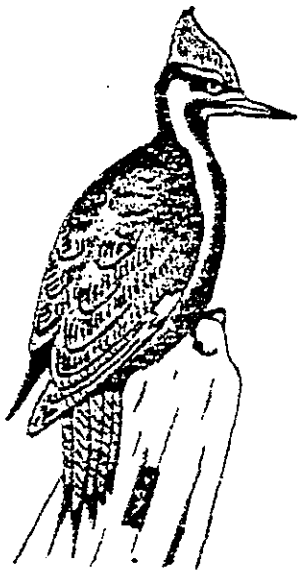
An
Ecological Inventory
Of

WOODBOURNE FOREST

&

WILDLIFE SANCTUARY



by
JOYCE BARNES STONE

JBS

AN ECOLOGICAL INVENTORY

OF

WOODBOURNE FOREST AND WILDLIFE SANCTUARY

Dimock, Pennsylvania

By

Joyce Barnes Stone

1979

To the Cope family for making Woodbourne possible;
our little daughter, Lila, for encouraging our
frequent walks into the woods, and for her
patience while this Inventory was being prepared;
and to future Naturalists at Woodbourne,
I dedicate this Inventory.

FOREWORD

The actual field studies and data collecting for this Inventory began in the early summer of 1976 and continued through August, 1979, giving the author four growing seasons in which to make her observations. Eleven different habitats were recognized on the 602 acres contained in the Woodbourne Sanctuary. These include three sections of climax woods, the lower swamp and pond, three stages of second-growth woods, the larger Cope Pond and its floating islands, open fields and pastures, wooded pastures, and evergreen plantations. All the trees, shrubs, and herbaceous plants observed in each of these areas were identified and their names appear following the description of the habitat. The vertebrates - birds, mammals, reptiles, amphibians, and fish which inhabit each of these areas (with the exception of the evergreen plantations) have been described as well. All the flora and fauna described were personally observed except for the sightings of the river otter and the bobcat which are explained in the text.

Estimates of the population size of each species were made only after numerous visits to each habitat. (The criteria used to judge the frequency of the plants and vertebrates can be found in the Climax Woods section.) At least 40 visits were made to the Nature Trail habitat to determine the plants and trees which were most characteristic of the climax woods. A tree survey was finally performed to determine the actual tree composition in that area. The results of the tree survey with explanations concerning the history of each species in the sanctuary is included.

Theodore M. Cope made an ecological inventory of the sanctuary in 1932 for her Cornell University M.S. Degree which was entitled "Some Observations on the Vertebrate Ecology of a Pennsylvania Mountain Farm." (A copy of this was made by the Nature Conservancy's Regional office in Boston.) Four years later she again described the flora and fauna in her PhD thesis, "Observations on the Vertebrate Ecology of Some (Four) Pennsylvania Virgin Forests." Cope described 7 habitats in her 1932 thesis which included the Copes' orchards. Since the orchards are not contained in the sanctuary, they were excluded from this study. Many changes which have occurred in the past 46 years in the remaining habitats have been described, using Cope's studies as a basis for comparison. Explanations have been offered in several instances to account for unexpected changes in the succession of some communities.

Studies describing the plant composition of two other virgin forests in the 1930's (one in western Pennsylvania and the other in New York) were presented as they compared so closely with the findings of this author. Information included in this text regarding the status of certain birds in 1898 which continue to nest in the sanctuary today was acquired from

Francis Cope's article "The Summer Birds of Susquehanna County."

Though this Inventory became a much greater task than the author originally believed it would be, the experience has added greatly to her knowledge and understanding of natural areas, especially climax woods and swamps. If this study ever aids in the identification, protection or research of Woodbourne Sanctuary or other climax woods areas, then the effort will be that much more justifiable.

The author wishes to express her sincere appreciation to the Woodbourne Forest and Wildlife Sanctuary Management Committee and to Ron Killian, Assistant Stewardship Director of the Eastern Region for The Nature Conservancy, for the opportunity to perform the Inventory; to Fred Studer, Chairman of the Management Committee, for his willingness to assist in all aspects of the study from constructing live animal traps used in the mammal study to proofreading and xeroxing copies of the text; to Harriet Marsi, Theodora C. Gray, and to Elizabeth Washburn for proofreading the Inventory and for their comments to ensure its accuracy and readability; to her husband, Benjamin particularly for preparing the Habitat Map; and to everyone involved for their forbearance in seeing this project completed.

Joyce Barnes Stone
Resident Naturalist
The Woodbourne Forest and
Wildlife Sanctuary

September 9, 1979

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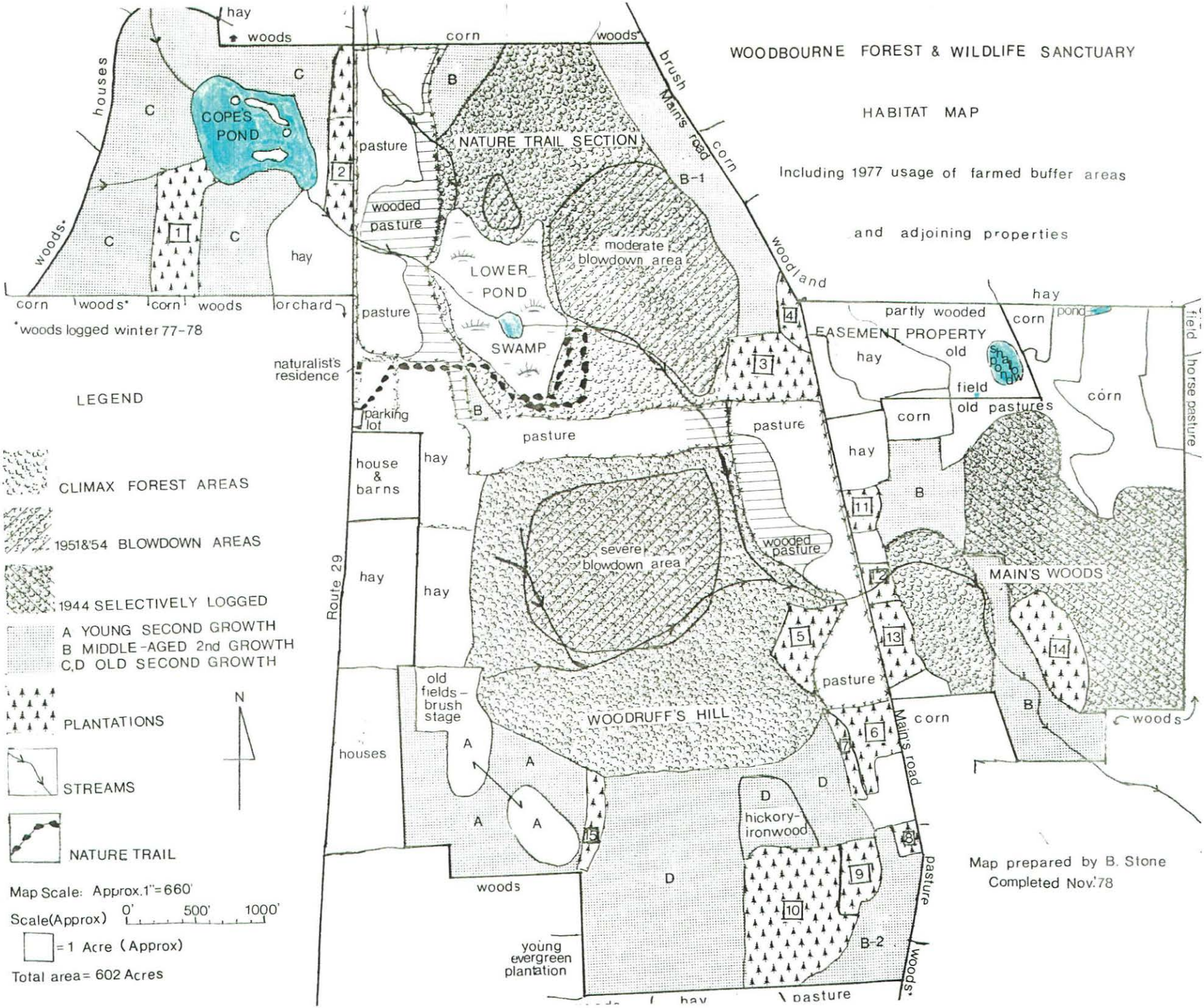
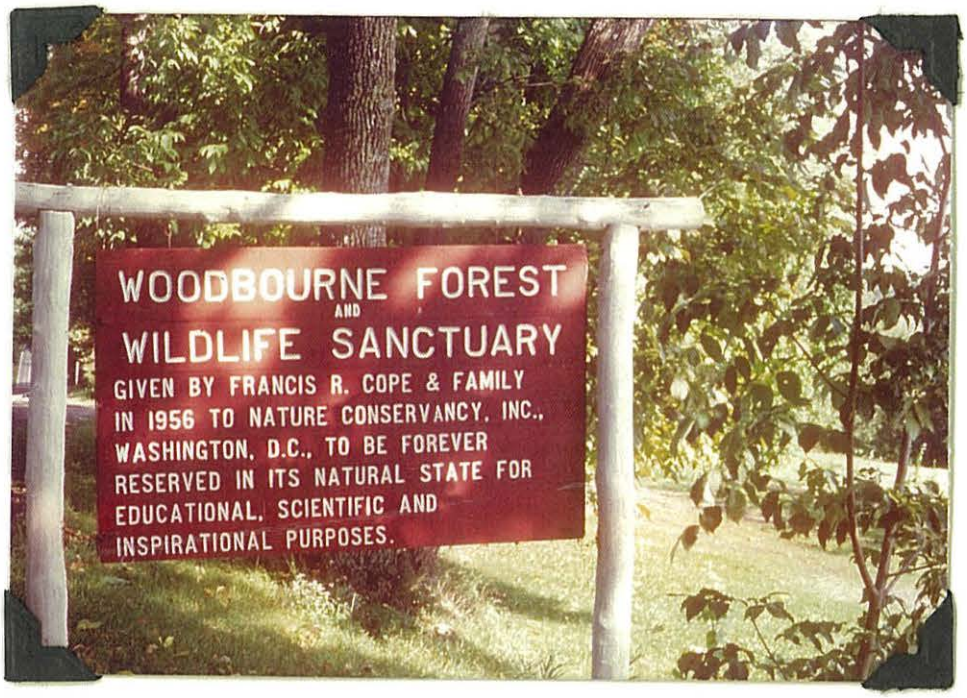

WOODBOURNE FOREST & WILDLIFE SANCTUARY
HABITAT MAP
Including 1977 usage of farmed buffer areas
and adjoining properties
LEGEND
CLIMAX FOREST AREAS
1951&'54 BLOWDOWN AREAS
1944 SELECTIVELY LOGGED
A YOUNG SECOND GROWTH
B MIDDLE-AGED 2nd GROWTH
C,D OLD SECOND GROWTH
PLANTATIONS
STREAMS
NATURE TRAIL
Map Scale: Approx.1"=660'
Scale(Approx) 0' 500' 1000'
=1 Acre (Approx)
Total area= 602 Acres
*woods logged winter 77-78
COPES POND
LOWER POND
SWAMP
NATURE TRAIL SECTION
moderate blowdown area
severe blowdown area
WOODRUFF'S HILL
MAIN'S WOODS
EASEMENT PROPERTY
old fields - brush stage
hickory-ironwood
young evergreen plantation
naturalist's residence
parking lot
house & barns
houses
Route 29
Main's road
brush
woodland
pasture
wooded pasture
old pastures
horse pasture
corn
hay
orchard
pond
N
Map prepared by B. Stone
Completed Nov.'78



Parking Lot and Sanctuary Sign
Looking north along Route 29.

Looking east from the Sanctuary's Parking Lot, one sees the Elk Mountains in background, Main's Hill in the center, mowed fields and beginning of nature trail.

INTRODUCTION

Although negotiations to acquire The Nature Conservancy's fourth preserve began several years earlier, it was not until April 10, 1956 that a certain tract of land which would be known as the Woodbourne Forest and Wildlife Sanctuary was formally signed over to the Conservancy by the well-known naturalist, Francis R. Cope Jr. of Dimock, Pennsylvania, his wife Margaret W. Cope, and daughter Theodora Cope Sumner. Richard H. Pough, President and one of the founders of the Nature Conservancy, and George B. Fell, Executive Director, were present to accept the gift of 478 acres of land "on which was located a virgin forest." The sanctuary, which contains examples of rare old hemlock-hardwood growth, was presented to the Conservancy so that it would forever be maintained in its natural state for scientific, educational, and inspirational purposes.

Following the death of Mr. Cope, his family donated to the Conservancy on March 31, 1965 an additional 72 acres of their property which includes a 9.6 acre pond containing several floating bog islands. A third gift of land consisting of 52 acres of forest and high open fields was recently purchased and conveyed to the Conservancy on August 3, 1977 by Philip H. Gray and his wife Theodora Cope Gray for buffer protection. All totaled the Woodbourne Forest and Wildlife Sanctuary comprises 605 acres of land according to the descriptions in the various deeds with an additional 25 acres protected by a conservation easement.

Location

Woodbourne Sanctuary is situated in Dimock Township which is a part of Susquehanna County in the northeastern section of Pennsylvania. The preserve is located approximately thirty miles south of Binghamton, New York and thirty-five miles northwest of Scranton, PA. Its parking lot is situated about a mile north of Dimock's four corners along State Highway 29 which runs north to south.

Topography

The Woodbourne preserve is an unevenly shaped parcel which is roughly a mile long by a mile wide. It is part of the Allegheny and Pocono plateau, which may be described as hilly, rocky country, interspersed with innumerable small valleys. Though there are few streams of any size in the county, numerous small ponds and lakes exist as well as the Susquehanna River which meanders briefly into the northern section of the county. Other than Elk Mountain which rises to an altitude of 2,693 feet, most of the other hills do not rise much above 2,000 feet. The highest elevation in the sanctuary is 1,600 feet which is found along the ridge on the northeastern border. The lowest elevation, 1,300 feet, occurs where the main stream leaves the sanctuary in Main's Woods. A U.S.G.S. map showing the topography and the preserve boundary is included in this Inventory.

Parking Area and Nature Trail

Standing in the Sanctuary's parking lot, the covered picnic and instructional shelter is situated at the north end. A grove of white ash and sugar maple trees provides privacy and a wood-

land setting for picnickers. Further north of the shelter, one comes to the resident naturalists' gardens, garage and then house which faces the sanctuary. South of the parking lot one sees a white colonial house, first built and used by the Cope family but now lived in by their caretakers, large gray barns, and green meadows, all of which still remain in the Copes' private ownership. Despite these slight obstacles, the visitor still has a good view of the sanctuary and the surrounding area. The mile long, self-guided nature trail begins at the south end of the parking lot. Trail guides, interpreting the ecology of the sanctuary, are available in a register box for the visitor's use.

Special Features

Looking east from the parking lot one gazes down upon open, mowed hay fields separated by hedgerows, which descend into a wooded stream valley. Here lies the coveted climax woods, which is the outstanding feature of Woodbourne Sanctuary. This hemlock-hardwoods section, containing from 50 to 100 acres, is the largest known example of a climax woods remaining in northeastern Pennsylvania. The dominant tree species include Eastern hemlock, American beech and red maple, with smaller numbers of yellow birch, sugar maple, white ash, black cherry, black birch and red oak. Hobblebush and striped maple are the principal shrubs making up the undergrowth. The herbaceous flora in the climax woods consists of a variety of ferns, lycopodiums and wild flowers which bloom primarily in the spring.

In addition to the climax forest sections, Woodbourne features a variety of other habitats which include open fields and

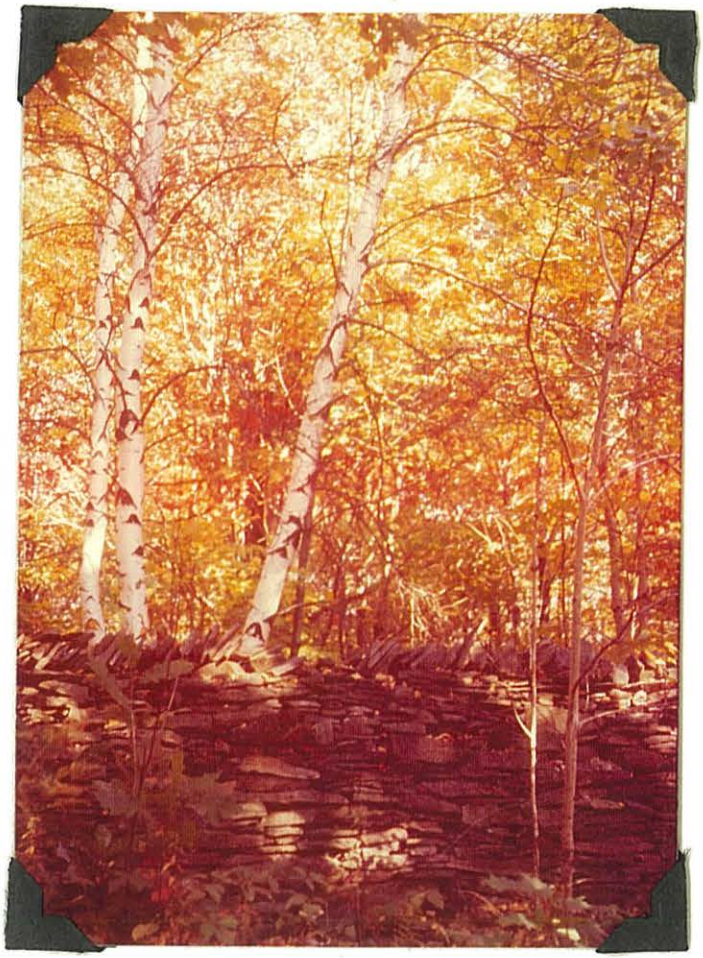
pastures, second-growth woods at several stages of succession, 71 acres of evergreen plantations, a 16 acre speckled alder swamp in which lies concealed a .6 acre pond, and a 9.6 acre pond on the west side of Route 29. The Cope Pond is unusual in having several sphagnum covered, floating islands which contain leather leaf, sundews, and pitcher plants.

Flora and Fauna

In the last few years 303 species of plants have been identified in the sanctuary; 146 species of birds have either resided here or been observed passing through in migration; 28 mammal species including mink, otter, red fox, long-tailed weasel, and the bobcat have been observed or live-trapped; and seven species of salamanders including the rare purple salamander have been discovered at Woodbourne.

Due to the sanctuary's position and high elevation on the Allegheny Plateau, certain species of plants, e.g., hobblebush and striped maple, which are characteristic of northern areas such as the Adirondacks, grow here. The fauna also reflects a strong tinge of this Canadian element especially in the primeval forest. Here, northern species such as the Canada warbler, black-throated blue and black-throated green warblers, hermit thrush, winter wren and red-breasted nuthatch can be found nesting in the deep woods. Though several of these bird species nest more commonly in Canada's spruce or fir trees, at Woodbourne they accept and use the Eastern hemlock for a nesting site.

CULTURAL HISTORY



Two and a half miles of stone walls, similar to this one located .2 of a mile from the sanctuary, exist at Woodbourne.

Photo by Harold Sipe, Fall 1977

Cultural History (past land uses with interpretation)

As far as is known, there has not been any evidence of Indians having lived in the Woodbourne Sanctuary area. The Tuscarora and the Delaware Indians inhabited the County, and could have hunted in this region, but it is mainly along the rivers and creeks where traces of their existence have been found. Because of the uncertainty of whether Susquehanna County was owned by Pennsylvania or Connecticut, this area was settled relatively late. In fact, according to Emily Blackman's History of Susquehanna County, by the time of the Revolutionary War, there was still not a single inhabitant in the County! It was not until 1796 that the first settlers arrived in Dimock, sometimes referred to as the Basswood township because the tree was so common in the area.

