STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Petitions of BNE Energy Inc. for a Declaratory Ruling for the Location, Construction and Operation of 4.8 MW Wind Renewable Generating Projects on Flagg Hill Road in Colebrook, Connecticut ("Wind Colebrook South") and Winsted-Norfolk Road in Colebrook, Connecticut ("Wind Colebrook North")	**Petition Nos. 983 and 984**
	March 15, 2011

PRE-FILED TESTIMONY OF JOYCE HEMINGSON

Q1. Please state your name and address.

A1. My name is Joyce Hemingson, and I reside at 44 Rock Hall Road in Colebrook, Connecticut.

Q2. What is your connection to these proceedings?

A2. I am President of FairwindCT, Inc., a non-profit corporation that is party to this petition. I also am interested in Council's decision regarding the petitions as a resident of Colebrook, where I have lived for the past 39 years. My property is located less than half a mile from the Wind Colebrook North property and approximately one mile from the Wind Colebrook South property. My house is located less than 2300 feet from one of the turbines at Wind Colebrook North.

Q3. Please describe FairwindCT for the Council.

A3. FairwindCT, Inc. ("FairwindCT"), is a Connecticut non-profit corporation formed and run by Colebrook residents for the purpose of promoting conservation and natural beauty, protecting the environment, personal health and biological values, preserving historical sites, promoting consumer interests and promoting the orderly development of Colebrook and the surrounding area. To accomplish its purposes, FairwindCT is educating the general public and

the community about industrial wind energy projects, lobbying for wind energy regulations and advocating for the protection of the environment and the health, safety, and quality of life of Connecticut residents. FairwindCT's supporters live in Colebrook, Norfolk, Winchester and other Connecticut towns. Its officers and directors all live less than half a mile from Wind Colebrook North and approximately one mile from Wind Colebrook South.

Q4. How was FairwindCT formed?

A4. In November of 2010, my husband and I received a notice of an informational meeting BNE was holding at the Town Hall about their plans to construct two industrial wind farms in Colebrook. While we were aware of the town's decision in 2008 to allow construction of a certain "met tower" on Flagg Hill Road, until last November we had heard nothing about the construction of a wind farm. Between 2008 and 2010, the construction of a wind farm subject to the petitions before the Council were not discussed at any of Colebrook's biannual town meetings, nor were they discussed in any of the meetings of Colebrook's Board of Selectmen. A supporter of FairwindCT reviewed the minutes of those meetings to confirm that fact.

Accordingly, when we did learn of the plans for these wind projects last November, a group of three very quickly came together to create FairwindCT in order to provide a source of information and an outlet for the residents of Colebrook, who had to that point been completely ignored by both BNE and Colebrook officials. FairwindCT's web site (www.fairwindct.com) served as a place for information about BNE's plans and about wind turbines generally. FairwindCT also took steps to notify residents of the plans by mailing out a flyer, which was for many residents the first they had heard about the planned construction.

Since our formation, we have hired attorneys, gained party status in these petitions and the related Prospect petition filed by BNE, held informative meetings, sent out more mailers and emails, written to and met with local and state politicians, held press conferences, spoken with business leaders, testified before a legislative committee, hired experts, and otherwise worked

tirelessly to inform the general public and our representatives at all levels of government about the serious safety, health and environmental concerns associated with siting these massive industrial turbines near residential neighborhoods.

Q5. What is FairwindCT's position regarding these petitions?

A5. FairwindCT opposes these petitions and instead has called for a moratorium, public hearings, and regulations regarding siting wind turbines in Connecticut. Broadly, FairwindCT contends that industrial wind turbine facilities are, as a general matter, inappropriate for residentially zoned areas, and particularly FairwindCT contends that BNE's proposed facilities are fundamentally incompatible with the area surrounding the proposed sites in Colebrook.

Specifically, FairwindCT believes that:

- The Council should not consider petitions for declaratory rulings before it has engaged in the rule-making process and adopted appropriate regulations that will balance the State's goal of increasing renewable energy resources with the interests of its residents and the goals of the State Plan for Conservation and Development;
- BNE's petitions should be denied because industrial wind turbines should not be sited in proximity of residences;
- BNE's petitions should be denied because the projects contradict both the State Conservation and Development Policies Plan and Colebrook's Plan of Conservation and Development;
- BNE's petitions should be denied because the project will have significant adverse effects on the environment;
- BNE's petitions should be denied based on BNE's failure to provide the Council with complete and accurate information regarding the site, particularly with

respect to BNE's artificial and self-serving designation of the two petitions separate projects, and BNE's inaccurate data dealing with wildlife, wetlands, historic, stormwater, and noise impacts; and

- The process by which these petitions are being considered is patently unfair to FairwindCT and to the citizens of Colebrook who oppose the petition.

Q6. Why do you say that the process is unfair?

A6. The process by which these projects evolved has not been transparent and participation by the town's residents was not solicited either by the selectmen of the Town of Colebrook or by BNE. FairwindCT was organized on very short notice and has been funded by donations from citizens who felt marginalized and ignored. In contrast, BNE has had years to develop its petition in large part by using public funding. That means that in addition to citizens directly funding the opposition to these petitions, we have also indirectly funded the petitions themselves.

The minutes of the Connecticut Clean Energy Fund Board ("CCEF") for July 28, 2008 state the following under "6. Projects Committee Report": "Mr. Peters . . . stated the Projects Committee conditionally approved pre-development loans for two wind projects. With respect to the wind projects, staff was asked to verbally verify local support for the projects." Town residents did not know about the December 31, 2008 letter of support written by the First Selectman to the CCEF (attached as Exhibit 1), which was used as a basis for awarding BNE public funds in 2009. The letter mentions a "presentation" by Gregory Zupkus, one of the principals of BNE. Colebrook residents were not aware such a meeting took place and were never asked whether they would support these projects.

The first grassroots group concerned about a potential wind farm in Colebrook organized in early 2009 after the met tower was approved for Flagg Hill Road. A website,

www.flagghill.com, was developed and an online petition posted on GoPetition, calling for setbacks from property lines and occupied buildings.

The Minutes of the Projects Committee of the CCEF Board for October 15, 2009 state: "Mr. Hedman provided a brief update on the Colebrook and Prospect wind projects. A full presentation on Phase II will be made at the November 2009 Committee meeting. In response to a question about opposition to the projects, Mr. Hedman indicated that staff has copies of written letters from the town officials supporting the projects. The Committee members requested that staff encourage the developers to obtain as much support for the projects and alleviate potential opposition sooner rather than later in the process." No mention was made of the local opposition in the form of the Flagg Hill grassroots group.

The minutes of the Projects Committee of CCEF for November 12, 2009 state under "3. Pre-Development Loans Phase 2 – BNE Wind Colebrook and BNE Wind Prospect": "Mr. Hennessy raised questions about public relations and outreach. Mr. Hedman stated that the developer has been focusing on obtaining the data needed to move to Phase 2 and understanding the markets for the turbines. He noted that the activities for outreach and public relations will begin in the near future and before filing with the Siting Council."

The Flagg Hill grassroots group disbanded when BNE bought the property of the group's key organizer, Stephen King (the Warrantee Deed to BNE was filed on June 29, 2010). BNE did not conduct any outreach or public relations until a mailing was sent in November 2010 to some, but not all, residents in the Flagg Hill Road, Greenwoods Turnpike, and Rock Hall Road neighborhoods.

Q7. What is the basis for your other concerns about this petition?

A7. Over the past four months, I have read about wind energy and industrial wind turbines in other states and other countries, particularly with respect to the public health and quality of life impacts of industrial wind turbines sited near residences, but also impacts on

wildlife habitats and sensitive environmental areas such as migration routes. These issues need to be considered before industrial turbines are sited, and the State of Connecticut does not have regulations that specifically address them. The practices being used to site industrial turbines elsewhere are not uniform and are rapidly changing as communities learn, once turbines have been installed, what doesn't work.

I have spoken to residents of other New England states about the negative impacts of industrial turbines, including noise, habitat destruction, forest fragmentation and interruption of wildlife corridors, blasting, dramatic changes to scenic ridgelines, bat and bird casualties and a decline in property values. These effects will be cumulative throughout our state and in New England and will particularly hit areas such as Northwestern Connecticut, where many towns and land trusts have worked for decades to conserve land and other resources for future generations.

Q8. Please describe for the Council what you discovered when you visited Vinalhaven, Maine.

A8. One of the worst impacts that industrial turbines can have is on the relationships within a community. These projects divide towns and even families – into those who are directly affected and those who are not. I learned this firsthand when I visited Vinalhaven, Maine, where three 1.5MW GE turbines (262 feet hub height, 389 feet total height), began operation in November 2009. The project had wide community support at the beginning, but once the closest neighbors realized much noise they were being expected to live with, things changed. They formed Fox Islands Wind Neighbors (www.fiwn.org) and learned that a pre-construction engineering report had been suppressed. That report had recommended further study of the sound characteristics at the site, including a discussion with neighbors of possible effects, mitigation, sound easements, and changes to the local sound ordinance to be less restrictive.

The Vinalhaven site has three turbines arranged in a triangle and spaced closer to each other than the recommended number of rotor blades, and no matter which direction the wind

blows from, one turbine gets turbulence from the others. The site is located in a quiet residential area where the ambient sound level does not mask the sound of the turbines. The Fox Islands Wind Neighbors spent money on lawyers and sound measuring equipment and finally, after a year, got the attention of the Maine Department of Environmental Protection.

Neighbors who spoke up about the noise were dismissed until their measurements showed it was above the allowable limit of 45dBA at the closest property line. As a result, one turbine is now running in "power down" mode to lessen the noise. That property owner figures if turbines have a 20-year life span, then he has 19 years left to go – he speaks about his situation as though he's doing time. To avoid unpleasant treatment by other islanders, some neighbors have chosen not to complain openly, and at least one family left their home.

The Fox Islands Wind Tour Info (attached as Exhibit 2) has interesting facts in "Project Development." According to this document, "14 acres needed to be set aside for a salamander conservation area in order to mitigate any effects to vernal pool." Under "Grounding," the document states: "Turbines are virtually guaranteed to be struck by lightening [sic]. Not a question of if, but when. Blades are covered in copper webbing to serve as lightening [sic] conductor."

The 2008-2009 Annual Report for the Town of Vinalhaven had this in the Emergency Management Report, pages 25-26 (attached as Exhibit 3): "Probably not since the quarrying days, has the island seen as many people, or as much equipment or as many large items, as arrived here with the erection of the three wind power turbine units. Long before they arrived, detailed medical, fire, and public works sessions reviewed the many detailed operations involved in assuring a safe operation. Now up and operating, local Fox Islands Electric, Fire, and EMS crews have participated in specialized high angle rescue training, and are capable of rescuing anyone injured or has fallen within the towers." Will the State of Connecticut or BNE develop

and pay for a wind energy training program for Colebrook's volunteer fire department and volunteer first responders unit?

And lastly, the three wind turbines on Vinalhaven have created one part-time job on the island. There may also be someone who plows the roads there in the winter. The claim that industrial wind turbine projects will create numerous jobs has not proven true in Vinalhaven.

Q9. Let's go back to some of the other concerns you mentioned. How do these projects contradict the goals of the Conservation and Development Policies Plan for Connecticut 2005-2010?

A9. In the Conservation and Development Policies Plan for Connecticut 2005-2010, the fourth growth management principle is to Conserve and Restore the Natural Environment, Cultural and Historical Resources, and Traditional Rural Lands. More specifically:

- fulfill the responsibility of each generation as trustee of the environment for succeeding generations;
- assure for all residents of the state safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- preserve important historic, cultural, and natural aspects of our Connecticut heritage and maintain, where possible, an environment which supports diversity and variety of individual choice;
- achieve an ecological balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities;
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources; and
- practice conservation in the use of energy, maximize the use of energy efficient systems, and minimize the environmental impact of energy production and use. (C.G.S. Section 22a-1a(b)).

The bullet points above contain clear language and in no way suggest that industrial zones should be created within residential neighborhoods in a rural area. Each turbine requires several

acres of clear-cutting, grading, habitat destruction, and loss of wetlands. The effects will be real and cumulative, while the amount of usable energy that might be produced is not predictable. The wind varies from hour to hour, day to day, season to season, and year to year.

Under Rural Areas, we find this as a goal: "To ensure appropriately scaled economic development in rural communities which provides an adequate financial base and range of employment opportunities but which is compatible with the varied economic, social, and environmental needs and concerns of rural areas." More specifically:

> Ensure new projects are consistent with "rural design" principles and do not have unacceptable adverse impacts upon districts and sites of historic significance, important natural areas or concentrations of prime farmland;
>
> Supporting industrial and business development within Rural Community Centers only of a scale and type which respond to an existing local employment need without inducing major development.

Wind turbines that stand 492 feet tall are not appropriately scaled for Colebrook and the noise they create would not be appropriate for its residents or wildlife.

Remember, Colebrook does not have a gas station, a bank, a mall, a restaurant, a package store, a movie theatre, or many other conveniences of modern life. What we do have is the Algonquin State Forest, Sandy Brook Natural Area Preserve and Kitchel Wilderness Natural Area Preserve, Metropolitan District Commission watershed lands and Colebrook reservoir, two historic districts and scenic roads, and an active land trust with over 1,000 acres of preserved or easemented land. People choose to live here for the serenity and beauty of the natural environment, and for the community values that can be found in a small town.

The fifth growth management principle in the Plan is to Protect and Ensure the Integrity of Environmental Assets Critical to Public Health and Safety. Specifically:

> Human health and welfare cannot ultimately be maintained in an unhealthy natural environment. Healthy ecosystems provide a range of irreplaceable benefits; habitats for diverse animal and plant species, forest products and other economic goods, water supply sources, regulation of climate and flood flows, air

> and water purification, nutrient cycling and a wide range of open space and recreation opportunities. Protection of functioning natural systems is vital to maintaining our quality of life, which is in turn a key element in our health and economic progress.

Inserting Class C industrial projects into residential zones will diminish the quality of life for families subject to year-round views, noise, shadow flicker, and potential ice throws. It will also jeopardize the economic situation of anyone whose greatest asset is their home. As on Vinalhaven, the closest residents will face the loss of property value, inability to sell except perhaps to the developer, and the hard choice of staying in a stressful situation or leaving their home. Is this scenario to be repeated across Connecticut in order to meet wind energy goals by 2020? Again, the effect on our quality of life will be cumulative.

Q10. Why do you believe that industrial wind turbines should not be sited in proximity of residences?

A10. As I discussed above, I visited Vinalhaven and saw the results of siting turbines too close to homes. I've also read about other communities across the United States and the world that have been struggling with complaints about turbines, such as health issues (headaches, interrupted or insufficient sleep, rise in blood pressure at night, constant sound, excessive sound), reduced property values, and the destruction of scenic ridgelines and wildlife habitats. The State of Connecticut has the unique opportunity to learn from wind farms in other states and do its best to ensure the health and safety of its citizens. Problems seem to arise when there is poor sound modeling beforehand based on the terrain, less than the recommended spacing between turbines, calculation of setbacks based on the developer's desire to maximize the number of turbines, noise standards that are too high for the particular residential area, and a lack of honest communication between the developer and the residents.

Other states have adopted ordinances at the county or town level, often after a moratorium period to given them time to develop such regulations. An example from Maine,

which leads New England with 266MW of installed onshore wind energy projects, is the ordinance adopted by the town of Thorndike last March. The Thorndike ordinance includes this section about setback requirements:

5.2 Set-Back Requirements

A) A WEF [Wind Energy Facility] shall comply with the following set-back requirements, which shall apply in addition to the siting requirements found elsewhere in this Ordinance. If more than one set-back requirement applies, the greater set-back distance shall be met.

1) All parts of a WEF shall comply with all applicable set-back requirements in the Town's zoning Ordinance.

2) Each WT [Wind Turbine or Turbine] shall be set back at least 1,800 feet from the property line of any Non-Participating Parcel. Property owners may waive this setback with a written Mitigation Waiver agreement.

3) Each WT shall be set back at least 1,500 feet from any public way.

4) Each WT shall be set back at least 1,200 feet from any above-ground electric power line or telephone line except that a lesser setback shall be permitted if the utility agrees, in writing, and this agreement is approved by the Planning Board.

5) Each WT shall be set back not less than 5,280 feet from any residence, business, school, daycare facility, church, hospital, or other Occupied Structure on any Non-Participating Parcel. Property owners may waive this setback with a written Mitigation Waiver agreement.

6) All WTs must be set back a minimum of 2,500 feet from any Scenic or Special Resource as defined in Section (III).

7) All set-back distance measurements shall be based on horizontal distances.

Q11. Why do you believe that BNE's proposed projects will have significant adverse effects on the environment?

A11. BNE's wildlife "studies" are inadequate and show a disregard for the diversity of plants and wildlife found in the northwestern highlands of Connecticut.

A special property abuts the Flagg Hill site and is not mentioned in the petition. It's Beckley Bog, the first Connecticut property preserved by The Nature Conservancy (back in 1957) and designated a National Natural Landmark by the National Park Service in 1977. Linc Foster led a field trip there in 1955 for the Connecticut Botanical Society, and I led one there in June 2003. Two studies of Beckley Bog are available for reference at the Norfolk Library: a master's thesis by Waller MacNiven Conrad (1960; attached as Exhibit 4) and Ted Elliman's natural resources inventory conducted for The Nature Conservancy when he was a student intern in 1982 (attached as Exhibit 5). According to BNE's viewshed maps, Beckley Pond will have a year-round view of the turbines and is less than one mile from the Flagg Hill site. Elliman's inventory lists 51 bird species, including 3 hawks and an owl, and states "a detailed census during migration and breeding season over several years' time should reveal many other species."

Shelley Harms is a licensed bird bander who lives at 10 Schoolhouse Road in Norfolk (south of the proposed Flagg Hill project). She sent me a list of 118 bird species she has observed on her property from 1993 to 2010 (attached as Exhibit 6), which includes 8 hawks and 3 owls. Ms. Harms also co-authored a report, "21st Century Breeding-Season Birds of Aton Forest" (attached as Exhibit 7), which identified 94 bird species on preserved land in northern Norfolk. That list listed includes 5 hawks and two owls. BNE's study of birds listed only 39 species and no hawks. That conclusion is contradicted by the attached documents, two of which were freely available to BNE's consultants at the Norfolk public library but were apparently not consulted.

Another significant effect the BNE petitions would have on the environment is on the quality of the air beyond the property lines of the proposed wind farms, because noise pollution is air pollution. The U.S. Environmental Protection Agency (EPA) web site (http://www.epa.gov/air/noise.html#what) answers the question "What is Noise Pollution?" in this way:

> The traditional definition of noise is "unwanted or disturbing sound". Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life. The fact that you can't see, taste or smell it may help explain why it has not received as much attention as other types of pollution, such as air pollution, or water pollution. The air around us is constantly filled with sounds, yet most of us would probably not say we are surrounded by noise. Though for some, the persistent and escalating sources of sound can often be considered an annoyance. This "annoyance" can have major consequences, primarily to one's overall health.

The EPA also discusses health effects of noise pollution:

> Noise pollution adversely affects the lives of millions of people. Studies have shown that there are direct links between noise and health. Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. Noise Induced Hearing Loss (NIHL) is the most common and often discussed health effect, but research has shown that exposure to constant or high levels of noise can cause countless adverse health affects.

During my visit to Vinalhaven, Maine, the neighbors of Fox Islands Wind recounted their experiences of living with constant wind turbine noise over the past 15 months. I listened to the sound from the three turbines within the wind farm (at less than 600 feet away), at the home closest to the "powered down" turbine, at two homes half a mile away, and on a rise about 3,000 feet away. The air at ground level was calm and there were no sounds in the neighborhood to mask the turbines. The turbine sound was repetitive and could be heard from all locations. According to the neighbors, the sound was about normal on those two days. Frankly, I was glad to be able to leave.

A year from now, my husband and I do not want to be in the same situation as the neighbors from Vinalhaven. I don't want anyone else in Connecticut to end up like them, either.

The statements above are true and accurate to the best of my knowledge.

March 15, 2011
Date

Joyce Hemingson
Joyce Hemingson

ATTACHMENTS

Exhibit 1	Letter from Thomas McKeon, First Selectman of Colebrook, to Dale Hedman, Director – Project Development of the Connecticut Clean Energy Fund Board, dated Dec. 31, 2008
Exhibit 2	Fox Islands Wind Tour Info
Exhibit 3	Town of Vinalhaven, Maine. 2008-2009 Annual Report.
Exhibit 4	Waller MacNiven Conrad. Master's thesis on Beckley Bog (1960).
Exhibit 5	Ted Elliman. Natural Resources Inventory of the Frederic C. Walcott Preserve (1982).
Exhibit 6	Shelley E. Harms. Birds present at 10 Schoolhouse Road in Norfolk between 1993 and Jan. 4, 2011.
Exhibit 7	Shelley E. Harms, Roland C. Clement and John P. Anderson, Jr. 21st Century Breeding-Season Birds of Aton Forest.

