A Greenway Management Plan for Salisbury & Sharon, CT.

by

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and Sate University
in partial fulfillment of the requirements for the degree of

MASTER

in

LANDSCAPE ARCHITECTURE

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May 1996
Blacksburg, Virginia

Key Words: Biological Diversity, Water Quality Enhancement, Historic Destination Points, Recreation, Ecological Greenway Design, Questionnaire Survey

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(Abstract)

The Ten Mile Region Sub-watershed study area in the northwest hills of Salisbury and Sharon, Connecticut have been impacted by excessive nitrate fertilization for decades. The sub watershed lakes and in particular Mudge Pond (classified as mesotrophic) is considered degraded by The Connecticut Department of Environmental Protection. The DEP has concluded that large farming operations near Mudge Pond and its environs were contributing nutrient rich fertilizers in the sub-watershed.

An ecological greenway model will be applied to direct the conceptual design. A network of greenway corridors offers a best management plan for the Ten Mile Region Sub-watershed and could enhance both the water quality and biological diversity while offering limited recreation to residents and visitors. The BMP network of greenways was adopted following extensive discussions with local planners, biologists and land owners.

Acknowledgments

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Arthur Gingert Wildlife Management Consultant and Naturalist/Photographer, Cornwall, Connecticut...thesis document reader.

My efforts could not have become a reality without the support of many individuals who generously contributed their in kind resources and in one case a private benefactor who wished to remain anonymous. A special thank you to Mr. Robert Moeller, First Selectman of Sharon for his open door policy at Town Hall when I needed his input throughout my research. Additional thanks goes to The Town of Salisbury, The Sharon Conservation Commission, Sharon Eighth Grade Class Volunteers, The Hotchkiss School, The Salisbury School, The Libraries of Salisbury and Sharon, Riga Mt. Coffee House in Lakeville, Radio Stations WKZE & WQQQ, Housatonic Regional Valley High School and last but not least The Salisbury Association.

I would be remiss in my acknowledgments indeed if I overlooked my family who gave their time, and encouragement so that I could complete my studies at Virginia Tech.

"Viva Donne" UT PROSIUM

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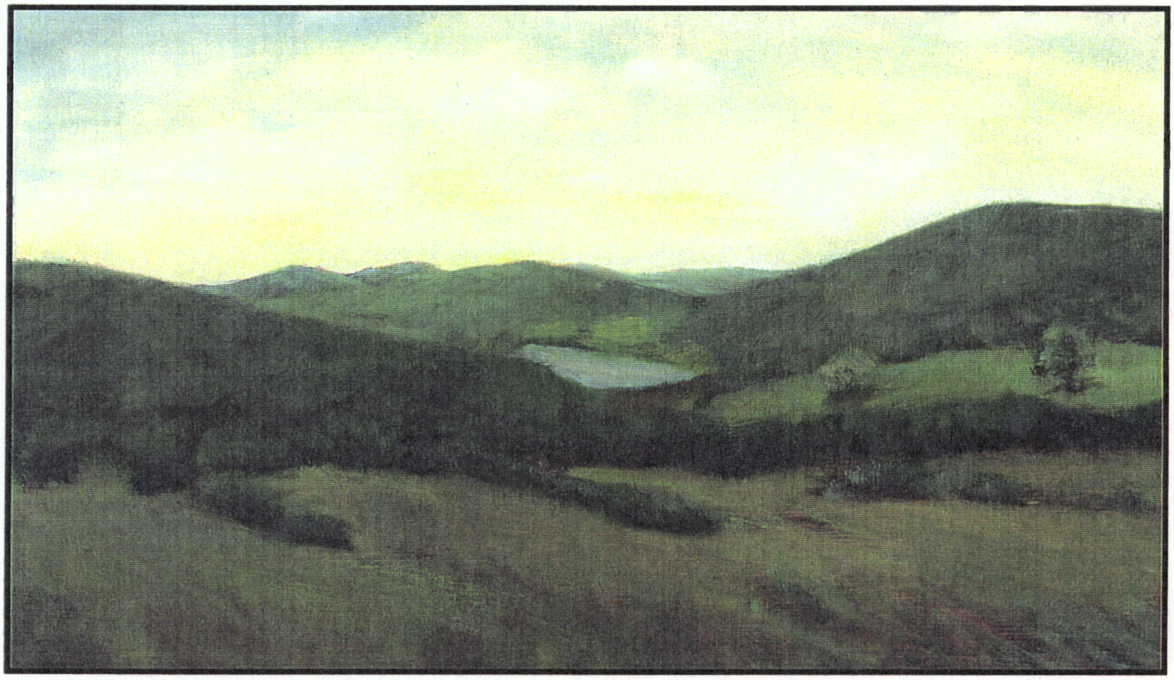


Mudge Pond, Sharon, Connecticut Oil On Board   By: Karen Kellogg 1995

Chapter I.

Introduction

Can a greenway corridor offer more than an excursion connecting one destination with another? Is it possible for a greenway to provide recreation, water quality enhancement, and biological diversity while avoiding sites with threatened species? Could a network of Greenways function as a Best Management Plan in a community watershed affected by nitrate pollution?

Greenway development has and will continue to draw attention from citizens, public officials and others skeptical of their virtues. Landscape architects and others charged with the responsibility of corridor concept can benefit substantially by referring to principles of greenway design that will enable them to filter through the enormous volume of data prior to design. This thesis claims that it is possible to design a network of greenway corridors that can offer a Best Management Plan within the confines of a sub-watershed region replete with threatened and endangered species.

Background

The "Wequadnacks" a Sachemdom of the great tribe of Mohicans spent their summers in the Ten Mile Region Sub-watershed which is the geographic focus of this study. The Wequadnacks named the location "The Valley of Great Hunting and Fishing" and for the most part it still is today with the exception of open hunting that is not advocated and thus curtailed. The geomorphology of this region of the western highlands is atypical in its form, making it a popular destination since its early discovery by Indian tribes, visitors and newcomers. The north west highlands, with their wide open valleys and true mountains, are considered by many to be among the most beautiful areas of Connecticut and all of New England. This robust landscape is the Connecticut extension of New York's Hudson Highlands and Taconic Mountains. The north west highlands are by far Connecticut's most rugged and dramatic region (Bell 1985). The beautiful natural landscape, close proximity to major urban centers (less than three hours drive) and reduction in traditional farming has changed the former agricultural land uses. The former working farms have taken on a new land use as weekend getaway retreats and longer term summer vacation homes for urban dwellers primarily from New York City. In fact it is reported that the town of Salisbury (within the document study area) supports a non year round population in excess of 50 percent (Trotta 1995).

In the early 1980's concerned citizens of Sharon, Connecticut requested that a water quality study be undertaken for Mudge Pond within the Ten Mile Region Sub-watershed in Litchfield County. Mudge Pond has been a popular recreational destination for avid anglers and swimming enthusiasts by residents and visitors for decades. Recreation users observed a preponderance of algae blooms/weed growth and it was suspected that effluent from "Silver Lake Shores" a residential community was responsible for nutrient enrichment entering Mudge Pond. The quality of water in a lake in a real sense reflects the quality of land management within its watershed. Land use practices within a lake watershed that increase loadings of phosphorus and nitrogen compounds to surface runoff and/or groundwater may result in undesirable aquatic plant growth. If the nutrient inputs to the lake can be reduced in the long term, the water quality of the lake can be protected and improved (Litchfield County Soil and Water Conservation District 1990. pp. 2 & 3). Pond development was, and is, essentially centered in two small land holdings. One, a seasonal youth summer camp "Camp Easton," located on the eastern edge of Mudge Pond. The second, "Silver Lake Shores" cottage colony (with a few year round residences) developed in the 1940's. Mudge Pond is the repository of most of the surface runoff within the three town sub-watershed covering 209.2 square miles.

MUDGE POND

Mudge Pond is located in Litchfield County in the town of Sharon. It has a surface area of 201 acres, a maximum depth of 35 feet and an average depth of 22 feet. The level has been raised by a dam.

Two streams converge in a wetland north of the pond before entering. One stream is Spring Brook and the other is the outlet of Wananpakook Lake. Three other small streams also feed Mudge Pond, two from the east and one from the north. The outlet is to the south via Mudge Pond Brook. The eastern slopes of Indian Mountain dominate the western section of the watershed.

A blend of moderate to severe slopes exists throughout the remaining landscape (Frink and Norvell 1984).

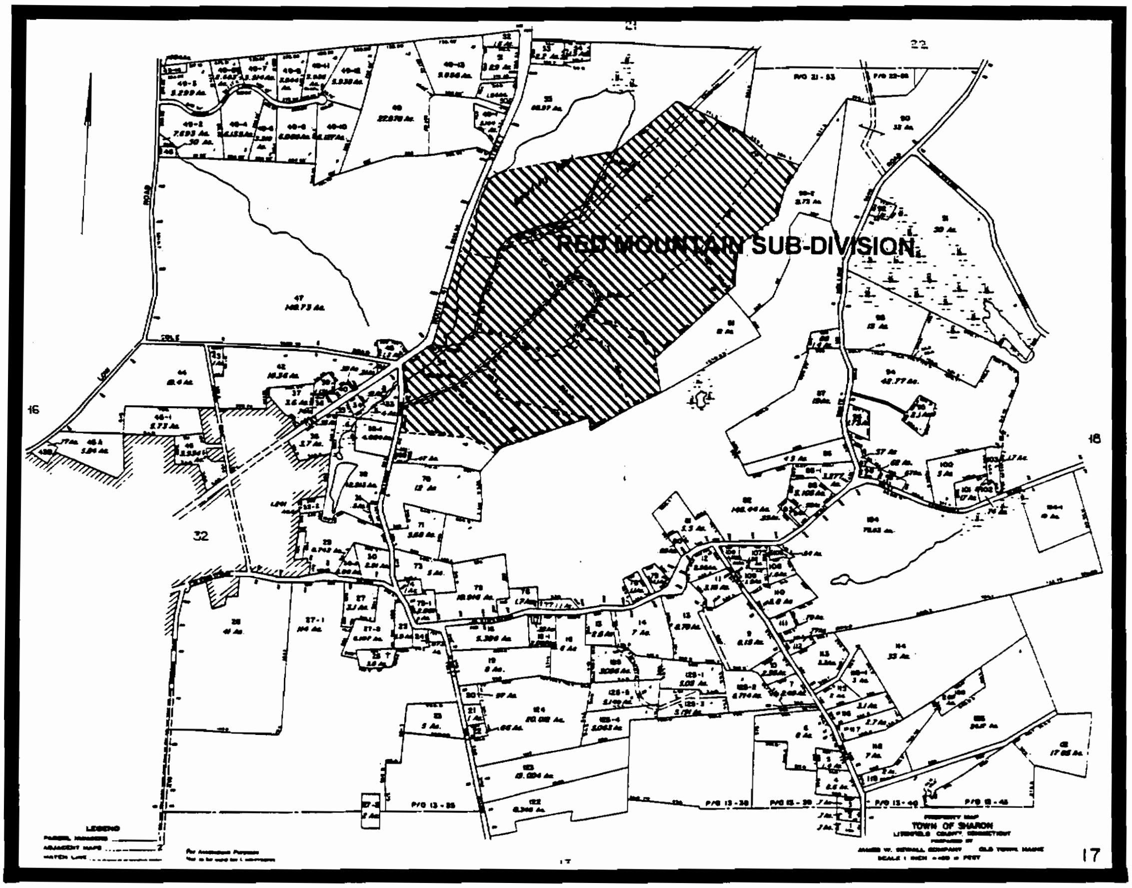
The towns of Salisbury and Sharon have a combined population of 6,500 year round residents and are geographically located 55 miles west of Hartford, the state capitol, 150 miles west of Boston, Massachusetts and 100 miles north of New York City. The population swells during the summer by urban visitors drawn by its recreation and cultural activities, spilling into the foothills of the Southern Berkshires of Massachusetts and Dutchess County New York.

Hydrological studies were conducted in the sub-watershed and two ecological reports revealed that the eutrophication process can be accelerated by man's activities in the lake watershed which increase nutrient inputs to the lake. The nutrient loading from agricultural land is approximately five times greater than woodland. Although much of this increase in nutrient export from the watershed is inevitable and unavoidable, best management practices can be provided for some degree of mitigation. Mudge Pond in Sharon is presently in a mesotrophic state. Algae blooms and weed beds have diminished recreation opportunities to some degree for many years. It is suspected that the existing systems (sub-surface sewage disposal) have little affect upon aquatic weed and algae growth in Mudge Pond. A more critical factor would likely be <u>large farming</u> industry within the watershed. The relative steep slopes indicated on U.S.G.S. maps also cause rapid runoff of surface flows which in turn create erosion and siltation problems (Kings Mark 1982).

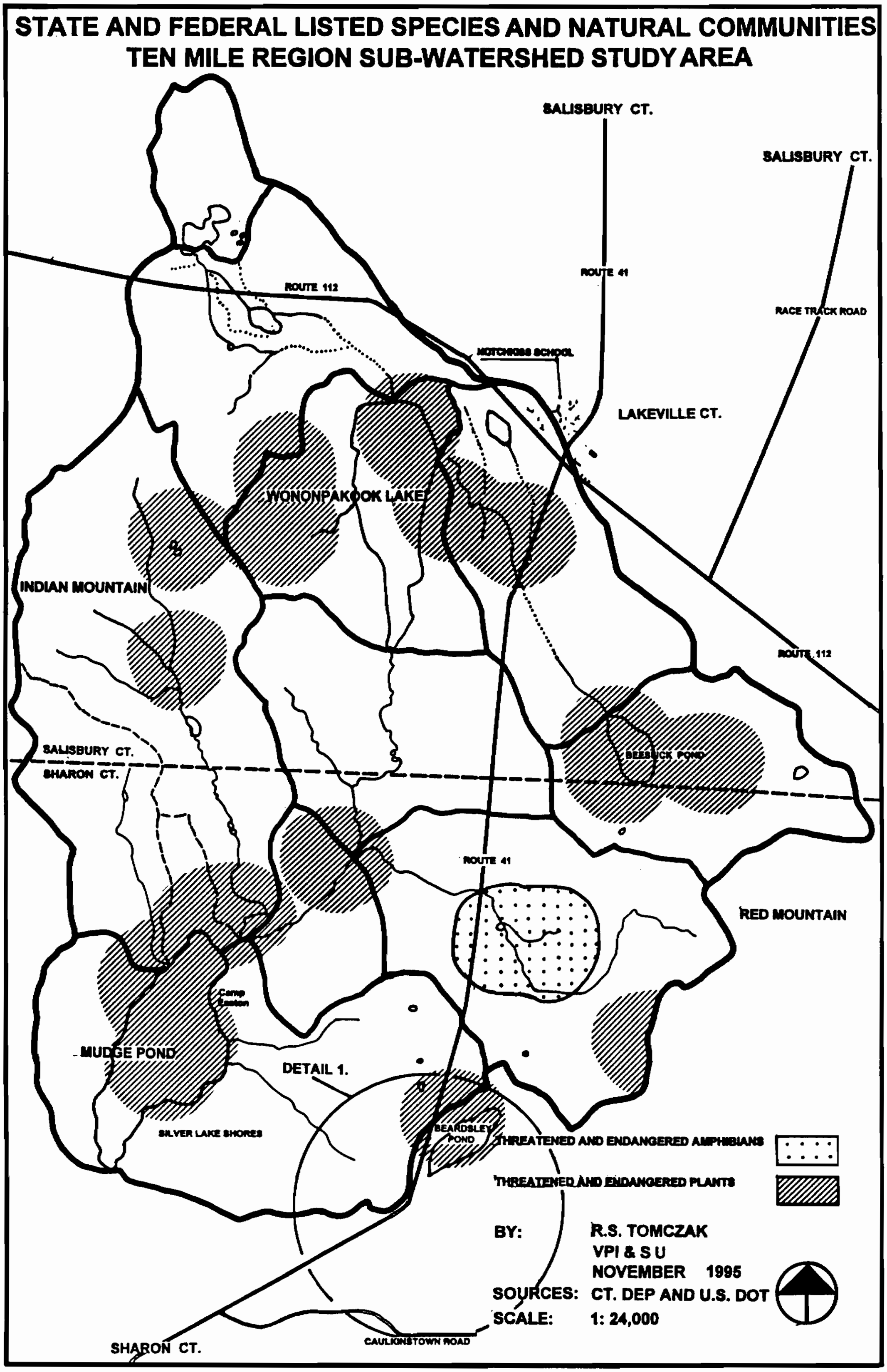
Subsequent to the Kings Mark report, a second study in 1986 revealed that organic fertilizers extremely high in nitrogen were in the watershed and working their way into Long Pond Brook which meanders its way parallel through corn and hay farm land to Mudge Pond. The report further concluded that there was a probable relationship between fertilization and high nutrient levels in the perennial water course (Ballie 1986).

A more recent study undertaken by the Connecticut Department of Environmental Protection in 1989 indicated that Mudge Pond remains in a degraded condition despite grass filter strips and the continued reduction of farming practices in the watershed. It was the conclusion of the CT. DEP. that the former tracts of open farmland now weekend hobby farms, and summer/retirement gentrified estates have established enormous "great lawns" that have not diminished the volume of nitrate and phosphate fertilization. It is suspected that this trend will continue into the foreseeable future for Sharon and its environs (Smith 1995). The "Great Lawn" trend and juxtaposition of the largest expanses of protected inland wetlands has provided ideal habitat for year round resident Canadian geese. Flocks numbering in the thousands migrate from ponds and lakes in the sub-watershed resulting in added nutrient loading of Mudge Pond. Furthermore, a sub-division development was approved by the Town near an existing edge habitat on Indian Mountain (Detail 1.) that could impact the biological diversity between upland and lowland species near a threatened inland wetland habitat (Map 1.).

RED MOUNTAIN SUB-DIVISION DETAIL 1.



Detail 1.


STATE AND FEDERAL LISTED SPECIES AND NATURAL COMMUNITIES
TEN MILE REGION SUB-WATERSHED STUDY AREA
SALISBURY CT.
SALISBURY CT.
ROUTE 41
ROUTE 112
RACE TRACK ROAD
HOTCHKISS SCHOOL
LAKEVILLE CT.
WONONPAKOOK LAKE
INDIAN MOUNTAIN
ROUTE 112
SALISBURY CT.
SHARON CT.
BEESLICK POND
ROUTE 41
RED MOUNTAIN
Camp Easton
MUDGE POND
DETAIL 1.
SILVER LAKE SHORES
BEARDSLEY POND
THREATENED AND ENDANGERED AMPHIBIANS
THREATENED AND ENDANGERED PLANTS
BY: R.S. TOMCZAK
VPI & S U
NOVEMBER 1995
SOURCES: CT. DEP AND U.S. DOT
SCALE: 1: 24,000
SHARON CT.
CAULKINSTOWN ROAD

Map 1.

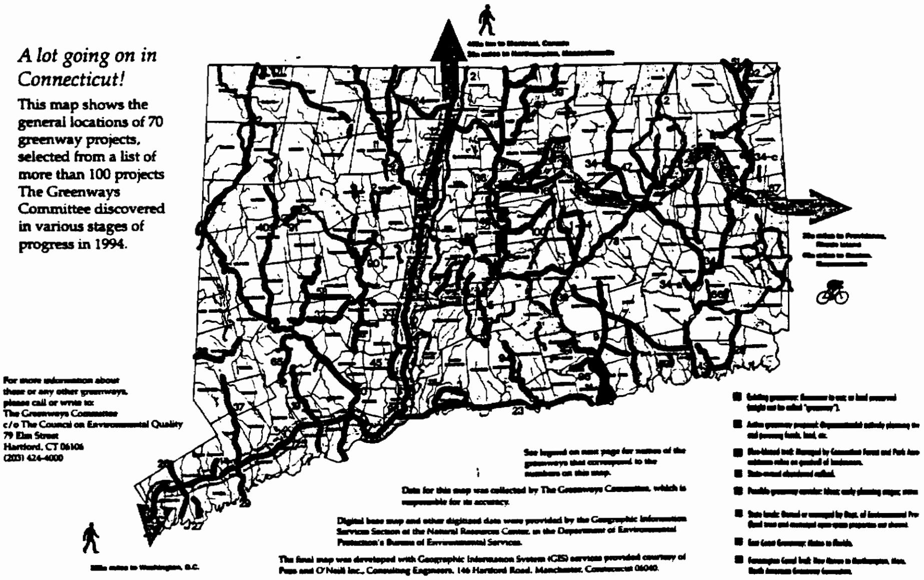
Local wildlife biologists revealed the avian species inhabiting edge locations along Indian and Red Mountain appear to be flourishing because of the rural nature of the sub-watershed and Connecticut's rich avian heritage. In fact, so favorably is Connecticut situated, that few equal area in the country can boast a greater number of birds than may be found within its limits (173 species in its small 5,009 square miles) (Bevier 1994). However, the addition of certain edge understory native woody shrub species would offer more cover and food varieties to the existing landscape and enhance the well being of avian habitat (Dudek 1995 and Smith 1995). Field analysis at Long Pond Brook in the area of intensive crop farming revealed that shrub vegetation is reduced to less that ten feet in some locations. Further examination of the natural topography revealed a variety of diverse landscape features, trail heads and historic destination points, offering potential users a unique interpretive experience.

On July 1, 1995 the Connecticut General Assembly enacted into law Public Act No. 95-335 and for the first time in Connecticut history established legislation that recognizes greenways and their potential value. The enthusiasm for greenway development is certainly not unique to the State of Connecticut. This form of further land development has created an enthusiasm in the state for greenway trail design used primarily as recreational corridors. With this enthusiasm for greenway trail design are also several associated risks or negative impacts that can result in destruction of the environments that greenways pass through. Currently in the State of Connecticut there are over one hundred greenway concepts in the process of being developed with only two of these being accompanied by natural resources inventories (Map 2.) (Gibbons 1995). Designers and community groups with a misguided sense of direction can create irreparable harm to fragile ecosystems by blazing greenway trails through sensitive environments in their quest for user accessibility.

CONNECTICUT GREENWAYS

A lot going on in Connecticut!

This map shows the general locations of 70 greenway projects, selected from a list of more than 100 projects The Greenways Committee discovered in various stages of progress in 1994.



1. Blackledge River Greenway
2. Blue-blazed Trails
3. Walk Around Branford
5. Coginchaug River Greenway
6. Connecticut River
7. Devil's Hopyard Greenbelt
8. East Coast Greenway
9. Eightmile River
10. Farmington Canal Trail
11. Farmington River Greenway
12. Farmington Valley Greenway
14. Green-Links
16. Charter Oak Greenway
18. Hockanum River Linear Park
19. Pequonnock River Greenway
20. Housatonic Riverbelt Greenway
23. Long Island Sound Greenway
24. McLean Game Refuge
25. Merritt Parkway Trail
26. Mianus River Greenway
27. Mill River Greenbelt
28. Mystic River-Whitford Brook Greenway
29. Norwalk Heritage Park
32. Larkin State Park Trail
33. Prospect Ridge
34. Quinebaug-Shetucket National Heritage Corridor
34a. Heritage Riverfront Park
34b. Marrow Meadow Park
34c. Quinebaug-Five Mile River Trail
36. Riverfront Recapture
37. Route 7 Linear Trail
38. Salmon River
39. Scantic River Greenway
40. Shepaug Greenway
43. Pequonnock River Boardwalk
45. West Rock Ridge
46. Wethersfield/Rocky Hill Bikeway
47. Willimantic River Greenway
48. Windsor Locks Canal
49. Rockville Rail/Trail Greenway
51. Southbridge Branch Rail-to-Trail
58. Middlebury-Woodbury Rail-to-Trail
59. Jordan Brook
65. Pootatuck Greenway
66. Poquetanuck Cove
67. Moosup Valley State Park Trail
70. Naugatuck River
75. Meriden Bikeway
77. Lamentation Mountain
78. Air Line State Park Trail
87. Hazardville Greenway
88. Still River Greenway
89. Berlin Rail-to-Trail
90. Hancock Brook Trail
91. Shepaug Valley Railbed
92. Heritage Way Community Park
94. Hammonasset River Greenway
95. Pattaconk Brook
96. Falls River
97. Captain John Bissell Greenway
98. Savin Rock Bike Path
100. Roaring Brook Greenway
101. North Canaan Greenway

Map 2.

Thesis Goals And Objectives

Based on the foregoing assessment of biophysical and sociocultural factors a greenway management plan will be developed for the towns of Salisbury and Sharon Connecticut. A secondary goal is to test Smith and Hellmund's "Method For Ecological Greenway Design" by implementing their principles in the development of a network of greenway corridors. The corridors will focus on a geographic area within the confines of the Ten Mile Region Sub-watershed.

Research Methods And Approach

Recent inquiry by the author revealed that five greenway proposals out of the 101 appear to be nearing implementation. They are, The Heritage Riverfront Park (Norwich), The Coginchaug River Greenway (Guilford, Durham, Middletown and Middlefield), The Farmington Canal Trail (southern section: New Haven to Cheshire) The Housatonic Riverbelt Greenway (Stratford and Milford Connecticut to Massachusetts) and The Capitol Greenways System (Hartford, East Hartford, Manchester and surrounding towns). In each case non biological criteria drove the outcome of the final design except the Coginchaug River Greenway The Coginchaug concept resulted in a comprehensive management plan that laid the groundwork for a model that could be refereed to by other greenway designers in Connecticut.(Gibbons 1995). Original ideas of a continuous trail along the river were modified to include a shorter trail, with a sharper focus on conservation and preservation of important water and land resources in other areas. The greenway could serve two functions, provide protection for environmentally sensitive areas, and offer the public access to the river for recreational use.

Field studies and interviews with officials of the CT. DEP, USDA, regional planners, local biologists and other public conservation agencies indicated that similar biophysical conditions existed in the Ten Mile Region Sub-watershed study area (Cardini, McNealy, Murray, Ruude, & Hemingston 1995). Based on this knowledge, it was concluded that an ecological approach to greenway design for the towns of Salisbury and Sharon be adopted. The rational for an ecologically based greenway concept evolved from data provided by the CT. DEP and the US. DOT identifying sites of threatened and endangered species within the Ten Mile Region Sub-watershed study area. Research revealed that a fairly even distribution of threatened plant and amphibian species were present in the wetland regime. It was concluded that Smith and Hellmund's ecological greenway design methodology would best facilitate a holistic approach to the management of the study area. Smith and Hellmund's model provides a series of four stages that leads the designer through a process of questions concerning ecological issues. It provides a framework for comprehensive corridor conception. In essence, it is a process of layers designed to eliminate areas of the landscape that do not meet the goals of the project i.e.: water quality enhancement, biological diversity and recreation. Since an ecological approach to the establishment of greenway corridor routes is relatively new in the State of Connecticut the model would offer landscape architects and others an opportunity to evaluate its effectiveness in this region of the United States. Further background inquiry uncovered a recently published newspaper article that featured a rail to trail greenway plan for the town of Salisbury and the concerns of citizens. Concerns ranged from privacy, to trail surface material and lack of public input prior to application for funding through an ISTEA grant. A recent trend to conserve farmland "in trust" has removed many acres of land from commercial development in the study area. This practice of land preservation presented an opportunity to design a greenway(s) through large parcels that would not infringe on the privacy concerns of the public.

A local sub-watershed approach in the development of final corridor routes was employed for the study area. The design program was based on scientific water quality studies in the early 1980's suggesting that large farming operations in the sub-watershed were responsible for high yields of nitrate loading in Mudge Pond (Ballie 1986). Further analysis and field studies by this author indicated that one minor sub-watershed continues to support the largest contiguous farming operation between the towns of Salisbury and Sharon. This particular sub-watershed will be the focus of a series of details that traverse the area along a north/south axis and identified as the "Wequadnack Greenway." Based on the following assessment of land use, current farming practice and future development patterns, a greenway management plan was deemed a legitimate design alternative. A network of greenway's will provide an additional measure of ecological enhancement for the study area along Indian and Red Mountain's connecting the Wequadnack at a low point in the sub-watershed.

Citizen participation prior to greenway conceptual plans would take the form of newspaper articles, public service announcements, telephone interviews and a questionnaire survey. The queried data in addition to synthesis of biophysical and sociocultural data would determine the location of a final corridor(s) and route(s) through the sub-watershed. A final evaluation of the Greenway Best Management Plan and critique of Smith and Hellmund's ecological greenway design model will be addressed.

Chapter II.

