Geology of Mt. Mansfield State Forest. Vt. Geol. Survey. Montpelier, Vt.
- Countryman, W.D. 1978. Rare and Endangered Vascular Plant Species in Vermont. New Engl. Botan. Club and U.S. Fish and Wildlife Service.
- Evans, Llew 1944. Mount Mansfield: Capstone of Vermont. Appalachia (June).
- Fernald, M.L. 1933. Callitriche anceps in New England. Rhodora 35:185-186.
- Flaccus, Edward 1978. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Hagerman, Robert L. 1971. Mansfield - The Story of Vermont's Loftiest Mountain. Essex Publ. Co.. Essex Jct., Vt.
- Hancock, William et al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Jacobs, E.C. 1938. The geology of the Green Mountains of northern Vermont. Vt. State Geologist's 21st Rept. Montpelier.
- Jacobs, E.C. 1942. The Great Ice Age in Vermont. Vt. State Geol. 23rd Rept. Montpelier.
- Jacobs, E.C. 1950. The physical features of Vermont. Vt. State Development Dept.. Montpelier.

- Johnson, Charles 1980. The Nature of Vermont. University Press of New England: Hanover, N.H.
- Kennedy, George G. 1904. Flora of Willoughby, Vermont. Rhodora 6(66):93-134.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Moore, H.P. 1861. Mount Mansfield and its environs. Moore's New England: Concord, N.H.
- Stephens, R. 1967. The Green Mountains. Vermont Life 21(4):34-45.
- Stewart, James 1980. Comments on fragile area draft (personal communication).
- Stewart, David P. 1961. The glacial geology of Vermont. Vt. Geol. Survey. Bull. 19. Montpelier.
- Vt. Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Nat. Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta., Univ. of Vt., Burlington.
- Walker, Lawrence R. 1977. Microenvironments of Saxifraga aizoon, S. oppositifolia, and S. aizoides in northern Vermont. University of Vt. M.S. Thesis (unpublished).
- Worley, Ian 1980. Notes in response to initial registry draft (personal communication).



## MISSISQUOI RIVER DELTA

### Location

Lat. 44° 58' 0" N, Long. 73° 10' 0" W. Franklin County. Towns of Swanton and Highgate. See accompanying map.

### Site Description

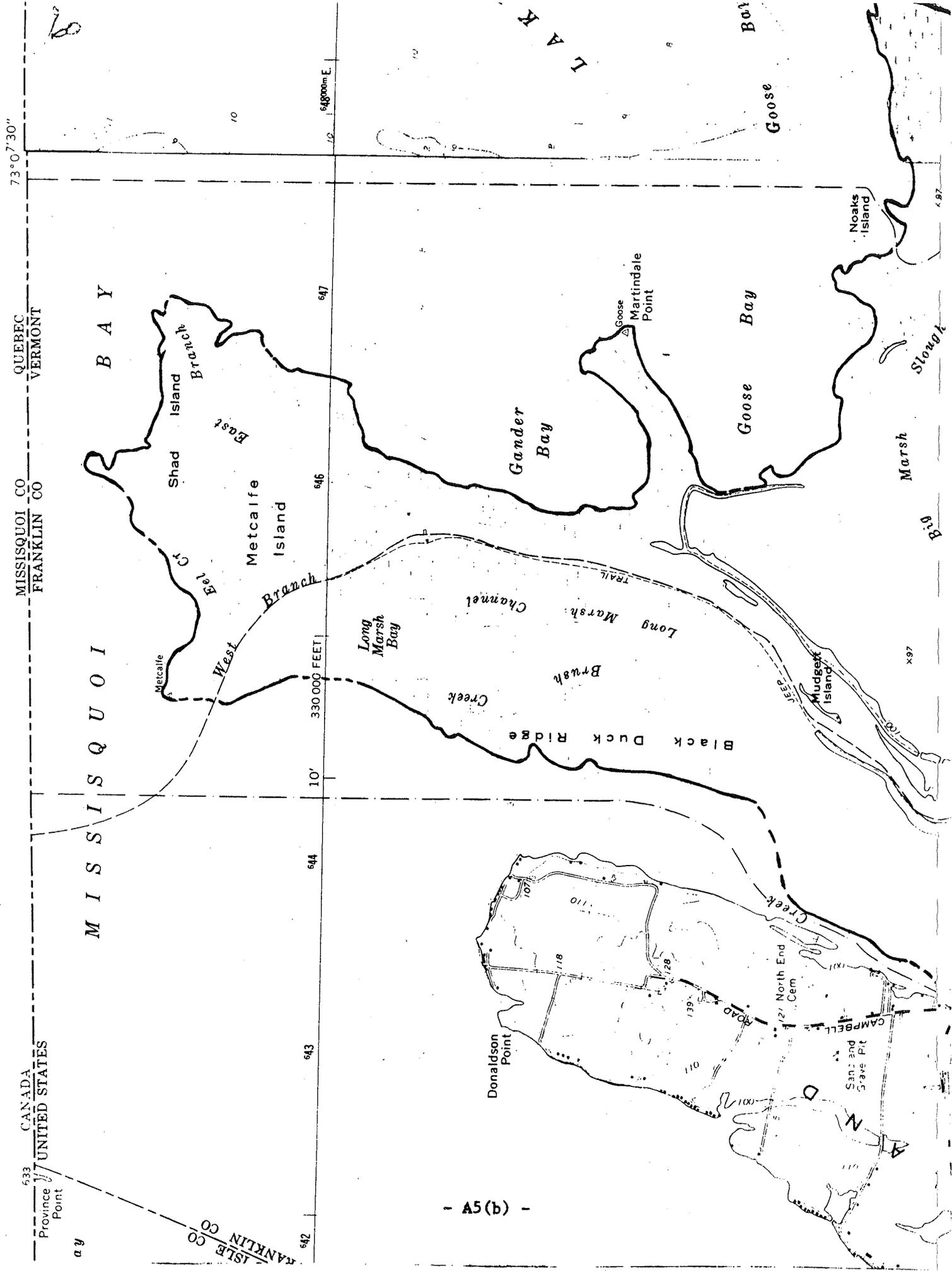
Approximately 1500 acres of freshwater marsh and swamp forest habitat at the delta of the Missisquoi River midway between Swanton and East Alburg, Vt. The delta itself is geologically distinctive, being one of few "bird's foot" deltas in the United States and a classic display area for postglacial depositional and shoreline geologic features. The marshes contain great floristic diversity and a wide range of life forms, from fully-submerged plants (eelgrass, pondweeds, coontail and bladderworts) to extensive populations of emergent types (great bulrush, bur-reed, pickerelweed, cattail, and sedges). A splendid (Vogelmann 1969) swamp forest occurs on the seasonally flooded margins of the marsh. These forests are dominated by silver maple and swamp white oak, with black alder and buttonbush occurring as common shrub associates. These wetlands are important as feeding and breeding areas for migratory waterfowl and wading birds, and a wide variety of songbirds. They also contain the principal spawning ground in the northern part of the state for a number of migratory game fish species. The area is also an important archaeological site for Indian antiquities (Day 1980).

### Critical Features

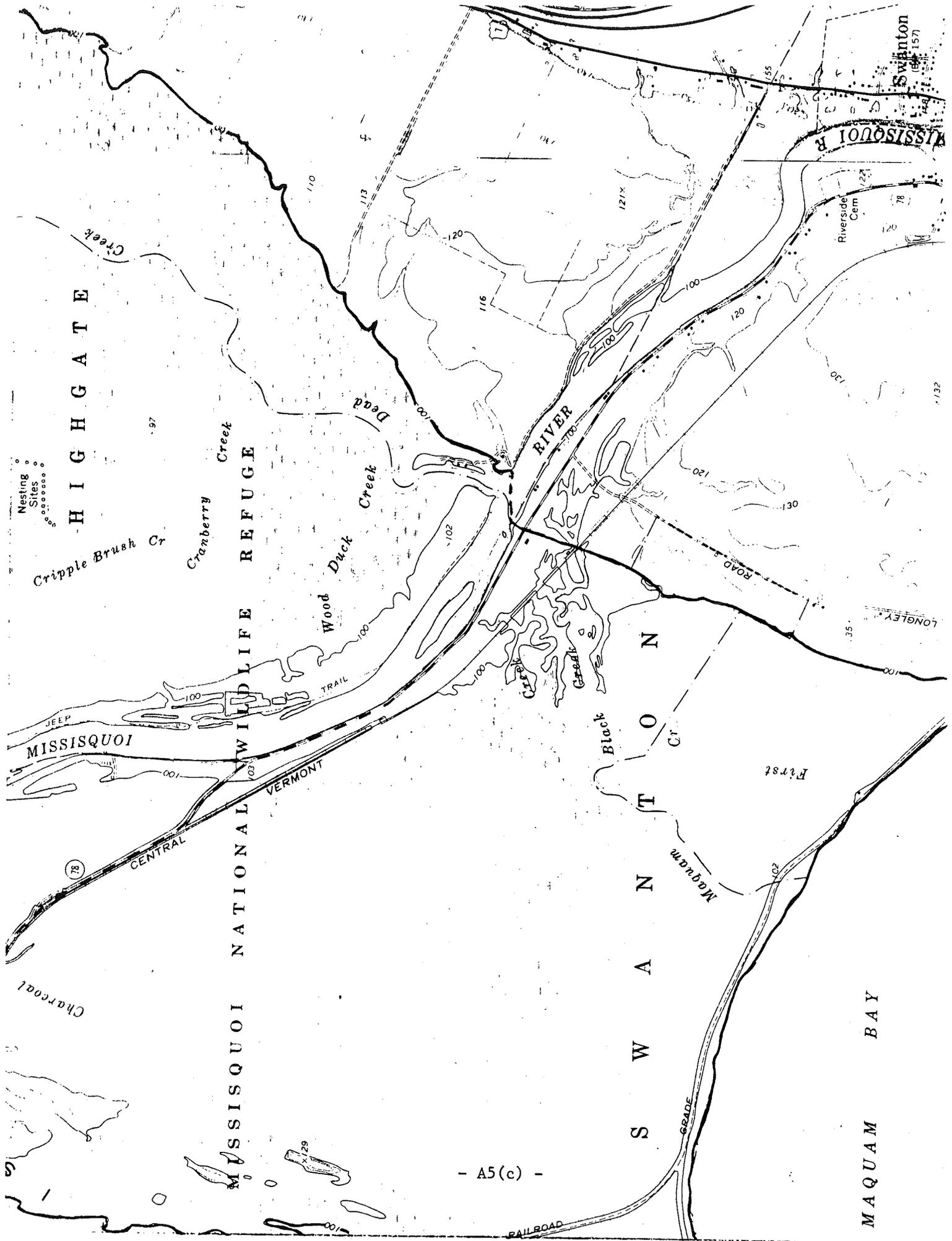
This is a particularly rich ecosystem and a large one. The variety of wildlife and the size of the populations it supports are testimony to its size, integrity, and the quality of stewardship it has enjoyed under the direction of the U.S. Fish and Wildlife Service. This extensive wetland complex, including the river itself, is a critical spawning habitat for migratory game fish species (notably walleye, pickerel, bass, muskellunge, and northern pike, the latter being the most notable and subject (Sladyk 1980) to habitat alteration. Of the resident and migratory bird populations found in the Missisquoi delta area the following have been classified (see references) as rare or endangered with Vermont:

- bald eagle (endangered)
- peregrine falcon (endangered)
- osprey (endangered)
- yellow rail (rare)
- least bittern (rare)

The area also contains one of the state's largest great blue heron rookeries. Viewed hydrologically this large deltaic deposit (Ratte 1980) has the potential for being a major source of potable ground water for northwestern Vermont.



- A5(b) -



Nesting Sites

H I G H G A T E

M I S S I S Q U O I N A T I O N A L W I L D L I F E R E F U G E

S W A N T O N

M A Q U A M B A Y

- A5(c) -

## Evaluation Categories

- (1) Knowledge: this area's research and documentation goes back nearly 100 years and has continued into recent years with studies associated with developing an understanding of the Lake Champlain Basin as a whole (see references).
- (2) Representation: numbered among ten large marshes within the state, Missisquoi stands out because of its diversity, stability of ownership, and its key position along the Champlain flyway. It is the only area chosen to represent the needs of migrating fish.
- (3) Diversity: classified as a freshwater marsh environment, as a swamp forest, and for its value as a spawning habitat for restricted fish species, Missisquoi is an excellent representative of all these categories, as well as being a classic geologic study area for the observation of postglacial depositional features.
- (4) Scarcity: one of ten large marsh complexes in the state, this one is proposed because of its quality and for the populations (rare birds and valuable game fish) it supports.
- (5) Status: largely owned by the U.S Fish and Wildlife Service and managed according to government regulations. Public access is limited, as is public impact. Because of the position of the river relative to the town of Swanton this area is subject to the influences (and effluents) of the town, however.
- (6) Persistence: this will depend on continued exposure to the quality and quantity of Lake Champlain's water level fluctuation the marsh and swamp have lived with for centuries. A different regimen would probably have drastic effects (a drier one would quickly allow the replacement of aquatic forms with those more characteristic of the uplands, and a considerable loss of food and habitat for waterfowl and other aquatic species (this would be true for all of the Champlain marshes).
- (7) Distribution: the only Franklin County marsh and swamp recommended for inclusion in the Registry. Plays an important role in providing an unbroken series of marshes along the Champlain Valley from Lake George to the St. Lawrence River. No other river fulfills the role this one plays for the spawning species involved.
- (8) Manageability: capable of being intensively managed for resident and migratory water birds and other wildlife and protected through existing programs, Act 250, the Clean Air and Water Act, and through cooperative understanding developed between Fish and Game scientists and town (Swanton) landowners and officials.
- (9) Area Size Needs: sufficient to include significant areas of both swamp forest and marshland (of a variety of types), and for facilitating the breeding requirements of the species involved.
- (10) Habitat Specificity: rare and endangered birds of this natural area are generally restricted to this site type (either marsh or swamp forest). The riverine habitat is critical for a significant part of the state's population of the fish species mentioned.

- (11) Mobility: plants not seasonally mobile; bird populations are migratory for the most part; these fish are migratory, but their genetic patterning calls for use of this particular waterway.

#### Ownership

U.S. Dept. of Interior - Fish and Wildlife Service Missisquoi National Wildlife Refuge, RD #2, Swanton, Vt. 05091, and a complex of state, municipal and private ownership.

#### Recognition

The Shad Island forest is a nationally recognized SAF Natural Area (only one of two in the state). The marsh is a primary natural area (Vt. Nat. Resources Council).

#### Management/Protection Strategy

- (1) Careful delineation of the area intended for recognition, based on further study of actual spawning grounds.
- (2) Continued monitoring and management in keeping with state and federal regulations.
- (3) Initiation of greater effort toward total wildlife censusing (particularly invertebrates) to improve knowledge of wildlife food resources.
- (4) Absolute resistance to any major change in Lake Champlain's water level fluctuation regime, such as proposed by the International Joint Commission.

#### References

- Baldwin, S.P. 1894. Pleistocene History of the Champlain Valley. Amer. Geol. 13:170-184.
- Barber, E., D.J. Bogucki, G.K. Gruendling and M. Madden 1977. Historical Land Use Changes and Impacts in Lake Champlain Wetlands. Lake Champlain Basin Study. New England River Basins Commission. Burlington, Vt..
- Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Commission. Burlington, Vt.
- Capen, David 1980. Comments on fragile areas draft (personal communication).
- Day, Ben 1980. Comments on fragile areas draft (personal communication).
- Fillon, Richard H. 1969. Sedimentation and recent geological history of the Missisquoi Delta. M.S. Thesis. University of Vermont. Burlington, Vt.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. Nat. Park Service. Natural Landmarks Program Research Report.

- Gruending, G.K. and Donald J. Bogucki 1978. Assessment of the Physical and Biological Characteristics of the Major Lake Champlain Wetlands. Lake Champlain Basin Study. New England River Basins Commission.
- Hancock, William et al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vermont Natural Resources Council. Montpelier, Vt.
- Perkins, George H. 1908. Report of the State Geologist of Vt. #6. Montpelier, Vt.
- Perkins, George H. 1918. The Physiography of Vermont. Report of the State Geologist of Vt. #11. Montpelier, Vt.
- Perkins, George H. 1931. Physiography of Vermont. Report of the State Geologist of Vt. #17. Montpelier, Vt.
- Pierce, C.H. 1923. Progress of Stream Gaging in Vermont. Report of the State Geologist of Vt. #13. Montpelier, Vt.
- Ratte, Charles 1980. Notes on fragile areas draft (personal communication).
- Sladyk, William 1980. Comments on fragile areas draft (personal communication).
- Vermont Endangered Species Subcommittee 1978. Revised preliminary list of endangered, threatened, and rare species of birds in Vermont. Vt. Agency of Env'tl. Conservation. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1969. Natural Areas in Vermont. Report 2. Vt. Central Planning Office. Montpelier, Vt.

## MOOSE BOG

### Location

Lat. 44° 41' 0" N, Long. 71° 43' 0" W. Essex County, Town of Ferdinand. See accompanying map.

### Site Description

Approximately 15 acres of shallow open water, a glacial kettle pond, surrounded by another 15-16 acres of a floating bog mat, over which are distributed most of the characteristic species of bog vegetation, including sphagnum moss, sedges, pitcher plant, sundew, and a variety of low heath shrubs. The bog mat grades into a peatland of higher shrubs, and then to an open to dense forest of black spruce and tamarack. The open area and surrounding bog forest occupy approximately 330 acres. An adjacent site of an additional 150 acres (in private ownership) along the same drainage as the bog pond, containing a combination of swamp forest (black spruce and white cedar) and upland boreal forest (red spruce, balsam fir, and white birch), is also included within this area.

### Critical Features

This bog is proposed for the Registry on the basis of its having features which place it in two classification categories: as a peatland, and as a habitat for bird, mammal, and plant species which are very restricted in their distribution within the state.

It is considered an exceptional boreal natural area; exceptional for its size, its wildness, and for the character of its living inhabitants.

Moose, black bear, white-tailed deer, and beaver inhabit the bog and surrounding forest, while unusual plant populations include the rare white form of the moccasin flower (sought and removed in quantity along with the pitcher plant and other bog species by commercial plant collectors). The populations most unique to the bog and its adjacent swamp and bog forests are the birds. In the boreal black spruce forest of this area the following species are of special note because of their placement on the proposed rare, threatened and endangered list of birds for the state:

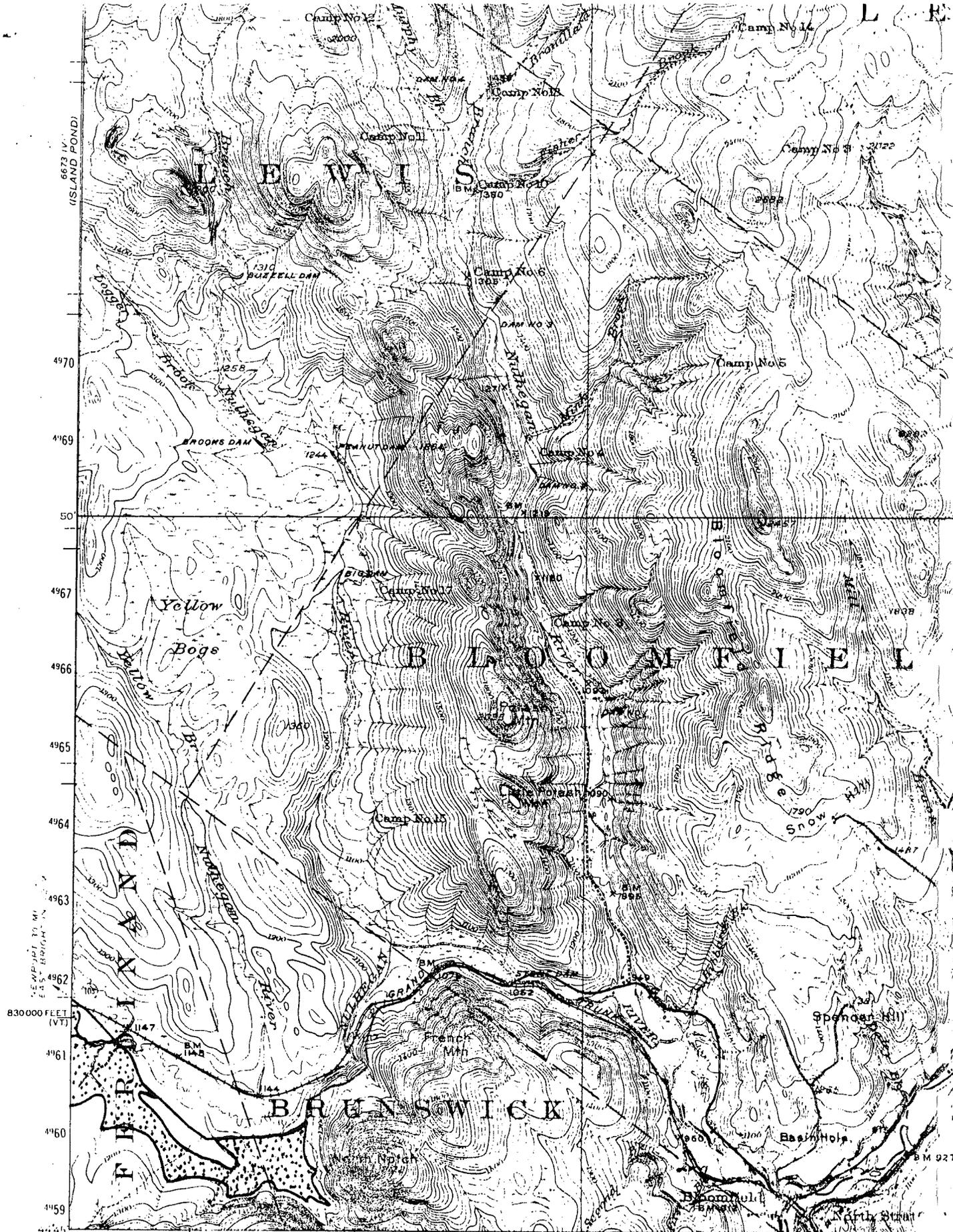
Spruce grouse (endangered)

Gray jay (threatened)

Black-backed three-toed woodpecker (threatened)

The latter has its primary Vermont breeding habitat in the Moose Bog area.

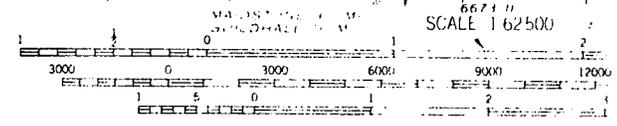
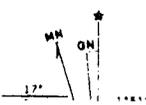
The area is also part of the largest deer yard (wintering area) in Vermont, and is crucial to the survival of the species in this section of the state.