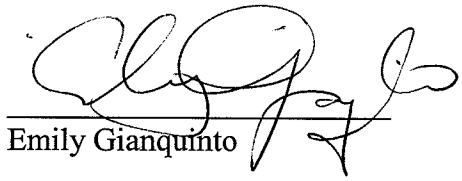
CERTIFICATION

I hereby certify that a copy of the foregoing document was delivered by first-class mail and e-mail to the following service list on the 15th day of March, 2011:

Carrie L. Larson
Paul Corey
Jeffery and Mary Stauffer
Thomas D. McKeon
David M. Cusick
Richard T. Roznoy
David R. Lawrence and Jeannie Lemelin
Walter Zima and Brandy L. Grant
Eva Villanova

and sent via e-mail only to:

John R. Morissette
Christopher R. Bernard
Joaquina Borges King



Emily Gianquinto

EXHIBIT 1

Town of Colebrook

COPY

562 Colebrook Road • PO Box 5 • Colebrook Connecticut 06021 • Telephone 860-379-3359 • Facsimile 860-379-7215

December 31, 2008

Dale A. Hedman
Director – Project Development
Connecticut Clean Energy Fund
200 Corporate Place, 3rd Floor
Rocky Hill, CT 06067

Dear Mr. Hedman:

I am a proponent of renewable energy and understand the importance of developing clean sources of electricity that benefit our environment. I was impressed by the presentation of Gregory Zupkus of BNE Energy regarding the potential for a wind project in the Town of Colebrook. The project would produce clean, renewable electricity and be a sizeable addition to our Grand List. I am please to support the measuring of wind resources on their site to determine if the project is viable.

Please feel free to contact me if you have any questions.

Sincerely,

Thomas D. McKeon
First Selectman

cc: Gregory Zupkus
TDM:lc

EXHIBIT 2

The Fox Islands Wind Project

Leading the Way on U.S. Coastal Wind Power

With the largest community-based wind project on the East Coast, the residents of Maine's Fox Islands have become renewable energy leaders by coming together to lower their own electricity bills and move toward a clean energy future. The commissioning of three 1.5 MW General Electric wind turbines in November 2009 will serve as a strong example to the rest of Maine and New England that the vast wind power potential of the region can power communities, create jobs, and clean the air.

Tapping into the self-reliant nature of the islands' resource-based communities, and grounded in Yankee ingenuity, the project is expected to meet the communities' total electric power needs and cut their electric bills immediately.

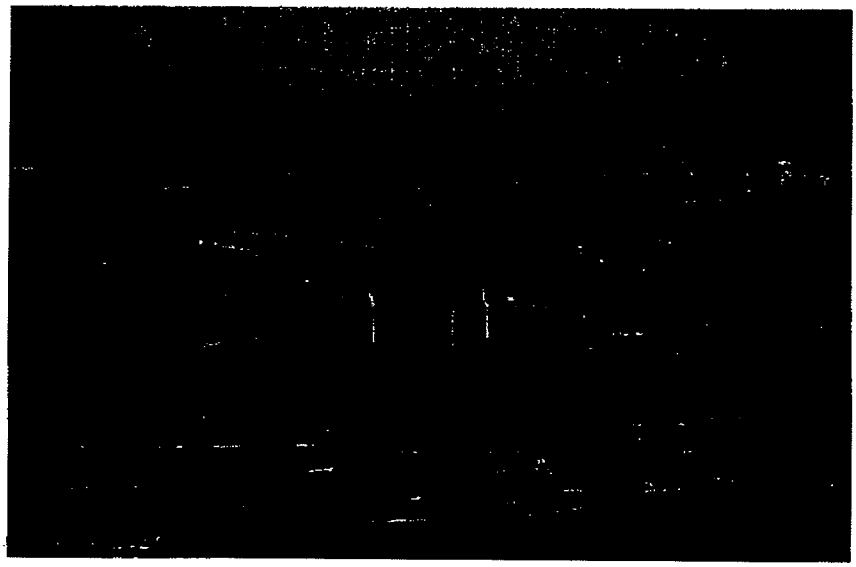
Features of Fox Islands Wind

Community Embraces the Project

- A vigorous public education and outreach effort resulted in a nearly unanimous vote in July 2008 to proceed with the project.
- Over 100 community members gathered at the Vinalhaven wharf to cheer the arrival of the first load of turbine blades on the island in September 2009.
- Excitement has continued to build through project updates and town newsletters that reach all residents, both seasonal and year-round.

The Tradition of Wind Power Comes Full Circle

- Maine's strong offshore winds made these communities viable 100 years ago, when sailboats carried granite, timber, livestock, people, food and vital supplies between islands and the mainland. Those winds will now power 21st century homes and businesses on these two islands.



Wind Power Works for the Fox Islands

- The project benefits are kept in the community to offset the high cost of electricity on the islands – it's not about shipping power off somewhere else.
- The project is scaled to a size that serves the electric needs of the islands by, on average, generating the amount of electricity that the islands need.
- The grid is already sized to this capacity – the community is not going into the power-selling business.

www.foxislandswind.com

Fox Islands Wind
FACT SHEET

Project Specifics
- Three 1.5 megawatt (MW) General Electric turbines
- Total project capacity: 4.5 MW
- Estimated annual production: 11,605 megawatt-hours (MWh)
  - November 2009 – March 2010 production: 6,000 MWh
- Hub height: 262 feet
- Blade length: 124 feet
- Total height: 389 feet
- Project site: 73 acres of land (roughly 25 acres developed) purchased by two local residents for a community-owned wind project
- Project Cost: $14.5 million, financed by a tax equity investment from Diversified Communications and a low-interest loan from the federal Rural Utility Service

Project Benefits
- Stabilization and reduction of electricity rates
  - Rates reduced by roughly 15% so far
- Significant annual emissions reductions:
  - 5,400 tons of carbon dioxide (CO2)
  - 14 tons of sulfur oxides (SOx)
  - 5 tons of nitrogen oxides (NOx)

Project Timeline
- July 2008: Community vote: 383 in favor, 5 opposed
- May 2009: Permitting and financing completed
- June 2009: Site prep and blasting
- July 2009: Road construction and foundation work
- August 2009: Delivery of components
- September 2009: Turbines erected, electrical work
- October 2009: Commissioning by General Electric and utility tie-in
- November 2009: Project begins to generate electricity

Project Partners
Fox Islands Wind is a New England-based partnership:
- Fox Islands Wind, LLC (Vinalhaven, ME)
- Fox Islands Electric Cooperative (Vinalhaven, ME)
- Diversified Communications (Portland, ME)
- Island Institute (Rockland, ME)
- Cianbro (Pittsfield, ME)
- EOS Ventures (Hancock, MA)

www.foxislandswind.com

Become a Fan on Facebook: Search *Fox Islands Wind*

Site Construction

- For the most part, no materials were brought to the island to build the roads, all of that material was created on site, from blasted rock and mulched trees
  - Exception: a little bit of straw for revegetation and special concrete for foundations
- Roads were 30 ft wide but are in the process of being revegetated back to 12-15 ft.
- Will eventually look like a road in the middle of a meadow; no big trees will grow along the sides in case a crane ever has to come back in

Foundations

- Each foundation required 9 cement trucks; the 3 were poured on the same day
  - 3 trucks came at a time via the Island Transporter at the north end of the island
- Foundations are held into place with 28 rock anchors (the large bolts that you see sticking up around the foundation)
  - Rock anchors are 2.5" threaded steel rods that were drilled 30 feet down into the granite ledge, and filled with grout
  - They are permanently fixed into the granite
- The Foundation is 30 ft in diameter and 5 ft deep
  - 30,000 lbs of rebar was poured into mold
  - Base section of tower is held to the foundation with 140 1" vertical steel rods in two rings (70 in each ring)
- In order to tighten the bolts, a vertical lift pulled up on the rods in order to get the tension out, then bolts were tightened and fell into place
- Joke! Since the foundation is anchored to the granite with the rock anchors and the base is held to the foundation with the steel rods, if the wind blows, the turbines aren't going anywhere. Vinalhaven may be a different story.

Turbine Components

- See fact sheet for height and length of components
- Comprised of nine components:
  - 3 blades
    - Manufactured in Brazil, shipped to Eastport, trucked to Rockland
  - 3 tower sections
    - Manufactured in Quebec, trucked to Rockland
  - Nacelle
    - Manufactured in Florida, trucked to Rockland
  - Hub
    - Manufactured in U.S.
  - ETS (electrical stuff)
    - Manufactured in U.S.
- Blades are constructed out of fiberglass and balsa wood
  - Fairly high tech in design but low tech in terms of manufacture
- GE is a global company – much of design work done in U.S. but manufacturing done all over the world

Grounding

- Turbines are virtually guaranteed to be struck by lightening. Not a question of if, but when.

- Blades are covered in copper webbing to serve as lightening conductor
- Grounding serves 2 purposes:
  - 1) electronics don't get fried
  - 2) people are safe
- The site is very extensively grounded due to cover of solid copper and grounding materials.
  - Behind Turbine 3 – didn't have enough space to lay copper so there is a 30x20 ft copper carpet laid in the ground behind turbine
- In addition, 30 wells between 10-30 feet have been drilled all around the turbines
- All of this is to provide 2 ohms or less to ground, low resistance level

Turbine Installation

- Crane had to be higher than hub so it came on 18 flat bed trucks and was assembled on site
- Turbines are comprised of 9 components – 3 towers, 3 blades, hub, ETS, nacelle
- Logistics of getting components to the site was by far the most complicated part of the project; the rest of it was mostly standard for wind development
- Construction was handled by Cianbro
  - Cianbro stories (stuck truck, switching cars, etc.)

Operations and Power Generation

- Very computer intensive machines
- Blades are pitched to optimally account for wind speed
- The computers sense direction via the wind vane at the top of the nacelle
  - Based on wind direction, the nacelle turns very slowly into wind via yaw motor
- Turns very slowly, taking 5-7 min to turn 360 degrees
  - Has to turn slowly because the gyroscopic forces on blade would tear the machine apart if it moved too fast
- Turbines generate power at 575 volts so a lot of current is sent through a fat cable that runs down the tower. Saddle at top of tower knows that 3 twists of nacelle will force the nacelle to turn in opposite direction so that the cables are not tangled
- Power comes down the cables in the tower at 575 volts DC. Using line voltage, the inverter inside turns to 575 at 60 hz (AC). Power is then run to the transformer next to the machine and is stepped up to 14,400 volts for the line on the North Haven Road – some power goes up the road to NH, some goes to VH
- At the first crossroads on the site, the pole on right with gray box is the transfer trip cutout
  - Cut out because max load ever put on cable was 2.8 MW in August PM. When turbines are at peak production, there is 4.5MW on the system. If something went wrong with submarine cable, tvs on the island would blow up.
  - Gray box is hooked up by fiber optics to the Fish Head station which is constantly monitoring cable. If the cable goes down, the transfer trip cutout box will shut down the wind farm within a millisecond in order to prevent overloading the system
  - This means there is no chance of an "islanding" event (turbines on by themselves)
- Air switch cuts out the whole farm. Lever at the bottom of pole will turn off power, enables maintenance to be done on wires

Fox Islands Wind
Tour Info

Please advise all tour participants of the following information before the tour begins:

1. **This is an active industrial site! Please be careful as you are walking through the site, keep an eye on your footing and be conscious of where you are. This is an organized tour; please stay as a group on the road and do not wander off.**

2. **Do not stand directly under the blades when they are turning.**

3. **Under no circumstances are people allowed to be on the site if there is ice or snow build up on the blades or if a lightening storm is in the forecast.**

The Turbines

- Turbine 1 is at the very end of the access road
- Turbine 2 is to your left as you walk up the access road (where the ribbon cutting took place)
- Turbine 3 is to your right as you walk up the access road

Project Development

- Project cost $14.5M
  - $5M tax equity investment and $9.5M low interest loan from the USDA's Rural Utility Service (RUS)
  - Turbines from came from GE and cost $7.5M
  - Remainder of project costs were in construction, permitting and lawyers
- Community wind model is unique as compared to other "community" projects in U.S.
  - Fox Islands community controls, operates and benefits from project via FIEC
  - Different from Midwest farmer model
  - Community wind makes up less than 5% of all U.S. projects but is far more prevalent in Europe
  - FIW is the:
    - Largest community wind project on the East Coast
    - Maine's first island wind facility
    - Second largest coastal wind facility in the Eastern U.S.
- FIW was the first project permitted under the DEP Small Wind Certification process
  - Permit applications submitted in December 2008
  - Permits received June 5, 2009
  - Cianbro started construction on June 8, 2009
  - Groundbreaking ceremony held on June 28, 2009
  - Ribbon cutting ceremony held on November 17, 2009
- Project needed to be completed before October because fall winds would make installation infeasible
- Vernal pool near Turbine 1 created a regulatory hurdle; 14 acres needed to be set aside for a salamander conservation area in order to mitigate any effects to vernal pool

EXHIBIT 3

re participating in outdoor burning you must obtain a permit. Burning of bited material such as rope, plastic, rubber, asphalt, etc. or burning without mit is punishable by fine and/or imprisonment. Burning Permits can be ob- d at the Fire Station or Town Office. Deputy Chief Ivan Olson and Asst. Chief Bunker are also authorized to issue permits.

Fire Department has chimney cleaning equipment available for use to the c at no charge. I urge people to take advantage of the equipment and to clean chimney once a year at a minimum. All chimney fires could be prevented if le regularly inspect and clean their chimneys. The Fire Department will also request do chimney and woodstove inspections for residents and property rs.

Fire Department also has smoke detectors as well as fire extinguishers for for what we pay for them. If you are interested in purchasing one or the other e stop by the Fire Station.

09, four personnel received their Firefighter II Certification. This was a long ss that required over 234 hours of training as well as many days and nights e mainland. Participants then had to pass a written and practical state exam in to receive this certification. Congratulations..... Fire Department personnel d over 900 hours of training throughout the year by participating in Fire At- Schools and in-house training sessions.

e everyone to practice fire safety everyday and to ensure working smoke de- rs inside every bedroom as well as outside every bedroom and at least one on level of your home. Test them once a month and change the batteries twice r. They will save you or a loved ones life should you have a fire.

proud of the department and where it has come over the past several years. y year there are more and more requirements, rules, and regulations that we department must follow to not only stay compliant with State and National dards, but also to comply with OSHA / Bureau of Labor Standards require- s as well as stay safe while performing our job. Though not always easy the and women of the department listen, learn, and adjust to these changes and nue to train so that we can be the best we can be when we are called. My hat off to them all.

ectfully Submitted,

ic Candage

Chief

EMERGENCY MANGEMENT REPORT

The national H1N1 flu epidemic, several severe winter storms, erection of the three new wind power turbine towers and combining our EMS and Fire units into a new emergency operating center, kept the town medical, fire, power, and public works crews fully utilized under Vinalhaven Emergency Management Agency concept during this past year.

As the national "Swine Flu" epidemic gradually increased from level to level in required preparedness, the island developed under Dr. Rich Entel, Town Health Officer, a planned response, including operational plans, ordering of supplies and vaccines, and arranging informational epidemic updates. Vinalhaven Emergency Management Agency Representatives at all town levels received a thorough briefing on the disease with anticipated probables involved. Each Friday a team of medical and EMA reps participated in a conference call linkup with the Maine Primary Care Association, who were linked with the National Center for Disease Control and state public health authorities. These sessions gave our reps the opportunity to track current developments, compare recommended procedures, and track incoming vaccine supplies. In addition to the regular season flu vaccine, everyone who wanted one, received a regular and/or "swine flu" shot recommended in priority order. Our medical staffs already are alert to potentials in the upcoming season.

Although winter storms ravaged Maine and the Northeast this year, producing new records in places, our position kept us relatively free from the record storm ravages. Two spring wind and rain storms, with recorded gusts of over 75mph, were more of a concern and taxed all town volunteers, staff, and equipment. During one blast our Communications Center received over 30 calls reporting trees, wires and poles down, flooded and blocked roads, flooded cellars, and other storm related damages. Combined teams of Fire, EMS, Fox Islands Electric, and Public Works crews worked for over twelve hours to open affected areas for resident and emergency vehicles. Damage in the woods was extensive, some of it in populated areas. Early predictions from national weather authorities suggest the possibility of a more active hurricane season this year.

Probably not since the quarrying days, has the island seen as many people, or as much equipment or as many large items, as arrived here with the erection of the three wind power turbine units. Long before they arrived, detailed medical, fire, and public works sessions reviewed the many detailed operations involved in assuring a safe operation. Now up and operating, local Fox Islands Electric, Fire,

EMS crews have participated in specialized high angle rescue training, and apable of rescuing anyone injured or has fallen within the towers. Automated n systems monitor safety of the turbines themselves.

ajor improvement that will enhance response to emergency incidents will be eved with the completion of the fire station addition to house the two ambu-s now quartered in different locations. The new building will not only house , but provide offices for the EMS Chief and Knox County Deputy Sheriff, plus ing, bath, potential bunking and storage areas. Linking the community center a FEMA like Emergency Operations Center better utilizes both our medical le equipment and volunteer manpower into joint service activity.

ovements are underway in our emergency radio links to the mainland with the x County Regional Communications Center, via a new radio repeater mounted e water tower. A Future warming shelter will be established in line with state county plans, school safety programs are in place and we continue to service Mat and other calls of a regional nature. Our forests are in catastrophic condi-following the recent storms and any drought period will result in a high wild-anger. Everyone must be alert and maintain a cleared area around residences. tional information can be obtained at the Fire Station.

ways, we urge all to be safe and alert and report to us anything unusual that not fit the island style, ways, or operations. Thank You.

ectfully Submitted,

rc Candage, EMA Director
ndler Blackington, Deputy Director

AMBULANCE SERVICE REPORT

Webster defines "infrastructure" as "...the basic installations and facilities on which the continuance and growth of a community...depend". A logical extension of the definition is that infrastructure must also grow and replenish in order to keep pace with the ever increasing requirements of federal, state and local entities. Replacement, Growth, and Compliance are the three areas having the greatest impact on the 2010-11 ambulance budget.

Replacement: Rescue 2 (Blue & White) has been a reliable unit for seven years. The rough road, and sometimes off-road conditions, along with normal, increasingly frequent use of this fifteen year old vehicle have exacted a price. Unscheduled repairs costing approximately $3,200.00, (Almost 25% of the purchase price), have exceeded the vehicle maintenance budget, and still, electronic problems persist. Once again, replacement of this vehicle is requested.

Growth: Increased demand = increased consumption, and increased crew hours. Although monthly figures are erratic, the annual trend is clearly increasing, especially considering the total number of runs for 1994 was forty five.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2007	9	8	10	10	7	9	20	20	11	9	19	13	145
2008	13	13	12	13	6	19	21	24	13	8	13	10	165
2009	16	7	8	11	13	13	22	16	22	22	9	20	180
2010	20	14	10	-	-	-	-	-	-	-	-	-	Est. 200

On a more positive note, the new ambulance facility, financed entirely from non-tax dollars, is at this writing approximately 50% completed. When finished it will consolidate all ambulance assets in one location, and allow for much needed expansion space at ICMC and the town garage. Many thanks to Marty Stein, who designed the new facility. A thank you to the many people who have assisted with the project seems inadequate, particularly so in one case. Without the building, managerial, leadership skills, and patience of Chief Marc Candage, this project would still be on a "Wish List". The Ambulance Service is appreciative beyond words for his contribution and dedication.