Ecological Greenway Planning and Design

Historical Context

History has shown that landscape architects and others charged with the design of linear corridors have had at their disposal greenway models that did lay the foundation for success . Greenway models (or principles) are not entirely new to the field of landscape architecture. In 1890 Frederick Law Olmstead designed Boston's *"Emerald Necklace"* creating a linear park system along the fens in the Back Bay of the city. Olmstead's concept employed for the first time a design system that actually recognized that a linear corridor could be much more than a carriage trail. Olmstead and Vaux continued to use linear connections in many of their later designs, including parkways and open space systems in Buffalo, New York and Chicago, Illinois. A focus on the Ecological function of greenways began to take root in Olmstead's design for Boston's *"Emerald Necklace"* which he developed in stages between 1878 and 1890, addressing problems of drainage and water quality. Although these modifications were more akin to modern engineering solutions than to an ecological approach, Olmstead nonetheless established an early precedent for the idea of using greenways to accommodate multiple uses (Smith & Hellmund 1993). Olmstead and Vaux emphasized social and aesthetic issues in most of their work because these were the most pressing needs of their day. Other noted landscape architects H.W. S. Cleveland, Charles Elliot and Jens Jensen followed Olmstead and Vaux's model for their green corridor designs. Green corridors or *"greenways"* began to take fashion throughout the United States. The term greenway refers to open space or natural areas that have a linear form. Charles Little offers a useful expanded definition: a greenway is a "linear open space established along either a natural corridor, such as a riverfront, stream valley, or ridgeline, or overland along a railroad right-of-way converted to recreational use, a canal scenic road, or other route" or, alternately, an "open space connector linking parks, nature reserves, cultural features or historic sites, with each other and populated areas" (Flink & Searns 1993 preface:). The concept of the greenway developed into the greenbelt used in the design of *"new towns"* that made their entrance in the United States. The greenbelt concept was further developed by the American regional planner Benton Mackaye in 1928. MacKaye proposed systems of wooded open space that "would form a linear area, or belt around and through the locality" (Hellmund & Smith 1993 p.6).

A turning point in the ecological approach to planning and design occurred during the 1960's when landscape architects such as Phillip Lewis Jr., Professor of Landscape Architecture at the University of Wisconsin, introduced the concept of ecology as a principle in land conservation (Lewis 1964). Other contemporaries such as Ian McHarg, of the University of Pennsylvania proposed a system of transparent map overlays representing different categories of natural features that would guide design professionals in land management planning. It is worth noting that overlay techniques are only as useful as the ecological inventory and analysis that preceded them. Many projects that use overlays look almost exclusively at the *pattern* of resource distribution, with little regard for ecological *processes*, which are less readily uncovered because they so often extend beyond the obvious boundaries of natural features(Hellmund & Smith 1993). For instance, it is one thing to identify the extent of riparian vegetation, but it is quite another to determine the width of a corridor beyond (or perhaps within) this area that will effectively filter out contaminants emanating from adjacent areas or that allows wildlife to pass unimpeded. If the nature of these processes is understood, they can be incorporated into the method (Hellmund & Smith 1993).

Since the 1890's there have indeed been significant changes to our population settlement patterns throughout the country with a move outward into the suburban regions adjacent to many major metropolitan areas. Lewis Mumford in an early essay reminded his readers that in the years before the nineteenth and twentieth century transportation schemes set off wave after wave of urban flight. Regional development had normally been of service to "mans evolution" by creating for people a connectedness that widened their mental and spiritual horizon (Hiss 1990). That trend continues today into the hinterlands beyond the suburban reaches of megalopolitan urban centers. The continued migration has affected former agricultural regions of our country, converting them to hobby farms by retirees, weekenders and vacation home residents. These land use patterns, cultural influences and changes in agriculture have in many ways impacted the landscape nationally, and particularly in Connecticut because of its juxtaposition between New York City and Boston. The resulting effect of the *"new residents"* interest in experiencing the outdoors along greenways for recreation, education, and overall preservation of the natural environment has generated the need for additional greenway design approaches.

Current greenway proposals in the State of Connecticut reflect only a pragmatic set of issues that accompanied each proposal. Aspects such as: employment and revenue, tourism connections, scenic overlooks, funding resources, technical advise, volunteerism, historic preservation, stewardship and reclamation headed the agenda. Landscape architects can be more effective in their approach to holistic greenway design through the implementation of scientific design principals that are sometimes not a part of their education or training. It is therefore important that landscape architects and others draw on the expertise of social scientists, natural scientists, biologists and ecologists in designing a greenway strategy for a particular community. Geographers can offer additional background linking both biophysical and sociocultural aspects of a prospective region being considered for a greenway corridor.

Ecological Greenway Design Method

Most greenway design projects commence with some general considerations regarding its location and use in a given environment. Often times designers tend to confine the greenway to a narrow context. The ecological greenway design method however, takes a much broader perspective. It concerns itself with various kinds of conservation throughout a broader perspective and includes a number of goals to enhance the outcome of the concept. It is not generally in the best interests of communities to simply introduce a greenway corridor as a trail only. The ecological greenway design model addresses additional factors such as biological diversity, water and recreational issues even when the main focus is recreation. This approach to greenway corridor design offers landscape architects and other design professional the ability to promote the acceptance of a particular concept to the community. It should be noted however, that greenways are not necessarily panaceas unto themselves. Greenways serve only as one form of environmental conservation and designers should consider additional forms of ecological management in addition to corridor design. The four stages of ecological greenway design offered by Hellmund in this study were distilled from a broad spectrum of design principles that fit the program for the Ten Mile Region Sub-watershed study area.

Stage 1: Understanding Regional Context

Are there significant unprotected biological, water, recreational or other features in the region that could be maintained or enhanced by a greenway or network of greenways?

What are the characteristics of greenways that successfully maintain or enhance natural features and processes?

Are there significant opportunities for maintaining or enhancing biological diversity in the region? What are the constraints?

Are there significant opportunities for maintaining or enhancing water resources in the region? What are the constraints?

Are there significant opportunities for maintaining or enhancing outdoor recreation in the region? What are the constraints?

Are there other significant opportunities for greenway development in the region? Are there any other constraints?

Overall Question

With the knowledge gained from the contextual study, should the greenway project go forward?

Guidelines To Help Answer The Overall Question

The project should continue to Stage 2 for further study if there appears to be a potential role for a greenway in the region and no insurmountable constraints.

Stage 2: Selecting Project Goals and a Study Swath

Which ecological or recreational issues of the region discovered in Stage 1 should be addressed by the goals of a greenway?
What are the workable objectives for each of the goals?
What are the key uses of the greenway?
What will be the most important uses of the greenway?
What are the ecological conditions needed to maintain and enhance each use?

Where Is The Most Promising Study Swath?

A promising study swath should cover a broad area that encompasses known biological, water resource, and restoration and recreation *opportunities for a greenway and has few serious obstacles to the projects goals.*

Eliminate from the study obviously inappropriate lands, including insurmountable barriers.

Not all lands designated for conservation should be assumed to have the qualities needed to serve as nodes for a greenway connect areas of known quality.

What areas within the region have the qualities needed to serve as nodes for the greenway?

Which areas are already managed for biological diversity, water resource protection, or recreation?

Where are the linear landscape elements, such as abandoned rail lines or hedgerows, that might form a spine of a greenway (even though they may not connect significant nodes)?

Overall Question

With the knowledge gained to this point should the project go forward?

Guidelines To Help Answer The Overall Question?

The project should go to stage 3 if there is a swath within which there appears to be sufficient resources to support a greenway.

Stage 3: Defining Greenway Boundaries

Overall Question

Where within the swath is the best general alignment for the greenway?
What are the disturbance characteristics of the swath that might affect either greenway alignment or width setting?
Where are the best alignments for the key biological uses?
Where are the best alignments for the key water resource uses?
Where are the best alignments for the key recreational uses?
How are the best alignments combined into a single unified greenway system?
Where should the boundaries for the greenway be set?
How can widths be set locally along the greenway alignment in response to the needs of key users?
What is the priority for acquiring and implementing each segment of the greenway?

Overall question

With the knowledge gained to this point should the project go forward?

Guidelines To Help Answer The Overall Question

If there are viable alignments and widths that will meet the requirements of the key uses, then the project can go to Stage 4

Stage 4: Creating And Implementing Site Designs And Management Schemes

Overall Question

What is the design program for the greenway?

Where should facilities (such as trails, wildlife underpasses, bridges etc.) be sited and how should they be implemented?
How should ecological restoration be accomplished where it is needed?
How should the greenway be managed?

Since the study area does support a number of sites designated "threatened" every effort will be taken to avoid them. If a network of greenways is adopted, they will be connected to provide circulation. The connectivity of greenway corridors will be made to facilitate movement of various species throughout the sub-watershed study area. The establishment of a network of greenways will offer a long term management plan providing future movement for lowland and upland species, in the event of intensive development. The corridor connections will facilitate the need for links with larger patches of potential fractured habitat to insure long term species diversity. The final corridor(s) selected may reflect only one of the core criteria i.e.: recreation, biological diversity or water quality enhancement. It is conceivable that any one corridor could support all three criteria. Hellmund's model will be evaluated regarding its effectiveness in accomplishing the three core elements of Stage 1 and subsequent stages 2,3, and 4. The first stage of the method is intended to help designers step back from a greenway project and look beyond what may already seem to be obvious solutions based on local perceptions. Starting a project with a greenway alignment or neglect a conservation need that may cause designers to overlook a better alignment or neglect a conservation need that may be more urgent (Hellmund 1993 p.131). Greenways are effective when they maintain or enhance natural features and processes; otherwise they would hardly be worth the effort it takes to create them. The crucial question at the first stage of the model is to determine to what extent linear conservation zones can be useful in protecting important landscape features and processes in the region (Hellmund 1993 ibid.). Attention should be paid not only to the conservation opportunities present in the region but also to the existing or potential development of the landscape that could threaten the region's ecological features (Hellmund 1993 p.132). The presence of environmental problems, such as water pollution, soil erosion, flooding and sedimentation of streams and lakes, may indicate areas that could greatly benefit from a greenway or other form of conservation (Hellmund 1993 p.133).

In stage 2 of the process a designer begins to develop her goals regarding the greenways purpose. Once the goals have been identified the task of alignments, width, network schemes etc. can begin to develop. Public input comes into play during this stage in various forms from newspaper articles, questionnaires and public meetings. The concerns of the public can aid the landscape architect in determining key uses of a greenway corridor. Selecting key uses for a project deserves careful consideration. For a recreation goal, one must ask what kind of recreation is intended. For biological diversity protection, ask what species or guilds of plants and animals need special consideration (Hellmund 1993 p.135). Once the goals have been discovered it is possible to focus on a potential study area, from a regional scale to a smaller study swath. The design evolves further and connections are then considered, linking nodes for wildlife that may use the corridor. If the concept is to facilitate animal movement only then it is not necessary to link the corridor with an urban destination. Mapping at stage 2 will generally take the form of hand-drawn overlays in a further attempt to identify opportunities and obstacles for the corridor path. Once a composite map has been produced, the design professional can begin to define a study swath. The steps of stage 2 culminate in one of the following decisions: (1.) There is an appropriate study swath and the greenway process should continue with the current goals, (2.) the project should be dropped, or (3.) the project should be started over again with new or revised goals (Hellmund 1993 p.139).

In stage 3: it is determined where the actual greenway boundaries are to be located. Alignments based on functional connectivity are also considered in this stage. As in the case of streamside buffering, cycling, or animal movement the corridor's length is considered. Redundant links can be very helpful to consider so that if a break occurs in the system, the remaining corridor infrastructure does not fail. Areas that have the potential to be good-quality nodes and that are already protected may be utilized as especially attractive points to include in the greenway alignment. Also attractive might be large, single owner properties (Hellmund 1993 p.143). The greenway design should vary depending on adjacent land uses. Since future changes in land use may occur over time, greenway buffer widths should be as wide as possible. After widths have been determined the corridor is evaluated to identify potential problem areas. If inequities are discovered then compromises will be made with the width or alignments. Once adjustments are completed the final stage can be implemented.

Stage 4: addresses the key uses of the greenway and its components that insure its effectiveness over time. Items such as natural features that are fragile and may be negatively affected by users need to be monitored. The types of materials used in the construction of the greenway must be selected carefully so as not to disrupt the corridor's ecological integrity. Recreational goals should not compromise native wildlife uses of a greenway. Details such as bridges, and seasonal flooding need to be considered, in addition to facilities that would not disrupt other key uses of the design.

Chapter III.

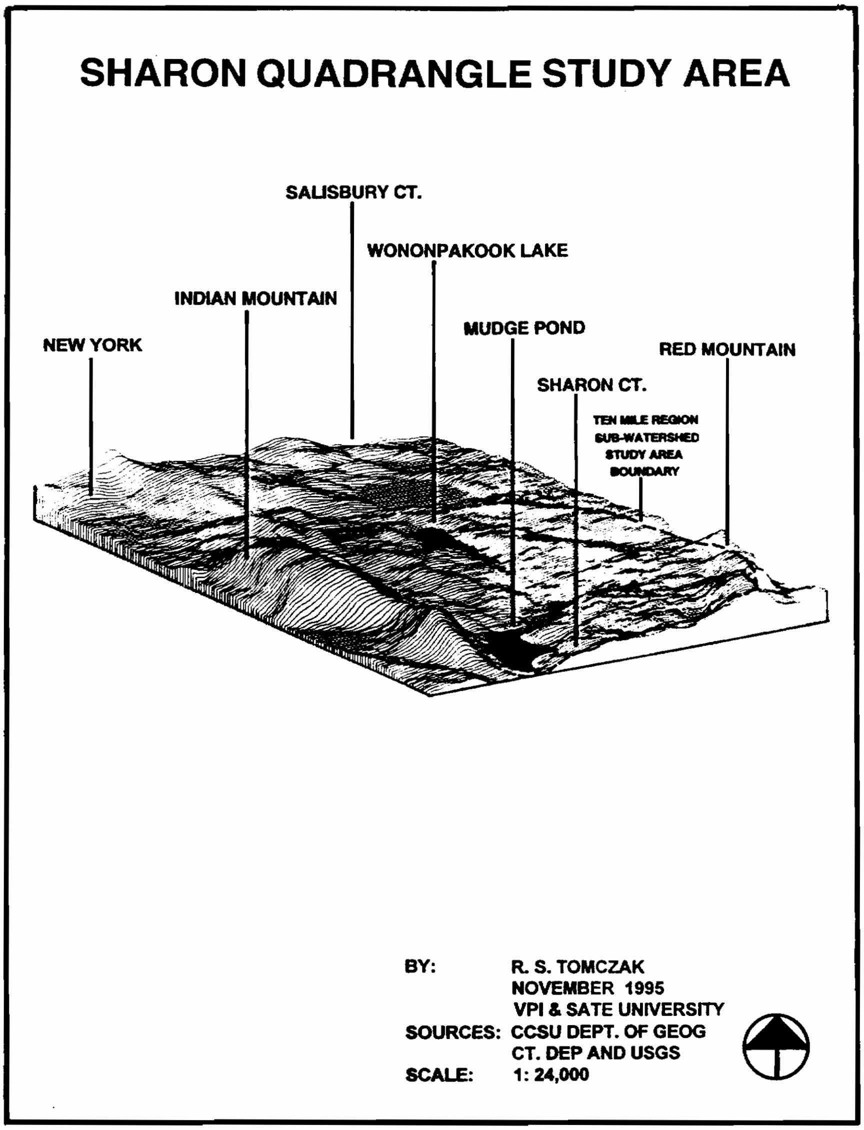
1. Biophysical Analysis

This chapter devotes itself to the biophysical aspects of the study area commencing first with the geological history of its formation, physiographic features such as forested upland, valley sub watershed, conservation lands (including protected sites) and avian habitat. Secondly, sociocultural data is presented in the form of a telephone and questionnaire survey to provide additional community responses for the concept of an ecological greenway corridor. The third and final section presents the development of the greenway management plan based on synthesizing of the first two sections.

The physiographic character of the study area is comprised of two uplifted mountain ridges and valley that run north and south between the towns of Salisbury and Sharon, Connecticut . The two thrust faults of Precambrian gneiss extend to the Berkshires of Massachusetts and can be found along the Hudson Highlands of New York state Kirby 1995). At one point in geologic time a great inland sea covered the valley area resulting in a deposit of limestone. The limestone deposition is known locally as the marble valley. The marble valley landscape is dimpled by many shallow basins and deep pockets. In humid climates worldwide, lime rich rocks like marble or limestone are eroded into deep hollows and depressions, and Connecticut's marble valley is no exception (Bell 1986). The deep pockets and ravines of region support the state's largest inland wetlands and lakes. In fact, the town of Salisbury boasts the deepest natural lake in the State of Connecticut , Lake Wononskopomuc. The limestone wetlands provide an uncommon habitat for some of the most unique varieties of lime dependent flora and fauna in the state (Bell 1986).

Approximately two million years ago, during the Pleistocene epoch a great glacier advanced and retreated through the valley between Salisbury and Sharon. The boundary between the Pliocene and the Pleistocene is generally placed at the beginning of widespread glaciation. Modern glaciers cover only about 10 percent of the earth's land surface, and most of these are located in Antarctica, Greenland, Iceland and mountainous terrain's. Pleistocence glaciers covered more than three times that area or about 17 million square miles based on the outer limits of glacial deposits. Seismic studies and test drilling in Greenland and Antarctica indicate that the ice reaches thickness of 10,000 and 13,000 ft. However, since continental glaciation may have begun as early as 60 million years ago it is not possible to define the Pleistocene as the time of the ice ages. It has been estimated that the Pleistocene ice sheets had a volume of 18.4 million cubic miles. A corresponding volume of sea water converted to glacial ice would require a drop in sea level of about 644 ft. (Seyfert & Sirkin 1973). During the more recent Wisconsin glacial stage about 20,000 to 30,000 years ago, ice in the northern Housatonic Valley was about a mile thick (Kirby 1995). The rate of retreat has been determined in nearby Hudson Valley, New York from radiocarbon dates and pollen stratigraphy in lake and bog sediments. The age of the tundra or herb pollen zone in a given bog provides an approximate age for the beginning of deglaciation in a specific region. The retreat of the ice was slow at first, but by 15,000 B.P. the ice front had retreated into southern New York and southern New England. The thickness of the glacial ice and weight contributed to the rounded and scoured topographical features of the mountains and valleys that comprise the study area. As the glacial ice began to melt and retreat, pro-glacial lakes formed both in the valley and in high isolated depressions. Pro-glacial lakes are defined as lakes occupying a basin in front of a glacier, generally in contact with the ice (Kirby 1995). Mudge Pond in Sharon and Wononpakook Lake in Salisbury are characterized as pro-glacial.

There are three distinct physiographic features that comprise the general study area. At the western edge of the marble valley in Salisbury and Sharon lie the forested uplands of Indian Mountain. At the eastern edge of the marble valley are the forested uplands of Red Mountain. The lowland valley connects both uplifted mountains running north and south for approximately six miles (Map 3.).


SHARON QUADRANGLE STUDY AREA
SALISBURY CT.
WONONPAKOOK LAKE
INDIAN MOUNTAIN
MUDGE POND
NEW YORK
RED MOUNTAIN
SHARON CT.
TEN MILE REGION
SUB-WATERSHED
STUDY AREA
BOUNDARY
BY: R. S. TOMCZAK
NOVEMBER 1995
VPI & SATE UNIVERSITY
SOURCES: CCSU DEPT. OF GEOG
CT. DEP AND USGS
SCALE: 1: 24,000

Map 3.

The Forested UpLand

Second growth upland forest covers miles of mountain topography that is typical of the Litchfield Hills of northwest Connecticut and the study area. The Litchfield Hills are at the southern extreme of the Berkshire Mountains just north of the study area in Massachusetts. Upland forest cover remains essentially undisturbed along Red and Indian Mountain with the exception of an occasional residence at the edge between field and forest. Selective logging occurs in the study area but no evidence of clear-cutting practice is present in either mountain location. Large tracts of upland forest remain under the control of a few private land owners in the sub-watershed. The tree growth is comprised of deciduous hardwoods i.e.: oak, maple, birch, and ash with additional smaller stands of evergreen pine and hemlock. Understory trees such as shad bush present themselves in the uplands along with other native species including witch-hazel. In the 1800's witch-hazel was harvested for several years in Salisbury and delivered to a processing plant in the southern part of the state for medicinal purposes. The practice of gathering the woody plant has been discontinued. Several streams that feed the ponds and lakes in the valley begin in the forested uplands as part of the hydrologic cycle of the Ten Mile Region Sub-watershed. The first-order streams course their way down the eastern and western slopes of Red and Indian Mountain as they enter both Lake Wononpakook and Mudge Pond.

The Valley

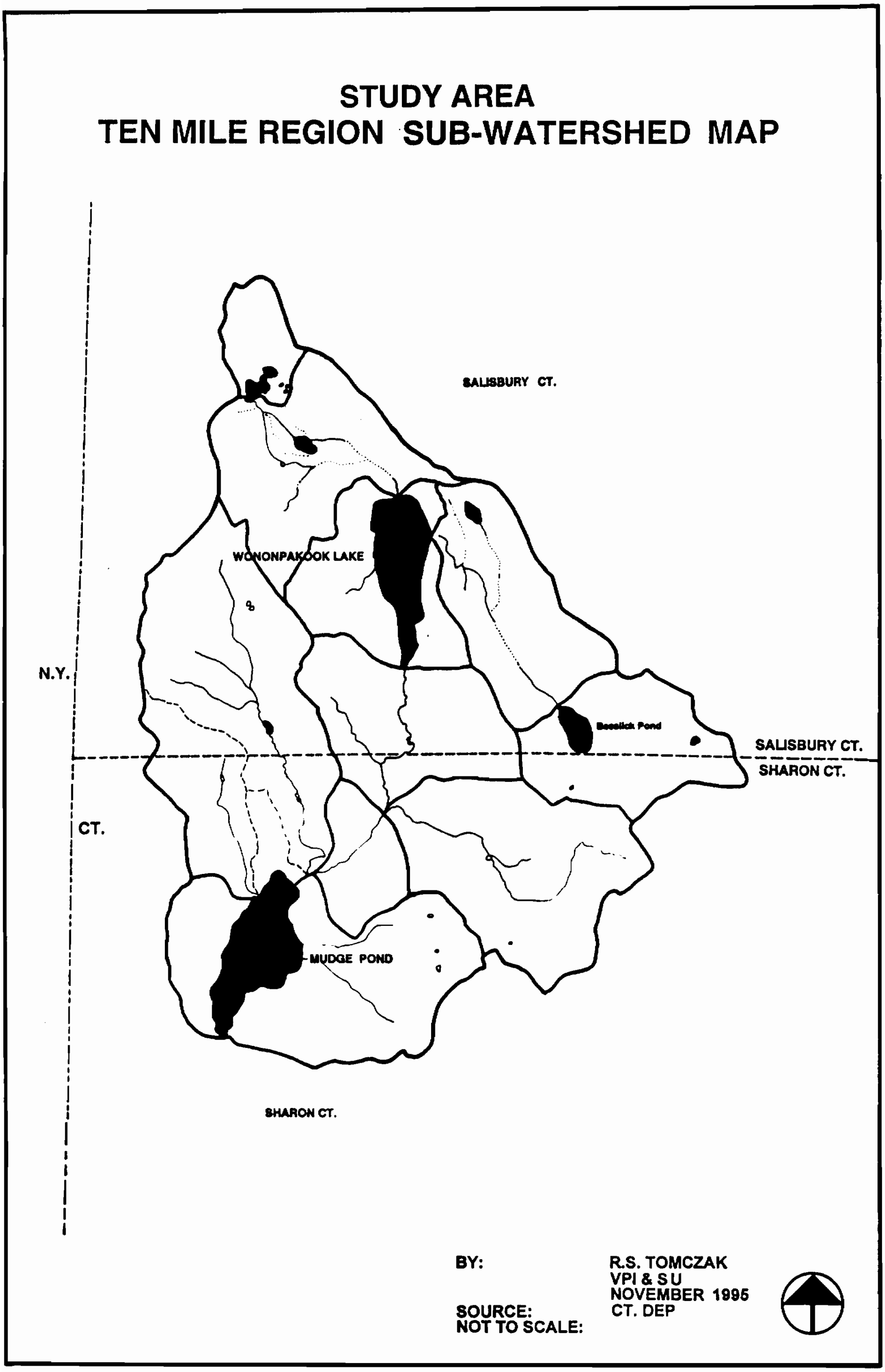
The marble valley region of the study area is gently rolling with steeper hollows that contain a number of small ponds and lakes. The valley remains largely cleared of dense woodland where agriculture in the form of crops and some cattle farming are still present. Hayfields and grazing pastures are separated by remnant hedgerows of deciduous trees and woody shrub species that generally line the fencerow property lines of land owners.

There are scattered patches of larger stands of woodlands that have continued reverting to climax forest where farming practices have been abandoned in the valley.

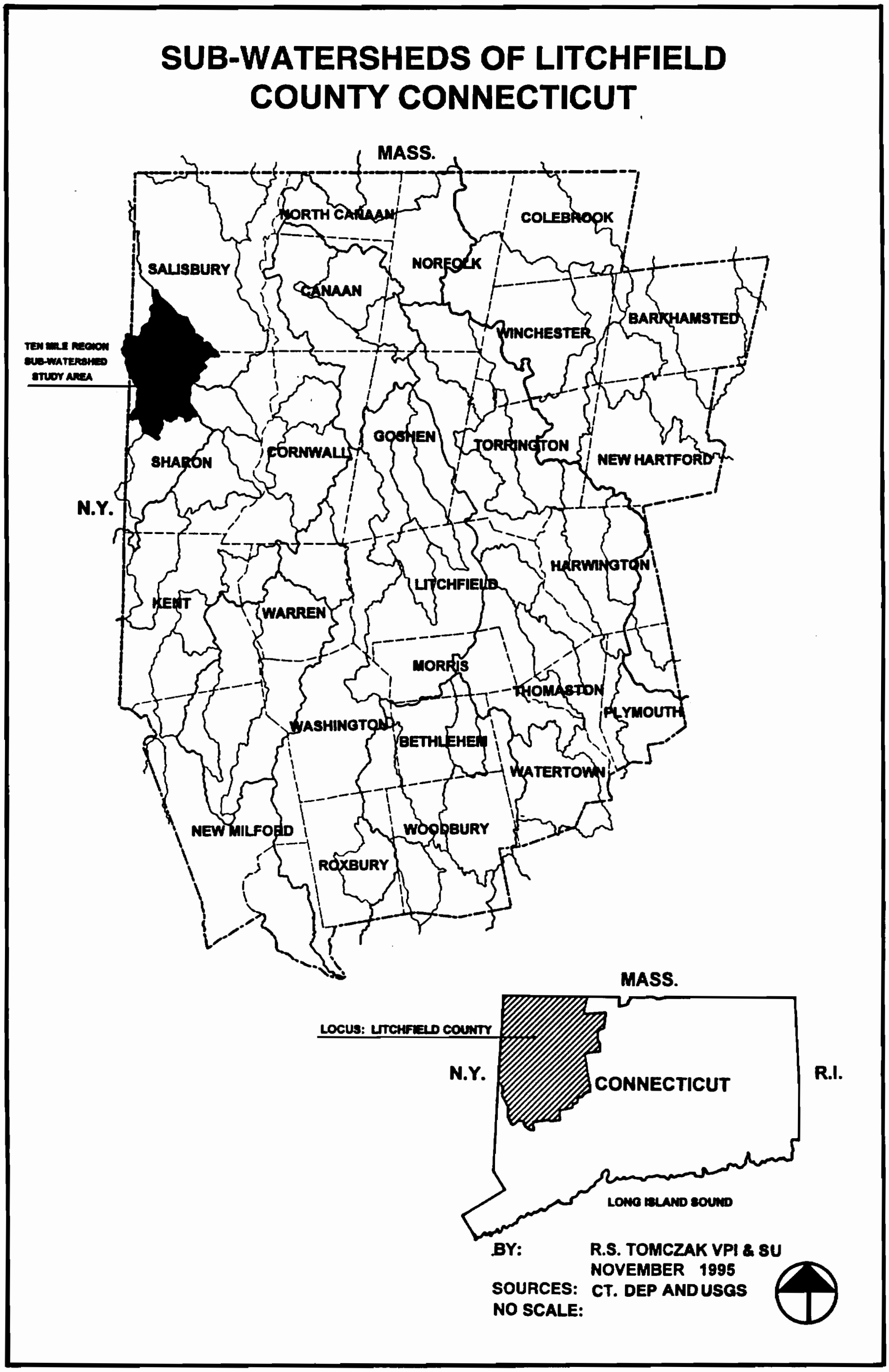
The valley soils are comprised of silt loam's that are considered highly productive with trace elements that make up for their rocky underpinnings. The soils tend to be erodable during periods of high storm events when planted with row crops such as corn for silage.