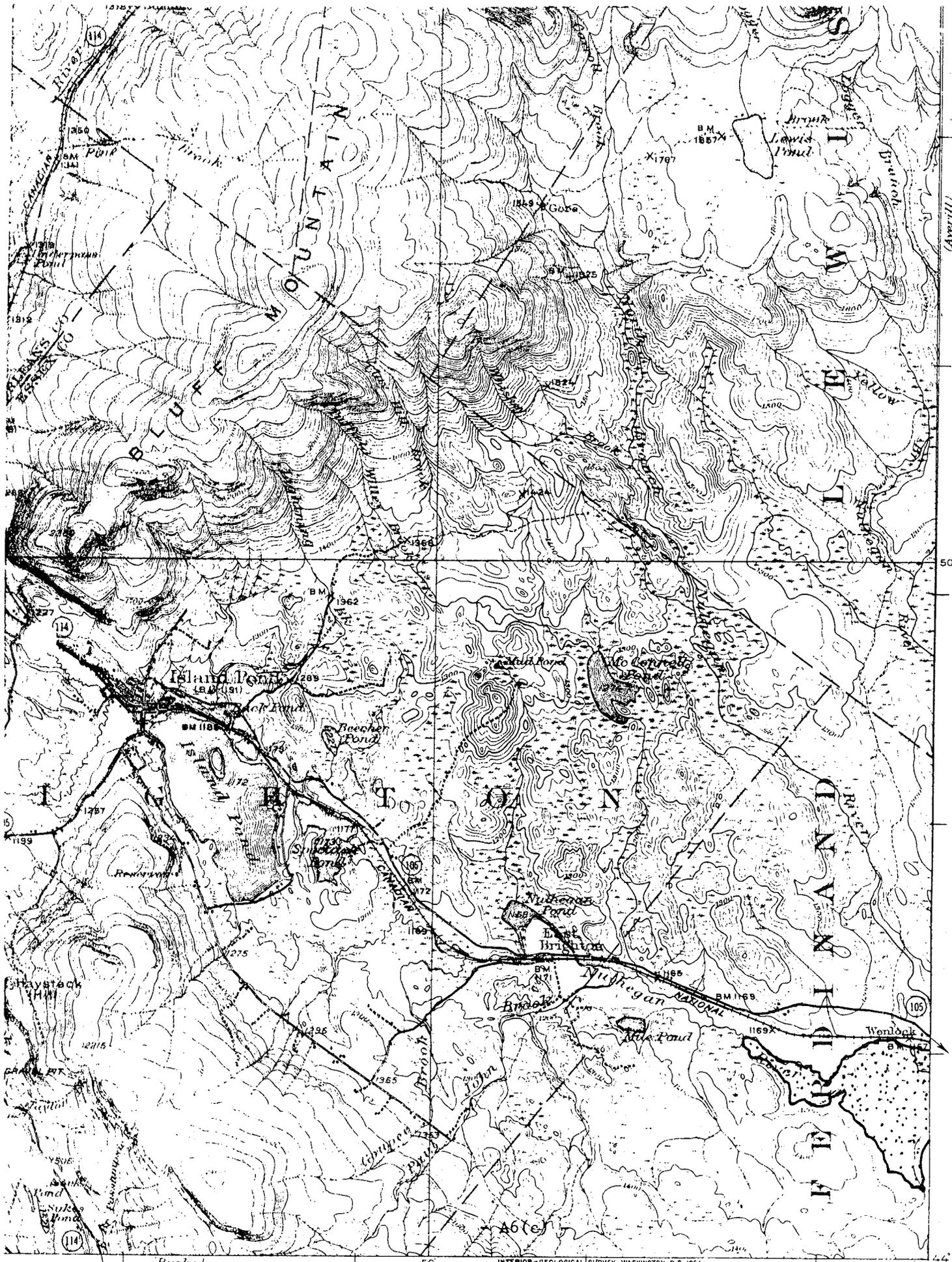
(BURKE)  
6673 III

Mapped, edited, and published by the Geological Survey  
 Control by USGS, USCGS, Vermont-New Hampshire Boundary  
 Commission, and International Boundary Commission  
 Topography by plane-table surveys 1926 Revised 1953  
 Polyconic projection 1927 North American datum  
 10,000-foot grids based on Vermont and New Hampshire  
 coordinate systems

- A6(b) -



(GUJL DHALI)  
6671 II  
SCALE 1:62,500



HAVEN 9.3 MI.  
 SONVILLE 20 MI.

(Burke)  
 SCALE 1:62500

50

INTERIOR- GEOLOGICAL SURVEY, WASHINGTON, D. C. 1954

71  
 45

ROAD CLASSIFICATION

BLOOMFIELD 6.2 MI.  
 LANCASTER 33 MI.

## Evaluation Categories

- (1) Knowledge: most of our present information about this area has come from studies during the past eight years. Birds have been banded here regularly since 1972 and the Audubon Christmas Census has focused on the area, particularly in recent years. Vegetation and floristic inventories have been done, also in recent years.
- (2) Representation: one of four peatlands chosen for Registry. This habitat has a limited distribution in the United States as a whole and is of particularly good quality in Vermont, hence the proposal of several sites.
- (3) Diversity: classified as a significant peatland and also as a critical habitat for restricted species (beyond the usual degree of endemism characteristic of bogs in general).
- (4) Scarcity: though scarce in most states, bogs are relatively common in Vermont, thus a selective process has been exercised in the choice of this bog for the Registry. It is clearly an outstanding example of its kind, chosen on the basis of several criteria.
- (5) Status: 330 acres of this area secured by the state Fish and Game Department in May 1980 along with an additional 1670 acres of surrounding fields and forest. The adjacent 150 acres of swamp and upland forest is still in private ownership.
- (6) Persistence: as some bog communities are successional there is no assurance of long-term persistence of the Moose Bog communities in their present condition. Bog succession, compared with upland communities, is gradual, however, and one can predict relative stability for several human lifetimes, even with minor water level fluctuations due to beaver activities, which have apparently characterized the recent history of this bog.
- (7) Distribution: the only peatland proposed for the Registry in the northeastern part of Vermont.
- (8) Manageability: capable of management; some recommendations have been offered in a recent pre-acquisition plan (Jervis 1980).
- (9) Area Size Needs: for preservation of the critical area sufficient for the integrity of maximum peatland diversity and assurance of the favored habitat of the restricted species involved, means should be found for acquiring the 150-acre plot adjacent to the bog itself on the southeastern end of the newly-purchased property.
- (10) Habitat Specificity: the restricted breeding bird species of this habitat are mostly those dependent on the boreal wetland environment for their feeding and breeding requirements.
- (11) Mobility: plants of the area not seasonally mobile; some of the animal populations are, and use the bog differently in different seasons (though present the year round). Moose, black bear and white-tailed deer have definite seasons of use and non-use. The restricted bird species are all year-round residents, as well.

### Ownership

The 330 acre bog/forest plot is presently owned by the Vermont Fish and Game Department as a part of its recent (May 1980) purchase of 2000 acres in the area; the adjacent 150 acre swamp forest and upland boreal forest plot are owned by the St. Regis Paper Company. The entire area was purchased by the Fish and Game Department primarily for habitat and management for white-tailed deer.

### Recognition

Discovery of the biological significance of this bog has come too recently to have been included in natural area evaluation schemes. It was recognized in the Vermont Natural Areas Inventory in 1972 and included in the National Natural Landmarks Program search, without any major recognition. In view of recent findings relative to animal habitat, this area has again been proposed for Natural Landmark status. It is considered a Primary Unique and Fragile Area, according to the Vermont Breeding Bird Atlas (Laughlin 1980).

### Management/Protection Strategy

- (1) Designation as Fragile Area does not mean that the area will not be managed by the Fish and Game Department, but rather the habitat needs of critical bird species will be considered when management is being conducted.
- (2) Purchase or conservation easement of adjacent 150 acre swamp.

### References

- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior National Park Services. National Landmarks Program Research Report. 550 pp.
- Goodwin, B.K. 1963. Geology of the Island Pond Area, Vt. Vt. Geol. Survey Bull. 20. Montpelier, Vt.
- Jervis, R.A. 1977. Preliminary botanical survey of Moose Bog in Ferdinand, Vermont. Unpublished notes.
- Jervis, R.A. 1980. Pre-acquisition plan for Moose Bog, Ferdinand, Vt. Report to Nature Conservancy.
- Laughlin, Sarah 1980. Comments on fragile areas draft (personal communication).
- Metcalf, Marion 1972-1980 Annual bird-banding records. In possession of Mrs. Metcalf. Plainfield, Vt.

Oatman, Frank 1977. Proposal for an Island Pond Nature Preserve.  
Report submitted to Nature Conservancy.

Sladyk, William 1980. Comments on fragile areas draft (personal  
communication).

Vermont Endangered Species Subcommittee 1978. Revised preliminary  
list of endangered, threatened, and rare species of birds in  
Vermont. Vermont Agency of Environmental Conservation. Montpelier, Vt.

Vermont Institute of Natural Science 1976-1979. Vermont Breeding  
Bird Atlas Project. Moose Bog data sheet (unpublished.)  
Woodstock, Vt.

Vermont Institute of Natural Science 1973-1980 Records of Vermont  
Birds. Woodstock, Vt.

Vermont Natural Resources Council 1972. Vermont Natural Areas  
Inventory. New England Natural Resources Project. Montpelier, Vt.

## LONE ROCK POINT

### Location

Lat. 44° 29' 15" N, Long. 73° 14' 27" W. Chittenden County.  
Town of Burlington. See accompanying map.

### Site Description

One-hundred acre holding that includes textbook exposure of Champlain overthrust fault. The fault outcrops into Lake Champlain, showing older red cambrian dolostone resting on younger black ordovician shale. Best panoramas from the lake itself.

### Critical Features

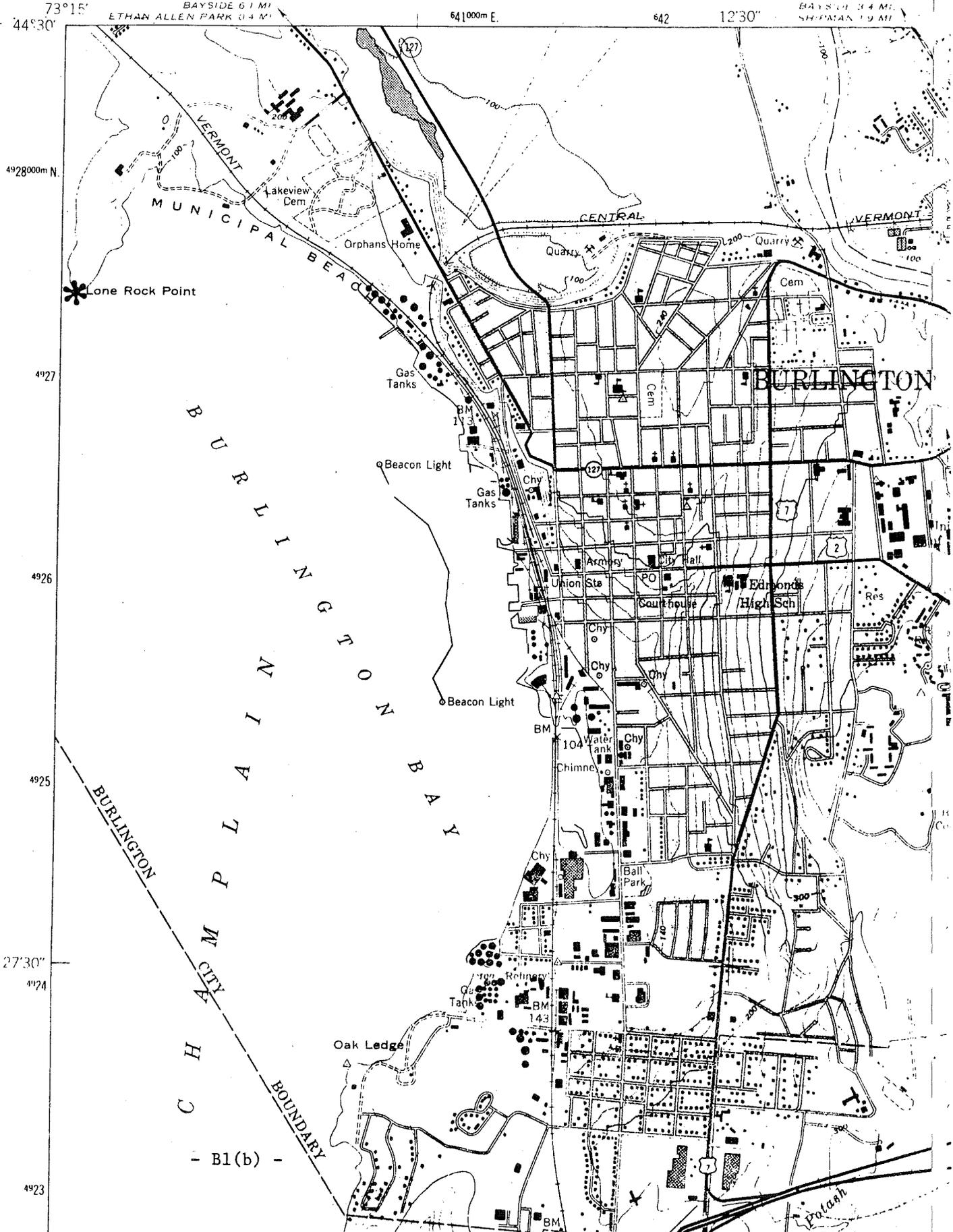
Considered one of the best examples of overthrusting in the United States and widely visited by international geologists and students of geology. This site chosen to represent the phenomenon of thrust faulting in several geologic texts.

### Evaluation Categories

- (1) Knowledge: well documented (see references) and described over a period of more than a century.
- (2) Representation: unique in New England for clarity of exposure and representation of this kind of geologic formation. Only example of this kind proposed for Registry.
- (3) Diversity: classified as significant for its bedrock features alone.
- (4) Scarcity: other exposure of Champlain overthrust in Vermont, but none as well defined as this one.
- (5) Status: nature of the site itself (extending into lake), the lack of intensive public visitation, and the stability of present ownership bode well for relatively permanent protection.
- (6) Persistence: not an issue here; has lasted more than 425 million years.
- (7) Distribution: being the only area proposed for its particular features, this site stands alone in its category. Its distribution, thus, is not at issue.
- (8) Manageability: has recognized value and minimal threat to its continued existence from competing demands for cliff-face shoreline.
- (9) Area Size Needs: sufficient to include critical area of exposure.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

73  
6373 (USE  
COLCHESTER  
POINT)

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY



- B1(b) -

Ownership

Episcopal Diocese of Vermont, Rock Point, Burlington, Vermont.

Recognition

Vermont Natural Areas Inventory (Vt. Nat. Resources Council).

Primary Natural Area (Vermont Natural Resources Council).

Worldwide geological recognition through visitation, study and textbook photographs.

Management/Protection Strategy

- (1) Monitoring of site to assess any impacts from possible increase in visitation.
- (2) Secure conservation easement that would assure perpetuation of site in the face of any possible conflicting land-use demands.

References

Bearse, R. 1968. Geology of Vermont (in Vermont: a Guide to the Green Mountain State). Houghton-Mifflin Co.. Boston.

Billings, E. 1862. Further observations on the age of the Red Sandrock formation of Canada and Vermont. Amer. Jour. Sci. 33(2):100-105.

Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Commission.

Gordon, C.E. 1921. Studies in the Geology of Western Vermont. Rept. of State Geologist #12.

Hancock, William, et.al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.

Hard, W.R., Jr. 1959. Lake Champlain - Land and Water. Vermont Life 13(4):2-7.

Jacobs, Eldridge C. 1950. The Physical Features of Vermont. Vt. State Development Dept., Geological Survey. Montpelier, Vt.

Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.

Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier, Vt.

Newton, E.W. 1947. The geography and geology of the Green Mountain State. Vermont Life 2(1):4-8; 41-45.

Perkins, G.H. 1919. The physiography of Vermont. Science (new series) 49:77-81.

Sargent, F.O., H.W. Vogelmann and R.S. Stanley. 1970. Lake Champlain Basin Studies. No.6. Natural Areas in Chittenden Co. Lake Champlain Committee. Burlington, Vt.

Stephens, R. 1967. The Green Mountains. Vermont Life  
21(4):34-35.

Vermont Natural Resources Council 1972. Vermont Natural Areas  
Inventory. New England Natural Resources Project.  
Montpelier, Vt.

Welby, Charles W. 1961. Bedrock geology of the central  
Champlain Valley of Vermont. Vt. Geological Survey.  
Bulletin #14.

## CHAZYAN CORAL REEF

### Location

Lat. 44° 51' 15" N, Long. 73° 20' 23" W. Grand Isle County.  
Town of Isle La Motte. See accompanying map.

### Site Description

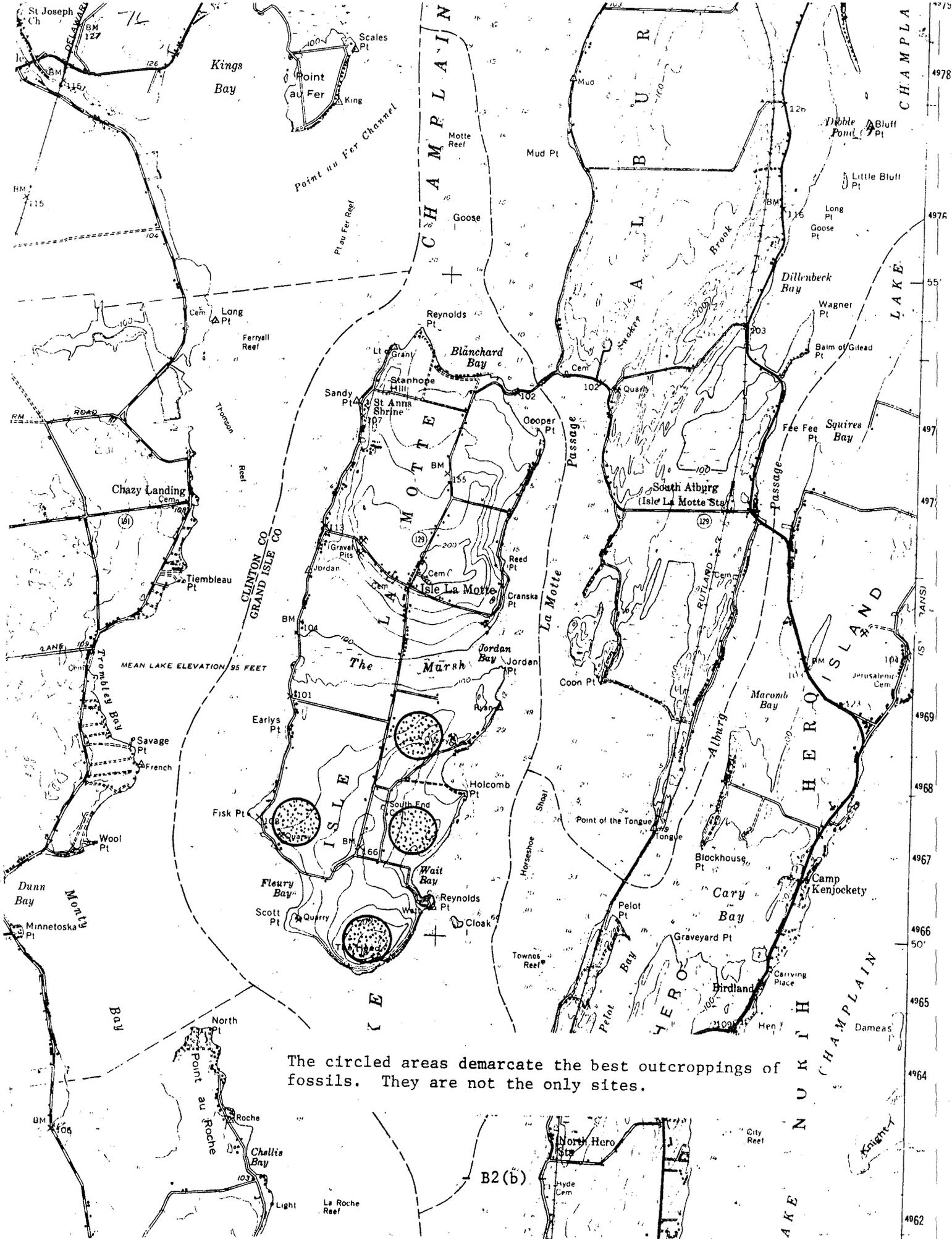
Largest sections (approx. 160 acres) of the island of Isle La Motte in northern Lake Champlain contain outcroppings of the oldest coral reef in the world. At least 500 million years in age, the rocks of this fossil reef are exposed in many places on the island and contain excellent examples of the marine invertebrate life of that period.

### Critical Features

An extremely important geologic area regionally, even on a world wide basis. An important paleontological laboratory for Vermont students and scientists.

### Evaluation Categories

- (1) Knowledge: well documented geologically over a more-than-100-year period (see references). Paleoecology of the reefs has also been studied.
- (2) Representation: this area stands alone on the Registry as a representative of its kind of physical feature in Vermont.
- (3) Diversity: this area represents a single classification category, that of a significant bedrock feature.
- (4) Scarcity: while Isle La Motte contains an unbroken sequence of tilted Ordovician sedimentary rocks, providing the student of invertebrate paleontology with an exciting natural evolutionary laboratory, this sequence itself is not unique, even within Vermont. Its reef outcroppings, however, and the clear exposures of reef structure and its biological content, are unique to the state and stand among the world's best representations of Ordovician coral reefs.
- (5) Status: this area is largely in private ownership and, for the most part, is routinely grazed by dairy herds. Little attention is given the area, except by scientists and schools and nature study groups.
- (6) Persistence: Given some provision for discouraging removal of fossils, this area should be able to retain its value as a natural area indefinitely.
- (7) Distribution: not applicable; not an equivalent site elsewhere in the state.
- (8) Manageability: present land-use practice (private ownership, with grazing of cows) is favorable to maintenance of short-grass cover, which permits ready accessibility and visual observation of reef outcroppings.



The circled areas demarcate the best outcroppings of fossils. They are not the only sites.

B2(b)

(9) Area Size Needs: sufficient for observation of geologic features.

(10) Habitat Specificity: not applicable.

(11) Mobility: not applicable.

#### Ownership

Private holdings. Permission to visit is required. Inquiry through Town Clerk's Office, Isle La Motte, Vermont 05463.

#### Recognition

Vermont Natural Areas Inventory (Vt. Nat. Resources Council).

Primary Natural Area (Vt. Nat. Resources Council).

Worldwide recognition by geologists and paleontologists; included in field excursion itineraries and pictured in textbooks (see references).

#### Management/Protection Strategy

- (1) Protection of some of the island's reef outcroppings through acquisition or conservation easements by a conservation organization.
- (2) Efforts to maintain the present grazing practices, as they keep the grass short and retard plant succession that would, without the grazing, allow the pastureland to revert to forest, obscuring the outcrops from view.
- (3) Efforts to discourage removal of fossils from the area, as this practice often involves destruction of reef surfaces and leaves the site lacking in some of the best and most obvious representatives of this ancient ecosystem.

#### References

- Adams, A.N. 1875. The geology of Vermont as developed along the western border in the oldest fossiliferous rocks of the continent. pp.3-6.
- Bearse, R. 19-8. Geology of Vermont (in Vermont: A Guide to the Green Mountain State. Ch. 3, p.23-27. Houghton-Mifflin Co.: Boston.
- Brainerd, E. and H.M. Seely 1890. The calciferous formation in Champlain Valley. Geol. Soc. of Amer. Bull. v.1, p.501-516.
- Brainerd, E. and H.M. Seely 1891. The Chazy Formation in the Champlain Valley. Geol. Soc. of Amer. Bull. v.2, p.293-300.
- Brainerd, E. and H.M. Seely 1896. The Chazy of Lake Champlain. Bull of Amer. Mus. of Nat. Hist. 8(21):pp.305-315.
- Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Comm.
- Chamberlain, B.B. 1968. Vermont's Billion-Year Past. Vermont Life. 22(3):p.47-53.