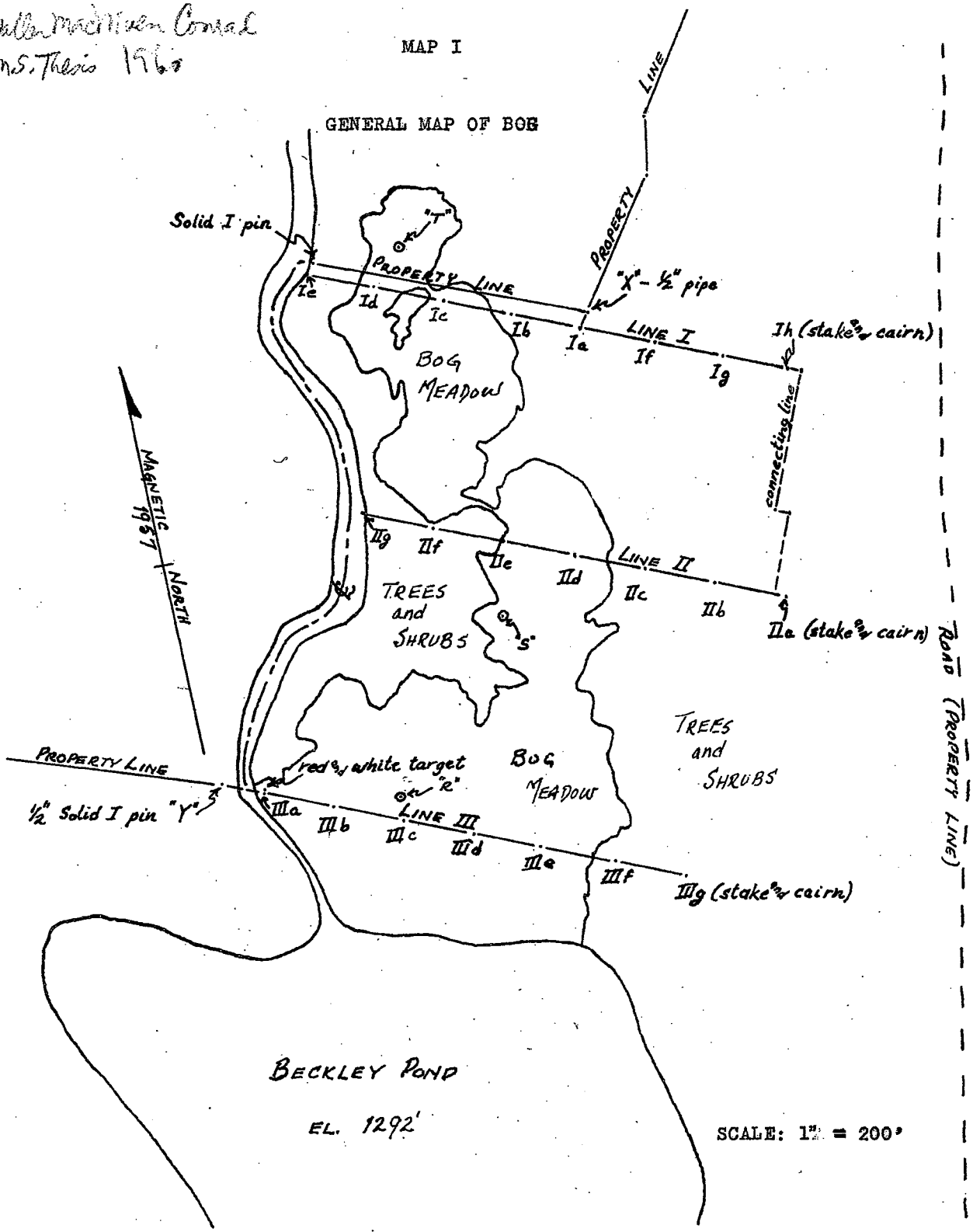
Compliance: At the federal level, the communications system for all public entities is being overhauled. The emphasis is on the ability for all providers, (Fire/Police/EMS/Public Works), to be able to talk with each other, ("Interoperability"), during large scale operations; and to do so on frequencies not available to general

EXHIBIT 4

Willa MacMeen Conrad
M.S. Thesis 1960

MAP I

GENERAL MAP OF BOG



Property lines, stream and pond outlines, and corners are traced from the property survey map made by Douglas G. Little, Engineer and Surveyor, and dated January 18, 1958. The outlines of the bog meadow are traced from the aerial photograph, Figure 1, clarified by the transect data.

LYCOPODIACEAE (Club-moss Family)

Lycopodium inundatum L.
Bog Clubmoss (60-131)

OSMUNDACEAE (Flowering Fern Family)

Osmunda regalis L.
Flowering or Royal Fern (60-113)

Osmunda cinnamomea L.
Cinnamon Fern (---)
Most common fern in the bog.

POLYPODIACEAE (Fern Family)

Onoclea sensibilis L.
Sensitive Fern (60-112)

Dryopteris Thelypteris (L.) Gray var. pubescens (Lawson) Nakai
Marsh Fern (---)

This is reported in Cobb's Field Guide to the Ferns as Thelypteris palustris Schott.

Dryopteris noveboracensis (L.) Gray
New York Fern (---)

This is reported in Cobb's Field Guide to the Ferns as Thelypteris noveboracensis (L.) Nieuwl.

Dryopteris spinulosa (O. F. Muell.) Watt
Spinulose Wood-fern (60-101) (LF)

Dryopteris cristata (L.) Gray
Crested Wood-fern (60-100) (LF)

PINACEAE (Pine Family)

Tsuga canadensis (L.) Carr.
Hemlock (---)

Picea mariana (Mill.) BSP.
Black or Bog Spruce (----)

Larix laricina (Du Roi) K. Koch
American or Black Larch, Tamarack, or Hackmatack (60-23)

Pinus Strobus (L.)
White Pine (---)

GRAMINEAE (Grass Family)

There were several undetermined grasses among the samples collected.*

CYPERACEAE (Sedge Family)

Carex spp.
There were several of this species of sedge among the samples collected.*

ARACEAE (Arum Family)

Arisaema triphyllum (L.) Schott
Small Jack-in-the-pulpit (60-44) (DW)

XYRIDACEAE (Yellow-eyed Grass Family)

Xyris montana Ries
(Northern Yellow-eyed Grass) (60-105)

ERIOCAULACEAE (Pipewort Family)

Eriocaulon septangulare With.
Seven-angled Pipewort, White-buttons, Duckgrass. (60-103)

*The sedges, grasses, or rushes have been sent off to be identified.

PONTEDERIACEAE (Pickerelweed Family)

Pontederia cordata L.
Pickerelweed (60-158)
From along the pond edge of the bog.

JUNCACEAE (Rush Family)

There are undoubtedly some members of this family in the bog although there were no immediately identifiable rushes among the samples collected.

LILIACEAE (Lily Family)

Lilium canadense L.
Wild Yellow or Canada (Nodding) Lily (60-109)

Clintonia borealis (Ait.) Raf.
Corn-Lily, Bluebead-Lily (Yellow Clintonia) (60-159)

Smilacina trifolia (L.) Desf.
Three-leaved False Solomon's-seal (60-97) (LF)

Maianthemum canadense Desf.
False or Wild Lily-of-the-valley, Two-leaved Solomon's-seal (60-2)

Trillium erectum L.
Stinking Benjamin, Squawroot (60-62) (DW)

IRIDACEAE (Iris Family)

Iris versicolor L.
Blue Flag (60-10)

ORCHIDACEAE (Orchis Family)

Habenaria blephariglottis (Willd.) Hook.
White Fringed Orchis (---)

Pogonia ophioglossoides (L.) Ker.
(Rose) Pogonia, Beard-flower (60-70)

Calopogon pulchellus (Salisb.) R. Br.
Grass-pink or Swamp-pink Orchid (60-63)

MYRICACEAE (Wax-Myrtle Family)

Myrica Gale L.
Sweet Gale, "Meadow Fern" (60-25) (LF)

CORYLACEAE (Hazel Family)

Betula lenta L.
Black Birch (60-152a)

Betula populifolia Marsh.
Gray Birch, Fire or Oldfield Birch (60-152)

Alnus sp.
Alder (60-75v)

This unidentified alder was found next to the stream in an area of black muck.

Alnus rugosa (Du Roi) Sprang.
Speckled Alder (60-38) (WN)

FAGACEAE (Beech Family)

Quercus sp.
Oak (---)

This appeared to be a red oak (Q. rubra L.) but on considering the habitat, which was in the fosse at the lower end of the bog, it is unlikely.

NYMPHAEACEAE (Water-lily Family)

Nuphar advena (Ait.) Ait. f.
Spatter-dock (60-156)
From the stream.

Nymphaea odorata Ait.
Fragrant Water-lily, Pond-lily (60-133)
From along the pond edge of the bog.

RANUNCULACEAE (Crowfoot Family)

Thalictrum polygamum Muhl.
Tall Meadow-rue (60-80)

Coptis groenlandica (Oeder) Fern.
Goldthread, Canker-root (60-81)

SARRACENIACEAE (Pitcher-plant Family)

Sarracenia purpurea L.
Pitcher-plant (60-12)

DROSERACEAE (Sundew Family)

Drosera intermedia Hayne
Intermediate or Spatulate-leaved Sundew (60-104)

Drosera rotundifolia L.
Round-leaved Sundew (60-14)

ROSACEAE (Rose Family)

Spiraea Tomentosa L.
Steeple-bush, Hardhack (60-147) (DW)

Pyrus melanocarpa (Michx.) Willd.
Black Chokeberry (60-29) (LF)

Amelanchier sp.
Tentatively identified as A. intermedia Spach.
Swamp Juneberry, Swamp Shadbush (60-114)

Rosa sp. (60-127a)
Rose

Prunus serotina Ehrh.
Black Cherry (---)

ANACARDIACEAE (Cashew Family)

Rhus Vernix L.
Poison Sumac (---)

AQUIFOLIACEAE (Holly Family)

Ilex spp.	(60-65 & 111)
Ilex verticillata (L.) Gray Black Alder	(60-90) checked by (DW)
Nemopanthus mucronata (L.) Trel. Mountain Holly	(60-26) (LF)

ACERACEAE (Maple Family)

Acer rubrum L. Red Maple	(---)

VIOLACEAE (Violet Family)

Viola sp. Violet	(---)
Viola cucullata Ait. (Blue Marsh Violet)	(60-7)

LYTHRACEAE (Loosestrife Family)

Decodon verticillatus (L.) Swamp-Loosestrife, Water-willow	(60-98) (LF)

ARALIACEAE (Ginseng Family)

Aralia nudicaulis L. Wild Sarsparilla	(---)

ERICACEAE (Heath Family)

Ledum groenlandicum Oeder
Labrador-tea (60-94) (LF)

Rhododenron roseum (Loisel.) Rehd.
Honeysuckle, Early Azalia, Election-pink (60-4) (LF)

Rhododendron viscosum (L.) Torr.
Swamp Honeysuckle (60-37) (LF)

Kalmia latifolia L.
Mountain Laurel (---)

Kalmia angustifolia L.
Sheep-laurel, Lambkill (60-18)

Kalmia polifolia Wang.
Bog Laurel (60-46) (LF)

Andromeda glaucophylla Link.
Bog-Rosemary (60-19)

Chamaedaphne calyculata (L.) Moench.
Leather-leaf (60-45) (LF)

Gaylussacia baccata (Wang.) K. Koch.
Black (High-bush) Huckleberry (60-28) (LF)

Vaccinium sp.
Tentatively identified as V. corymbosum L. (60-39)
Highbush Blueberry

Vaccinium sp.
Tentatively identified as V. caesariense Mackenz.
Highbush Blueberry, New Jersey Blueberry (60-123) (DW)

Vaccinium Oxycoccus L.
Small Cranberry (60-15)

Vaccinium macrocarpon Ait.
Large or American Cranberry (60-102)

PRIMULACEAE (Primrose Family)

Lysimachia terrestris (L.) BSP
Swamp-candles (60-92)

Trientalis borealis Raf.
Star-flower (60-1)

RUBIACEAE (Madder Family)

Galium trifidum L.
Small bedstraw (60-146) (DW)

Cephalanthus occidentalis L.
Buttonbush (60-86) (LF)

CAPRIFOLIACEAE (Honeysuckle Family)

Viburnum sp.
Tentatively identified as V. alnifolium Marsh.
Hobblebush (60-75v1) (DW)

Viburnum cassinoides L.
Wild-raisin (60-32) (DW)

Viburnum recognitum Fern.
Arrow-wood (60-89)

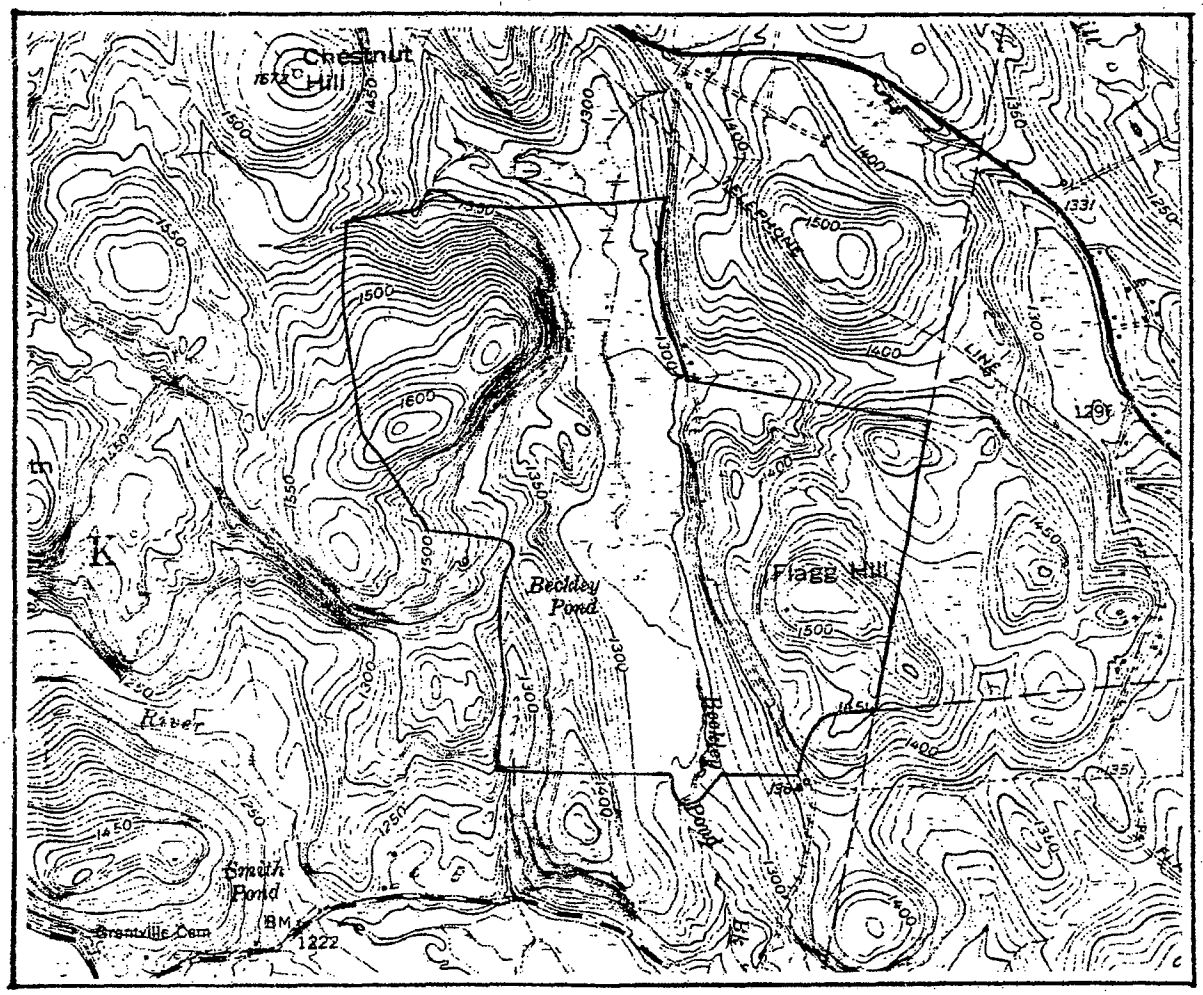
COMPOSITAE (Composite Family)

Solidago sp.
Goldenrod (60-116) (LF)

Senecio aureus L.
Golden Groundsel, Golden Ragwort (60-8)

EXHIBIT 5

NATURAL RESOURCES INVENTORY
of the
FREDERIC C. WALCOTT PRESERVE



THE NATURE CONSERVANCY

CONNECTICUT CHAPTER

STUDENT INTERNSHIP PROGRAM

1982

ACKNOWLEDGEMENTS

I gratefully acknowledge the assistance and advice of a number of people who generously donated time in helping me complete this inventory. For the vegetation, Lincoln Foster, a botanist from Falls Village, and George Keifer, a Salisbury forester, each spent a day with me in the field. They imparted invaluable information and insights about the dynamics of forest communities, and I am especially appreciative of their help. In compiling the bird list, I would like to thank Art Gingert and Sandy DeSimone of the Sharon Audubon Center, and Dr. Robert Prouty of Norfolk, all of whom gave valuable time, expertise, and enthusiasm. The mammal species list rests heavily on information given me by Peter Begley of East Canaan, conservation officer for the region. Two lifetime residents of the Beckley Pond area, Arthur D. Smith and Robert Anstett, deserve special mention. Both have a deep appreciation for the natural features of the preserve, and each provided vivid accounts of the history and changing land use patterns of the area.

I would also like to thank all members of the local committee, and particularly Allen Mali, for their hospitality and support throughout the summer. I am deeply grateful also, for the generosity of Mr. and Mrs. Alex Vagliano, who provided me with housing for most of my stay in Norfolk.

INTRODUCTION

The Frederic C. Walcott Preserve, owned by The Nature Conservancy of Connecticut, Inc., is located in Norfolk, Connecticut (U.S.G.S. Topographic Map, 7.5 minute series, Norfolk Quadrangle, 73 10'00" West Longitude, 41 57'30" North Latitude, elevation 1292 to 1620 feet (388-486 m) above sea level. To reach the preserve from the center of Norfolk go south on Rte 272. Watch for the Grantville Cemetery on the left at about 1.3 miles and at 1.8 miles turn left onto Danbury Quarter Road. At the first intersection in about 1.5 miles take a left and go about 0.5 mile, passing a barn on the left. The preserve is on both sides of the road a few hundred feet north of the barn. It is situated approximately 1.5 miles north of the Conservancy's Silas Hall Pond Preserve. See page 3.

During the summer of 1980, a natural resources inventory was conducted on the preserve as part of the Student Internship Program sponsored by the Connecticut Chapter of The Nature Conservancy. Part I of this report, with accompanying maps, summarizes the results of this inventory. Part II states the goals for the Preserve Stewardship Committee and outlines the long-term stewardship plans.

Over a period of 21 years, the Conservancy purchased or was given the 589 acres (235 ha) that now comprise the Walcott Preserve. The original parcels, consisting of 197 and 84 acres (79 ha and 34 ha) and including Beckley Pond and Bog, were purchased in 1957 and 1960 from Victor Toillon of Torrington. In 1962, Happy Kitchel Egler granted a 55-acre (22 ha) easement to The Nature Conservancy, north of, and contiguous to, the acquisitions from Toillon. These 55 acres came to TNC in fee upon her death in 1978. In 1964, the Conservancy purchased 250 acres (100 ha), in two parcels, from the Anstett family of Norfolk. The Conservancy then sold one of these parcels, consisting of 20 acres (8 ha), to Barbara Girdler of Riverside, Connecticut, who in turn, quit-claimed this parcel back to the Conservancy in 1969, releasing it in trust. Finally, the Grant Swamp Group donated 3 acres (1 ha) to TNC in 1972. This parcel contains a beaver pond on the extreme south end of the preserve.

Little is known about the Indians inhabiting this region prior to white settlement. The relative severity of the climate limited the Indian population, and their permanent settlements in and around Norfolk are believed to have been small (Egler, 1940). Norfolk and neighboring Colebrook were the last two towns in the state to be settled in the mid-18th century. Dairy farming was the major occupation until the early 19th century, when industry and manufacturing became the primary industrial activities. In the mid-19th century, cutting for charcoal to fire the iron mills in Canaan and Salisbury stripped Norfolk of much of its forests. The numerous charcoal pits on the preserve are evidence of the intensity of this activity.

The Walcott Preserve forest is primarily composed of the Northern Hardwoods-Hemlock-White Pine Association with Beckley Pond and Beckley Brook forming a central drainage system in the preserve. The preserve

is located in the Northwest Highlands Ecoregion (Dowhan & Craig, 1976), which occupies a very small part of northwest Connecticut, but includes the entire Town of Norfolk. The climate of this region is the coldest in the state, with a mean annual temperature of 46°F (8°C.) Average annual precipitation is about 50 inches (127 cm) and the yearly snowfall in Norfolk averages 100 inches (254 cm). The preserve is underlain by gneiss and schist with numerous outcrops, especially in steeper areas. Low-lying areas are covered by swamp and marsh deposits, while the uplands are largely covered by glacial till. The soils range from peat and muck to stony fine sandy loams.

This inventory was conducted by Ted Elliman, a recent graduate of the Environmental Studies Department of Antioch-New England Graduate School, Keene, New Hampshire. The study was coordinated and directed by Winky Wright, Master Plan Coordinator, of The Nature Conservancy, Connecticut Chapter, and was edited by Susan Cooley, Associate Director of The Nature Conservancy, Connecticut Chapter.

Anyone who would like to visit Beckley Pond, please contact The Nature Conservancy — either the Preserve Management Committee in Norfolk, or the State Chapter in Middletown, Connecticut.

FREDERIC C. WALCOTT PRESERVE in relation to SILAS HALL POND PRESERVE

CULTURAL HISTORY

Climate and topography have been controlling factors in the cultural history of the Norfolk region. Most of Connecticut was settled by Indians, but cold weather, deep snow, and rugged terrain prevented the development of permanent villages in the Norfolk area. The local Algonquin peoples practiced a nomadic system of hunting and gathering and wintered in the milder river valleys. There is a lack of evidence of periodic fires that were commonly set by Indians in most of Connecticut to clear forest undergrowth for better hunting.

Norfolk and neighboring Colebrook were the last towns in Connecticut to be settled by European colonists. Cornelius Brown, the first settler, arrived in 1744. The town was incorporated in 1758.

Lumbering and dairy farming were the primary economic activities of the town throughout the latter part of the 18th century. Norfolk became a large producer of cheese. Climate and soils were not favorable to the development of profitable agriculture, however, and most farming was at a subsistence level.

The early 19th century marked the beginning of small-scale industry in the town. Farm implements, produced by harnessing water power, were marketed beginning around 1823. Their manufacture was augmented by the production of guns and ammunition as the Civil War years approached.

Other early-mid 19th century industries included limited mining for iron ore (a small surface mine from this era exists on the preserve), and forest cutting to provide charcoal for smelting. Much of the charcoal was transported to furnaces in Canaan and Salisbury, which had relatively large iron and lime kiln industries. Charcoal production demanded vast amounts of wood, and Norfolk woodlands were stripped in the middle years of the 19th century.