The first family to settle on what was later to become the Cope property was Asahel Avery, his wife and six children, who in 1801 came from New London Co., Connecticut, built a log cabin and moved in when it was but two-thirds roofed! The Averys sold a portion of their land in 1808, apparently that which was located on the west side of the highway. This property changed hands twice again before William Drinker Cope purchased it. Just when, the author has not been able to determine, but it must have been before 1830, since in that year Blackman states that William D. Cope's frame house which the Averys had begun, burned, and "Mr. Cope lost with it the most of his furniture." A letter quoted by Theodora Cope in her 1932 thesis indicates that William Cope was living in Dimock on October 26, 1826. The letter,

written by William D. Cope to his brother Henry Cope, gives a fascinating account of his personal encounter with a cougar on the night of a severe storm while he was travelling between Dimock and Elk Lake.

According to the Journal of Thomas P. Cope (father of William and great-grandfather of Francis R.), he purchased a tract of about 25,000 acres in Susquehanna County from Henry Drinker in 1817 But it appears that comparatively little of Thomas's large land holdings existed in Dimock township. The Deed Books at the County Court House record thousands of acres of land which were sold by Thomas's heirs in the surrounding townships of Springville, Rush, Auburn, and Jessup, but the author could find only one ten acre parcel which changed hands in Dimock. The map of Susquehanna County dated 1858 shows a house and land including the Cope Pond on the west side of Route 29 belonging to William D. Cope. But again, this was the property which changed hands from Asahel Avery to John Williams in 1808 or 1809, to John W. Robinson, and finally to William D. Cope. Avery may have originally purchased the land from Henry Drinker in 1801.

One fact which is certain is that the property on the east side of Route 29, where the bulk of the sanctuary exists, was not purchased until 1835 or afterwards. Registered in the Deed Book for that year are two purchases of land made by William D. Cope. He purchased a farm, containing 189 acres of land from Adonijah Moody and his wife "including the houses, outhouses, edifices and buildings thereon erected and water courses, woods, fences, gardens and minerals." In the same year William Cope began action to purchase 188 acres from Charles Avery, son of

Asahel Avery, and this land was situated both north and south of the Moody farm, according to a land map prepared in 1940 by Francis Cope and his son-in-law, John F. Stanwell-Fletcher. These purchases include what now constitutes the climax woods in the sanctuary which exists around the nature trails, and the open lands along the east side of the highway.

Between 1902 and 1917, Francis Cope, his father Alexis, and his aunts added several hundred acres to their farm which are now a part of the sanctuary. (The land map prepared in 1940 by Francis Cope shows these parcels and the dates of their purchases.) These additions include the south end of Woodruff's Hill, Main's Woods which contains sections of climax woods, and pasture land along Main's Road, some of which is now second growth woods or evergreen plantations. A cellar hole, situated on the south end of Main's Road, is all that remains of the Riley Lindsey farm purchased by Francis Cope. Other stone-lined cellar holes within the sanctuary tell of other settlers who remained in the area for a period of time before moving on.

(This history of the acquisition of the land presently contained in the sanctuary conflicts with the statement made by T. Cope in her 1932 thesis. On page 10 in that document she stated that "Since 1817, with the exception of a short period from about 1861 to 1876, the land which makes up the Cope farm has been in the possession of the Cope family." When asked recently what happened to the Cope property between 1861 and 1876, T. Cope and other members of her family whom she asked believe that "there were incomplete or conflicting records of that period.")

Summarizing the cultural events, it can be seen that this area was settled quite late compared to New England and New York and to the present time has remained in general sparsely settled. Both events have helped to preserve the integrity of the climax woods in the sanctuary. The land was probably first cultivated by the white man in 1801, and the fields which now exist on the east side of the highway were probably cleared about that time. Though the climax woods did have dead trees removed from them for use as firewood, and trees may have been removed by the Averys or Moodys or Copes to build their houses or farm buildings, it appears by the present age of the hemlocks, some of which are 250 years old, and by the other vegetation which is characteristic of climax woods, that the primeval woods of Woodbourne have been disturbed very little by man.

The Cope Family

The cultural history of Woodbourne Sanctuary would not be complete without some mention of this outstanding family of naturalists, the Copes who came to Susquehanna County in 1817 from Philadelphia. As was previously stated, William Drinker Cope purchased the climax woods section of the sanctuary and the fields bordering it on the west in 1835. At this time, when everyone else was either felling or burning the forest to create farm land and when the hemlock tree was seen mainly as a source of profit for the tannin in its bark, William Cope had the nearly unparalleled foresight to leave his climax woods undisturbed. His wisdom was passed on, for each generation of Copes following him continued to protect the 200 acres of primeval forest until they were entrusted to the Conservancy in 1956 by Francis R. Cope.

The rather humorous story of how Francis Cope first became seriously interested in natural history was told by his second wife, Margaret Cope. Apparently when Mr. Cope was still quite a young boy, he and a friend shot a number of birds and laid them neatly on the porch railing for his mother to see, Frank expecting praise for his skill as a gunsman. Instead he received a scolding and was told he had to look up and identify every bird he had killed! This experience initiated his lifelong scientific curiosity and appreciation for living things. In 1898, while only 20 years of age, his article on "The Summer Birds of Susquehanna County" was published in The Proceedings of the Academy of Natural Sciences of Philadelphia. He kept a journal of the

birds that he observed at Woodbourne every day for ten years! His records and articles are invaluable to present bird studies of this area, and it is fortunate that they are contained in the files at the Woodbourne cottage.

Mr. Cope and his first wife Evelyn, who was also an ardent outdoor enthusiast, started the Dimock Nature Club. For 20 or more years they brought groups of young people camping on North Mountain which is situated about a mile from Jamison City. At the time North Mountain still contained virgin woods. While Mrs. Cope efficiently organized all the camp's material needs and taught basic skills in living in the out-of-doors, Mr. Cope brought the youths on long hikes, developing their awareness and appreciation for the wilderness. One of their students, Ruth Sheen who still resides in Dimock, just recently donated her notebooks to Woodbourne in which she described vividly their camping adventures in the summers from 1919 to 1921. Her photos and drawings of the scenery, campers, and the flora and fauna give great insight into the times in which they were made.

Francis Cope possessed tremendous enthusiasm and love for Woodbourne Sanctuary and delighted in showing these woods to other interested individuals. All who had the fortune of knowing him acclaim his great spirit, generosity and knowledge of the natural world.

Francis Cope must have kindled his only child's interest in nature, for Theodora went on to become one of the first students to study ecology at Cornell University. After completing her master's degree in 1932 with a thesis on "Some Ob-

servations on the Vertebrate Ecology of a Pennsylvania Mountain Farm" (Woodbourne Sanctuary) and her PhD thesis on "Observations on the Vertebrate Ecology of Some Pennsylvania Virgin Forests" in 1936, she and her husband travelled to a remote section of British Columbia and established a wilderness home where they lived for a number of years collecting material on the wildlife for the British Columbia Provincial Museum. She later wrote the best selling book "Driftwood Valley" describing her experiences and adventures during this sojourn. Still as much interested in nature as ever, she enlivens our spring bird walks with her sharp ears and eyes for the hidden birds in the bush.

Mr. Cope's second wife, Margaret Wysong Cope, who just recently passed away, possessed tremendous community spirit and supported many causes, the most important of which was Woodbourne Sanctuary. Like her husband, she believed strongly in the values to be found in these woods, and was ever gracious in receiving visitors to her home who were interested in the preserve. The deep respect and love which her townspeople felt for her will be an asset for Woodbourne Sanctuary long into the future.

Mr. Cope also had two famous naturalist cousins. Stewardson Brown was a well-known botanist who first discovered the small variety of Jack-in-the-Pulpit in the Pocono Mt. swamps. This species is also found at the sanctuary.

His more famous cousin, Edward Drinker Cope (1840-1897) is considered the master pioneer of American paleontology and vertebrate zoology, having discovered great numbers of living and extinct genera and species. The Journal of Ichthyology, Copeia,

is named after him. It is possible that some of his first insights into his theories on evolution might have come to him on his occasional visits to the Woodbourne woods.

CLIMATE

The climate of the Woodbourne Sanctuary area is generally cool and humid. Susquehanna County in which the sanctuary lies is noted for having long, cold winters, cool summers, and bountiful precipitation well distributed throughout the year. The temperature and other atmospheric conditions tend to change every few days in winter and spring and somewhat less frequently in summer and fall. This is a result of westerly winds bringing most of the weather systems affecting this area eastward from continental regions.

The following data regarding the local climate was recorded in Montrose, PA., the county seat which is located about 5 miles north of the sanctuary. The elevation of Montrose is 1,560 feet which compares to the highest elevation found at Woodbourne, 1,600 feet. The data is based on records for the period 1903-1967 by the National Weather Service.

Average winter temperature	24° F.
Average summer temperature	68° F.
Average annual temperature	45.5° F.
Average annual precipitation	41.2 inches
Average annual snowfall	71.4 inches

These statistics compare to those collected from 1888-1920 by the Weather Bureau which T. Cope presented in her 1932 M.S. Thesis. For that period the annual precipitation was 39.5 inches while the annual mean temperature was 45.2 degrees.

Temperatures for this area are zero or below on an average of nine days per winter, and an extreme of -27 degrees F. was recorded in December 1917 and -29 degrees F. in January 1977. Maximum temperatures annually reach 90 degrees on only five days

per summer, and the highest recorded temperature was 100 degrees in July, 1936. Short period dry spells may develop at any time but extended severe droughts are rare.

The growing season, defined as the interval between the last 32 degree temperature in the spring and the first in fall, normally extends from mid-May to early October. At Montrose the growing season ranged from 97 to 171 days over the period of record.

Data was summarized from the Soil Survey , Susquehanna County, Pennsylvania and was prepared by the Soil Conservation Service, August, 1973.

HYDROLOGY

Woodbourne is a well-watered wildlife sanctuary containing 5 ponds, a stream, swamp, and 29 or more springs. (See Hydrology Map, Appendix.) The sanctuary occupies approximately 68% of the watershed in which it lies and wherein starts a tributary of Meshoppen Creek. The extreme head of the valley is isolated from the watershed by a drainage ditch which effectively protects the sanctuary from the ground water runoff from around the main Louden Hill complex. This ditch removes 56 acres (7%) from the watershed.

The main stream is fed by two ponds and many springs, the majority of which are on the sanctuary. The stream, sometimes referred to as Minnie Creek by the Copes, varies in width from about 15 feet where it leaves the lower pond along the nature trail loop to 3 feet where the stream leaves the sanctuary in Main's Woods. The depth also varies of course from a trickle in mid-summer to a foot or more in spring. There is a small "stream" on the north side of the Cope Pond which does not originate in a spring (See map), but instead appears to come from a trailer home across the road. There does not appear to be any other above ground runoff from other adjacent homes into the sanctuary.

The largest pond in the sanctuary, the Cope Pond, covers 9.6 acres and is described in detail in the text. The .6 acre lower pond is surrounded by a 16 acre swamp which contains water throughout the year. Two other ponds exist on the Gray's property on which the Conservancy has a conservation easement.

Though the larger of the two is approximately 330 feet long by 110 feet wide, it has dried up the past two summers. Surprisingly, the smaller pond which is only about 20 feet across but probably spring fed, remains wet throughout the summer months. The fifth pond, located on the new addition in the far northeastern corner of the sanctuary, is also very small but it too contains water throughout the hot days of summer.

GEOLOGY

The rock units underlying Susquehanna County and probably most of Woodbourne Sanctuary consist largely of green to grayish-green, (and sometimes red or brown) cross-bedded flaggy sandstones, red and gray shales and thin local limestone near the top. Termed the New Milford formation of the Catskill Sandstone the maximum thickness of this layer is 400 to 500 feet. Good examples of the grayish-green sandstone can be found in outcroppings on the higher elevations in the sanctuary. A beautiful 15 foot high outcropping was unexpectedly exposed in the fall of 1978 on the new addition when the Baker dump on this site was removed and buried in an adjoining field on the sanctuary. Due to the fact that the sanctuary comprises 68% of the head of a valley which is gently sloped, the stream has not yet exposed the sandstone underlying it.

The origin of the green sandstone dates back to the Upper Devonian Period which began approximately 355 million years ago and lasted until 340 million years ago. At that time most of Pennsylvania was covered with a shallow sea. Three major rivers, the New Jersey, Pennsylvania and the Maryland flowed from the east into this sea. As their deposits were laid down, the shoreline of this sea gradually migrated westward. It was shoreline deposits mainly from the ancient New Jersey River consisting of the beach and drowned river channels, as well as the offshore environments, bar systems and tidal flats, and the lower delta plains in which sediments were deposited that formed the green sandstone of the New Milford formation.

The New Milford sandstone has been extensively quarried for commercially valuable flagstone. Susquehanna County, with over 800 active and formerly active quarries, is a major producer. Quarries which were once active occur along Woodbourne's borders to the east and west.

Although fossils have not been found at the sanctuary to reveal what life existed here during the Devonian Period, paleotologists have discovered elsewhere in this rock strata invertebrates of all kinds, especially brachiopods and corals. The Devonian was the Age of Fishes when many new species of both fresh water and marine fishes developed including sharks and armored fishes which reached lengths of 30 feet. The "lobe-finned" fishes gave rise to the first amphibians that today would resemble giant salamanders.

For the first time plants invaded the land. There were true spore-bearing ferns, horsetails, scale trees, and mosses of which the Lycopodiums in the sanctuary are dwarf relatives.

About 175 million years ago the north-south Appalachian ridges were shoved and compressed into alps a mile or more in height. Susquehanna County, which is a dissected plateau, was uplifted but was not as violently compressed as the Appalachians to the south, as the bedrock remains horizontally bedded with little folding or faulting.

The last major geologically significant event affecting Woodbourne was the ice age, a succession of glaciers which descended across North America between about a million and 14,000 years ago. At the time of the last Wisconsin Glacier's climax - perhaps 25,000 years ago - there was probably 600 feet of ice

over the sanctuary.

The immense weight of the glaciers bearing upon weak rock formations scoured the countryside creating lakes and ponds such as the Cope Pond and the lower swamp and pond. The climax forest and the aging ponds and developing bogs represent the undisturbed natural evolution of the land from the arctic conditions.

The ubiquitous pebbles and small rocks in the soil and the extensive walls in the sanctuary built of stones early settlers cleared from fields, are other daily reminders of the ice age.

SOILS

Formation of soil types presently occurring at Woodbourne began with the retreat of the last Wisconsin Glacier. Depending upon the amount and type of till left behind by the glaciers, and the erosion which has since occurred, soil types range from a reddish to grayish brown, shallow, medium textured, moderately well-drained, flaggy soil found on the uplands to a dark brown, deep, poorly drained, medium to heavy textured soil in the swamp. A soil survey including a detailed map and description of all the soil types found at Woodbourne was completed by the Soil Conservation Service of the U. S. Department of Agriculture in 1966 and is included in the appendix.

THE CLIMAX WOODS

The Climax Woods
Photo taken in 1943
by Francis R. Cope

Virgin or Climax Woods?

The outstanding feature for which Woodbourne Sanctuary has been noted is its "virgin woods." The question of whether or not to call these woods virgin has occupied much of our thoughts since coming to the Sanctuary four years ago. If one is observant while walking along the nature trail, he can see an occasional stump of a tree whose trunk has been removed from the forest. The trees had probably fallen naturally perhaps as a result of the hurricanes which swept through the area in the 1950's, but from a strictly scientific point of view removal of the trunks constitutes an unnatural disturbance.

Woods roads also exist in the old growth woods. The Copes developed these roads for removing dead and dying trees to be used as firewood and the roads were also used as horseback riding trails. Substantiating the fact that dead trees were removed is a letter contained in the Woodbourne files written by Reginald Forbes on October 19, 1943. Mr. Forbes, who had been hired as a consultant to determine the commercial forestry possibilities of Main's woods, stated that "the volume of topwood left after removal of the sawlogs in Main's woods might well amount to 250 cords. At the very least they would provide several years supply of fuel now obtained in the 200 acres of virgin forest from dead and dying trees, the annual removal of which now considerably disturbs natural conditions and deprives the hemlock and birches of an important seedbed."

Though the Cope family has stated that the virgin woods were a part of some 26,000 acres purchased in 1817 by Thomas P.

Cope of Philadelphia, evidence turned up while presently researching the subject for this inventory revealed that there were two previous owners of these virgin woods between 1801 and 1835 who could have removed living trees. In addition, the fierce and devastating hurricanes which swept through Woodbourne in 1950 and 1954 felled half of the largest trees and changed much of the climax forest to second growth. (See Habitat Map.) These blowdown areas may still be virgin in quality, but lacking the fallen trees which were removed to reduce fire hazards, they have the appearance of an area which has been cleared.

It must also be recognized that the presence of civilization has an inescapable effect on the forest via air pollution, some water pollution, insecticide spraying and the introduction of tree diseases, and the unnatural control of animal populations.

Using Robert Gordon's definition of a virgin woods given in 1940 as one "which applies to the original vegetation as it existed when Europeans first settled in the region" and as "an area that has been undisturbed for centuries at least by human industry," it seems inaccurate in light of the above facts to call the mature woods at Woodbourne <u>virgin</u>. Though Theodora Cope Gray and her father Francis Cope described these as virgin woods in their articles and studies, they sometimes referred to them as semi-virgin or almost virgin considering the minor effects of man upon the forest. The decision to refer to these woods using either of these two terms then comes down to semantics which in the case of this term can be rather amusing. The story is told that a nun once questioned Mr. Cope on one of his tours of the sanctuary as to how something could be semi-virgin!

It would seem that the old growth portions of Woodbourne Forest can best be characterized as a climax forest which contains many trees that antedate the settling of the area by the white man. Kendeigh, 1961, defines a climax community as "the final stage in the succession of communities." He wrote that "the climax may be recognized by the fact that in a uniform climatic area all seres (communities) tend to converge into it, and by its steady state in respect to structure, species composition, and productivity. In the climax community, all species, including the dominant ones, are continually able successfully to reproduce and there is no evidence that new and different species are invading." This definition of climax woods accurately describes the old growth sections which exist at Woodbourne.

For this Inventory, I determined that three separate parcels within the sanctuary contain climax woods. I've identified these areas as the Main's Woods, Woodruff's Hill, and the Nature Trail sections. Because my initial field studies revealed that some differences existed between the three plant communities due to the openings which were created, I decided to make separate lists of the plants found in each of these areas so that the reader has an accurate picture of each community. It was also believed that such detailed information might be appreciated in the future if additional studies are performed.

Climax Woods Section I: Main's Woods

Main's Woods contains the most secluded tract of climax woods in Woodbourne Sanctuary. Situated on the eastern side of the sanctuary far removed from Route 29, access to it is gained from Main's Road, a narrow dirt lane along which only three houses exist. When the Main's house and farm were up for sale in 1976, T. Cope Gray and her husband Philip purchased the property and donated 52 acres of the farm to The Nature Conservancy to provide permanent buffer protection for Main's Woods and the sanctuary in general. A conservation easement was agreed upon for the farm's remaining 24 acres to ensure that unwanted development will not infringe upon the north side of Main's Woods.

Main's Hill area was all considered to be virgin or semi-virgin woods in T. Cope's theses. But in 1944 her father, Francis Cope, decided to have a large section of the Hill selectively logged upon the recommendation of Reginald Forbes who had performed intensive forestry studies on virgin tracts in the Tionesta Area in western Pennsylvania. (The Habitat Map depicts the area affected.) It was believed at the time that the removal of "over-mature" trees would improve the over-all vigor and health of this forest stand. Because great care was exercised during the logging operation not to disturb the ground vegetation, the flora in Main's Woods today is much the same as it is in the Nature Trail section.