- 72
- Cooper, G.A. 1956. Chazyan and related brachiopods. Smithsonian Inst. Misc. Collections. v.127 parts I & II.
- Erwin, R.B. 1955. Biostromes and bioherms in the Lower-Middle Ordovician of Isle La Motte, Vt. Master's Thesis. Brown Univ. Providence, R.I.
- Erwin, R.B. 1957. The geology of the limestone of Isle La Motte and S. Hero Island, Vt. Vt. Geol. Survey Bull. no.9. 94 pp.
- Finks, R.M. and D.F. Toomey 1972. Paleoecology of Chazy reef-mounds. In Guidebook, N. Eng. Intercolleg. Geol. Conf. 64th Ann. Mtg. pp. 443-456.
- Flower, Rousseau H. 1955. New Chazyan Orthocones. Jour. of Paleontology 32(3): p. 433-458.
- Gordon, C.E. 1921. Studies in the geology of Western Vermont. Rept. of the Vt. State Geologist #12.
- Hancock, William, et. al. 1978. The Vermont Atlas and Gazetteer. David Delorme Co.: Yarmouth, Me.
- Indridason, Louise and Ottar 1974, Vermont Natural Areas Part 4. Miller Brook Cirque and The Chazyan Reefs. Vermont Life 28(3): pp.50-53.
- Jacobs, E.C. 1950. The physical features of Vermont. Vt. Geol. Survey: Montpelier.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England: Hanover, N.H.
- Kapp, U.S. and C.W. Stearn. 1975. Stromatoporoids of the Chazy group (Middle Ordovician), Lake Champlain, Vermont and New York. Jour. Paleontology. vol.49(1): pp.163-186.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council Montpelier, Vt.
- Moore, R.C., C.G. Lalicker and A.G. Fisher 1952. Invertebrate fossils. McGraw-Hill: N.Y.
- Oxley, Philip 1950. Chazyan stratigraphy west of the Champlain thrust, New York and Vermont (abs.) Geol. Soc. Amer. Bull. vol.61. p.1492.
- Oxley, Philip and G.M. Kay 1959. Ordovician Chazyan series of Champlain Valley, New York and Vermont, and its reefs. Amer. Assoc. Petrol. Geol. Bull. vol. 43(4): p.817-853.
- Perkins, G.W. 1902-1906. Reports of the State Geologist. Nos. 3-5. Montpelier, Vt.
- Raymond, P.E. 1910. Trilobites of the Chazy of the Champlain Valley. Rept. of the State Geologist #7.
- Raymond, P.E. 1925. The oldest coral reef. Rept. of the Vt. State Geologist #14. p. 72-76.
- Seely, H.M. 1904. The stromatoceria of Isle La Motte. Vt. State Geol. 4th Rept. pp. 144-152.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.

Welby, Charles W. 1961. Bedrock geology of the central Champlain Valley of Vermont. Vt. Geol. Survey Bull. #14.

Welby, Charles W. 1962. Paleontology of the Champlain Basin in Vermont. Spec. Publ. #1 Vt. Geol. Survey. Vt. Develpt. Dept. Montpelier.

Whitney, S.T. 1966. Grand Isle County. Vermont Life vol. 20(4) pp. 16-26.



## QUECHEE GORGE

### Location

Lat. 43° 38' 13" N, Long. 72° 24' 30" W. Windsor County. Town of Hartford. See accompanying map.

### Site Description

An outstanding part of Vermont's geologic heritage, Quechee Gorge is a deep (140'), narrow ravine with nearly vertical walls, cut by the Ottauquechee River. Located about midway between Woodstock and White River Jct., the gorge is spanned by the Route 4 highway bridge near its midpoint. The steep ravine slopes are forested with hemlock and a mixture of hardwood and other conifer species. Some of these forests are untouched. The wet, dripping ravine walls and ledges, accessible along the river from below, harbor a rich and colorful boreal flora.

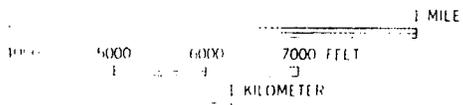
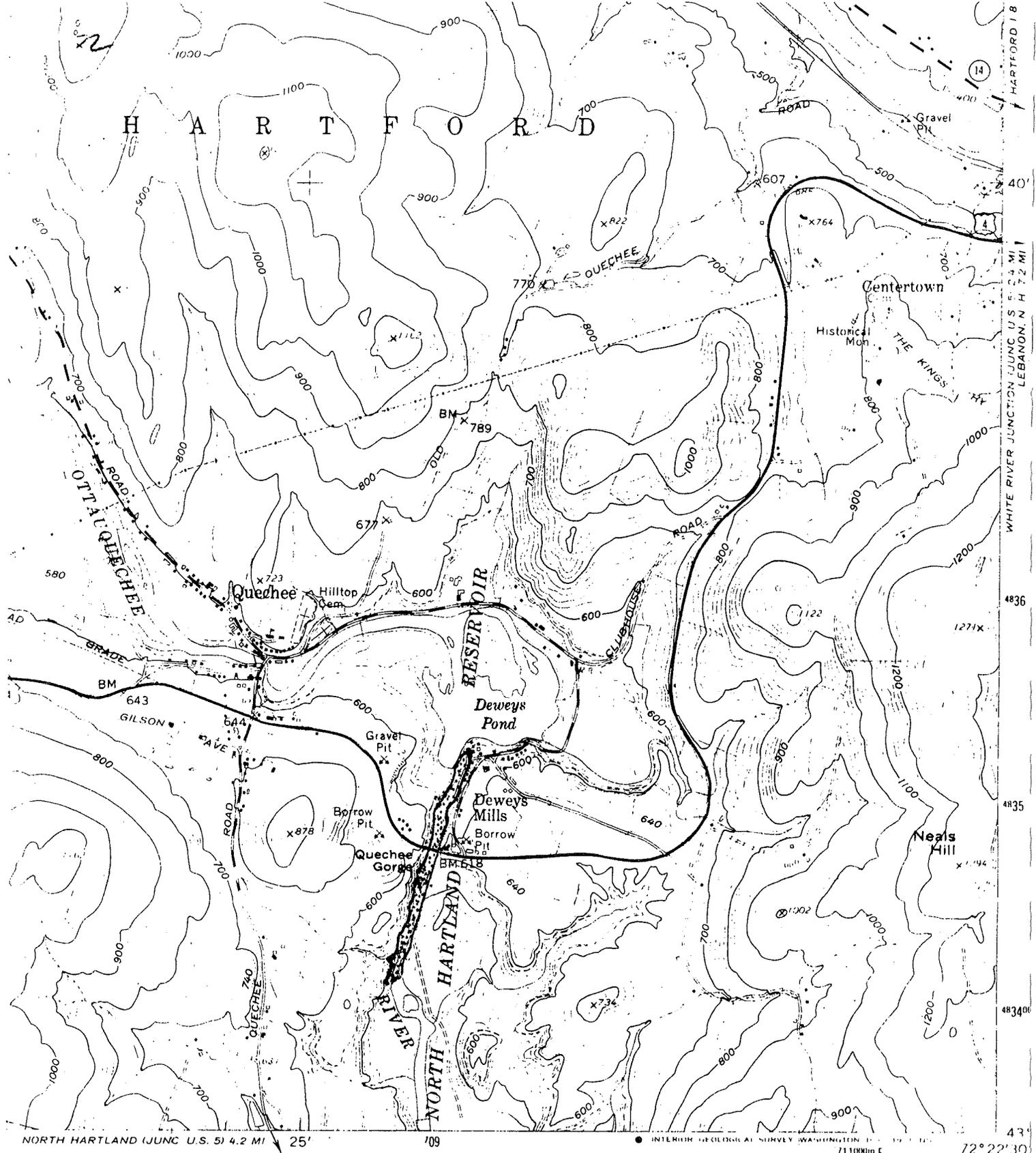
### Critical Features

The integrity of the gorge itself, with its forests, ledges and ferns and wildflowers, is the main critical feature here. Continued stewardship of the kind the gorge has seen to date should result in its persistence for many generations. Two rare ferns, the northern and smooth woodsias, are found on Quechee's cliffs near the bottom of the gorge. Both are considered disjunct in their distribution and are at the southern limit of their range.

Quechee Gorge was, for a number of years, the only known habitat for the rare ground beetle, Bembidion rufotinctum Chaudoir. This beetle demands rock ledges with a scum of algae, and must live within a few feet of the swift flowing waters of a large river. Recently it has been discovered at several additional sites in Vermont and New Hampshire. However, proposals to increase the construction of small hydroelectric power plants along New England rivers might put it in peril except at some of these other locations.

### Evaluation Categories

- (1) Knowledge: descriptions and references to Quechee Gorge are not difficult to find. Actual studies of its formation and vegetation and other ecological features are available, but not in great abundance.
- (2) Representation: the only feature of its kind proposed for the Registry.
- (3) Diversity: classified as a significant geologic feature but with the presence of the two rare woodsias the area also qualifies as a habitat for species limited in their range.
- (4) Scarcity: no other gorge of similar depth and botanical interest in the state.
- (5) Status: minimal human disturbance at present.



ROAD CLASSIFICATION

- Heavy-duty Light-duty
- Medium-duty Unimproved dirt
- U.S. Route State Route



- B3(b) -

QUECHEE, VT.

NW/4 HANOVER 15 QUADRANGLE

- (6) Persistence: the gorge has every chance of persisting intact for many more centuries, although its forest composition may change with time. Possible threats lie in the area of water management: (1) if the Corps of Army Engineers decided to enlarge its storage pond at Hartland Dam there could be partial inundation of the gorge; and (2) if proposed hydroelectric dams upstream fail to allow minimum discharge, water could be prevented from flowing through the gorge.
- (7) Distribution: not applicable, since this is the only gorge currently being proposed for Registry.
- (8) Manageability: to a large extent capable of being protected through existing programs and through stewardship agreements with the departments of Water Resources and Forests, Parks and Recreation. Direct management responsibility lies in the hands of the Department of Forests, Parks and Recreation (through agreement with Water Resources), which has a resident seasonal ranger and owns property adjacent to the west side of the gorge.
- (9) Area Size Needs: sufficient to include the entire gorge.
- (10) Habitat Specificity: the two endangered plants of this community are restricted to wet ledges such as are found in this location.
- (11) Mobility: not applicable.

Ownership

U.S. Corps of Army Engineers. Regional Office, North Springfield, Vt. 05150.

Recognition

Vermont Natural Areas Inventory (Vt. Nat. Resources Council).

Management/Protection Strategy

Continued monitoring through Vermont Public Law 250 and federal regulations. Some threats exist in area of possible mismanagement of watershed (see (6) above).

References

Bearse, R. 1968. Geology of Vermont (in Vermont: a Guide to the Green Mountain State). Houghton Mifflin Co.. Boston.

Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).

Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine - Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service. Natural Landmarks Program Research Report.

Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.

24  
Johnson, Charles 1980. The Nature of Vermont. University Press  
of New England. Hanover, N.H.

Lyons, John B. 1955. Geology of the Hanover Quadrangle, N.H.- Vt.  
Geol. Soc. Amer. Bull.: 66(1):105-145.

Lyons, John B. 1958. The geology of the Hanover Quadrangle,  
New Hampshire. N.H. State Planning and Develpt. Comm.

Vermont Natural Resources Council 1972. Vermont Natural Areas  
Inventory. New England Natural Resources Project.  
Montpelier, Vt.

Vogelmann, H.W. 1969. Vermont Natural Areas. Report 2. Vt.  
Central Planning Office. Montelier.

## TEXAS FALLS

### Location

48° 50' 7" N, 72° 54' 0" W. Addison County. Town of Hancock. See accompanying map.

### Site Description

Five acre gorge of deeply carved and highly polished boulder terrain with waterfalls, rapids and glacial potholes. Shaded by hardwood/conifer mixture.

### Critical Features

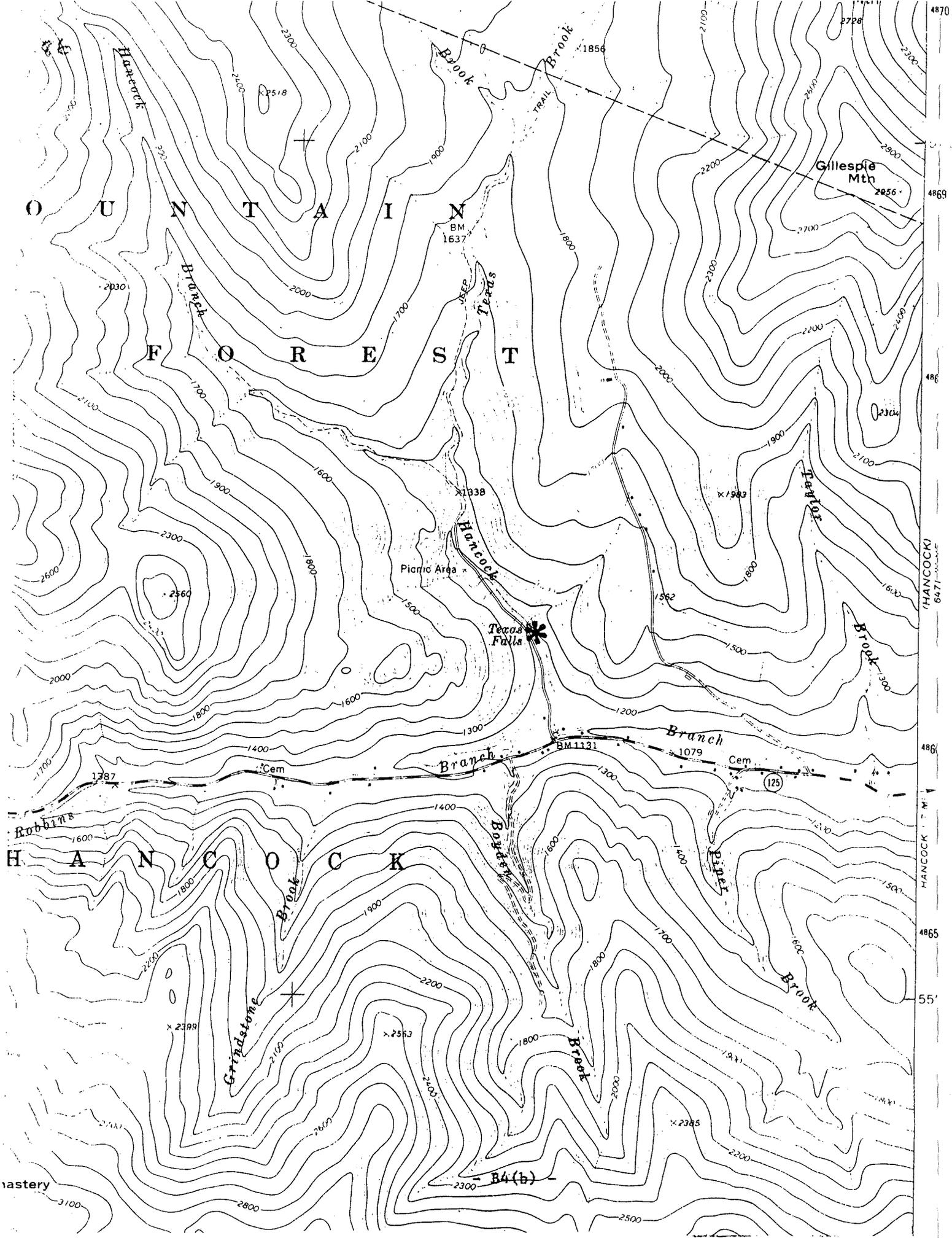
As with other scenic geologic areas, the peripheral forest is probably more fragile than the site itself and requires some management and protection for the maintenance of the scenic quality of the area as a whole.

### Evaluation Categories

- (1) Knowledge: first described in 1823. Widely visited and studied as example of scouring by glacial melt water.
- (2) Representation: only area of its type chosen for Registry.
- (3) Diversity: selected as a prime example of particular bedrock features (waterfalls with glacial scouring) which have scenic value as well.
- (4) Scarcity: chosen for its particularly good examples of several aspects of glacial scouring. No other waterfalls, as such, are proposed for Registry.
- (5) Status: natural conditions of stream and streambank environments not readily influenced by the kind and amount of public use this area receives. Geologic features even less susceptible to disturbance.
- (6) Persistence: not threatened.
- (7) Distribution: other sites exist but none selected for Registry. None of comparable quality. Question of distribution thus not applicable.
- (8) Manageability: capable of being managed through existing National Forest regulation.
- (9) Area Size Needs: sufficient to include critical features.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

### Ownership

U.S. Forest Service. Green Mountain National Forest.



OUONTAIN FOREST

Gillespie Mtn  
2956

Picnic Area

Texas Falls

Branch

Branch

HANCOCK

Grindstone

B4(b)

mastery

4870  
4869  
486  
486  
4865  
55'

Recognition

Vermont Natural Areas Inventory (Vt. Natural Resources Council).

Management/Protection Strategy

Continued monitoring through National Forest regulations.

References

- Badger, R.L. 1973. A study on the stratigraphy and structural relationships in Hancock, Vermont. Thesis, Middlebury College. Middlebury, Vermont.
- Hall, I. 1823. Notice of a curious waterfall and of excavations in the rocks. Amer. Journal of Science 6:252-254.
- Hancock, William, et. al. 1978. The Vermont Atlas and Gazetteer. David DeLormi Co.. Yarmouth, Me.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Lee, William S. 1955. The Green Mountains of Vermont. Henry Holt. New York.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vermont.



## WEYBRIDGE CAVE

### Location

Lat. 44° 3' 37" N, 73° 12' 22" W. Addison County. Town of Weybridge. See accompanying map. Only the cave itself and one acre around the entrance is the fragile area.

### Site Description

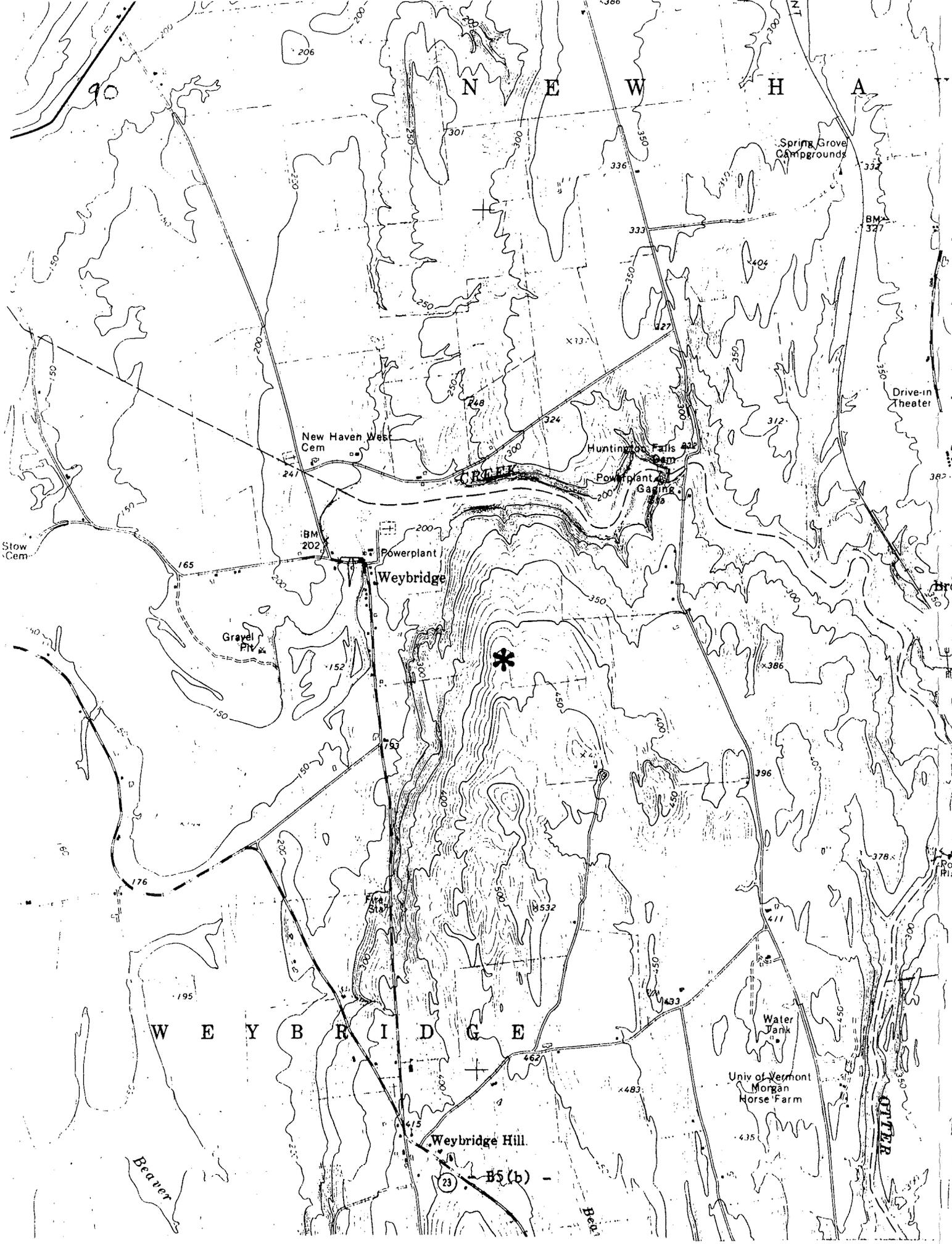
Large cave (five acres) produced by solution of limestone bedrock. Many chambers at different levels within this complex and interesting cave. Characteristic dripstone formations and wall and floor ornamentation present. Biological content of cave uncertain. Located within undeveloped 97 acre state park.

### Critical Features

One of states largest and most complex solution caves. Possibly a roosting and hibernation locale for bats.

### Evaluation Categories

- (1) Knowledge: physical features known from preliminary explorations. Maps drawn and descriptions written (see Dept. of Forests, Parks and Recreation). No data available on biological component of cave.
- (2) Representation: the only area on the proposed Registry chosen to represent the phenomenon of limestone solution cave formation.
- (3) Diversity: considered for its physical feature of a limestone cave, this area also contains a habitat of possible value to resident and migratory bats.
- (4) Scarcity: while caves are not uncommon in the Champlain Valley, this cave stands out as worthy of recognition because of its size, complexity and beauty.
- (5) Status: scarcely known to Vermonters and accessible only to experienced and well-equipped spelunkers, this cave seems assured of minimal human visitation. Efforts to control the impact of whatever level of visitation should be a part of park management strategy.
- (6) Persistence: its potential for persistence would be measured in geologic time if it weren't for the human factor; deposits, biota, and solution factors are very vulnerable in the face of visitation.
- (7) Distribution: because of the restricted distribution of extensive limestone deposits in Vermont, caves of this type are restricted accordingly. Only two caves were selected for the Registry and for different reasons. This one for its geology; Dorset for its biological significance.
- (8) Manageability: capable of minimal protection through existing programs and Forests, Parks and Recreation regulations. Cave regulations should be specifically written.