In spite of these industries, Norfolk never became a profitable center of enterprise. The development of steam power and rail transportation, along with the discovery of richer natural resources in the Midwest, further depleted the town's economic base. Abandonment of area farmlands for richer terrain in Ohio, Indiana and Illinois occurred simultaneously. The lament of Edward Ryan, a 19th century entrepreneur, illustrates the situation in town.

"I have spent twenty of the best years of my life in Norfolk; have used my best efforts in business, and leave the town poorer by several thousand dollars than when I came here as a young man." (Crissey, 1900). In the late 19th century, the town's bleak economic picture changed somewhat. The area was "discovered" by wealthy New Yorkers in search of a summer resort. As a Norfolk Historical Society bulletin states: " what had originally been regarded as detriments to the town, the altitude, cool climate, rugged mountainsides and tangled forests ... was recognized by city dwellers seeking a pleasant summer atmosphere and surroundings of natural beauty as positive attributes."

Aided by the construction of a railroad, the influx of summer residents in the late 19th century pumped money into the town's languishing economy. Cultural institutions -- the Litchfield Choral Union and the Yale Summer School of Art and Music -- were established in Norfolk and persist to the present.

The particular history of the Walcott Preserve, with its stone walls, charcoal pits, old farmhouse foundations, and second-growth forests, fits the general pattern of the town's history. The recollections of two life-time neighbors of the preserve details its land-use patterns in the recent past.

Mr. Arthur Smith, an elderly farmer whose land borders the southwest corner of the preserve, states that his family has lived and farmed in the Grantville area of Norfolk since 1757. Mr. Smith is the last of a family and community of farmers who raised crops and pastured cattle in this section of Norfolk.

Mr. Smith's recollections date to the earliest years of this century, and he recounts activities that supplemented farm income. His grandfather built a dam across the Mad River, creating Smith Pond. Runoff from the dam was fed into a channel that provided power for a sawmill. Mr. Smith remembers regularly trapping foxes, raccoons, and skunks. He also happens to be the first person to have seen a porcupine in Connecticut, in 1915, a sighting which earned a picture and a story in the Hartford Courant. During his boyhood, chestnuts -- now reduced by blight to stump sprouts -- were a major feature of the woods. He recalls large trees, as much as 4 feet in diameter (greater than one meter), providing hundreds of nuts for the annual gathering. Mr. Smith also remembers beaver inhabiting the Beckley Pond watershed early in this century. The animal left the area around 1920, and did not reappear for forty years.

Mr. Smith's persistence in farming is unique in the Grantville region. Other dairy farmers had abandoned the practice by the 1930's, and the land began to revert to forest. A railroad serving the Grantville settlement was abandoned during the Depression, coinciding with the decline in farming as a viable economic activity. Mr. Smith recalls that Victor Toillon, who owned a large tract of Walcott land from the 1930's until its purchase by TNC in 1960, timbered his property but never farmed it.

A pattern of diminishing farm use through the 20th century is also recounted by Mr. Robert Anstett, who owns land north of the preserve. In 1900, Bob Anstett's father, Louis, purchased a 365-acre (146-hectare) farm for $900 which they worked until the mid 1960's when TNC purchased the greater part of the farm. During their ownership, the Anstetts cut hay and firewood from sections of their property and raised a small red pine plantation along Beckley Road. Their most intensive activity was cutting and selling cordwood from what is now the northwest section of the preserve.

The Anstetts discontinued most of these practices by the late 1930's. Bob Anstett recalls their last hay cutting in the Gaylord meadow in 1938, also the year of the last cutting for cordwood. The red pine project was abandoned soon after it had been planted. All of these lands, now owned by the Conservancy, have been growing back to forest for over 40 years.

Like Mr. Smith, Bob Anstett remembers "a lot of chestnut" in the forest 50 to 60 years ago (also basswood not seen in 1980). He trapped mink, muskrat, and fox and recalls seeing bobcat, snowshoe hare, and otter on their former holdings. Mr. Anstett related catching an abundance of fish from Beckley Pond and Brook, including brook trout, pickerel, carp, bullhead, perch, and sunfish.

The recollections of Mr. Smith and Mr. Anstett present a history of 20th century land use in and around the present Walcott Preserve. This history details a decline in agriculture and in the use of local natural resources in general. The current TNC policy of restricted use offers the potential of the land's return to pre-settlement conditions.

CLIMATOLOGICAL DATA[1]

Norfolk, sometimes referred to as "the ice-box of Connecticut", commonly has the coldest temperatures, on an annual basis, recorded in the state. Seasonal mean temperatures from the Norfolk and Norfolk Valley stations of the U.S. Weather Service are: winter, 22.7 F (-5 C); spring, 42.6 F (6 C); summer, 65.8 F (18 C); fall, 47.7 F (9 C), while the annual mean temperature is 44.7 F (7 C). Each of these mean temperatures is the coldest recorded at any station in the state. The coldest temperature recorded in Connecticut, -37 F (-38 C), was noted at the Norfolk Valley Station on February 16, 1943.

In addition to its cool climate, Norfolk has a relatively high precipitation. The annual average precipitation, 53.69 inches (136 cm), is the third highest of the Connecticut stations. The snowfall is, however, the climactic factor that truly distinguishes Norfolk. The mean annual snowfall (1941 - 1962) was 100.5 inches (255 cm); the next highest figure, in Salisbury, is 68.6 inches (174 cm). The record annual snowfall for the state of Connecticut is 177.4 inches (450 cm) which fell in Norfolk in the winter of 1955-56.

Norfolk's high elevation, ranging to 1700 feet (515 m) above sea level, is a contributing influence to this cold and wet climactic pattern. It is clearly a limiting factor on vegetation, and is primarily responsible for the presence of plant communities and particular flora characteristic of the Northern Hardwoods-Hemlock-White Pine Region.

BEDROCK GEOLOGY[2]

Most of the bedrock underlying the Walcott Preserve is gneiss of Pre-Cambrian origin, dating from 700 million to one billion years ago. This bedrock is known locally as Becket gneiss, a formation which is probably the oldest in the region. Rice and Gregory (1906) describe Becket gneiss as follows:

> "Where typically developed, the Becket gneiss is light gray in color, of firm texture, and has a uniform banded structure produced by the segregation of biotite along certain planes . . . so that layers composed chiefly of feldspar and quartz alternate with those of biotite . . . "

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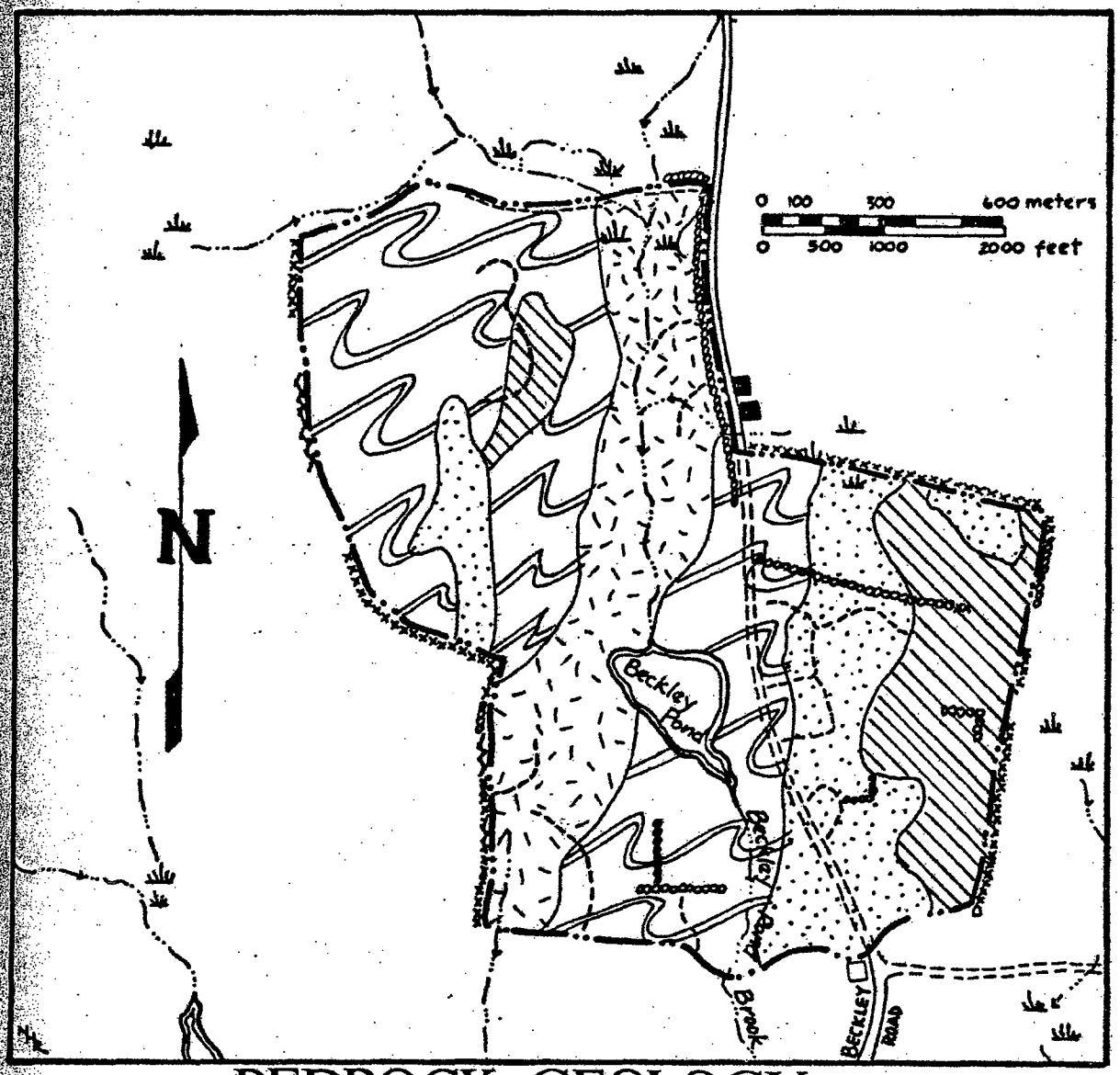
[1]All data from years 1931 to 1963 from Brumbach, Joseph, 1965. The Climate of Connecticut. State Geological and Natural History Survey Bulletin #99.

[2]Information taken directly from the files at the Natural Resources Center, Department of Environmental Protection, Hartford, Connecticut.



BEDROCK GEOLOGY

- Granitic Gneiss
- Washington Gneiss
- Hornblende-Biotite Gneiss
- Granofels
- Preserve Boundary
- Stream
- Swamp
- Pond
- Wood Road
- Stone Wall
- Barbed Wire Fence
- Chestnut Rail Fence
- House
- Barn

In a broader perspective, Norfolk is the southern terminus of the Berkshire Plateau (Egler, 1940), a broad plateau bounded by lowlands to the east and west. The underlying bedrock of the Plateau is predominantly gneiss and schist, with none of the limestone and marble which occurs just to the west and south in Canaan and the Housatonic River Valley.

Although the bedrock can be a determinant in the composition of soils, glaciation has been a greater influence, and one cannot directly correlate bedrock with vegetation types.

The Bedrock Geology map shows the locations of various types of bedrock. The characteristics of these rock types are as follows.

Granitic gneiss

Gray locally pinkish gray medium to coarse grained strongly foliated but generally unlayered granitic gneiss composed of about equal parts of quartz, microline, sodic plagioclase, with lesser amounts of biotite, muscovite, or ferrohastingsite, apatite, zicron and magnetite. Granitic gneiss is strongly conformable to surrounding units but locally intrudes small cross-cutting sills and dikes into adjacent rock.

Hornblende - biotite gneiss

Black and white rough-ribbed weathering medium to coarse grained gneiss composed of hornblende, plagioclase, quartz, biotite, epidote, sphene, magnetite, apatite, zicron, and locally garnet. Black hornblende rich and white plagioclase-rich layers range in thickness from a few centimeters to a few meters with an average thickness of about 15 cm. Layering is commonly contorted, and thicker mafic layers are boudinaged, broken, and offset by late slip cleaveage.

Washington gneiss

Dark rusty brown weathering strongly foliated locally well layered muscovite rich schist and feldspathic quartzite. Schist is composed of quartz, plagioclase, muscovite, red-brown biotite, garnet, sillimanite, zicron, and apatite. Quartzite beds, characteristic of this unit, range in thickness from a few centimeters to about a meter and weather to a distinctive gray, vitreous, lacework pitted surface. Quartzite beds are more resistant and give weathered surface strongly ribbed appearance when present.

Ganofels

Orangish-tan-weathering biotite-muscovite ganofels composed of quartz, plagioclase, biotite, muscovite, sillimanite, apatite, and locally coarse-grained garnet. Strongly foliated and locally well-layered with layers ranging in thickness from about 2 centimeters to about one meter. Contains scattered white quartz-feldspar-rich layers studded with coarse garnets rimmed by black biotite.

SURFICIAL GEOLOGY*

The last glaciation period, known as the Wisconsin, occupied the southern New England region 10,000 to 15,000 years ago. Its impact on the surficial geology is significant. Most of the upland areas consist of glacial till, an unsorted mixture of sand, clay, and rock. The presence of till is the result of the ice sheet having scooped up and transported pieces of bedrock and rock debris as it moved from northwest to southeast. These rocks were then deposited when the climate warmed and the ice gradually receded.

Till is a common feature of the New England landscape, and, as the Surficial Geology Map shows, the upland areas of the Walcott Preserve are no exception. On the steep slope to the west of Beckley Pond, there are many glacial erratics--large boulders torn from bedrock and deposited a considerable distance to the south.

According to Egler (1940) parent material (or bedrock) and surficial deposits in the Berkshire Plateau are similar in type. The till may originate as much as a hundred miles to the northwest, but the region has such geologic uniformity that the deposited material is essentially the same as the bedrock immediately underlying it.

Most of the drainage system north and south of Beckley Pond consists of swamp and marsh deposits, the result of thousands of years accumulation of organic matter. The presence of a sharply defined ridge on the lower slope of the hill east of the drainage is probably an ancient shoreline (Conard, 1960). The implication is that the pond has been filling in with peat and muck since the last glaciation, causing the slow advance of bog and swamp communities along edges.

Two small areas of the preserve along the northern drainage represent kame terraces (ice-contact stratified drift), "flattish bod(ies) of sand and gravel deposited by running water between a stagnant lobe of glacial ice and an adjacent valley wall" (Jorgensen, 1976, p. 248). Logically, these areas lie between the drainage and steeply sloping hills to the east and west. According to the surficial geology map, the lower of these two kame terraces was once quarried for sand and gravel.

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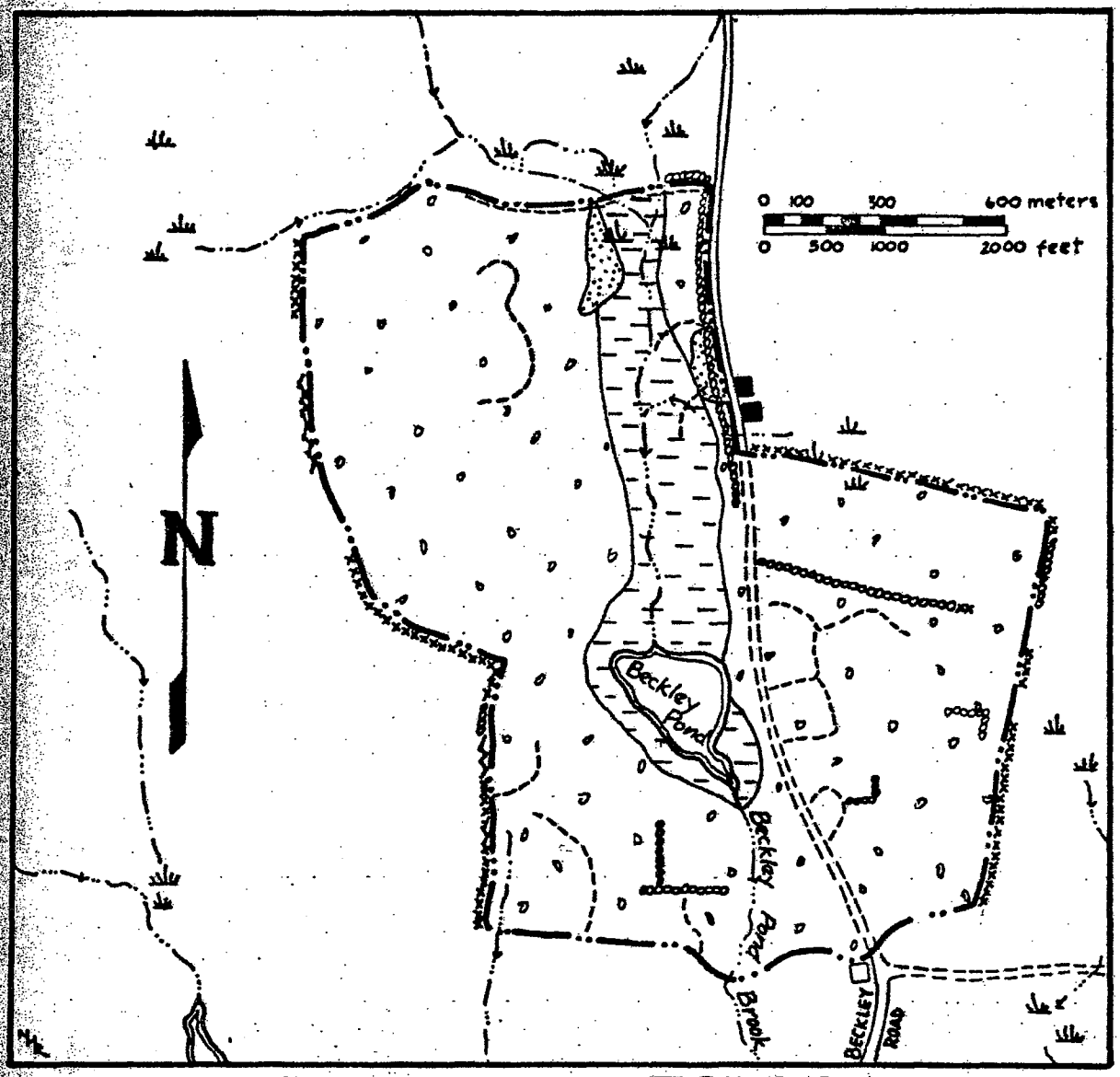
*Information taken directly from the files at The Natural Resources Center, Department of Environmental Protection, Hartford, Connecticut.



SURFICIAL GEOLOGY

- Till
- Swamp and Marsh Deposits
- Ice Contact Stratified Drift
- Preserve Boundary
- Stream
- Swamp
- Pond
- Wood Road
- Stone Wall
- Barbed Wire Fence
- Chestnut Rail Fence
- House
- Barn

SOILS*

The map displays a complex arrangement of soils, but these can be divided into two broad categories.

Wetland and Lowland Soils

Peat and muck (Pk) occupy most of the drainage running through the center of the preserve. The peat and muck region also includes the wooded swamp on the Hamilton parcel at the northeast end of the preserve. The underlying deposits are the remains of wetland plants such as sphagnum, sedge, cattail, etc. In general, deposits range from 3 to 25 feet (1 - 7.5 m) in depth. The water table is at or near the surface for most of the year in these wetlands.

Birdsall silt loam (Bz) occupies an area mostly to the north and south of the peat and muck. The soil is poorly drained, having the water table at or near the surface most of the year. Raynham silt loam (Rc) .....

Leicester (Lg) very stony fine sandy loam is also saturated for much of the year. On the map, these soils lie adjacent to, and at a slightly higher elevation than the peat and muck and Birdsall soils.

Merrimac sandy loam (MyB) occurs on the kame terraces discussed in the surficial geology section. This soil, underlain by stratified sand and gravel, is very permeable and generally free of surface stones.

Other soils occupying a very small area along the drainage are Tisbury soils (TwA) and alluvial land (Am), the latter submerged by beaver flooding.

There is a clear correlation between soil and vegetation type in these lowland areas. The muck and peat supports bog and swamp vegetation, primarily herbaceous plants, wetland shrubs (including heaths), red maple, and some tamarack and black spruce on the bog. The Birdsall and Leicester soils support tree species characteristic of the Walcott lowlands. The most prevalent are red maple, hemlock and yellow birch.

Upland soils

The well drained upland soils of the Berkshire Plateau are derived from glacial till and are generally acidic with a pH ranging from 4.0 to 5.5 (Egler, 1940). They share similar characteristics, being stony fine sandy loams, but differ in their degree of slope, relative amount of stone or rock, and depth to bedrock.