Sub-Watershed

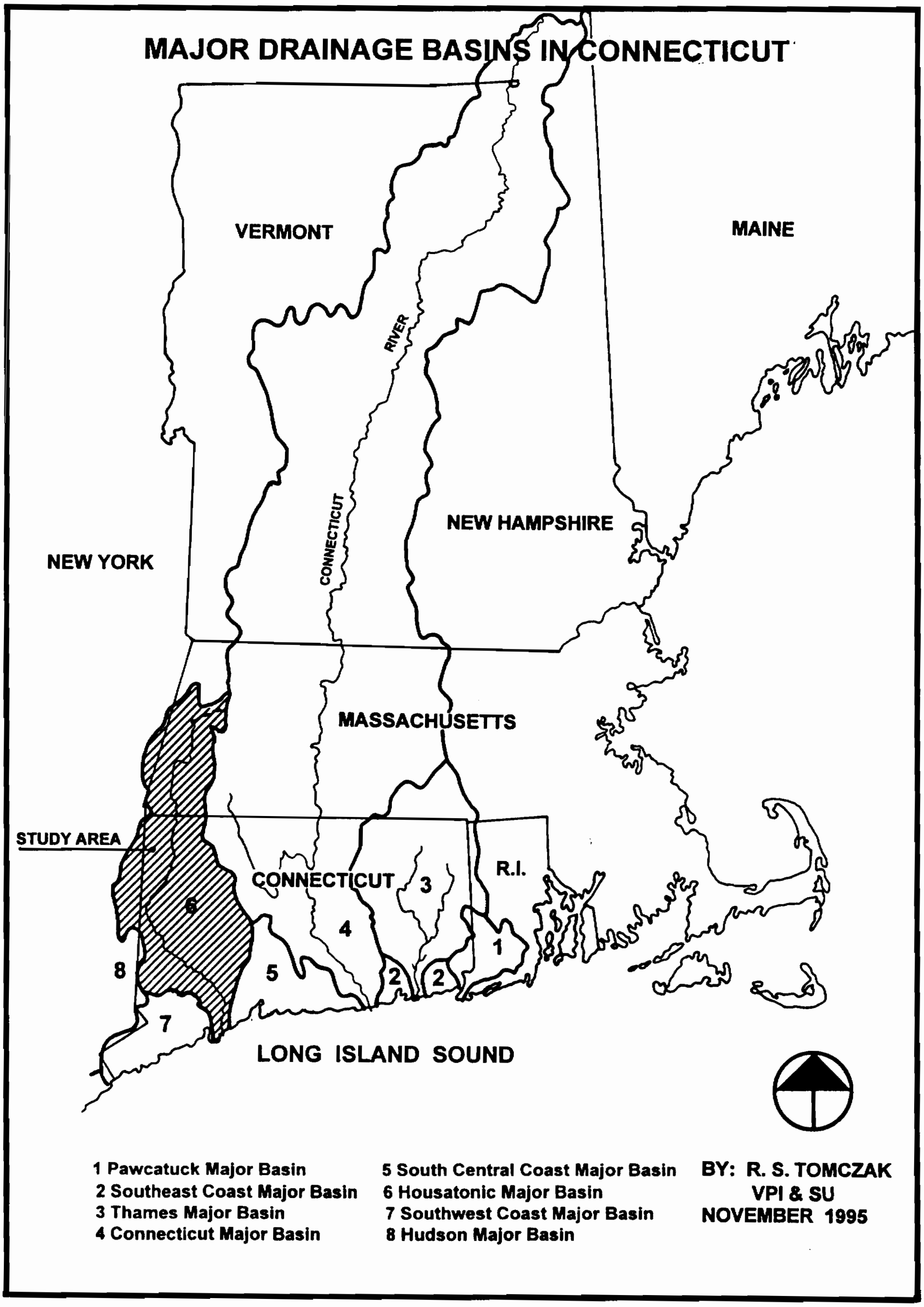
The Ten Mile Region Sub-watershed (Map 4.) is located in the Litchfield County sub-watershed (Map 5.) a part of the Housatonic Major Basin (Map 6.) that runs along the western edge of Massachusetts and Connecticut. The sub-watershed occupies a humid region with an average yearly rainfall of 56.4 inches (Ruffner & Bair 1974). Agricultural practices within the watershed continue on slopes that often exceed 15 percent, adding to the potential runoff of nutrients. Manure spreaders are still in use by some farmers in addition to the watering of cattle herds in perennial open streams that meander across several remaining agricultural tracts in the study area (Rudde 1995). The sub-watershed consists primarily of first and second order perennial streams that eventually drain into Lake Wononpakook and Mudge Pond. Most all of the sub-watershed's main streams travel through inland wetlands that function as natural filtration sinks removing contaminants that could adversely affect both bodies of water. The inland wetlands further serve as flood control retention basins during periods of major storm events that can occur in the sub-watershed. Further inquiry has revealed that although more than ten years have passed since the research into the causes of nitrate pollution at Mudge Pond, continued use of high nitrogen fertilizers is still practiced (Rudde U.S.D.A. Litchfield Connecticut 1995). Some farms now employ the use of filter strips to reduce the amount of surface fertilizers from entering streams and creeks adjacent to farmlands (Rudde 1995).


STUDY AREA
TEN MILE REGION SUB-WATERSHED MAP
SALISBURY CT.
WONONPAKOOK LAKE
N.Y.
Beeslick Pond
SALISBURY CT.
SHARON CT.
CT.
MUDGE POND
SHARON CT.
BY:
SOURCE:
NOT TO SCALE:
R.S. TOMCZAK
VPI & S U
NOVEMBER 1995
CT. DEP

Map 4.


SUB-WATERSHEDS OF LITCHFIELD
COUNTY CONNECTICUT
MASS.
NORTH CANAAN
COLEBROOK
SALISBURY
NORFOLK
CANAAN
WINCHESTER
BARKHAMSTED
TEN MILE REGION
SUB-WATERSHED
STUDY AREA
GOSHEN
TORRINGTON
NEW HARTFORD
SHARON
CORNWALL
N.Y.
HARWINGTON
LITCHFIELD
KENT
WARREN
MORRIS
THOMASTON
PLYMOUTH
WASHINGTON
BETHLEHEM
WATERTOWN
NEW MILFORD
WOODBURY
ROXBURY
MASS.
LOCUS: LITCHFIELD COUNTY
N.Y.
CONNECTICUT
R.I.
LONG ISLAND SOUND
BY: R.S. TOMCZAK VPI & SU
NOVEMBER 1995
SOURCES: CT. DEP AND USGS
NO SCALE:

Map 5.


MAJOR DRAINAGE BASINS IN CONNECTICUT
VERMONT
MAINE
NEW HAMPSHIRE
NEW YORK
CONNECTICUT RIVER
MASSACHUSETTS
STUDY AREA
CONNECTICUT
R.I.
LONG ISLAND SOUND
1 Pawcatuck Major Basin
2 Southeast Coast Major Basin
3 Thames Major Basin
4 Connecticut Major Basin
5 South Central Coast Major Basin
6 Housatonic Major Basin
7 Southwest Coast Major Basin
8 Hudson Major Basin
BY: R. S. TOMCZAK
VPI & SU
NOVEMBER 1995

Map 6.

However, these best management practices devised do not offer a year round buffer strip of vegetation. Through a number of projects and field demonstrations, SCS personnel are gaining a clearer idea about how to get the most erosion control with narrow sod alleys (Taylor 1990). Second to soil erosion among farmland watersheds are agricultural sources of nonpoint pollution. Studies are being conducted throughout the country by various agencies charged with determining what best management practices can be employed to reduce the threat. The results of studies by agricultural researchers revealed that nutrient levels were high in watersheds with artificial drainage improvements, such as straightened channels and tile drains. Apparently the capacity of wet soil or swampy areas with forested land near streams, and *"buffer areas,"* to assimilate and trap agricultural pollutants was eliminated by plowing right up to streams and ditches or by applying cow manure to steep slopes (Johnson 1985). This practice can be observed in locations of the Ten Mile Region Sub-watershed. Despite the overall reduction of large farming practices in the study area former working farms (now residential gentrified tracts) are compounding the problem of nitrate fertilization while enhancing their "Great Lawns" (Smith 1995).

Conservation Lands

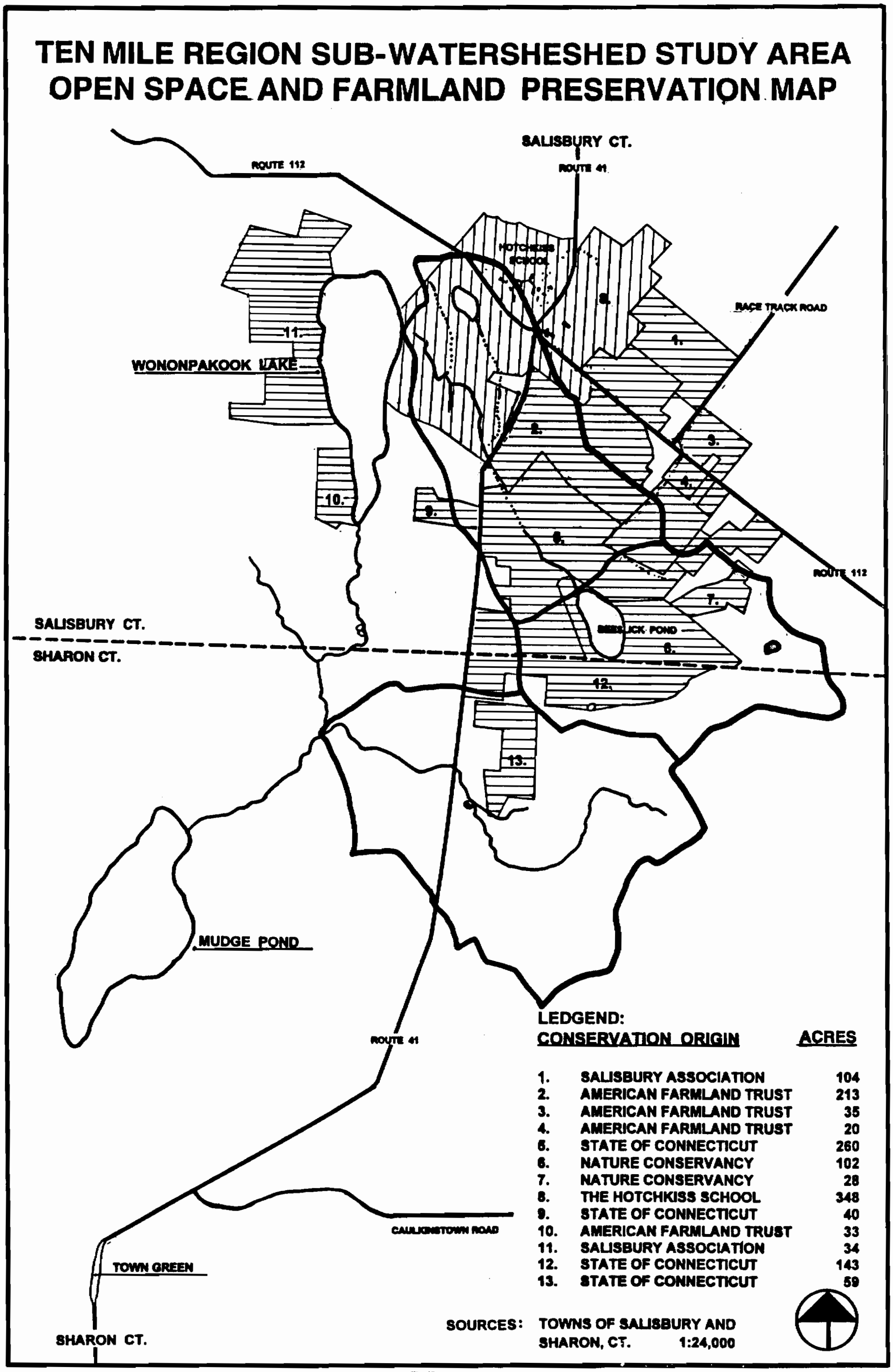
The State of Connecticut has been affected by human development since colonial times. Early explorer Bradford Morse wrote in 1804 that "the state is checkered with innumerable roads or highways crossing each other in every direction. A traveler on any of these roads in even the most unsettled parts of the state will seldom pass more than a mile without finding a house and a farm under such improvements, as to afford the necessaries for the support of a family. The whole state resembles a well "cultivated garden" (Bell 1985).

Vast regions of the State of Connecticut and the United States have been impacted by unrestricted development over the decades since Bradford Morse wrote his observations in 1804. In the Northeast, according to Hooper Brooks, vice president of the Regional Plan Association in New York City and director of its Regional Open Space Program, development activities are for the first time becoming a uniform presence throughout the thirty-one counties in New York, New Jersey, and Connecticut that make up the New York metropolitan region. This means that shops on Fifth Avenue, theaters in Times Square, row houses west of Central Park, and unspoiled farmland in northern New Jersey and northwestern Connecticut, up along the Hudson River Valley, and out on the North Fork of Long Island-neighborhoods and landscapes often well over a hundred miles apart are now almost equally at risk (Hiss 1990).

Communities throughout the country have adopted planning and zoning regulation policies to guide their future growth and development. Recently, land trust conservation programs have become popular for preserving the American landscape and the Ten Mile Region Sub-watershed is no exception to this phenomenon.

In 1963, the Connecticut General Assembly declared "that it is in the public interest to encourage the preservation of farmland, forest land and open space in order to maintain a readily available source of food and farm products close to the metropolitan areas of the state, to conserve the state's natural resources and to provide for the welfare and happiness of the inhabitants of the state." (P.A. 490, 1; C.G.S. Section 12-107a).

In December 1982, the Town of Salisbury adopted an official Plan of Development which has as explicit goals to "maintain the rural and village character of the Town" and to "preserve prime agricultural farmland". The town of Sharon has also followed suit but has not protected as great a land area as Salisbury (Map 7.).


TEN MILE REGION SUB-WATERSHESHED STUDY AREA
OPEN SPACE AND FARMLAND PRESERVATION MAP
SALISBURY CT.
ROUTE 112
ROUTE 41
HOTCHKISS SCHOOL
RACE TRACK ROAD
WONONPAKOOK LAKE
ROUTE 112
SALISBURY CT.
SHARON CT.
MUDGE POND
ROUTE 41
CAULKINSTOWN ROAD
TOWN GREEN
SHARON CT.
LEDGEND:
CONSERVATION ORIGIN ACRES
1. SALISBURY ASSOCIATION 104
2. AMERICAN FARMLAND TRUST 213
3. AMERICAN FARMLAND TRUST 35
4. AMERICAN FARMLAND TRUST 20
5. STATE OF CONNECTICUT 260
6. NATURE CONSERVANCY 102
7. NATURE CONSERVANCY 28
8. THE HOTCHKISS SCHOOL 348
9. STATE OF CONNECTICUT 40
10. AMERICAN FARMLAND TRUST 33
11. SALISBURY ASSOCIATION 34
12. STATE OF CONNECTICUT 143
13. STATE OF CONNECTICUT 59
SOURCES: TOWNS OF SALISBURY AND SHARON, CT. 1:24,000

Map 7.

These land preservation policies have maintained the open valley essence and charm of the Ten Mile Region Sub-watershed.

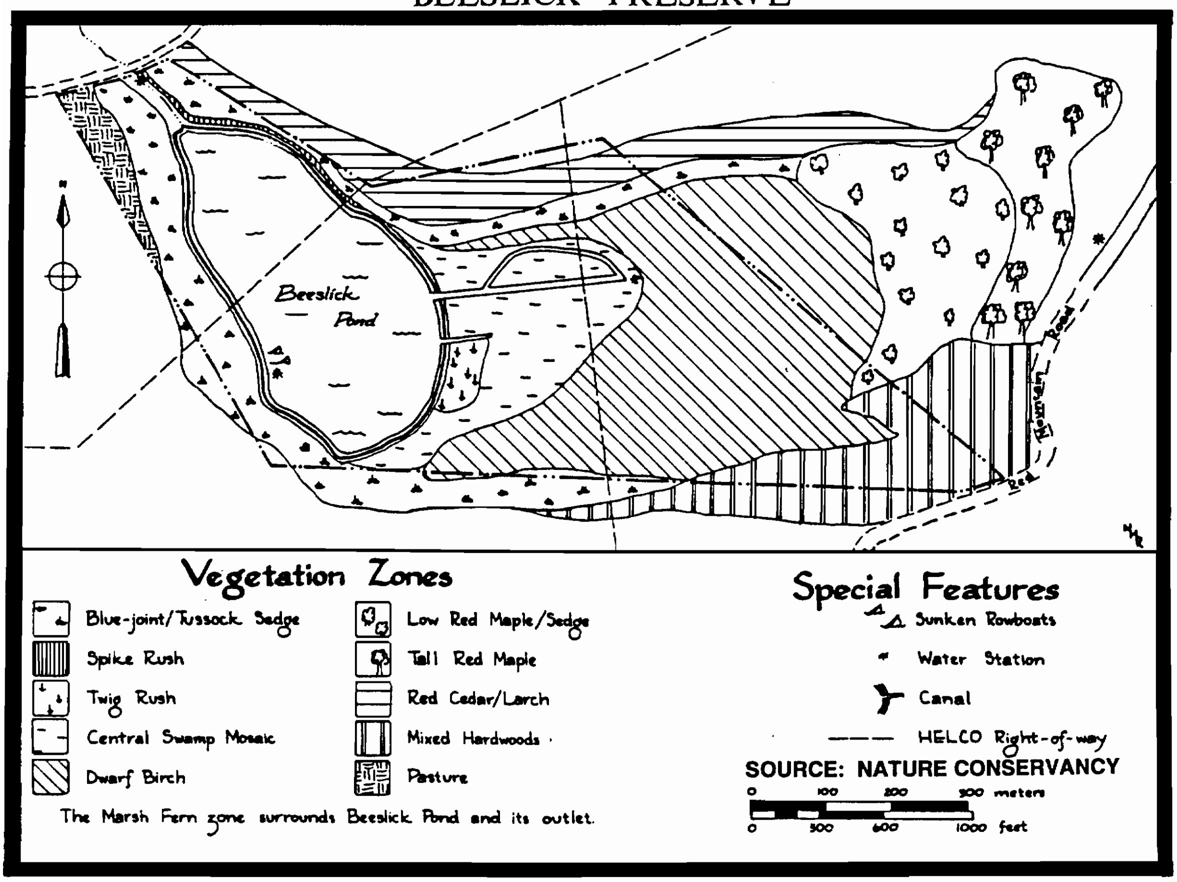
The uninterrupted valley view rolling landscape with white clapboard farm houses and red barns are lasting examples of the rural character of the cultural landscape for all those to admire. It is conceivable that the trend to preserve open farmland along Sharon's part of the valley of could match that of Salisbury in the future, thus removing the potential for small lot- residential development from occurring. However, the preservation of valley agricultural lands could result in even greater demand for residential development in the highlands of Indian and Red Mountains, affecting the edges of both landforms while increasing surface nutrient runoff.

Protected Valley Sites

Beeslick Preserve There are several locations in the sub-watershed that support communities of threatened and endangered species. One such habitat *"The Beeslick Preserve"* presently Nature Conservancy land (Map 8.) comprises an area of 102 acres. Donated in 1977, the preserve is home to a unique species of birch and provides habitat for a few bird species seldom seen in the State. Nature Conservancy studies conclude that a trail could be developed along the high ground of the preserve along the north edge of the pond without harm to the environment. It was also recommended that a small area be cleared on the northern shoulder of Red Mountain at the Conservancy's point of access. "Bird watching stations" for birders to observe the avian community should be established as an alternative to an extensive system of paths that would adversely impact the preserve.

Beeslick Brook Woods This inland wetland area of approximately 200 acres is located just off the main campus grounds of The Hotchkiss School in Lakeville (a Hamlet of Salisbury) (Map 9.) The wetland occupies more that fifty percent of the total side trails in the woods. There is a year round babbling brook in a cathedral woodland setting with much understory tree and shrub growth removed, creating a very open woodland floor in a cool environment. The present trails are used by the science faculty and student body at the school for interpretive studies. The trail system meanders through various vegetation zones replete with sedges, ferns, spike rushes, twig rushes, waterlilies and mixed hardwoods. Initial trail access is from Route 112 just south of the campus entry.

BEESLICK PRESERVE



Map 8.

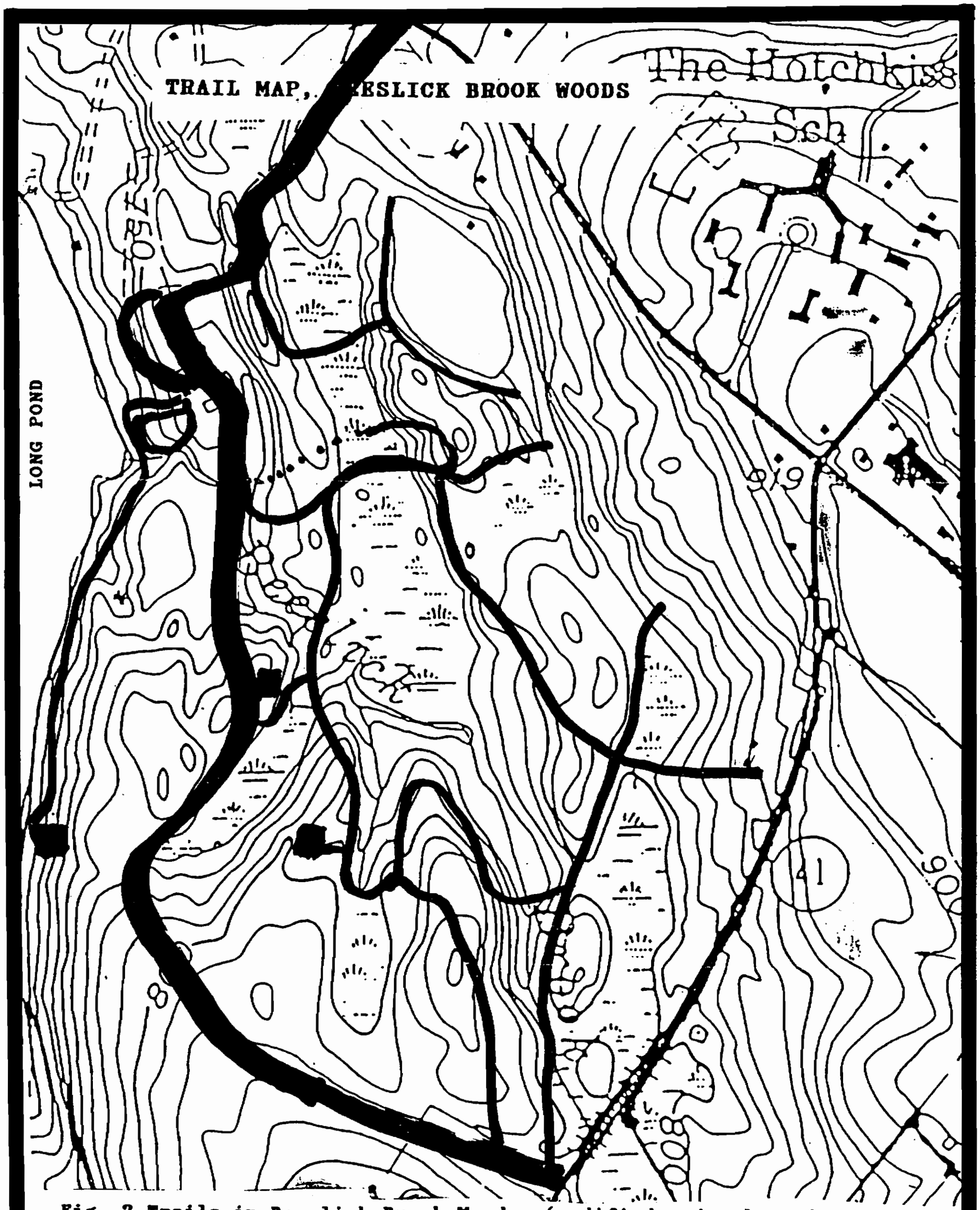


Fig. 2 Trails in Beeslick Brook Woods. (modified and enlarged from U.S. Geological Survey 1956, Sharon, CT-NY 7.5 minute map sheet). Scale: 1/2 inch = 670 feet

SOURCE: HOTCHKISS SCHOOL

Red = Main Woods Trail Green = Other Trails Blue = Interpretive Nature Trails

Map 9.

Avian Habitat

Biologists concur that approximately 135 avian species nest regularly in the State of Connecticut. Like other populated states, Connecticut, has been affected by development which has decreased the quality of bird habitats. In some cases, however, bird populations of several species e.g., "northern cardinals and northern mockingbirds" have adjusted to the new landscape changes in the state and are flourishing as permanent residents. It is widely accepted though, that on the whole species diversity has been dramatically impacted in several regions of Connecticut, with a few exceptions.

The Ten Mile Region Sub-watershed study area supports a diversity of species within the confines of its general borders. Habitat selection and species diversity correlates in large measure to the quality of existing habitat and diversity of the natural landscape. The ability of experienced birders to predict roughly the kinds of birds likely to breed in a particular habitat is based on the regularity with which breeding birds of a different species occur in certain kinds of associations. In general, the variety of breeding species tends to be higher in more complex habitats than in simpler ones (Bevier 1994). An additional factor affecting numbers of avian species appears to be foraging opportunities that present themselves in a particular habitat. The two town study area has over time maintained an abundance of hedgerows primarily due to low impact development and/or the acquisition of former farm properties which has kept them intact. There are no guarantees, however, that the practice of large tract land holding will continue into the future and the prospect of land being subdivided into smaller building lots must be reckoned with.

Background

At present there are over 100 avian species that inhabit the environment of the Ten Mile Region Sub-watershed which is located in the Sharon USGS Quadrangle of northwest Connecticut (Figure 2.).

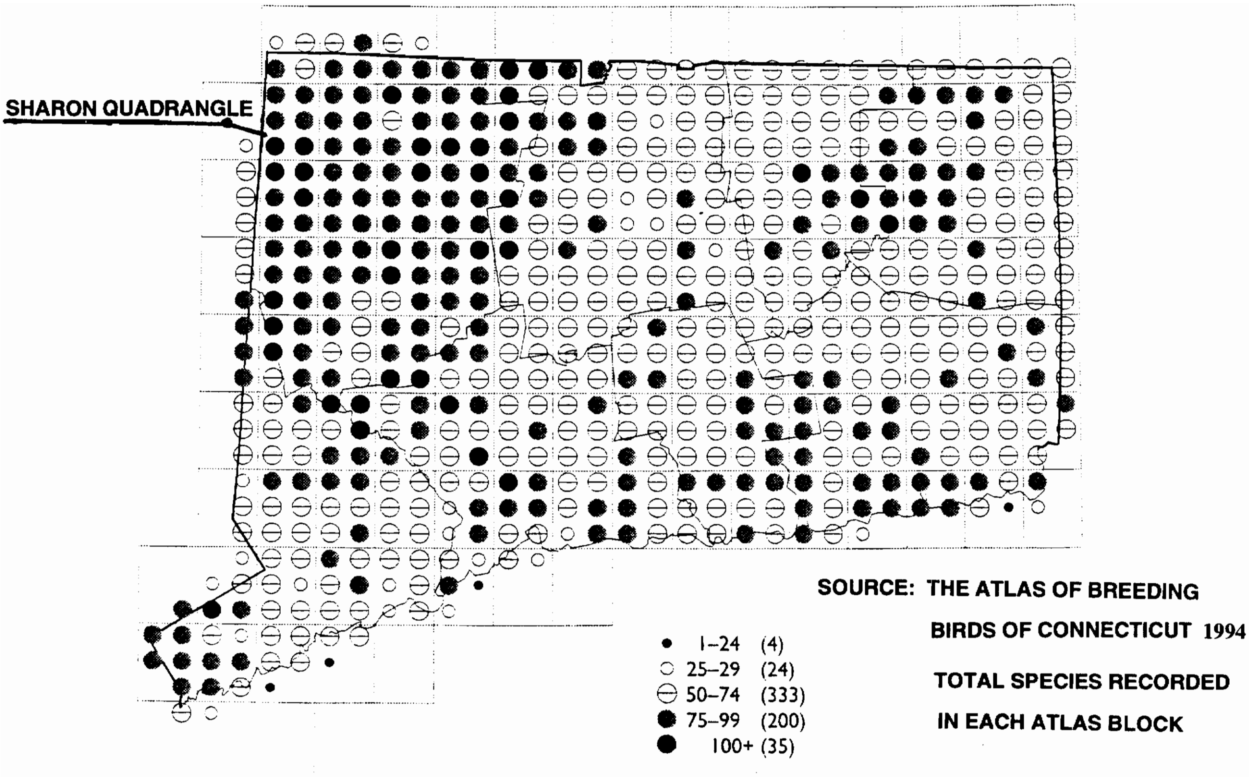
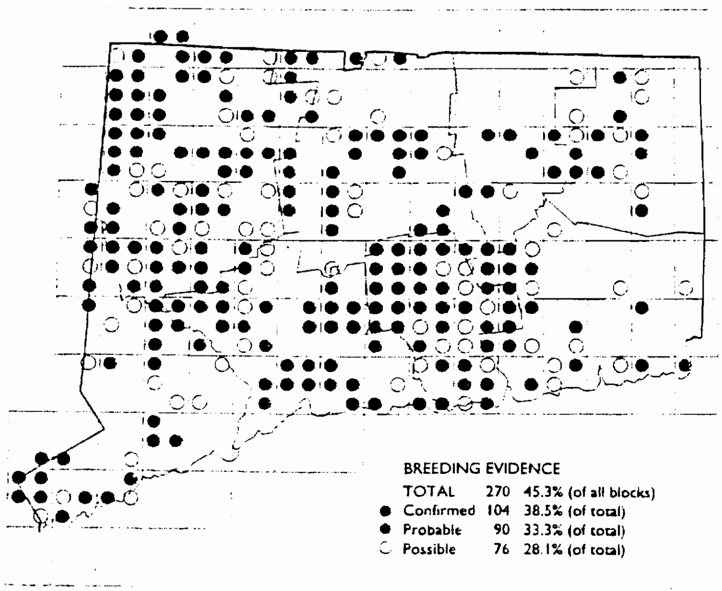


Figure 2.