90

N E W H A

Spring Grove Campgrounds

New Haven West Cem

Huntington Falls

Stow Cem

BM 202

Powerplant

Weybridge

Powerplant

Garing

Gravel Pit

Water Tank

Univ of Vermont Morgan Horse Farm

Weybridge Hill

23 B5(b)

Beaver

Beaver

OTTER

- 31
- (9) Area Size Needs: more than adequate to protect critical cave features.
  - (10) Habitat Specificity: not applicable (unexplored biologically).
  - (11) Mobility: not applicable (see above).

Ownership

Vermont Department of Forests, Parks and Recreation. Montpelier, Vt.

Recognition

Vermont Natural Areas Inventory (Vt. Natural Resources Council)  
Dept. of Forests, Parks and Recreation Natural Area  
Management/Protection Strategy

- (1) Continued monitoring through Forests, Parks and Recreation regulations.
- (2) Drafting of specific cave visitation regulations that would spell out cave etiquette and specify fines for depredation.

References

- Hitchcock, Harold 1965-1968. Correspondence with Robert Carroll, Jr. Classified documents on file at office of Vt. State Geologist. Montpelier, Vt.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Scott, J. 1959. Caves in Vermont: A spelunker's guide to their location and lore. Killololect Independent Speleological Society: Hancock, Vt.
- Soule, J.M. 1967. Structural geology of a portion of the north end of the Middlebury synclinorium. Weybridge, Addison County, Vermont. Thesis. Middlebury College, Middlebury, Vt.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.

T2

## MILLER BROOK CIRQUE

### Location

Lat. 44° 28' 15" N., Long. 72° 43' 0" W. Lamoille County. Town of Stowe. See accompanying map.

### Site Description

Glacially carved basin with 1,000 foot walls and a variety of surficial geologic features characteristic of alpine glaciation. Acreage of the site between 1,200 - 1,300, surrounding and including Lake Mansfield in Stowe's Nebraska Valley. The area is defined by height of land above basin (watershed of Lake Mansfield) and geologic features adjacent to Miller Brook.

### Critical Features

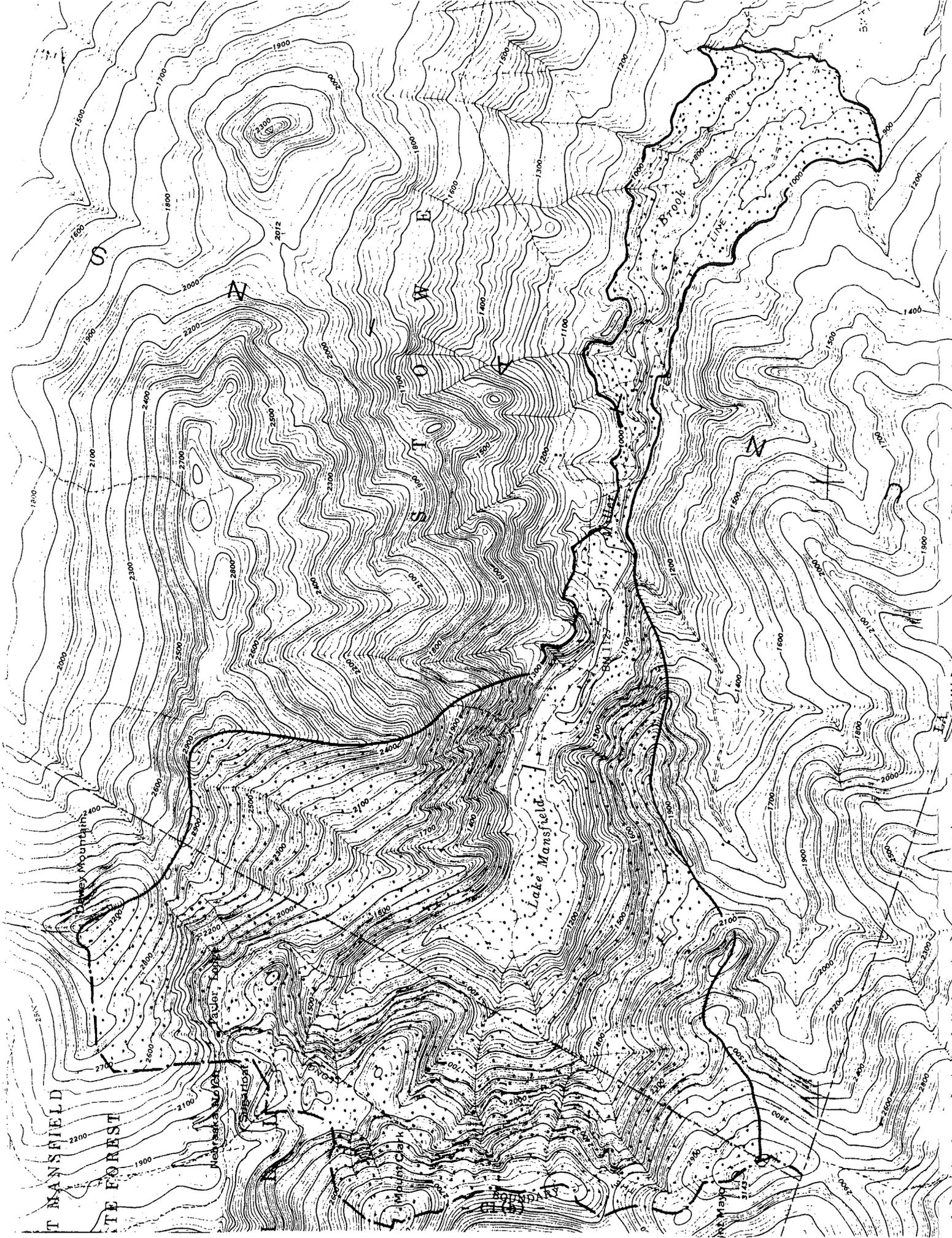
Within this area are contained many of the classic features of mountain valley glaciation; the cirque basin itself, moraines, kame and kettle topography, an esker delta, and a tarn lake (Lake Mansfield - now artificially impounded) at the head of Miller Brook. Considered one of the best examples of alpine glaciation in the United States east of the Rocky Mountains. An old-growth stand of hardwoods (2-3 acres) exists on the southern shore of Lake Mansfield.

### Evaluation Categories

- (1) Knowledge: well-known and described by geologists, and visited by geology students from a wide radius.
- (2) Representation: the only area proposed for Registry that has this particular array of geologic features.
- (3) Diversity: presented only as an example of surficial geology.
- (4) Scarcity: clearly the state's outstanding example of this particular array of glacial features.
- (5) Status: some of the major features of geologic interest here are under stress from sand and gravel mining operations.
- (6) Persistence: long-term potential for the most part, but not without some protection.
- (7) Distribution: not applicable, as no other sites currently chosen for Registry fall within this category.
- (8) Manageability: given the artificial impoundment of Lake Mansfield it is not possible to maintain the site under truly natural conditions. Future management must involve the entire valley if total preservation of glacial features is desired.
- (9) Area Size Needs: sufficient for demonstration of special features, probably irrespective of ownership or land-use practice (within reason).
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

### Ownership

Owned by the Vermont Dept. of Forests, Parks and Recreation and many private landowners.



MANSFIELD  
FOREST

Lake Mansfield

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37

### Recognition

Vermont Natural Areas Inventory (Vt. Nat. Resources Council).  
Primary Natural Area (Vt. Nat. Resources Council).  
Considered exemplary in written geological literature.

### Management/Protection Strategy

- (1) Large-scale protection of shoreline of Lake Mansfield by land acquisition or easements.
- (2) Preservation of important surficial geologic formations.

### References

- Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Commission.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Indridason, Louise and Ottar 1974. Vermont Natural Areas. Part 4. Miller Brook Cirque and the Chazyan Reefs. Vermont Life 28(3):50-53.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vermont Natural Resources Council. Montpelier, Vt.
- Ratte, Charles 1980. Notes on fragile areas draft (personal communication).
- Stewart, D.P. 1961. The glacial geology of Vermont. Vt. Geological Survey Bull. no. 19.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Wagner, W.P. 1971. Pleistocene mountain glaciation in northern Vermont. Geol. Soc. Amer. Bull. 81(8):2465-2469.



## SHELBURNE POND

### Location

Lat. 44° 23' 0" N, Long. 73° 10' 0" W. Chittenden County. Town of Shelburne. See accompanying map.

### Site Description

Located only a few miles south of Burlington, Shelburne Pond is the only undeveloped pond remaining in the Champlain Valley. It is especially remarkable for the fact that it still remains a semi-wild area despite its proximity to the urban sphere. The picturesque rocky shores, vertical bluffs, marshes and bogs, and wooded upland surrounding the 432 acre pond harbor a great variety of plant and animal life. Complex wetlands occupy large bays of the pond, most of its western side, and fill its outlet. There are swamp forests of elm and maple, dense alder and willow shrublands, expanses of cattail marshes and sedge meadows, and two bogs. Beaver, muskrat, otter, and many resident and migratory bird species breed in the wetlands surrounding the pond. Shelburne Pond is also a notable archaeological site.

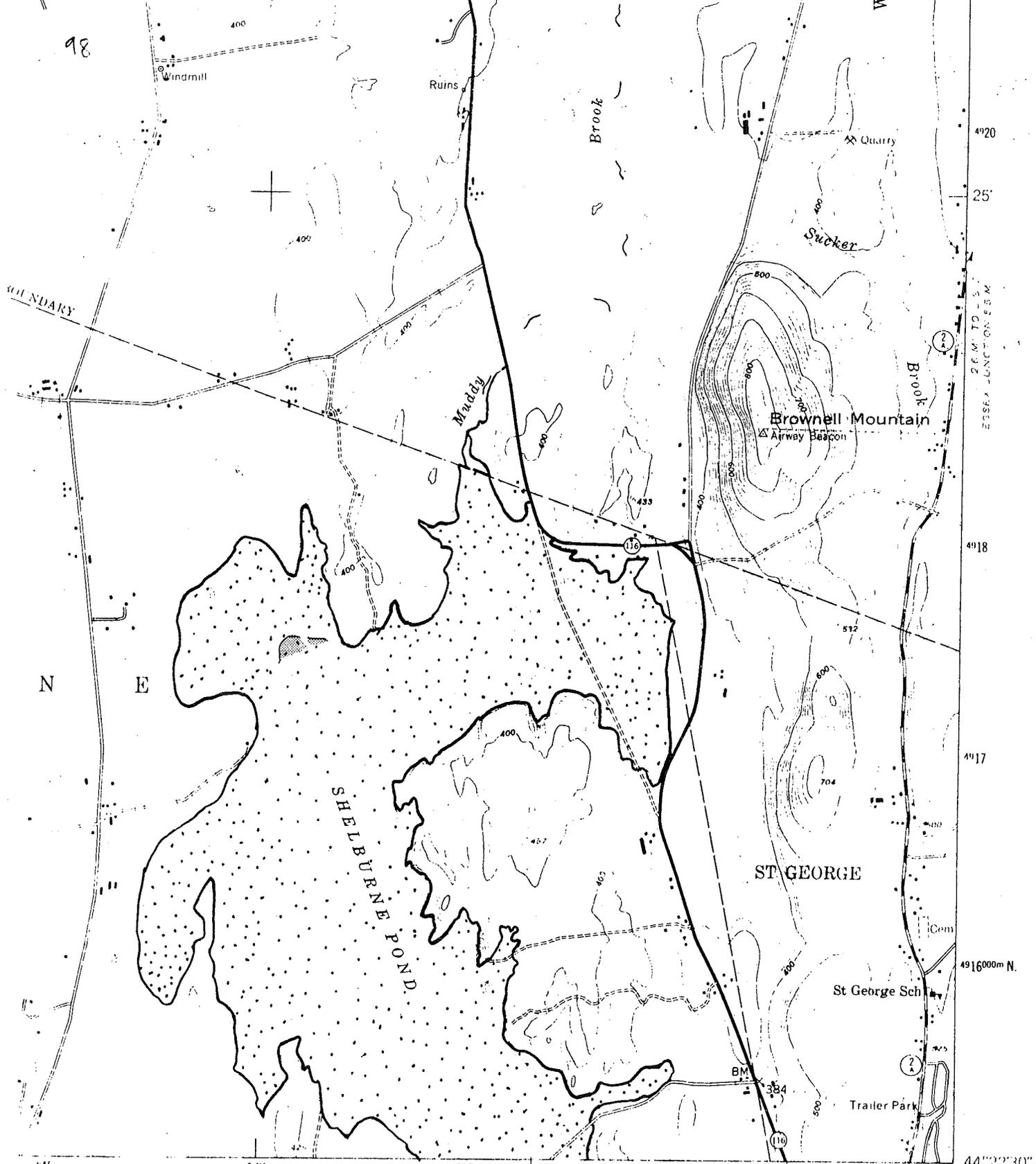
### Critical Features

Being the only major undeveloped pond ecosystem in the Champlain Valley puts a special premium on the retention of this site. Hidden in the simple designation of "pond" is a complex of wetlands of such great diversity that a biology class would have to travel little beyond its boundaries for an entire semester of ecological study. Of its diverse resident and migratory wildlife, three species - the osprey, marsh hawk, and least bittern - bear special note because of their proposed designation as endangered, threatened and rare species (respectively) in Vermont. The limestone ledges near the pond have yielded several invertebrates rare in Vermont (particularly millepedes), and are also important as overwintering sites for the marsh insects. This is one of four known localities for the rare water bug Sigara hydatotrepes, otherwise known only from Georgia and Alabama. From which habitat at Shelburne Pond this species was collected is not known.

### Evaluation Categories

- (1) Knowledge: plentiful scientific documentation for this area (see references), especially recent ecological studies on file with the University of Vt. Botany Dept. Continuing studies in ecology, fisheries, hydrology, and archaeology.
- (2) Representation: the only natural area proposed for the Registry to represent the pond ecosystem.
- (3) Diversity: classified as a significant aquatic community, the Shelburne Pond Natural Area also contains within its boundaries significant marsh, bog, and swamp forest communities that add to its diversity and ecological value.

98

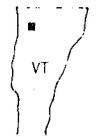
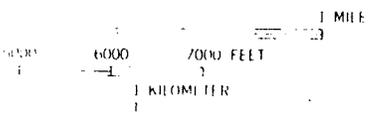


45 107 647000 E 4920 25' 4918 4917 4916000 N 44°22'30" 13°07'30"

ROAD CLASSIFICATION

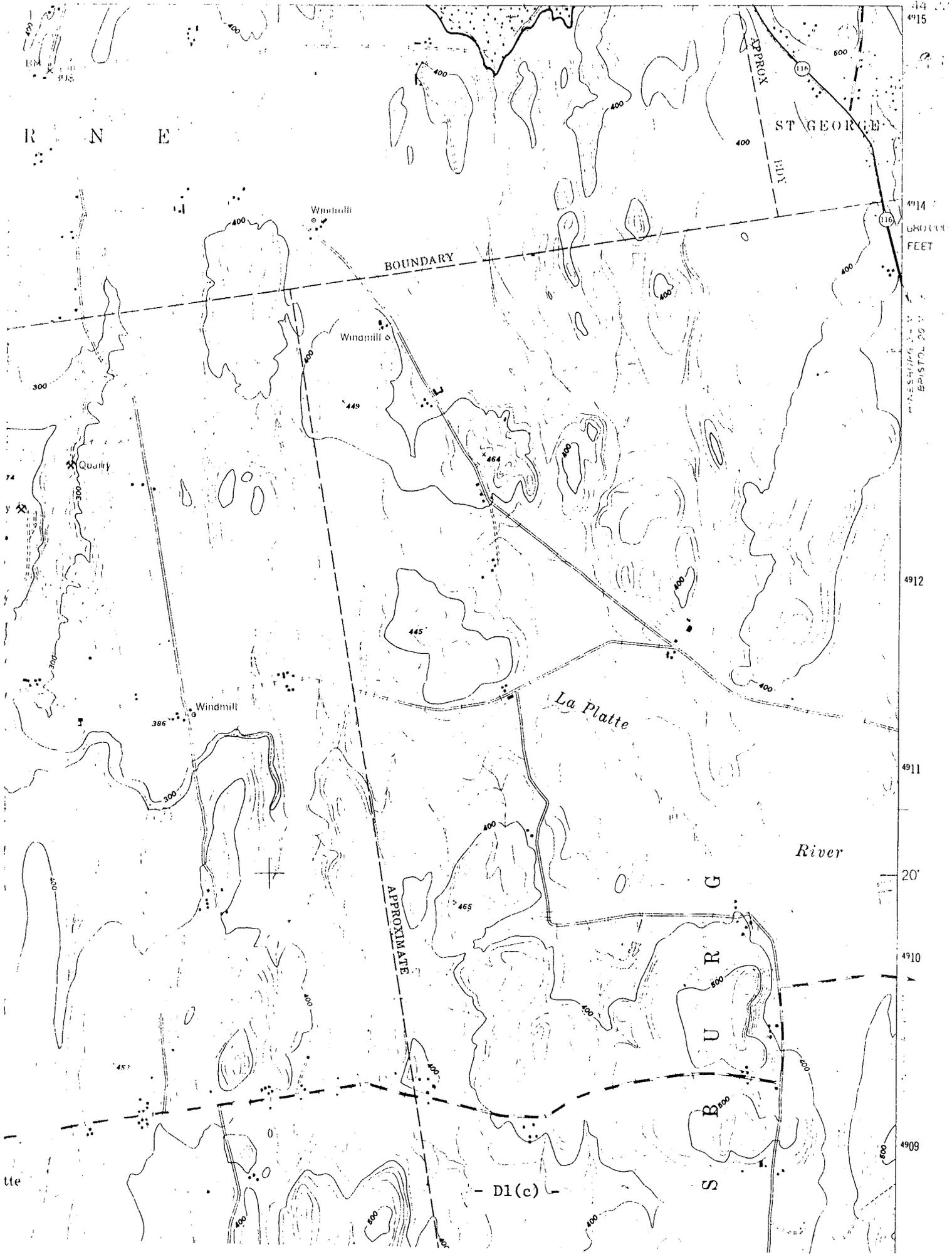
- Heavy-duty Light-duty
- Medium-duty Unimproved dirt
- Interstate Route U.S. Route State Route

- D1(b) -



BURLINGTON, VT.

UNIVERSITY OF VERMONT



R N E

ST GEORGE

APPROX  
HIGHWAY

BOUNDARY

Windmill

Windmill

Quarry

Windmill

La Platte

River

APPROXIMATE

S  
B  
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G

- D1(c) -

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68000  
FEET

4912

4911

20'

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MINESHAFT  
BRISTOL, MO

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- (4) Scarcity: few comparable sites exist in Vermont (or New England) because of great popularity of pond sites for homes and recreation.
- (5) Status: surprisingly minimal human impact despite proximity to Burlington and its suburbs.
- (6) Persistence: the pond itself has sufficient depth (averaging 10-15') and acreage that, even with succession occurring at its present rate along the shoreline, the area will retain its aquatic character for many generations. The successional communities are actually a desirable feature of this landscape and contribute to the diversity of the entire ecosystem.
- (7) Distribution: as the only pond proposed for the Registry the question of distribution is not applicable.
- (8) Manageability: for the large segment of the pond system in University ownership the capability for management lies with existing provisions of Act 250 and University regulations. The pond itself, owned by the state, is managed by the Dept. of Fish and Game through a fish stocking program and maintenance of a state fishing access area.
- (9) Area Size Needs: sufficient to include the diversity found in the area; the main reason one might wish to expand this area would be to insure the status quo and to provide a complete natural area buffer zone about the pond itself.
- (10) Habitat Specificity: rare and threatened species of this community are restricted to the marshes that fringe the pond.
- (11) Mobility: not applicable.

#### Ownership

Sizeable tracts surrounding the pond have been acquired from private ownership by the Nature Conservancy regularly since 1973, largely through the generosity of H. Laurence Achilles. Upon purchase these parcels have been subsequently deeded to the University of Vermont, with the provision that they be used for educational and scientific purposes. The goal of the Nature Conservancy is to eventually acquire or protect through easements between 800 and 900 acres around the pond to complete this natural area. It will be known as the H. Laurence Achilles Natural Area.

#### Recognition

University of Vermont Natural Area

Primary Natural Area (Vt. Nat. Resources Council).

#### Management/Protection Strategy

- (1) Continued purchase of private land holdings surrounding the pond until a complete natural buffer zone is achieved.
- (2) Continued monitoring through both Fish and Game and University regulations.

## References

- Bacon, Edgar 1975 a. The Ewing Site. Shelburne, Vt. Report of the 7th Annual Mtg. of the Vt. Archeol. Soc. Vt. Acad. Sci. Newsletter II (I). January.
- Bacon, Edgar 1975b. The Ewing Site Progress Report. Report of the 8th Annual Mtg. of the Vt. Archeol. Soc. Vt. Acad. Sci. Newsletter II (IV). December.
- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Borie, Louis 1977. University of Vermont Natural Areas. Environmental Progress. University of Vt., Burlington.
- Carr, Patricia, I. Worley and M. Davis 1977. Post-lake Vermont history of a pond wetland in the Champlain Basin. Proc. Lake Champlain Basin Env'tl. Conf. (Aug.) Inst. for Man and Env't. Chazy, N.Y.
- Cowan, Frank 1977. History and present status of the Ewing Site investigations. Newsletter of the Vt. Archaeol. Soc. V (III):307.
- Crandall, Trafton 1974. A study of the nutrient availability of a fresh water stream as affected by a swamp on Shelburne Pond in Vermont. Botany #160 research paper (Sept. 3). On file Botany Dept. Univ. of Vt., Burlington.
- D'Avango, Tom, Sherry Davies, Bob Haney and Neal Smith 1975. The ecological diversity of habitat patterns, plant life form groups, and Arachnidae populations - as related to selected biotic and abiotic factors - in four communities at West Bog, Shelburne Pond. Botany #295 research paper (June). On file at Botany Dept. Univ. of Vt., Burlington.
- DeYoe and Hudson 1980. A study of the seasonal periodicity of Stephanodiscus spp. and Staurastrum spp. in Shelburne Pond, Vt. M.S. Thesis in progress. Botany Dept. Univ. of Vt., Burlington.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Godzyk, J.M., S.S. Forte, D.B. Maddocks and R.F. Thodal. 1975. The correlation between vegetation diversity and water, soil, and elevation factors from a wet to dry area. Botany #295 research paper (June 27). On file at Botany Dept. Univ. of Vt., Burlington.
- Hall, Robert, V. Hall, and G. Ragan 1975. The change in diversity of macroscopic autotrophic organisms in three communities of the Shelburne Pond-West Bog Complex. Botany #295 research paper (June 27). On file Bot. Dept. Univ. of Vt., Burlington.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Howland, William G. 1976. An application of multispectral aerial photography to wetland vegetation mapping. M.A. Thesis. Geogr. Dept. Univ. of Vt., Burlington.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.

- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Nat. Resources Council. Montpelier.
- Lief, Janice 1978. Guide to the common marsh and bog plants of Shelburne Pond. Univ. of Vt., Burlington.
- Osheyack, Gary 1980. A study of the relationship between some phytosociological information and productivity information from the Shelburne Pond-West Peatland System. M.S. Thesis (in progress). Botany Dept. Univ. of Vt., Burlington.
- Page, Stephen and P. Thompson 1972. The Shelburne Pond Watershed, Chittenden Co., Vt.: A Study of the streams flowing into Shelburne Pond. Botany #160 research paper. On file Botany Dept. Univ. of Vt., Burlington.
- Peterson, J.B. 1977. A study of the prehistoric ceramics of Vermont. The Ewing Site. Anthropology #195 research paper (Dec). On file Botany Dept. Univ. of Vt., Burlington.
- Sargent, F.O., H.W. Vogelmann, and R.S. Stanley 1970. Natural Areas in Chittenden County. Lake Champlain Basin Studies. No. 6. Lake Champlain Committee, Burlington, Vt.
- Schuyler, S.A. 1972. Summer community metabolism in Shelburne Pond. M.S. Theses. Univ. of Vt., Burlington.
- Vermont Endangered Species Subcommittee 1978. Revised preliminary list of endangered, threatened, and rare species of birds in Vermont. Vt. Agency of Env'tl. Conservation. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1969. Vermont Natural Areas. Report 2. Vt. Central Planning Office. Montpelier.
- Wilson, M., M. Davis and R. Festa 1975. Algal diversity in ionic composition of wetland communities in West Bog. Shelburne Pond, Vt. Botany #295 research paper (June 27). On file Botany Dept. Univ. of Vt., Burlington.
- Worley, Ian and W.M. Rooks 1979. Rotation of a wetland at Shelburne Pond, Vt. due to a large storm. Bull. Torrey Bot. Club (In Review).
- Worley, Ian, W.M. Rooks, G. Ragan, R. Hall and V. Hall 1979. Phytosociological characteristics of a bog-carr-lagg upland wetland transition zone at Shelburne Pond, Vt. (In Review).
- Worley, Ian 1980. Notes on fragile areas draft (personal communication).

ALPINE COMMUNITIES

1. Mt. Mansfield Alpine Area -- see A1
2. Camel's Hump Natural Area -- see A2
3. Lake Willoughby Natural Area -- see A3
4. Smugglers Notch -- see A4



## CAMBRIDGE PINE WOODS

### Location

Lat. 44° 39' 0" N, Long 72° 53' 0" W. Lamoille County. Town of Cambridge. See accompanying map.

### Site Description

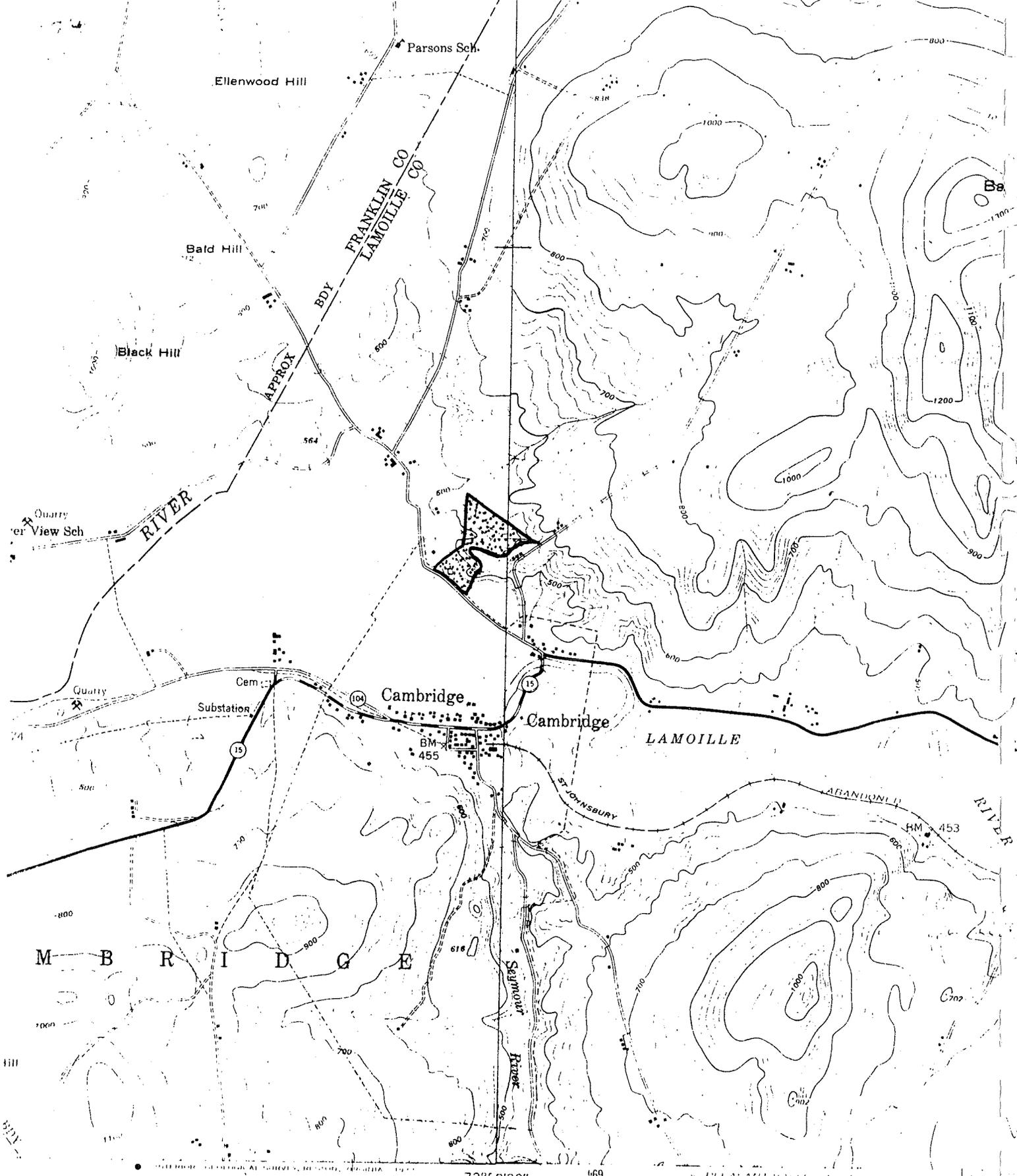
A splendid (Johnson 1980) stand of old-age white pine and hemlock on both sides of a steep-sided ravine with a stream at the bottom. Found within the Cambridge State Forest, behind the village cemetery, this stand is approximately 22 acres in area. Several trees are to be found within the 36-48" diameter range. A hardwood understory shows a successional trend toward sugar maple, red oak, yellow birch, and beech for the coming forest generation. The herb layer is sparse.

### Critical Features

Due to the economic issues associated with white pine there are very few pine stands of comparable size and age in Vermont. This is an important forest type, both in the glimpse it offers backward in time, and in the opportunity it offers to watch succession in action - the eventual replacement of pine by hardwoods.

### Evaluation Categories

- (1) Knowledge: the forest is minimally documented and described; little in the way of serious ecological study.
- (2) Representation: one of two areas chosen to represent this forest type.
- (3) Diversity: classified solely as a significant forest community.
- (4) Scarcity: distinctly a limited kind of forest; it will be more than a hundred years before comparable areas are available.
- (5) Status: minimal human disturbance.
- (6) Persistence: as with all Vermont white pine forests, this one is destined to be gradually replaced by hardwoods. This replacement is under way and should be carefully documented.
- (7) Distribution: for such few stands of comparable quality as exist, the two proposed for the Registry are fortunately quite widely separated geographically.
- (8) Manageability: capable of being managed through Forests, Parks and Recreation regulations.
- (9) Area Size Needs: sufficient to include the bulk of the forest community, although some of the larger trees are actually to be found in the adjacent town cemetery.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.



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ROAD CLASSIFICATION	
Heavy-duty	<u>4 LANE 16 LANE</u>
Medium duty	<u>4 LANE 6 LANE</u>
Light-duty	---
Unimproved dirt	----
U. S. Route	( )
State Route	(○)

Mapped by the Army Map Service  
 Published for civil use by the Geological Survey  
 Control by USGS, USC&GS, and USCE  
 Topography from aerial photographs by multiplex methods.  
 Aerial photographs taken 1947. Field check 1948  
 Polyconic projection 1927 North American datum

12.5

Ownership

Vermont Department of Forests, Parks and Recreation. Montpelier, Vt.

Recognition

State Natural Area (Dept. of Forests, Parks and Recreation)

Primary Natural Area (Vt. Nat. Resources Council)

Management/Protection Strategy

Continued monitoring through Forests, Parks and Recreation regulations.

References

- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. Nat. Park Service. Natural Landmarks Program. Research Report.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Vermont Natural Areas. Report I. Vt. Agric. Expt. Sta. Univ. of Vt., Burlington.



## CANFIELD-FISHER MEMORIAL PINES

### Location

Lat. 43° 6' 12" N, Long. 73° 8' 30" W. Bennington County. Town of Arlington. See accompanying map.

### Site Description

The largest white pines in Vermont. An exceptional stand of old-growth white pine, relatively undisturbed. The stand is even-aged, with trees having diameters mostly in the 30-40" range (up to 42") and heights up to 130 feet. Most of the stand is on a moderate to steep slope, 2 1/2 mi. w. of Arlington village (the former retreat of well-known Vermont writer Dorothy Canfield Fisher). Hardwood understory shows successional trend, and favorable moisture gradient from top of slope to brook at the bottom provides for good variety among shrubs and herb species.

### Critical Features

Because of its value on the lumber market few stands of white pine of this size and age exist in New England to show us the grandeur of these trees as they must have appeared to the original settlers. The present lack of such stands is an unfortunate missing link, as well, in trying to piece together the successional story of white pine. It is important that forests of a wide range of ages be a part of our landscape and ecological heritage.

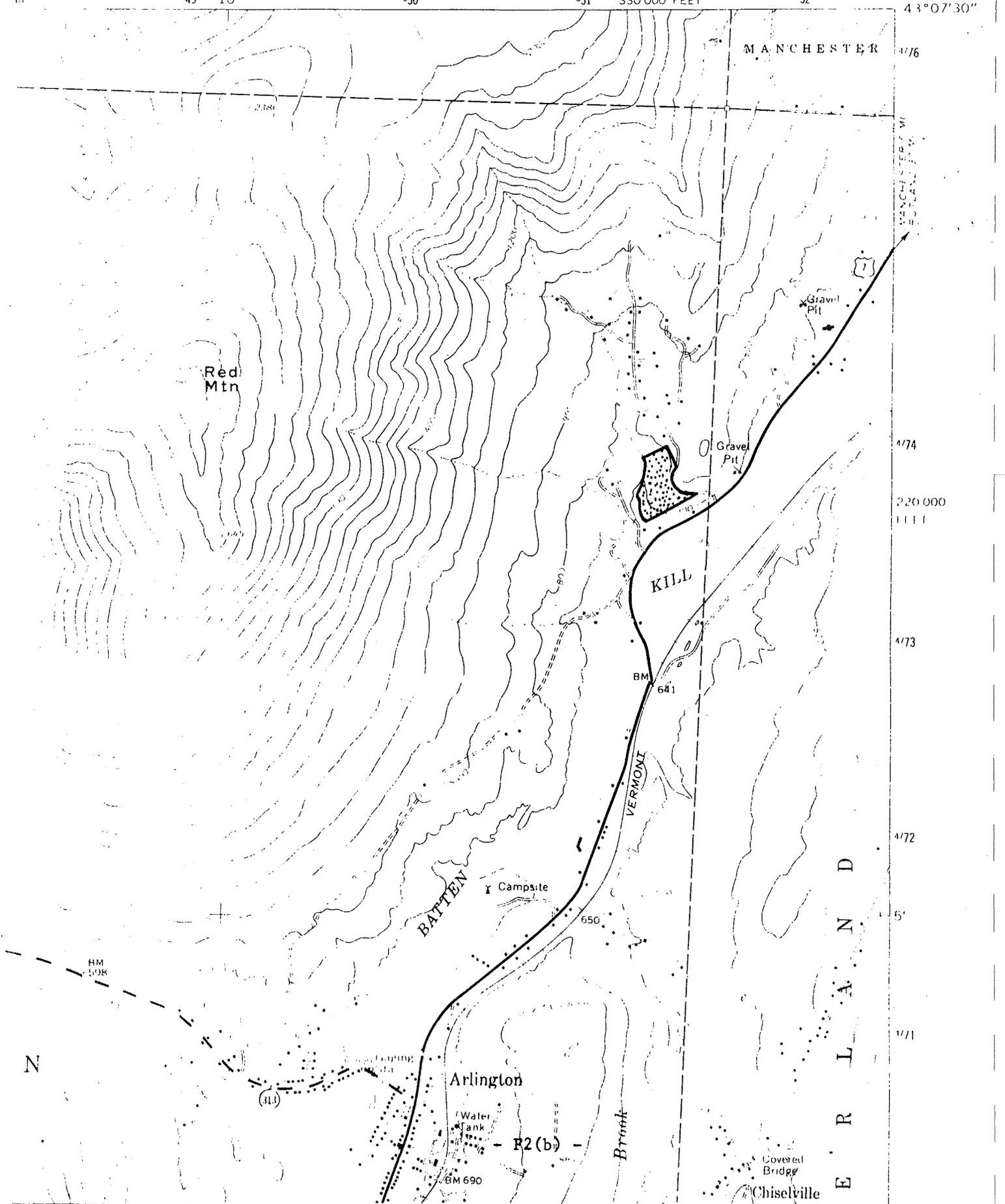
### Evaluation Categories

- (1) Knowledge: the forest is documented and described but no serious study has yet been published on the ecology of this natural area.
- (2) Representation: one of two areas chosen to represent this forest type.
- (3) Diversity: classified simply as a significant forest community.
- (4) Scarcity: distinctly a limited kind of forest; it will be more than a hundred years before comparable areas are available.
- (5) Status: minimal human disturbance.
- (6) Persistence: as with all Vermont white pine forests, destined to be gradually replaced by hardwoods. This replacement is under way and should be documented with care.
- (7) Distribution: for such few stands of comparable quality as exist, the two proposed for the Registry are fortunately quite widely separated geographically.
- (8) Manageability: capable of being managed through Forests, Parks and Recreation regulations (if management in this case means letting "nature take its course").
- (9) Area Size Needs: only 13 acres, but adequate to encompass the forest in question.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

ARLINGTON QUADRANGLE  
VERMONT-BENNINGTON CO.  
7.5 MINUTE SERIES (TOPOGRAPHIC)

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(MANCHESTER)

48 49 10' 50 51 330 000 FEET 52 73°07'30" 43°07'30"



MANCHESTER 476  
474  
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473  
472  
5'  
471

VERMONT  
BENNINGTON CO.  
ERLAND

104

Ownership

Vermont Department of Forests, Parks and Recreation. Montpelier, Vt.

Recognition

Primary Natural Area (Vt. Nat. Resources Council)

National Natural Landmark (U.S. Dept. of the Interior)

Management/Protection Strategy

- (1) Designation of the area as a State Natural Area (this would insure the continuance of the natural successional process even after the desirable pines in this stand are over-mature or dead.
- (2) Continued monitoring through Forests, Parks and Recreation regulations.

References

- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White-Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. Nat. Park Service. Natural Landmarks Program. Research Report.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.

110

## LORD'S HILL HARDWOOD FOREST

### NATURAL AREA

#### Location

Lat. 44° 19' N. Long. 72° 22' W. Washington County, Town of Marshfield. See accompanying map.

#### Site Description

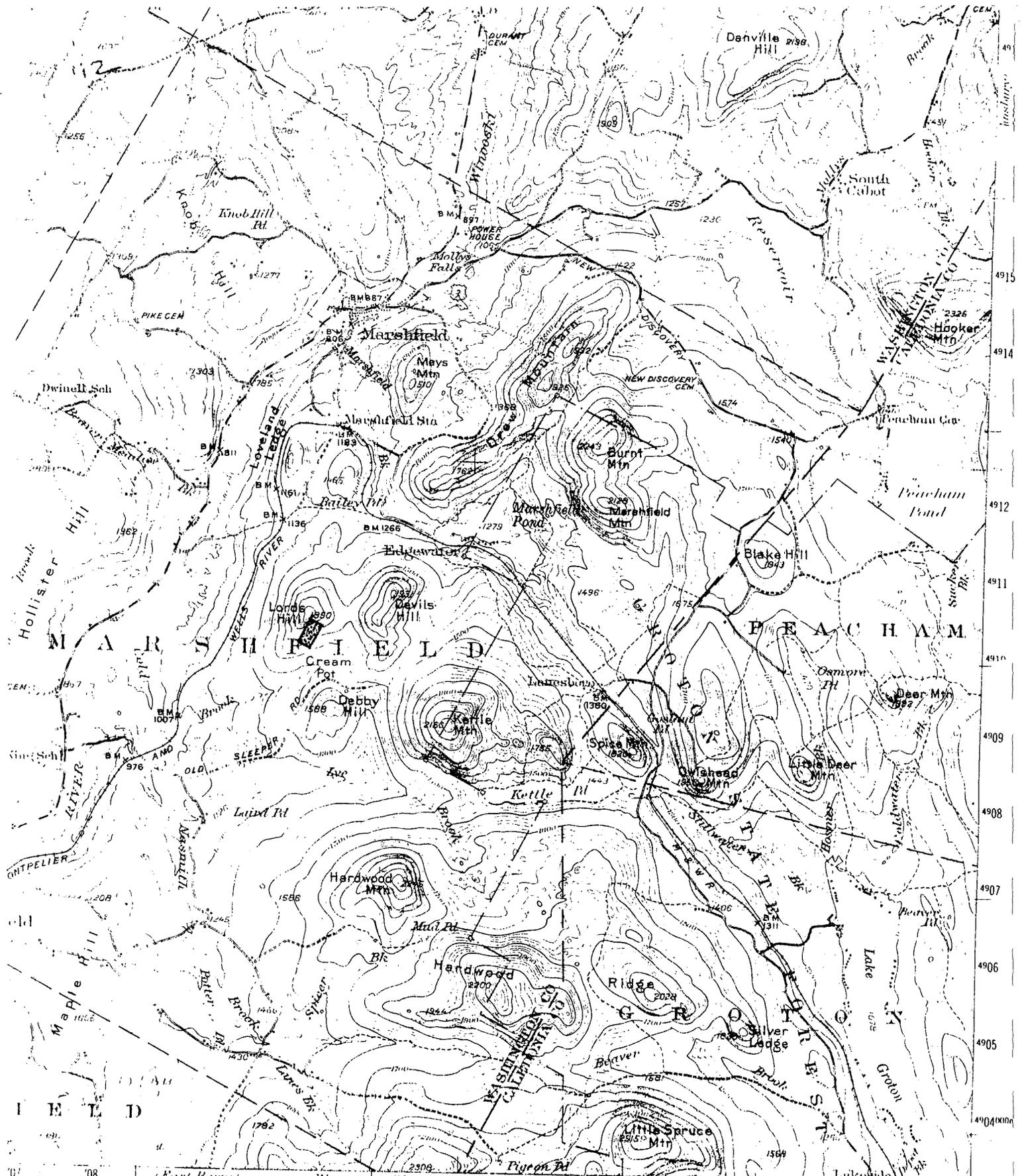
The area includes a 25 acre hillside stand of mixed hardwoods and conifers (between 1,300-1,600' elevation approximately). Included in this larger stand is an approximately 13 acre, predominately hardwood forest with trees of grand dimensions and age, deemed by some to be the finest of its kind in Northern New England. Among the twelve tree species reaching at least 18" in diameter, more than 120 trees measure greater than 24", including the state's largest measured sugar maple (Acer saccharum) and striped maple (Acer pensylvanicum), and second largest beech (Fagus grandifolia), yellow birch (Betula lutea), balsam fir (Abies balsamea) and red spruce (Picea rubens). Trees of several species (including sugar maple) exceed 100 feet in height and 40" in diameter. Age measurements for several species (not the largest specimens) exceed 400 years. Shrub and herb components of forest are typical; not unusually rich in species (nearly all species are native). Many breeding birds and good representation of forest mammals, including several active black bear dens.

#### Critical Features

Although old-age hardwood/conifer mixtures are not rare in the state, this stand shows evidence of being Vermont's finest example of this kind of forest, both from the standpoint of size and age of trees and also in having a characteristic climax representation of size and ages of trees species from seedlings on up. Such a stand represents an important example of the state's original forest cover.

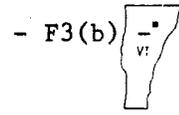
#### Evaluation Categories

- (1) Knowledge: studied intensively since 1977, when this area first came to the attention of the scientific community. Several vegetation studies completed. Total tree inventory (10" d.b.h.) nearly completed. Continuing research on animal populations, bryophytes, and fungi.
- (2) Representation: relatively undisturbed old-age hardwood/conifer stands are uncommon in the state. Among proposed fragile areas only one other represents the hardwood forest type.
- (3) Diversity: classified in a single category, as a significant forest community, representing the northern forest region.
- (4) Scarcity: the northern hardwood forest type is not at all unique in Vermont. This stand, however, is a virgin or near-virgin representative of the type and is especially valuable in this regard.
- (5) Status: minimal disturbance to date, although potential exists for peripheral disturbance should adjacent forest stands be mismanaged. Especially critical is the threat of fire from piles of dry slash remaining from recent timber cutting activities immediately downslope.



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 East Barry 6572 III  
 SCALE 1:62,500  
 5 MILLS  
 0 1000 2000 3000 4000 5000 FEET  
 0 1 2 3 4 5 KILOMETERS  
 ROAD CLASSIFICATION  
 Medium-duty — — — Light duty  
 Unimproved dirt  
 U S Route State Route

CONTOUR INTERVAL 20 FEET  
 NATIONAL GEODETIC VERTICAL DATUM OF 1929



PLAINFIELD, VT.  
 1:62,500

- (6) Persistence: obviously a climax forest community with a long history of stability. Clearly demonstrated (from results of vegetation analysis) self-perpetuation and great age. Lack of signs of any major vegetation change in centuries.
- (7) Geographic Distribution: one of only two hardwood stands currently being proposed for registry, Lord's Hill's location is two countries away from the other (Gifford Woods) and stands almost alone among proposed fragile areas in the eastern central part of the state.
- (8) Manageability: has been assured protection as a state natural area and is sufficiently accessible to scientific study and educational field trips (although not so accessible as to invite the uninterested wanderer).
- (9) Area Size Needs: large in extent relative to other stands of comparable quality. Interior of stand protected to forest buffer zone on all sides. Stand sufficiently extensive to offer protection to most forest inhabitants even in the event of cutting of adjacent forest cover.
- (10) Habitat Specificity: this forest has persisted for a long period in the face of human settlement and encroachment of adjacent lands for farming and lumbering. During this time it has served as a refuge for plant (and possibly some animal) populations that are adjusted to a forest existence.
- (11) Seasonal Mobility: although Lord's Hill is visited by migratory bird species and deer herds with some regional mobility, its major populations are local and relatively confined to this and immediately adjacent forests.

#### Ownership

Vermont Department of Forests, Parks and Recreation (Main office - Montpelier, Vermont 05602).

#### Recognition

State Natural Area (Dept. of Forests, Parks and Recreation).

Under consideration for National Natural Landmark Status.

#### Management/Protection Strategy

Continued monitoring through Forests, Parks and Recreation regulations.

Continued scientific study, allowing for sufficiently frequent contact to detect problems that may arise as more people come to know about the area.

Development of a self-guiding pamphlet to help visitors understand significance of the forest and direct them to major reference points.