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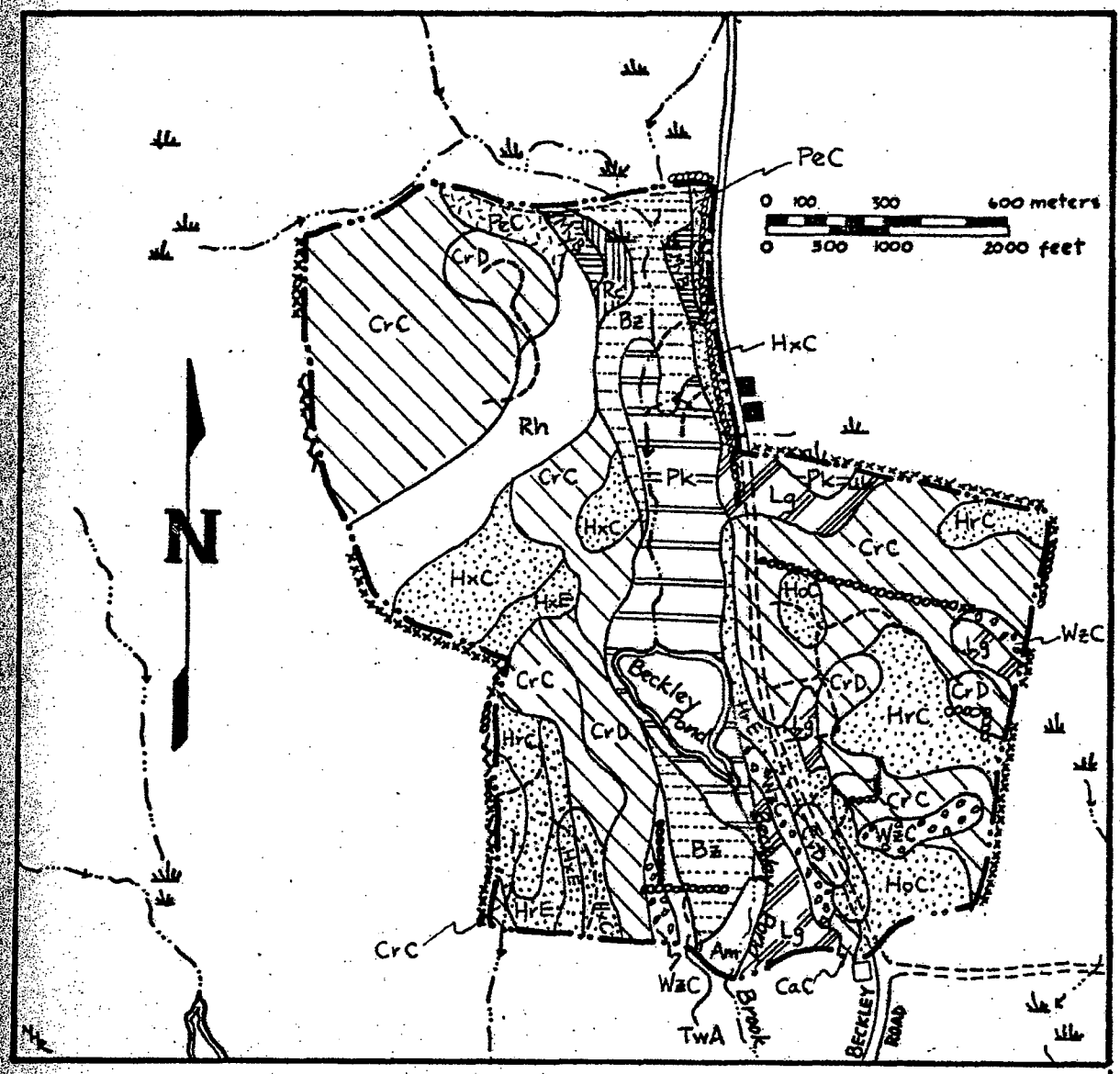
*Information taken from USDA Soil Conservation Service, 1970. Soil Survey: Litchfield County, Connecticut. Government Printing Office, Washington, DC.



SOILS

- Am – Alluvial land
- Bz – Birdsall silt loam
- CaC – Charlton fine sandy loam, 8-15% slopes
- CrC – Charlton very fine sandy loam, 8-15% slopes
- CrD – Charlton very fine sandy loam, 15-35% slopes
- HoC – Hollis rocky fine sandy loam, 3-15% slopes
- HrC – Hollis very rocky fine sandy loam, 3-15% slopes
- HrE – Hollis very rocky fine sandy loam, 15-35% slopes
- HxC – Hollis extremely rocky fine sandy loam, 3-15% slopes
- HxE – Hollis extremely rocky fine sandy loam, 15-35% slopes
- Lg – Leicester very stony fine sandy loam
- MyB – Merrimac fine sandy loam, 3-8% slopes
- PeC – Paxton very stony fine sandy loam, 8-15% slopes
- Pk – Peat and muck
- Rc – Raynham silt loam
- Rh – Rock land
- TwA – Tisbury soil, 0-3% slopes
- WzC – Woodbridge very stony fine sandy loam, 3-15% slopes

The soils occupying most of the upland area are the Charlton series (CaC, CrC, CrD), very stony fine sandy loams found on moderate and steep slopes. The Hollis series (HoC, HrC, HrE, HxC, HxE), the most widespread soil type in Litchfield County, is next in extent. These soils have a high percentage of outcrop, are shallow to bedrock, and are generally characterized as very rocky. Rock land (Rh), occurring on the steep slope rising up northwest of Beckley Pond, has exposed bedrock covering most of its surface. Two very stony sandy loams occupying small areas of the uplands are Paxton (PeC) and Woodbridge (WzC).

The upland soils are well to excessively drained and influence the rate of vegetation growth as well as species composition. Shallow rooted species such as beech and hemlock occur on steep slopes with thin soils where run off is excessive. Plants here receive limited moisture and nutrients available for their growth. The deeper rooted hardwoods -- sugar maple, red oak, white ash -- do best in areas of more moderate slope and richer soils.

Soils are not the only influence on plant growth. An equally important influence on current patterns of vegetation results from human land use over the past two hundred years. Cultivation, grazing, and logging have altered the natural trend of vegetation composition and development at the Walcott Preserve.

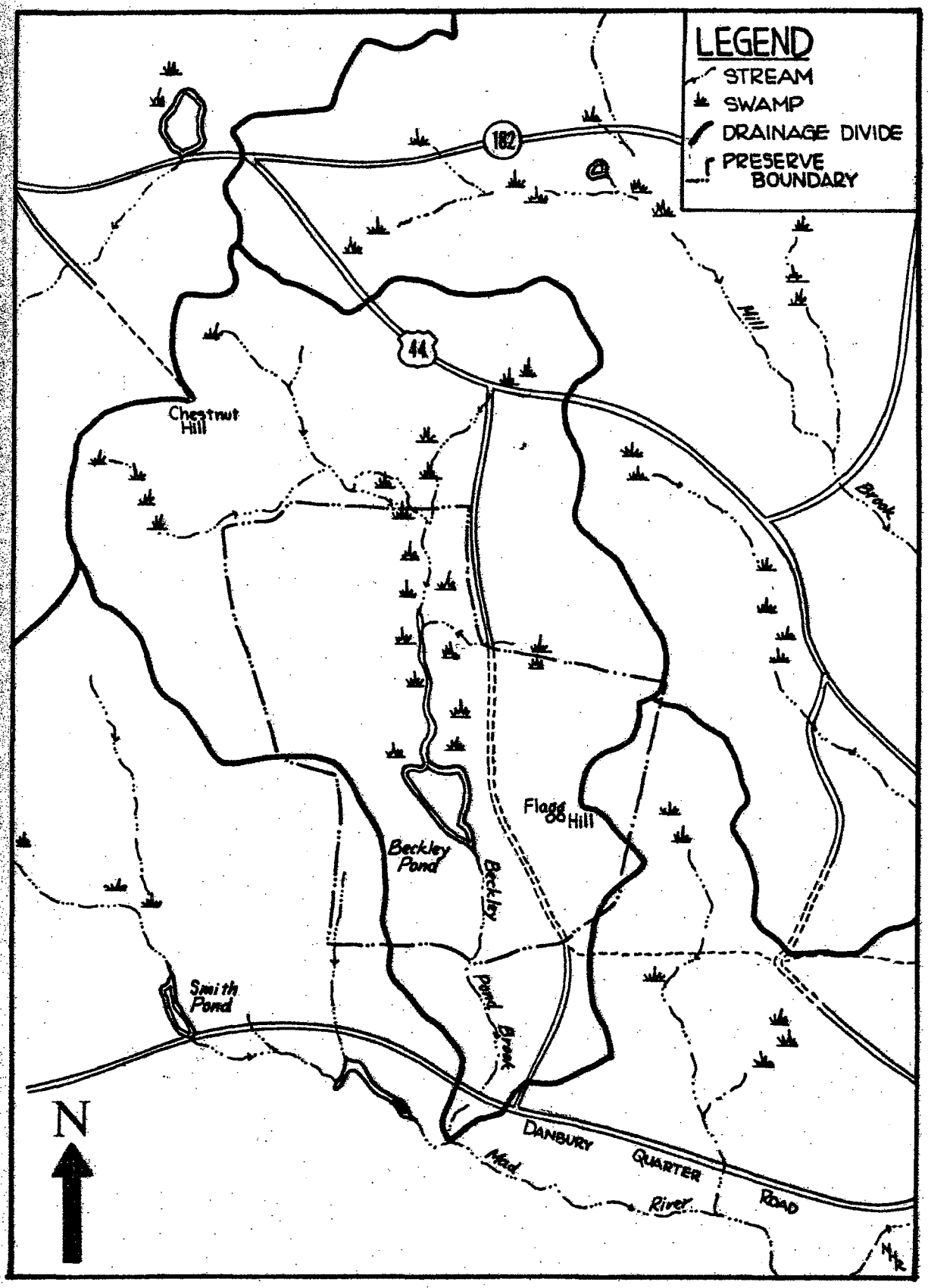
HYDROLOGY

The major hydrological feature of the Walcott Preserve is its central drainage system, which includes Beckley Pond with Beckley Pond Brook flowing into and draining the pond. The headwaters of the brook begin in the region of Chestnut Hill, a steep ridge northwest of the preserve. A feeder stream drains a swamp abutting the junction of Beckley Road and Route 44 and joins Beckley Pond Brook near the north line of the preserve, forming the wide, slow-flowing, meandering inlet to the pond. The brook is then joined by an unnamed stream which drains a swamp at the north end of the Hamilton parcel.

Beckley Pond Brook flows southward from the pond and joins the Mad River, across Danbury Quarter Road near the Grantville settlement. A second unnamed stream beginning in the extreme southwest part of the preserve also feeds into the Mad River.

The drainage system has been significantly influenced by beaver activity. Lodges and dams are evident throughout the water course. Damming by beaver has raised the water level of the pond and inundated the wide, flat areas east and west of the pond and brook. land that was once forested has become swamp and marsh. The presence of a shoreline dike, an abrupt ridge east of the pond, indicates the original extent of the waters.

HYDROLOGY


LEGEND
STREAM
SWAMP
DRAINAGE DIVIDE
PRESERVE BOUNDARY
182
44
Chestnut Hill
Flagg Hill
Beckley Pond
Beckley Pond Brook
Smith Pond
Danbury Quarter Road
Mad River
N

VEGETATION

Methodology

Thirteen plant communities were distinguished after an initial reconnaisance of the preserve. The composition and structure of the eight forested associations and of the five wetland types were determined by laying out permanent plots to sample vegetation. Sample plots are of two kinds: linear transects used to measure shifts in vegetation, and square quadrats established in representative forest types. These data and a more detailed description of sampling methods appear in Appendix A. Appendix B is a preliminary plant species list. Vegetation mapping was accomplished with the aid of aerial photographs. Boundaries of plant associations were drawn after checking in the field.

General Description of Plant Associations

The vegetation of the Walcott Preserve, consisting of upland and wetland plant communities, falls within the Northern Hardwoods-Hemlock-White Pine Association, an area which occupies a small section of northwest Connecticut (Egler and Niering, 1976), primarily in the Town of Norfolk. Dowhan and Craig (1976, p. 28) describe the major vegetational characteristics of this Northwest Highlands Ecoregion as follows:

> "Dominant or characteristic tree species are sugar maple (Acer saccharum), beech (Fagus grandifolia), yellow birch (Betula lutea), white pine (Pinus strobus); and hemlock (Tsuga canadensis); white ash (Fraxinus americana) and black cherry (Prunus serotina) are frequent associates. Except on very dry sites, oaks--other than northern red oak (Quercus rubra)--and hickories (Carya spp.) are conspicuously absent or at least scarce . . ."

Past human use in the form of cutting for charcoal, cordwood, and pasture clearance -- primarily in the nineteenth and early twentieth centuries -- has had a major impact on the current status of the vegetation. More recently abandoned areas, including much of Flagg Hill and the slope between Beckley Road and the pond, are characterized by plant associations in intermediate stages of vegetational development; these areas are reverting from open pasture and cutover land towards the Northern Hardwoods-Hemlock-White Pine Association. Gray birch (Betula populifolia) and fire cherry (Prunus pensylvanica) are still evident in these areas, though these species are giving way to red maple (Acer rubrum) red oak and black birch (Betula lenta). White pine, also a pioneer species on abandoned pasture land is quite common in the Flagg Hill area and on ridge plateaus in the northern Anstett addition to

the preserve. Mountain laurel (Kalmia latifolia) frequently grows here in association with white pine. The more mature upland forests are dominated by American beech and hemlock. Growing commonly in association are red oak, red maple, sugar maple and white ash. This forest type occupies most of the preserve, beech being most abundant in upper slope areas, and hemlock in mid to lower slopes. Data gathered from transects indicate that sugar maple, now in a fairly young stage, is becoming the third major component of the upland forest.

In addition, there are two other distinct upland communities. One type, dominated by hemlock, occupies broad, level lower slope areas. Yellow birch and red maple are the two associated hardwood species in this community. The area southwest and south of Beckley Pond supports much of this type, as do the borders of swamps east of Flagg Hill and the Hamilton parcel. Finally, an association of shagbark hickory (Carya ovata) and hop hornbeam (Ostraya virginiana), with a broad carpet of sedge (Carex pensylvanica), occurs on the exposed, east-southeast facing ridge northwest of the pond (See particular community descriptions and transect data for more detail).

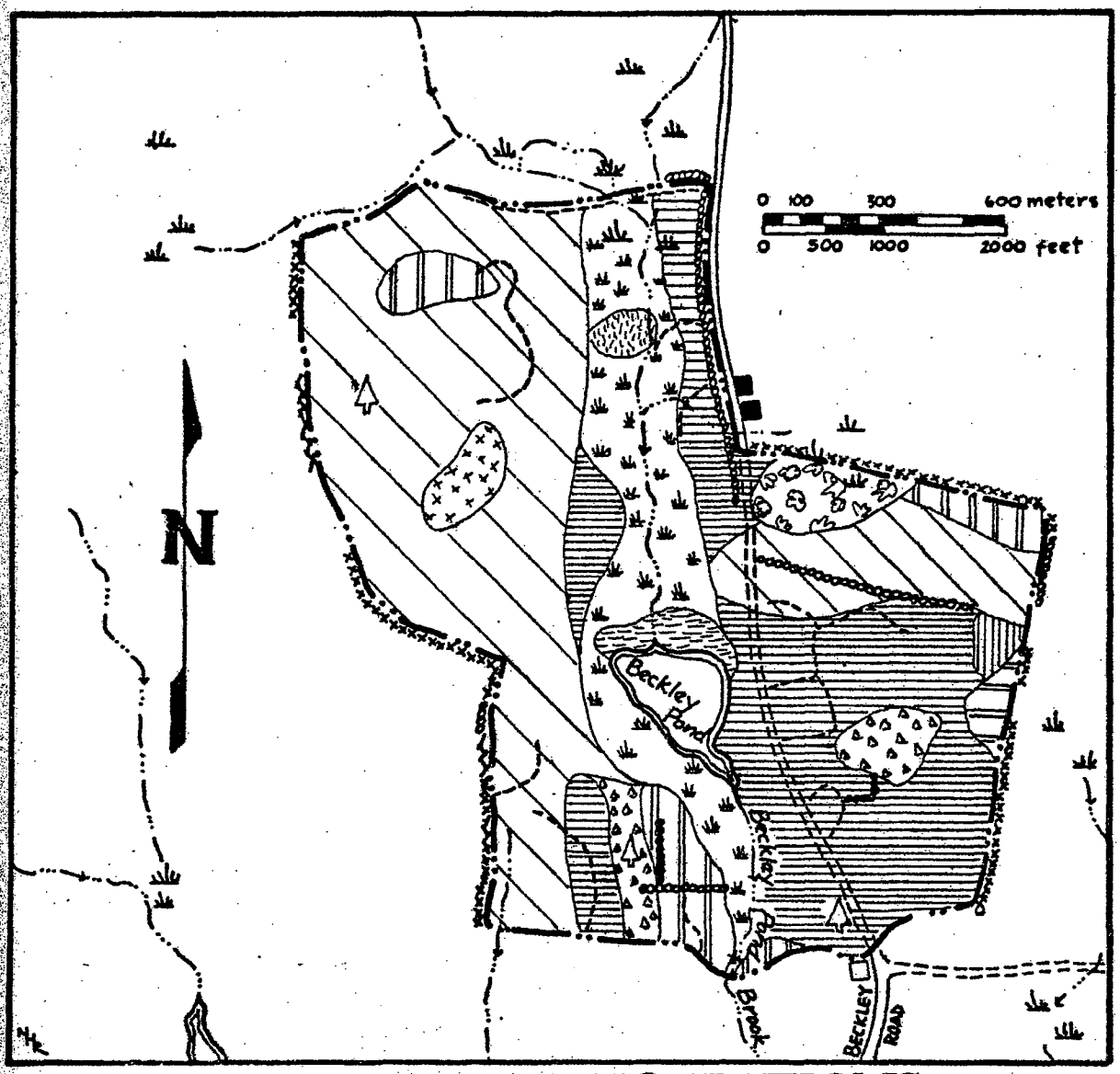
The wetland vegetation of the preserve can be broadly categorized into four types: pond, marsh, swamp, and bog. Most of the wetlands occur in the Beckley Pond drainage system whose salient features are the pond, the bog, and the broad belt of swampland on both sides of the brook. Neither the pond nor the very moist marshy areas were studied in detail.

The bog north of Beckley Pond has been the subject of a thorough study (Conard, 1960) and has received attention from knowledgeable observers over the past 30 years. The major plant species on the bog include tamarack (Larix laricina) black spruce (Picea mariana), sweet gale (Myrica gale), and leatherleaf (Chamaedaphne calyculata). Beaver activity has raised the water level, floating and deepening the fosse around the periphery. There also appears to be a significant incursion of red maple onto the bog mat.

The swampland along the drainage was forest until beavers flooded the area and cut down many of the deciduous trees. Now standing snags of dead trees dominate the borders of the wetland while a lush growth of herbaceous vegetation extends from the edge of pond and brook to the bases of the ridges to the east and west. Tussock sedge (Carex stricta) forms characteristic hummocks throughout this swamp. Other vegetation includes a variety of sedges (primarily Carex spp.) and rushes (Juncus spp.), as well as ferns -- especially royal fern (Osmunda regalis) and marsh fern (Thelypteris palustris) --, and a great many flowering plants. The swampland becomes more wooded nearer the ridge. Various shrubs, including willows (Salix spp.) arrow-wood (Viburnum recognitum) and speckled alder (Alnus rugosa) appear, as does red maple.

A wooded swamp occurs on the north end of the Egler parcel. This swamp is again characterized by tussock sedge, but here there is a much thicker growth of both tree species (primarily red maple) and shrubs than around Beckley Pond.

Natural Resources Inventory of the Frederic C. Walcott Preserve by Ted Elliman 1982



VEGETATION ASSOCIATIONS

UPPER SLOPE SITES
- Hickory-Hornbeam
- Young Hardwoods-White Pine
- White Pine
- Northern Hardwoods-Hemlock

MIDSLOPE SITES
- Red Oak-White Ash
- Red Oak-Red Maple

LOWER SLOPE SITES
- Hemlock
- Hemlock-Red Maple-Yellow Birch

WETLAND SITES
- Wet Meadow
- Shrub Swamp
- Wooded Swamp
- Bog

- Preserve Boundary
- Stream
- Swamp
- Pond
- Wood Road
- Stone Wall
- Barbed Wire Fence
- Chestnut Rail Fence
- House
- Barn

A wet meadow occurs within the shrub swamp north of Beckley Bog. This area was cut for hay by the Anstett family until 1938. Beaver activity has since saturated the meadow, and the result is a lush, almost uninterrupted growth of reed canary grass (Phalaris arundinacea) growing six feet (2 m) in height.

UPPER SLOPE SITES

Hickory-Hornbeam Association

This community is exceptionally well-developed. It occurs near the top of an exposed east-southeast facing ridge northwest of Beckley Pond, at an elevation of about 1500 feet (450 m). The soils are thin and well drained; broad areas of bedrock are exposed throughout; and a significant amount of sunlight penetrates to the forest floor.

Shagbark hickory occurs nowhere else on the preserve while hop hornbeam and Pennsylvania sedge are abundant only here. The hickory zone ends abruptly and, with the exception of the lower east edge, is sharply delineated from the surrounding Northern Hardwoods-Hemlock Association, which will be discussed further along in this report.

In his study on Berkshire Plateau vegetation, Egler (1940, p. 168) comments on this type of area:

> "On certain of the most exposed hilltops in the Blandford area [this includes Norfolk], there is developed a very unique type of vegetation, floristically related to the forest communities of southern New England and co-respondingly distinct from the generally distributed northern hardwood types in this vicinity. Only a half dozen examples of this community, varying from one to four acres in extent, have been studied; it is doubtful if twice this number are in existence . . ."