One explanation suggests that the high number of species is attributed to the existing "richness of habitat" providing excellent forage and nesting opportunities (Hemingston 1995). The present avian habitat condition in the study area is worthy of protection and management, both of which are encouraged through development of a comprehensive greenway system. The remaining fencerows present in and presently surround many farm fields afford a variety of food and cover plant species, enhancing mammalian and avian habitat. The system of fencerows or hedgerows was derived by earlier English Settlers who cleared the Connecticut woodland and established small farms in their new environment. Some enclosure of the open fields in England had begun as far back as the mid fifteenth century, and as might be expected, enclosures frequently gave rise to disputes between the different parties involved, so that it became necessary to establish a legal basis for the action (Richardson & Streeter 1984).

Baptist and Zeranski reveal that during the first half of the 1800s the amount of acreage in Connecticut devoted to farming was at its greatest, peaking in the early 1860's during the Civil War. At that time about 75 percent of the land was "improved" or modified for farming (Bell 1986). Then many of the native animals inhabiting woodlands were at their lowest numbers and some had been extirpated altogether. But the transformation of the land had positive effects on wildlife that favored, fields, meadows and marshes. Several smaller mammal species, including woodchucks, which favored grasslands and brushy areas became widespread. Among birds many sparrow species maintained high numbers, as did bobwhite, upland sandpiper, bobolink, eastern meadowlark, and eastern bluebird (Baptist & Zeranski 1990).

An interview with a local wildlife manager in the field revealed that identifiable indicator species for the ten Mile Region Sub-watershed are unknown (Hudek 1995). The only census of avian counts available in the study area over a long time frame is for the Miles Sanctuary located on 1,447 acres in the village of Sharon. The census does reveal that larger avian species such as the red tailed hawk, great horned owl and blue jay appear to maintaining their vitality in the study area. The census has been recorded each year in December since 1961 (General Appendix). A recently published avian book, *The Atlas of Breeding Birds of Connecticut* (Bevier 1994) was reviewed for avian study data and provided much of the background referenced in this study. The book employed a computer generated USGS quadrangle system with geographic referencing of bird counts in the state by species. The data was collected by 500 individuals, principally volunteers. This is the first publication of its kind in Connecticut and was published in 1994 (Figure 3.).



SOURCE:
THE ATLAS OF BREEDING BIRDS OF CONNECTICUT 1994
TOTAL SPECIES RECORDED IN EACH ATLAS BLOCK

Current Study Area Habitat Condition

The major environmental changes, effecting avian populations in the study area during the last 50 to 75 years has been the decline of agriculture. Against great odds, conservationists have challenged traditional values and initiated legislation to protect natural resources and improve avian habitat (Baptist & Zarenski 1990). Increased environmental awareness in the study area and importance of environmental protection in the Ten Mile region Sub-watershed has resulted in a general improvement of environmental quality. Currently, remnant hedgerows or fencerows support a diversity of plant species such as *honeysuckle, grape, poison ivy, multiflora rose* and *red-osier dogwood.* Several plant species were introduced to the study area under the auspices of the USDA farm program for soil stabilization. These introductions have now established themselves throughout the study area and are sometimes confused as native species. Existing fencerow vegetation is considered diverse by local wildlife biologists (McNeally 1995). There is some discord among biologists regarding the proliferation of non-native plant species such as *bittersweet, Japanese* honeysuckle and *Japanese barberry* due to their invasive qualities. However, it is well accepted that despite the preponderance of non-natives their capacity to provide diverse forage to avian species compensates for their aggressive nature. The rich diversity of forage and cover species in the Ten Mile Region Sub-watershed fencerows continues to play an important role in the quality of avian habitat present in this region of the state.

Long Term Management

A major detriment to future protection of existing fencerow habitat in the study area will be in the form of land development. It is conceivable that development could eradicate much of the existing edge habitat that currently supports a wide variety of avian habitat. Personal inquiry of residents revealed that existing hedgerows are not considered a high priority landscape element worthy of protection. It appears that much of the public considers existing fencerows as tangled masses of overgrown weeds that should be removed in favor of the "kept look;" this would be to the detriment of avian species. Several parcels of agricultural farmlands have been set aside as part of the Connecticut Farmland Preservation Program in the study area. This conservation practice will preserve some of the remaining fencerows, however, remaining edge habitats could be lost over time. The fracturing of fencerows will disrupt the richness of the habitat and result in the reduction of forage, cover and nesting environments for many birds. Habitats and species may also be lost as a result of fragmentation of existing wetlands and old fields. Fragmentation may ultimately result in the functional loss of some habitat types and associated animal species. The increasing distance between similar patches decreases the likelihood that species can migrate among patches. As species are exterminated within a given patch, new individuals find it difficult or impossible to immigrate and diversity decreases (harker et. al. 1993). These conditions combine to reduce species richness to the survival of avians.

Landscape architects, biologists and others who recognize the value of maintaining species richness through greenway planning can contribute to the preservation of avian habitats. By bringing together planning officials, wildlife biologists, ecologists, developers and allied community conservation groups a best management plan can be adopted to half preserve existing fence rows through a "greenlinks" concept. Greenlinks are divided into three basic parts 1) introducing the target audience to the idea of naturalizing the landscape by use of a strong education program 2) working with adjacent landowners throughout the area to link more and more open spaces and natural areas together in a regional system and 3) developing a detailed naturalization plan (such as a greenway) for the managed site (harker et al 1993 p.5). This concept could be employed in the study area by adoption of the three principles presented for the existing fencerows along the Wequadnack Greenway in the Ten Mile Region Sub-watershed study area. The fencerows should remain in place as a way to preserve avian biological diversity for residents and visitors to experience and learn from. Once a management plan is conceived it should be presented before the entire community for endorsement and written into future land use policy. Policies could identify parcels of land identified as "rich" in terms of habitat diversity and worthy of preservation. The plan could be administered by local conservation groups and environmental managers to insure that preservation policies are followed as prescribed.

Designers of greenway corridors recognizing the value of forage can enhance the experience of trail users and increase avian diversity by introducing native species of plants. These plants could supplement existing forage along lowland and upland edge habitats. As previously noted the Ten Mile Region Sub-watershed contains a variety of landforms that support a diversity of plant species enhancing foraging opportunities for birds. However, one that is generally lacking in the study area is red-osier dogwood

Cornus stolonifera. The fruit of this species is consumed by a wide variety of songbirds readily identified in stomach analysis (Martin 1949). The fruits of the woody stemmed dogwood are valued by wildlife.

Cornus stolonifera:

Stem:	Slender, upright, dark blood red, appressed, elongated, essentially no difference between this species and *C. alba*
Fruit:	Drupe, white globose; stand as broad as high or slightly broader, rounded at base.
Size:	7' to 9' spreading to 10' or more.
Habit:	Loose, broad spreading, rounded, multi stemmed shrub with horizontal branches at base; freely stoloniferous as it spreads by underground stems.
Rate:	Fast, seems to be quite vigorous.
Texture:	Medium in leaf and in winter.
Stem Color:	Red, various authorities list the stem color as dark blood-red dark purplish red, brilliant red; very handsome and eye appealing in a winter setting especially with a sprinkling of snow to set off the stem color.
Culture:	Fibrous rooted, easily moved bare root or balled and burlaped; extremely adaptable to wide range of soil and climatic conditions; does best in moist soil and is often observed in the wild in wet swampy situations.
Diseases:	No major problems.
Use:	Excellent for massing in large areas, along highways, parks, golf courses; interesting stem color makes it suitable for many applications. Can be an effective bank cover for it holds soil quite well (Dirr 1983).

Research with major northeast floriculture wholesalers revealed that the number one year round woody stem design product was the red-osier dogwood, *Cornus stolonifera* (Frey 1995). The red-osier dogwood could be encouraged to protect soils, filter pollutants, provide habitat and be pleasing to the eye. The red-osier plant species is not a nitrogen fixing specimen and considered an attribute when designed for nitrogen uptake applications.

Farmers in the mid-western United States are now realizing a profit generated from permanent filter strips of woody species previously allowed to remain in a steady state un-harvested. Considering how long it takes most conservation practices to catch on, the contour buffer strip has made a quantum leap in its rate of acceptance (Taylor 1990). These alternative concepts are providing additional economic incentives for farmers that have historically reduced their acreage near streams etc., to accommodate maximum production for crop farming. Research revealed that woody stemmed plant species like *Cornus stolonifera were* more effective in removing surface nutrients by up-take than grasses commonly used in buffer strips near wetlands. Scientists concluded that it is important to remove vegetation utilized for nutrient controls in a sub-watershed. Although not as simple as mowing grass, selective harvesting of woody-stemmed species is possible, thereby permanently removing nutrients from the vegetated buffer system (Lance 1972, Leak and Martin 1975; Ehrenfeld 1987). Woody-stemmed species are good long term nitrogen sinks, but removal of the entire plant also removes the nitrogen uptake and storage mechanism. Should a vegetated buffer not be periodically harvested, eventually the nitrogen stored in plant tissues will reenter the system through decomposition (Lance et. al. 1972). This steady state condition exists, when a vegetated buffer is allowed to reach maturity while withholding nitrates in its biomass that will eventually return into the watershed. As riparian ecosystems mature, net annual nutrient uptake in vegetation may decline, and buffers may become less effective filters (New England Division Army Corps Of Engineers p.18 1991). Lowrance reveals that in order to maintain the ability of riparian buffers to assimilate nutrients it may be necessary to periodically remove nutrients sequestered in vegetation (NEDACOE p.18 1991). There is however the option of selectively harvesting the Cornus species for sale to floriculture markets in major metropolitan areas thus removing nitrates and allowing the plant to continue its normal growth and vigor. This method of selective harvesting could improve the nitrate uptake efficiency of a greenway buffer without the need for costly replanting or site impact damage associated with logging of market trees.

Based on the foregoing, the author of this study has selected *Cornus stolonifera* as a plant worthy of introduction as an effective greenway buffer companion species along with existing native varieties. For plantings intended both to beautify the landscape and to attract birds, red-oiser dogwood is one of the very best (Martin 1949). By introducing *Cornus stolinifera* as a monoculture mass planting the species would establish itself as a dominant plant complex. Site analysis by the author along a potential greenway corridor route in the valley region of the study area revealed that *Cornus stolonifera* was present as ten dispersed single specimens along a three mile remnant hedgerow. Other woody shrub species included small complexes of *Lonicera, Ligustrum* and *Berberis*. This observation indicates that the potential exists in some areas to establish a community of *Cornus stolonifera* species. Juniperus virginiana is also recommended as an evergreen to complement the Cornus stolonifera along the Wequadnack Greenway corridor as an additional preferred cover and forage species.

Juniperus virginiana

Leaves:	Scale-like leaves arranged in 4 ranks closely pressed and overlapping, about 1/16"
Cones:	Dioecious, female cones ripening in one year, sub-globose, ovoid, up to ¼" long, often glaucous; seeds 1 to 2, ovoid, furrowed, shining brown, cones can be quite handsome and some appear almost blue.

Size:	40 - 50' high by 8' to 20' spread; extremely variable over its extensive native range.
Hardiness:	Zone 2 to 9.
Habit:	Densely pyramidal when young and slightly pendulous in old age; variable in the wild from almost columnar to broadly pyramidal.
Rate:	Medium
Texture:	Medium
Bark:	A handsome reddish brown, exfoliating in long strips.
Leaf Color:	Medium green in summer becoming a dirty green in winter.
Flowers:	Usually dioecious; staminate yellow, pistillate green
Fruit:	Cones globular or ovoid, about 1/5" across, brownish violet, glaucous bloomy. Ripening in the first season; seeds 1-2, ovoid, small, apex blunt angular, deeply pitted, shining brown.
Culture:	Easily transplanted balled and burlapped if root pruned; tolerant of adverse conditions, poor gravely soils; acid and high pH soils; prefers a sunny, airy location, and deep moist loam on well drained subsoil; will tolerate shade only in extreme youth.
Diseases:	Cedar apple rust and bagworms.
Landscape Use	An excellent specimen and mass if used with care as to color combinations; useful as windbreaks, shelter belts, hedges, and topiary work (Dirr 1983).

The scheme could greatly enhance biological diversity in the existing habitat where soil, light and moisture conditions permit, provided the distances are not too great. The biological diversity in the existing plant community would be further enhanced by richness of habit providing for a wider variety of avian and mammalian species. Scientists measure and evaluate biological diversity in several ways. One concept of diversity is the number of different types of species of organisms within an ecosystem or over a defined parcel of landscape. In order to compare different sites and different studies, ecologists have developed ways to measure diversity. One of the simplest measurements of diversity is the number of species that dwell in a habitat. The number of species is referred to as species richness. Habitats with more species are considered more diverse. But simple numbers of species often do not tell the entire story of diversity. A forest with 90 percent of one tree species and 5 percent of two other species is different from a community containing the same three tree species but at densities of 25, 35, and 40 percent. Each forest has the same richness with three species of trees, but the forest with the more even distribution is considered more diverse. The distribution of abundance among different species or the relative abundance of species is referred to as eveness. Forests with high eveness are considered more diverse than forests with low eveness (Harker Et Al 1993. p.21).

2. Sociocultural Analysis

Telephone & Questionnaire Survey Background

The use of a systematic telephone random sampling and questionnaire survey of residents becomes necessary regarding overall greenway designs in this study. A series of questions were developed following the four stages of Hellmunds ecological greenway design model. No matter how much economy and restraint are exercised in gathering information, we will inevitably end up with masses of data too unwieldy to manage and difficult to make real sense of. We obviously cannot remember all of it, and even major items are likely to get lost. We therefore need a means not just of organizing the data but of putting it together in a way that will lead us directly to the shaping of a plan. This is where models enter the picture (Lyle 1985). The data obtained from the public can be further synthesized to fit the principles set forth in any given ecological design model. This dynamic approach can insure that the net conceptual design facilitates the communities needs as well as the environment.

The survey questions focused on scientific and pragmatic principals of corridor design to be applied in the Ten Mile Region Sub-watershed. There are several ways to determine public demand. First, find out what the public has already said it wants. One commonly use technique is the public opinion survey. This can be done inexpensively by telephone poll, mail out questionnaire, or other technique (Flink 1993). The systematic telephone random sampling reached a total of sixty (60) residents in the communities of Lakeville, Salisbury and Sharon, Connecticut. Twenty residents in each town were contacted over the course of several day's duration. To insure accuracy and objectivity, ten names representing every 40th subscriber were selected from the first half of the telephone directory and the balance were chosen from the second part of the volume..

Telephone Random Sampling Data Results

Four core questions formed the basis of the systematic telephone sampling of the three town study area (Appendix A).

Question 1. was written with Hellmunds Stage 1. overall question as a cornerstone to subsequent greenway design principle...**Hellmund**: *Are there significant biological, water, recreational or other features in the region that could be maintained or enhanced by a greenway or network of greenways?*

The study area sub-watershed does reflect a wide variety of hydrological diversity i.e.: streams, ponds, lakes and wetlands with threatened and protected species, including excellent avian biological diversity, as well as several existing recreational trail heads.

Telephone Sampling Question 1. "Do you think it would be important to help protect the water quality of streams, lakes and ponds between Sharon, Lakeville and Salisbury and to help protect endangered species in the area by designating a greenway corridor? Yes or No! if no, Why Not?"

Yes	**58**
No	**2**

"If yes "Should areas be off-limits to people? Some? All? Explain."

There was a broad consensus of opinion that threatened and endangered species locations should be protected from human impacts where feasible. Private land could be accessed provided a prospective corridor was kept a distance away from residential dwellings, to insure privacy.

The next series of questions is taken from Hellmund's Stage 2. model principle.

Hellmund: Selecting project goals and a study swath. *Every greenway project should start with biological conservation, water resource protection, and recreational goals.* **Do you have any recommendations for protecting water quality or rare plant and animal species in the area?"**

Two general recommendations predominated regarding water quality protection. One was to limit the use of chemical fertilization and the second proposed a broad based public education commencing at the elementary school level.

Question 2. "Do you think it would be important to link Sharon, Lakeville and Salisbury with a pedestrian path for recreation or transportation?" Yes or No if no, "Why not?"

Yes 54

No 6

Four of the "no" respondents indicated that there are currently roads in place that could be utilized as a link with the communities. Two revealed that there were existing trails that would serve with roadways as connections.

If Yes, how would you use such a path? "Walking, jogging, cycling etc".

56 Walking

4 Cycling

"Would you be willing to use existing roads or utility easements?"

50 Yes

10 No

The "no" respondents registered a fear regarding electromagnetic fields.

Questions 3 and 4 would be relevant to Hellmunds Stage 3. of the greenway model.

Helmund: Defining Greenway Boundaries *Where within the swath is the best general alignment for the greenway?*

Question 3. "What should people using the greenway have access to?"

The respondents revealed that they wished to experience a diversity of natural features in the study area. i.e.: water features, woodlands, valley and historic points of interest.

Question 4. "What features or places should be off-limits to people?"

The respondents largely agreed that "sensitive sites" should be off-limits where protected and threatened species may exist.

Questionnaire Data Results

A nineteen question survey was adopted to develop an understanding of the study area prior to developing a design concept of proposed corridor routes (Appendix B). The responses would further support a concept that offered a biophysical experience for users. The questions focused on ecological greenway design principals, trail design parameters and short answers allowing the respondents to add their own reflections regarding the study area. It is relevant for designers to query the residents of a particular community either by personal interview, public forum or standard questionnaire survey to determine the cultural, natural and historic landscape. Inquire into its image in the minds of users and decision makers: how they characterize it, how they feel about it, what they expect of it. Much of the flavor of place, and its present direction of change, is thereby revealed. Finally, one must look at the place as an ongoing ecological system, including its present human use: how it maintains itself and where the vulnerable points may be. Understanding site history, ecology, and image are always fundamental (Lynch, 1990). A total of 2,800 questionnaires were prepared for mailing to residents of three towns that comprise the ten mile region sub-watershed study area. A group of volunteers were retained to collate, fold and staple the cover letter, study area map and nineteen-question-and-answer three page mailing. It was recognized that this method of inquiry traditionally proves to have a low net return. However, it would reach the largest percentage of the population polled because of the rural nature of the study area. The interview can be converted into a written questionnaire, filed out in private, and returned by mail. The answers are now restricted to multiple-choice boxes. The meaning of questions must be patent, since there is no opportunity for on the spot clarification. The questionnaire must be brief, since there is no strong motive for working on it (Lynch, 1990).

The respondents were given approximately one month to return their completed questionnaires to two (2) locations in Salisbury and Sharon, Connecticut. A total of 143 questionnaires were returned or .5 percent. Only complete responses were compiled for each question tabulated. Incomplete or unanswered responses were excluded to avoid biasing the results. Raw data was then plotted by IBM Lotus Spread Sheet with relative frequency histograms and circle charts diagramming percentages (Appendix B).

Relevance of Telephone And Questionnaire Data

Landscape Architects and other design professionals are called on frequently to interpret and synthesize community responses that will guide the outcome of proposed concepts. Survey information becomes the medium for such design direction. Once assembled, the survey must be put into concise and usable form, a brief graphic and written statement that describes the essential nature of the site for the purpose at hand, and how it is changing. Major constraints, problems, and potentialities are indicated. This concept of the site will be modified as the design unfolds, as further information is stumbled upon, or must be sought out: site analysis is not self-contained (Lynch, 1990).

As initially revealed by question one (1.) of the systematic telephone random sampling and questionnaire returns, a vast majority of residents responded favorably to the overall concept of a greenway corridor that would protect the quality of water and biological diversity in the study area. Question (2.) of the telephone survey revealed that the residents would also be in favor of a pedestrian path that would link Sharon, Lakeville and Salisbury for recreation or transportation. Question six (6.) of the survey questionnaire showed that 61 percent of the residents would be willing to provide an easement for a greenway on their private property to biological diversity and preserve wildlife habitat. A total of 68 percent of the residents in question seven (7.) indicated that they would be willing to provide a filter strip to reduce surface runoff from entering streams, ponds and lakes in the sub-watershed. For question eight (8.) respondents were quite evenly split in their desire to participate in greenway buffer strip design despite the low number of returns. It should be further noted that 79 percent of respondents indicated that they did not own farm land in the study area. Question nine (9.) suggested that 83 percent were in favor of linking other existing nature trails with a major greenway with historical/cultural features including side trails. 42 percent nearly half revealed that privacy was a primary concern, followed by 13 percent for crime and third 11 percent for litter on question eleven (11). Most were evenly divided on a high corridor elevation 54 percent and low elevation 46 percent for question twelve (12). 91 percent were in favor of making use of abandoned roads question thirteen (13). Native soil received 86 percent of the responses for question fourteen (14).

Based on the findings of earlier water quality reports by Baillie and Kings Mark 1982-86 regarding nutrient loading and BMP recommendations , a sub-watershed boundary approach was adopted. From a broad perspective, because greenways must interact with surrounding lands, it is crucial to consider a greenways context within the landscape.

Understanding context may mean deciphering the ways in which animals use neighboring unprotected lands in addition to the greenway itself. Or, it may mean determining the type and magnitude of contaminants flowing toward a greenway from adjacent areas (Hellmund & Smith 1993).

3. Development Of The Greenway Management Plan

Three (3) greenway corridor routes were designed for the sub-watershed study area. The concepts were based on data reviewed by Hellmund's "Four Stage Model", *systematic telephone sampling*, questionnaire returns and personal interviews. A process of reductive analysis was employed to Hellmund's "Four Stage Model" of the study area in an effort to determine if key principles would apply. Further research and analysis indicated that the principles could indeed be adopted and would form the basis for further synthesis. Residents of the towns of Sharon and Salisbury revealed that four major issues were of concern.

1. Recreation

Research indicated that the community was generally in favor of the greenway corridor concept with limited recreational use, primarily for walking. The corridor should connect Sharon and Salisbury and afford users a diversity of landscape experience. Privacy should be considered where possible when near residences

2. Biological Diversity

Respondents would favor a corridor that would avoid sites designated as habitat for endangered/threatened species or sensitive in relation to protecting water quality. The community members would be willing to grant easements on private lands earmarked for the enhancement of biological diversity.

3. Erosion/Pollution Control

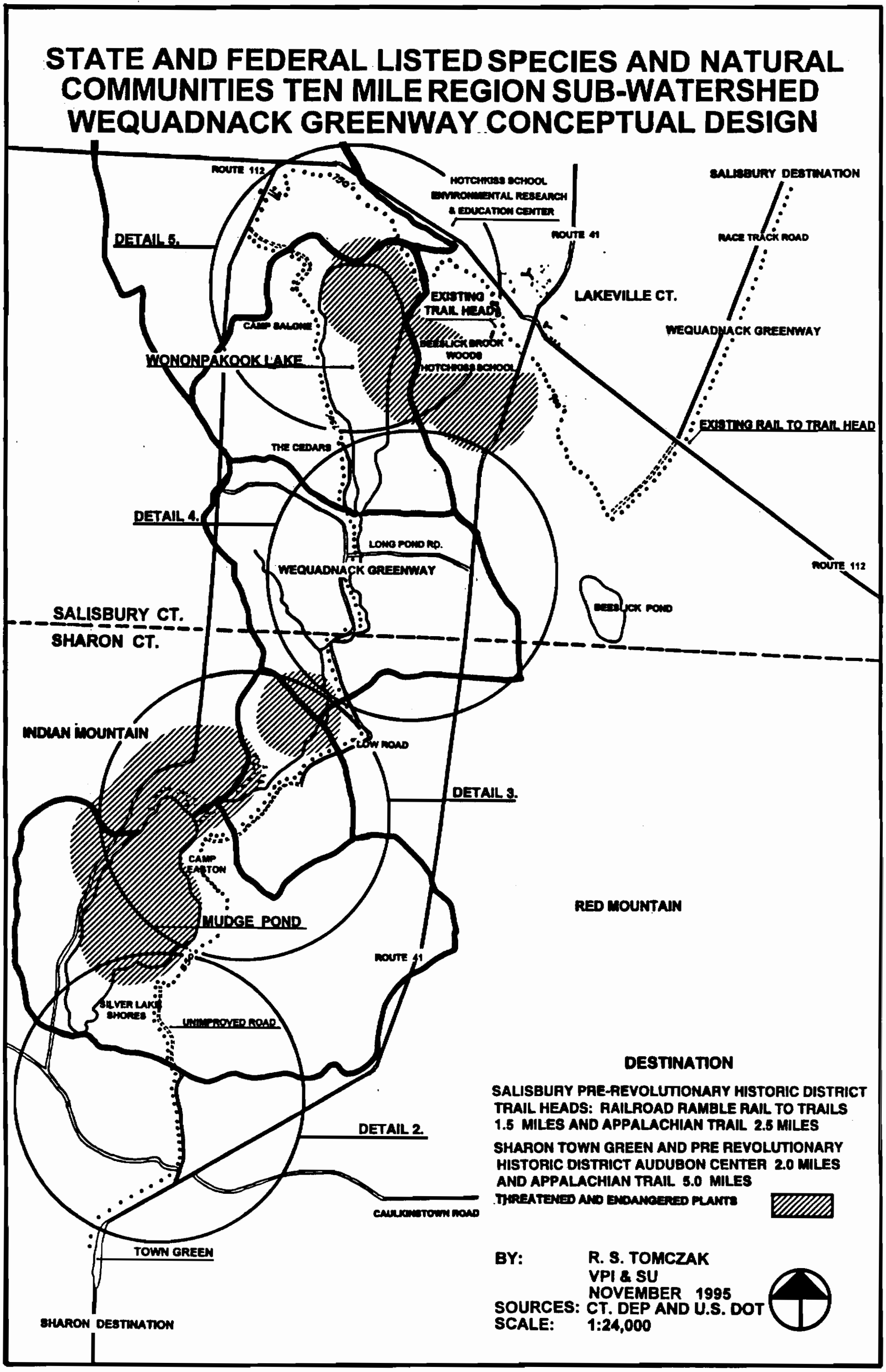
Community residents were in support of a greenway management plan that would provide a measure of water quality enhancement designed to intercept sources of non-point source pollution.

4. Socioeconomic Incentives

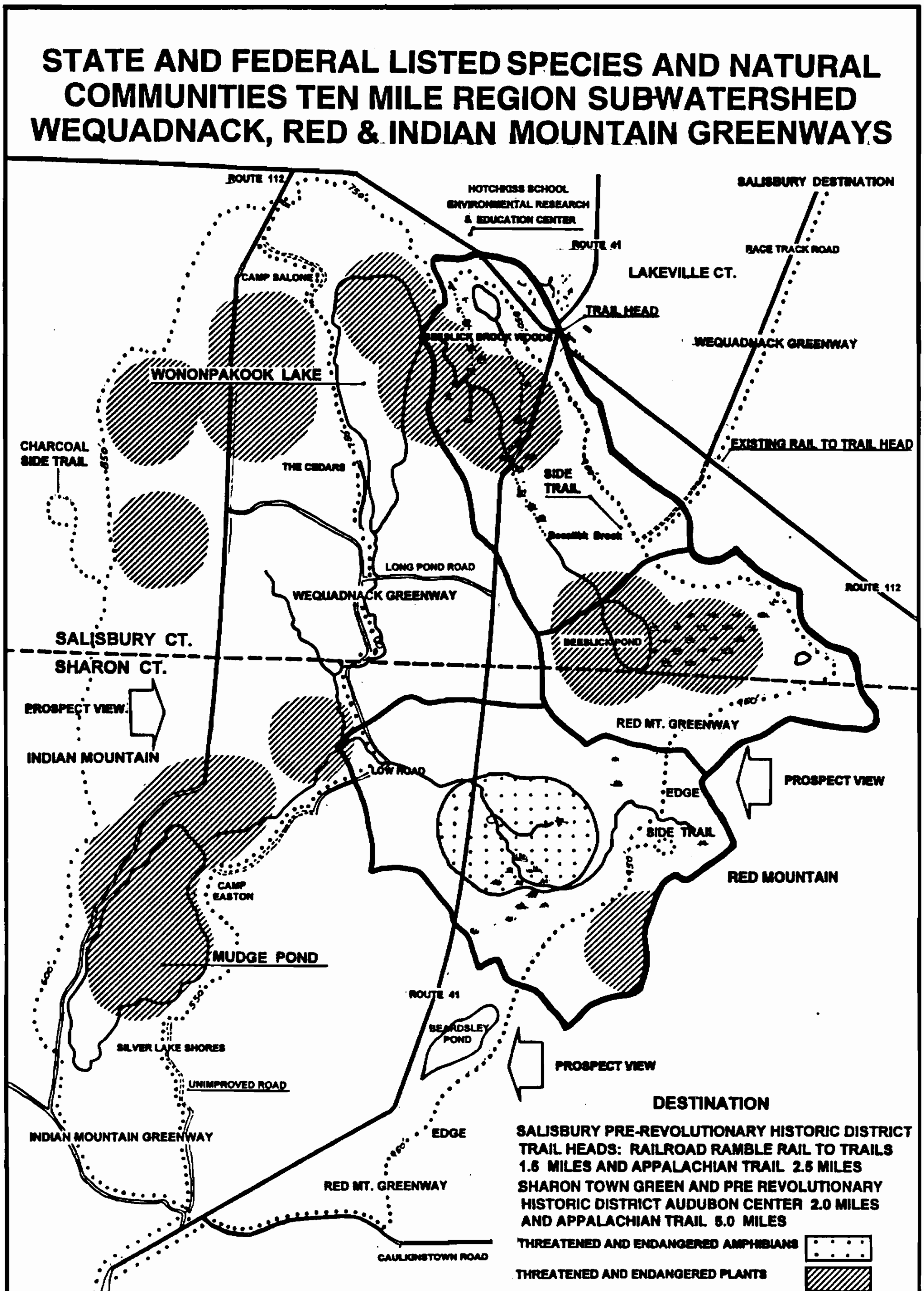
The residents surveyed would support a greenway concept that offered opportunities and environmental incentives for the farming community in the study area. The use of *Cornus stolonifera* as a potential cash crop to floriculture markets could supplement incomes to farmers.