About seven acres of climax woods were left undisturbed which are along the same stream that flows out of the lower pond. This tract was studied in 1967 by Carmen Mazzotti who prepared a for-

est management plan for the sanctuary. He determined the following distribution of tree species for this seven acre tract:

Average Percent Distribution of Compartment by Species

Eastern Hemlock	22%	American Basswood	4%
Red Oak	21%	Black Cherry	4%
American Beech	14%	Yellow Birch	4%
White Ash	14%	Slippery Elm,	
Sugar Maple	7%	Shellbark Hickory,	
Red Maple	7%	Ironwood	3%

The average tree diameter at the time in this stand was 9 inches. The average board-foot volume per acre was estimated to be 15,838 board feet which compares closely to the estimated board-foot volume per acre for the Tionesta Scenic and Research Natural Area in northwestern Pennsylvania.

The stream in Main's Woods is particularly beautiful as well as accessible to walk along. Even on one of summer's hottest days, cool relief may be found amidst the hemlocks and sugar maples which lean over its waters. Soft, cushiony mosses grow along the banks out of which sometimes is found growing foam flower, jewelweed, silvery spleenwort, violets and other rich, green plants. Several deep, permanent pools exist in the stream which support a population of black-nose dace. The aquatic life is prolific and varied, the underside of every stone supporting stone flies, may flies and other clinging, crawling creatures. Raccoon tracks reveal their nightly hunts along the stream for crayfish, salamanders, and other delectable items which raccoons relish.

At dusk deer with their young fawns come to the stream for drink and refuge. At this time also scarlet tanagers, wood thrushes, veerys and oven birds fill the evening air with a con-

cert joined in on the chorus by green frogs. This is the cherished place where the Cope family often picnicked and camped out for an evening. Teddy Cope and her childhood girlfriends spent as much as a week here enjoying the solitude of these woods and its life.

Climax Woods Section 2: Woodruff's Hill

Woodruff's Hill and the large forested area north of it which contains the Cope family's cemetery, are located in the approximate center of the sanctuary. A spring-fed stream divides the Hill from the gradually sloping tract of woods adjoining it. The summit of Woodruff's Hill, named after an early settler to the area, is about the same height as surrounding hills, its highest elevation reaching 1,580 feet. This drops down to 1,340 feet at its eastern edge along Main's Road.

The Hill and the tract of woods north of it comprise about 110 acres. These hemlock-hardwood woods were all considered to be virgin or semi-virgin when T. Cope did her studies in the 1930's. The general appearance and species composition of these woods was significantly altered, however, by the 1950 and 1954 hurricanes which appeared to hit harder here than at any other place in the sanctuary. (See Habitat Map for the area of severe blowdown as outlined by Frank Cope in 1956 and identified again recently by B. Stone.) Following the 1954 hurricane, 500,000 board feet of lumber, all fallen trees, were removed from this tract. Today the most common trees on the Hill include beech, red maple, hemlock, sugar maple, white ash, and yellow birch. Though the openings which were created have encouraged new species to enter such as fire cherry, (Prunus pensylvanica), much of the flora remains which represents the old climax forest.

Woodruff's Hill contains the greatest amount of running pine (Lycopodium complanatum) of any area within the sanctuary.

In the spring it is also carpeted with spring beauties, hepaticas, and squirrel corn. Several rock ledges jut out near the top of the Hill upon which various mosses, lichens (British Soldiers, Forked Shrublet) and ferns grow. In 1932 T. Cope discovered an active red fox den underneath one of these ledges. Despite campaigns to exterminate the fox in the 30's and 40's, the species fortunately still remains in the area. Though no new dens have been found recently, red foxes are observed once or twice a year hunting in the sanctuary.

Woodruff's Hill contains a long abandoned woods road which is still discernable but as yet no public trails have been made through the area. As a result, the wildlife on Woodruff's Hill which includes Ruffed Grouse remain nearly completely undisturbed.

Climax Woods Section 3: Nature Trail

The Nature Trail Section within the sanctuary represents the best remaining example of a climax forest. After studying all the old growth sections of the sanctuary in July, 1977, James Runkle who was then writing his PhD thesis on climax forests, was also of this opinion. As can be observed on the Habitat Map large portions of these hemlock-hardwood woods exist both north, east, and south of the lower pond and swamp. Narrower parcels also exist along the west edge of the swamp permitting the visitor who is walking on either Trail 1 or Trail 2 to be continuously amidst a primeval forest.

Along the nature trail tall, towering hemlock trees, more than 100 feet high and between 200 and 300 years old, inspire the visitor with their great age, size and beauty. Some Eastern hemlocks have fallen with ring counts of 300 to 350 years. And there is a record of a giant which died in 1921 at the age of 427 years! The average diameter of 16 large hemlock trees measured in June, 1978 was 29 inches. Presently the largest Eastern hemlock, located near the end of Trail 2 has a diameter of 52" and is about 120 feet tall!

Before the severe hurricanes of 1950 and 1954 which swept through Woodbourne, about 130 acres of virgin woods existed in this section according to a map included in T. Cope's 1932 thesis. There appears to be between 50 and 100 acres of climax woods which remain for the most part undisturbed in this section today. As was previously stated the Cope family had owned these woods since 1835 and other than removing dead and dying trees for firewood,

and the blowdown trees to prevent a forest fire from occurring, it is believed that these woods have remained untouched by the white man.

Trees and Shrubs

The climax forest at Woodbourne is composed chiefly of Eastern hemlock mixed with beech, red maple, yellow birch, sugar maple, white ash, black cherry, black birch and red oak. Hobblebush and striped maple are the principal shrubs making up the undergrowth. Mountain maple is still present but in very small numbers which was the case in the 1930's.

Another interesting understory shrub of which only a few exist is Leatherwood (Dirca palustris). The bark of leatherwood is supposedly remarkably fibrous and strong and was used by the Indians for thongs and cordage.

An overpopulation of deer in the sanctuary in the last seven years has kept most of the understory shrubs including hobblebush, leatherwood, fly honeysuckle, mountain laurel, and maple-leaved viburnum almost at ankle-knee high level. In the northern section of these woods numerous mountain laurel and hobblebush stems can be observed that have been killed by deer. But deep snows the last two winters have given many understory shrubs a chance to recover. Hopefully, the deer herd in the region will become more in balance with the available food supply before any of these shrubs in the climax woods are totally lost.

Herbaceous Flora

The herbaceous flora in the climax woods consists of a variety of ferns, lycopodiums and wild flowers which bloom primarily in the spring. In the very shaded sections of the woods where the tree canopy is dense, the most common plants in the author's frequent observations are:

Spinulose wood fern	Dryopteris spinulosa
Shining club moss	Lycopodium lucidulum
Common wood-sorrel	Oxalis montana
Clintonia	Clintonia borealis
Star flower	Trientalis borealis
False lily-of-the valley	Maianthemum canadensis
Tree club moss	Lycopodium obscurum
Painted trillium	Trillium undulatum
Indian cucumber root	Medeola virginiana

In the northern and eastern sections where openings have been created due to the blowdowns other ferns appear including the maidenhair, Christmas and New York fern. Also common in the opened areas are:

Sharp-lobed hepatica	Hepatica acutiloba
Spring-beauty	Claytonia virginica
Blue Cohosh	Caulophyllum thalictroides
Round-leaved Yellow Violet	Viola rotundifolia
Fragrant Bedstraw	Galium triflorum

Meadow spikemoss (Selaginella apoda), spotted touch-me-not (Impatiens carpensis), and foam flower (Tiarella cordifolia) form a densely woven carpet in the wet areas of the climax woods.

Although false violets (Dalibarda repens) and smaller enchanter's nightshade (Circaea alpina) are scarce in these woods, the author believes that they may still be characteristic of climax woods. Apparently Dalibarda was uncommon in the past as well, as Theodora Cope did not observe it until her work began for her PhD thesis in 1936. Smaller enchanter's nightshade was

not mentioned in either of her studies but Hough (1936) felt that though both of these plants occurred in somewhat less abundance in the virgin forest at East Tionesta Creek, they were nonetheless characteristic of that area.

Comparison with Cope's Studies of the Virgin Woods

Other than those plant species inhabiting wet areas, fragrant bedstraw, and smaller enchanter's nightshade, all of the previously mentioned plants were listed in T. Cope's theses. In 1932, however, she described the dominant plants of the forest floor as being "partridge berry, wood sorrel, hepaticas, violets, and the common wood ferns such as Spiny-toothed Shield Fern (Thelypteris spinulosa), and Christmas fern with one or two rarer species like the Walking leaf fern (Camptosorus rhisophyllus) located on some rock ledges. Four or five species of Lycopodium, as well as American Yew, are also fairly prominent."

American yew is very hard to find in these woods today; I have only come upon it in two locations. Partridge berry is less than common. Walking leaf fern has not been observed during this study, but this and other new species might still be found.

Generally, I have found the same plants growing in the sanctuary today that were mentioned as occurring here in the 1930's. I have 18 plants listed which do not appear on Cope's lists. Ms. Cope has some species listed that I have not found. For several reasons it is difficult to make further comparisons of the climax woods today with the way it may have been before

using T. Cope's theses. First, her habitat boundaries for the climax woods must have been different from mine because she has plants listed which are found in swamps, fields, or second growth areas today. Secondly, she did not quantify most of the species she observed so it is difficult to know if a species was abundant or scarce. Thirdly, it does not appear that she carried her observations through the late summer and fall periods as I have done, so it cannot be said that certain plants exist here today which weren't present before, because her studies did not cover as long a period of time. Lastly, I separated the climax woods into three areas because of the differences which exist between them due to the hurricanes, selective cutting, etc., which have occurred since she did her studies. It would be a burdensome task to compare every plant of one area in two different studies (M.S., PhD) to its presence or absence on three other areas today.

Comparison With Other Primeval Tracts in Existence

Intensive studies were made on two other virgin tracts of woods in the 1930's. The descriptions of these areas, one in the Allegany State Park in New York and the other at East Tionesta Creek in western Pennsylvania, compare very closely with the present plant community in Woodbourne's climax woods. In the New York State Museum Bulletin, "The Primeval Forest Types of Southwestern New York" published in 1940, botanist Robert Gordon found that the dominant trees at the virgin tract in Allegany Park were hemlock, beech, yellow birch, red

maple, black cherry and sugar maple. The ground cover of herbaceous plants consisted largely of the following species:

Common wood fern	Dryopteris spinulosa
Common wood sorrel	Oxalis acetosella
Shining club moss	Lycopodium lucidulum
False lily-of-the-valley	Maianthemum canadensis
Foam Flower	Tiarella cordifolia
Yellow clintonia	Clintonia borealis
Twisted-stalk	Streptopus roseus
Starflower	Trientalis borealis
Indian cucumber root	Medeola virginiana
Stemless yellow violet	Viola rotundifolia
Woodland white violet	Viola incognita

A. F. Hough made a detailed analysis of a climax forest community on East Tionesta creek in northwestern Pennsylvania which was published in the Journal of Ecology in 1936. The Tionesta Scenic and Research Natural Area and the Woodbourne Sanctuary contain, to my knowledge, the only remnants of a climax forest left in this State. Hough found that the "dominant stand (trees 70 feet and over in height) was made up almost entirely of hemlock and beech with small percentages of sugar maple, yellow birch, red maple, black birch, black cherry, and others." Of the shrubby and herbaceous vegetation in the Hemlock-Beech forest of that region, the commonest plants were:

Shining club moss	Lycopodium lucidulum
Common wood fern	Dryopteris spinulosa
True wood sorrel	Oxalis acetosella
Partridge-berry	Mitchella repens
Hobblebush	Viburnum alnifolium
False lily-of-the-valley	Maianthemum canadensis
Foam Flower	Tiarella cordifolia

Other ground cover species that occurred in somewhat less abundance were:

Smaller enchanter's nightshade	Circaea alpina
Yellow clintonia	Clintonia borealis
Round-leaved yellow violet	Viola rotundifolia
Large-leaved white violet	Viola incognita

Indian cucumber root	Medeola virginiana
Starflower	Trientalis americana
False violet	Dalibarda repens

All the above species except the large-leaved white violet have been mentioned as being common to the Woodbourne woods. Bjorkbom (1977) reporting on the understory changes at the Tionesta area beteen 1942 and 1972 stated that "the frequency rates for ferns, beech, wood sorrel, birch, and sugar maple remained relatively stable for this period. Violets, club-mosses, and hobblebush decreased in frequency during the period, while striped maple, red maple, and hemlock increased."

Conclusion

The author's observations concerning the dominant plants in the Woodbourne climax woods coincides with the findings of Gordon and Hough on other virgin tracts in the 1930's. Because the Woodbourne woods compare so closely with these virgin areas studied 40 years ago, I would postulate that they stand today as a classic example of a climax community for this section of the country. Because present data compares more closely with Gordon's and Hough's studies than does the information Cope presented in her theses, it may be that the Woodbourne woods are closer to their climatic climax today than what they had been in the 1930's.

Description of Plant Terms

The following descriptions explain the terms used by the author in determining the frequency of a plant species:
An Abundant plant exists in large numbers in the habitat and would likely be seen each time a person visited the habitat.

A Common plant exists over most of the habitat in smaller numbers and would be seen most of the time a person visited the habitat.

An Uncommon plant would only be found in certain parts of the habitat and in small numbers.

A Scarce plant is one of which only a few plants have been found over the entire habitat. Without special instructions as to its exact whereabouts it would require a considerable time for an individual to find the plant.

Generally the plants are listed in this order as well from those that are most abundant in the sanctuary to those that are scarce.

Climax Woods

Woody Plants	SECTIONS Nature Trail	Woodruff's Hill	Main's Woods
Eastern Hemlock	A	C	C
Yellow Birch	C	C	C
American Beech	A	A	A
Black Cherry	C	C	C
Red Maple	C	A	C
Sugar Maple	C	C	A
Black Birch	C	C	C
White Ash	C	A	C
American Basswood	U	C	C
Red Oak	U	U	U
Striped Maple	C	U	U
Hobblebush	C	U	U
Shadbush	U	C	U
White Pine	U	S	U
Mountain Laurel	U		
Mountain Maple	S		
Eastern Hop Hornbeam	U	C	U
Witch-hazel	U		
Leatherwood	S		
American Chestnut	S	S	S
American Elm	S		
Northern Arrowwood	S	S	
American Yew	S		S
Alternate-leaved Dogwood	U		U
Highbush Blueberry	S		
American White Birch		S	
Black Walnut		S	
Red Pine, Intro.			U
Choke Cherry			C

Woody Plants	Nature Trail	Woodruff's Hill	Main's Woods
Maple-leaved Viburnum	U	C	C
Bitternut Hickory.	U	C	
Ironwood.	U		U
Japanese Barberry	S		U
Shagbark Hickory.		C	
Red Elderberry.	S	U	
Virginia Creeper.			C
Garden Red Currant.		S	S
Fire Cherry		C	
Fly Honeysuckle	S		

Climax Woods

Herbaceous Plants	SECTIONS Nature Trail	Woodruff's Hill	Main's Woods
Common Wood Fern	A	C	C
Christmas Fern	C	C	C
Hay-scented Fern	C *	C	
Cinnamon Fern.	U		C
Fragile Fern	U	U	U
Long Beech Fern.	U	U	U
Broad Beech Fern			U
Maidenhair Fern.	C *		
New York Fern.	C		C
Bracken Fern	U	C	C
Rattlesnake Fern	U	U	U
Lady Fern.	U		U
Sensitive Fern	U		U
Oak Fern	S		
Tree Club Moss	C	A	C
Shining Club Moss.	A	C	C
Stiff Club Moss.	S		
Running Pine		A	
Wood Sorrel.	C	U	C
Gold Thread.	C		C
Canada Mayflower	A	C	C
Patridge Berry	C	C	C
Wintergreen	U		
Blue-beaded Lily	C		U
Painted Trillium	C	U	
Purple Trillium, Wake Robin.	C *	U	
Spring Beauty.	A *	A	C
Blue Cohosh.	A *	U	U

Herbaceous Plants	Nature Trail	Woodruff's Hill	Main's Woods
Foam Flower	C *	U	C
Sharp-lobed Hepatica	C *	C	U
Star Flower	C	C	C
Dwarf Ginseng	S	S	
Indian Cucumber-root	C	U	
White Baneberry	U *	U	U
False Solomon's Seal	C *	U	U
Wild Leek	S	S	U
Dew Drop, False Violet	S		U
Spotted Touch-me-not	A *	U	C
Twisted-stalk	C *		
Pink Ladies Slipper	S		
Canada Violet	U		
Round-leaved Yellow Violet	U	U	U
Kidney-leaved Violet	U	U	
Northern White Violet	U	U	
Sweet White Violet	U		
Wild Sarsaparilla	C	U	
Shinleaf	U	U	U
Turtlehead	U	U	U
Trout-lily, Adder's-tongue	U	A	C
Northern Jack-in-the-pulpit	U	U	
Woodland Jack-in-the pulpit	U	U	U
Beechdrops	C	C	C
Indian-pipe	C		U
Fragrant Bedstraw	C *	U	U
Stinging Nettle	S		U
Enchanter's Nightshade	U		C
Smaller Enchanter's Nightshade	U *	U	U
Helleborine	S		S

Herbaceous Plants	Nature Trail	Woodruff's Hill	Main's Woods
False Hellebore	U		U
Tall White Lettuce	S	S	S
White Avens	S		S
Whorled Wood Aster	U		
Crooked-stemmed Aster	U		
White Wood Aster		U	U
Tall Hairy Agrimony	S		S
Sweet Cicely	S		
Meadow Spikemoss (wet areas)	C		
Golden Saxifrage, Water Carpet	C		
Moneywort (stream)	U		
Blackberry	U *		
Hog Peanut			U
Mad Dog Skullcap			U
Swamp Buttercup			U
Swamp Saxifrage	S		S
Barren Strawberry			U
Bristly Dewberry			U
Common Strawberry			U
Dwarf Cinquefoil			U
Pepperwort			U
Virginia Waterleaf			U

*Plant exists mainly in blowdown areas

1978 Tree Survey of Climax Woods

In June, 1978 a survey was undertaken by the author and her husband to determine the actual tree composition of the climax forest within the Nature Trail section. Thirty plots, each with a diameter of 24 feet, were designated 25 paces apart (center to center) along a line. All woody trees over 1 inch in height within these plots were identified, measured as to their diameters and recorded.

The first survey plot was begun at the largest hemlock tree (dbh 35") found along the nature trail loop, this tree being located south of the swamp at the east end of the first catwalk. Successive plots were studied going north northeast from this tree towards and across the stream. At approximately 50 paces northeast of the stream the plots were continued north through the portion of the climax woods which appears to have been the least disturbed by the hurricanes. The 17 plots made in this area were kept about 100 feet east of the swamp. A total of 13,572 square feet or .3 of an acre of forest were studies in the survey. The results of this study are summarized in Table 1.

Table 1. Tree Composition by Species and Diameter Class in the Woodbourne Sanctuary Climax Forest - 1978

Species	Diameter Class in Inches				
	0"-<2"	2"-<4"	4"-<9"	9"-<22"	22" and larger
	Percent %				
Hemlock	22.2	51	71	16	75
Beech	18.6	17.6	10.9	20	0
Red Maple	14.9	2	10.9	24	0
Yellow Birch	1.2	2	3.6	12	25
Sugar Maple	3	7.8	1.8	4	0
Black Cherry	0	0	0	8	0
Red Oak	.5	0	0	4	0
Black Birch	.5	0	0	4	0
White Ash	1.7	2	0	8	0
Striped Maple	5.4	9.8	0	0	0
Hobblebush (shrub)	31.5	0	0	0	0
Elm	.5	0	1.8	0	0
Witch Hazel	0	7.8	0	0	0
Total	100%	100%	100%	100%	100%
Total Trees in each class	409	51	55	25	8
Total Trees in survey	548				

Results of the Tree Survey

Hemlock

The Eastern Hemlock tree remains the dominant tree species in the Woodbourne climax woods. All available evidence suggests that the hemlock has always been an important and widely distributed species in the virgin forests of Pennsylvania. Hemlock was by far the most common tree in all the diameter classes except in the 9-22 inch class. The tree grows on nearly all site conditions in the forest, young hemlocks having appeared in 26 of the 30 plots studied. The results of the survey indicate that a healthy, young generation of hemlocks is present and on its way to maturity. Deer browsing has been less noticeable on small hemlocks than on other species. The 1950's blowdowns were probably effective in opening up the forest and aiding this younger age group of hemlocks to survive, but were not severe enough for the initiation of a white pine stand.