Shagbark hickory, the only canopy species, has attained a maximum height of 50 feet (15 m). Hop hornbeam is the most important understory tree, reaching 30 to 40 feet (9-12 m) in height. Shadbush (Amelanchier sp.) and hawthorn (Crataegus sp.) occur intermittently in the shrub zone. Sedge forms a thick carpet beneath the trees; other commonly occurring herbaceous plants include marginal shield fern (Dryopteris marginalis), climbing false buckwheat (Polygonum scandens), sheep sorrel (Rumex acetosella), cow-wheat (Melampyrum lineare), and Virginia creeper (Parthenocissus quinquefolia.

The canopy is quite open and trees are widely scattered. Deer trails and bedding areas are evident in the abundant sedge growth. Exposure to sunlight and thin, droughty soils are important limiting factors in this hickory-hornbeam community. The excessive dryness coupled with the damage caused by foraging rodents appears to prevent tree regeneration on the site. Although very few sprouts or seedlings of any kind were noted in the area, the hickory-hornbeam association appears to be stable for the present.

According to George Kiefer, a forester from Salisbury, the area was grazed at one time, contributing to the open, dry conditions which allowed this community to develop. Mr. Kiefer believes there may be some successful white pine regeneration, but that hickory, a tough, long-lived species will endure as the predominant tree species.

Young Hardwoods-White Pine Association

This community occurs on Flagg Hill, primarily on the broad, flat plateau about 1500 feet (450 m) in elevation. Flagg Hill was pastured early in the century; but, according to Bob Anstett, a long-time resident, the area has been growing back to woods at least since the 1930's. Vegetation development appears to have been slow, probably due to thin, rocky soil.

Gray birch and, more infrequently, pin cherry are in evidence. Although more than half the individuals observed were dead, either standing or fallen, their characteristic clumps still thrive in rare spots and grow up to 40 feet (12 m). More frequently these species are succumbing to the competition for space and light with the younger red maple and red oak . Only in areas opened by the 1976 tornado is there any gray birch regeneration.

The most common tree species occurring on the plateau are young slender red maple and red oak, probably no older than 25 to 30 years. Both species now reach 50 feet (15 m) in height and probably will continue to grow. The canopy, still partially open, is closing; the lack of sunlight will prove fatal to the gray birches.

Black cherry (Prunus serotina) is an occasional associate in these woods. Like gray birch and pin cherry, it germinates best in full sunlight but grows faster and larger. Saplings are now evident in tornado damaged areas. It is currently the tallest hardwood on the Flagg Hill plateau, reaching 70 feet (21 m).

White pine (Pinus strobus), a pioneer species on abandoned pasture land is a common component of the association.

The shrub and herb layers occurring on Flagg Hill are dense. There are thickets of mountain laurel and highbush blueberry (Vaccinium corymbosum) reaching up to 10 feet (3 m). Other shrubs include arrow-wood, striped maple (Acer pensylvanicum), meadowsweet and steeplebush (Spiraea latifolia and S. tomentosa), and black huckleberry (Gaylussacia baccata).

The herb layer is dominated by hay-scented fern (Dennstaedtia punctilobula). This species, easily the most abundant fern on the preserve, grows in extensive stands throughout the Flagg Hill area, often to the exclusion of other herbaceous species. The fern grows so thickly and has such a dense root system that it may inhibit the germination of other plants. In shadier areas, it does not fare as well, and other herbs appear in abundance. Among the more common are: New York fern (Thelypteris novaboracensis), clubmosses (Lycopodium clavatum and L. complanatum), Canada mayflower (Maianthemum canadense), starflower (Trientalis borealis), and dewberry (Rubus hispidus).

Barring a major disturbance, the development of this forest in the near future, is towards a red maple-red oak dominated community. Unlike the stable hickory-hornbeam community described before, the Flagg Hill site is clearly in the process of change. The variety of plant species and their abundance is likely to decrease as the forest matures. The remaining gray birch and many of its associated shrubs will disappear.

White Pine Stands

White pine is not especially common on the preserve, but it grows abundantly on several sites. Of special interest are two, one near Flagg Hill (especially along the southeast boundary of the preserve) and the other in the northwest section (the Anstett Parcel), to the north and west of the Hickory-Hornbeam Association.

Around Flagg Hill, white pine is fairly young and not especially tall, reaching only 80 feet (24 m). In spots it has clearly outcompeted gray birch and other early hardwoods, forming a thick canopy. The shrub layer is dominated by mountain laurel, and the herb layer is relatively sparse with dewberry, Canada mayflower, and starflower among the most common. The white pine stands in this area are stable for the present; there is little incursion of hardwoods under the pine canopy. Years ago grazing pressure on hardwood seedlings gave the pines a competitive advantage on certain sites. The pine grew rapidly and abundantly enough to eliminate competition by the hardwoods.

The pines in the northwest section are much larger, many being over 100 feet (30 m). Most of these have been attacked by the white pine weevil and are forked-trunk specimens. The most interesting aspect of this pine community is the lack of associated trees in the canopy and understory. The only common plant here occurs on the forest floor and is, again, hay-scented fern. Interrupted fern (Osmunda claytoniana) occurs at intervals. The density of the ferns growing in a semi-open condition is probably suppressing other forms of growth. The Northern Hardwoods-Hemlock Association forest type appears to be encroaching on this pine stand from the north.

The dominance of the pines in the northwest area result from lumbering practices from the early '20s to 1938. Bob Anstett related that his family would cut the hardwood species for cordwood, leaving the pines intact. This activity would account for the unusual nature of

these woods -- large, well-spaced pines, a dearth of hardwoods, and an extraordinarily dense fern growth. Regeneration of pines is uncommon on the preserve. The species is restricted to the flattish plateaus mentioned above, and, to a much lesser extent, to the edges of the Beckley Bog wetlands. Since pine requires full sunlight to germinate successfully, the present growing condition of the forests of Walcott Preserve will suppress its development.

Northern Hardwoods-Hemlock Association

The predominant tree in this community type, American beech, occurs in mature woods in all upland areas, but grows in greatest abundance on the upper slopes of the preserve,

Jorgensen (1978, p. 323) observes:

> "... the combination of deep shade, sharply acidic soils, and surface-feeding roots, characteristic of [beech] usually renders the ground beneath the trees totally barren of plant life."

Here, its tolerance of shade and thin soils and its habit of spreading by root suckers enable it to grow to the virtual exclusion of other species.

There is an exceptional beech stand at the top of the plateau in the northwest section (1600 feet or 480 m). In this beech coppice, the species is represented by mature trees (70 feet or 21 m), young saplings, and all age classes in between. The thick leaf litter and the heavy shade caused by the spreading branches have excluded nearly every other species of plant. Only wild oats (Uvularia sessilifolia) is growing in the leaf litter.

Most of the other beech stands on the preserve are more even-aged, and are associated with other hardwood species and hemlock. Still, the predominance of beech in the upper slopes of these mature woods is unchallenged. The greatest abundance of beech occurs on the ridges west of the Beckley Bog basin, and there are also extensive stands in the northeast areas (Egler parcel and Girdler easement now owned in fee).

The other tree species associated with beech include red and sugar maple, red oak, hemlock, and occasional white ash and yellow birch. The variety of shrubs is very limited. Beech appears to be holding its own; its root suckers fill most of the understory and shrub layer, while the mature trees form the canopy. Two shrubs occurring occasionally are hobblebush (Viburnum alnifolium) and maple-leaved viburnum (V. acerifolium). The herb growth is very sparse. In addition to

wild oats, mentioned above, ground cover species include: Indian pipe (Monotropa uniflora)--a root saprophyte, starflower, Solomon's seal (Polygonatum biflorum), partridge berry (Mitchella repens), and whorled wood aster (Aster acuminatus).

The future of beech in the Walcott Preserve (and elsewhere in its range) is uncertain. Along with sugar maple, beech is the major hardwood component of the mature Northern Hardwoods-Hemlock Association, being long-lived and sprouting prolifically in cool, shaded conditions. Now, however, beech is being attacked by a bark fungus (Nectria coccinea var, faginata), which invades lesions in the bark caused by the beech scale (Cryptococcus fagi). Many of the beeches on the preserve, especially the older ones, are diseased. In ten years, according to George Kiefer, beech could suffer severe depletions. The openings in the forest resulting from their death and fall will allow other more shade-intolerant species to become established (probably red oak and red maple), and the composition of the upper slope communities may change significantly.

MIDSLOPE SITES

Red Oak-White Ash Association

Midslope communities generally have a greater variety of species than the upper slopes. Except for steep outcrop areas, midslope soils tend to be deeper to bedrock, richer in nutrients, and more moist than those on summits and upper slopes.

The Red Oak-White Ash Association occupies the rich, moist site on the northeast slope of Flagg Hill. The closed canopy casts a deep shade, and the largest hardwood species of the entire preserve occur here. Red oak reaches almost 90 feet (27 m), and white ash, which is more prevalent here than in other areas of the preserve, grows almost as tall. These two species and, to a lesser extent, black cherry comprise the canopy. Beech and sugar maple grow generally between 40 to 60 feet (12-18 m) forming a secondary cover just beneath the larger trees.

The most common understory tree (15-30 feet or 4.5-9 m) is also beech; its spreading branches making a third tier in the forest. The understory is shared by striped maple, sugar maple and hop hornbeam.

The ground cover, while poorly developed, still contains a diversity of species, which includes such deep woods types as Christmas fern (Polystichum acrostichoides), spinulose wood fern (Drypteris spinulosa), shining club moss (Lycopodium lucidulum), round-leaved violet (Viola rotundifolia), sweet white violet (Viola blanda), and Indian cucumber-root (Medeola virginiana).

The relative abundance of sugar maple in this community is indicative of rich soil conditions. As in other areas of the preserve, the maples are young, and may well become a more dominant presence in years to

come. The black cherries, some of which are comparable in size to the largest oak (for example, 35 cm in diameter) are infrequent and beginning to be overtopped by the oaks and ashes. There is one pure stand of magnificantly tall, arrow-straight ashes on this slope. Being shade intolerant, both red oak and white ash have attained the crown position before sugar maple and beech reach maturity.

Although this community is limited in extent, its structure and composition provide a benchmark by which to measure the development of other midslope areas. In the absence of major disturbances, more of the surrounding forest will, most likely, come to resemble this community. The beech fungus will probably be an important influence on this development.

Red Oak-Red Maple Association

Red oak and red maple share dominance on most other midslope areas on the preserve. The oaks are largest, the red maples most abundant. Beech and hemlock are frequently present as understory trees. Common shrubs include mountain laurel, witch hazel (Hamamelis virginiana), and striped maple. Common herbaceous plants are hay-scented fern, New York fern, bracken fern (Pteridium aquilinum), long-awned wood grass (Brachyelytrum erectum) and a great variety of flowering plants. Several species of club moss occur (Lycopodium obscurum, L. clavatum, L. complantum, and L. annotinum). This last species is listed as rare by Dowhan & Craig because, in Connecticut, is at the southern limit of its range. It is very common on the preserve.

By counting annual growth rings of trees blown down and cut after the 1976 tornado, one can determine that the oaks are generally 60 to 65 years old. Larger individuals grow from 80 to 100 feet (24-30 m) tall. Red maples form a second tier, usually around 50 feet (15 m) tall. Hemlock, beech, and in richer areas, sugar maple, are now associated as part of an understory from 15 to 40 feet (4.5 to 12 m). This profile is necessarily simplified. One notable variation is the local abundance of black birch. This species occurs scattered over the preserve, growing best on steep hillsides, generally facing south to southwest, that receive a lot of sunlight. There is one such community on the west side of Flagg Hill; another occurs on a southwest facing slope along the southern preserve boundary line, west of Beckley Bog drainage. In both areas there are remnants of a once prolific gray birch community, now being succeeded by red oak, red maple and black birch.

Another variation is the presence of white birch (Betula papyrifera) in limited numbers on the preserve. In Norfolk, the species is near the southern limit of its natural range and does not appear in great abundance anywhere on the preserve. The best growth of large white birches occurs on a northeast facing slope near the northern boundary. It appears that the more northerly conditions on this slope are favorable to white birch and the species here can hold its own with other intermediate-stage hardwoods. Associated trees are, primarily, red oak, red maple, beech and black cherry. Immediately below, on the same slope, there is a dense hemlock stand.

In places between Beckley Road and the wetlands, there are unusually tall and abundant stands of red oak, where the species is more clearly predominant than in the "typical" area described above. Red maple is the most common associate, along with scattered black birch. Shrub species include mountain laurel, arrow-wood, shadbush, and witch-hazel. Typical ground covers are: wild sarsaparilla (Aralia nudicaulis), starflower, Canada mayflower, purple trillium (Trillium erectum), partridgeberry and clubmosses (Lycopodium complanatum, L. obscurum). The ferns, as usual, are the most abundant herbaceous growth, sometimes forming a 100 percent of the cover. Four species -- hay-scented, interrupted, New York, and bracken -- are the most common.

The area that suffered the heaviest tornado damage in 1976 was an even-aged Red Oak-Red Maple complex. Counting annual rings on several representative fallen trees showed the ages and diameters of trees to be:

SPECIES	AGE	DIAMETERS (cm)
red oak	58	51
red oak	52	46
white pine	54	39
beech	55	25
yellow birch	55	23

At that time, many large red oaks on the east side of the pond and south along the drainage fell, breaking the continuity of the canopy. Now, in 1980, there are places were there is virtually no canopy or understory cover (see transect 8). The variety and density of the present vegetation is extraordinary. Dense tangles of brambles (Rubus spp.) are characteristic, as are thick growths of speckled alder and mountain laurel. Other shrubs and small trees springing up in these recently opened areas include: gray birch, quaking aspen (Populus tremuloides), bigtooth aspen (P. grandidentata), red-berried elder (Sambucus pubens), and staghorn sumac (Rhus typhina). Steeplebush, meadowsweet, nannyberry (Viburnum lentago), alternate-leaved dogwood (Cornus alternifolia) and grapes (Vitis spp.) are also abundant.

Wildflowers include such open-field types as goldenrod (Solidago spp.), common St. Johnswort (Hypericum perforatum), pearly everlasting (Anaphalis margaritacea), and agrimony (Agrimonia sp.). To an even greater extent than the Flagg Hill woods, this area is in a vigorous state of growth, competition, and flux. Tracing its development in future years will provide informative data on successional trends.

The Red Oak-Red Maple Association is currently the most extensive midslope community on the preserve. Shade tolerant trees -- beech, sugar maple, hemlock, and yellow birch (to a lesser degree) -- are now in the understory of this forest complex and will gradually become more important in the canopy. Transect 9 (See Appendix A) surveys an area of special interest where beech and sugar maple appear to be outcompeting red maple and red oak.

Two Atypical Midslope Forest Types

Two midslope areas, limited in extent and unusual in their floristic composition are worth mention. Because of their small size, they were not placed on the vegetation map. The first area occurs in a very steep part of "Beckley Lookout" hill (see Special Features Map) where outcrops are common. Species growing abundantly are sugar maple, witch hazel, red-berried elder, and jewelweed (Impatiens pallida). Bob Anstett informed me there was basswood (Tilia americana) growing here also, though I was unable to locate it in 1980. This species association indicates somewhat less acid soils than exist on most of the preserve. More thorough investigation may reveal additional unusual plant species growing on the Walcott Preserve. A few bitternut hickory (Carya cordiformis) individuals grow farther downslope.

The second atypical midslope community occurs along a seasonal streambed running closely parallel to, and at times forming, the extreme northwestern line. The surrounding woods are a rich mix of mature hemlock and northern hardwoods with the most unusual aspect of this very moist, deeply shaded woods being the herbaceous vegetation. Shade-loving ferns grow here in profusion. Species include: Christmas fern, spinulose wood fern, lady fern (Athyrium filix-femina), silvery spleenwort (A. thelypteroides), long-beech fern (Thelypteris phegopteris), broad beech fern (T. hexagonoptera), northern maidenhair (Adiantum pedatum) and oak fern (Gymnocarpium dryopteris). Neither maidenhair nor oak fern was seen elsewhere on the preserve.

A single meadow horsetail (Equisetum pratense) was observed growing along the streambed. It is listed in Dowhan & Craig (1976) as rare in Connecticut, being at the southern limit of its range. This one specimen should be re-checked in the future.

Wildflowers growing here include: foamflower (Tiarella cordifolia), round-lobed hepatica (Hepatica americana) and violets. This area would most likely be rich in spring wildflowers.

Two species of shrubs also unusual for the preserve occurred here -- alternate-leaved dogwood and American hazelnut (Corylus americana). This latter species indicates that this northwestern area also contains less acid soils than most of the preserve, and further investigation may uncover more uncommon plant species.

LOWER SLOPE SITES

Hemlock Forest

The lower slope, as defined here, refers to upland areas at and near the bases of ridges. This community does not include wooded swamps where the water table is frequently on the surface, and tussocks of sedge form the base for most of the woody vegetation.

Hemlock is predominant on lower slopes, often covering extensive

areas. The best-developed forest occurs on the southern side of Beckley Pond where topography is flat and broad, often rising no more than a few feet above the elevation of the swamps. It appears that many of these hemlock-dominated communities have evolved from a wooded swamp condition (the swamp on the Egler parcel illustrates this transition gradient from wooded swamp to hemlock forest.)

In the more extensive regions of hemlock, there is virtually no other species of tree (see Quadrat I, Appendix B), except for an occasional red maple. Hemlocks occur in all the forest strata and range in size from very large trees (70 cm in diameter) to tiny seedlings. Hemlock so entirely blocks the light reaching the shrub layer and forest floor, that only its own offspring is able to grow. The strongly acid soils and the thick needle duff also inhibit herbaceous growth, with the result that ground cover vegetation is very sparse.

The Quadrat I sample, taken in a near-pure stand of hemlock, yields the following information: of the total 43 trees counted in a 30 x 30 m plot, 37 were hemlock (86%). Of the total 22 understory saplings and shrubs (in three 5 x 10 m plots), 20 were hemlock (91%). Hemlock seedlings also comprised the great majority of ground cover plants, and over 90% of the forest floor is hemlock needle duff. These data are representative of many hemlock areas and indicate the tendency of hemlock not only to predominate but to succeed itself in these almost monocultural stands.

The characteristics of hemlock are similar, in several respects, to those of beech (Jorgensen, 1978). The species germinates and grows best in shaded conditions, the trunk of young individuals being subject to sun-scald and the shallow roots to excessive heat and drought if too much sunlight impinges on the adjacent forest. Like beech, its monocultural tendencies and thickly spreading branches cast a deep shade, creating a cool habitat on the forest floor. This species, also, is clearly succeeding as the forest matures.

As with beech, it is an oversimplification to restrict the definition of hemlock communities to specific slope locales. The tree also grows well on midslopes and even occurs with regularity on the highest plateaus. Still, it reaches its greatest abundance on these lower slopes. The few associated shrubs that occur with hemlocks include: mountain laurel and Canadian yew (Taxus canadensis). Ground cover vegetation includes Canada mayflower, painted trillium (Trillium undulatum), partridgeberry, starflower, clintonia (Clintonia borealis) goldthread (Coptis groenladica), and clubmosses.

Hemlock-Red Maple-Yellow Birch Association

Another common lower slope community includes hemlock with red maple, yellow birch and occasional beech. This community type appears to thrive best at slightly lower elevations than is typical for the more uniform hemlock stands. An example of this association occurs in the lowlands-verging-on-swamp near the northeastern boundary. Red maple is

the largest tree here; the diameter of one particularly large individual measured 54 cm. Hemlock is characteristically smaller (30-35 m maximum) and its crown at a height of about 50 feet (at 15 m) is 20 to 25 feet (6-7.5 m) below the red maple canopy. Yellow birch is even smaller and occurs less frequently. It does not appear particularly well-suited to the preserve environment but grows as a scraggly, medium-sized tree 40 to 50 feet (12 - 15 m) maximum. The diameter of the largest individual measured 21 cm.

The ground cover under this association is richer than in the uniform hemlock stands. Goldthread is locally very abundant, and common wood sorrel (Oxalis montana), listed as rare in Connecticut by Dowhan & Craig (1976) is fairly common. Starflower, Canada mayflower, and occasionally bunchberry (Cornus canadensis) and wintergreen (Gaultheria procumbens) also occur here. Judging from wooded swamps in the area which are dominated by red maple, the Hemlock-Red Maple-Yellow Birch Association appears to represent the first major terrestrial step along the gradient from swampland to forest. The red maple phase is slowly yielding to the incursion of hemlock as the ground loses moisture. The area will eventually become still more dominated by hemlock.

Certain hemlock areas were devastated in the tornado blow-down in June, 1976. A broad belt of fallen trees, nearly 27 by 90 meters, borders the lower slope communities described in this section. There is also an area of hemlocks along the southern boundary line, west of the Grant Swamp addition, that must have received the full force of the twister. Significant openings in the canopy have resulted. Succeeding herbaceous vegetation currently filling these gaps includes grasses and sedges: Carex lurida, C. scoparia, Glyceria striata, Scirpus validus and a variety of ferns (hay-scented, New York, and interrupted). Other ground cover includes dewberry, partridgeberry and blackberry (Rubus allegheniensis).