Stage 1: Understanding Regional Context

Since water quality enhancement in the watershed was of concern, a corridor route was selected in each of the designs that would run perpendicular to surface flow along the Wequadnack, Red and Indian Mountain Greenways (Maps 10. & 11.). The design intent is to intercept and buffer surface runoff that would drain into the valley floor by the use of red osier dogwood, *Cornus stolonifera* planted in mass along specific lengths of the Wequadnack Greenway. The three (3) corridors could effectively maintain or enhance the natural features present in the Ten Mile region Sub-watershed. The potential for mountain sites to be developed does exist and could impact biological diversity in the study area. The uplands of Red and Indian Mountains, (currently undeveloped) could be preserved along the edges as future species corridors for limited recreational use.


STATE AND FEDERAL LISTED SPECIES AND NATURAL COMMUNITIES TEN MILE REGION SUB-WATERSHED WEQUADNACK GREENWAY CONCEPTUAL DESIGN
ROUTE 112
HOTCHKISS SCHOOL ENVIRONMENTAL RESEARCH & EDUCATION CENTER
SALISBURY DESTINATION
DETAIL 5.
ROUTE 41
RACE TRACK ROAD
EXISTING TRAIL HEADS
LAKEVILLE CT.
CAMP SALONE
WEQUADNACK GREENWAY
WONONPAKOOK LAKE
BEESLICK BROOK WOODS HOTCHKISS SCHOOL
EXISTING RAIL TO TRAIL HEAD
THE CEDARS
DETAIL 4.
LONG POND RD.
WEQUADNACK GREENWAY
ROUTE 112
BEESLICK POND
SALISBURY CT.
SHARON CT.
INDIAN MOUNTAIN
LOW ROAD
DETAIL 3.
CAMP EASTON
RED MOUNTAIN
MUDGE POND
ROUTE 41
SILVER LAKE SHORES
UNIMPROVED ROAD
DESTINATION
SALISBURY PRE-REVOLUTIONARY HISTORIC DISTRICT TRAIL HEADS: RAILROAD RAMBLE RAIL TO TRAILS 1.5 MILES AND APPALACHIAN TRAIL 2.5 MILES
DETAIL 2.
SHARON TOWN GREEN AND PRE REVOLUTIONARY HISTORIC DISTRICT AUDUBON CENTER 2.0 MILES AND APPALACHIAN TRAIL 5.0 MILES
THREATENED AND ENDANGERED PLANTS
CAULKINSTOWN ROAD
TOWN GREEN
BY: R. S. TOMCZAK
VPI & SU
NOVEMBER 1995
SOURCES: CT. DEP AND U.S. DOT
SCALE: 1:24,000
SHARON DESTINATION

Map 10.


STATE AND FEDERAL LISTED SPECIES AND NATURAL COMMUNITIES TEN MILE REGION SUBWATERSHED WEQUADNACK, RED & INDIAN MOUNTAIN GREENWAYS
ROUTE 112
HOTCHKISS SCHOOL ENVIRONMENTAL RESEARCH & EDUCATION CENTER
SALISBURY DESTINATION
ROUTE 41
RACE TRACK ROAD
LAKEVILLE CT.
CAMP SALONE
TRAIL HEAD
WEQUADNACK GREENWAY
WONONPAKOOK LAKE
CHARCOAL SIDE TRAIL
THE CEDARS
EXISTING RAIL TO TRAIL HEAD
SIDE TRAIL
LONG POND ROAD
WEQUADNACK GREENWAY
ROUTE 112
SALISBURY CT.
SHARON CT.
PROSPECT VIEW
RED MT. GREENWAY
INDIAN MOUNTAIN
LOW ROAD
PROSPECT VIEW
EDGE
SIDE TRAIL
CAMP EASTON
RED MOUNTAIN
MUDGE POND
ROUTE 41
BEARDSLEY POND
SILVER LAKE SHORES
PROSPECT VIEW
UNIMPROVED ROAD
DESTINATION
INDIAN MOUNTAIN GREENWAY
EDGE
SALISBURY PRE-REVOLUTIONARY HISTORIC DISTRICT
TRAIL HEADS: RAILROAD RAMBLE RAIL TO TRAILS 1.5 MILES AND APPALACHIAN TRAIL 2.5 MILES
SHARON TOWN GREEN AND PRE REVOLUTIONARY HISTORIC DISTRICT AUDUBON CENTER 2.0 MILES AND APPALACHIAN TRAIL 5.0 MILES
RED MT. GREENWAY
THREATENED AND ENDANGERED AMPHIBIANS
CAULKINSTOWN ROAD
THREATENED AND ENDANGERED PLANTS
TOWN GREEN
BY: R. S. TOMCZAK
VPI & S U
NOVEMBER 1995
SOURCES: CT. DEP AND U.S. DOT
SCALE: 1:24,000
SHARON DESTINATION

Map 11.

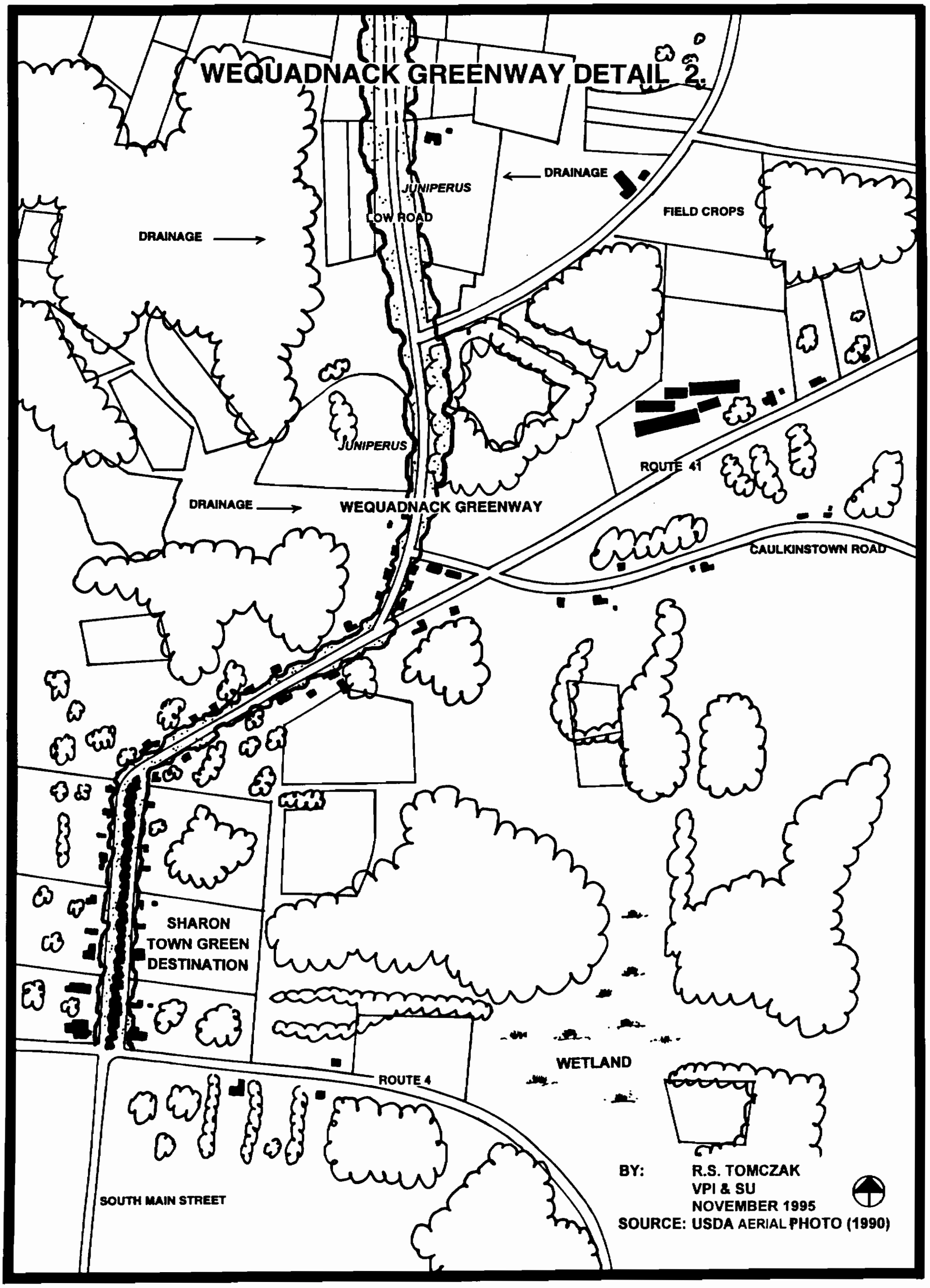
Stage 2: Selecting Project Goals And A Study Swath

The communities of Sharon and Salisbury were concerned with the enhancement and protection of biological diversity. Therefore, all three corridors were designed to avoid existing sites designated threatened. The Wequadnack Greenway affords residents and visitors the opportunity to recreate in various sections of the corridor without adverse site impact. The use of existing country roads and unimproved roads link existing summer camps and limited private lands. The three corridor routes each connect with existing trailheads in Salisbury and beyond. Each corridor design affords the community with a potential buffer and pollution control.

Stage 3: Defining Greenway Boundaries

The Wequadnack Greenway was designed through a particular area of non-point source pollution disturbance. The range and size of the disturbance areas were determined and a greenway length and width was established to mediate the effects of surface nutrients flowing into the corridor. The design intent is to intercept and buffer surface runoff that would drain into the valley floor by the use of red osier dogwood, *Cornus stolonifera* planted in mass along specific lengths of the greenway. Woody stemmed species such as *Cornus stolonifera* have deeper and more developed root systems for removal of nutrient pollutants. Active growing vegetation will further enhance the plant's uptake potential in a greenway buffer concept. Selective market harvesting of the *Cornus* species will further promote the plant's uptake capabilities in the sub-watershed discouraging the species from reaching "steady state". Most BMP buffers currently in use in a "steady state" condition returning nitrogen into the watershed through biomass upon decomposition.

Buffer width is an important criteria to consider by landscape architects contemplating its use in design. The width of a buffer can extend from two meters to nearly two hundred. Based upon mean values reported by category, however, forty-five meter buffers appear adequate to protect water quality in general, at least within fresh water systems and areas where sediment and absorbed pollutants are concerned (Pogue, Lee & Wolf 1994). Buffer width for the Wequadnack Greenway corridor concept was designed at 10 meters near residences and 45 and 90 meters for species diversity and uptake as required (Details 2., 3., 4., 5., & Figure 1.). The simple composition would provide additional quality forage for avian species as well as habitat for smaller mammals, enhancing species diversity in the sub-watershed. Each corridor offers a varied experience away from predominantly populated areas, insuring privacy for landowners that would provide easements for the series of trails.


WEQUADNACK GREENWAY DETAIL 2.
JUNIPERUS
DRAINAGE
LOW ROAD
DRAINAGE
FIELD CROPS
JUNIPERUS
ROUTE 41
DRAINAGE
WEQUADNACK GREENWAY
CAULKINSTOWN ROAD
SHARON
TOWN GREEN
DESTINATION
WETLAND
ROUTE 4
BY: R.S. TOMCZAK
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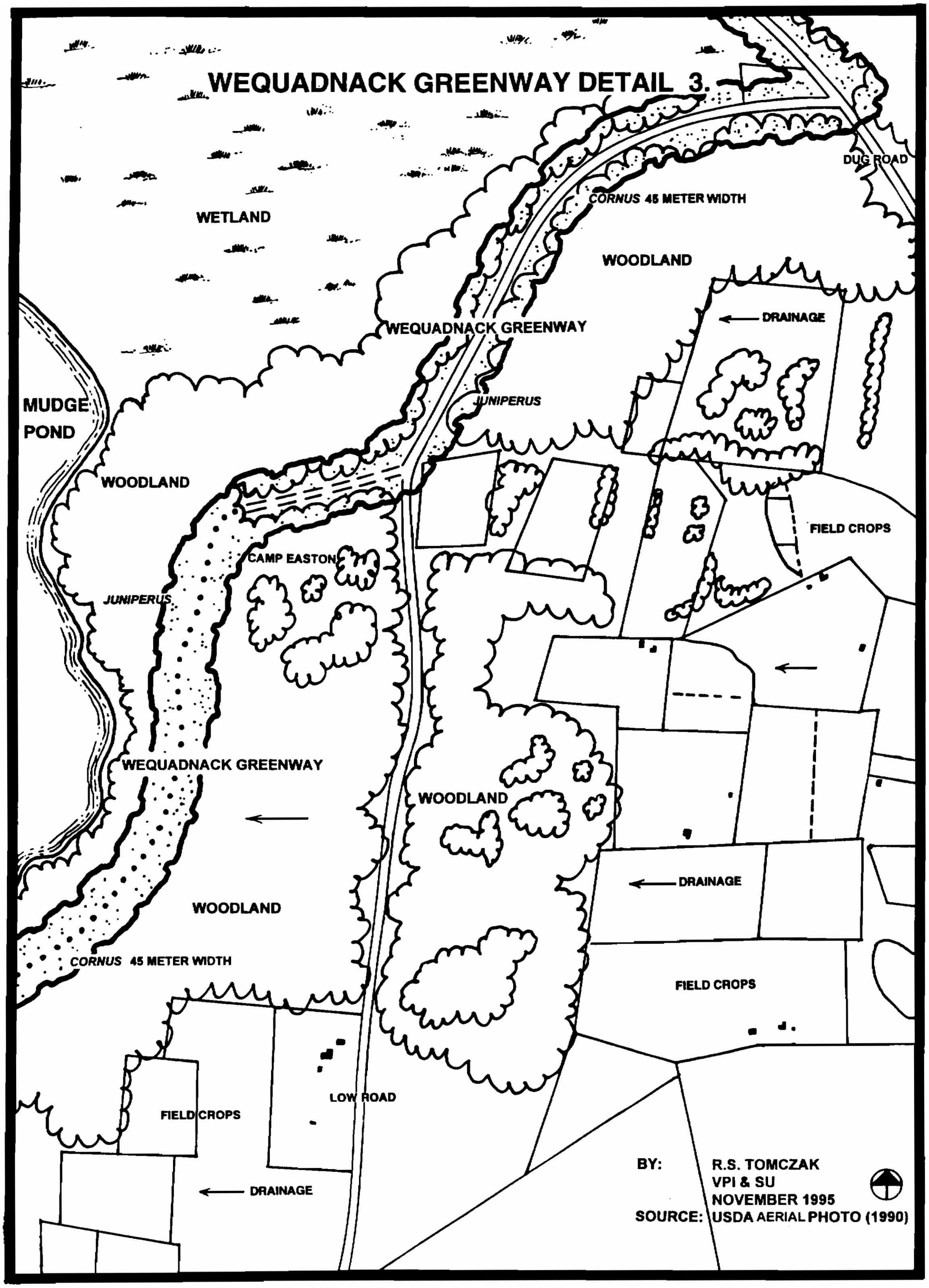
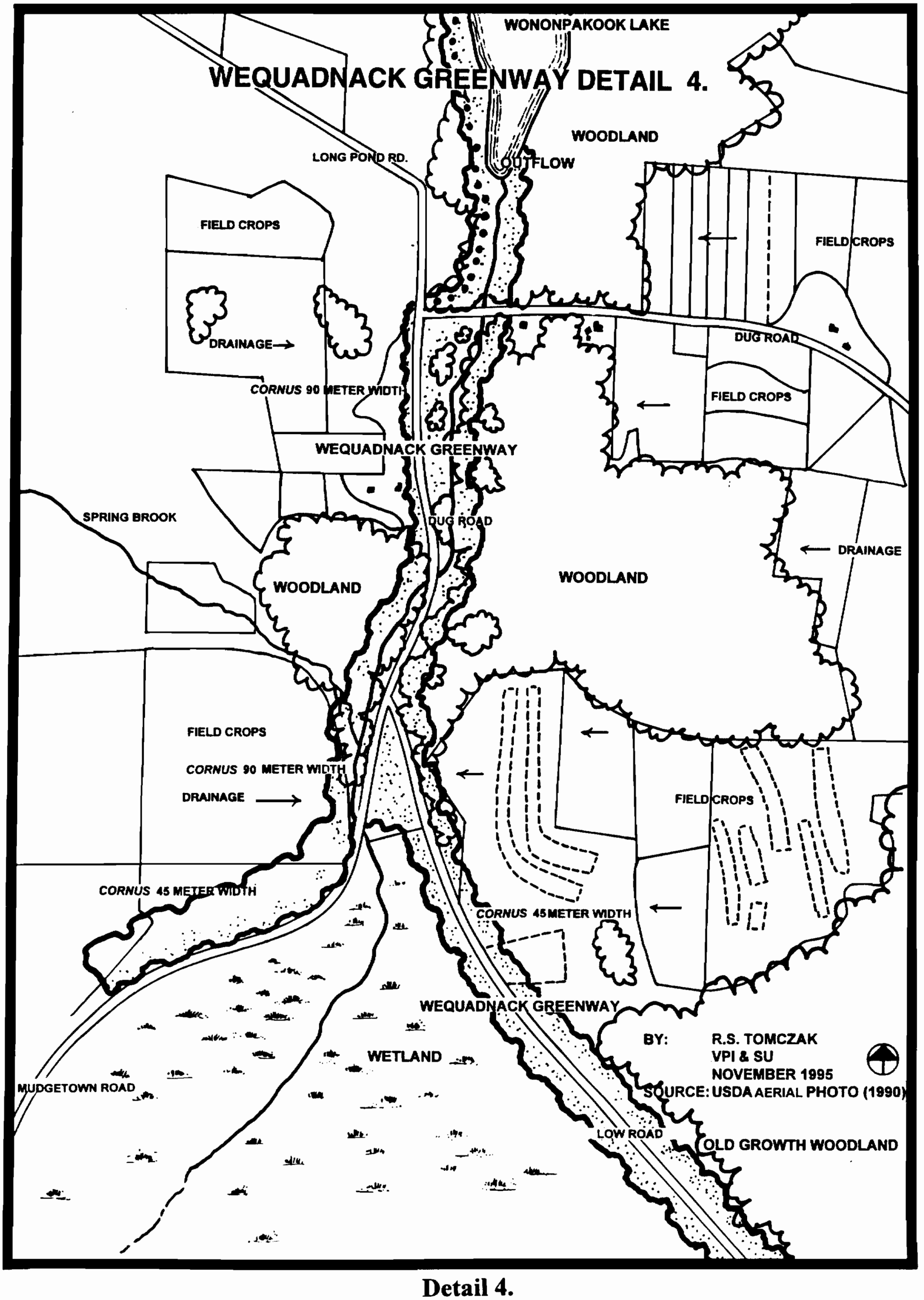
NOVEMBER 1995
SOURCE: USDA AERIAL PHOTO (1990)
SOUTH MAIN STREET

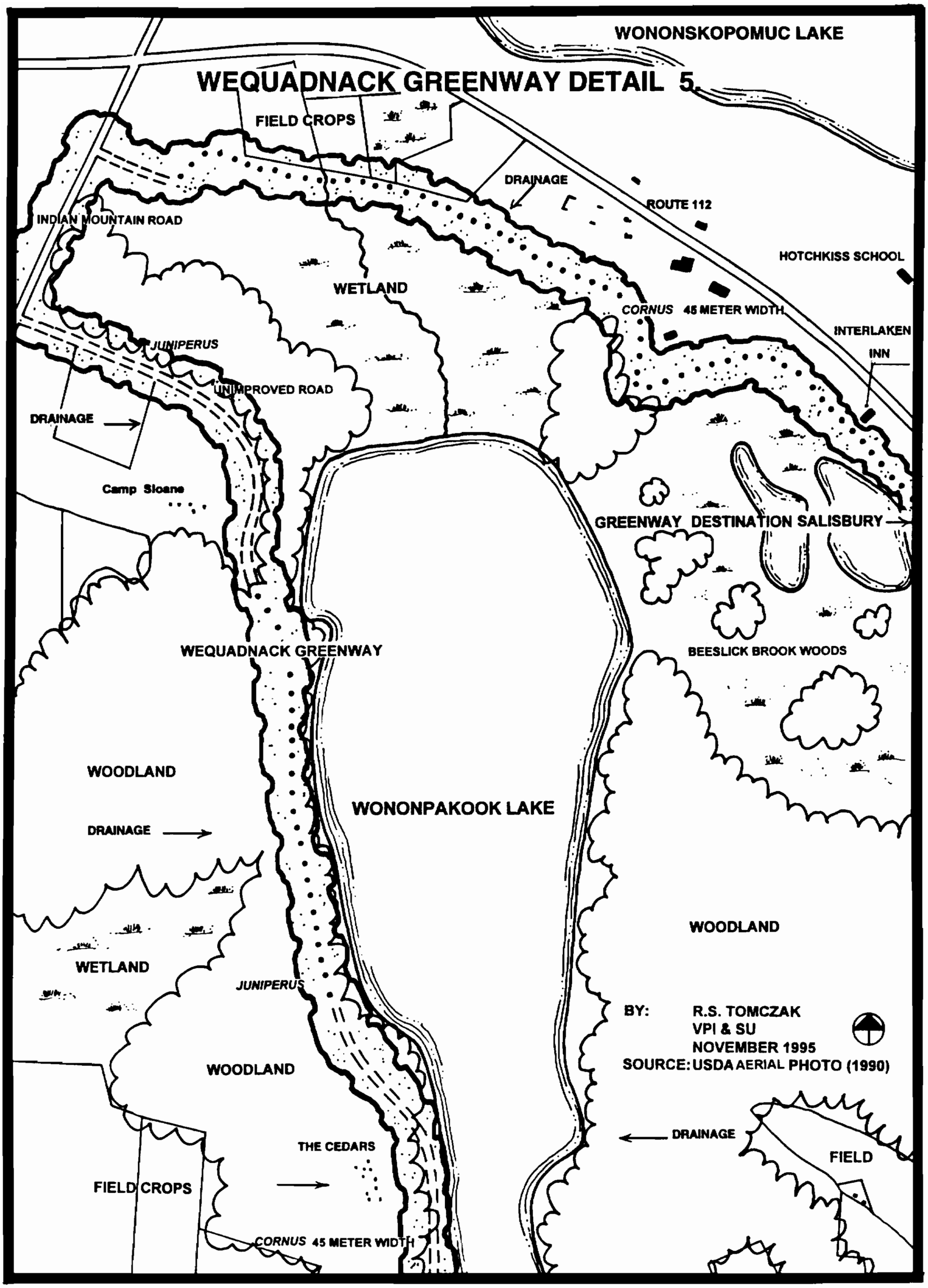
Detail 2.


WEQUADNACK GREENWAY DETAIL 3.
DUG ROAD
CORNUS 45 METER WIDTH
WETLAND
WOODLAND
DRAINAGE
WEQUADNACK GREENWAY
JUNIPERUS
MUDGE
POND
WOODLAND
FIELD CROPS
CAMP EASTON
JUNIPERUS
WEQUADNACK GREENWAY
WOODLAND
DRAINAGE
WOODLAND
CORNUS 45 METER WIDTH
FIELD CROPS
LOW ROAD
FIELD CROPS
DRAINAGE
BY: R.S. TOMCZAK
VPI & SU
NOVEMBER 1995
SOURCE: USDA AERIAL PHOTO (1990)

Detail 3.


WONONPAKOOK LAKE
WEQUADNACK GREENWAY DETAIL 4.
WOODLAND
LONG POND RD.
OUTFLOW
FIELD CROPS
FIELD CROPS
DRAINAGE
DUG ROAD
CORNUS 90 METER WIDTH
FIELD CROPS
WEQUADNACK GREENWAY
SPRING BROOK
DUG ROAD
DRAINAGE
WOODLAND
WOODLAND
FIELD CROPS
CORNUS 90 METER WIDTH
DRAINAGE
FIELD CROPS
CORNUS 45 METER WIDTH
CORNUS 45 METER WIDTH
WEQUADNACK GREENWAY
BY: R.S. TOMCZAK
VPI & SU
NOVEMBER 1995
WETLAND
SOURCE: USDA AERIAL PHOTO (1990)
MUDGETOWN ROAD
LOW ROAD
OLD GROWTH WOODLAND

Detail 4.


WONONSKOPOMUC LAKE
WEQUADNACK GREENWAY DETAIL 5
FIELD CROPS
DRAINAGE
ROUTE 112
INDIAN MOUNTAIN ROAD
HOTCHKISS SCHOOL
WETLAND
CORNUS 45 METER WIDTH
INTERLAKEN INN
JUNIPERUS
UNIMPROVED ROAD
DRAINAGE
Camp Sloane
GREENWAY DESTINATION SALISBURY
WEQUADNACK GREENWAY
BEESLICK BROOK WOODS
WOODLAND
WONONPAKOOK LAKE
DRAINAGE
WOODLAND
WETLAND
JUNIPERUS
BY: R.S. TOMCZAK
VPI & SU
NOVEMBER 1995
SOURCE: USDA AERIAL PHOTO (1990)
WOODLAND
DRAINAGE
FIELD
THE CEDARS
FIELD CROPS
CORNUS 45 METER WIDTH

Detail 5.

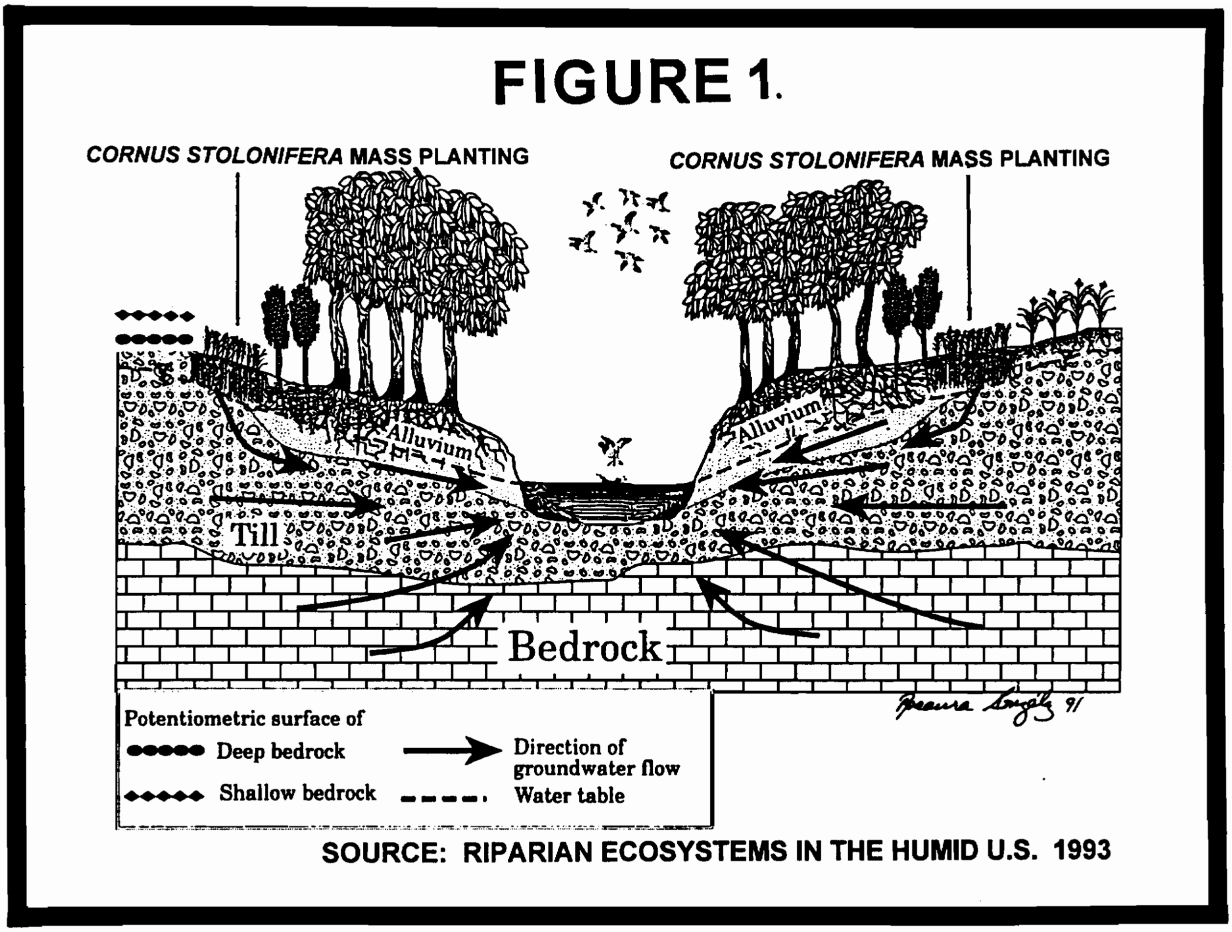


FIGURE 1.
CORNUS STOLONIFERA MASS PLANTING
CORNUS STOLONIFERA MASS PLANTING
Alluvium
Alluvium
Till
Bedrock
Potentiometric surface of
Deep bedrock
Shallow bedrock
Direction of groundwater flow
Water table
SOURCE: RIPARIAN ECOSYSTEMS IN THE HUMID U.S. 1993

Figure 1.