Three-quarters of the largest and oldest trees found in the old growth woods are hemlock also. Some of these larger hemlocks measured along the Nature Trail beginning at a point just before the catwalk and continuing to the stream had the following diameters:

29"
34"
31" (by catwalk)
35" (large tree across from catwalk)
33" (hemlock containing bulging sides and opening at base)
25"
27"

28"
21" (hemlock nearest to the fallen Towering Pine)
25"
26"
31" (tree closest to the stream)

Across the stream some hemlock diameters measured were 28", 33", 30", and 30". Of these 16 trees, the average diameter was 29 inches. The twin hemlocks, whose trunks have grown together up to five feet, had a diameter at breast height (dbh) of 52 inches. The largest hemlock growing in the Sanctuary, which is in the northern section east of trail 2, has a dbh of 52 inches and is approximately 125 feet tall.

American Beech

Beech ranked second to hemlock in frequency of trees having a diameter less than 4 inches. Beech suckers are sprouting up from roots everywhere in the climax woods. Many of the young beeches have been over-browsed and show the typical growth distortions that follow browsing by deer.

Because beech does not live as long as hemlock, many trees in the 22 inch and larger category were not anticipated. Although 20% of the Woodbourne forest trees 9-22 inches in diameter were beeches, at the rate that the beech bark scale disease is spreading through the Pennsylvania woods, most of these trees may not be living in a few years. Infestations of this disease were first reported at Woodbourne in 1967 in C. Mazzotti's Forest Management Plan. James Runkle also commented verbally to the author on the devastations of the beech tree in the

climax forest areas in 1977. Presently there seems to be nothing that can be done to control this disease except to wait it out and hope its toll is much less than the near extirpation of the American chestnut tree. Houghs and Forbes in 1943 had reasurring words about the permanency of the beech tree in the climax woods. They stated that "judging from its ubiquity under all conditions of stand history, in all physiographic, soil, and site conditions, and over long periods of time (the study covered 350 years), beech ranks highest in its capacity of establishments, survival, and growth in association with species of the East Tionesta tract. Its ability to establish seedling and root sucker reproduction and to thrive, despite suppression, under conditions unfavorable to these conifers and to many of the hardwoods, insure its place in the forests of the High Plateaus."

Yellow Birch

The yellow birch tree was mentioned after beech by T. Cope (1932) in her descriptions of the most common trees in the Woodbourne virgin woods. In the Trail Guide which was printed about 1967, the birch was described as "one of the most interesting of the dominant trees of the Hemlock-Hardwood forest." In the tree survey, however, yellow birch composed only a small percentage of the total number of trees which fell within the study plots. Only 1.2% to 3.6% of the trees in the 6 to 9 inch diameter classes were yellow birches. The species ranked higher in classes of trees having larger diameters. There are three

conclusions one could make from these results.

The first conclusion is that the study area was not representative of the yellow birch population. Though possible, this explanation does not seem probable as birch is generally found near swamps and streams and in shaded areas which describes the type of habitat the plots fell within.

The second conclusion that could be made is that the birch was more dominant in the past and that its numbers have decreased in the last 35 years. If this is so, why have they decreased?

The author cannot state with certainty what could have caused the decline of especially young yellow birches in the climax woods. The deer population could be responsible for the low number of trees under 2 inches but probably wouldn't account for the low percentage of trees 4" to 9" in diameter as the deer herd was not unusually large in this area until ten years ago. Drought, especially on shallow soils and steep slopes, results in heavy mortality among shallow rooted tree species such as eastern hemlock and yellow birch trees. (Hough) But hemlocks were found to be abundant in the woods and no serious droughts have been known to occur in recent times.

The most likely explanation the author has for the low numbers, if they are low, is that according to the Hough and Forbes 1943 study entitled "The Ecology and Silvics of Forests in the High Plateau of Pennsylvania," birches and hemlocks seem to be dependent in a virgin woods on fallen trees or nurse logs upon which to germinate. Thirty-eight percent of the

yellow birches which grew on the study plots at the Tionesta area, grew on rotted wood of fallen tree boles. Hough stated that "a greater percentage of yellow birch grew on such sites than of any other species." As was previously mentioned, the Cope family did remove some dead and dying trees for firewood from the climax woods never believing, the author is sure, that this could affect the regeneration of trees. Almost all of the large trees which were blown over after the 1950 hurricanes were removed as well to prevent a fire from occurring. Many of the older yellow birch trees found at Woodbourne today do possess root structures that look as if the tree is growing on stilts, indicating that the tree began its growth on a fallen log. In view of Hough's findings, it appears that removing the fallen trees from the Sanctuary might account for the lower population of yellow birches present now.

The last conclusion one could make concerning the low number of birch trees in the plots is that perhaps this species was never as abundant as was supposed! No previous studies to determine the frequency of each species were ever performed in this Nature Trail section and opinions based on general observations can be erroneous. The birch's unusual silver curled bark may make it stand out more amongst the hemlocks, maples and beeches making it appear to be more common than what it ever was. Hough stated that at E. Tionesta creek "the dominant stand (trees 70 feet and over in height) is made up almost entirely of hemlock and beech with small percentages of sugar maple, yellow birch, red maple, black birch, black cherry and others." Only 3% of trees in the 4 to 9 inch

diameter class were birches at the E. Tionesta forest in 1930. Gordon (1940) felt that there was no essential difference in composition between the climax forest at Tionesta and the one at Cattaraugus County in New York. As these virgin forests seem to compare closely to the Woodbourne forest, the frequency of yellow birch may not have changed significantly, if at all. In any case enough birch trees remain at Woodbourne to build the species population up again if indeed it is lower now than in the past.

Hobblebush

Hobblebush, which is not a tree but a shrub, was identified in the study plots because there has been concern in recent years that the abnormally high deer population which has existed in the State may be eliminating this species from the climax woods. Also called witch hobble because its supple branches often droop to the ground and take root forming loops which may trip up a careless wayfarer, this viburnum has large, heart-shaped leaves 4 to 8 inches long and beautiful white flower clusters in the spring.

Theodora Cope stated in her 1932 Master's thesis on Woodbourne that "a large proportion of hobblebush made up the understory in the virgin woods." In Walter Gould's 1966 study on The Ecology of Viburnum Alnifolium (hobblebush) he stated that "there appears to be little doubt that hobblebush was formerly abundant in the climax forest of the Allegheny Plateau but it has been nearly extirpated and since held in check by the deer

herd eruption which began ca. 1930." Due to the overbrowsing which has occurred at Woodbourne, only a few shrubs and small sprouts are noticeable today and the observer would not realize that the hobblebush had ever been an important part of the understory.

However, when a survey is taken and actual numbers of trees are counted, a truer picture of the forest sometimes emerges, and in the case of witch hobble, the picture appears to be a bright one! Hobblebush comprised nearly one-third of the total number of woody plants identified in the 0<2 inch diameter class. It was surpassed by no other woody tree in numbers for this class and was present in 18 of the 30 plots! Though probably 95% of the shrubs counted contained only two to four leaves, the fact that so many seedlings exist today testifies to the species' previous abundance and also gives hope that if protected, hobblebush could once again become a beautiful and significant feature of the understory!

Gould found from studying deer exclosures that were built in the 1930's that if hobblebush were given complete protection from both deer and rabbits, it could recover markedly from overbrowsing in five to ten years. If only protected from deer, the hobblebush was present but in lesser abundance.

In the fall of 1977 a deer exclosure, 30x30x8 feet high was built in the Woodbourne Sanctuary to protect the hobblebush that remained in that area. Counts on the number of shrubs surviving in the exclosure should continue to be made each year to determine the success of this project . Fencing may

have to be added on the lower half to exclude rabbits as well but it is not believed at this time that many rabbits exist in the forest area. One or two other exclosures could be built in the northern section of the climax woods to ensure a source of hobblebush seeds in that area for the future.

Almost all of the second growth woods surrounding the sanctuary were clear-cut this spring. Deer are sure to be attracted to these areas for some years to come while a third shrub stage emerges there and alas, to the sanctuary also during the hunting seasons and winters which follow!

Maples

No one to our knowledge has ever performed a study at Woodbourne to determine which of the two maples, red or sugar, was more abundant in the climax woods. "Maple" is mentioned as being one of the dominant trees in T. Cope's theses and in the Woodbourne brochure. The Trail Guide used for many years states that "the dominant trees at Woodbourne are Hemlocks, Beeches, Birches, and Maples. The Maple to be expected is the Hard or Sugar Maple, but also found are many Red Maples."

Our plot studies revealed that the red maple was actually five times more abundant than the sugar in the 0-<2 inch class. Red maple was also about six times more common than sugar as an older seed tree in the 4 inch and larger classes. In fact red maple ranked first for frequency of trees in the 9-<22 inch class and third in two smaller size classes.

At the Tionesta Natural Area in 1930 sugar maple ranked third to beech and hemlock in trees less than 30 feet in height (Bjorkbom). The climax woods that remain at Woodbourne which we sampled were in lowland areas surrounding the swamp where the red maple would be more expected to exist. The drier slopes which now contain second growth woods contain many more sugar maples under 4 inches in diameter but definite counts have not been made in such areas.

Vertebrates of the Climax Woods

Description of Vertebrate Terms

The following descriptions explain the terms used by the author in determining the frequency of a vertebrate.

An Abundant mammal, reptile, amphibian, or bird exists in large numbers in the habitat and would likely be seen or heard each time a person visited the habitat.

A Common vertebrate ranges over most of the habitat in smaller numbers as has been observed by droppings, tracks, etc., but would most likely not be seen due to the animal's nocturnal or secretive habits.

An Uncommon vertebrate exists only in certain parts of the habitat in small numbers as has been evidenced by sightings, droppings, tracks, etc.

A Scarce or Rare vertebrate is one which has only been observed from one to three times over the past several years.

P.R. - Permanent Resident

Mammals

Eastern Chipmunk - Tamias striatus. P.R. Common. Probably the most commonly seen mammal in these woods. Can almost always count on each school group seeing one scurrying near the trail.

Red Squirrel - Tamiasciurus hudsonicus. P.R. Common.

Gray Squirrel - Sciurus carolinensis. P.R. Common. In her 1932 thesis T. Cope said that in "the last 2 or 3 years the gray squirrel was becoming very common." She has been concerned that the gray squirrel has driven out the red squirrel while local hunters still believe the tale that the red squirrel catches and castrates the gray, keeping their numbers down! In the report "Mammals of Pennsylvania" the authors state that "the red squirrel, like the other squirrels, fluctuates in numbers, although at irregular intervals." "Apparently, all three species of squirrels can live in harmony, but when they do it would appear that the red plays the part of the poor cousin. It seems to live on the outer fringe of the habitat and takes the least attractive section of the woods for its home." We see both species in the climax woods today which offers among other food items hemlock cone seeds for the red squirrel and acorns and beech nuts for the gray squirrel, but we do not know which is the more common.

Eastern Flying Squirrel - Glaucomys volans. P.R. Common. Several years ago when the Griffins resided here as Naturalists, Mrs. Griffin slapped a hollow dead tree along the nature

trail for a group of children and to everyone's delight, several flying squirrels bounded out of the tree's open top! When this same tree fell over two years ago, squirrel droppings could still be found on the stump that remained.

Theodora Cope picked up a dead flying squirrel near the boathouse a year or so ago which I identified as an eastern and not a northern (sabrinus) flying squirrel whose range falls within this area. Volans was the species mentioned in Cope's thesis as well.

Woodchuck - Marmota monax. P.R. Uncommon. Though seldom observed in the climax woods, one does come across their burrows. Most burrows exist in areas close to the pastures such as in the nature trail loop or in the woods west of the swamp.

Beaver - Castor canadensis. Occasional visitor. Rare. A few beavers dammed up the stream at the outlet of the lower pond several years ago. Breaking the dam repeatedly did not discourage their taking up residence here. After removing a number of trees from the swamp and the edges of the climax woods, two beavers were suddenly found dead along the highway and another near the dam, their deaths never explained. During the winter of 1977 when the swamp and pond were frozen over so as to permit entry, the author observed an alder that had recently been cut by a beaver. No other sign of beaver activity has been seen since. Large beaver colonies do exist in the immediate

area, however, so it is only a question of time and the suitability of Woodbourne's habitats before they are again here!

Eastern Cottontail - Sylvilagus floridanus. P.R. Uncommon. Droppings and tracks observed in winter but seldom seen in the climax woods during the spring or summer probably because the woods are too shady to permit very much underbrush to grow.

Snowshoe Hare - Lepus americanus. Occasional visitor. Tracks were observed three years ago in the winter but not since. Its status seems to have remained the same since around 1890 when Edgar Cope reported having seen them.

Skunk - Mephitis mephitis. P.R. Uncommon. As skunks are nocturnal and seldom seen, it is difficult to assess their numbers. Tracks are seen occasionally in the winter. I don't recall having seen any dead skunks on the highway since we've been here which might indicate that they are uncommon. This road is probably responsible for the skunk's low numbers as hardly anything survives crossing it and the skunk has never mastered a defense against the automobile.

Raccoon - Procyon lotor. P.R. Common. Raccoon droppings have been found throughout the climax woods, usually to a site the author has felt would have made a good place to sit down, such as at the base of a big tree or on a large rock. Raccoon tracks are seen frequently along the stream and last fall we found a skull by the stream in

Main's Woods.

Red Fox - Vulpes vulpes. Uncommon. Tracks are usually seen in the winter. An active red fox den was discovered by T. Cope in 1932 on Woodruff's Hill but no dens have been found recently. Once or twice a year a red fox is noticed just before it slips out of sight.

Porcupine - Erethizon dorsatum. P.R. Uncommon.

Black Bear - Ursus americanus. Occasional visitor. Rare. Though black bears are common now in the Pocono Mountains, they are not often seen in these parts. In July, 1979 the author and her dog were walking along the trail in the evening. As she approached the massive root system of a recently fallen hemlock near the stream, her dog Happy, who was by the side of the roots, stopped abruptly, and gave a timid bark. After producing another small bark, he hastily retreated to her side. From her vantage point behind the root system, the author could not see or know what her dog had just seen and knew, but she sensed that a bear must be there. One had been seen only a mile away a week earlier. She retreated a few steps and waited to see what the animal might do. Minutes later the animal could be heard leaving the stream. It walked slowly, alas, on the other side of the swamp's ancient ridge where it could not be seen. The creature was only about 35 feet away but the author lacked the nerve to climb the ridge to see for certain what it was. Branches could be heard snapping as the bruin moved

through the underbrush, and the impact of the bear's weight on the forest floor could be felt. Her dog would not have been frightened of the animal had it been a deer. Deer also remain frightened of man in this area and the author has never seen one that did not flee instantly when approached at this range. A few nights later the author returned with her daughter, Lila, to find evidence of the bear having been there. Instead, they encountered a nearly albino skunk just 5 feet from them!

White-tailed Deer - Odocoileus virginianus. P.R. Common. Seen only occasionally in 1932, the numerous deer trails, droppings, and the overbrowsed understory testify that too many deer have taken refuge in these woods for at least the last seven years.

River Otter - Lutra canadensis. Occasional visitor. Rare. A dead otter was discovered about four years ago (1974) near the catwalk by Philip Gray, but we have not found evidence of otters having appeared here since that incident.

Opossum - Didelphis marsupialis. P.R. Common. The Virginia opossum had not yet reached Dimock in its movement northward by the 1930's so no mention is made in Cope's theses of this adaptable and persistent creature.

Long-tailed Weasel - Mustela frenata. P.R. Common. Weasel tracks have been observed in winter in the climax woods. This species was described as being seen occasionally in

1932. It was in all likelihood the long-tailed weasel that the author has been fortunate enough to see below the naturalist's house - once in December 1977 and again in June 1978, apparently robbing a mouse's nest. The December weasel was still wearing its summer brown coat which five out of six long-tails are known to do during the winters in Pennsylvania. All short-tailed weasels turn pure white in winter. During the years when weasels were on the bounty list, about one ermine was probated for every fifteen long-tails. (Doutt).

Masked Shrew - Sorex cinereus. P.R. Status is unknown but it is regularly found in the State according to Mammals of Pennsylvania. The author's cat deposited a dead masked shrew on the doorstep several years ago which was made into a study skin. This species is included in this section because the masked shrew is primarily a woodland creature where it occurs under cover of fallen logs, in leaf-littered forest mold and along cool hemlock ravines. Often, however, this smallest of the seven species of shrews found in the State will venture out into fields.

Short-tailed Shrew - Blarina brevicauda. P.R. Common. See Small Mammal Study.

Deer Mouse - Peromyscus maniculatus. P.R. Abundant. The White-footed mouse was mentioned in T. Cope's thesis as being found in the climax woods but this species was not found in the author's trapping study. One Woodland Jumping Mouse was also mentioned as being seen by F. R. Cope in

January, 1931. I believe I saw this species in the Cope's second growth woods three years ago but it has not been trapped in any area.

Climax Woods

Small Mammal Study

Small, hand-made, live-animal traps, baited with peanut butter, sunflower seeds and liver, were set out in the climax woods in 1977 to sample the small mammal population. In 69 trap experiences, 11 deer mice (Peromyscus maniculatus) and two short-tailed shrews (Blarina brevicauda) were caught. The deer mice were found both near and far from the stream; in more open sections of the woods and in dense young hemlock stands; under fallen logs and tree roots but not inside the base of live trees; and more generally on knolls where it was drier than in the vales in between.

It was interesting that no white-footed mice were captured in the climax woods whereas in the second growth woods, the white-footed outnumbered the deer mouse three to one. More oak trees existed in the second growth woods as well as a denser understory composed of mountain laurel, rhododendrons and hemlocks. Almost every deer mouse climbed up the nearest tree or shrub when released, sometimes running 20 feet up, while its cousin, the white-footed, would run hurriedly along the ground to the nearest hole in a knoll for retreat.

One short-tailed shrew was taken inches away from the stream under a tree's roots; the other was caught on a knoll under a young hemlock tree where the underbrush was quite sparse.

Small Mammal Study

Climax Woods

Period Traps Set	Number of Nights	Number of Traps Set	Number of Trap Experiences	Description of Area	Species Captured	Number	Age
June - 77	6	1	6	25 feet west side of swamp	None	--	--
June 18-21, 1977	4	1	4	" " "	None	--	--
Nov. 1- 11, 1977	8	7	56	Inside Nature Trail Loop	Deer Mouse	11	6 young 5 adults
					Short-tailed Shrew	2	1 young 1 adult
Total	18		66			13	

Number of experiences in which traps were released or tripped over by animals - 19

Climax Woods

Birds

Unless stated otherwise, the following species are believed to nest within the climax woods.

S.R. - Summer Resident P.R. - Permanent Resident

Black-capped Chickadee - Parus atricapillus. P.R. Common. The only bird that can regularly be counted on being seen or heard in these woods every day of the year. On May 17, 1976, a Chickadee was observed carrying plant fiber to its nesting cavity which was situated 30 feet up in a black cherry tree in the woods on the west side of the swamp. The entrance to the nesting cavity faced the morning sun in the east.

Hairy Woodpecker - Dendrocopos villosus. P.R. Common. Though not as abundant as the chickadee, the sounds of the hairy woodpecker drilling away at dead trees or giving its familiar loud rattle can usually be heard most days in the climax woods. On the same occasion as above and only 20 feet away, a hairy woodpecker was seen carrying a large insect to its young brood whose loud, hungry screams could be heard from their nesting hole, 70 feet high in a red maple tree whose top had fallen off.