Like beech, hemlock is shallow-rooted, and such storms are clearly a threat to the tree. Another threat to hemlock is fire to which the species is very susceptible. The absence of fire has influenced the spread of hemlock to its current level of abundance. Barring these kinds of catastrophes, the position of hemlock in the Walcott Preserve is a stable and enduring one.

Hemlock was spared during the mid-1800's when cutting for charcoal was prevalent in Norfolk. There are immense hemlocks still standing in the western section of the preserve where the presence of pits and mounds indicates the land was never logged nor tilled. The largest living hemlock to be sampled in 1980 measured 88.3 centimeters in diameter; one nearly dead measured 93.3 cm. A fallen and cut hemlock on the southern boundary line had 180 annual rings. Field observations indicate that hemlock is the most abundant tree species on the preserve, and includes among its population the Walcott Preserve's oldest and largest trees. It seems probable that hemlock will maintain its predominance on the lower slopes and become increasingly important in terms of numbers and cover throughout the preserve.

WETLAND SITES

Open Marsh

The five wetland associations merge and blend, but there are enough vegetational differences to describe them as distinct and separate communities. The marsh, broadly defined, is a wetland characterized by the year-round presence of shallow open water containing a rich variety of submergent and emergent vegetation. At Walcott Preserve, classically defined marsh areas are quite open and limited to the narrow margins between the pond or brook and adjacent to the neighboring, more terrestrial habitats, whether swamp or forest. The open marsh has not been mapped. It extends in breadth in the southern drainage near the Grant Swamp addition and on the fringes of a small beaver pond on the northern boundary. Marsh flora include some especially beautiful plants, including two water lilies: bullhead lily (Nuphar variegatum) and fragrant water lily (Nymphaea odorata); and two bladderworts: greater bladderwort (Utricularia vulgaris) and purple bladderwort (U. purpurea). The latter, an extraordinarily delicate mauve flower, appears in profusion in the marsh shallows in early-to-mid August. Pickerelweed (Pontederia cordata) and broad-leaved arrowhead (Sagittaria latifolia) are very common in the marsh. Colonies of cattails (Typha angustifolia) are scattered in the shallows.

This brief survey does not do justice to the abundance of marsh life. Amphibians: bullfrogs, green frogs, and pickerel frogs are very common, as are certain reptiles, such as water snakes, snapping turtles, and doubtless, a number of other species. Waterfowl, including black duck, American merganser, Canada goose, and Great blue heron, were observed swimming and feeding in marsh areas. Although this habitat is of limited extent on the preserve, a more thorough investigation of marshland flora and fauna is highly recommended.

As natural systems develop, the marsh is the farthest outpost of the terrestrial environment into the watery realms. Along the east shore of Beckley Pond, marsh vegetation is gradually establishing a terrestrial habitat as plants decay and the deep muck substratum approaches the surface. Beckley Pond has been filling in for centuries, as the presence of an old shoreline ridge, or dike, 50 feet (15 m) east of the present pond border attests.

Wet Meadow

The wet meadow occupies a scant fraction of the entire drainage area, but the community is distinct in its uniformity and abundance of grassy vegetation (Phalaris arundinacea) growing nearly 7 feet (2 m) high. The meadow is located in the northern portion of the basin, bounded by swampland to the north and south, a forested ridge to the west, and a beaver pond to the east. Jorgensen (1978) describes a wet meadow community as follows:

"Some experts recognize a drier type of marshland which they call a wet meadow. Though the water table--especially in summer--may be slightly below the level of the ground, the soil on these sites receives a continuous supply of moisture... Grasses are usually the dominant vegetation, though sedges and other marsh plants grow in sloughs and mudholes where the grassy turf may have been lifted by frost during the winter and stripped away by the spring freshets" (pg. 262).

The Anstetts mowed the tall grases for hay until 1938. The area has been growing back naturally since then, affected mainly by beaver activity which has raised the water level and made the soils extremely wet in the recent past.

The meadow is approximately 300 m (E-W) by 120 m (N-S). Reed canary grass comprises over 90% of the vegetation cover. Beneath this tall, waving grass is a limited number of other herbaceous species: jewelweed, cow vetch (Vicia cracca), swamp candles (Lysimachia terrestris), blue flag (Iris versicolor), crested fern (Dryopteris cristata), and marsh fern.

Several shrubs grow in occasional patches among the grasses. Speckled alder, silky willow (Salix sericea) and beaked willow (S. bebbiana) have established small colonies throughout the meadow. Meadowsweet occurs intermittently. On the western end of the meadow, the predominance of reed canary grass ends near the base of the ridge. A sedge, wool grass (Scirpus cyperinus), becomes increasingly common, mixed with the shrubs mentioned above. Closer to the ridge, the dominance of the grass and sedge gives way to a dense thicket of the shrubs mentioned above, plus blackberry (Rubus allegheniensis), and two tree species, red maple and gray birch.

One can conjecture on the development of the community as dictated by the level of water. A decrease of beaver activity and resulting breakages in their dams, would lower the water level and most probably allow the normal process of shrub encroachment onto wet meadow habitats to occur. Drier soils would eventually lead to the development of a shrubby (red maple) swamp, similar in type to other wooded swamps in Walcott Preserve.

Shrub Swamp

A shrub swamp occupies most of the wetland area of the Walcott Preserve. The remnants of forest trees -- red maple, white pine, and gray birch, and tamarack in boggier sections -- is evidence of the character of the area before the advent of the beaver. The industry of these animals, in the last twenty years, has dramatically transformed the lowland vegetation. Swamp now occupies broad belts of land to the east and, to a greater extent, west of Beckley Pond and brook. In summer, there is little standing water in the shrub swamp although the deep,

oozing muck is very wet. The amount of moisture present depends on the swamp's stage of development. The open, recent swamps are wetter, with occasional, small areas of shallow open water. Not only is the shrub swamp extensive, but the abundance of vegetation is great and the diversity very rich.

Most of the swamp plant species occupy the herbaceous stratum with tussock sedge a primary component. It forms characteristic tussocks which are unstable underfoot in spite of the dense growth. Other sedges, rushes and grasses include Carex crinita, three-way sedge (Dulichium arundinaceum), wool grass (Scirpus cyperinus), twig rush (Cladium mariscoides), a rush, (Juncus canadensis), blue-joint (Calamagrostis canadensis), reed meadow grass (Glyceria grandis) and bur-reed (Sparganium sp.). A more complete list of the herbaceous layer follows. It well illustrates the great diversity of the shrub swamp.

Other flowering herbaceous plants

swamp milkweed	Asclepias incarnata
wild calla	Calla palustris
bedstraw	Galium trifidum
dwarf St. Johnswort	Hypericum mutilum
marsh St. Johnswort	H. virginiana
jewelweed	Impatiens capensis
larger blue flax	Iris versicolor
bugleweed, water hore-hound	Lycopus virginicus
swamp candles	Lysimichia terrestris
arrow-leaved tearthumb	Polygonum sagittatum
broad-leaved arrowhead	Sagitaria latifolia
common skullcap	Scutellaria epilobiifolia
mad-dog skullcap	S. lateriflora
common cattail	Typha latifolia
slender nettle	Urtica gracilis

Ferns

crested fern	Dryopteris cristata
sensitive fern	Onoclea sensibilis
cinnamon fern	Osmunda cinnamomea
royal fern	O. regalis
marsh fern	Thelypteris palustris

Shrubs

speckled alder	Alnus rugosa
buttonbush	Cephalanthus occidentalis
huckleberry	Gaylussacia baccata
swamp rose	Rosa palustris
poison sumac	Rhus vernix

raspberry	Rubus idaeus
meadowsweet	Spiraea latifolia
highbush blueberry	Vaccinium corymbosum

As one crosses the swamp from west to east, a different kind of plant community occurs closer to the pond. Here there is an intergrading of swamp and bog plants, with sweet gale and

leatherleaf growing thickly and pitcher plant (Sarracenia purpurea) and sundews (Drosera rotundifolia and D. intermedia) occurring in sphagnum beneath the shrubs. What appears to be happening is a gradual invasion of the boggier habitat by swamp plants, and the continued development of the sphagnum mat onto the pond.

Occasional, small red maples occur in the shrub swamp. Their lack of development at present, is indicative of extremely wet soil conditions. It is also too wet for much shrub growth. The successional trend towards a wooded swamp condition will probably be slow as long as beavers inhabit Beckley Bog basin.

Wooded Swamp

The Egler parcel is dominated by red maple (to 50'; 12 m), with some yellow birch and hemlock. The tussocks are still evident, although here they mainly serve as a foundation for woody vegetation. The shrub zone is dense. Spicebush (Lindera benzoin), withe-rod (Viburnum cassinoides), arrow-wood and winterberry (Ilex verticillata) are common. Water-horehound (Lycopus sp.), the most common wildflower, grows in massive colonies. Hemlock grows on slightly higher and drier hummocks of the swamp and is associated with different plants, including mountain laurel, goldthread, Canada mayflower and starflower. The slightly wetter areas include several species unique to this site, such as turtlehead (Chelone glabra), small woodland orchis (Habenaria clavellata) and halberd-leaved tearthumb (Polygonum arifolium).

Bog

A black spruce-tamarack bog lies on the north side of Beckley Pond. Most of the open portion of the bog lies east of the stream feeding into Beckley Pond. Bogs are distinguished by the high acidity of their waters (pH 3-4.5) and by the growth of sphagnum moss. Sphagnum, which dies and decomposes very gradually, forms a floating mat as it grows onto open water. This is the substrate on which bog vegetation grows. Bog water is very low in nutrients, which in turn, are generally unavailable to plants. Some bog flora have evolved unusual adaptations to cope with this deficiency; carnivorous species (bladderworts, sundews, and pitcher plants) get nutrients by entrapping and digesting insects and small crustacea. Heath plants are also adapted to prevent excess water loss by hard, waxy coatings on their leaves.

The development of bogs requires a cool climate and an acidic mantle of rock beneath the pond. These conditions are unusual in southern New England, and contribute to the rarity of the black spruce bog community in Connecticut (Dowhan and Craig, 1976). Black spruce here is near the southern limit of its range. This bog also includes several other rare plants (Dowhan and Craig, 1976); bog rosemary (Andromeda glaucophylla), white-fringed orchis (Habenaria blephariglottis), and yellow-eyed grass (Xyris montana).

The extremely acidic conditions of the bog create a favorable environment for an unusual association of plants. Three insectivorous species grow commonly on the bog mat: pitcher plant, round-leaved sundew, and spatulate-leaved sundew.

The sphagnum mat also hosts a spectacular array of orchids throughout the summer. In addition to white-fringed orchis (in flower from early to mid August) are grass pink (Calopogon pulchellus) and rose pogonia (Pogonia ophioglossoides). These orchids, in shades of red ranging from crimson to light pink, bloom from late June to mid-July. In late summer, two species of brilliant yellow flowers--yellow-eyed grass and horned bladderwort (Utricularia cornuta)-- are ablaze in the bog meadow. Humped bladderwort (U. gibba) floats in shallow, wet potholes on the mat. Another unusual species, bog clubmoss (Lycopodium inundatum) grows in a massive, sprawling colony on a wet part of the bog meadow.

The meadow is bounded by dense shrub zones (see transect 4, Appendix A). Most woody species on the bog are heaths (family Ericaceae), including leatherleaf, sheep laurel (Kalmia angustifolia), swamp laurel (K. polifolia), bog rosemary, large cranberry (Vaccinium macrocarpon), small cranberry (V. oxycoccus) highbush blueberry, huckleberry and swamp azaela (Rhododendron viscosum). Sweet gale is a very abundant shrub on the mat, as is water willow, or swamp loosestrife (Decodon verticillatus), which grows in thick, tangled colonies in wetter spots.

In his 1960 study, W. M. Conard reported one species, three-leaved false Solomon's seal (Smilacina trifolia), which was also listed as rare by Dowhan & Craig in 1976. The species is at its southern limit in Connecticut and grows on bog margins. On Beckley Bog, these specialized habitats are gradually being invaded by swamp vegetation, and may no longer support this species. It was not found in 1980.

The two bog trees, black spruce and tamarack, are more common in low bushy, stunted form than as trees. Both species grow very slowly; 60-year old individuals may be less than 1 inch in diameter (Conard, 1960). Black spruce tends to spread in colonies by layering, a vegetative process by which the tips of branches grow into the mat, forming roots from which new growth occurs.

As Jorgensen (1978) notes, conditions for bog development in southern New England are often marginal. The area is too warm, in general, and bogs are frequently succeeded by red maple swamps. On Beckley bog, this natural process may be occurring and given added impetus by beaver activity. According to Lincoln Foster, who has been acquainted with the

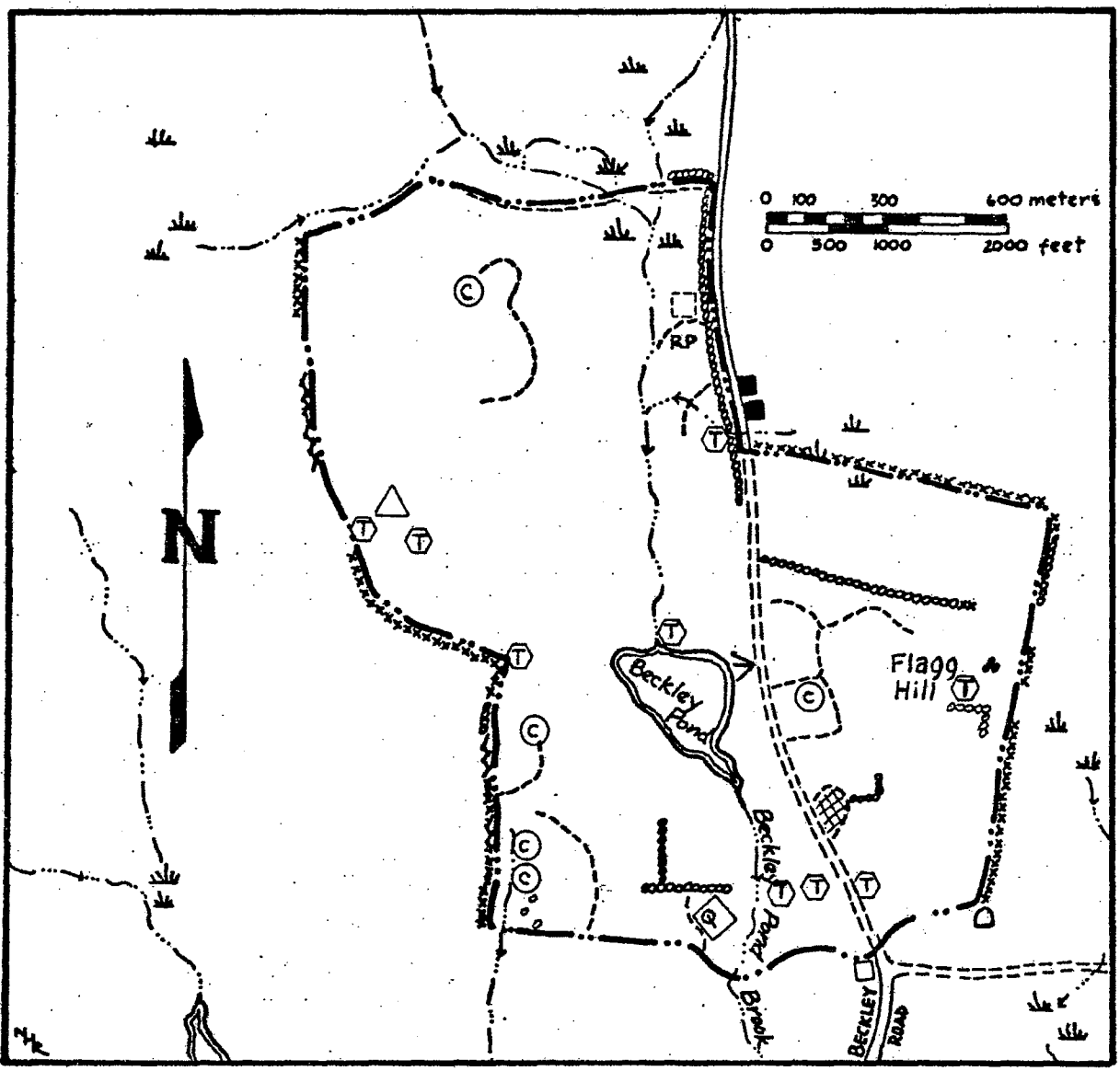
area since the early 1950's, the vegetation on Beckley Bog has changed remarkably since 1960, due to the saturation of the mat. Former meadows are now grown over with shrubs; red maple seedlings are scattered throughout the mat; swamp vegetation is encroaching from the flooded region bordering the bog to the east. The areas most threatened appear to be the meadows which contain the orchids, bladderwort, and insectivorous plants.

Mr. Foster observed that beaver dams raise water levels on the mat, making water generally more available to plants. Various shrubs and red maple seedlings, which require more water than bog meadow vegetation, take advantage of this situation and are encroaching onto meadow habitat. The process, however, is cyclical. After exhausting their food supply, beavers abandon the area, dams break, and water levels decrease. This development signals a return to the more acidic, xeric conditions favoring meadow species (such as sedges and orchids). Shrubs and red maples, presumably, suffer significant mortality after beaver abandonment occurs. According to Mr. Foster, the approximately 20-year cycles of beaver activity may, in the long run, extend the life of the bog.

In the absence of specific data relating to vegetation changes on the bog, these explanations are offered as speculation, and await confirmation by future studies.

The bog is also growing outwards onto the pond. Two shrub species, leatherleaf and water willow, are especially instrumental in this process. The roots of leatherleaf "form a framework for" the growth of the mat -- mainly sphagnum and sedges -- onto the open water (Jorgensen, 1978). "The layering tips of water willow also create a network of stems over the water surface, and within this network sphagnum moss grows and makes a floating carpet. Other plants find anchorage in the carpet, and so the bog grows." (Niering, 1966).

Trends on Beckley Bog can only be determined by long term studies. It was not possible, in 1980, to survey the bog in as much detail as Conard did in 1960. Future studies, including a resurvey of his vegetation maps and transect lines, would provide important information about the dynamics of bog succession and the influences of beaver.



SPECIAL FEATURES

- Beckley Lookout
- Large Glacial Erratics
- Stone Pile
- Charcoal Pit
- Old Foundation
- Town Marker
- Area Logged in 1980
- RP Red Pine Plantation
- Quadrat Location
- Transect Location
- Preserve Boundary
- Stream
- Swamp
- Pond
- Wood Road
- Stone Wall
- Barbed Wire Fence
- Chestnut Rail Fence
- House
- Barn

FAUNA

Class Aves

Birds observed throughout the summer of 1980 are noted below. While a formal survey was not undertaken, I observed a diversity of species which was corraborated by ornithologists Art Gingert and Sandy DeSimone of the Sharon Audubon Society and Robert Prouty of Norfolk who visited the preserve on several occasions. A detailed census during the migration and breeding seasons over several years' time should reveal many other species and more useful information.

Branta canadensis	Canada goose
Anas rubripes	black duck
Mergus merganser	American merganser
Cathartes aura	turkey vulture
Circus cyaneus	marsh hawk*
Buteo jamaicensis	red-tailed hawk
B. platypterus	broad-winged hawk
Pandion haliaetus	osprey**
Bonasa umbellus	ruffed grouse
Colinus virginianus	quail (Bob-white)
Ardea herodias	great blue heron
Philophela minor	woodcock
Zenaidura macroura	mourning dove
Strix varia	barred owl
Megaceryle alcyon	kingfisher
Colaptes auratus	yellow-shafted flicker
Dryocopus pileatus	pileated woodpecker
Dendrocopos pubescens	downy woodpecker
D. villosus	hairy woodpecker
Tyrannus tyrannus	eastern kingbird
Sayornis phoebe	phoebe
Contopus virens	wood peewee
Hirundo rustica	barn swallow
Tridoprocne bicolor	tree swallow
Stelgidopteryz ruficollis	rough-winged swallow
Cyanocitta cristata	bluejay
Corvus brachyrhynchos	crow
Parus atricapillus	black-capped chickadee
Sitta carolinensis	white-breasted nuthatch
S. canadensis	red-breasted nuthatch
Certhia familiaris	brown creeper
Troglodytes aedon	house wren
Turdus migratorius	robin
Hylocichla mustelina	wood thrush
H. fuscescens	verry
Sialia sialis	bluebird***
Bombycilla cedrorum	cedar waxwing
Mniotilta varia	black & white warbler
Dendroica petechia	yellow warbler

*State endangered (Dowhan & Craig) probably in migration, seen 8/17.
**Declining (Dowhan & Craig) possibly resident, seen 8/17, 9/7
***Declining (Dowhan & Craig) seen 8/19.