Stage 4: Creating And Implementing Site Designs And Management Schemes

The final stage of the design addresses the key uses of the greenway and its components that insure its effectiveness over time. Items such as natural features that are fragile and may be impacted by users need to be monitored. The type of materials used in the construction of the greenway were selected carefully so as not to disrupt the corridor's ecological trail surface integrity, using native soil and limestone fines. Recreational goals should not compromise wildlife functions of the greenway. The Wequadnack, Red and Indian Mountain corridors provide ample space for users and biological species to coexist. Details like seasonal flooding were avoided in addition to potential facilities that could disrupt other key uses of the design. Outdoor recreation along the proposed greenways could be enhanced by connecting existing trailheads like the Appalachian Trail, an existing rail-to-trail head in Lakeville and Beeslick Brook Woods at the Hotchkiss School. Additional opportunities exist by linking former charcoal roads, utilized by earlier iron ore colliers when the region was first settled. Beeslick Preserve, currently Nature Conservancy land, could be accessed by selected groups of environmental students and others from a future environmental center facility designed on the grounds of the Hotchkiss School. These forms of outdoor recreation and nature study could broaden the economic base of the region by bringing in revenue to local businesses.

CHAPTER IV.

Conclusions

More and More landscape architects and others will be called upon in the future to develop greenway corridors that are holistic in concept. Future generations will benefit from their combined efforts to establish a network of corridors that will stand the test of time by following sound principles of ecological design. This study has brought forth a series of ecological based greenway principles to an existing region of northwest Connecticut that has not previously experienced this type of endeavor. The implementation of principles adapted from Paul Hellmund's ecological model for greenway design were employed in developing a series of greenway corridors for the Ten Mile Region Sub-watershed. The scientific based principles offer designers the building blocks necessary for creating linear corridors that are much more comprehensive in structure and function than the formation of simple recreational trails. Historic destination points (Salisbury and Sharon) diversified landscape features (including mountain slopes, farmland and wetland), the protection of natural resources, and provision for recreational and interpretive experiences for users, were each brought forth in the study area through the use of the Ecological Greenway Design Method.

Strength's and Weaknesses of Hellmund's Ecological Greenway Design Model

The strength of the Ecological Greenway Design Model lies in its comprehensive approach to greenway management. The approach is one that can be adapted to other planning programs and design settings by design professionals. The model provides a series of overall questions that leads the practitioner from one stage of the greenway planning and design endeavor to another helping to focus on substantive environmental and sociocultural issues. Factors such as biological diversity, water quality, and outdoor recreation are each focal points within Hellmund's stages, helping to assure that these issues are accounted for in appropriate ways and ultimately lead to greater acceptance of a greenway program by the public. Furthermore, Hellmund's greenway model addresses the importance of applying his four stages of ecological principles that are easy to follow when approaching such a complex subject initially. The step by step process provides landscape architects and others with the important strategies for implementing a scientific approach to proposed greenway planning and design. Another apparent strength is the acceptance of his principles by lay persons, particularly property owners. Returns of the mail survey questionnaire revealed that ecological issues such as biological diversity, water quality enhancement and environmental land preservation were at the forefront of the peoples concerns in the thesis study area. The general acceptance of Hellmund's ecological greenway design method in the study area should offer encouragement to greenway planners. The apparent enthusiasm of the public to the ecological geenway method offers the prospect for its use in the development in other areas. One final strength of the Ecological Greenway Design Method lies in its ability to lead to a broad range of meaningful alternatives. The open structure of the four stages is invaluable with regards to the process of contriving a particular scheme that fits with the rural region it is tested in.

A weakness in the model is highlighted by the political issues facing towns in the study area. In this and many provincial regions of New England new ideas or plans are not readily accepted despite scientific evidence supporting these ideas or plans. Grassroots advocates who are public opinion leaders can lend strong support in a greenway project if it becomes popular with them and their constituents. Therefore, it is important for the designer to recognize this fact early on in their attempt to communicate concepts and to establish credibility among these potential allies. Furthermore, Hellmund does not offer any strategies for thinking about long term management or stewardship for prospective greenway projects. The ultimate success or failure of a design concept could rest in large part on short and long range policies that should be considered and developed during Hellmund's four stages. Lastly, it is possible that the model itself may be too comprehensive in its approach. The length of each stage could be pared down to reduce the time required to complete a conceptual design. Designers can go into greater detail once a conceptual design has been brought to the public and other reviewing groups.

Importance of Public Participation in Greenway Development

After a careful analysis of Hellmund's principles for ecological greenway design the author prepared and sent out a questionnaire to residents in the study area. Following receipt and review of the questionnaire a systematic telephone random sampling of residents in the study area was done. The four key questions asked in the telephone sampling revealed that the respondents averaged well over 97 percent in their desire to preserve the quality of existing streams, lakes and ponds. 90 percent favored a corridor trail, 93 percent would walk it and 83 percent would be willing to use existing roads or utility easements. Based on the encouraging results of the telephone random sampling, a detailed list of corridor design questions was prepared that paralleled Helmund's process of ecological greenway design. The author learned through research and personal interviews that the public was indeed interested in an ecologically sensitive greenway concept that could enhance and preserve the existing natural environment in their communities.

Earlier efforts by ad hoc pro greenway groups met without success because the focus of their greenway blueprint was primarily the trail itself intended strictly for recreational purposes. These earlier concepts were not considered a best management plan because it was not holistic in its approach to planning a greenway. The narrow view for greenway design was not acceptable to the responding public and was therefore defeated as a plan worthy of introduction into the community.

In the process of interviewing residents it was discovered that the author's method of inquiry was one of the first times that a questionnaire had been used to obtain public input. This participatory approach was a departure from the norm as planning decisions are often discussed and acted upon behind closed doors. For the greenway management plan the public was given the opportunity to respond to a series of questions that helped the designer to develop several possible greenway alternatives developed for the thesis. The questionnaire was thus shown to be a valuable asset in the initial presentation of a preliminary greenway plan for public review. The strategy earned the respect of the citizens in the proposed study area, resulting in greater acceptance of the recommended greenway management plan.

Returned questionnaires revealed that most of the 19 questions were answered in full. The rendered greenway map that accompanied the survey was not generally filled in by the respondents, perhaps because some of the map graphics were somewhat confusing. Some questions, such as question #1, were found to be ambiguous because both a positive and negative response were requested with the same question. On the other hand, allowing the respondents to add their own comments proved an invaluable way to glean additional information and constructive suggestions related to the scociocultural, political/legal environmental, recreational, and management context for the proposed greenway. The questionnaire also allowed residents time to reflect about the issues related to developing and adopting the greenway concept and they were not pressed in responding to a series of questions through an on-the-spot interview. Some questionnaires were observed unopened in trash receptacles at the Salisbury and Sharon post office, however, this phenomenon was not considered unusual considering the volume of advertising regularly allowed into postal patron box's. The author learned that the .5 percent return was considered reasonable for a questionnaire sent out in this region (Cox 1995). A higher net return might have resulted if the questions asked would have been fewer in number and shorter in length.

A questionnaire or similar type of written survey is just one of several approaches possible in querying the public to determine what their needs and interests are in relation to a proposed greenway or other design concept. Although questionnaires can be more limiting than an interactive workshop or a public meeting the value of a questionnaire lies in its ability to offer respondents a private method of expressing their viewpoints and of reaching the population in a given study area.

Strength and Weakness of the Greenway Management Plan for Salisbury and Sharon, Connecticut

The strength and weakness of any greenway design program lies in the hands of the designer who may or may not address the myriad of issues facing a community. There are fortunately many sources of greenway information available through publications, subject texts, seminars, professionals for various fields, and the academic community. In addition, to similar, built greenway projects are an excellent reference point. Each source can serve a designer well. Paul Hellmund's scientific model used and evaluated in this study, offered excellent guidance in considering the diversity of biophysical and sociocultural issues related to the location and function of a greenway design.

One of the strengths of addressing a broad range of concerns in the development of a greenway is that more folks are likely to have an interest in its short and long term success involving them in the process of developing a greenway plan will help increase their interest. For example, stewardship and management of greenway corridors can be carried out by volunteer residents and students, who could be organized to help research the long term effects of implemented greenway concepts. The findings from selected research efforts could than be used to help promote additional environmental benefits in the greenway corridor.

It is noteworthy for designers to recognize that "time" can adversely affect the original design intent of a proposed greenway concept. Land use policy can indeed alter the biological, and recreational use of a corridor-as exemplified in the Blue Ridge Parkway in the State of Virginia. In some locations along the Parkway there were no provisions for visual buffers to insure the long term integrity of viewsheds, and in time these viewsheds were disrupted visually because of development along the edge of the Parkway. Time should be considered an element of design by every planner and landscape architect with greenways being no exception. There is one way in which landscape design differs substantially from all other arts, and that is the part which time must play (Crowe 1981).

In the final analysis, public involvement, along with the expertise of professional engineers, biologists, ecologists, planners, town officials, etc., are needed to successfully create a greenway that functions well through time and in space. The role of the landscape architect, with his/her knowledge of science, engineering and design, can naturally move into the role as project manager or team leader of such a diversified endeavor. A interdisciplinary approach is essential in dealing with the myriad of tasks that need to be accomplished.

The establishment of a greenway committee could be enacted to help provide, implement and monitor the project. Community participation can sustain a greenway over the long term. The project manager, greenway committee and public can work together to establish short and long range polices that reflect the central desires of the community. A preservation trust could be established in order to help establish conservation easements or otherwise legally acquire greenway properties contiguous with each other and the greenway. Abutting land owners could help to monitor their own sections of the corridor and provide volunteer services in resource inventories. The greenway committee should seek many supporters and resources as possible in achieving its final objective of providing a viable long range best management plan that restores or retains the integrity of the cultural landscape. Landscape architects and other design professionals cannot expect a potential concept to carry itself on the strength of any one design model. The "Four Stage Model" of Ecological Greenway Design adopted in this study is no exception. In the final analysis, greenway design models should be considered a means to an end for a prospective greenway concept but not an end in themselves.

A final note is made regarding a future research need highlighted in the body of this thesis. Additional research should address the marketability of *Cornus stolonifera* in the international floral industry. Economic incentives for farmers will encourage the use of red-osier dogwood to intercept and buffer surface runoff along the valley floor. The general public can also be encouraged to use red-osier dogwood on their lands for similar purposes. Nitrate uptake studies of *Cornus stolinifera* (and other plant species) could improve the use of such plants by landscape architects, landscape designers, contractors, farmers and land managers in this and other areas. Other native plants, woody and herbaceous, may provide important ecosystem services presently missing, and could also help restore or maintain local diversity and ecological integrity.

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Dear Resident:

May I take a few moments of your time to introduce myself. I am a resident of Sharon, Connecticut and a graduate student of Landscape Architecture at Virginia Polytechnic Institute and State University (Virginia Tech), near the Appalachian Trail in Blacksburg, Virginia.

The purpose of this letter is to acquaint you with my effort to test an ecological greenway model in Sharon and Salisbury.

What is a Greenway?

> A greenway is a linear open space established along a natural corridor such as a riverfront, stream valley, or ridgeline, a corridor along a railroad right-of-way converted to recreational use, or a canal, scenic road or other route. It is any natural or landscaped course for pedestrian and/or bicycle passage. adapted from *Greenways For America* by Charles Little
>
> Greenways offer powerful strategy for helping to maintain ecological integrity in human-dominated landscapes, especially with regard to preserving biological diversity and maintaining high quality water. adopted from *Ecology of Greenways* by Daniel S. Smith and Paul Hellmund

The model I am testing is outlined in the book Ecology of Greenways and focuses on the use of greenways for the combined purposes of water quality protection, biological diversity and recreation. I believe that the design ideas presented in the text are relevant to the needs of the communities of Salisbury and Sharon. Hence, I have decided to test their model in my own landscape architecture design thesis.

The following questionnaire is an important aspect of the model and it gives me the opportunity to better understand the needs of the area and to include your comments in my research. I have included on the reverse side of this cover letter the study area which is shown encompassed by a bold boundary line.

As you finish the questionnaire, please let me know if there are specific features in the study area that you think should be accessed, protected and/or made off-limits to greenway users. Please note these features on the map and draw a line or lines where you think a greenway or network of greenways might run.

It is extremely important to me to have responses from residents of both Salisbury and Sharon before I recommend greenway corridors in my design thesis. Because of this, I am sending this questionnaire to all postal patrons within the study area. Your responses will be confidential; ideas will be presented in my thesis but no names presented (unless you otherwise indicate that you would like to be referenced).

In order for me to incorporate your thoughts into my thesis work, I need you to answer the questionnaire and mail it back (REFOLD AND STAPLE) as soon as you can. To be included in my document I need your response by September 30, 1995.

Thank you very much for your time and ideas. Please feel free to add any comments that you think would help to guide my thesis work on greenways for the Sharon and Salisbury.

Sincerely,
Robert S Tomczak
Robert S. Tomczak
student of landscape architecture
Virginia Tech

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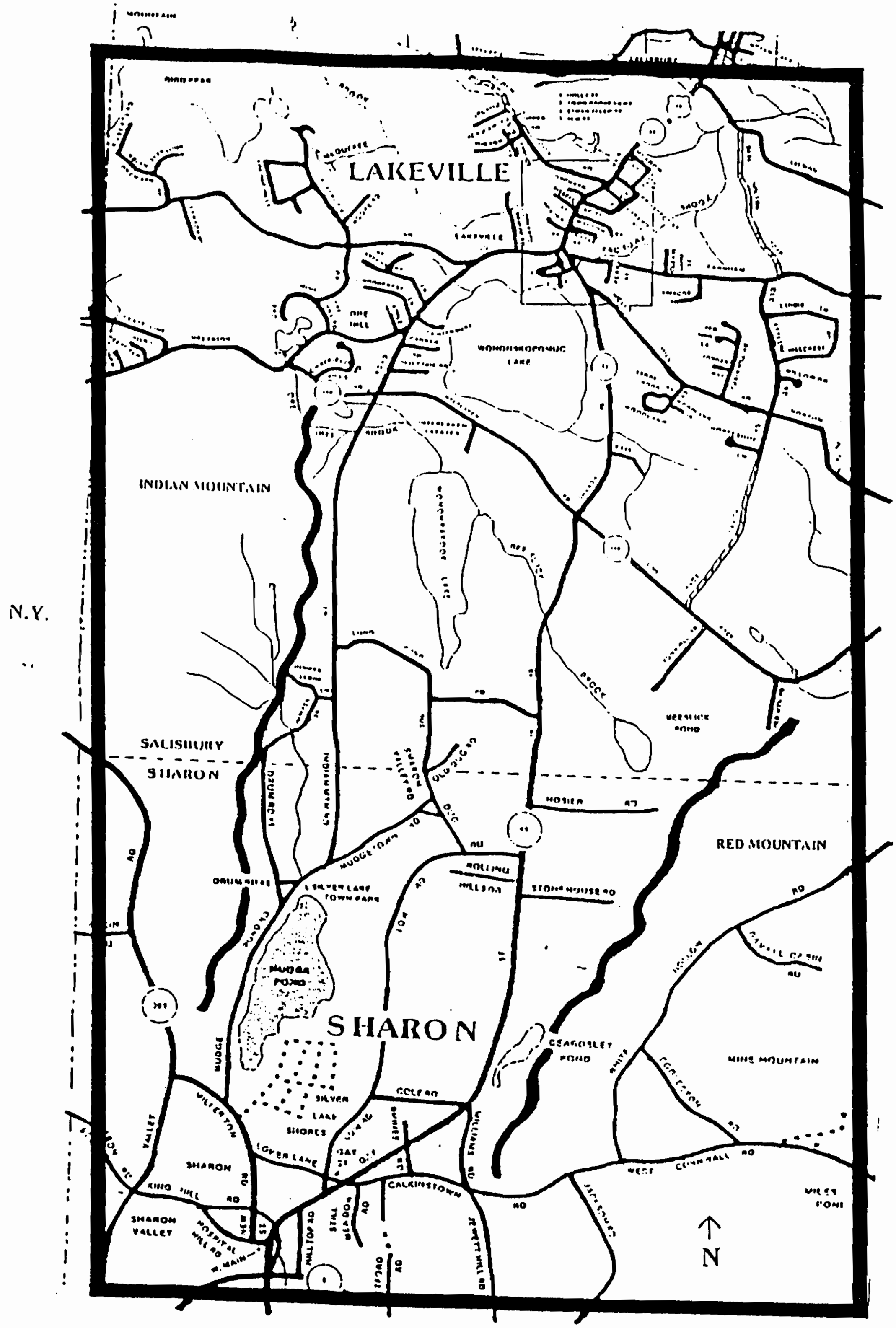

LAKEVILLE
INDIAN MOUNTAIN
N.Y.
SALISBURY
SHARON
RED MOUNTAIN
MUDGE POND
SHARON
SILVER LAKE SHORES
CALKINSTOWN
KING HILL RD
SHARON VALLEY
N

QUESTIONNAIRE

1. **If a greenway trail(s) were designed, what features do you feel should be accessed protected and/or made off limits? (Please refer to the enclosed map).**

2. **Are there any natural or cultural/historic features in Sharon Valley that you would like included in a greenway design?**

3. **Greenways can serve communities as recreational amenities...Please rank your top five choices.**

   walking
   jogging
   Cycling
   Cross Country Skiing
   Bird Watching
   Picnicking
   Other:

4. **Greenways can function as transportation and information corridors...Please rank your top three choices the greenway would serve you. From Highest 1 to Lowest 3.**

   To connect home and workplace
   To reduce automobile dependence
   To educate and interpret
   To link home with recreational destinations
   To visit neighbors
   Other:

5. **Greenways often protect views along their paths...What views are most important to you. Please rank in order from lowest in importance 6. to highest 1.**

   Valley Views
   Farm Lands
   Water Features Streams, Ponds & Lakes
   Wetlands
   Woodlands
   Hedgerows

6. **Greenways often preserve wildlife habitat and biological diversity...Would you provide an easement for a greenway trail corridor along or near your property for wildlife habitat or biological diversity?**

Yes
No
Other :

7. **Greenways often function as filter strips reducing surface sediments, pesticides and fertilizers from entering streams, ponds and lakes...Would you support a filter strip easement on your property to accomplish the latter.**

Yes
No
Other:

8. **Farmers are now establishing filter strips and realizing profits from plants grown and harvested for the floral industry...If you are a farmer would you be interested in participating in such a program?**

Yes
No
If No, Please Comment
If Yes, how many feet of land would you contribute or place in easement?
10' to 25'
25' to 50'
50' to 100'
100' to 600'
Over 600'

9. **Would you be in favor of linking other existing nature trails with a major greenway corridor in Sharon Valley?**

Yes
No

10. **Would you be in favor of linking a major greenway corridor with historical/cultural features such as the charcoal roads still present in our woodlands and once part of the iron industry in Sharon and Salisbury?**

Yes
No
Other:

11. What objections if any would you have regarding the establishment of a greenway trail on or near your property? Please list and rank comments in order i.e.: Highest 1. privacy etc.

12. A greenway or trail corridor linking Salisbury and Sharon could be designed along a low elevation between Long Pond and Mudge Pond or a higher elevation for example at the forest edge of Indian or Red Mountain. Please Indicate Your Choice.

13. Would you use a greenway trail that made use of existing roads, abandoned roads and/or former power line corridors? (If Available)

Yes
No

14. Greenway surfaces are a concern of trail users...Please indicate the type of surface that most appeals to you.

Asphalt
Compacted Gravel Aggregate
Limestone Fines
Native Soil
Other (Please Comment)

15. What types of greenway site features would be important to you? Please indicate your choice by marking yes or no after each item.

Fencing	**Yes**	**No**
Vehicle Barriers	**Yes**	**No**
Boardwalks	**Yes**	**No**
Shelters	**Yes**	**No**
Benches	**Yes**	**No**
Trash Receptacles	**Yes**	**No**
Camping Facilities	**Yes**	**No**
Others	**Yes**	**No**

16. Stewardship is critical to the success of any greenway corridor linking communities...Would you volunteer time to maintain the integrity of a greenway trail?

Yes
No

17. How would you use a greenway if one were created in Sharon Valley?

18. There is currently a design proposal to develop the *Housatonic River Belt Greenway* along the Housatonic River in Sharon and Salisbury...Do you believe that the river is accessible to residents?

Yes
No
Comment:

19. Please provide additional comments...

QUESTIONNAIRE RESPONSES

1. **If a greenway trail(s) were designed, what features do you feel should be accessed, protected and/or made off limits? (Please refer to the enclosed map).**

    Sensitive habitats should be avoided, diversify as many natural features in the study area as possible.

2. **Are there any natural or cultural/historic features in Sharon and Salisbury that you would like included in a greenway design?**

    Link the towns of Salisbury and Sharon. Include former charcoal roads in the Indian Mountain and Red Mountain Area was the general consensus.

3. **Greenways can serve communities as recreational amenities...Please rank your top five choices.**

    Complete Responses 82

Walking	**Rank**	**1**	**56**
	Rank	**2**	**14**
	Rank	**3**	**4**
	Rank	**4**	**4**
	Rank	**5**	**2**
Jogging	**Rank**	**1**	**3**
	Rank	**2**	**8**
	Rank	**3**	**23**
	Rank	**4**	**17**
	Rank	**5**	**19**
Bird Watching	**Rank**	**1**	**1**
	Rank	**2**	**19**
	Rank	**3**	**18**
	Rank	**4**	**21**
	Rank	**5**	**21**
CC Skiing	**Rank**	**1**	**1**
	Rank	**2**	**17**
	Rank	**3**	**18**

	Rank	4	24
	Rank	5	20
Cycling	Rank	1	12
	Rank	2	21
	Rank	3	19
	Rank	4	10
	Rank	5	13

Other:

1. Sitting Meditatively
2. Foraging
3. Nest Boxes
4. Roller Blading
5. Observing Plants
6. Canoeing
7. Observing Nature

8...10. HorseBack Riding

11. Picnicking
12. Canoeing

4. Greenways can function as transportation and information corridors...Please rank the top three choices of how the greenway would serve you.

Complete Responses __67__

To connect home and workplace	Rank	1	2
	Rank	2	3
	Rank	3	9
To educate and interpret	Rank	1	20
	Rank	2	14
	Rank	3	22
To visit neighbors	Rank	1	3
	Rank	2	2
	Rank	3	16
To reduce automobile dependence	Rank	1	30
	Rank	2	21
	Rank	3	9

To link home and recreation destinations	**Rank**	**1**	**14**
	Rank	**2**	**31**
	Rank	**3**	**13**

Other:

1. **To get outside**
2. **Quiet walking exercise**
3. **To keep environment o.k.**
4. **Enjoy nature**
5. **Walk dog**
6. **Recreation**
7. **Safe biking**
8. **Pleasant trail walking**
9. **Pleasure**
10. **Preserve nature**
11. **Recreational**
12. **Recreation**
13. **Exercise**

5. Greenways often protect views along their paths...What views are most important to you. Please rank in order from highest 1. To lowest 6.

Complete Responses 95

Valley Views	**Rank 1**	**42**
	Rank 2	**19**
	Rank 3	**21**
	Rank 4	**13**
	Rank 5	**5**
	Rank 6	**0**
Water Features Streams, Ponds & Lakes	**Rank 1**	**38**
	Rank 2	**33**
	Rank 3	**16**
	Rank 4	**19**
	Rank 5	**3**
	Rank 6	**0**
Woodlands	**Rank 1**	**7**
	Rank 2	**18**
	Rank 3	**28**
	Rank 4	**25**
	Rank 5	**12**
	Rank 6	**6**

Farm Lands	**Rank 1**	**10**
	Rank 2	**10**
	Rank 3	**22**
	Rank 4	**18**
	Rank 5	**23**
	Rank 6	**13**
Wetlands	**Rank 1**	**3**
	Rank 2	**14**
	Rank 3	**8**
	Rank 4	**30**
	Rank 5	**28**
	Rank 6	**12**
Hedgerows	**Rank 1**	**1**
	Rank 2	**0**
	Rank 3	**2**
	Rank 4	**6**
	Rank 5	**26**
	Rank 6	**61**

6. Greenways often preserve wildlife habitat and biological diversity...Would you provide an easement for a greenway trail corridor along your property for wildlife habitat or biological diversity?

Complete Responses	**<u>99</u>**
Yes	**76**
No	**23**
Other Responses	**25**

Other:	**1.........4.**	**Renting**
	5.......10.	**Depends on how it's monitored.**
	11.	**Dependent on nature of greenway.**
	12.	**Yes, for wildlife, no, for human use.**
	3.	**Yes, as long as property was respected.**
	14.	**Yes, but no hunting.**
	15.	**Already have.**
	16.	**Don't live in area covered by map.**
	17.	**I have my own wildlife habitat.**
	18......21.	**Depends**
	22.	**Own property in common, agree to an easement.**
	23.	**Possible**

24.	Would depend when and how much.
25.	Not sure.

7. Greenways often function as filter strips reducing surface sediments, pesticides and fertilizers from entering streams, ponds and lakes...Would you support a filter strip easement on your property to accomplish the latter.

Complete Responses	102
Yes	84
No	18
Other Responses	20

Other:	1.	Depends on degree to which it impacts use of property.
	2..........3.	Possible
	4.	Not needed.
	5..........8.	Rent
	9.	Don't live in the area.
	10.	Already have.
	11.	Don't understand details of a filter strip.
	12.	We are already protected.
	13.	Not with taxpayers money.
	14........20.	Not applicable

8. Farmers are now establishing filter strips and realizing profits from plants grown and harvested for the floral industry...If you are a farmer would you be interested in participating in such a program?

Complete Responses	14
Yes	8
No	6
Other Responses	54

Other:	1.	Yes, 50' to 100' responding as a wanna be property owner.
	2.	I have farm land 50' to 100'.
	3.	No, I am a farmer.
	4.	Yes, I am not a farmer have open land.
	5.	Yes, 10' 25'.
	6.	No, I don't believe in giving easements.
	7.	No, I'm capable of managing my property as my forebears for 100 years.
	8.	Bad idea.

9. Yes, are these linear feet? I have 300' on Salmon Kill and would participate!
10. I am not a farmer but endorse filter strips.
11. Why ask when so few are farmers.
12. I would if I were a farmer.
13. Yes, can consult with our seeding with native wildflowers.
14. Yes, 10' 25'
15. No, A farmer needs as much land as he can get.

9. Would you be in favor of linking other existing nature trails with a major greenway corridor in Sharon and Salisbury?

Complete Responses	<u>123</u>
Yes	102
No	21

10. Would you be in favor of linking a major greenway corridor with historical/ cultural features such as the charcoal roads still present in our woodlands and once part of the iron industry in Sharon and Salisbury?

Complete Responses	<u>116</u>
Yes	103
No	13

Other:

1. Unless it interrupts the integrity of other venues such as the Appalachian Trail.
2. Depends on location.
3. Need more information.
4. Perhaps
5. Yes, only if horses are allowed.
6. We don't want a Stockbridge.
7. Would extend scope.
8. Only if it makes practical sense.
9. Possibly
10. Yes, If they don't encroach on private land too closely.
11. Not sure.
12. Yes, if landowners voluntarily agreed/not with public funds.

11. What objections if any would you have regarding the establishment of a greenway trail on your property? Please list and rank comments in order i.e.: 1. Privacy etc.

Complete Responses **<u>152</u>**

Response Categories

1.	**Privacy**	**65**
2.	**Litter**	**17**
3.	**Vandals**	**8**
4.	**Control of Private Property**	**11**
5.	**Security**	**5**
6.	**Not Applicable**	**20**
7.	**Noise**	**9**
8.	**Liability**	**7**
9.	**Destruction of Property**	**2**
10.	**One Each-Property Value, Hunters, Don't Know, Pollution, Aesthetics, Daytime Use, and Teenage Drinking**	**8**

12. A greenway trail corridor linking Salisbury and Sharon could be designed along a low elevation between Long Pond and Mudge Pond or a higher elevation for example, at the forest edge of Indian or Red Mountain. Please Indicate Your choice.

Complete Responses	**<u>116</u>**
Low Elevation	**53**
High Elevation	**63**

13. Would you use a greenway trail that made use of existing roads, abandoned roads and/or former power line corridors. (If Available)

Complete Responses	**<u>126</u>**
Yes	**115**
No	**11**

14. Greenway surfaces are a concern of trail users...Please indicate the type of surface that most appeals to you.

Complete Responses	**<u>123</u>**
Asphalt	**5**
Native Soil	**106**
Limestone Fines	**9**

Other	Wood Chips	2
Other	Fine Gravel	1

15. What types of greenway features would be important to you? Please indicate your choice by marking yes or no after each item.