Downy Woodpecker - Dendrocopos pubescens. P.R. Common. About as common as the hairy woodpecker but less conspicuous. With all the standing dead trees in the climax woods, there would appear to be no shortage of insects for

birds who can either drill for them or remove them from the bark of trees.

White-breasted Nuthatch - Sitta carolinensis. P.R. Common.

Red-breasted Nuthatch - Sitta canadensis. Uncommon. Theodora Cope had this species listed as an "Irregular S.R. One pair apparently nesting in 1931." In the winter of 1975, at least one pair remained in the sanctuary, and in the middle of June in 1977, one pair was determined to be nesting here. It's difficult to assess their residency, but they remain uncommon and a special treat to observe.

Tufted Titmouse - Parus bicolor.* P.R. Common. The Titmouse is a newcomer to the area, having extended its range northward since the 1950's. T. Cope does not mention the bird in her 1932 Master's thesis. Though common here, it is still rare 60 miles to the north of Woodbourne. It is an insect eater and nests in tree cavities.

Blue Jay - Cyanocitta cristata. P.R. Common. The blue jay has good cause for giving its alarm call when a hawk or owl appears in the area. On several occasions the author has discovered the scattered feathers of blue jays near the large hemlock tree across from the first catwalk. This area is apparently one of the avian predator's favorite hunting grounds.

Common crow - Corvus brachyrhynchos. P.R. Common. Relentlessly chases the owls out of the sanctuary.

Great Horned Owl - Bubo virginianus. P.R. Uncommon. Great Horned owls have appeared in the sanctuary since 1898

when they were described in Francis Cope's article. In 1932 his daughter, Theodora, stated in her thesis that "At least one pair apparently nesting each year in the virgin woods." The soft hoots of the great horned have been heard it seems on the coldest nights of the winter the last two years.

Long-eared Owl - Asio otus. Rare. On several nights in July, 1979 this bird could be identified by its unowlish shrieks and cat-like calls. Though it remained nearby for several weeks, its whereabouts revealed by the crows' incessant cawing, the owl was never seen. In 1935 T. Cope came close to a quite tame long-eared owl which was sitting in a pine tree. The one heard in July is the first reporting of one at the sanctuary since 1961 when the Griffins began their bird lists. A long-eared was seen at close range near the Brooklyn to Dimock road this past spring.

Barred Owl - Strix varia. P.R. Uncommon. F. Cope regarded this owl as rare in 1898; T. Cope reported hearing them frequently at night in 1932. The species was apparently absent from 1963-74 when Edwina Griffin was naturalist but in 1977, a pair returned, nested here and produced offspring. Present here in 1978 and 1979 as well.

Red-tailed Hawk - Buteo jamaicensis. P.R. Uncommon. One pair is believed to have nested in the climax woods for the last few years. T. Cope stated that red-tail hawks nested in Main's Woods each year. Another pair can

usually be seen on the western edge of the property; these birds appear to do their hunting on Louden Hill property.

Ruffed Grouse - Bonasa umbellus. P.R. Uncommon. The population seems about the same size now as in 1932. One or two can sometimes be flushed up out of Woodruff's Hill; occasionally one appears crossing Main's Road near the evergreen plantation.

Pileated Woodpecker - Dryocopus pileatus. P.R. Uncommon. In 1898 F. Cope reported that the species "breeds sparingly" in Susquehanna County. The following description by T. Cope in 1932 is apt today as well. Then she wrote that the Pileated was "seen and heard frequently throughout the year. At least one pair apparently nests in the semi-virgin timber each year. Their favorite haunt seems to be in the northern section of the semi-virgin timber east of the swamp." Many dead trees exist in the woods today containing the 10-inch rectangular holes drilled by these magnificent birds in their search for insects.

Goshawk - Accipiter gentilis. P.R. Scarce. An immature goshawk which had sustained brain injuries incurred from charging into a chain linked fence recovered and was released here in August 1976. To our surprise the bird has remained in the immediate area and was observed near Woodruff's Hill on the recent January 1, 1978 Bird Count. Doubtless, the many pigeons roosting on the nearby farms are easy prey for the bird. Susquehanna County is close to the south-

ern limits for the goshawk's range. It had not been observed as a resident in 1898 or in 1932.

Sharp-shinned Hawk - Accipiter striatus. P.R. Uncommon. Listed as a Summer Resident in 1932 it has been seen occasionally throughout the year. It has not been found nesting in the sanctuary in recent years.

Brown Creeper - Certhia familiaris. P.R. Common. Mentioned as an Irregular S.R. in 1932 it has been seen here in recent years in all seasons. Appeared in the 1977 breeding census.

Winter Wren - Troglodytes troglodytes. S.R. Uncommon. The winter wren was described as being "very rare" in 1898, and that "it probably breeds only in the wildest portions of the county." T. Cope stated that it was an Irregular S.R., saying that one pair nested during the summer of 1930. Several pairs were heard in 1975, 76, and 77, but none were observed in 1978. More than any other bird, the winter wren seems to epitomize the wild state of the climax woods. Its exquisite high trill song can most often be heard near the stream.

Wood Thrush - Hylocichla mustelina. S.R. Common.

Veery - Hylocichla fuscescens. S.R. Common.

Hermit Thrush - Hylocichla guttata. S.R. Scarce. One was heard during the 1977 breeding census, and the year before in August, 1976. T. Cope reported that they were seen frequently each spring and that they nested each summer until 1913.

Olive-backed Thrush - Hylocichla ustulata. Uncertain if it nests here. Observed the past two springs in the climax

woods.

Robin - Turdus migratorius. S.R. Uncommon in the climax woods. Nests more frequently in hedgerows or more open woods.

Red-eyed Vireo - Vireo olivaceus. S.R. Common.

Solitary Vireo - Vireo solitarius. S.R. Uncommon.

Wood Pewee - Contopus virens. S.R. Common but seems to prefer slightly more open woods such as in mature second growth areas.

Scarlet Tanager - Piranga olivacea. S.R. Common.

Rose-breasted Grosbeak - Pheucticus ludovicianus. S.R. Common.

Ovenbird - Seiurus aurocapillus. S.R. Common.

Great-crested Flycatcher * - Myiarchus crinitus. S.R. Common.

Catbird - Dumetella carolinensis. S.R. Uncommon in climax woods.

Northern Waterthrush - Seiurus noveboracensis. S.R. Uncommon in climax woods except along the stream. Nests in the swamp.

Black-throated Blue Warbler - Dendroica caerulescens. S.R. Common.

Canada Warbler - Wilsonia pusilla. S.R. Uncommon.

Black and White Warbler - Mniotilta varia. Scarce. A male was seen on May 25, 1977 in the climax woods but am not certain it nested in the area. Has been known to nest in second growth woods at the sanctuary.

Yellow-bellied Sapsucker - Sphyrapicus varius. S.R. Uncommon. T. Cope reported that this bird was an irregular S.R. It hasn't been personally observed in the climax woods but their pattern of drilling holes on trees has been seen here.

Cardinal - Richmondena cardinalis.* S.R. Uncommon in dense woods.

Cedar Waxwing - Bombycilla cedrorum.* Winter Resident. Uncommon.

Golden-crowned Kinglet - Regulus satrapa. Winter visitor and migrates through in spring and fall. T. Cope listed it as irregular throughout the winter.

Yellow-shafted Flicker - Colaptes auratus.* S.R. Uncommon. Have not found it nesting in these woods.

T. Cope described the following species in the climax woods which were not observed during this study.

Cooper's Hawk

Snowy Owl

Ruby-crowned Kinglet - Seen in other habitats in the sanctuary.

Yellow-throated Vireo - " " " " " " "

Magnolia Warbler " " " " " " "

Blackburnian Warbler " " " " " " "

White-throated Sparrow " " " " " " "

* Species was not described in Cope's 1932 thesis.

Climax Woods

Amphibians

American Toad - Bufo americanus. Uncommon.

Green Frog - Rana clamitans. Uncommon.

Wood Frog - Rana sylvatica. Uncommon.

Red-spotted Newt - Notophthalmus viridescens. Uncommon.

Northern Dusky Salamander - Desmognathus fuscus. Common in the stream.

Two-lined Salamander - Eurycea bislineata. Uncommon. Found in springs.

Purple or Spring Salamander - Gyrinophilus porphyriticus. Rare. Either this species or the Northern Red Salamander was observed on November 3, 1977 on the bank of the stream bordering the nature trail attempting to swallow a good sized green frog! The jerking movements of the frog trying to escape were first noticed and it was thought that the predator clutching it must be a snake. Upon moving closer to this dramatic struggle, the predator released the frog and retreated into the stream whereupon in the water it could be seen to be a large, uncommon salamander! In another instant it had moved under a rock for protection. The author lifted the rock aside, and placing cupped hands under the denizen, attempted to bring it to the surface for examination. Just at the moment she realized and exclaimed that it was one of those rare purple or red salamanders, never personally seen before, the animal jumped out of her hands and tunnelled into a

hole in the sandy stream bed. Its long brownish-purple tail extended out of the hole for a few moments before disappearing.

Discovering the spring salamander was the kind of thrilling experience one doesn't expect (or perhaps even secretly want) to occur again, and this attitude may account for our not having seen the salamander since. But our efforts do continue because it is important to have accurate identification of the salamander. The spring salamander has only been observed on one other occasion in the sanctuary. T. Cope pencilled in on her PhD thesis that in May, 1940 John Stanwell-Fletcher discovered one in the lower swamp stream.

Spotted Salamander - Ambystoma maculatum. The only observation of this species the author has made thus far was of a spotted salamander's egg cluster in the lower swamp stream. From Theodora's excellent descriptions of salamanders in her PhD thesis, the spotted was common at that time. She stated that the best time to judge its numbers was during the first warm nights of spring when the males and females come into the lower pond to breed.

Red-backed, Slimy and the Four-toed Salamanders were also reported in Cope's PhD thesis. Red-backeds have been seen frequently elsewhere in the sanctuary; the slimy which was reported to be uncommon then has not been observed here recently but it has been seen elsewhere in Dimock; only one four-toed was found in 1931 and none have been found since in the sanctuary.

Climax Woods

Reptiles

Snapping Turtle - Chelydra serpentina. Scarce. A large snapping turtle submerged quietly in the stream was noticed by one of the school children this spring about 80 feet south of the swamp. It looked to be about 17 inches long from its nostrils to the tip of its tail. This is the only snapping turtle observed here in the last three years but it's possible that others may exist in the lower pond which is very difficult to reach and to study in the summer.

LOWER SWAMP AND POND

The lower swamp and pond is a dazzling emerald of green vegetation which when compared to the hushed climax woods surrounding it, is teeming with life and activity! In the spring months northern water-thrushes, yellowthroats, catbirds, rose-breasted grosbeaks and cardinals are continuously singing from the dense thickets and identifying their nesting areas with clear calls. The pileated woodpecker's loud hammering can often be heard here as it drills for insects on the tall, dead trees standing in the swamp. Ruby-throated hummingbirds may whiz by your face while seeking nectar from the jewelweeds' orange flowers. During the height of the spring and fall migration, nearly every shrub in the swamp seems to contain several birds, sometimes all different species of warblers! And in the evening hours, large choruses of spring peepers, American toads, and gray tree frogs take their turn being the dominant croakers in seasonal succession.

Though the plant life may have changed in the last 46 years, bird and other animal populations seem to have remained quite stable. The same species of birds T. Cope observed in May, 1932 are still returning to the swamp today, now accompanied by the cardinal and the tufted titmouse which have expanded their ranges northward in the last 30 years. Despite trapping and other pressures exerted on their populations in the "outside world," the red fox, long-tailed weasel, mink, and raccoon remain the dominant predators in the swamp, especially in the winter.

In 1932 Theodora Cope estimated the size of the swamp to be

eight acres and the lower pond to be three acres, but she probably did not have topographic maps on which to base her decision. Maps in the Woodbourne files prepared by the U. S. Forest Service, The Nature Conservancy, and the U. S. Geological Service show that since 1947 to the present time, the swamp has comprised about 16 acres and the pond within the swamp .6 acre.

Because the swamp contains a great variety of plants which vary in abundance as well, an individual walking through the area might have a different impression of what the swamp was like on each occasion, depending on where he entered the area. Walking in from the western edge of the swamp towards the pond (which lies concealed in the approximate center of the swamp), one first works his way for about 50 to 100 feet through a usually thick layer of vegetation about two to three feet high. This fringe layer of vegetation mostly consists of sedges, long-leaved coarse grasses, touch-me-nots, ferns and goldenrods. A few trees also live in this area. Yellow birches which reach up to 23 inches in diameter, white ashes, witch hazels and hornbeams don't venture very far out into the swamp but they can grow in this outer perimeter.

After about 75 feet, one stops walking and is forced to begin leaping from hummock to hummock to avoid the deep pools of water which were described by T. Cope as "containing treacherous muck." Interesting as well as beautiful plants appear here which can grow with their roots partially or wholly submerged in water. These include the wild calla, jack-in-the-pulpits, white turtleheads, marsh St. Johnswort and swamp candles (yellow loosestrife). Royal fern and cinnamon fern grow also in the nearly full sun-

Lower Pond and Swamp Feb. 1977
Looking north towards Inlet
Foreground: Speckled Alder
Background: Lower Vegetation - Buttonbush
Middle Layer - Speckled Alder
Trees - Climax Woods

Lower Pond and Swamp Feb. 1977
Looking southeast
Outlet can be distinguished faintly to the left.
Background shows buttonbush, blueberry shrubs and alders, surrounded by climax

light conditions existing here and raise the level of plant growth to a height of three to four feet.

A few red maples, the dominant tree in the swamp, small hemlocks and an occasional white pine grow on the sphagnum covered hummocks in this region also. The size of some of these red or swamp maples seems to indicate that they have been growing in the swamp for some time. Nine trees measured at random ranged in size from two inches to 28 inches, the average diameter being 13 inches. The average diameter of eleven hemlocks measured was only 2½ inches. Where the sphagnum moss has grown over the roots of these trees and over fallen logs, skunk currant, bristly dewberry and plants from the climax woods such as Canada mayflower, star flower, and tree club moss have taken root.

Shrub Stage

At varying distances from the swamp's edge, usually about 100 to 150 feet, a tall shrub stage springs up mostly composed of speckled alder. High-bush blueberry, wild raison (witherod), swamp rose, and poison sumac grow amidst the leaning alders which are three inches or more in diameter. These shrubs were all listed in Cope's thesis as well as mountain holly, black huckleberry and pussy willow which, although they have not been identified in the last two years, might still exist today in small numbers. One can only theorize today why certain plant species do not appear to exist while many others are present in large numbers which were not listed in Cope's theses. Cope listed a total of 21 woody plants and 27 herbaceous plants in her M.S. thesis for the swamp habitat. This observer identified 29 woody plants and 51 herbaceous plants of which only one was alien.

Bog Plants in the Swamp

The shrub stage exists to the edge of the pond where many alders, sumacs, and red maples actually lean over the pond's edge so thickly that gaining a view of the pond is extremely difficult during the growing season. Beneath this canopy of alders close to the western shore of the pond, carnivorous pitcher plants grow amidst spaghnum moss. In July, 1978 twelve pitcher plants, each with several vases, were counted near the one poison sumac bush that overhangs the water. A few other pitcher plants may exist also in this nearly impenetrable habitat, but to date no others have been observed.

South of the pond a noticeably drier and more opened area exists within the shrub stage where clumps of grass intertwine with sphagnum. Two plant species which have not been found elsewhere in the swamp fill this area of about 80 by 70 feet. Thousands of the large cranberry plant and leatherleaf grow here in small pools of water and across the sphagnum covered roots of the speckled alder and highbush blueberry. The cranberries are the densest in open areas that have only a few scattered shrubs. Beavers, which resided in the lower pond area several years ago, probably benefited these plants, if nothing else, by removing some of the alder stems which lets in more sunlight.

In her thesis T. Cope called this cranberry area a "sphagnum bog" and stated that it was "covered with pitcher plants, sundews, and cranberries. These plants are now being choked out, however, by numerous red maple seedlings." As this cranberry area was not discovered until March, 1979 (after this Inventory had already been approved by several committee members), the author has not had the opportunity to study the area thoroughly. Sundews were not observed, however, in the hour spent there in May of this year. One clump of pitcher plants grows a few feet in from the edge of the pond. And one small topped red maple, about seven inches in diameter, is the only tree living on this cranberry site. It seems very unlikely that red maples caused the disappearance of the sundews and pitcher plants. There is no evidence, such as dead tree stumps or fallen logs, which would indicate that other trees had lived on this site within the past 25 to 50 years. The bog plants have had suffic-

ient time to make a "come-back" if red maple seedlings were shading them out because only this one maple tree near the edges of this area has existed here for many years. Alders, growing on the site today, shade the bog plants the most but they appear to be about the same age as those found elsewhere in the swamp. Again, one can only speculate, in the absence of detailed, scientific measurements, as to what causes the various changes in the habitats.

Although bog-type plants have in the past or are now growing in the swamp, the area has probably never been a true bog. True bogs ordinarily have little or no drainage and the oxygen is in very low concentration. At Woodbourne a stream with well-oxygenated water flows in and out of the lower pond and swamp. The steep banks along this stream which are 12 feet or more high in places indicate that this stream has probably been flowing in its present course for thousands of years. Thus, for as long as the pond has been here, it has in all probability been filled and drained by this stream.

A sedge mat is also characteristic of bogs. Although sphagnum moss grows profusely across the swamp area, it does not penetrate into or across the open pond. Instead of a floating mat, there is a stable muddy shore around most of the pond. During a particularly wet spring or summer, however, one might question just how safe this shore is to stand upon as one's boots settle ever more deeply into oozy muck!

Unlike bogs also, a true, hardpan bottom exists in the lower pond. This fact was revealed in April, 1979 when beavers

returned and dammed up the stream, allowing the author and her family to canoe up the stream and into the lower pond. The greatest depth of the pond was determined to be nine feet.

The attempt of this writer was to make as thorough an inventory as was possible of the species in each habitat and to enumerate their approximate abundance. This being done, plot studies should begin of each habitat to document the actual frequency of these species. For the swamp many plots would have to be made as every few feet the frequency of plants changes greatly. As there is particular interest in the status of pitcher plants at present, this would seem an appropriate area in which to begin. Any researcher might respect the fact that as the swamp has seldom had a human foot trod upon it, it is in many ways more of a "virgin area" than the climax woods may be!

Lower Swamp and Pond

Woody Plants

Speckled Alder - *Alnus rugosa*. A

Buttonbush - *Cephalanthus occidentalis*. C

Besides filling the northern edges of the pond, this shrub can be found growing along the western and southern shores.

Northern Arrowwood - *Viburnum recognitum*. C

Northern Wild-Raison - *Viburnum cassinoides*. C

Red Maple - *Acer rubrum*. C

Common Highbush Blueberry - *Vaccinium corymbosum*. C

Winterberry - *Ilex verticillata*. C

Skunk Currant - *Ribes glandulosum*. C

Common Elderberry - *Sambucus canadensis*. U

Bristly Dewberry - *Rubus hispidus*. A

Swamp Rose - *Rosa Carolina*. (Britton & Brown) U

Witch Hazel - *Hamamelis virginiana*. C

Shadbush, Juneberry - *Amelanchier*. U

Narrowleaf Spirea (Meadowsweet) - *Spiraea alba*. C

Poison Sumac - *Rhus vernix*. U

Yellow Birch - *Betula lutea*. U

American Elm - *Ulmus americana*. S

Basswood - *Tilia americana*. S

White Pine - *Pinus strobus*. U

Eastern Hemlock - *Tsuga canadensis*. U

Marsh St. Johnswort - *Hypericum virginicum*. U

American Beech - *Fagus grandifolia*. S

Striped Maple - *Acer pensylvanicum*. S

Black Raspberry - *Rubus occidentalis*. S

Hornbeam - *Ostrya virginiana*. S

Woody Plants

Common Burdock - *Arctium minus*. S

White Ash - *Fraxinus americana*. C

Large Cranberry - *Vaccinium macrocarpon*. Abundant in one small area.