References

- Deller, Mary Beth 1978. Lord's Hill: An Old-Age Northern Hardwood Climax Forest. Goddard College Senior study. Bound ms and microfilm. Plainfield, Vt.
- Fish, Keith 1978. Studies in the Lord's Hill Forest Natural Area in The Study of Ecology Through Field and Academic Experiences. Goddard College Senior study. Bound ms and microfilm. Plainfield, Vt.
- Jervis, Robert A., Keith Fish, Mary Beth Deller, Nancy Knox and John Wires 1980. Preliminary studies of Lord's Hill Forest Natural Area, Marshfield, Vermont: A Climax Hemlock-Northern Hardwoods Forest. In preparation for publication.
- Khouri, Lance 1980. Vermont's Big Woods. In preparation for publication.
- Knox, Nancy 1979. A study of the Lord's Hill Forest in Marshfield, Vermont. Unpublished ms. University of Vermont. Burlington, Vt.

## GIFFORD WOODS

### Location

Lat. 43° 42' 0" N, Long. 72° 48' 0" W. Rutland County. Town of Sherburne. See accompanying map.

### Site Description

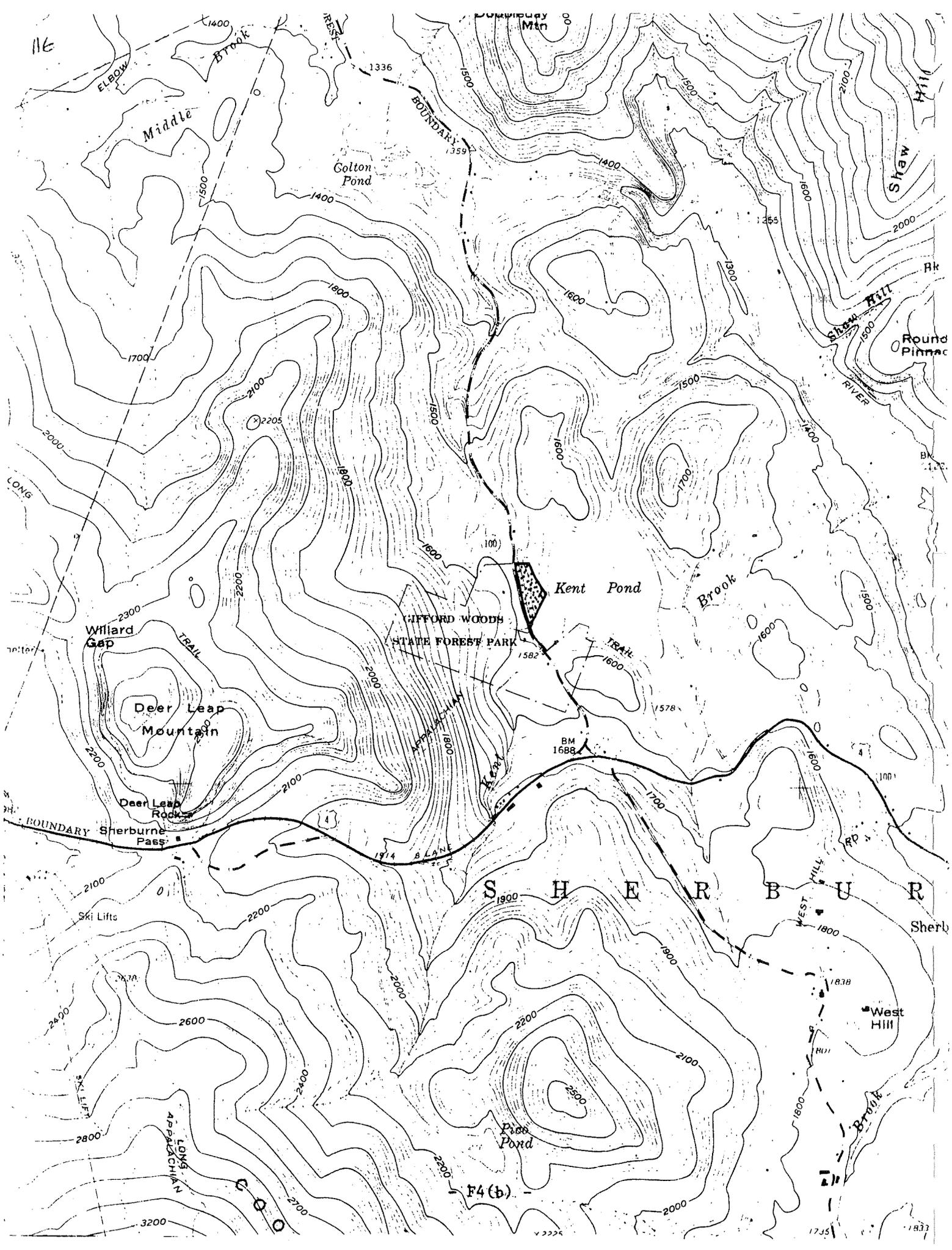
A five acre stand of virgin growth of hardwood forest along the east side of Route 100, within the Gifford Woods State Park near Sherburne, Vt. The stand contains sugar maple (predominately), beech, yellow birch, basswood, hemlock, white ash, and elm, all of considerable size and age.

### Critical Features

Very few undisturbed hardwood forests exist in New England. Those that managed to escape the axe, however, are likely to be very old indeed, although their individual trees may be but a fraction of the age of the forest's historic continuum. Gifford Woods represents an old-age hardwood stand, though a very small one, that quite probably belongs to the select few of its type still remaining. Its small size, multiple uses, and its roadside location, however, are all deterrents to the continued health of this forest and to its continued credibility as a natural area.

### Evaluation Categories

- (1) Knowledge: several key research studies have served to call scientific attention to Gifford Woods. Most of the recent literature is descriptive and based on these initial studies.
- (2) Representation: one of two old-age hardwood forests currently being proposed for the Registry. Both are excellent examples of this forest type, although additional hardwood stands, particularly in the southern portion of the state, should be added at a future date.
- (3) Diversity: classified solely on the basis of being a significant hardwood forest community.
- (4) Scarcity: in a state dominated by hardwoods this forest type could not be considered scarce. At the same time, the resultant wide choice has permitted the selection of the "best of the best."
- (5) Status: definitely threatened as a natural area by its location and extensive human use. The trees may survive the presence of Route 100 with road salt and culvert runoff, a parking lot and picnic area, and an adjacent fishing access area, but the integrity of the forest ecosystem has been seriously compromised, possibly beyond repair.
- (6) Persistence: a climax community with expected long-term stability, but facing problems because of stresses from factors noted in (5) above.
- (7) Distribution: the two sites proposed to represent this forest type have a reasonably wide geographic separation.



116

Middle Brook

Colton Pond

1336

BOUNDARY

Kent Pond

SHERBURNE STATE FOREST PARK

Willard Gap

Deer Leap Mountain

Deer Leap Rocks

Sherburne Pass

BM 1688

SHERBURNE

Ski Lifts

Rice Pond

F4(b)

LONG

3200

1735

1837

- 117
- (8) Manageability: capable of being managed through existing regulations, but should be closely monitored.
  - (9) Area Size Needs: definitely inadequate except as a showcase for Gifford Woods' large trees. This should have been considered in 1960 when it was decided to carve a recreation area out of the eastern half of the forest, removing the edge of the forest itself, changing light and moisture relationships, and all but destroying wildlife access to the forest from that side.
  - (10) Habitat Specificity: not applicable.
  - (11) Mobility: not applicable.

#### Ownership

Vermont Department of Forests, Parks and Recreation. Montpelier.

#### Recognition

State Natural Area (Vt. Dept. of Forests, Parks and Recreation)

National Natural Landmark (U.S. Dept. of the Interior)

#### Management/Protection Strategy

- (1) Continued monitoring through Forests, Parks and Recreation regulations.
- (2) Close attention to changes in adjacent land uses and potential impacts on this site.

#### References

- Bormann, F.H. and Murray F. Buell 1964. An old-age stand of hemlock-northern hardwood forest in central Vermont. Bull. Torrey Bot. Club 91:451-465.
- Braun, E. Lucy 1950. Deciduous Forests of Eastern North America. Hafner Press. N.Y.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. Nat. Park Service. Natural Landmarks Program Research Report.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Indridason, Louise and Ottar 1973. Vermont's Natural Areas: Part 2. Deciduous Forests. Vermont Life 28(1): 41-45.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Experiment Station. Univ. of Vt., Burlington.



## MAYNARD MILLER (VERNON) BLACK GUM SWAMPS

### Location

Lat. 42° 44' 0" N, Long. 72° 32' 0" W. Windham County. Town of Vernon.  
See accompanying map.

### Site Description

A rare stand (actually four small isolated stands) of old-age black gum trees growing in a swampy depression in the upland hardwood-covered hills of Vernon, just north of the Massachusetts border. Black gum is a species of more southerly latitudes, although scattered trees occur in Vermont. This stand is probably a relic from a warmer climatic period. The trees grow in a hummocky swamp of about 5 acres in area and appear quite old. Associated with black gum here are hemlock, yellow birch, and red maple, with a shrubby understory of ferns, mountain holly, withe rod, highbush blueberry, and black alder.

### Critical Features

Represents not only an unusual forest type not generally found in Vermont but serves as a climatic marker from a period, somewhere between 5,000 to 3,500 years ago, when Vermont's climate (and accordingly its vegetation to some extent) was more like the climate of areas further south. The milder temperatures of the climatic optimum (Klein 1976) allowed many southern plants to extend their ranges into Vermont. Then, with a shift to colder conditions again, these plants' distributions contracted. Often small pockets of a population were left behind. These disjunct stands are exciting and important biologically. The rare Massachusetts fern (Thelypteris simulata) and Virginia chain fern (Woodwardia virginica) - both southern species - grow here. Both have been proposed for inclusion on the new state endangered species list.

### Evaluation Categories

- (1) Knowledge: floristic and vegetation studies have been the only form of written documentation for the swamp to date. Current ornithological censusing will add another dimension. The UVM Invertebrate Collection has a small collection of invertebrates from this site. A complete inventory of invertebrates would be desirable.
- (2) Representation: the only area chosen as representing the black gum swamp in Vermont.
- (3) Diversity: selected solely for its significance as a disjunct forest community, but incidentally possesses a fern listed as rare, whose distribution is also disjunct.
- (4) Scarcity: while black gum trees have been found in scattered locations in Vermont this is the only known actual forest stand in which black gum is the predominant tree.
- (5) Status: minimal human presence and/or interference.
- (6) Persistence: uncertain; black gum, which shows signs (in the seedling and sapling classes) of reproducing, is now competing with species

STATE OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

BERNARDSTON

MASSACHUSETTS

7.5 MINUTE SECTION

MI. 1  
MI. 1 (BRATTLEBORO 1:62 500) '00

32'30"

702

BRATTLEBORO (U.S. 5) 7 MI.  
VERNON 1 MI. 33C



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which may be better adapted to the present climate. Further study is needed.

- (7) Distribution: not applicable.
- (8) Manageability: capable of management; protected in the Vernon Town Forest Management Plan.
- (9) Area Size Needs: sufficient to include the ecosystem but very little of the fringing upland. It would be desirable to have at least a small buffer zone around each swampy pocket.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

#### Ownership

Vernon Municipal Forest, Vernon, Vt. (total area 461 acres), and State of Vermont Fish and Game Department (Roaring Brook Wildlife Management Area).

#### Recognition

Primary Natural Area ( Vt. Natural Resources Council)

#### Management/Protection Strategy

- (1) Investigate purchase by a conservation organization (or easement) of at least one of the four small swamps within the municipal forest. The acreage involved would be very small.
- (2) Continued protection through Town of Vernon Forest Management Plan.

#### References

- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Countryman, W.D. 1978. Rare and Endangered Vascular Plant Species in Vermont. New England Botanical Club & U.S. Fish and Wildlife Service.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior National Park Service. Natural Landmarks Program Research Report.
- Fosburg, F.R. and Terry Blunt 1970. Vernon Black Gum Swamp. Rhodora 72(790):280-282.
- Indridason, Louise and Ottar 1973. Vermont's Natural Areas: Part 2 Deciduous Forests. Vermont Life 28(1):41-45.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England: Hanover, N.H.
- Klein, Robert 1976. Technical Report; Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier, Vt.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.

Vogelmann, H.W. 1969. Vermont Natural Areas. Report 2. Vt. Central Planning Office. Montpelier.

Vogelmann, H.W. 1976. An unusual black gum swamp in Maine. Rhodora 78(814):326-327.

LITTLE OTTER CREEK MARSH

Location

Lat. 44° 14' 0" N., Long. 73° 17' 0" W. Addison County. Town of Ferrisburg. See accompanying map.

Site Description

Described by Vogelmann (1964) as "the best large expanse of marshland in Vermont", this area lies near the mouth of Little Otter Creek where several tributaries join to form an extensive area of shallow water. The flooded river channel supports a vast series of marsh communities, ranging from purely aquatic, to seasonally exposed mudflats, to shoreline tree and shrub ecosystems. An area of more than 1,000 acres, 4/5 of which is in public ownership (Vt. Dept. of Fish and Game). Many species of waterfowl and marsh birds nest here, including some on the state's endangered, threatened and rare list.

Critical Features

Given a fairly large number of extensive marshes within the boundaries of the state, it seems important to propose the acknowledged "best" of these for inclusion in the Registry. Chief among the critical features of this marsh complex is the habitat it provides for resident and migratory water birds and birds of prey. Those of special note, by virtue of their proposed placement on the rare, threatened and endangered list of birds for the state, are the following:

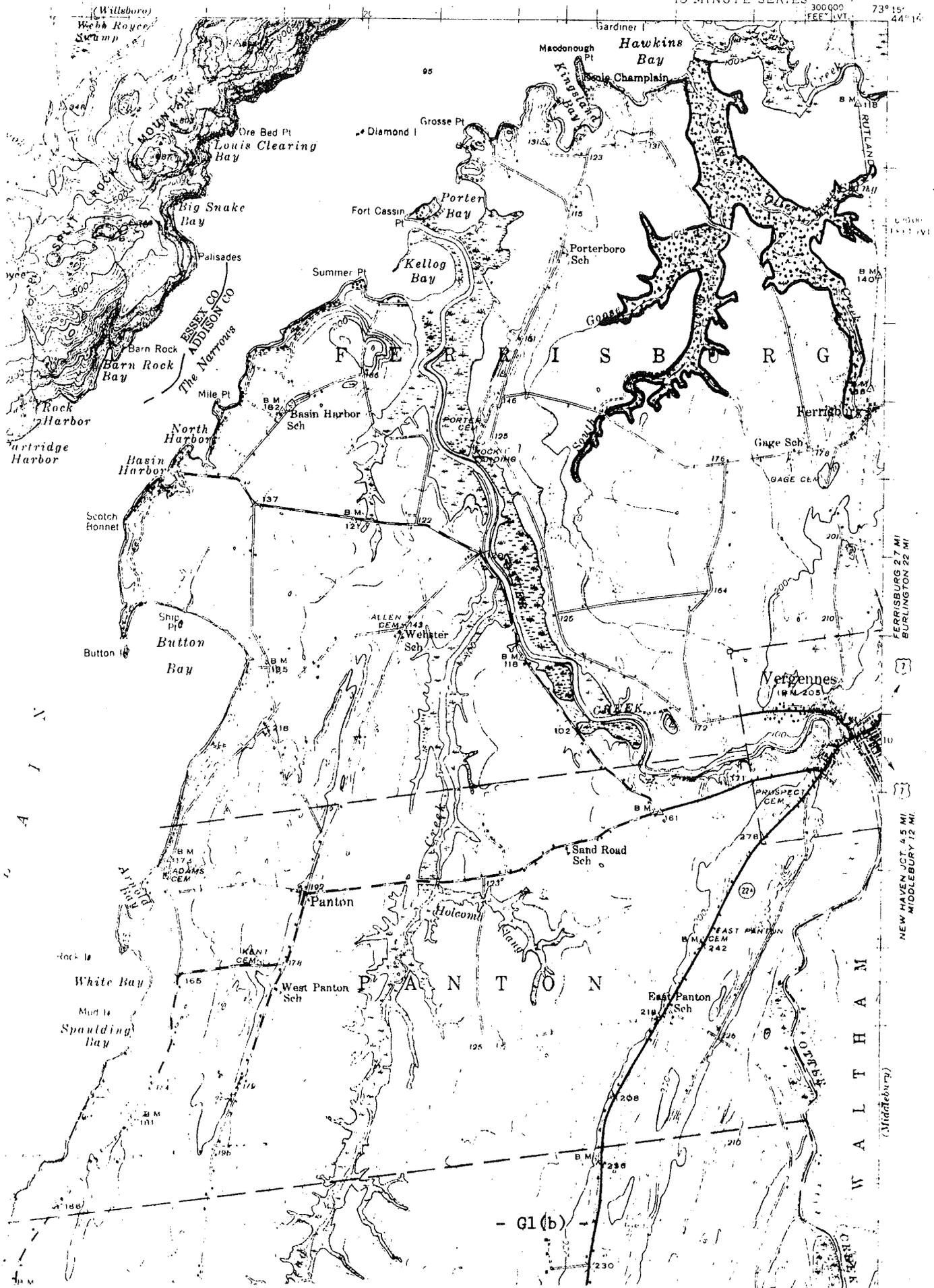
- Bald Eagle (endangered)
- Osprey (endangered)
- Marsh Hawk (threatened)
- Least Bittern (rare)

The seasonally flooded swamp-oak-silver-maple forests are perhaps the richest habitat in the state for invertebrates. These, and the hemlock grove that occupies the point between Little Otter and Lewis Creek, contain many unusual species. The lacustrine forest is the only locality north of New Jersey for the ground beetle Agonum picticorne. It is evidently favored by the seasonal flooding and the mild climate. On the other hand, the hemlock forest supports Scaphinotus viduus, a large snail-eating ground beetle otherwise known only from mountain forests. This area has a large population of the blue-flecked salamander, Ambystoma laterale, which is thought to be decreasing in numbers in the northeast, possibly as a result of acid rain.

Evaluation Categories

- (1) Knowledge: researched and documented (see references), largely from the botanical and general ecological standpoint, and almost totally within the past ten years. Current studies of bird populations awaiting at least one more summer of data collection. This area has been used for years by the University of Vermont Zoology Department as a place to study wetland ecosystems. The UVM Invertebrate Collection has extensive material, and it would be possible to make an inventory of invertebrate species from these collections.

300000  
FEET  
73° 15'  
44" 16"



(Hartington)

FERRISBURG 2.7 MI  
BURLINGTON 22 MI

NEW HAVEN JCT. 4.5 MI  
MIDDLEBURY 12 MI

(Middlebury)

- G1 (b) -

- (2) Representation: one of four marshes chosen to represent this habitat type on the Registry; this one is clearly outstanding for its size and diversity.
- (3) Diversity: selected solely as a significant freshwater marsh; could also be considered a critical habitat for restricted species.
- (4) Scarcity: considering the vital importance of the Champlain marshes to the waterfowl and other wildlife associated with this part of Vermont it seems worthwhile to single out as many of these critical wetland as possible. Marshes are not scarce along the lakeshore, but they are not plentiful either.
- (5) Status: little adverse human impact.
- (6) Persistence: with maintenance of traditional water level regime it seems likely that this marsh complex has every chance for long-term stability.
- (7) Distribution: the four marshes proposed for the Registry are reasonably wide-ranging in their geographical distribution, being located in three different countries in the northeastern, northwestern and central western parts of the state.
- (8) Manageability: capable of management through existing programs, and Fish and Game regulations.
- (9) Area Size Needs: sufficient to include the entire range of the marsh community complex found in the region.
- (10) Habitat Specificity: waterfowl and associated food plants and aquatic animals have distinctive habitat requirements that relate to presence of an extensive wetland environment. Feeding (especially) and breeding of aquatic bird populations require the combination of shallow water and adequate cover found in the freshwater marsh ecosystem.
- (11) Seasonal Mobility: Most of the waterfowl species found in this marsh are migratory, while its fish, mammal and invertebrate species and, of course, the vegetation are not. The character of the habitat does not change significantly from year to year.

Ownership

About 80% owned by Vermont Dept. of Fish and Game; the remainder owned by a variety of private individuals.

Recognition

Primary Natural Area (Vt. Nat. Resources Council)  
National Natural Landmark (U.S. Dept. of the Interior)

Management/Protection Strategy

- (1) Continued monitoring through Fish and Game regulations.
- (2) Encouragement of further research, particularly on nutrient levels, productivity, and the influence of water level fluctuations on these and other features of marsh life.

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## References

- Barber, Eileen, D.J. Bogucki, G.K. Gruending, and M. Madden 1977. Historical land use changes and impacts in Lake Champlain wetlands. Lake Champlain Basin Study. New England River Basins Comm., Burlington, Vt.
- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Comm., Burlington, Vt.
- Calab, S.A. 1972. A sedimentaological investigation of the Otter Creek Delta. Vergennes, Vt. (source unknown).
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Gruending, G.K. and D.J. Bogucki 1978. Assessment of the physical and biological characteristics of the major Lake Champlain wetlands. Lake Champlain Basin Study. New England River Basins Commission. Burlington, Vt.
- Indridason, Louise and Ottar 1973. Vermont Natural Areas. Part 3. Marshes. Vermont Life 28(2):6-10.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier, Vt.
- Stewart, James 1980. Comments on fragile areas draft (personal communication).
- Vermont Endangered Species Subcommittee 1978. Revised preliminary list of endangered, threatened, and rare species of birds in Vermont. Vt. Agency of Env'tl. Conservation. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta. Univ. of Vermont. Burlington.

## BARTON RIVER (COVENTRY) MARSH

### Location

Lat. 44° 53' 0" N, Long. 72° 12' 0" W. Orleans County. Town of Coventry. See accompanying map.

### Site Description

River mouth of Barton River as it flows northward into South Bay of Lake Memphremagog. Marshland and shallow meandering river channel occupy 1,545 acres at 700' elevation.