Complete Responses <u>119</u>

Fencing	Yes	29	No	90
Boardwalks	Yes	39	No	80
Benches	Yes	84	No	35
Camping	Yes	17	No	102
Vehicle Barriers	Yes	105	No	14
Shelters	Yes	39	No	80
Trash Receptacles	Yes	93	No	26

Other:

1. Carry out what you bring in.
2. Drinking water and emergency telephone.
3. Features, information maps, rules.
4. Carry own shelter.
5. Stiles to cross fences.
6. Informative sculptures.
7. Picnic tables.
8. Map signage.
9. Public parking.
10. Exercise stations.

16. Stewardship is critical to the success of any greenway corridor linking communities...Would you volunteer time to maintain the integrity of a greenway trail?

Complete Responses	<u>119</u>
Yes	81
No	38

17. How would you use a greenway if one were created in Sharon or Salisbury?

The majority of respondents would use the trail for walking.

18. There is currently a design proposal to develop the *Housatonic River Belt Greenway* along the Housatonic River in Sharon and Salisbury...Do you believe that the river is accessible to residents?

Complete Responses	**110**
Yes	**71**
No	**39**

The respondents indicated that the river was generally accessible to the public.

19. Please provide additional comments...

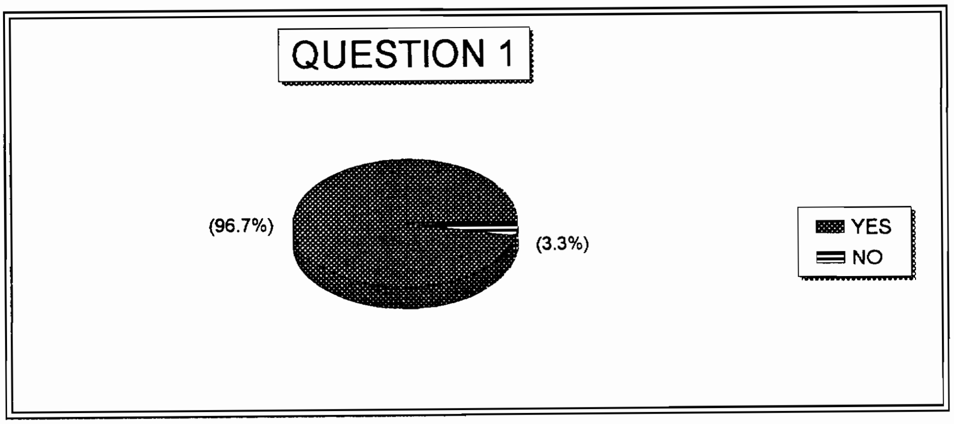
Comments ranged generally in favor of the concept with detractors indicating that lack of privacy, control of private property, vandalism and litter could become issues.

APPENDIX A

Systematic Telephone Random Sampling

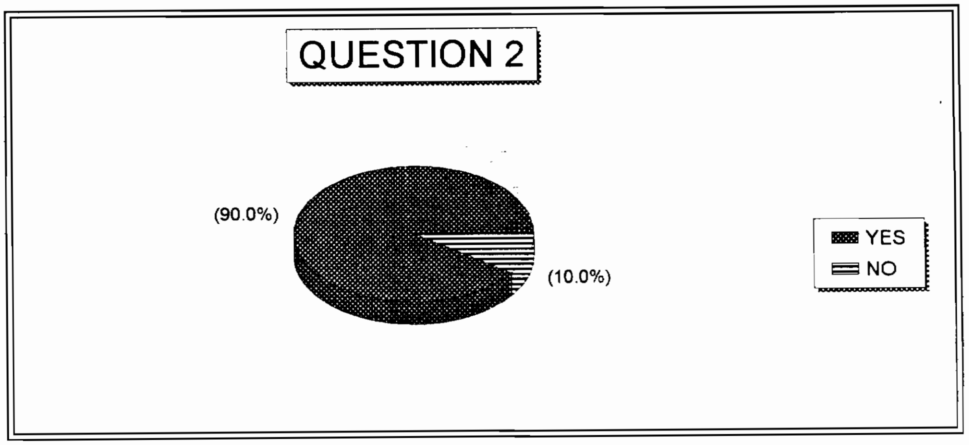
"Do you think it would be important to help protect the water quality of streams, lakes and ponds between Sharon, Lakeville and Salisbury to help protect endangered species in the area designating a greenway corridor?" Yes or No! If no, why not?

Yes 58
No 2



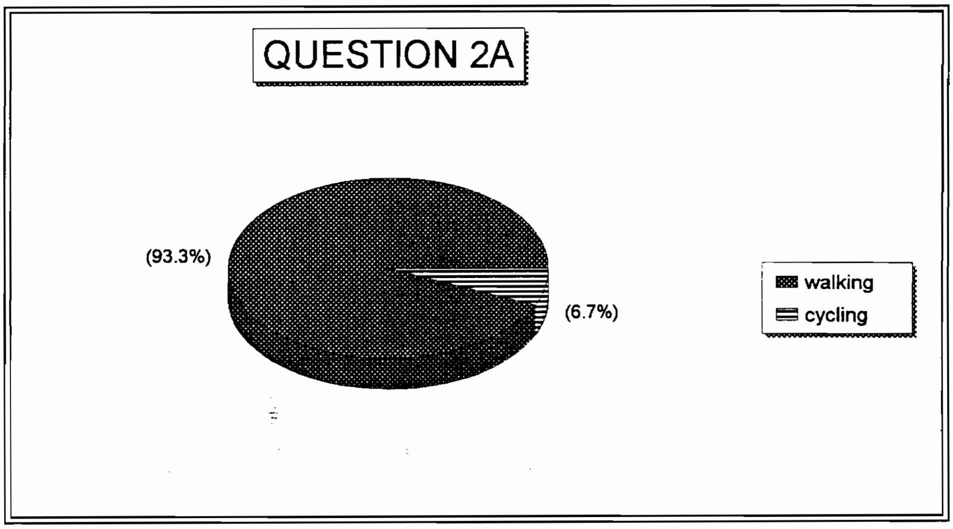
"Do you think it would be important to link Sharon, Lakeville and Salisbury with a pedestrian path for recreation or transportation?" Yes or No! If no, why not?

Yes 54
No 6



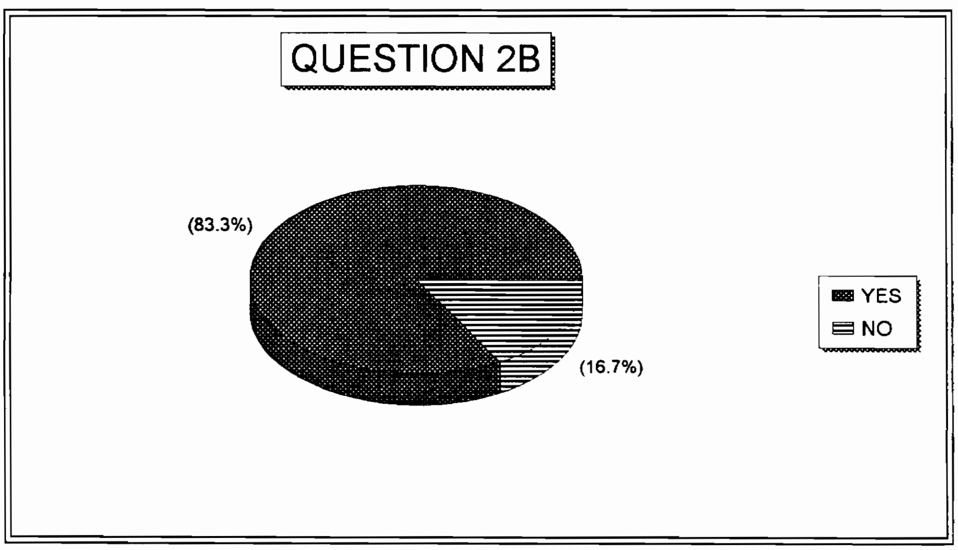
"If yes, how would you use such a path?"

Walking 56
Cycling 4



"Would you be willing to use existing roads or utility easements?"

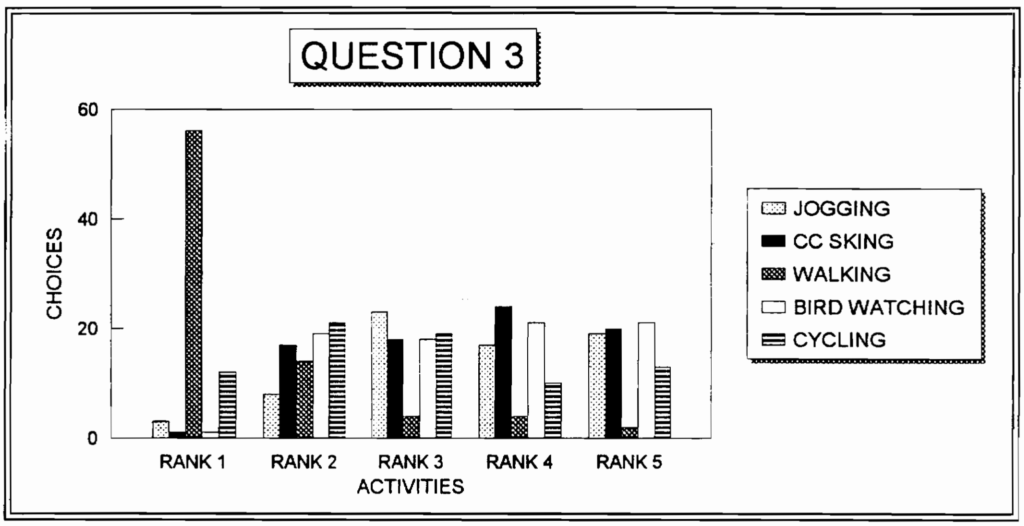
Yes 50
No 10

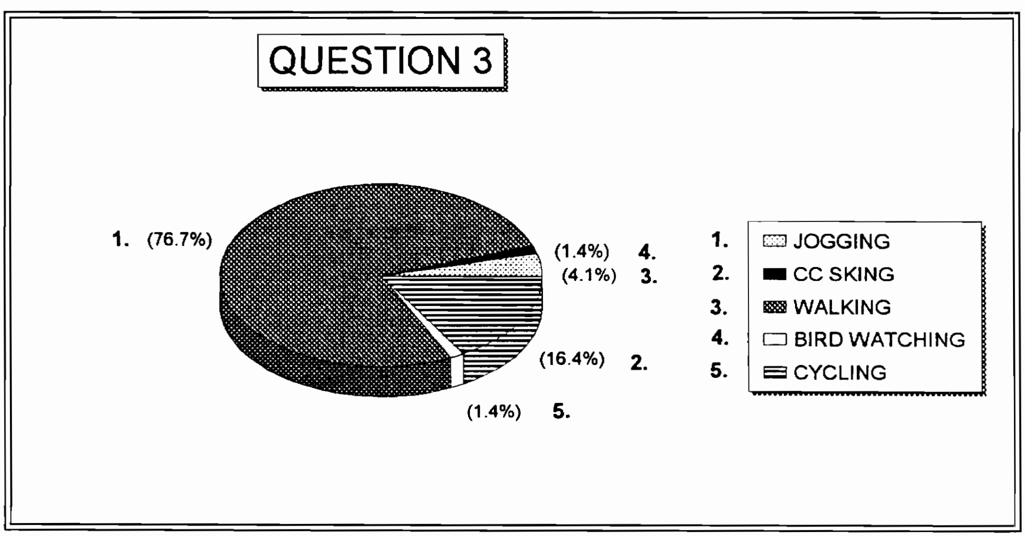


APPENDIX B

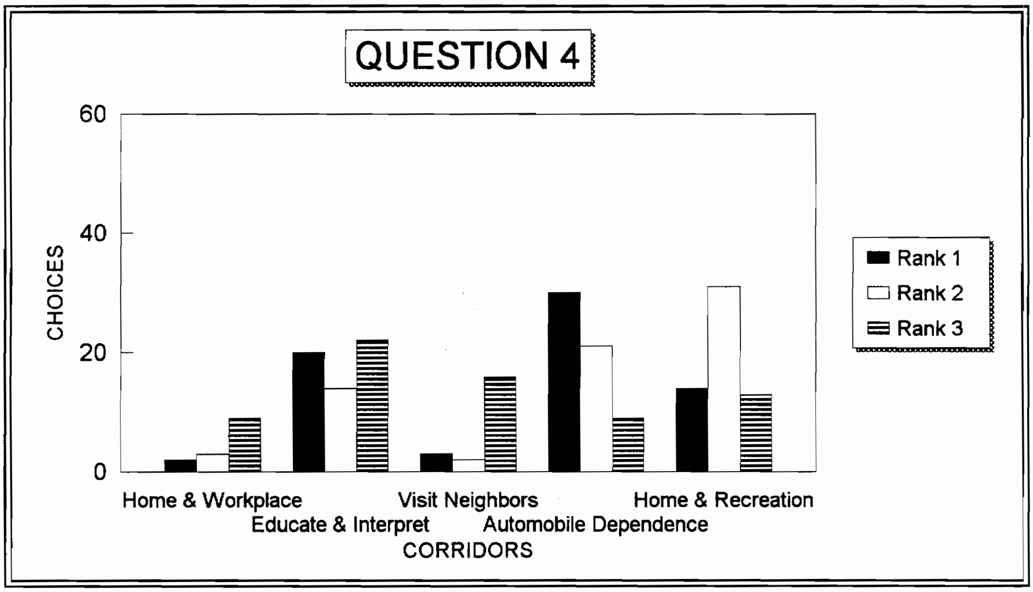
Questionnaire Survey

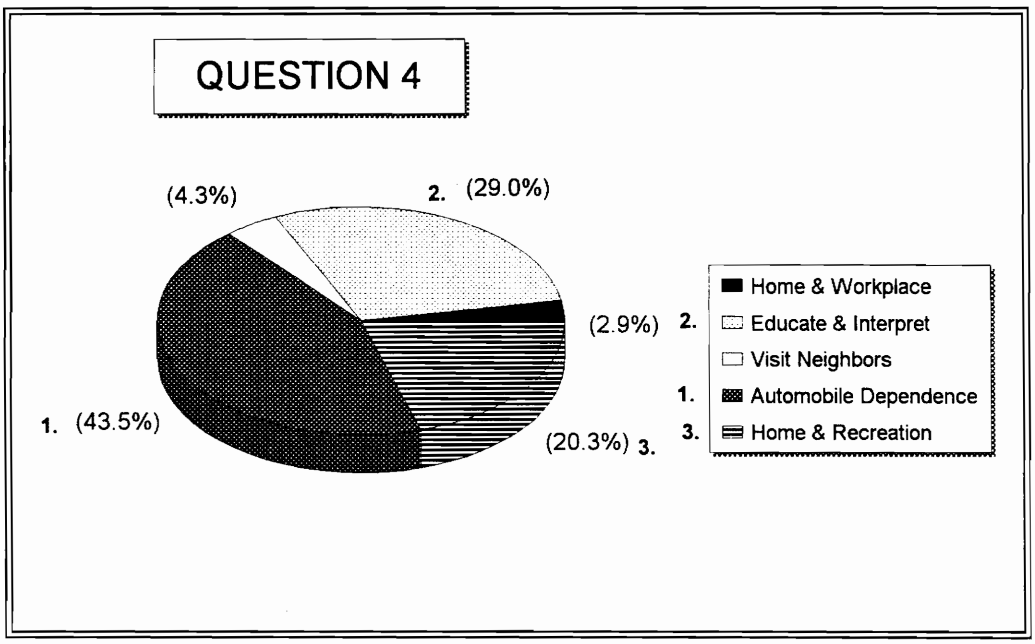
Greenways can serve communities as recreational amenities...Please rank your top five choices.



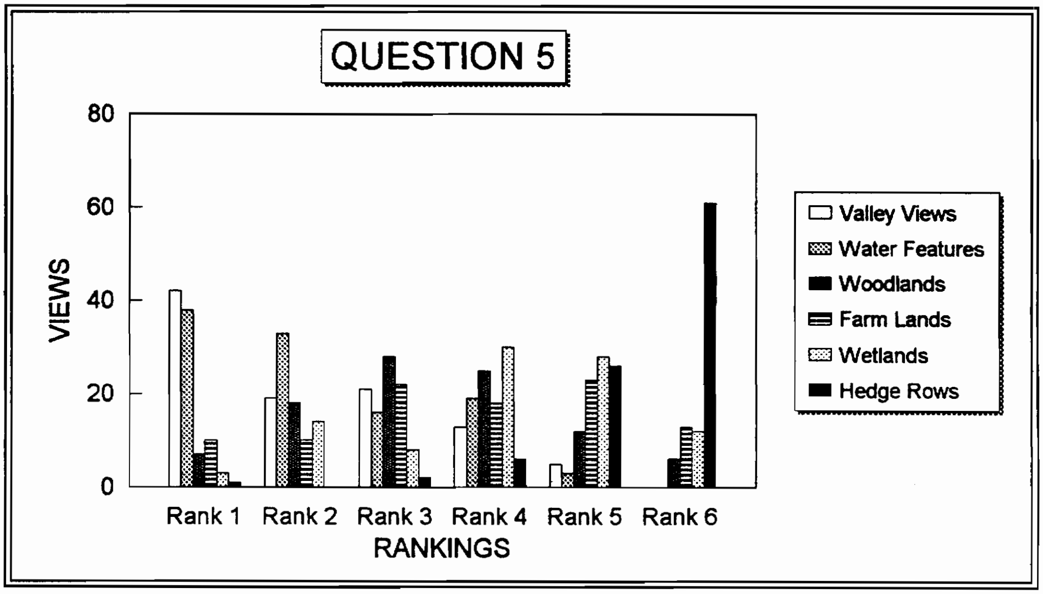


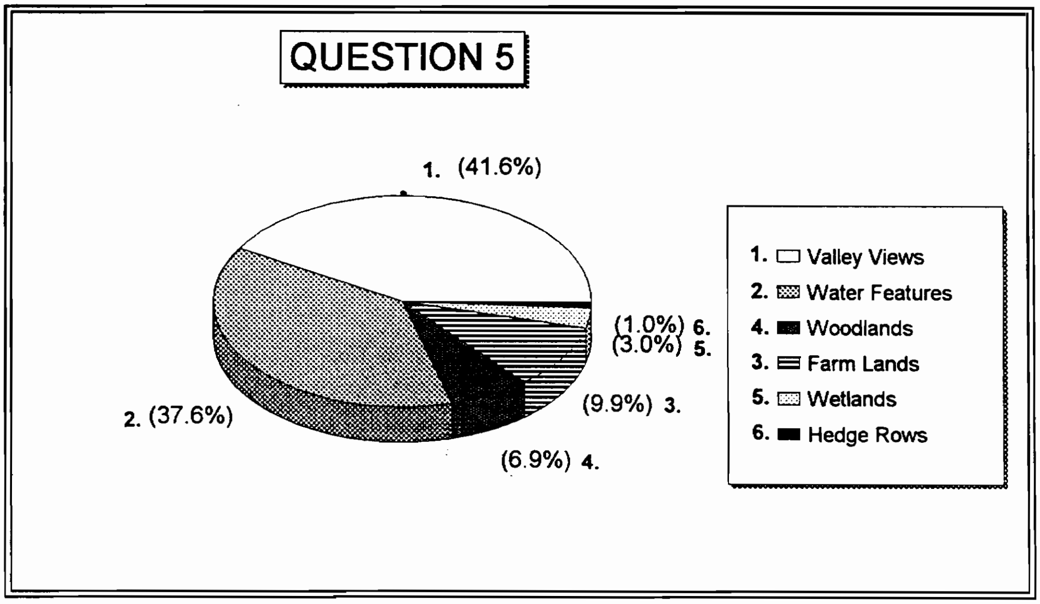
Greenways can function as transportation and information corridors...Please rank your top three choices the greenway would serve you.



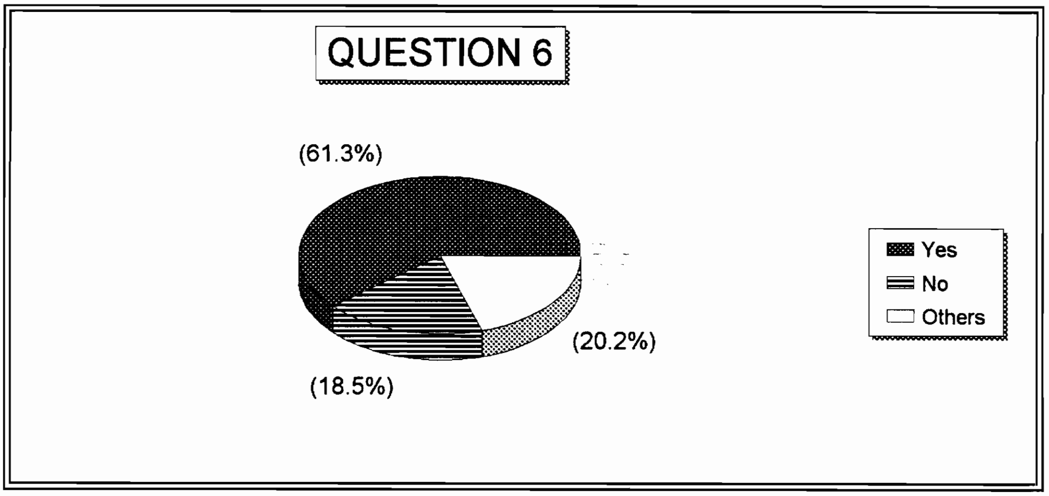


Greenways often protect views along their paths...What views are most important to you?

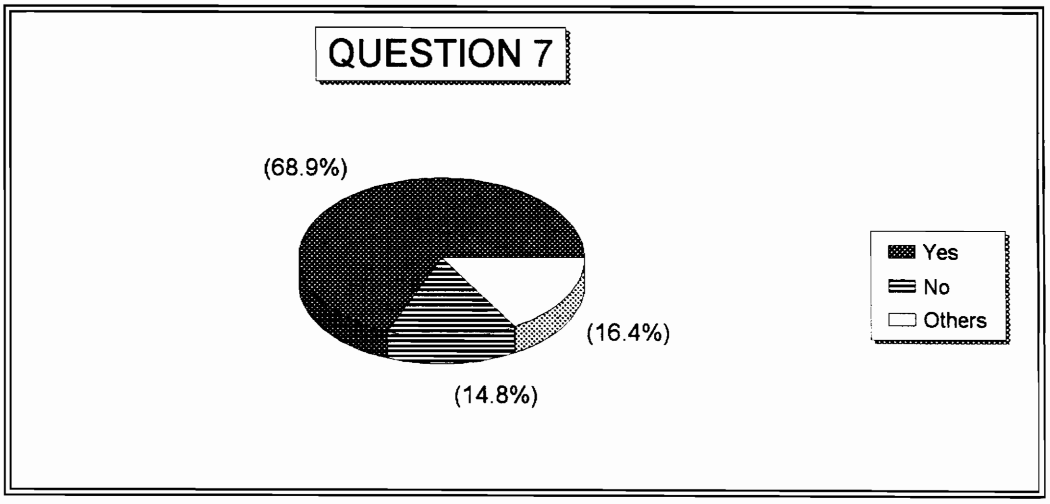




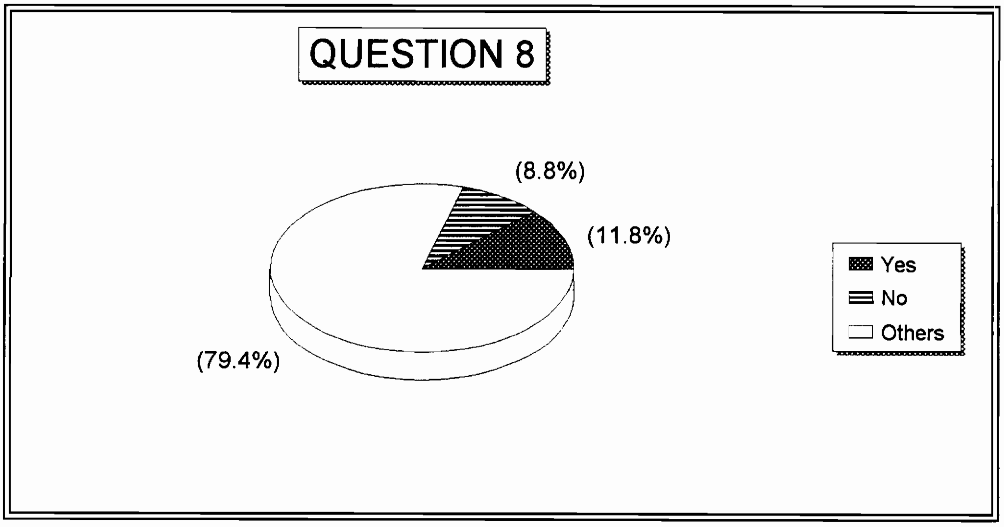
Greenways often preserve wildlife habitat and biological diversity..Would you provide an easement for a greenway trail corridor along your property for a wildlife habitat or biological diversity?



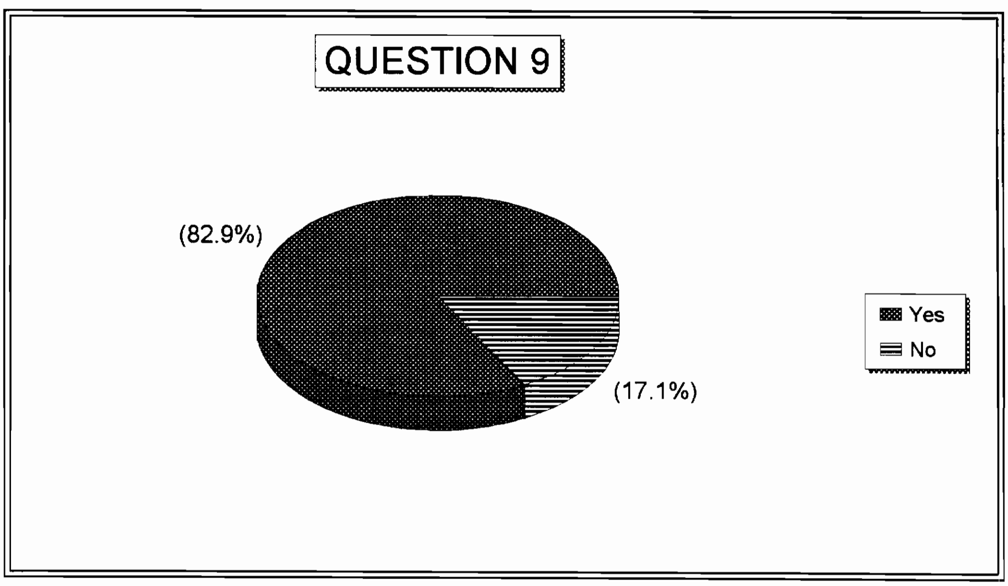
Greenways often function as filter strips reducing suface sediments, pesticides and fertilizers from entering streams, ponds and lakes...Would you support a filter strip easement on your property to accomplish the latter?



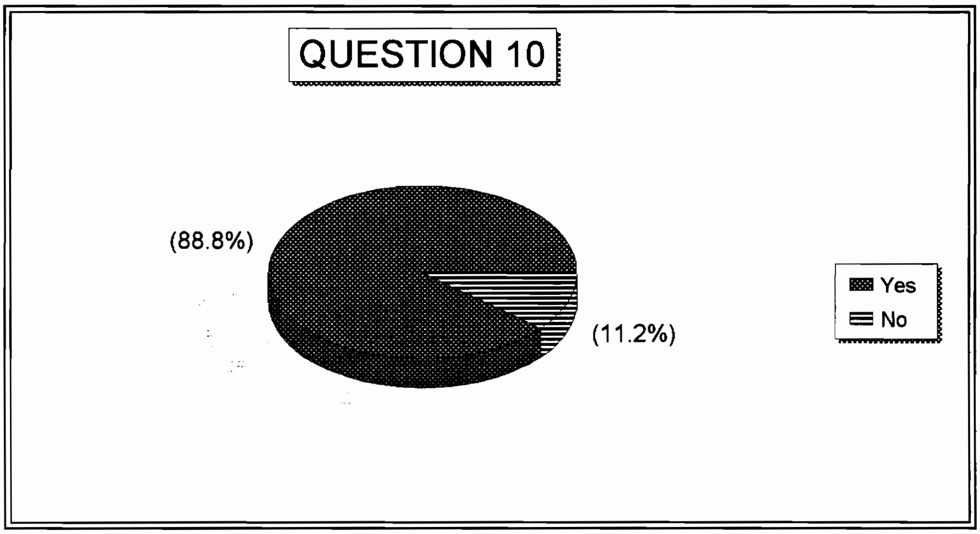
Farmers are now establishing filter strips and realizing profits from plants grown and harvested for the floral industry...If you are a farmer would you be interested in participating in such a program?