Leatherleaf - *Chamaedaphne calyculata*. Abundant in one small area.

Lower Swamp and Pond

Herbaceous Plants

Cinnamon Fern - *Osmunda cinnamomea*.	A
Sensitive Fern - *Onoclea sensibilis*.	A
Royal Fern - *Osmunda regalis*.	A
Crested Shield Fern - *Dryopteris cristata*.	C
Marsh Fern - *Thelypteris palustris*.	C
Clinton's Fern - *Dryopteris Clintonia*.	U
Boott's Fern - *Dropteris Boottii*.	U
Silvery Spleenwort - *Athyrium thelypteroides*.	U
American Shield Fern - *Dryopteris spinulosa*.	C
Sphagnum Moss - Sphagnum spp.	A
Meadow Spikemoss - *Selaginella apoda*.	C
Tree Clubmoss - *Lycopodium obscurum*.	C
Wild Calla - *Calla palustris*.	A
Spotted Touch-me-not - *Impatiens capensis*.	A
Yellow Loosestrife, Swamp Candles - *Lysimachia terrestris*.	C
Canada Goldenrod - *Solidago canadensis*.	A
Lance-leaved Goldenrod - *Solidago graminifolia*.	C
Arrow-leaved Tearthumb - *Polygonum sagittatum*.	A
Halberd-leaved Tearthumb - *Polygonum arifolium*.	A
Common Smartweed, Water Pepper - *Polygonum hydropiper*.	C
Goldthread - *Coptis trifolia*.	C
Canada Mayflower - *Maianthemum canadense*.	C
Star Flower - *Trientalis americana*.	C
Turtlehead - *Chelone glabra*.	C
Purple-stemmed Aster - *Aster puniceus*.	C
Wood Sorrel - *Oxalis montana*.	U
Swamp Buttercup - *Ranunculus septentrionalis*.	C
Marsh Marigold - *Caltha palustris*.	U
Northern Jack-in-the-pulpit - *Arisaema stewardsonii*.	C

Herbaceous Plants

Woodland Jack-in-the-pulpit - *Arisaema triphyllum*.	C
Mad Dog Skullcap - *Scutellaria laterifolia*.	U
Rough Bedstraw - *Galium asprellum*.	C
Pitcher Plant - *Sarracenia purpurea*.	U
Larger Blue Flag - *Iris versicolor*.	U
Marsh Blue Violet - *Viola cucullata*.	U
Northern White Violet - *Viola pallens*.	U
Water Pennywort - *Hydrocotyle americana*.	U
Boneset - *Eupatorium perfoliatum*.	S
White Avens - *Geum canadense*.	U
Teasel - *Dipsacus laciniatus*.	S
Tall White Lettuce - *Prenanthes altissima*.	U
Indian Cucumber-root - *Medeola virginiana*.	U
Bugleweed - *Lycopus virginicus*.	U
Nodding Bur-Marigold - *Bidens cernua*.	S
Swamp Saxifrage - *Saxifraga pensylvanica*.	S
False Nettle - *Boehmeria cylindrica*.	U
Branching Bur-reed - *Sparaganium* sp.	A
Purple-leaved Willow Herb - *Epilobium coloratum*.	U

Grasses

Sedges - *Carex* sp.

Open Water

Bulb-bearing Water-Hemlock - *Cicuta bulbifera*.	S
Duck Weed - *Spirodela polyrhiza*.	A
Larger Blue Flag - *Iris versicolor*.	U
Bullhead-lily - *Nuphar variegatum*.	U

Lower Swamp and Pond

Mammals

Eastern Cottontail - Sylvilagus floridanus. P.R. Common. Tracks observed on the swamp and pond in winter.

Snowshoe Hare - Lepus americanus. Occasional visitor. (See Climax Woods.)

White-footed Mouse - Peromyscus leucopus. P.R. Common? Two specimens livetrapped in the summer of 1977. Tracks observed in winter.

Meadow Vole - Microtus pennsylvanicus. P.R. Status unknown. A meadow vole was seen scurrying along the stream in the swamp this spring. After the deep snows melted this year, numerous narrow runways apparently made by this species could be seen in the ice that remained on the outer edges of the swamp. T. Cope mentions in her PhD thesis that "this species was taken in large numbers in the swamp of the virgin timber region." In November, 1933 Ms. Cope was trapping in this area with a Mr. Hawkins when he grabbed a live, male southern bog lemming (Synaptomys cooperi) on the east side of the swamp. Despite what sounds like a massive trapping campaign at the time, no other lemmings were captured. In the early 1930's few reports of bog lemmings existed for this latitude and the discovery of one at Woodbourne brought considerable excitement in the halls of Cornell University. By 1952, however, the species according to Burt's Field Guide to Mammals had been found as far

south as Tennessee. Traps were set in the swamp during this Inventory in the hopes of catching a lemming but the author had little success catching anything in the wet swamp at the time. Determining whether the bog lemming still exists at Woodbourne would make an interesting study for someone in the future.

Muskrat - Onodatra zibethica. P.R. Uncommon.

Beaver - Castor canadensis. Occasional visitor. Rare. (See Climax Woods for experiences with beaver at Woodbourne.)

Red Fox - Vulpes vulpes. Uncommon. Tracks observed in winter. A dropping containing rose hips, mouse bones and dried corn was found on the frozen swamp in the winter of 1977.

White-tailed Deer - Odocoileus virginianus. P.R. Tracks observed in winter. Use of the swamp in the summer is unknown.

River Otter - Lutra canadensis. Occasional visitor. Rare. (See Climax Woods.)

Raccoon - Procyon lotor. P.R. Common.

Long-tailed Weasel - Mustela frenata. P.R. Uncommon. Tracks have been observed in the winter on the pond and in the swamp. (See Climax Woods.)

Mink - Mustela vison. P.R. Uncommon. Following a mink's trail as it hunts along the small brooks that fill the snow-covered pond is one of the delightful adventures available to the resident naturalists in the winter. Bounding along in some stretches of its route, tunnelling through snow banks and tree roots in others, the mink

makes its way to the open water where it adeptly slips under the ice, its muddy tracks revealing where it later emerged on the opposite shore. The mink and the weasel, identified in the 1930's, continue to play an important role in the balance of nature in the lower swamp and pond.

Lower Swamp and Pond

Birds

Black-capped Chickadee -	Parus atricapillus.	P.R.	Common
Hairy Woodpecker	Dendrocopos villosus.	P.R.	Common
Downy Woodpecker	Dendrocopos pubescens.	P.R.	Common
White-breasted Nuthatch	Sitta carolinensis.	P.R.	Common
Tufted Titmouse	Parus bicolor.	P.R.	Common
Blue Jay	Cyanocitta cristata.	P.R.	Common
Common Crow	Corvus brachyrhynchos.	P.R.	Common
Red-tailed Hawk	Buteo jamaicensis.	P.R.	Uncommon

Observed hunting over the swamp. Occasionally rests in dead tree tops.

Pileated Woodpecker	Dryocopus pileatus.	P.R.	Uncommon
Ruffed Grouse	Bonasa umbellus.	P.R.	Scarce
Cardinal	Richmondena cardinalis.	P.R.	Common
Brown Creeper	Certhia familiaris.	P.R.	Common
Northern Waterthrush	Seiurus noveboracensis.	S.R.	Common

Heard singing from dawn until night falls almost the entire spring and summer.

Yellowthroat	Geothlypis trichas.	S.R.	Common

Heard almost as often as the waterthrush

Catbird	Dumetella carolinensis.	S.R.	Common

Nests are often found in the swamp in the winter months.

Rose-breasted Grosbeak	Pheucticus ludovicianus.	S.R.	Common
Great-crested Flycatcher	Myiarchus crinitus.	S.R.	Common
Wood Thrush	Hylocichla mustelina.	S.R.	Common
Veery	Hylocichla fuscescens.	S.R.	Common
Red-winged Blackbird	Agelaius phoeniceus.	S.R.	Common
Song Sparrow	Melospiza melodia.	S.R.	Common
Swamp Sparrow	Melospiza georgiana.	S.R.	Uncommon
Scarlet Tanager	Piranga olivacea.	S.R.	Common
Ruby-throated Hummingbird	Archilochus colubris.	S.R.	Common
Belted Kingfisher	Megaceryle alcyon.	S.R.	Uncommon

Winter Wren	Troglodytes troglodytes.	S.R.	Uncommon
(See Climax Woods.)			
Mallard	Anas platyrhynchos.	S.R.	Uncommon
Wood Duck	Aix aponsa.	S.R.	Uncommon
Great Blue Heron	Ardea herodias.	S.R.	Uncommon
Common Grackle	Quiscalus quiscula.	S.R.	Uncommon
Olive-sided Flycatcher	Myiarchus crinitus.	Migrant.	Rare.
Observed one male singing in the swamp in spring of 1977.			
Dark-eyed Junco	Junco hyemalis.	Winter Resident	Common
Evening Grosbeak	Hesperiphona vespertina.	Winter Resident	Common
Canada Warbler	Wilsonia pusilla.	S.R.	Uncommon
Nashville Warbler	Vermivora ruficapilla.	Migrant.	Common
Bay-breasted Warbler	Dendroica castanea.	Migrant.	Common
Blackpoll Warbler	Dendroica striata.	Migrant	Uncommon
Chestnut-sided Warbler	Cendroica pensylvanica.	Migrant.	Uncommon
Black-and-White Warbler	Mniotilta varia. Was considered a S.R. in the 1930's and probably still does nest here. One male observed the first week of June, 1977.		
American Redstart	Setophaga ruticilla.	S.R.	Common

Bird Census

Swamp

Date :	May 27, 1932	June 10, 1978
Time:	4:30 - 7 A.M.	7:30 - 11 A.M.
Area Covered:	12 Acres	16 Acres

Species	Numbers of Individuals	
Wood Duck	1	--
Hairy Woodpecker	1	1
Downy Woodpecker	1	1
Crested Flycatcher	2	4
Blue Jay	2	2
Black-capped Chickadee	3	1
Catbird	3	2
Veery	4	3
Red-eyed Vireo	4	1
Blackpoll Warblers (Probable migrants)	7	--
Northern Waterthrush	1	3
Northern Yellowthroat	5	--
Canada Warbler	8	1
Red-winged Blackbird	2	2
Scarlet Tanager	1	3
Swamp Sparrow	2	1
Song Sparrow	2	3
Rose-breasted Grosbeak	--	2
Wood Thrush	--	2
Tufted Titmouse	--	2
Pileated Woodpecker	--	1
Crow	--	4
Cardinal	--	1
Number of Species	17	20
Number of Individuals	49	40

Lower Swamp and Pond

Amphibians

American Toad *	Bufo americanus.	Common
Green Frog	Rana clamitans.	Uncommon
Bull Frog	Rana catesbeiana.	Uncommon
Spring Peeper	Hyla crucifer.	Abundant in spring
Gray Treefrog	Hyla versicolor.	Abundant in spring
Red-spotted Newt	Notophthalmus viridescens.	Status uncertain

Reptiles

Eastern Painted Turtle	Chrysemys picta picta.	Common
Snapping Turtle *	Chelydra serpentina.	Scarce

(See Climax Woods - Reptiles.)

Water snakes (Natrix sipedon) have not been seen in the lower swamp or pond recently but that does not mean that they are not there because it is very difficult to spend any amount of time in this area observing the wildlife. Pickeral frogs, also mentioned in T. Cope's thesis, have not been heard or seen here.

* Species not mentioned under this habitat in Cope's thesis.

OPEN FIELDS

OPEN FIELDS

Fifty-two acres of hay fields and 45 acres of pastures exist within the sanctuary. These fields were probably first cleared around 1801 when Asahel Avery and other settlers began farming this area. One-third or more of the plant species growing in the open fields are native to Europe or to Asia and were either deliberately introduced by settlers or arrived here by accident. Some of these alien plants include the dandelion, ox-eye daisy, various hawkweeds, yellow goat's beard, and the tiny white-flowered lesser stitchwort.

Since 1956 the open fields have been maintained primarily as firebreaks. In order to keep them as firebreaks, each year the pastures and hay fields are "rented out" to nearby farmers, bringing in a small income for the sanctuary which is referred to as a donation. Most years the farmer whose cattle graze the pastures mows these areas as well to control the multiflora rose, hawthorne and Japanese barberry. The farmers who have used the hay fields have been permitted to rotate their crops and to apply fertilizer in order to have a more successful yield. Although pesticides have not been used to our knowledge in the past, the present Master Plan calls for a policy to control the use of fertilizers and pesticides.

The open fields also add to the variety of habitats and wildlife that can be studied at the sanctuary. Woodchuck burrows give an opportunity to discuss the interesting habits and values of this true hibernator. The tall grasses and flowering plants also enable small children to see close at hand such

insects as the spittlebug! Woodbourne's fields are active places where goldfinches, meadowlarks and song sparrows build their nests and raise young. Red-tailed hawks which nest in the sanctuary are often seen soaring over these areas in search of one of the thousands of meadow voles which inhabit the fields.

OPEN FIELDS

Woody Plants

Red Maple	*Acer rubrum*.	U
White Ash	*Fraxinus americana*.	U
Tartarian Honeysuckle	*Lonicera tatarica*.	U
Poison Ivy	*Rhus radicans*.	U
Broadleaf Spirea, Meadowsweet	*Spiraea latifolia*.	U
Blackberry	*Rubus allegheniensis*.	U
Red Raspberry	*Rubus idaeus*.	U
Staghorn Sumac	*Rhus typhina*	U
Multiflora Rose	*Rosa multiflora*.	C
Hawthorn	*Crataegus sp*.	U
Japanese Barberry	*Berberis thunbergii*.	U
Black Raspberry	*Rubus occidentalis*.	U

OPEN FIELDS

Herbaceous Plants

Dandelion	*Taraxacum officinale.*	A
Common Plaintain	*Plantago major.*	A
King Devil Hawkweed, Field Hawkweed	*Hieracium pratense.*	A
Ox-eye Daisy	*Chrysanthemum leucanthemum.*	A
Common Buttercup	*Ranunculus acris.*	C
Mouse-ear Hawkweed	*Hieracium pilosella*	C
Common Strawberry	*Fragaria virginiana.*	C
Curled Dock	*Rumex crispus.*	C
Yellow Goat's-beard	*Tragopogen pratensis.*	U
Winter Cress	*Barbarea vulgaris.*	C
Orange Hawkweed	*Hieracium aurantiacum.*	C
Rough-fruited Cinquefoil	*Potentilla recta.*	U
Common Speedwell	*Veronica officinalis.*	U
Cow Vetch	*Vircia cracca.*	U
Red Clover	*Trifolium pratense.*	C
White Clover	*Trifolium repens.*	C
Alsike Clover	*Trifolium hybridum.*	C
Yellow Wood Sorrel	*Oxalis europaea.*	U
Field Pennycress	*Thlaspi arvense.*	C
Heal-all	*Prunella vulgaris.*	C
Bladder Campion	*Silene cucubalus.*	U
Purple Milkweed	*Asclepias purpurascens.*	U
Bull Thistle	*Cirsium vulgare.*	U
Lesser Stitchwort	*Stellaria graminea.*	C
Sheep Sorrel, Common Sorrel	*Rumex acetosella.*	U
Live-Forever, Orpine	*Sedum telephium.*	U
Moneywort	*Lysimachia nummularia.*	U
Bugleweed	*Lycopus virginicus.*	U
Cypress Spurge	*Euphorbia cyparissias.*	U
False Hellebore	*Veratrum viride.*	S
Horse Nettle	*Solanum carolinense.*	U
Indian Tobacco	*Lobelia inflata.*	U

Herbaceous Plants

Daisy Fleabane	Erigeron strigosus.	U
Yarrow	Achillea millefolium.	C
Queen Anne's Lace, Wild Carrot	Daucus carota.	C
Spreading Dogbane	Apocynum androsaemifolium.	U
White Avens	Geum canadense.	S
Butter-and-eggs	Linaria vulgaris.	C
Basil	Satureja vulgaris.	C
Pearly Everlasting	Anaphalis margaritacea.	U
Smooth Hawksbeard	Crepis capillaris.	U
Crooked-stemmed Aster	Aster prenanthoides.	U
New England Aster	Aster novae-angliae.	U
Panicled Aster, Tall White Aster	Aster simplex.	U
Canada Goldenrod	Solidago canadensis.	A
Rough-stemmed Goldenrod	Solidago rugosa.	A
Early Goldenrod	Solidago juncea.	U
Lance-leaved Goldenrod	Solidago graminifolia	C
Leafy-bracted Beggar-ticks	Bidens comosa.	U
Beggar-ticks	Bidens frondosa.	U
Feverfew	Chrysanthemum parthenium.	S
Lady's-thumb, Redleg	Polygonum persicaria.	S
Boneset	Eupatorium perfoliatum.	S
Teasel	Dipsacus sylvestris.	S
Common Ragweed	Ambrosia artemisiifolia.	U
Nipplewort	Lapsana communis.	U
Mouse-ear Chickweed	Cerastium vulgatum.	U
Dame's Rocket	Hesperis matronalis.	U

OPEN FIELDS

Mammals

Meadow Vole - Microtus pennsylvanicus. P.R. Abundant. Active both summer and winter. Major food source for hawks, owls, and other predators in the sanctuary.

Hairytail Mole * - Parascalops breweri. P.R. Common.

White-footed Mouse * - Peromyscus leucopus. P.R. Tracks observed in the winter near the woodland edges are probably those of the white-footed rather than the deer mouse which seem to prefer the deep woods.

Eastern Cottontail - Sylvilagus floridanus. P.R. Common. Though this is within the range of the New England Cottontail, none have been seen of which I know. The Eastern Cottontail is out-competing the New England in much of its range. The cottontails do a remarkable trimming job on the blackberry bushes each winter. Driving up to the Cope house at night, one sees a dozen or more rabbits scurrying about on the lawns.

Whitetail Deer * - Odocoileus virginianus. P.R. Common.

Woodchuck - Marmota monax. P.R. Common. Their sharp whistle can easily be mistaken by the uninformed for a bird's call, especially when it is given in a hedgerow.

Striped Skunk - Mephitis mephitis. P.R. Uncommon. Tracks have been observed each winter in the fields. Probably searches for grubs and mice in the summer months as well as in the fields and pastures.

Virginia Opossum * - Didelphis virginiana. P.R. Common. An opossum was discovered at high noon in February, 1977 struggling to walk across the deep snow in the field below the naturalists' house. Its ears and tail were both frost-bitten. That winter was one of the coldest on record. It had not yet reached this area in the 1930's in its movement northwards.

Little Brown Bat - Myotis lucifugus. S.R. Common.

Raccoon * - Procyon lotor. P.R. Common. Though more common to the climax woods, raccoons have been heard in the summer in the hedgerow wailing at each other. In the past they apparently consistently raided the local gardens but we have thus far been fortunate!

Long-tailed Weasel - Mustela frenata. P.R. Common. (See Climax Woods.)

The Star-nosed Mole, mentioned in Cope's thesis, has not been found in the last three years at the sanctuary.

Muskrats, which Ms. Cope then observed in the fields near the stream, have only been seen at the ponds.

* Species was not mentioned in T. Cope's theses in this habitat.