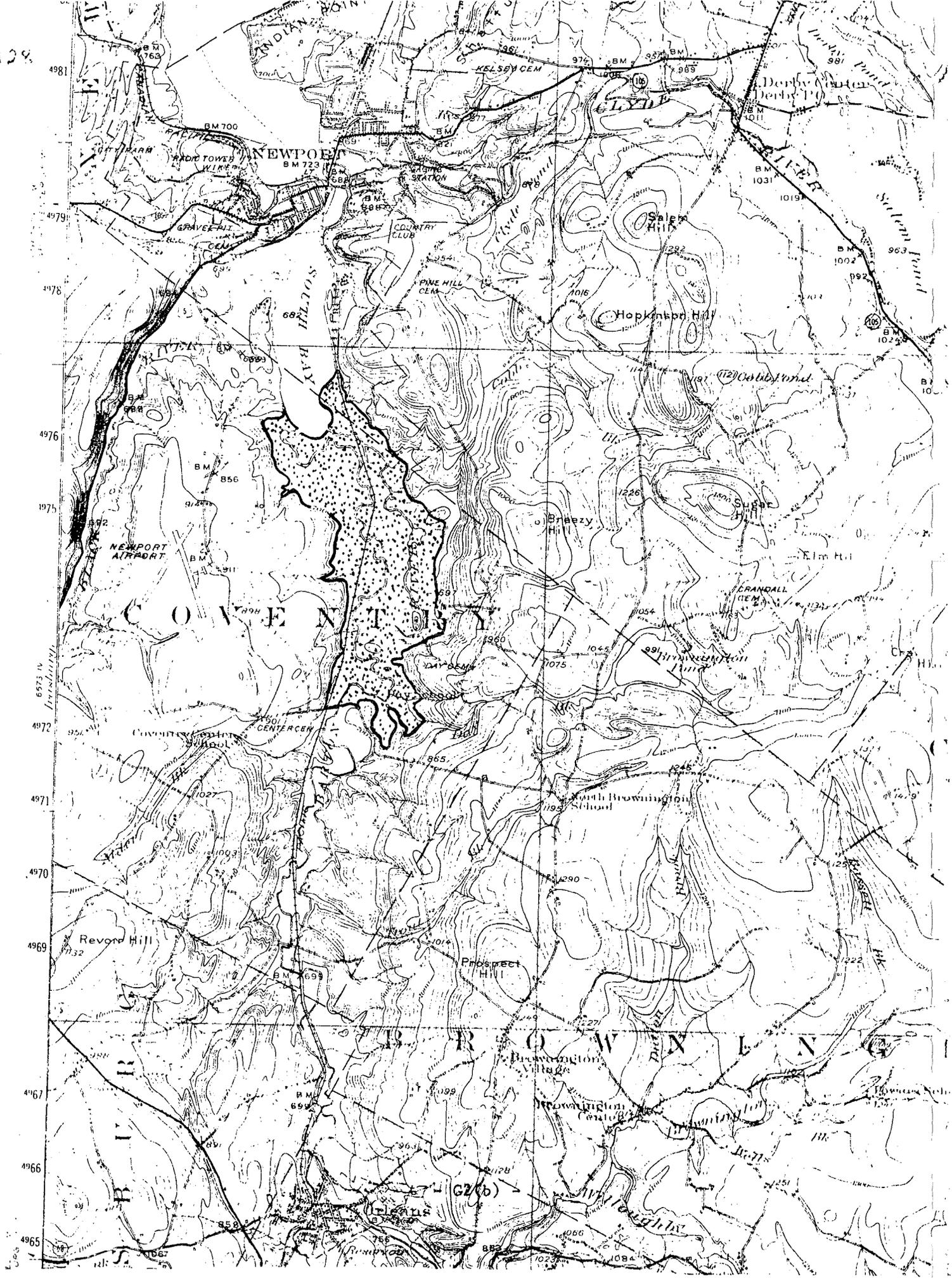
### Critical Features

This extensive wetland provides an important environment for breeding and migratory waterfowl and other marsh birds and wildlife. An excellent site for encountering a great diversity of aquatic and emergent plants. This area was the site of the last documented osprey nest in Vermont (Sladyk 1980) and is considered (Stewart 1980) the state's most likely location for sighting of bald eagles. This area serves as the primary source of entrance to the Barton and Black River spawning areas for brown and rainbow trout. The spawning areas are located considerably upstream.

### Evaluation Categories

- (1) Knowledge: botanically and ornithologically studied and evaluated positively for its potential as an important natural area.
- (2) Representation: one of only two areas proposed for the Register strictly for its representation of the freshwater marsh habitat and wildlife.
- (3) Diversity: represents a single classification category - that of a significant natural community (marsh), but could be also considered a habitat for endangered or threatened animal species, the osprey, peregrine falcon, and bald eagle, which have been seen during the summer in the marsh. It may also be considered as a critical habitat for migratory marsh and water birds, especially because of its extent (1,100 acres) and position on the Connecticut River migratory flyway.
- (5) Status: relatively free from disturbance, even with seasonal fishing and hunting, although water levels, in recent years, have been manipulated (see (8) below).
- (6) Persistence: although a seral community, ultimately facing change, in time, as the marsh is invaded by woody plants, this marsh today is stable and self-perpetuating and seems likely to remain a marsh for many more years.
- (7) Distribution: one of only three areas proposed for the registry from the Northeast Kingdom and the only marsh among these three. All other proposed marshes are in the western half of the state.
- (8) Manageability: much of the wetland acreage in South Bay has resulted from the raising of water level in Lake Memphremagog earlier in the century. The water levels in the marsh are subject to water level changes in the lake controlled at outlet in Magog, Quebec.

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G2(b)

- (9) Areas Size Needs: excellent size for assuring protection and biological needs of large and varied plant and wildlife populations.
- (10) Habitat Specificity: waterfowl and associated food plants and aquatic animals have distinctive habitat requirements that relate to presence of an extensive wetland environment. Feeding (especially) and breeding of aquatic bird populations require the combination of shallow water and adequate cover found in the freshwater marsh ecosystem.
- (11) Seasonal Mobility: Most of the waterfowl species found in this marsh and the brown and rainbow trout are migratory, while its mammal and invertebrate species and, of course, the vegetation are not. This area serves as the primary source of entrance to the Barton and Black River spawning areas for brown and rainbow trout. The spawning areas are located considerably upstream.

#### Ownership

Vermont Fish and Game Department. Montpelier, Vt.

#### Recognition

National Natural Landmark (U.S. Dept. of the Interior).

Primary Natural Area (Vt. Natural Resources Council).

#### Management/Protection Strategy

- (1) For protection of nesting waterfowl and "wild" character of river channel the marsh itself should remain free of motorboat travel, at least during critical periods for wildlife populations (chiefly the spring and early summer months).
- (2) Construction of additional platforms to enhance nesting opportunities for somewhat abundant osprey population.

#### References

- Flaccus, Edward 1972. Vegetation Natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior, National Park Service. Natural Landmarks Program. Research Report.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Nat. Resources Council. Montpelier, Vt.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Sladyk, William 1980. Comments on fragile areas draft (personal communication).
- Stewart, James 1980. Comments on fragile areas draft (personal communication).
- Vermont Institute of Natural Science. 1976-1979. Breeding Bird Atlas Project. South Bay data sheet (unpublished). Woodstock, Vt.
- Vogelmann, H.W. 1969. Natural Areas in Vermont. Report 2. Vt. Central Planning Office. Montpelier.



## FRANKLIN BOG

### Location

Lat. 44° 59' 30" N, Long. 72° 53' 45" W. Franklin County. Town of Franklin. See accompanying map.

### Site Description

A splendid (Vogelmann 1969) and extensive quaking bog occupying an elliptical basin of about 300 acres in the town of Franklin, Vt., about 1/2 mile south of the Canadian border and 20 miles east of Lake Champlain. It is about 1/4 mile north of Lake Carmi.

The bog is roughly zoned with a wet, sparse conifer forest on the outside, an open bog mat within, and a small pond with streams and beaver-flooded areas in the middle. The three zones interpenetrate in a complicated manner. The vegetation is complex and the flora correspondingly rich.

### Critical Features

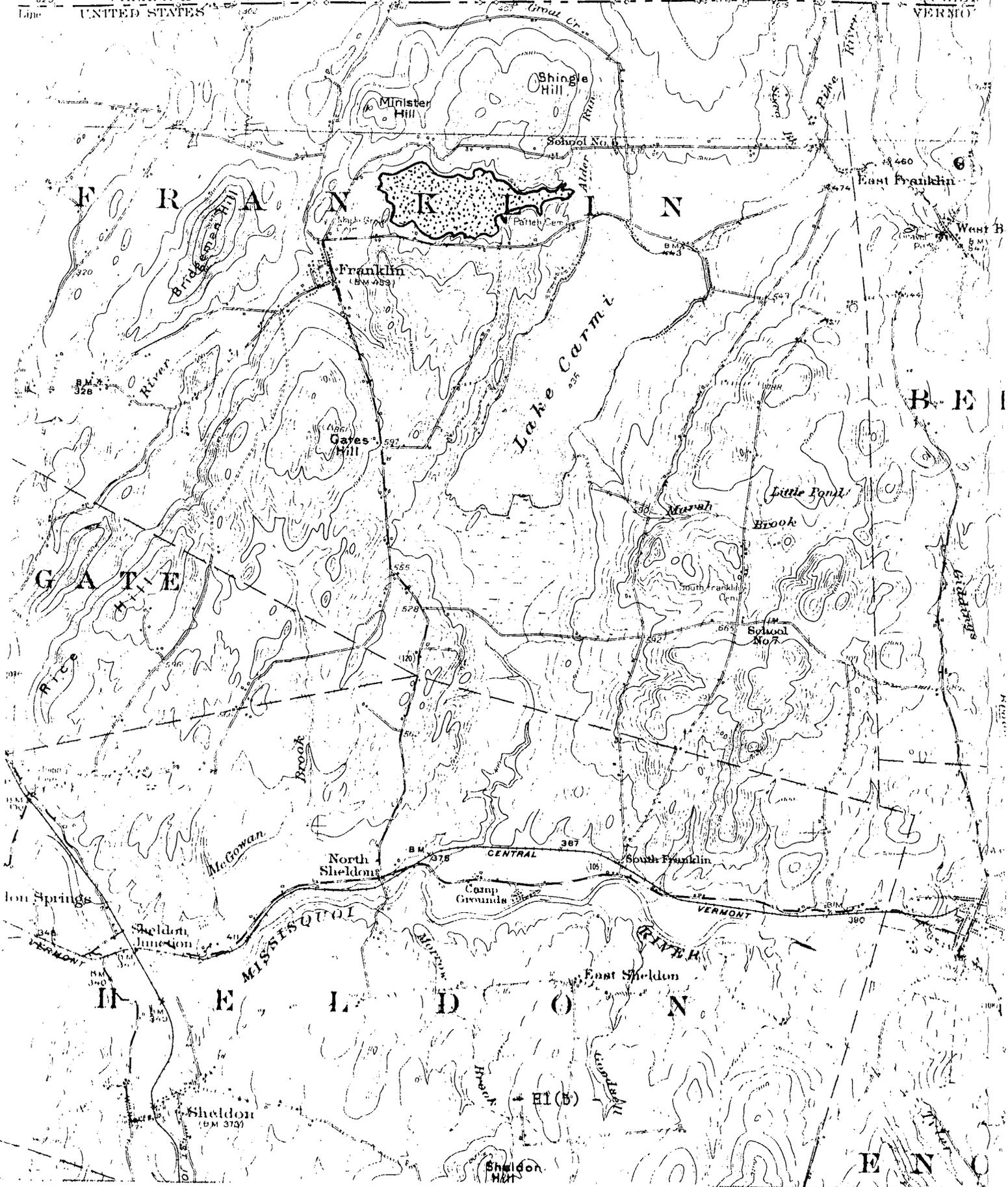
Large in comparison with most of Vermont's bogs, studies have shown Franklin to be correspondingly rich in species and particularly useful in demonstrating bog formation (Jenkins 1979). It also possesses greater stability than most bogs, also a function of its size. Difficulty with access prevents the idle sightseer from visitation and keeps the bog in near-wilderness condition.

### Evaluation Categories

- (1) Knowledge: only recently researched and documented, and that fragmentarily. A collection of invertebrates was made by P. Soyka and C. Quinlan of the Nature Conservancy. It is in the UVM Invertebrate Collection, and is in the process of labelling and identification.
- (2) Representation: one of several bogs chosen to represent the category of peatlands; selected from many possibilities. The only bog representing Franklin County.
- (3) Diversity: classified in one category - as a significant northern peatland.
- (4) Scarcity: one of very few really outstanding bog environments in the state; chosen as a particularly good example of a large bog.
- (5) Status: minimal human disturbance.
- (6) Persistence: not in question over a period of many human generations.
- (7) Distribution: the only Franklin County bog proposed for Registry.
- (8) Manageability: capable of management (although present ownership is soon to change hands and plans for protection, though positive, have not been publicized).
- (9) Area Size Needs: sufficient for inclusion of entire bog complex.
- (10) Habitat Specificity: not applicable.
- (11) Mobility: not applicable.

STATE OF VERMONT  
CHARLES S. DOLL  
STATE GEOLOGIST

620 CANADA 62 619 618 617 666 616 615 667 614 613 612 611 610 QUEBEC  
Line UNITED STATES VERMONT



Ownership

The Vermont Chapter of The Nature Conservancy owns a portion of the bog. The rest is in several private ownerships.

Recognition

- Primary Natural Area (Vt. Nat. Resources Council)
- National Natural Landmark (HCRS - National Park Service)

Management/Protection Strategy

- (1) Increased protection through land acquisition or conservation easements.
- (2) Implementation of Jenkins' suggestions regarding future Franklin Bog research; amphibians, birds, butterflies, bryophytes and lichens; a hydrologic profile; a vegetation map; and permanent study plots.
- (3) It is desirable that more invertebrates be collected and added to the inventory. In particular, the bog should be collected in late May and June, when the invertebrate population is at its highest.

References

Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).

Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.

Jenkins, Jerry 1979. Preliminary Report on Franklin Bog. Submitted to Nature Conservancy. Montpelier, Vt.

Johnson, Charles 1980. Preliminary studies of peats, climate and hydrology. Work in progress.

Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier, Vt.

Vermont Institute of Natural Science 1979. Vermont Breeding Bird Atlas Project. Franklin Bog data sheet (unpubl.) Woodstock, Vt.

Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.

Vogelmann, H.W. 1969. Vermont Natural Areas. Report 2. Vt. Central Planning Office. Montpelier, Vt.

Worley, Ian 1979. Peatlands - An Ecological Perspective. Maine Peat Conference. Orono, Maine.



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## MOLLY BOG

### Location

Lat. 44° 30' 0" N, Long. 72° 38' 0" W. Lamoille County. Town of Morrystown. See accompanying map.

### Site Description

In valley lowlands east of Mt. Mansfield, this bog shows several stages of development. It includes a two acre pond fringed with pond and water lilies, surrounded by four distinct zones: a shrub edge of leatherleaf; a 20 acre bog mat, composed of a matrix of sphagnum moss and sedges with many of the characteristic bog species including leatherleaf (Chamaedaphne calyculata), bog laurel (Kalmia polifolia), bog rosemary (Andromeda glaucophylla), sweet gale (Myrica gale), cranberry (Vaccinium spp.), cottongrass (Eriophorum spp.), sundew (Drosera rotundifolia), and pitcher plant (Sarracenia purpurea); a coniferous forest zone of black spruce and tamarack completely surrounding the bog; and an extensive hardwood forest, dominated by red maple, as soils improve in drainage on the surrounding uplands.

### Critical Features

Considered exemplary of a postglacial bog (Vogelmann 1964), and is particularly valuable for showing several stages of bog development, from pond to bog forest. One of only two Vermont locations for the southern twayblade orchid (Listera australis).

### Evaluation Categories

- (1) Knowledge: botanically well-researched and documented. Continuing research on vegetation and bird populations.
- (2) Representation: one of four peatlands proposed for the Registry; the only one in Lamoille County. Exemplifies the bog flora.
- (3) Diversity: classified in one category, as a significant representative of the northern peatlands.
- (4) Scarcity: one of very few really outstanding bog environments in the state. Contains one species of plant found in only one other Vermont location.
- (5) Status: protected since its purchase in 1961 by the Vt. Botanical and Bird Clubs and its donation to the Univ. of Vt.. Its location and accessibility not widely publicized.
- (6) Persistence: as a dynamic peatland undergoing biological succession, this natural area will change gradually with time, but will persist as a bog for many generations.
- (7) Distribution: of four peatlands proposed for Registry, this is the only one in Lamoille County.
- (8) Manageability: capable of being managed by virtue of its University ownership, but restricted in the terms of the gift to teaching and research only.
- (9) Area Size Needs: sufficient to include totality of bog community.



MORRISTOWN

Sterling Brook

ROAD (100)

Gravel Pit

HM 807

MORRISVILLE 770

Moss

Glen

Brook

BR 730

BR 747

735

1077

Brush Hill

Riverbank Cem

River

Reservoirs

Sunset Hill

Stowe

X 1628

Taber Hill

1189

2349

W

E

Hollow

Brook

Gravel Pit

Stowe

- H2(c) -

4929

4928

7200 FEET

4927

4926

2730

4925

4924

2

(10) Habitat Specificity: endangered plant of this community is restricted to this site type.

(11) Mobility: not applicable.

#### Ownership

The University of Vermont owns the open bog and a small portion of surrounding bog forest (a total of approximately 25 acres); a significant area of bog forest and all of the surrounding upland are privately owned.

#### Recognition

University of Vermont Natural Area

Primary Nature Area (Vt. Nat. Resources Council)

National Natural Landmark (U.S. Dept. of the Interior)

#### Management/Protection Strategy

- (1) Continued policy of limited visitation and publicity.
- (2) Acquisition or protection by conservation easements of a buffer zone that would provide watershed protection and insure the bog against future development at its fringe.

#### References

- Borie, Louis 1977. University of Vermont Natural Areas. Environmental Progr. Univ. of Vermont. Burlington.
- Countryman, W.D. 1978. Rare and Endangered Vascular Plant Species in Vermont. New England Botanical Club and U.S. Fish and Wildlife Service.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. National Park Service Natural Landmarks Program. Research Report.
- Indridason, Louise and Ottar 1974. Vermont's Natural Areas. Part 5. Vermont Life 28(4):57-59.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier.
- Ragan, G. 1970. Plant succession at Molly Bog, Vt., as determined from 1942, 1964 and 1974 aerial photography. M.S. Thesis. Botany Dept. University of Vt.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta. Univ. of Vt. Burlington.

## COLCHESTER BOG

### Location

Lat. 44° 33' 0" N, Long. 73° 17' 0" W. Chittenden County. Town of Colchester. See accompanying map.

### Site Description

Area includes a 150 acre peatland located five miles northwest of Burlington on a peninsula between Lake Champlain and Mallet's Bay. The bog is largely covered with shrubs and trees, but an open quaking mat of sedge and sphagnum is present. Narrow sandy peninsula on eastern edge has several black gum trees (the species' only northwestern Vermont location).

### Critical Features

Unusually rich assemblage of bog and marsh plants and has been recognized as one of the most outstanding natural areas in northwestern Vermont. Presence of Nyssa sylvatica (black gum) an important clue to warmer postglacial climate than presently exists. Has the only known plant of Betula pumila (dwarf white birch) known in Vermont, and contains highly unusual (Worley 1980) stands of pitch pine (Pinus rigida) growing in a peat substrate. Depends upon the levels of a major lake (Lake Champlain) for its ecological character, a feature shared by very few other peatlands in the United States.

### Evaluation Categories

- (1) Knowledge: a wide range of ecological studies have been conducted and are presently underway (see references).
- (2) Representation: one of two wetlands proposed for Chittenden County, this is the only one totally a peatland. One of only four peatlands proposed for the Registry.
- (3) Diversity: classified as a significant northern peatland. Also contains a relict population of a species of very limited range in Vermont and offers breeding habitat for a threatened bird species.
- (4) Scarcity: one of very few really outstanding bog environments in the state. Contains a plant species whose disjunct distribution is of great climatological interest.
- (5) Status: purchased by the Vermont Chapter of the Nature Conservancy in 1973 and given to the University of Vermont. Used for teaching and research and little other direct visitation.
- (6) Persistence: not in question, though, as a peatland, its vegetation and animal populations may change with succession. The peatland is 9,000 or more years old.
- (7) Distribution: important location not only for bog itself (in relation to Lake Champlain levels) but also for black gum stand (the only one in northwestern Vermont) and for the presence of Betula pumila (the only Vermont location).

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DORSET BAT (GREEN PEAK) CAVE

Lat. 43° 14' 15" N, Long. 73° 2' 5" W. Bennington County. Town of Dorset.  
See accompanying map.

Site Description

Five acre limestone solution cave in Green Peak. The cave has two main chambers and possibly others deeper in the mountain. Both main rooms support hibernating bats in winter.

Critical Features

Likely the most important hibernaculum and roosting site in New England for the federally endangered Indiana bat (Myotis sodalis). Other bat species also use the cave for hibernation. Past research has documented great numbers of Indiana bats here (around 300,000 in some years), but little is known about their present status except that it is probable they still hibernate in this location. The Indiana bat is a colonial hibernator, so is especially vulnerable in winter. This cave may be the only locality in Vermont for a truly cavernicolous invertebrate, the white, eyeless amphipod Stygobromus sp. (the species is uncertain, as only immatures were included in the collection). However, there may be confusion over the name of the cave, as the specimens were labeled only "Dorset Cave".

Evaluation Categories

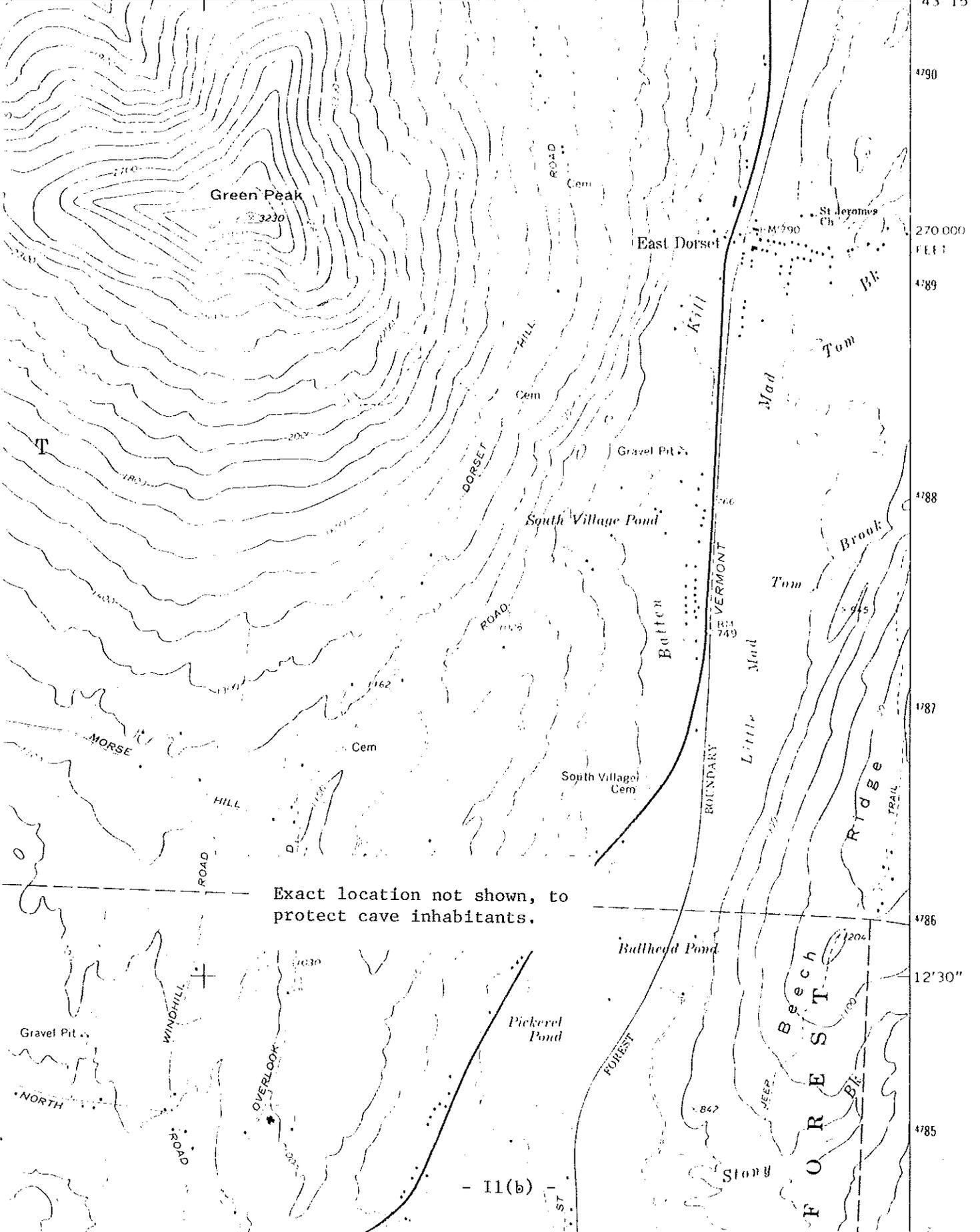
- (1) Knowledge: bat populations have been studied by several researchers over many years.
- (2) Representation: only area proposed for Registry that is a habitat for a federally endangered mammal species.
- (3) Diversity: classified as habitat for endangered species; also a critical habitat for a colonial species, and critical wintering area.
- (4) Scarcity: one of few such areas in state, or in the East.
- (5) Status: severely threatened by vandalism and casual visitation. Some snowmobilers and winter hikers build fires in the cave and knock hibernating bats off the ceilings. Unauthorized academic research through the years may contribute to problems.
- (6) Persistence: the bat itself (Myotis sodalis) apparently a very persistent species, with high site tenacity, returning to the same hibernaculum year after year.
- (7) Distribution: as one of very few locations in the state for this endangered species this area is prime for registry.
- (8) Manageability: capable of being managed, though presently is not. Problems with intensity of visitation from populations not directly interested in cave ecology: gliders, dirt bikers, and snowmobilers.
- (9) Area Size Needs: cave is a discrete unit which is sufficient to offer protection for hibernation populations there.
- (10) Habitat Specificity: Indiana bat restricted to this specific site type for hibernation period.
- (11) Mobility: bats have no mobility during critical hibernating phase.