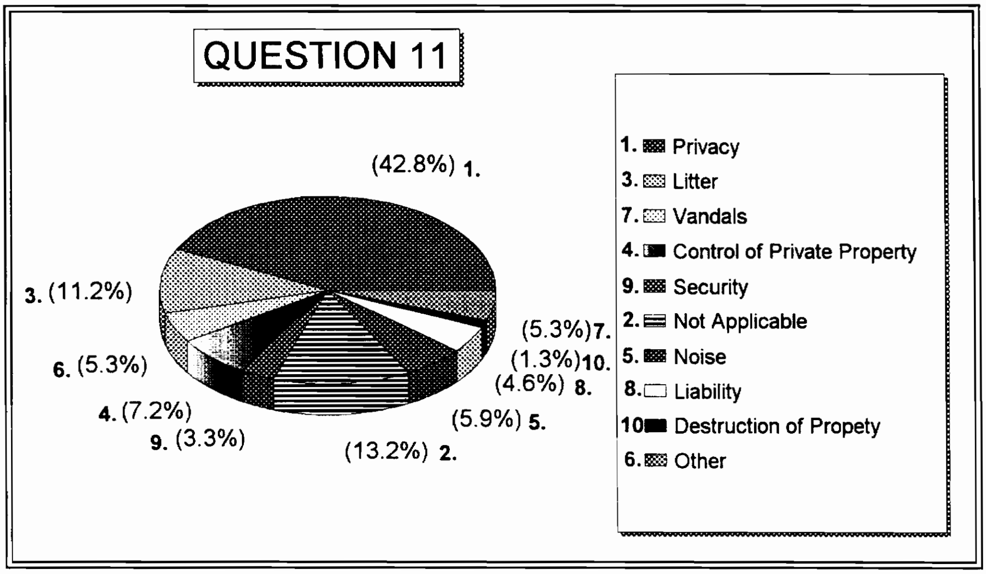
Would you be in favor of linking other existing nature trails with a major greenway corridor in Sharon and Salisbury?



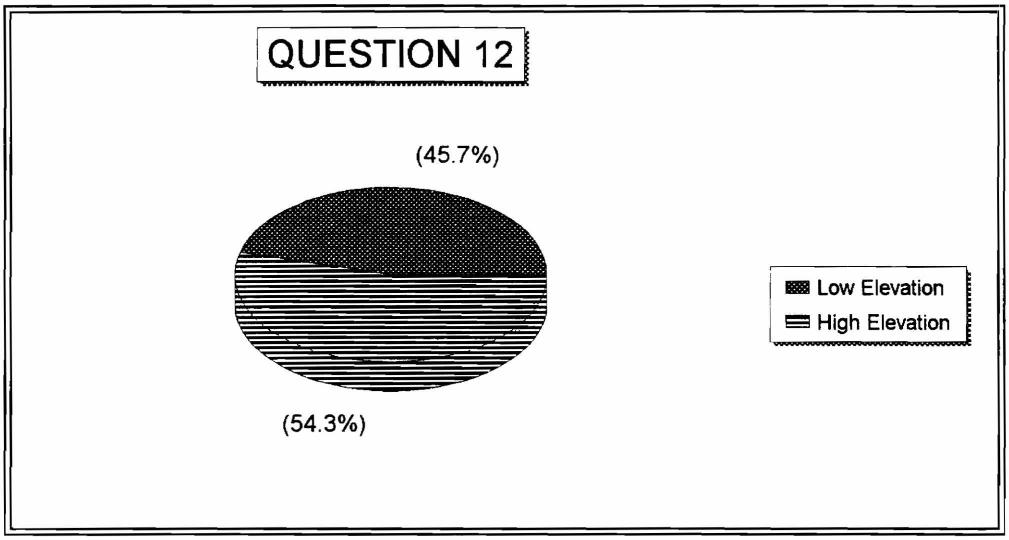
Would you be in favor of linking a major greenway corridor with historical/ cultural features such as the charcoal roads still present in our woodlands and once part of the iron industry in Salisbury and Sharon?



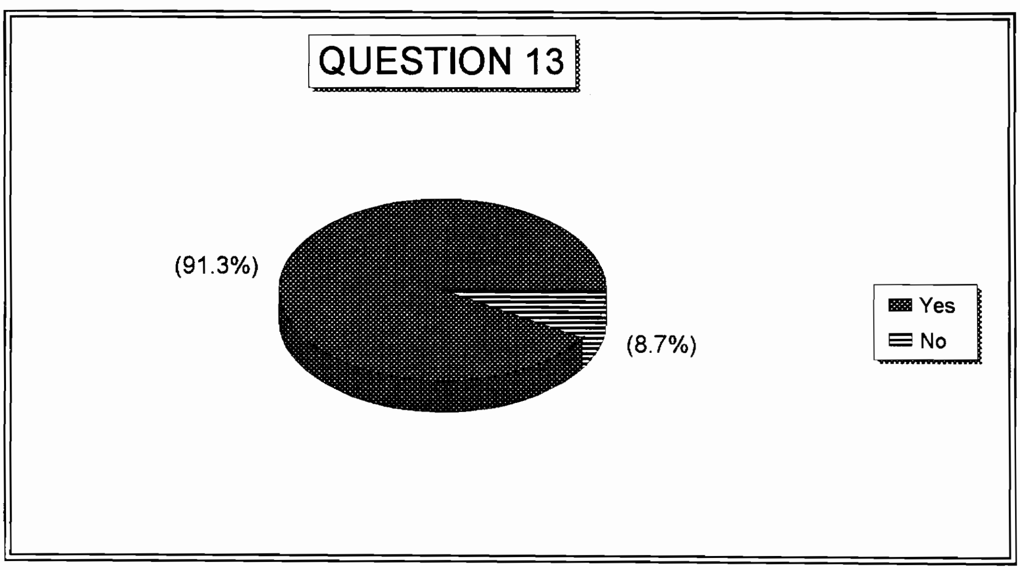
What objections if any would you have regarding the establishment of a greenway trail on your property?



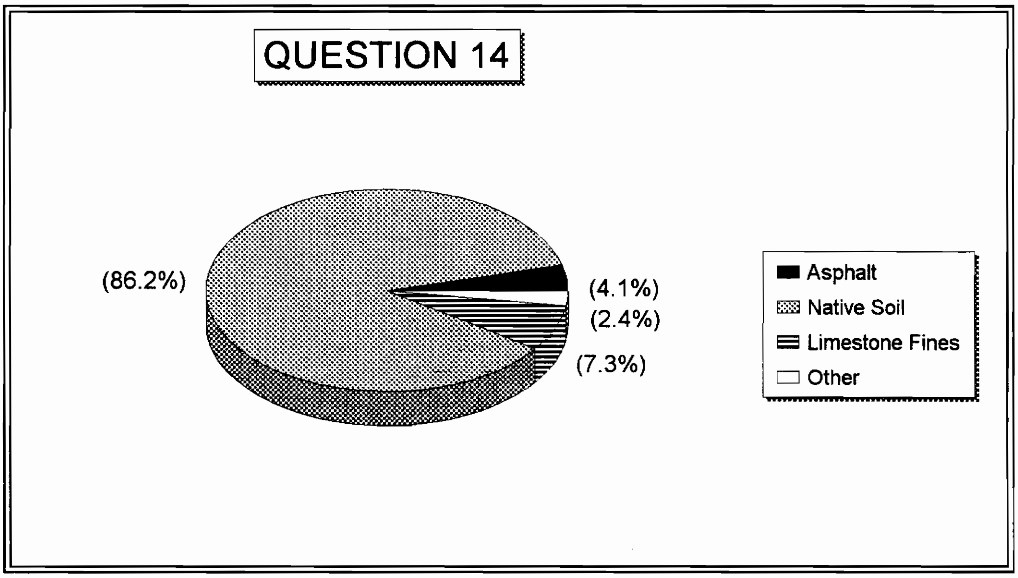
A greenway trail corridor linking Salisbury and Sharon could be designed along a low elevation between Long Pond and Mudge Pond or a higher elevation for example at the forest edge of Indian Mountain. Please indicate your choice.



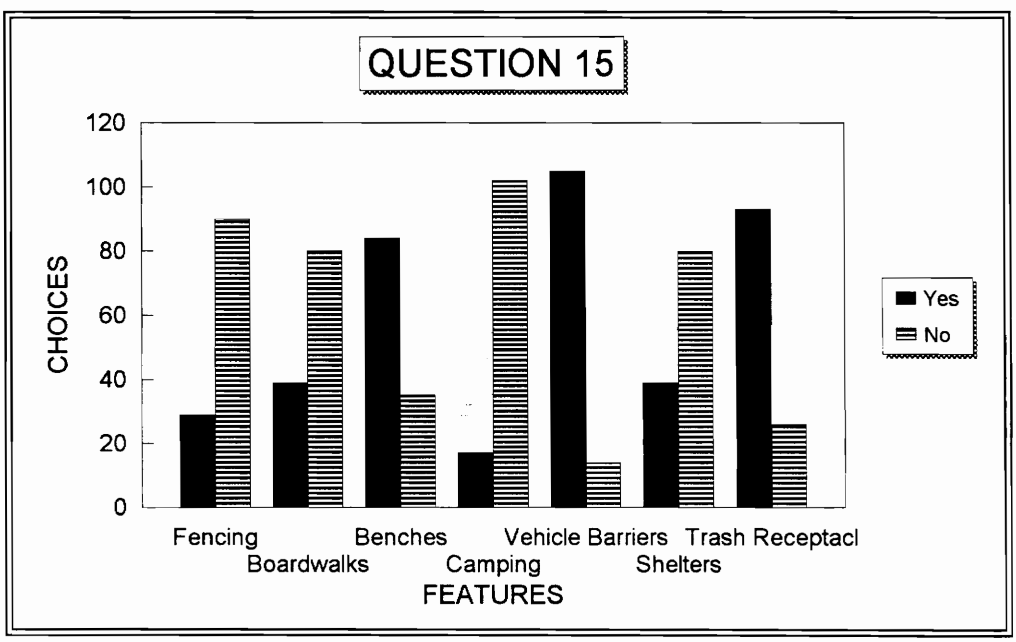
Would you use a greenway trail that made use of existing roads, abandoned roads and/or former powerline corridors?



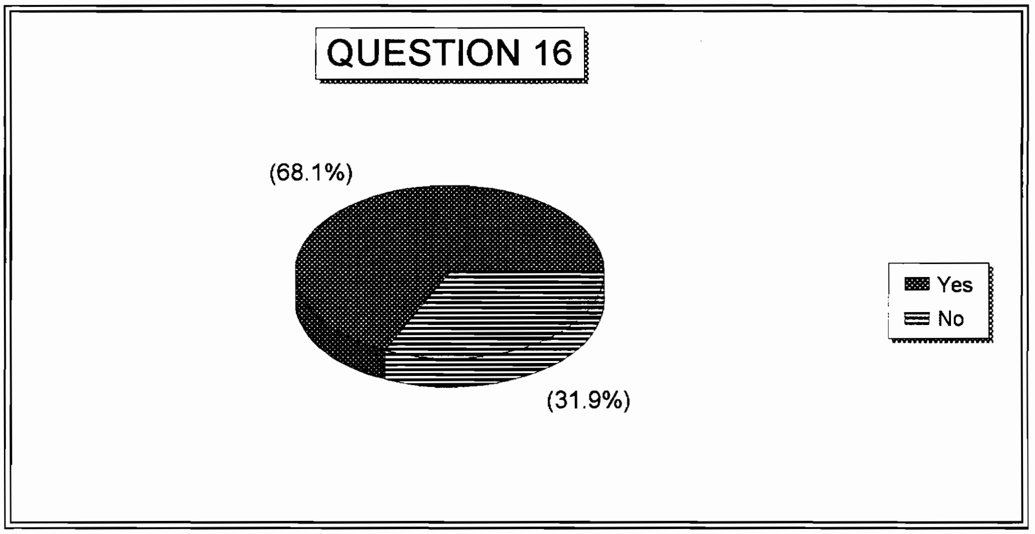
Greenway surfaces are a concern of trail users...Please indicate the type of surface that most appeals to you.



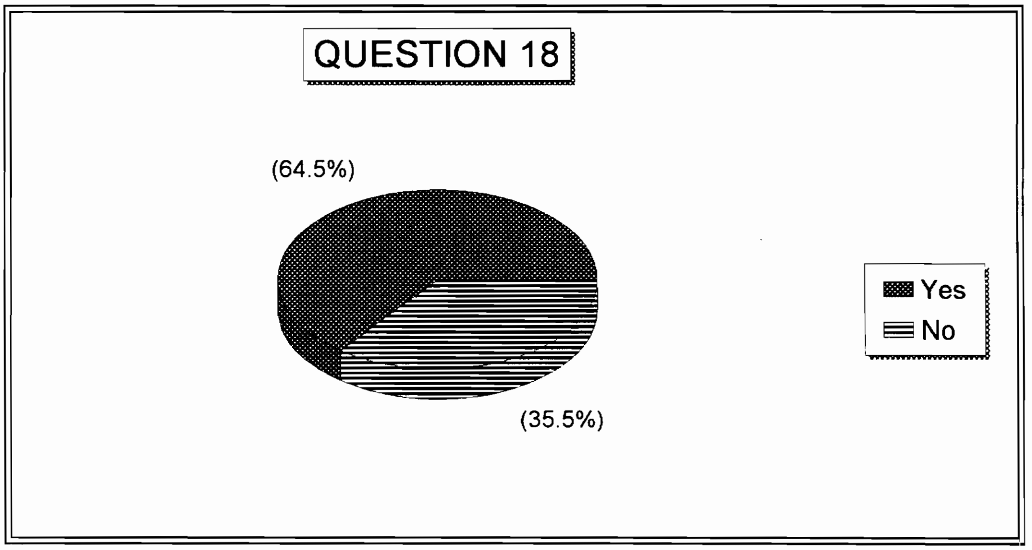
What types of greenway features would be important to you?



Stewardship is critical to the success of any greenway corridor linking communities...Would you volunteer time to maintain the integrity of a greenway trail?



There is currently a design proposal to develop the Housatonic River Belt Greenway along the Housatonic River in Sharon and Salisbury...Do you believe that the river is accessible to residents?



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General Appendix

Lakeville-Sharon Christmas Bird Count 1995:

LAKEVILLE - SHARON CHRISTMAS BIRD COUNT

SPECIES	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Red-thr. Loon																			1																	
Common Loon						1																											1	2		
Pied-billed Grebe	1		4		1	10	1	3	1	11	5	14	15	3	3		3	6	5		1	1		1		2					1	1		1		
Horned Grebe						1								1									1											1		
D-c Cormorant																																		2		
Great Blue Heron												1			1	1						2	2	1	1	1	1	1		1	4		5	2		
Tundra Swan						2																														
Mute Swan																			1								4	2		6	6		3			
Snow Goose						1	1			2			1	1	1	1	2 CP		3	8										7			1	2		
Canada Goose		11			566	1191	700	452	818	287	1868	347	1848	6772	2283	1675	974	3157	5208	2248	526	5299	510	3237	5020	4894	13691	6363	2930	4714	5092	2719	7109	9601		
Wood Duck	[illegible]												2																		5			1		
Green-winged Teal						1				1	1		4	1			11														1	1				
Am. Black Duck	124	60	64	45	410	503	320	293	52	142	472	88	154	50	81	97	162	83	97	127	10	63	61	55	34	155	134	18	62	62	102	78	57	184		
Mallard	552	16	563	600	3912	3403	5027	1685	504	415	1951	793	748	880	832	519	506	317	625	364	140	383	193	274	478	110	384	34	177	368	231	155	393	470		
Northern Pintail			2	2		7	1	2		1		2			1	1									3						16					
Blue-winged Teal											1																									
Northern Shoveler								1				1																								
Gadwall													1	2	1			2																		
American Wigeon			2			10		1			1		24	10			2		8				cp								2					
Canvasback	5		15	28	6	81		2		40	95	60	36	295	89			3	1			5	25	2	1	12	6									
Redhead	[illegible]																																			
Ring-necked Duck				1				1			6			1	6		2	15	8			5			1			5				1		4		
Greater Scaup																			1																	
Lesser Scaup			5	4	4			1	2	7	5	25					18	1	1											8	7					
Scaup species														3	2					1	4		1	4					1					1		
Oldsquaw																							1													
Com. Goldeneye							2			5	4	7	22	18	10	2	9	40	7		2	23	7	22		28	7	7		39	28	27	350	25		
Bufflehead						6							24	5	2		6	1			4		1	2							1		4	1		
Hooded Merganser			1		4	8			2					1			2				3	2		9	1	5		1		10		3	4	30		
Com. Merganser			1	2	12	6			7	30	51	18	1	3			14	24	67	2	3	6	6	126		11					36	27	72	67		
R.-brst. Merganser	[illegible]												1																					1		
Ruddy Duck				10	1	66		8	3	10	20	15	16	11	6		10	3	2	cp	6	5	5		1	2		1								
Turkey Vulture															10	3						cp														
Osprey																			2																	
Bald Eagle																	1	1	1	1			1	1										1		
Northern Harrier															1			4		1	1			5	4	1		1	2	4	11		1	2		
Sharp-shin. Hawk						1							1			2	2	2	1	3		4	1	2	1	4	3	3	2	2	6	4	5	5		
Cooper's Hawk		1			2	1					1	2			1				1	1		cp			2	4	3	1		3	3	5	1	2		
Northern Goshawk	1									1		2					3	3	1		2	cp	1	2	3	3		1	1			1	1	1		
Red-Shoulder Hawk			1		2										cp																					
Red-tailed Hawk	2	2	7	8	15	[illegible]	13	14	23	22	37	20	30	42	22	[illegible]	46	45	23	56	[illegible]	[illegible]	30	[illegible]	69	32	23	42	40	25	84	41	22	89		
Rough-leg. Hawk	2			2							2	cp		1	1	3	5	2		1			2	1	cp		1		2	3						
Golden Eagle	2																						1													
American Kestrel	5		2	1	8	9	3	8	5	6	10	11	18	17	12	15	23	13	6	13	10	8	4	5	7	4	4	2	2	2	7	1	1	1		
Peregrine Falcon													1	1																						
R-n. Pheasant	7	14	2	3	17	20	16	20	9	28	6	5	4	18	3	14	13	7	10	8	10	11	5	3	11	3	5	5		17	11	7	1	2		
Ruffed Grouse	7	14	39	2	79	29	32	45	37	25	23	27	24	9	9	34	22	37	39	37	41	48	48	38	21	25	9	11	5	8	11	4	6	9		

LAKEVILLE - SHARON CHRISTMAS BIRD COUNT

SPECIES	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Wild Turkey																	8		1	cp	12	58	13	27	27	61	176	117	31	68	24	67	164	205		
No. Bobwhite						15		2																												
Sora																		1																		
American Coot	50	2	128	200	404	590	150	120	102	266	367	319	274	251	434	6	235	249	221	[illegible]	90	36	33	60	63	65		13	1	24	34	8	33	120		
Killdeer							1					1		6	6																			2		
Common Snipe			2			1				1					1	1	1	1	2	2	1	4	1	1	1		1		2	1			1	2		
Am. Woodcock														2		1																				
Ring-billed Gull														1	1		2	81	18			36	147	298	8		3	18	1	144	53	6	49	100		
Herring Gull				2	8	2	1	6	9	3	10	4	6	4	8		37	124	15		3	80	166	893	189	1053	6	10	14	33	111	19	219	67		
Gt. Bl-bk. Gull																		1						8		5					2	2	28	4		
gull species																																		88		
Rock Dove	(Did not count until 1973)												82	163	411	118	287	267	256	245	443	318	237	278	619	263	379	477	262	225	225	293	170	410		
Mourning Dove	85	56	96	29	161	497	180	235	325	400	191	515	348	386	544	423	404	229	283	582	818	380	334	425	896	338	479	496	379	615	438	552	962	549		
E. Screech Owl						4		1	3		1		1		1	3	13	1	6	7	2	2	1	4	9	5	2	2	1	3	2	2	3	4		
Gt. Horned Owl	[illegible]																													4	8	4	6	13		
Snowy Owl																																1				
Barred Owl	3					1			1			1		1		5	6	4		1	4	4	5	9	8	2		1					2	3		
Short-eared Owl														1																1						
N. Saw-whet Owl																		1	1		1	1		2	4	14			2	1	1	1				
Belted Kingfisher	3	1	5		4	6	4	3		3	3	2	3	12	2	9	9	5	6	8	4	3	6	8	3	2	4	3	4	5	6	6	3	3		
R-h. Woodpecker									1		1		1						1			1						1						1		
R.-bel. Woodpecker																1	1		1		1		1			3	1	6	1	6	8	5	5	11		
Y-b. Sapsucker											1		1								1							cp				cp		1		
Downy Woodpecker	38	28	62	12	109	108	137	119	147	149	170	135	146	164	170	103	153	86	103	131	107	142	134	113	96	84	73	90	70	70	49	63	35	69		
Hairy Woodpecker	23	18	38	19	60	63	64	66	64	74	92	61	78	72	65	49	47	39	56	40	42	61	60	33	36	35	15	16	[illegible]	17	16	16	13	16		
Northern Flicker							4	1	4	3	4	1	cp	6		2	2	1	5	7	5		4	9	4	2	1	2	1	8	6	2	5	8		
Pileated Wdpecker		1	2	2	2	3	5			2	1	2	3	5		1	9	5	7	3	3	7	1	7	4	2		1	2	3	5	10	5	10		
Eastern Phoebe																cp															1					
Horned Lark	306	18	38	250	46	551	383	251	296	342	77	499		113	839	339	382	170	336	478	352	450	255	271	878	502	150	601	219	71	710	76	857	202		
Gray Jay													2																							
Blue Jay	105	132	159	49	379	758	718	452	659	407	687	837	709	545	414	762	1404	283	332	684	519	347	572	603	583	556	186	261	225	377	285	197	222	427		
American Crow	375	59	213	120	924	518	537	363	383	578	549	763	747	701	472	569	767	578	58	398	443	536	438	593	468	425	318	537	479	495	562	407	624	1347		
Common Raven																												2	1		9	4	4	1		
B.-c. Chickadee	286	55	479	133	714	495	696	581	876	629	896	669	972	930	664	615	784	690	745	827	803	1097	1180	1081	737	659	567	715	642	486	481	318	572	545		
Boreal Chickadee									4						cp																					
Tufted Titmouse	2	2	8	26	8	17	34	40	116	62	57	98	140	115	59	92	85	156	66	77	127	128	136	193	147	102	102	108	114	85	87	80	111	102		
R.-b. Nuthatch	4				5	1	2	5	51	5	14	17	21	8	6	31	13	6	3	27	19	13	25	6	11	7	6		10	25	4	14	33	12		
W.-b. Nuthatch	24	32	82	27	155	117	187	129	202	148	176	139	168	147	98	132	126	79	98	138	130	189	139	179	105	119	125	77	100	87	72	73	57	91		
Brown Creeper	4		1	4	10	10	15	5	25	17	8	4	18	4	1	15	4	4	13	18	12	18	40	31	12	3	8	7	1	9	13	3	8	5		
Carolina Wren															cp	1						cp			1			1	1		3	5	2	2		
House Wren															1																					
Winter Wren	1					1		1		2					2	2	1					2	2		1		1		2							
Golden-c. Kinglet	3		2			32	10	4	80	46	8	7	77	11	2	83	1	14	5	28	4	46	74	68	55	21	43	36	25	27	41	20	13	31		
Ruby-c. Kinglet			2	9			4			2			4	1		2	cp	5		1				1		1	13									
Eastern Bluebird										2	2			cp	2	41	4		6	6		13	8	28	37	20	18	40	32	71	130	86	86	114		
Hermit Thrush							1			1		1				3	1	2		8		1	2	4	1	1			2	3	1	1	88	1		
American Robin	2	5	1	2	20	2	5	25	38	1	79	16	42	10	173	153	339	99	405	650	82	728	132	199	17	14	50	77	76	221	2047	597	266	152		

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LAKEVILLE - SHARON CHRISTMAS BIRD COUNT

SPECIES	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Varied Thrush													1																							
Gray Catbird			1			2	1		6		4	1	1			7	2	1	2	5					1			1	3		cp			1		
No. Mockingbird				1	2	11	7	4	8	33	7	10	16	35	26	58	32	25	39	69	60	25	53	30	33	31	15	38	20	32	43	34	13	13		
Brown Thrasher													1								1															
Water Pipit																1																				
Cedar Waxwing			24	31	210	24	54	12	37		252	119		14	58	73	41	190	83	187	4	327	69	282	154	35	49	180	111	36	266	193	121	457		
Northern Shrike					1	1			1				2		2		3	1								1										
Loggerhead Shrike	[illegible]																																			
European Starling	556	211	362	142	864	1219	1361	597	724	1324	1902	845	1498	2106	1250	1529	1052	1466	1092	907	691	1165	1225	2575	1086	768	1228	1189	1312	1080	3145	987	1342	2072		
Y.-rumped Warbler																				1				5								2				
Com. Yellowthroat														1																						
Northern Cardinal	28	37	64	34	100	120	110	146	150	186	145	201	189	128	234	156	191	117	202	171	253	171	199	121	132	76	93	137	77	91	42	49	97	62		
Dickcissel			2						2							1																				
R.-sided Towhee	2	1		2					5	2	3	1	1	1					1	1																
Am. Tree Sparrow	188	109	234	48	221	295	694	581	544	359	666	658	627	541	371	451	742	231	379	261	350	450	466	160	394	445	223	178	382	251	97	103	273	89		
Field Sparrow								1		7		1				4	4				3	2	4	1				3			3					
Savannah Sparrow									2							2						1				2			2							
Fox Sparrow	2	1	24	2				14	8	4	11	2		2	4	8	1																			
Song Sparrow	12	1	31	7	9	20	41	20	40	93	52	47	32	40	62	62	90	16	67	43	48	48	40	44	28	8	11	28	29	27	28	18	17	20		
Swamp Sparrow			1		3				3	4	2	3	5	6	2	3	8	2	4	4	3	1	2		3	2			3				9			
W.-thr. Sparrow	2		22	8	9	24	43	37	196	97	89	107	50	73	283	479	227	78	166	160	130	138	77	144	144	64	67	114	91	28	79	66	58	75		
Wh.-crw. Sparrow			1			1					1	1	3			2	3		1			2	2	3	3				cp		3	4	3			
Harris' Sparrow																					1															
Dark-eyed Junco	122	109	279	128	153	472	644	303	563	509	537	614	352	244	484	502	425	200	409	400	473	504	526	721	849	291	254	494	589	320	375	181	345	304		
Lapland Longspur			1	11																1									1							
Snow Bunting	31	28				53	16	62	3	14	10			3	2	50				30	81							3	300							
Redwing Blackbird	2	1	2		5	4	1	8		2	3	6	10	4	91	35	4	6	60	37	18	161	53	688	10		14	2		160	16		146	14		
E. Meadowlark	31		22				27		19	20		20	49	94	70	76	13	81			37	17			8						14					
Rusty Blackbird	1				7					7			1		3	cp							cp	39	2								1			
Commmon Grackle				5	6	21	3			4	2	10	132	4	9	9	3	8	1	1	1	cp	1		1	1						cp				
Br.-headed Cowbird	51	10	129	14	21	634	1264	312	667	75	56	208	262	173	674	670	18	44	133	518	13	438	312	2302	287	32	1	1794	220	72	305	1	238	15		
Northern Oriole				1		1					1																									
Pine Grosbeak	59				22	2	2	320	21		9	169	7			3	24			42	71			5	26				4							
Purple Finch	5	13	8	8	6	12	55	60	137	6	78	77	9	35	64	97	59	94	37	58	74	211	85	175	55	53	32	38	11	16	15	20	8			
House Finch										2		8			3	15	23	110	39	142	99	514	386	474	490	479	452	468	396	591	642	706	535	434		
Red Crossbill									45																											
W-winged Crossbill									1								21				31				2											
Common Redpoll			13						2								3			66	120	12	3		36	115				16			78			
Pine Siskin			2		113				21		10	134	21		10		116			7	142	4	33	6	9	5	1	1	90	48		4				
Am. Goldfinch	39	20	44	54	191	29	259	267	308	165	535	371	293	415	220	426	537	172	73	250	287	233	135	427	132	85	84	68	173	114	198	68	149	86		
Evening Grosbeak	157	4	553	15	350		250	377	824	141	901	785	238	149	408	153	1036	549	129	767	532	427	552	311	186	158	158		45	38				1		
House Sparrow	727	336	412	171	780	775	729	493	697	1065	1073	670	696	628	676	538	300	367	686	723	1212	577	815	508	272	337	332	814	274	151	252	167	133	205		
TOTAL SPECIES	48	34	55	48	60	67	56	67	62	66	66	68	71	72	73	72	79	69	75	66	71	68	73	74	73	68	54	64	64	65	68	64	68	75		

SOURCE: MILES SANCTUARY SHARON, CONNECTICUT 1995

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Vita

The author received a Baccalaureate degree with honors from Central Connecticut State University, Located in New Britain, Connecticut and a Masters degree from the Virginia Polytechnic Institute & State University, located in Blacksburg, *Virginia. The author has perused further studies in landscape design at the Inchbald School, London, England and The Clock House School of Design, Fontwell, England.*