Class Aves cont'd

Seiurus aurocapillus	ovenbird
Geothlypis trichas	northern yellowthroat
Setophaga ruticilla	redstart
Agelaius phoeniceus	red-wing blackbird
Quiscalus quiscula	common grackle
Piranga olivacea	scarlet tanager
Spinus tristis	goldfinch
Pipilo erythrophthalmus	towhee
Junco hyemalis	slate-colored junco
Zonotrichia albicollis	white-throated sparrow
Melospiza georgiana	swamp sparrow
M. melodia	song sparrow

Class Mammalia

Procyon lotor	raccoon (tracks seen, edge of swamp)
Tamiasciurus hudsonicus	red squirrel (often seen in hemlock woods)
Sciurus carolinensis	grey squirrel (seen in deciduous woods)
Tamias striatus	eastern chipmunk (often seen in woods)
Sylvilagus floridanus	eastern cottontail (seen in young 2nd growth woods)
Odocoileus virginiana	white tailed deer (seen several times on various parts of the preserve)
Castor canadensis	beaver (pair seen frequently in pond)
Canis latrans	coyote (heard several times, N.W. area of preserve)
Erythion dorsatum	porcupine (gnawings seen in hemlock-beech woods)
Ondatra zibethicus	muskrat (one seen in brook north on pond)
Peromyscus sp.	mouse, white-footed (one seen, dead, in woods)

In a conversation with Peter Begley, Conservation Officer in Norfolk, the following animals were mentioned as probable inhabitants of the preserve.:

Vulpes fulver	red fox
Urocyon cinereoargenteus	gray fox
Lynx rufus	bobcat
Lutra canadensis	otter
Mustela vison	mink
M. frenata	long-tailed weasel,

Didelphis marsupialis	opossum
Mephitis mephitis	skunk
Myotis	little brown bat
Lepus americanus	snowshoe hare
Martes pennati	fisher*
Ursus americanus	black bear**

Reptiles and amphibians were noted when seen; their populations were not studied. More complete investigation should uncover a number of other species.

Class Reptilia

Lampropeltis doliata triangulum	milk snake, (one dead on Beckley Pond)
Natrix sipedon	water snake, (one in brook north of pond)
Thamnophis sirtalis	garter snake, (throughout preserve)
Chelydra serpentina	snapping turtle, (one sunning itself on beaver lodge)

Class Amphibia

Desmognathus fuscus	dusky salamander, (cool woods, near stream)
Eurycea bislineata	two-lined salamander, (under rock, near stream)
Plethodon cinereus	red backed salamander, (under rotting logs)
Diemictylus viridescens	red spotted newt and red eft (pond/forest)
Bufo americanus	American toad, (moist woods)
Hyla crucifer	spring peeper, (moist woods)
Rana catesbeiana	bullfrog (pond, marsh)
R. clamitans melanota	green frog, (pond, marsh)
R. palustris	pickerel frog, (swamps, pond, wet meadow)
R. sylvatica	wood frog, (moist woods)

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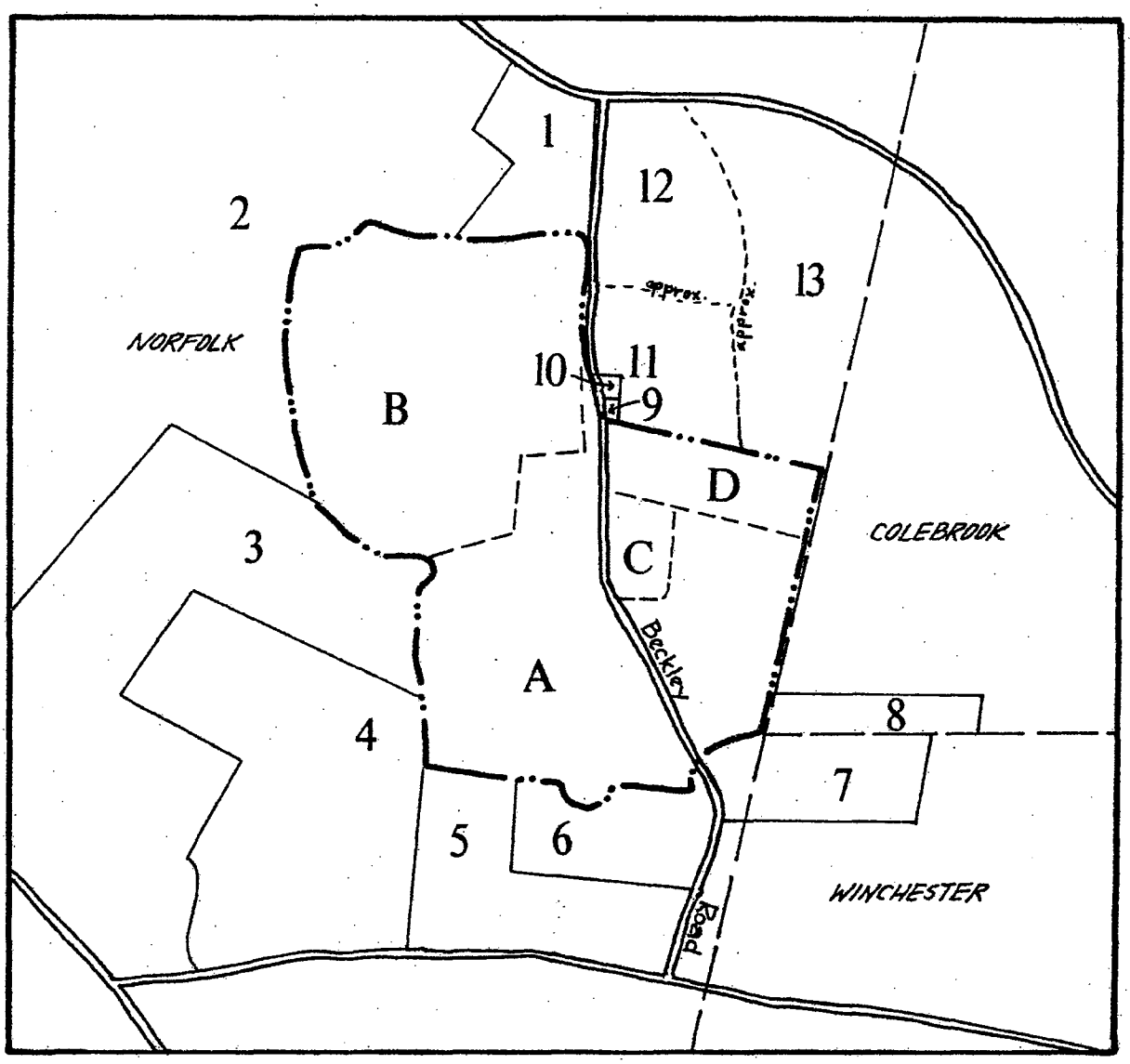
*The status of the fisher is unknown in the state. The animal prefers remote, coniferous forests and frequently preys on porcupine. Conditions on the preserve are suitable for its existence.

**Peter Begley mentioned that black bear wander through the wilder parts of Norfolk although they are not residents (hibernators) in the township.



PROPERTY OWNERSHIP

The Nature Conservancy
- A. from Toillon; 1957, 1960. 281 acres.
- B. from Anstett; 1964. 230 acres.
- C. from Girdler; 1969. 20 acres.
- D. from Egler; 1979. 55 acres.

1. John Schroeder
2. Conn. River Watershed
3. Girl Scouts of Bridgeport
4. Arthur Smith
5. Grant Swamp Group
6. Susan N. Wagner
7. Patrick & Beth Crossman
8. Osmund W. Leviness, Jr.
9. Blade Brokaw
10. Karl Seitz
11. Eugene Grincunas et. al.
12. Lester & Robert Anstett
13. D. Daniel Domato

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EXHIBIT 6

BIRDS AT NORFOLK, 10 SCHOOLHOUSE ROAD
1993 – present received from Shelley Harms, January 4, 2011

1. Gray Catbird (N,B)
2. American Robin (summer '93) (N,B)
3. American Crow
4. Blue Jay (B)
5. Barn Swallow (N)
6. Black Throated Green Warbler (ID by Dad)
7. Northern Flicker
8. Chickadee (N,B)
9. Eastern Towhee (fall '93)
10. Merlin (ID by Dad)
11. Turkey Vulture
12. Eastern Phoebe (N)
13. Ruby Throated Hummingbird
14. Eastern Bluebird (N,B)
15. European Starling (N)
16. Hairy Woodpecker
17. Cedar Waxwing
18. Dark-eyed Junco (B)
19. White-throated Sparrow (B)
20. House Finch (winter '93) (B)
21. Purple Finch (B)
22. Fox Sparrow
23. Evening Grosbeak
24. Song Sparrow (N)
25. White-crowned Sparrow
26. Canada Goose
27. Cardinal (B)
28. Tufted Titmouse (B)
29. Common Grackle
30. Red-breasted Nuthatch
31. American Goldfinch (B)
32. White-breasted Nuthatch (B)
33. Downy Woodpecker (B)
34. Tree Sparrow (B)
35. Brown-headed Cowbird (spring '94)
36. Red-wing Blackbird (N)
37. Chipping Sparrow
38. Tree Swallow (N, B)
39. Broad-winged Hawk
40. English Sparrow (N)
41. Mallard Duck
42. Magnolia Warbler
43. Mourning Dove (N, B)
44. Yellow-bellied Sapsucker
45. Rose-breasted Grosbeak (B)
46. Bobolink (N)
47. House Wren (N)
48. Yellow Warbler (5/14/94) (B)
49. Red-eyed Vireo (6/4/94)
50. Great Blue Heron

51. Pigeon (Rock Dove)
52. PILEATED WOODPECKER (7/3/94)
53. Red-bellied Woodpecker
54. Northern Oriole
55. Common Yellowthroat
56. Wild Turkey! (at last! 8/29/94)
57. Chestnut-sided Warbler
58. American Redstart
59. Warbling Vireo
60. Woodcock (fall '94)
61. Snow Bunting
62. Osprey (4/18/95)
63. Rough-legged Hawk
64. Eastern Kingbird (6/95)
65. Scarlet Tanager! (6/23/95)
66. Northern Mockingbird
67. Chimney Swift
68. Ruffed Grouse (11/5/95)
69. Canada Warbler
70. Northern Shrike (B)
71. Bay-breasted Warbler (B)
72. Indigo Bunting (B)
73. Northern Harrier
74. Veery
75. Pine Siskin (B)
76. Great Crested Flycatcher
77. Herring Gull (1/97)
78. Cooper's Hawk
79. Black & White Warbler
80. Wood Thrush (8/97)
81. Field Sparrow (B)
82. Common Redpoll (1/31/98)
83. Great Horned Owl
84. Wood Duck (4/98)
85. Savannah Sparrow
86. Golden Crowned Kinglet
87. Red-tailed Hawk (11/98)
88. Barred Owl
89. Common Raven
90. Kingfisher
91. Yellow-bellied flycatcher (and again 9/02)
92. Sharp-shinned hawk
93. Killdeer (3/2002)
94. Red-shouldered hawk (4/2002)
95. Common Nighthawk (8/2002)
96. Yellow-throated vireo (9/2002)
97. Carolina Wren (12/8/02)
98. Black-throated blue warbler (5/2003)
99. Palm Warbler (10/5/2004)
100. Yellow-billed Cuckoo (5/05)
101. Kentucky Warbler (8/05)
102. Rusty Blackbird (4/06)
103. Ovenbird (5/06)

104. Northern Parula (5/06)
105. Louisiana Waterthrush (5/06)
106. Eastern Screech Owl (9/06)
107. Nashville Warbler (9/06)
108. European Goldfinch
109. Northern Goshawk (9/07)
110. Blue-headed Vireo (9/07)
111. Pine Grosbeak (12/07)
112. Hoary Redpoll (1/5/08)
113. Brown thrasher (6/30/08)
114. American Kestrel (4/8/09)
115. Hooded Merganser (4/22/09 - pair on the pond)
116. Eastern Wood Pewee (6/24/09)
117. Black-billed Cuckoo (6/25/09)
118. Northern Parula (9/20/2010)

MAMMALS

1. Whitetail Deer
2. Eastern Cottontail
3. Eastern Chipmunk
4. Red Squirrel
5. Gray Squirrel
6. Shrew
7. White-Footed Mouse
8. Opossum
9. Big Brown Bat
10. Black Bear
11. Star-faced Mole
12. Red fox
13. Coyote
14. Short-tailed weasel (ermine)
15. Porcupine
16. Bobcat
17. Southern Flying Squirrel

OTHER

1. Eastern Garter Snake
2. Red-sided Garter Snake
3. Red-spotted Newt
4. Wood Frog
5. Pickerel Frog
6. American Toad
7. Spring Peeper
8. Gray Treefrog
9. Spotted Salamander
10. Red-back Salamander
11. Green Frog
12. Bullfrog

13. Northern Water Snake
14. Wood turtle
15. Eastern Painted Turtle
16. Snapping Turtle

First Robin

March 13, 1994
March 15, 1997
Feb. 15 1998
Irrelevant – they're here all winter

First Phoebe
April 4 2002
April 15, 2003
March 31, 2009
April 1, 2010

First wood frogs
March 31, 2005
March 30, 2009
March 22, 2010

EXHIBIT 7

21st Century Breeding-Season Birds of Aton Forest

By Shelley E. Harms, Roland C. Clement and John P. Anderson, Jr.

Aton Forest is a 1,100-acre preserve in Norfolk and Colebrook, Conn., at the Massachusetts border, centered on 42.01 degrees N, 73.08 degrees W. At elevations of between 1250 and 1655 feet, it is part of the Berkshire Plateau, and the northern character of its hardwood forests is quite unusual in Connecticut.

Over a seven-year period, we have developed a list of birds known to occur at Aton Forest during the breeding season. These are Aton Forest's "breeding-season birds of the 21st century." We used three different methods to develop the list. Our methodologies and the different results obtained by each may be of interest to other large landowners interested in determining what birds are using their property.

The Aton Forest breeding bird list includes 94 species (Table 1). The three methods used to create the list are as follows:

- First are confirmed sightings by researchers at Aton Forest, in particular bird observations recorded by Roland Clement when he spent two summer months in 2001 at the Aton Forest research cabin. Clement's observations were concentrated on a large beaver pond and the meadow and "edge" habitats surrounding the cabin. Clement observed 40 species, and other researchers have added two more to the list.
- In 2002, Shelley Harms and John Anderson established a MAPS (Monitoring Avian Productivity and Survivorship) station at Aton Forest near the beaver pond. The MAPS station contains two habitat types, one of the northern

hardwoods - red oak, yellow birch, beech and sugar maple with a floor of ferns; the other a higher and drier habitat dominated by hemlock, with sparse ground cover. The MAPS methodology involves seven mornings at the site, from June – August, during which Harms and her interns monitor 12 mist nets. The birds captured are banded and measured, and all bird species seen or heard at the station during the 7 hours of each session are recorded. In seven years at the MAPS station, 69 species have been observed and individuals from 37 of these species have been captured.

- Also in 2002, Harms and Anderson began doing point counts covering large portions and all habitat types of Aton Forest. Three transect lines crossing Aton Forest were established, known as the North, Middle and South lines. A total of 31 points were established at 200-meter intervals along the lines. By mapping these points on a forest cover/age map, Anderson has shown that the points are located in 11 different habitats: Red Oak/Mixed Hardwoods of three different ages, White Pine/Hemlock/Mixed Hardwoods of two different ages, Mixed Hardwoods age 60-80+ years, Open Water/Marsh/Shrub/Swamp, Northern Hardwoods of two different age classes, Hemlock age 60-80+ years, and Hemlock/Northern Hardwoods, age 40-60+ years. Harms and Anderson traversed these lines at least once each year from 2002 – 2006, and recorded the birds seen or heard during 10-minute intervals at each point. In 2007, John Anderson traversed these lines and recorded the birds with Robert Mueller. In seven years of point counts, 84 species have been observed.

Obviously, the sum of the three methods is greater than any one of them. None accounts for all 94 species of birds observed at Aton Forest during the breeding season over the past six years.

Point counts, which cover the greatest variety of habitats, come closest to the total, with 84 species. Limitations of point counts are that they have generally occurred only early in the season, and only in the morning hours. Also, the point count methodology only allows the observer to remain stationary for 10 minutes, while the other methods allow more sustained time periods for observation. The advantages of point counts are that this type of study does yield the most species, and it allows us to determine relative abundance and habitat utilization.

The MAPS study observations closely parallel the point counts. Only one species, Spotted Sandpiper, was observed during MAPS but not during point counts. The total number of species observed during the MAPS study, 69, is less than the number observed during point counts, probably because the MAPS station covers two habitats as opposed to the point counts' 11. However, the MAPS study has the advantage of certainty, particularly when a bird is captured. The interplay of MAPS with the point counts has helped us refine and verify our list of breeding-season birds. MAPS also yields more detailed information for confirming that a species is breeding at Aton Forest (e.g., presence of a brood patch, capture of juveniles, etc.). Furthermore, the MAPS data we collect becomes part of the continent-wide MAPS study that contributes larger-scale knowledge to the field of ornithology.

Clement and other researchers contributed eight species not observed in either MAPS or the point counts. Clement in particular, with 40 recorded species, observed six

species not included in either the MAPS or point count studies. Clement's observations were more sustained, and included observations during afternoon and evening hours that were not covered by MAPS or the point counts. This, along with the fact that he spent more time on a wetland, may account for the fact that Clement recorded birds such as Great Horned Owl, Hooded Merganser, Common Merganser and Green Heron that have not been observed during either MAPS or point counts. Clement also noted observations of breeding and other behavior. Thus, the value of the reliable observer cannot be overstated.

In addition to recording the presence of a species of bird, each type of monitoring study helps to add to our knowledge of which birds are actually breeding at Aton Forest, which birds use which particular habitats, what is the relative abundance of each species, and more. As the years progress, we will be able to monitor trends. Our list of birds will continue to grow and become more nuanced as the 21st century progresses.

Table 1. Aton Forest breeding-season birds and methods of detection.
* = captured in mist net

Aton Forest Birds	Source		
	Clement & Researchers	MAPS	Point Counts
1. Canada goose	X	X	X
2. Wood duck	X	X	X
3. Mallard	X	X	
4. American black duck			X
5. Common merganser	X		
6. Hooded merganser	X		
7. Ruffed grouse	X		
8. Wild turkey		X	X
9. Great blue heron	X	X	X
10. Green heron	X		
11. Turkey vulture	X	X	X
12. Cooper's hawk	X	X*	X

13. Northern goshawk	X		
14. Red-shouldered hawk			X
15. Broad-winged hawk			X
16. Red-tailed hawk		X	X
17. Spotted sandpiper		X	
18. American woodcock	X		X
19. Mourning dove	X	X	X
20. Black-billed cuckoo		X	X
21. Yellow-billed cuckoo			X
22. Great horned owl	X		
23. Barred owl		X	X
24. Chimney swift			X
25. Ruby-throated hummingbird	X	X*	X
26. Belted kingfisher	X	X	X
27. Red-bellied woodpecker	X		
28. Yellow-bellied sapsucker	X	X*	X
29. Downy woodpecker		X*	X
30. Hairy woodpecker	X	X*	X
31. Northern flicker	X	X	X
32. Pileated woodpecker		X	X
33. Eastern wood pewee	X	X*	X
34. Acadian flycatcher			X
35. Alder flycatcher			X
36. Willow flycatcher			X
37. Least flycatcher		X*	X
38. Eastern phoebe	X	X*	X
39. Great crested flycatcher		X	X
40. Eastern kingbird	X	X	X
41. Yellow-throated vireo	X	X	X
42. Blue-headed vireo	X	X*	X
43. Warbling vireo			X
44. Red-eyed vireo	X	X*	X
45. Blue jay		X*	X
46. American crow		X	X
47. Common raven	X	X	X
48. Tree swallow	X	X	X
49. Barn swallow			X
50. Black-capped chickadee		X*	X
51. Tufted titmouse		X*	X
52. White-breasted nuthatch		X*	X
53. Brown creeper	X	X*	X
54. Winter wren		X*	X
55. Blue-gray gnatcatcher			X
56. Veery		X*	X
57. Hermit thrush		X*	X
58. Wood thrush		X*	X

59. American robin	X	X*	X
60. Gray catbird		X*	X
61. Cedar waxwing	X	X	X
62. Blue-winged warbler			X
63. Nashville warbler	X		
64. Northern parula			X
65. Yellow warbler		X	X
66. Chestnut-sided warbler		X*	X
67. Magnolia warbler	X	X	X
68. Black-throated blue warbler		X*	X
69. Yellow-rumped warbler		X*	X
70. Black-throated green warbler		X*	X
71. Blackburnian warbler		X*	X
72. Black and white warbler		X*	X
73. American redstart		X*	X
74. Worm-eating warbler		X	X
75. Ovenbird		X*	X
76. Northern waterthrush			X
77. Common yellowthroat	X	X*	X
78. Canada warbler		X	X
79. Scarlet tanager		X*	X
80. Eastern towhee		X*	X
81. Chipping sparrow		X*	X
82. Song sparrow	X	X*	X
83. Swamp sparrow		X*	X
84. Dark-eyed junco		X	X
85. Northern cardinal		X	X
86. Indigo bunting			X
87. Rose-breasted grosbeak	X	X	X
88. Bobolink	X		X
89. Red-winged blackbird	X	X	X
90. Common grackle	X	X	X
91. Brown-headed cowbird	X	X*	X
92. Baltimore oriole	X	X*	X
93. Purple finch		X	X
94. American goldfinch	X	X	X

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