OPEN FIELDS

Birds

American Goldfinch	Spinus tristis.	P.R.	Common
Brown-headed Cowbird	Molothrus ater.	S.R.	Common
Red-winged Blackbird	Agelaius phoeniceus.	S.R.	Common
Common Crow	Corvus brachyrhynchos.	P.R.	Common
Yellow-shafted Flicker	Colaptes auratus.	S.R.	Common
Barn Swallow	Hirundo rustica.	S.R.	Seen commonly swooping down in fields after insects.
Chimney Swift	Chaetura pelagica.	S.R.	Common
Song Sparrow	Melospiza melodia.	P.R.	Common

In May 1976 a well-camouflaged Song Sparrow's nest containing four eggs was discovered hidden in a grassy hummock about twenty feet south of the Cope Pond.

Field Sparrow	Spizella pusilla.	S.R.	Uncommon
Chipping Sparrow	Spizella passerina.	S.R.	Common
Indigo Bunting	Passerina cyanea.	S.R.	Commonly seen in hedgerows and in the Cope's orchards.
Eastern Meadowlark	Sturnella magna.	S.R.	Uncommon

Nests in the grassy meadows south of the Cope barns.

Bobolink	Dolichonyx oryzivorus.	S.R.	Scarce
Bobwhite	Colinus virginianus.	S.R.	Scarce

Nested in the meadows behind the Cope barns in 1976.

Killdeer	Charadrius vociferus.	S.R.	Uncommon
Eastern Kingbird	Tyrannus tyrannus.	S.R.	Uncommon
Starling	Sturnus vulgaris.	P.R.	Common
Robin	Turdus migratorius.	S.R.	Common

Eastern Bluebird Sialia sialis. S.R. Scarce.

One or two pairs nest in the Copes' orchards. Appeared that a pair was going to build a second nest in the scrub apple trees in the pasture north of the nature trail but this effort failed. A nesting box was erected in the Cope orchards last spring. Hopefully, it will increase the population this year.

House Wren Troglodytes aedon. S.R. Uncommon

Nests in trees along hedgerows and around the houses where one can hear its bubbling, cheerful song.

Yellowthroat Geothlypis trichas. S.R. Common

Nests and feeds in shrubs on the edges of fields.

American Kestrel Falco sparverius. S.R. Uncommon
(Sparrow Hawk)

Flies over the fields hunting for food. Usually one pair nests within or near the border of the sanctuary each year. In early July, 1975, a young male was picked up off the ground near its nest by a farmer on the neighboring Woodbourne Farms. After being cared for by the Naturalists for several days, it was released to develop its flight capabilities. It disappeared in the hedgerows, and after several days of searching and worrying about its welfare, the hawk returned, landing on the roof of our automobile. It continued to return each day for about 10 days, carrying off chunks of beef heart left on the garage and house roof. It remained in the sanctuary that summer. The following spring it appeared that it had returned, as a male American Kestrel flew over the naturalist's house following the same course as the released hawk.

Red-tailed Hawk Buteo jamaicensis. P.R. One pair has resided in the climax woods for many years, hunting for mice over the fields.

OPEN FIELDS

Amphibians

American Toad	Bufo americanus.	Common
Pickeral Frog	Rana palustris.	Uncommon
Green Frog	Rana clamitans.	Uncommon

Reptiles

Eastern Garter Snake — Thamnophis sirtalis. Common. Almost any walk through the fields below the naturalist's house in the summer will produce a garter snake. Eighteen of these creatures were removed from the bushes near that house in two weeks during the summer of 1976 and were released in the farthest corners of the sanctuary! Next summer there was almost as many snakes as before. The former naturalist tried to remove them and had the same results.

Eastern Milk Snake — Lampropeltis doliata triangulum. Not as common as the Garter Snake. One large one was found in the spring of 1976 and 1978 in the back yard, and another under the cement steps. Occasionally one can be found dead in the road.

The Grass or Smooth Green Snake mentioned in T. Cope's studies has not been seen here in the last few years and is probably either very rare here or non-existent.

SECOND GROWTH WOODS

Old Fields - Young Second Growth

"Middle-Aged" Second Growth Woods

Old Second Growth Woods

Second Growth Woods - Section D

OLD FIELDS - YOUNG SECOND GROWTH

About 24 acres of abandoned fields, which have grown up to weeds, scattered shrubs, small saplings and older trees, exist on the southwestern corner of the sanctuary behind the Bendix houses on Route 29. (See Habitat Map.) Because of the numerous high-bush blueberry shrubs found here, the area is generally referred to as the blueberry field, at least by the resident naturalists.

It is difficult to know exactly when these fields might have been abandoned. Trees and shrubs presently cover about ten to fifteen percent of the fields but have filled in completely the young second growth portions of the area. Fifteen to twenty whorls of branches on the oldest white pines dates the time that the area was disused to 1956, the year that The Nature Conservancy acquired Woodbourne. Until a few years ago, a strip of the open fields was plowed to maintain a fire path, but since this practice was discontinued, quaking aspens and locusts have filled in the area.

Flora and Fauna

Broadleaf spirea or meadowsweet presently grows so profusely along with Canada and lance-leaved goldenrods on this western slope of Woodruff's Hill that only a few other species are hardy enough to compete successfully for existence. Patches of blackberries, which have been pruned and maintained by the eastern cottontail rabbit the last few winters, cover the north portion. Following the established paths of deer is the easiest way to wade through the dense vegetation which in late summer may be five feet high!

Some open ground does exist between the arrowwood and blueberry bushes where animals may rest upon the short carpet of dwarf cinquefoil, wild strawberries and buttercups. Large rock ledges which protrude from the side of the hill contain various lichens, including the showy British soldier, pyxie cup and the forked shrublet.

As the pastures and meadows in the rest of the sanctuary receive yearly mowings, this blueberry field is presently the best example of early second growth habitat. It is a particularly desirable area for wildlife in that good cover is available in the dense thickets, hedgerows and adjoining woodland. A small spring in the area provides water and more than half of the shrubs and trees contain edible fruits.

Certain species of birds such as the brown thrasher and the rufous-sided towhee which seek thickets with woodland edges have only been found here in the sanctuary. Suitable nesting sites are available for the thrasher, catbird and cardinal in the thickets while the dense lower weeds provide the nesting sites which the towhee, song sparrow, field sparrow, indigo bunting and common yellowthroat seek.

Because of its value to certain species of birds and to wildlife in general, the author recommends that if possible these fields be kept close to their present stage of succession. If a certain percentage of red maples, pines, and ashes which are rapidly coming in were cut annually, this should prevent the lower shrubs and weeds from being shaded out. If this

isn't possible, periodically mowing a path through the fields should create dense edges along the path where these bird species might continue to nest for some time.

OLD FIELDS - YOUNG SECOND GROWTH

Woody Plants

Broadleaf Spirea	*Spiraea latifolia.*	A
Blackberry	*Rubus allegheniensis.*	A
Northern Arrowwood	*Viburnum recognitum.*	C
Red Maple	*Acer rubrum.*	C
Running Blackberry	*Rubus hispidus.*	C
Highbush Blueberry	*Vaccinium corymbosum.*	C
White Pine	*Pinus strobus.*	C
Shadbush, Juneberry	*Amelanchier sp.*	C
Black Cherry	*Prunus serotina.*	C
Hawthorne	*Crataegus sp.*	C
White Ash	*Fraxinus americana.*	C
Black Locust	*Robinia pseudo-acacia.*	C
Domestic Apple	*Pyrus malus.*	C
Fire Cherry, Pin Cherry	*Prunus pensylvanica.*	U
Quaking Aspen	*Populus tremuloides.*	U
Common Burdock	*Arctium minus.*	S
Scotch Pine	*Pinus glauca.*	S

OLD FIELDS - YOUNG SECOND GROWTH

Herbaceous Plants

Canada Goldenrod	*Solidago canadensis*.	A
Lance-leaved Goldenrod	*Solidago graminifolia*.	A
Queen Anne's Lace	*Daucus carota*.	A
Dwarf Cinquefoil	*Potentilla canadensis*.	A
Yellow Hop Clover	*Trifolium agrarium*.	A
Spreading Dogbane	*Apocynum androsaemifolium*.	C
Yarrow	*Achillea millefolium*.	C
Sheep Sorrel	*Rumex acetosella*.	C
Heal-all	*Prunella vulgaris*.	C
Mouse-ear Hawkweed	*Hieracium pilosella*.	C
Birdfoot Trefoil	*Lotus corniculatus*.	C
Basil	*Satureja vulgaris*.	U

Marsh Skullcap - *Scutellaria epilobiifolia*. Common in moist places.

Pearly Everlasting	*Anaphalis margaritacea*.	U
Common Strawberry	*Fragaria virginiana*.	C
Common St. Johnswort	*Hypericum perforatum*.	U
Common Buttercup	*Ranunculus acris*.	C
Creeping Buttercup	*Ranunculus repens*.	U
Yellow Wood Sorrel	*Oxalis europaea*.	U

Arrow-leaved Tearthumb - *Polygonum sagittatum*. Common in wet areas.

Halberd-leaved Tearthumb - *Polygonum arifolium*. Common in wet areas.

Purple-leaved Willow-herb	*Epilobium coloratum*.	U
Purple-stemmed Aster	*Aster puniceus*.	U
Blue Vervain	*Verbena hastata*.	U
Red Clover	*Trifolium pratense*.	U
White Clover	*Trifolium repens*.	U
Ox-eye Daisy	*Chrysanthemum leucanthemum*.	U

Common Speedwell	Veronica officinalis.	U
Wild Mint	Mentha arvensis.	U
Marginal Woodfern	Dryopteris marginalis.	U

Exists on rock outcroppings on west side of Woodruff's Hill.

OLD FIELDS - YOUNG SECOND GROWTH

Mammals

Meadow Vole	*Microtus pennsylvanicus*.	P.R.	Common
White-tailed Deer	*Odocoileus virginianus*.	P.R.	Common
Woodchuck	*Marmota monax*.	P.R.	Uncommon
Eastern Cottontail Rabbit	*Sylvilagus floridanus*.	P.R.	Common

OLD FIELDS - YOUNG SECOND GROWTH

Birds

Brown Thrasher	*Toxostoma rufum*.	S.R.	Common
Rufous-sided Towhee	*Pipilo erythrophthalmus*.	S.R.	Common
Common Yellowthroat	*Geothlypis trichas*.	S.R.	Common
Nashville Warbler	*Vermivora ruficapilla*.		Migrant
Yellow Warbler - *Dendroica petechia*. Uncertain if it nests here.			
American Redstart	*Setophaga ruticilla*.	S.R.	Common
Cardinal	*Richmondena cardinalis*.	P.R.	Uncommon
Catbird	*Dumetella carolinensis*.	S.R.	Common
Rose-breasted Grosbeak	*Pheucticus ludovicianus*.	S.R.	Uncommon
Song Sparrow	*Melospiza melodia*.	S.R.	Common
Dark-eyed Junco	*Junco hyemalis*.	Winter Resident.	Common
Tufted Titmouse	*Parus bicolor*.	P.R.	Common
Black-capped Chickadee	*Parus atricapillus*.	P.R.	Uncommon
Field Sparrow	*Spizella pusilla*.	S.R.	Common
Common Crow	*Corvus brachyrhynchos*.	P.R.	Common
Indigo Bunting	*Passerina cyanea*.	S.R.	Uncommon
Northern Oriole	*Icterus galbula*.	S.R.	Uncommon
Blue Jay	*Cyanocitta cristata*.	P.R.	Common
Eastern Cowbird	*Molothrus ater*.	S.R.	Uncommon
Ruffed Grouse	*Bonasa umbellus*.	P.R.	Uncommon
Cedar Waxwing	*Bombycilla cedrorum*.	P.R.	Uncommon
White-crowned Sparrow	*Zonotrichia leucophrys*.	Winter Resident.	Uncommon
White-throated Sparrow	*Zonotrichia albicollis*.	Winter Resident.	Uncommon
Red-tailed Hawk	*Buteo jamaicensis*.	P.R.	Uncommon
Least Flycatcher	*Empidonax minimus*. Was observed migrating through this area in May, 1978.		
Magnolia Warbler	*Dendroica magnolia*.	Transient.	

OLD FIELDS - YOUNG SECOND GROWTH

Bird Census Taken from 8:30 to 10:00 A.M. on May 14, 1977

2	Brown Thrashers
2	Rufous-sided Towhees
2	Common Yellowthroats
12	White-throated Sparrows
1	Cardinal
2	Cowbirds
1	Crow
1	Song Sparrow
5	White-crowned Sparrows
1	Black-capped Chickadee
2	Nashville Warblers
4	Yellow Warblers
1	Red-tailed Hawk - flying overhead
2	Catbirds

OLD FIELDS - YOUNG SECOND GROWTH

Reptiles

Garter Snake - Thamnophis sirtalis. Only one has been seen here recently so its status is unknown.

"MIDDLE-AGED" SECOND GROWTH WOODS

"MIDDLE-AGED" SECOND GROWTH WOODS

Driving along the back road of the sanctuary, one views other second growth woods whose age, origin, and plant composition are distinct. Sections B1 and B2 on the Habitat Map are "middle-aged" second growth woods which are probably 40 to 50 years old. In 1936 these areas were identified as pastures on T. Cope's map of the Woodbourne area. However, only eleven years later in 1947 on a habitat map prepared by the Northeastern Experiment Station, the same areas were designated second growth. (This map also distinguishes young second growth areas as well so the authors apparently felt that the succession was beyond the young growth stage at the time.) The presence of many trees today which look to be over 50 years of age and whose diameters are over 15 inches would seem to indicate that these pastures were partially wooded by 1936. These woods were studied as a separate habitat because they are intermediate in age between the young second growth areas just described which are about 15 to 25 years old, and the old second growth woods surrounding the Cope Pond which are known to be 81 years old. Birds and other animal life were not recorded as these sections are relatively small, and the fauna is very similar to that found in the adjoining climax woods and to the old second growth woods which are described elsewhere.

Section B1

Approximately 15 acres of this habitat exist on the northeastern ridge of the sanctuary (Section B1). At 1600 feet the ridge contains the highest elevation found in the sanctuary. Because of the numerous bedrock outcroppings which protrude here, it is doubtful that this area was ever cultivated.

Red Maple and sugar maple are the dominant trees in the dense upper story of this section. Occasionally an individual white ash, black cherry or eastern hop hornbeam can be seen that is over 50 years of age as well as older groves of beech trees. The understory is almost entirely composed of sugar maple saplings of which thousands exist! Deer have been browsing on these sugar maples for about eight years, and by eliminating some trees and pruning the lower branches on others, they have undoubtedly contributed towards making this a better stand in the future.

At the edge of this ridge where the steep slope begins leading down into the climax woods, large hemlocks and beeches as well as striped maples immediately take hold. Though these species are again beginning to establish themselves on the ridge area, the sugar maple will be the dominant tree in this area for the next 50 to 100 years.

These woods, being predominantly deciduous, permit the blooming of many early spring wild flowers including trout lily, Canada mayflower, twisted-stalk, false solomon's-seal, toothwort, violets and trilliums.

Section B2

Section B2, which is situated on the southeastern corner of the sanctuary along Main's Road, contains about 7 acres of similar habitat similar to that of B1. This area previously contained a sugar maple grove and an orchard (Francis Cope's Map - 1939). It was apparently used for pasture land as well until 1936 according to T. Cope's map. In 1947 the Forest Service identified the northern half of this area as young second growth, and the southern corner as second growth.

Today this section is still somewhat more open than the ridge area. This is especially true of the woods close to the stone wall along Main's Road where stinging nettle, Virginia knotweed, yarrow, and white snakeroot can be found growing. A few short leatherwood shrubs (Dirca palustris), which are rare but characteristic of the climax woods sections, have been seen in Section B2.

Other second growth areas (B), which are similar in age and composition to B1 and B2, exist in Main's Woods and elsewhere in the sanctuary.

"MIDDLE-AGED SECOND GROWTH WOODS

Woody Plants

Sugar Maple	*Acer saccharum.*	A
Red Maple	*Acer rubrum.*	A
White Ash	*Fraxinus americana.*	C
American Beech	*Fagus grandifolia.*	C
Black Cherry	*Prunus serotina.*	C
Striped Maple	*Acer pensylvanicum.*	C
Yellow Birch	*Betula lutea.*	U
Eastern Hemlock	*Tsuga canadensis.*	U
Bitternut Hickory	*Carya cordiformis.*	U
Mapleleaf Viburnum	*Viburnum acerifolium.*	C
Eastern Hop Hornbeam	*Ostrya virginiana.*	U
American Basswood	*Tilia americana.*	U
Black Locust	*Robinia pseudo-acacia.*	U
Shagbark Hickory	*Carya ovata.*	U
Red Elderberry	*Sambucus pubens.*	U
Common Elderberry	*Sambucus canadensis.*	U
Garden Red Currant	*Ribes sativum.*	U
Leatherwood	*Dirca palustris.*	S

"MIDDLE-AGED" SECOND GROWTH WOODS

Herbaceous Plants

Spinulose Woodfern	Dryopteris spinulosa.	A
Interrputed Fern	Osmunda Claytoniana.	C
Marginal Woodfern	Dryopteris marginalis.	U
Christmas Fern	Polystichum acrostichoides.	U
Fragile Fern	Cystopteris fragilis.	U
Common Polypody	Polypodium vulgare.	U
Running Pine	Lycopodium complanatum.	C
Tree Club Moss	Lycopodium obscurum.	C
Trout Lily	Erythronium americanum.	A
Canada Mayflower	Maianthemum canadense.	A
Twisted-stalk	Streptopus amplexifolius.	C
Sweet White Violet	Viola blanda.	C
Round-leaved Yellow Violet - Viola rotundifolia.		C
Downy Yellow Violet, Stemmed Yellow Violet - Viola pubescens.		C
Squirrel-corn	Dicentra canadensis.	C
False Solomon's-seal -	Smilacina racemosa.	C
White Baneberry	Actaea pachypoda.	C
Toothwort	Dentaria diphylla.	C
Red Trillium	Trillium erectum.	C
Solomon's-seal	Polygonatum biflorum.	U
Striped Coralroot	Corallorhiza striata.	C
White Wood Aster	Aster divaricatus.	U
Indian-pipe	Monotropa uniflora.	U
Virginia Waterleaf	Hydrophyllum virginianum.	U
Red Baneberry	Actaea rubra.	U
Enchanter's Nightshade -	Circaea quadrisulcata.	U
Spotted Touch-me-not -	Impatiens capensis.	U
Virginia Knotweed	Tovara virginiana.	U
White Snakeroot	Eupatorium rugosum.	U
White Wood Aster	Aster divaricatus.	C
Stinging Nettle	Urtica dioica.	C
Yarrow	Achillea millefolium.	U
Yellow Wood Sorrel	Oxalis europaea	U

OLD SECOND GROWTH WOODS

OLD SECOND GROWTH WOODS

Section C - Habitat Map

The 46 acre woods surrounding the Cope Pond were identified as a separate habitat because they are the oldest second growth area in the sanctuary and because their origin and age can be traced back to a specific event and date, the fire of 1897. Studies of this area are of particular interest because data collected here and described by T. Cope in her 1932 M.S. thesis can be compared to present data to indicate the course of forest succession following a fire in this region.

The date of the fire and its extent, which includes the woods north, south and probably east of the Cope Pond, are known from a habitat map prepared in 1939 by Francis Cope and his son-in-law, John F. Stanwell-Fletcher. (The woods west of the pond seem to have escaped the fire, as they were labeled Old Mixed Growth on this map.)

The severity of the fire and the status of the woods in this area prior to the fire are not known for certain. The fact that the Cope family planted hemlocks, other evergreens, and possibly hardwoods in "natural clumps" south of the pond and pure stands of evergreens east and southwest of the pond to hasten regeneration suggests that the fire must have destroyed most of the trees. However, the rapid regeneration here by 1932 of herbaceous plants, similar in species composition to nearby areas of climax woods today, indicates both that the

area was probably old growth before the fire, and that the fire was not so severe as to have had a major impact on the herbaceous vegetation previously occurring here.