MANCHESTER QUADRANGLE  
 VERMONT-BENNINGTON CO.  
 7.5 MINUTE SERIES (TOPOGRAPHIC)

64 70 14  
 WALLINGFORD  
 1 62 300

NE/4 EQUINOX 15 QUADRANGLE

'58      2'30"      '60      36'00" ELLI      '61      '62      73°00'      43°15'



Exact location not shown, to protect cave inhabitants.

### Ownership

National Gypsum Company and private individuals.

### Recognition

Vermont Natural Areas Inventory (Vt. Nat. Resources Council).

Primary Natural Area (Vermont Natural Resources Council).

One of only two areas in Vermont recommended for U.S. Fish & Wildlife acquisition under Unique Ecosystems Plan.

### Management/Protection Strategy

- (1) Protection through conservation easements or acquisition by a conservation organization.
- (2) Relocation or elimination of trail away from entrance.
- (3) Initiate closely-monitored research on Indiana Bat population in area.
- (4) Investigate other methods to restrict visitation and vandalism.

### Referneces

- Allen G.M. 1904. Checklist of New England Mammals. Occasional Papers. Boston Soc. of Natural History 7(3):1-35.
- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Department of the Interior, U.S. Fish & Wildlife Service. 1979. List of Endangered and Threatened Wildlife and Plants. Washington, D.C.
- Department of the Interior, U.S. Fish & Wildlife Service. 1979. Unique Wildlife Ecosystems Concept Plan. State of Vermont.
- Godin, Alfred J. 1977. Wild mammals of New England. Johns Hopkins Univ. Press: Baltimore.
- Griffin, Donald R. 1932-1940. Banding data on bats in New England. Unpublished (available from Middlebury College, Middlebury, Vt.).
- Griffin, Donald R. 1940. Notes on the life histories of New England bat caves. Journal of Mammalogy 21:181-182.
- Hitchcock, Harold 1965-1968. Correspondance with Robert Carroll, Jr. (with maps). Classified in office of Vt. State Geologist. Montpelier, Vt.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H. p.194.
- Kirk, George L. 1916. The Mammals of Vermont. Vt. Botanical and Bird Clubs Joint Bulletin 2:28-31.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase IIO. Vt. Natural Resources Council. Montpelier, Vt.
- Osgood, Frederick R. 1948. The Mammals of Vermont. Journal of Mammalogy 19(4):435-441.

- Perry, Clay 1939. Underground New England. Stephen Day Press:  
Brattleboro, Vt.
- Scott, J. 1959. Caves in Vermont: A Spelunker's Guide to their location  
and lore. Killbuck Independent Speleological Society: Hancock, Vt.
- Thompson, Zadock 1853. Natural History of Vermont. Reprinted 1972.  
Charles Z. Tuttle Co. Rutland, Vt.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory.  
New England Natural Resources Project. Montpelier, Vt.

## DEAD CREEK WATERFOWL AREA

### Location

Lat. 44° 05' 00" N, Long. 73° 21' 0" W. Addison County. Town of Addison. See accompanying map.

### Site Description

The largest waterfowl management area in the state is this area in western Addison County bisected by Route 17 between Addison and Chimney Point. The waters of Dead Creek flow sluggishly north and empty into Otter Creek here. Conditions for marshlands are ideal and wetland vegetation of a variety of kinds spreads over a large area (more than 1,000 acres). Several dikes have been constructed to create favorable environments for nesting and feeding waterfowl. Aquatic plants, ranging from submerged to emergent, are found in great variety and in extensive stands. One of the most important wetland complexes in the state for waterfowl and marsh birds, a total of 168 species has been found within the area to date.

### Critical Features

Although some of the wetlands in this complex are the result of man-made impoundments, the basic marsh vegetation of the area was established naturally long before management began, and the migratory visitation patterns now seen here among the wildlife have been fixed for many years in the populations that use the marshes. Human visitation is relatively heavy but restricted from breeding areas during critical times. Among the many species of resident and migratory birds and mammals feeding and breeding in the waterfowl area, the following, because of their inclusion in the state's proposed list of rare, threatened, and endangered bird species, are worthy of note:

Least Bittern (rare)

Short-billed Marsh Wren (threatened)

Osprey (endangered)

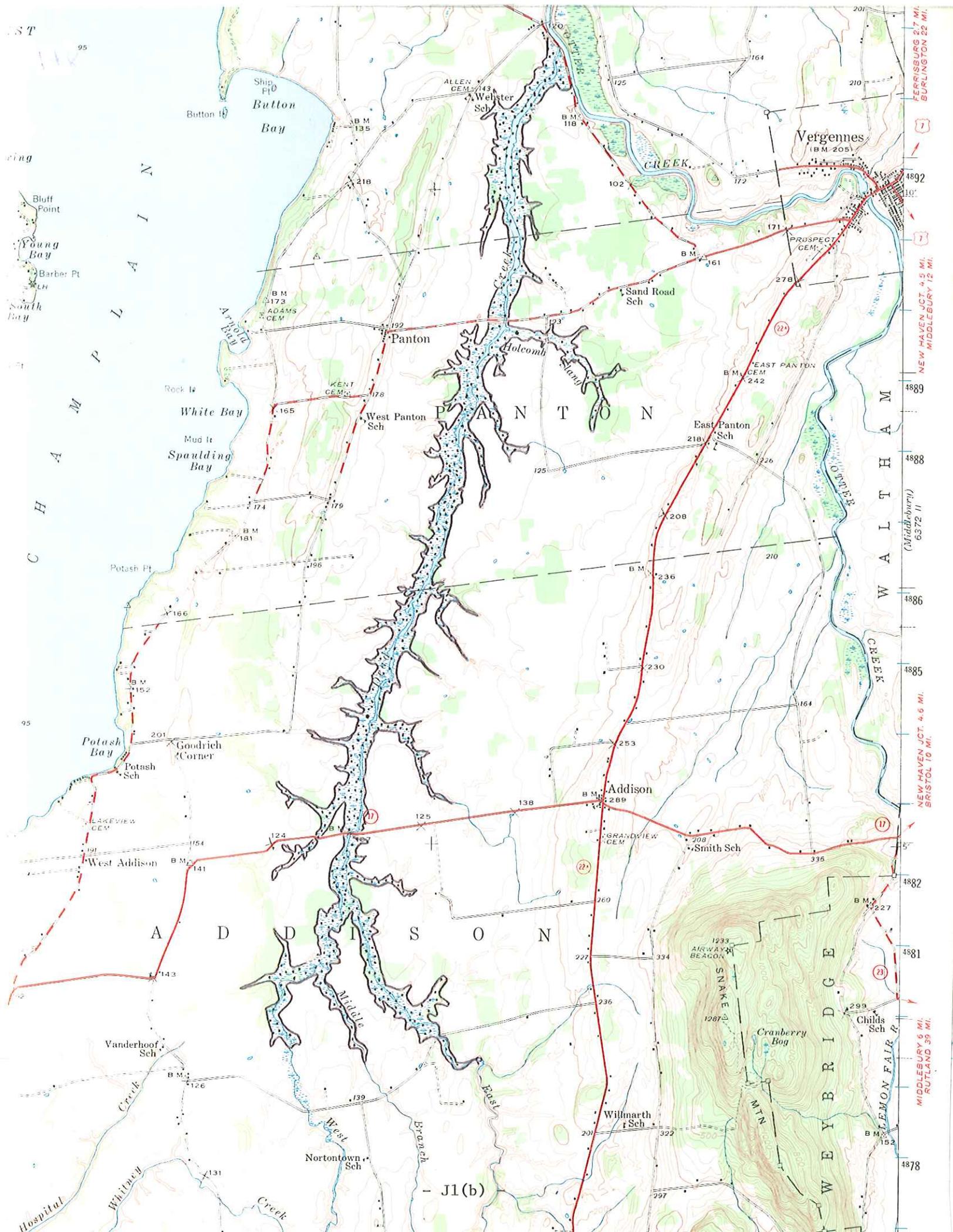
Peregrine Falcon (endangered)

This area is rich in marsh insects, and is the only known Vermont locality for the ground beetle Bembidion cordatum.

Indian artifacts are abundant in the region.

### Evaluation Categories

- (1) Knowledge: reasonably solid body of available information on environment and biological resources of this area.
- (2) Representation: of the marshes proposed for recognition this one differs in the kind of access it offers for wildlife observation. This is a distinct convenience and facilitates study.
- (3) Diversity: proposed for the Registry primarily as a critical habitat for restricted species. Also exemplifies marsh community diversity in response to water level differences, even though some



ST 95

CHAMPLAIN VALLEY

95

95

FERRISSBURG 2.7 MI.  
BURLINGTON 22 MI.  
NEW HAVEN JCT. 4.5 MI.  
MIDDLEBURY 12 MI.  
NEW HAVEN JCT. 4.6 MI.  
BRISTOL 10 MI.  
MIDDLEBURY 5 MI.  
RUTLAND 39 MI.

- J1(b)

of the wetlands are artificial in their origins.

- (4) Scarcity: not applicable.
- (5) Status: visitor impact minimized at critical periods in breeding cycles; relatively light overall impact.
- (6) Persistence: should not be at issue under present management regime.
- (7) Distribution: not applicable.
- (8) Manageability: capable of management and currently being effectively managed for the benefit of waterfowl and associated water birds.
- (9) Area Size Needs: adequate for foreseeable future.
- (10) Habitat Specificity: rare and threatened bird species of this community are restricted to the vegetation types in which they are found here.
- (11) Mobility: all of restricted bird species have a pattern of long-range movement (migration) but something of a long history of repeated return to these marshes.

#### Ownership

Vermont Dept. of Fish and Game. Montpelier, Vt.  
Regional Office - RFD #1, Box 130, Vergennes, Vt. 05491

#### Recognition

Primary Natural Area (Vt. Nat. Resources Council)  
National Natural Landmark (U.S. Dept. of the Interior)

#### Management/Protection Strategy

Continued visitor and environmental monitoring through existing Fish and Game regulations and practices.

#### References

- Barber, Eileen, D.J. Bogucki, G.K. Gruending, and M. Madden. 1977. Historical land use changes and impacts in Lake Champlain wetlands. Lake Champlain Basin Study. New England River Basins Comm. Burlington, Vt.
- Bell, R.T. 1980. Suggestions for the initial registry of fragile areas (personal communication).
- Brooks, Peter 1979. Critical Environmental Areas. Lake Champlain Basin Study. New England River Basins Commission. Burlington, Vt.
- Flaccus, Edward 1972. Vegetation natural areas of the Hemlock-White Pine-Northern Hardwood region of the Eastern Deciduous Forest. U.S. Dept. of Interior. Nat. Park Service Natural Landmarks Program. Research Report.
- Fuller, Robert 1961. A partial list of birds of the Dead Creek Waterfowl Management Area. Addison, Vermont.

- Gruendling, G.K. and D.J. Bogucki 1978. Assessment of the Physical and Biological Characteristics of the Major Lake Champlain Wetlands. Lake Champlain Basin Study. New England River Basins Comm. Burlington, Vt.
- Hancock, William et. al. 1978. The Vermont Atlas and Gazetteer. David DeLorme Co.. Yarmouth, Me.
- Indridason, Louise and Ottar 1973. Vermont Natural Areas. Part 3. Marshes. Vermont Life 28(2):6-10.
- Johnson, Charles 1980. The Nature of Vermont. University Press of New England. Hanover, N.H.
- Klein, Robert 1976. Technical Report: Vermont Natural Areas Project (Phase II). Vt. Natural Resources Council. Montpelier, Vt.
- Laughlin, Sarah 1980. Comments on fragile areas draft (personal communication).
- Vermont Endangered Species Subcommittee 1978. Revised preliminary list of endangered, threatened, and rare species of birds in Vermont. Vt. Agency of Env'tl. Conservation. Montpelier.
- Vermont Natural Resources Council 1972. Vermont Natural Areas Inventory. New England Natural Resources Project. Montpelier, Vt.
- Vogelmann, H.W. 1964. Natural Areas in Vermont. Report 1. Vt. Agric. Expt. Sta. Univ. of Vermont. Burlington.

APPENDICES

- I. FRAGILE AREAS LAW
- II. NATURAL AREAS LAW
- III. ENDANGERED SPECIES LIST



Title 10. CONSERVATION AND DEVELOPMENT  
Chapter 158 §6551 - §6552

Chapter 158. Fragile Areas Registry

§6551. Definitions.

As used in this chapter:

- (1) "Fragile area" means an area of land or water which has unusual or significant flora, fauna, geological, or similar features of scientific, ecological or educational interest;
- (2) "Register" means the fragile areas register which lists those fragile areas designated by the secretary;
- (3) "Secretary" means the secretary of the agency of environmental conservation; and
- (4) "Adjacent" means those lands and waters directly abutting a site on the register, including lands and waters separated from the site by highways or bodies of water where such separated lands and waters are an integral part of the site's ecosystem. - Added 1977, No. 129 (Adj.Sess.), §1.

§6552. Fragile Areas.

- (a) The secretary shall consider for designation on a register of fragile areas only a site which:
  - (1) is a significant statewide scientific, ecological or educational value; or
  - (2) is exemplary for the purposes of education or research in the natural sciences; or
  - (3) has rare, remnant or other unusual plants or animals, or contains endangered species as determined by the secretary under chapter 79 of Title 13; or
  - (4) contains a necessary wildlife habitat as that term is defined in section 6001(12) of this title.
- (b) To assist in the designation, the secretary shall seek the advice of at least five scientists, familiar with Vermont fragile areas, from the fields of biology, botany, geology and wildlife.
- (c) Prior to designating a fragile area on the register, the secretary shall:
  - (1) document the technical and scientific basis for the designation;
  - (2) conduct at least one public information and fact-finding meeting in each administrative district which contains a fragile area under consideration;
  - (3) provide each owner of such land, municipality and regional planning commission with a copy of applicable proposals no later than 30 days following the meeting;
  - (4) provide information and assistance upon request, to persons concerning the identification, protection and management of fragile areas contained in the register. - Added 1977, No. 129 (Adj.Sess.), §1.

Chapter 158. Fragile Areas Registry

§6553. Powers of the Secretary.

(a) The secretary shall:

(1) establish and maintain a register of fragile areas: and

(2) adopt standards for the maintenance and protection of state-owned properties contained on the register.

(b) Actions by the secretary shall be made pursuant to chapter 25 of Title 3.

(c) The secretary shall report biennially to all affected public agencies and municipalities concerning the status and extent of the register. - Added 1977, No. 129 (Adj.Sess.), §1.

§6554. Impact Statement.

A state agency, municipality or organization before making a capital improvement, which is funded in whole or in part by federal money, within or adjacent to a fragile area shall, in compliance with rules adopted pursuant to 42 U.S.C. 3334, 4231 and 4332, attach to the notice of intent for the state clearing house a statement of the impact of the proposed action on the fragile area. - Added 1977, No. 129 (Adj.Sess.), §1.

§6555. Cooperation of Agencies.

State agencies and regional planning commissions shall:

(1) notify the secretary before altering or transferring any publicly-owned property that is listed in the register; and

(2) provide for the maintenance or protection of state-owned properties listed in the register. - Added 1977, No. 129 (Adj.Sess.), §1.

Title 10. CONSERVATION AND DEVELOPMENT  
 Chapter 83 §2606 - §2607

Chapter 83. Department of Forests, Parks and Recreation

§2606. Acceptance of Gifts; Exchange, Purchase or Lease of Lands.

(a) The commissioner, with the approval of the governor, may accept gifts of land to the state or may purchase land in the name of the state to be held and administered as state forests or state parks.

(b) The commissioner, with the approval of the general assembly, may exchange or lease lands under his jurisdiction when in their judgement it is advantageous to the state to do so in the highest orderly development and management of state forests and parks.

(c) The commissioner, with the approval of the governor, may lease mine, quarry or other resource sites or rights as may be discovered on state forest or park lands unconditionally owned by the state.

(d) The commissioner, with the approval of the governor, may lease for a term of years, or otherwise, such lands as he deems necessary for the protection of state forest or park lands or for use by the state in connection therewith. - Added 1977, No. 253 (Adj.Sess.), §1.

§2607. Natural Areas; Designation.

(a) The commissioner, with the approval of the governor, may designate and set aside areas in the state forests and state parks as natural areas.

(b) "Natural areas" means limited areas of land which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest which are worthy of preservation for the use of present and future residents of the state and may include unique ecological, geological, scenic and contemplative recreational areas on state lands.

(c) Land uses and practices in natural areas shall be subject to regulations of the department to carry out the purposes of this chapter to manage or maintain the areas for the preservation of their natural condition. Areas so designated may be removed from such designation only by approval of the governor following public notice and hearing. - Added 1977, No. 253 (Adj.Sess.), §1.

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## STATE OF VERMONT

## ENDANGERED SPECIES LIST

PURPOSE It is the purpose of these regulations to carry out the mandate of the Vermont General Assembly to protect endangered species of fish, bird, quadruped, reptile, plant, flower, tree or shrub, and to prohibit the taking thereof, pursuant to the authority granted to the Secretary of Environmental Conservation by Section 3652 of Title 13, Vermont Statutes Annotated.

13-79.1 The following species of animal life are designated as endangered species, the taking of which (as defined by Section 3651(3)(A) of Title 13, Vermont Statutes Annotated) is prohibited.

A. Fish:

Lake Sturgeon - (*Acipenser fulvescens*)

B. Birds:

Southern Bald Eagle - (*Haliaeetus l. leucocephalus*)

American Osprey - (*Pandion haliaetus carolinensis*)

American Peregrine Falcon - (*Falco peregrinus anatum*)

C. Mammals:

Indiana Bat - (*Myotis sodalis*)

Pine Marten - (*Martes americana*)

Eastern Cougar - (*Felis concolor cougar*)

Canada Lynx - (*Lynx canadensis*)

13-79.2 The following species of plant life are designated as endangered species, the taking of which (as defined by Section 3651(3)(B) of Title 13, Vermont Statutes Annotated) is prohibited, except by a person upon lands owned and occupied by him; or from lands owned or occupied by another, or from public lands, under a signed permit from the owner or lawful occupier thereof. Such taking is limited to not more than a single up-rooted specimen or two cuttings of each of the following plants, and then for scientific purposes only.

Adder's mouth - (*Malaxis*)

Green-alder - (*Alnus crispa*)

Trailing-arbutus - (*Epigaea repens*)

Alpine-mountain ash - (*Pyrus decora*)

Mountain-astragalus - (*Astragalus blakei*)

Bog-bilberry - (*Vaccinium uliginosum*)

Dwarf-bilberry - (*Vaccinium cespitosum*)

Butter-wort - (*Pinquicula vulgaris*)

Calypso - (*Calypso*)

Three-toothed cinquefoil - (*Potentilla tridentata*)

Slender cliffbrake - (*Cryptogramma stelleri*)

Northern-comandra - (*Gedcaulon lividum*)

Coral-root - (*Corallorhiza*)

Cow-berry - (*Vaccinium vitisidaea*)

Few-flowered cranberry tree - (*Viburnum edule*)

Black-crowberry - (*Empetrum nigrum*)

Lapland diapensia - (*Diapensia lapponica*)

Braun's holly fern - (*Polystichum brunii*)

Fragrant fern - (*Dryopteris fragrans*, Schöot var. *remostinuscula*)

Northern-gentiana - (*Amarella*)  
Hoary or twisted-whitlow grass - (*Draba incana*)  
Alpine-goldenrod - (*Solidago calcicola*)  
Hedysarum - (*Hedysarum alpinum*, L. var. *americanum*)  
Bastard-helleborine - (*Epipactis*)  
Ladies' tresses - (*Spiranthes*)  
Chatelain, lady's slipper; moccasin flower - (*Cypripedium*)  
Great-laurel - (*Rhododendron maximum*)  
Club-moss - (*Lycopodium selago*)  
Orchid - (*Orchis*)  
Cranefly-orchid - (*Tipularia*)  
Rein orchid; fringed orchid - (*Habenaria*)  
Pale painted-cup - (*Castilleja septentrionalis*)  
Jack-pine, or gray-pine - (*Pinus banksiana*)  
Grass-pink - (*Calopogon*)  
Wild-pink - (*Arethusa*)  
Pinxter-flower - (*Rhododendron nudiflorum*)  
Rattlesnake-plantain - (*Goodyera*)  
Pogonia - (*Pogonia*)  
Three-lobed pogonia - (*Triphora*)  
Verticillate-pogonia - (*Isotria*)  
Dwarf canadian-primrose or Pale magenta-pink- (*Primula mistassinica*)  
Putty-root - (*Apelctrum*)  
Greenland-sandwort - (*Arenaria greenlandica*)  
Vernal-sandwort - (*Arenaria rubella*)  
Alpine-saxifrage - (*Saxifraga aizoon*)  
Mountain-saxifrage - (*Saxifraga oppositifolia*)  
Yellow-mountain saxifrage - (*Saxifraga aizoides*)  
Mountain-shadbush - (*Amelanchier bartramiana*)  
Spleenwort - (*Asplenium cryptolepsis*)  
Green-spleenwort - (*Asplenium viride*)  
Twayblade - (*Liparis*)  
Lister's twayblade - (*Listera*)  
Alpine-willow - (*Salix planifolia*)  
Alpine-willow - (*Salix uva-ursi*)  
Lesser-wintergreen - (*Pyrola minor*)  
Alpine-woodsia - (*Woodsia alpina*)  
Smooth- woodsia - (*Woodsia glabella*)

BY AUTHORITY

§ Martin L. Johnson

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Martin L. Johnson, Secretary  
Environmental Conservation

FILED AT THE OFFICE OF  
THE SECRETARY OF STATE:

§ M. E. Willey

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7/1/75-AEC-2500