Herbaceous Vegetation

As was previously mentioned, over half of the lycopodiums, ferns and wild flowers which were already growing in these second growth woods only 35 years after the fire, occur presently in climax woods, indicating that regeneration occurred fairly rapidly. Apparently similar conditions have continued to the present time as three-quarters of the plants Cope listed are still growing in the woods today. Open sections still do exist as well as an abundance of deciduous trees which permit many of the same early spring wild flowers to bloom. Cope's description that "quantities of lycopodium (complanatum and obscurum), bracken, hay-scented and New York ferns are found in the open sections" is as apt today as then.

More noticeable changes in the herbaceous vegetation have occurred in the shaded sections of the woods. Cope stated that "yellow violets, Canada mayflowers, trilliums, wintergreen and partridgeberry are found in the denser portions of the woods." Today in the denser portions partridgeberry is uncommon and the Canada mayflower is seen most frequently growing with wild sarsaparilla, star flower, Indian cucumber-root, twisted stalk, dwarf ginseng, and gold thread. The underlined species were not included on Cope's flora lists and indicate the return or reintroduction of more shade-tolerant species.

Woody Vegetation

1932

According to T. Cope's descriptions 48 years ago, "poplar and maple were the dominant trees in these second growth woods with smaller number of cherry, hemlock, beech and locust." The dominance of quaking aspen and maple 35 years after the fire is typical of succession in this region as these species are often the first trees to begin growing in a burned-over woods or an abandoned field. It would seem that the beech, hemlock and cherry trees either sprouted up from the roots of trees previously growing in the old forest or were planted by the Copes as these shade-loving species are generally characteristic of a mature forest. Juneberry, chokeberry, sumac, viburnums and alternate-leaved dogwood were also mentioned as being "fairly prominent."

1978

Today red maple is still the most abundant species growing in these woods and many trees exist that look to be 50 to 80 years old. Quaking aspen trees no longer exist probably because they were not able to germinate in the shaded conditions which, together with the maples, they created. (Beavers which were living at the pond about 8 to 10 years ago may have removed the older trees.)

Red oak trees, which were mentioned as present in 1932, are now one of the three most common tree species in this area. Of mature trees, red oaks have individuals of the largest diameters, many of which measure 25-28" dbh. Among seedlings, red oaks are

the most abundant, favored by well-drained soil and an overhead canopy which is still sparse in many places.

Hemlocks are common as well, both as an older shade tree and in the understory. Chokecherry, sumac, locust and dogwood have been replaced by white ash, black cherry, yellow birch, striped maple and hobblebush which are shade-tolerant species. Beeches can be more commonly found in the shaded sections where hemlock has formed a dense canopy but they are nowhere near as abundant as what they appear in the climax forest.

American chestnut trees were mentioned in the 1932 study as having been killed by the chestnut blight, and sound remnants of long-dead chestnut trunks still found in this area attest to the decay-resistance of this tree. From the numerous chestnut sprouts coming up today from still-living roots and the large number of ancient stumps which remain in the area, it appears that chestnut was one of the dominant species here in the past.

Conclusion

Eighty-one years after the fire occurred, all the major woody plant species characteristic of the climax woods in the nature trail section are present and the early pioneer species have been largely eliminated. It is not known whether these second growth woods, which are for the most part situated on a well-drained north-facing slope, will ever develop into the hemlock, beech, maple, and birch climax forest which is found in other sections of Woodbourne Sanctuary. Presently the

large numbers of red maples and red oaks, and proportionally the smaller numbers of hemlocks and beeches distinguishes this area the most from the climax sections. If it is to develop into a similar climax forest, then at the rate which succession has occurred thus far, it seems that an additional 80 to 150 years will be required before a stable climax state is reached.

OLD SECOND GROWTH WOODS

Woody Plants

Red Oak	*Quercus rubra.*		A
Eastern Hemlock	*Tsuga canadensis.*		A
Red Maple	*Acer rubrum.*		A
Black Cherry	*Prunus serotina.*		C
American Chestnut	*Castanea dentata.*		C
Shadbush, Serviceberry	*Amelanchier laevis.*		C
White Ash	*Fraxinus americana.*		C
Mountain Laurel	*Kalmia latifolia.*		C
Yellow Birch	*Betula lutea.*		C
Striped Maple	*Acer pensylvanicum.*		C
Bristly Dewberry	*Rubus hispidus.*		C
American Beech	*Fagus grandifolia.*		C
Mapleleaf Viburnum	*Viburnum acerifolium.*		C
New England Grape	*Vitis novae-angliae.*		U
Spreading Dogbane	*Apocynum androsaemifolium.*		C
Black Locust	*Robinia pseudo-acacia.*		C
Hobblebush	*Viburnum alnifolium.*		C
Shagbark Hickory	*Carya ovata.*		C
Sugar Maple	*Acer saccharum.*		U
American Basswood	*Tilia americana.*		C
Common Highbush Blueberry	*Vaccinium corymbosum.*		C
White Pine	*Pinus strobus.*		U
Black Birch	*Betula lenta.*		U
Red Spruce	*Picea rubens*	U Intro.	
American Larch	*Larix laricinia*	U Intro.	
Balsam Fir	*Abies balsamea.*	C Intro. Grows near the pond.	
Speckled Alder	*Alnus rugosa.*	C Grows near the pond.	
Great Rhododendron	*Rhododendron maximum.*	C Intro. Along edge of pond.	
Northern Arrowwood	*Viburnum recognitum.*	C In wet areas near the pond.	
Early Low Blueberry	*Vaccinium vacillans.*	C In wet areas near the pond.	

Woody Plants

Blackberry	Rubus allegheniensis.	U	Along edges of pond.
Partridgeberry	Mitchella repens.	U	Common along north side of stream.
Common Elderberry	Sambucus canadensis.	S	
Bigtooth Aspen	Populus grandidentata.	U	
Bitternut Hickory	Carya cordiformis.	U	
Nannyberry	Viburnum lentago.	U	In damp areas nearer to the pond.

OLD SECOND GROWTH WOODS

Herbaceous Plants

New York Fern	Thelypteris noveboracensis.	A
Hayscented Fern	Dennstaedtia punctilobula.	A
Spinulose Woodfern	Dryopteris spinulosa.	A
Lady Fern	Athyrium Felix-femina.	C
Bracken Fern	Pteridium aquilinum.	C
Sensitive Fern	Onoclea sensibilis.	C
Christmas Fern	Polystichum acrostichoides.	C
Fragile Fern	Cystopteris fragilis.	C
Crested Fern	Dryopteris cristata.	U
Tree Club Moss	Lycopodium obscurum.	A
Running Pine	Lycopodium complanatum.	A
Staghorn Clubmoss	Lycopodium clavatum.	U
Star Flower	Trientalis americana.	A
Wild Sarsaparilla	Aralia nudicaulis.	A
Canada Mayflower	Maianthemum canadense.	A
Trout Lily	Erythronium americanum.	A
Gold Thread	Coptis trifolia.	A
Moccasin Flower, Pink Lady's-Slipper - In one area.	Cypripedium acaule.	A
Twisted-stalk	Streptopus amplexifolius.	C
Indian Cucumber-root	Medeola virginiana.	C
Whorled Wood Aster	Aster acuminatus.	C
White Wood Aster	Aster divaricatus.	C
Dwarf Ginseng	Panax trifolius.	C
Solomon's-seal	Polygonatum biflorum.	C
False Solomon's-seal	Smilacina racemosa.	C
Turtlehead	Chelone glabra. C In wet areas.	
Wild Oats	Uvularia sessilifolia.	C
Painted Trillium	Trillium undulatum.	C
Round-leaved Yellow Violet -	Viola rotundifolia.	C
Northern White Violet	Viola pallens.	U

Herbaceous Plants

Tall White Lettuce	Prenanthes altissima.		U
Wintergreen	Gaultheria procumbens.		C
Purple Trillium	Trillium erectum.		U
Indian-pipe	Monotropa uniflora.		U
Enchanter's Nightshade	Circaea quadrisulcata.	C	In woods along stream.
White Avens	Geum canadense.		U
Beechdrops	Epifagus virginiana.		U
May-apple, Mandrake	Podophyllum peltatum.		U
Helleborine	Epipactus helleborine.		S

OLD SECOND GROWTH WOODS

Mammals

Eastern Chipmunk - Tamias striatus. P.R. Common

Gray Squirrel - Sciurus carolinensis. P.R. Common

Eastern Flying Squirrel - Glaucomys volans. P.R. Status uncertain. See Cope Pond - Mammal Section.

Woodchuck - Marmota monax. P.R. Common

White-footed Mouse - Peromyscus leucopus. P.R. Abundant

Deer Mouse - Peromyscus maniculatus. P.R. Common

Woodland Jumping Mouse - Napeozapus insignis. P.R. (See Cope Pond.)

Short-tailed Shrew - Blarina brevicauda. P.R. Common

Opossum - Didelphis marsupialis. P.R. Common

White-tailed Deer - Odocoileus virginianus. P.R. Common

Striped Skunk - Mephitis mephitis. P.R. Uncommon

Raccoon - Procyon lotor. P.R. Common

Red Fox - Vulpes vulpes. Occasional visitor.

Eastern Cottontail - Sylvilagus floridanus. P.R. Uncommon

Red Squirrels (Tamiasciurus hudsonicus) probably inhabit these woods as well as they've been observed in near-by hedgerows. The area does not contain many older hemlocks, however, which the red squirrel seems to prefer.

OLD SECOND GROWTH WOODS

Small Mammal Study

1977

Period Traps Set	# of Nights	# Traps Set	# of Trap Experiences	Species Captured	Number
Sept. 20 - Oct. 1	10	7	75	Short-tailed Shrew	2
Oct. 26, 27	2			White-footed Mouse	21
				Deer Mouse	7
Total	12				30

Number of experiences in which traps were released without success - 19

Small, hand-made, live-animal traps baited with peanut butter and sunflower seeds were set out in these second-growth woods south of the Cope Pond. The dominant trees in the area were red oak, red maple, hemlock, introduced evergreen trees, as well as mountain laurel and rhododendron.

Generally, more mice of both species were captured on the drier knolls, and in areas where the ground cover and understory shrubs were dense than where it was sparse. The white-footed mouse outnumbered the deer mouse 3 to 1 in these woods but was absent in the climax woods where a similar study was performed. The two short-tailed shrew individuals were caught about 200 feet south of the pond along the path leading to the Cope houses on a hemlock knoll.

A deer mouse carried a kernel of corn inside one trap; a black-capped chickadee was apparently attracted to the bait and probably died of fright inside another. A woodland jumping mouse observed in this area was not captured for positive identification.

Although more than half of the mice captured were young animals which would undoubtedly suffer a high mortality rate, these woods do support a high small mammal population. In only 75 trap experiences, 30 individuals were captured and 19 times the traps were released indicating that perhaps more animals would have been caught.

Birds Observed Nesting in Second Growth Woods Surrounding the Cope Pond each June from 1976 through 1978

Scarlet Tanager

Solitary Vireo

Red-eyed Vireo

Northern Oriole

Wood Pewee

Common Yellowthroat - Nests near edges of the woods and fields.

Black-capped Chickadee

Yellow-bellied Sapsucker

Veery

Wood Thrush

Oven Bird

Broad-winged Hawk (1977)

Great-crested Flycatcher

Robin

Common Crow

Blue Jay

American Redstart

Yellow-shafted Flicker

Rose-breasted Grosbeak

Brown Creeper

Red-winged Blackbird - Nests on islands in the pond.

Mallard - Nests on islands in the pond.

Birds Observed Migrating Through the Second Growth Woods

Blackburnian Warbler - 1976, 78

Black-throated Blue Warbler 77 (May nest here as well)

Black-throated Green Warbler 76, 78 (May nest here as well)

Black and White Warbler 76, 77, 78

Nashville Warbler 77

Bay-breasted Warbler 77

Myrtle Warbler 77, 78

Yellow-breasted Chat 76

Louisiana Waterthrush 77

Solitary Sandpiper 77

White-throated Sparrow 77, 78

White-crowned Sparrow 77

Birds Observed Visiting the Second Growth Woods that are Permanent Residents in the Surrounding Areas.

Great Blue Heron 76, 77, 78

Screech Owl 8/75

Great Horned Owl 8/77

Sharp-shinned Hawk 5/77

Red-tailed Hawk 77, 78 Numerous times

Pileated Woodpecker 78

OLD SECOND GROWTH WOODS

Amphibians

Red-spotted Newt - *Notophthalmus viridescens*. Uncommon

Red-backed Salamander - *Plethodon cinereus*. Uncommon

Wood Frog - *Rana sylvatica*. Uncommon

American Toad - *Bufo americanus*. Uncommon

Other amphibians and reptiles that have been mentioned as occurring in the sanctuary are probably found in these woods at times, but they have not been observed in the last three and a half years here.

SECOND GROWTH WOODS

Section D

The old second growth area labeled D on the Habitat Map includes and extends from the nearly level ridge of Woodruff's Hill downhill to the south and east. Most of this land was added to the Cope estate in 1912 and little is known of its history. However, judging from its lack of very old trees and relative lack of the "pit and mound" ground surface found in the climax woods areas, it is safe to assume that the area was once cleared and farmed. Its status as a second growth forest is supported by being so designated on the 1947 U. S. Forest Service Map of Woodbourne.

A nearly pure grove of shagbark hickory and Eastern hop hornbeam occupies about six acres on the eastern end of the Woodruff's Hill ridge. It is not known whether the hickories were planted but the fact that most of the trees have uniformly 7" to 9" diameters suggests that they originated at about the same time. Several seven inch trees measured by Mazzotti for the 1967 Forest Management Plan indicated an average age of 120 years, bringing their origin back to 1847. Shallow, dry, stony soil accounts for the slow growth rate.

The area sloping fairly steeply eastward from the hickory grove is predominantly American beech, sugar maple and American basswood. Better soil here accounts for trees with diameters up to 18 inches.

Westward from the hickory grove, the Woodruff's Hill ridge is inhabited by six to eight inch red maple, sugar maple, and

American beech as well as shagbark hickory and Eastern hop hornbeam. Shallow, dry, stony soils here also account for slow tree growth. Hummocks covered with thick mosses abound in this area.

Gently sloping southward from the ridge is an area of deeper soil and larger trees. Red oak predominates here but black birch, red and sugar maple, white ash, Eastern hemlock and American beech are also abundant. Shagbark hickories appear toward the southern border of the sanctuary, and quaking aspens are found in the more open places along the western edge of this area.

COPE POND

AND

FLOATING ISLANDS

COPE POND

The Cope Pond is situated on the northwest section of the sanctuary. (See Habitat Map.) Two wet-weather streams as well as numerous springs which originate within the sanctuary feed the 9.6 acre pond. In 1890 the pond was found to be 30 feet deep in the middle; in May, 1979, the greatest depth was found to be only 15 feet. (See Hydrology Map.) The Cope Pond appears to be a glacially formed kettle pond. The steep ravine which was carved by the outlet stream at the southeast end of the pond suggests that the pond may be very old geologically, and/or that it may have been larger in the past.

Dams Built

When the Cope family settled in the area, their pond was much smaller (5 acres according to T. Cope's thesis), but in 1870 a dam was built at the southeast end which increased it to its present, approximate size. The stumps of trees, cut 108 years ago at the time the pond was enlarged, still protrude out of the water or stand submerged in the outer portions of the pond, indicating the area that was previously forest.

In 1928 a new concrete dam was built to replace the older, existing structure. The present dam is 10 feet high, and the 11 foot wide, also concrete, spillway leading to it is 28 feet long. Now 50 years old, the dam and spillway still remain in sound condition. A few years after this dam had been built, T. Cope wrote (in her thesis) that leeches which were once abundant in the pond had disappeared. She credited their departure to the change in the water level, which had been raised

two or three inches by the new dam. What could have decimated the leeches was the lowering of the water level during the construction of the dam. Biologists know now that leeches winter in the mud under the shallow water along the shore. If the water level of the Cope Pond had been lowered by three feet in the fall, and kept lowered until November 1st, the leeches could have been very easily frozen out. To this time leeches have not been observed in the Cope Pond although in-depth acquatic studies have as yet to be undertaken.

Aquatic Plants

Pickerelweed, sedges, and blue flag are the dominant plants one sees emerging along the shore of the Cope Pond. Pink water lilies which Francis Cope planted and yellow bullhead lilies bloom continuously in the outer portions of the pond during the summer. Coontail (Ceratophyllum demersum) not mentioned in Cope's thesis, now grows so profusely in the water that it is difficult to wade or to even row a boat in the shallower sections of the pond without becoming entangled with this water weed.

Floating Islands

The pond is unique in that it contains several large (perhaps 80-100 feet long) and a few small, sphagnum covered floating islands. Although these islands do shift their position from time to time, and portions of them break away from the parent island and stray to other areas, measurements of their movements have never been determined.

Cassandra bushes (leatherleaf) and marsh fern are the most common plants growing on the sphagnum islands. Wild roses,

The Dam at the Cope Pond
Looking northwest
Photo taken by Philip Gray

Floating Bog Islands
on the Cope Pond
Photo taken by James Yaich

Pasture Woods - Spring 1977
Facing Southeast from the
Nature Trail

poison sumac, and winterberry which were once growing on the islands as well (Cope) have not been observed in recent years. However, these islands still do support the growth of other small woody plants including red maple, alder, and yellow birch as well as many other aquatic plants not mentioned in 1932.

Although sundews, pitcher plants, and cranberries continue to grow among the sphagnum moss, T. Cope remembers these plants being more plentiful when she performed her studies of the area. If a decrease in their numbers has occurred, perhaps it was caused by the raising of the water level in 1928 or by the increased use of fertilizers on the nearby farms. Plant studies of the islands need to be made over a period of time to determine what changes in plant populations are actually occurring.

Special Features Surrounding the Pond

Today except for a hay field which abutts its southeast tip, the Cope Pond is surrounded by sections of old second growth woods and evergreen plantations, most of which date their start back to 1898. A thick understory of pink rhododendron which Mr. Cope planted more than 50 years ago, and mountain laurel which is native to the area exist around all but the eastern side of the pond. Until 1931 when the eastern side was planted to red pine and douglas fir, it was an open meadow.

The path along the southern border of the pond is particularly beautiful to walk along because in addition to the evergreen shrubs and trees growing there, the ground is carpeted with Canada mayflower and club mosses. The fact that

the Canada mayflower even grows across the path as well reflects the sparing usage which this area has received. (The Cope family have had until 1974 the exclusive use of this area through the lifetime of Patricia Cope Bidlake and only occasionally have small groups of people been brought here.)* An added attraction in this area that impresses each visitor is a patch of about 200 pink lady's slippers which bloom each May amidst this green background.

Another botanical surprise exists along this trail about 100 feet west of the Cope's boathouse. Here surviving along a spring that feeds into the pond is Shortia Galacifolia, a plant mentioned on the Smithsonian Endangered Species list for the State of South Carolina! This rare plant was believed to be extinct and after it was rediscovered in the late 1940's, Mr. Cope somehow obtained a living specimen of it which he planted along his pond. About eleven plants now exist which bear lovely pink and white flowers which seem to indicate that Shortia is doing quite well in its northern refuge. A small enclosure should be maintained around this plant to protect it from browsing and from people walking upon it.

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* In 1974 the Agreement between TNC and the Cope family concerning this 72 acre addition was amended as follows: The condition that the general public shall not be admitted to the property except as a majority of the donors shall from time to time agree was eliminated. The phrase giving the donors and their licensees "the exclusive right to use this area for wildlife study and observation" was deleted, allowing the donors to "use the lake and the lands adjoining the same for fishing, swimming, and other recreation purposes as they now do."

COPE POND

Emergent Vegetation

Fragrant Water-lily	Nymphaea odorata.	C	(Pink and White)
Bullhead Lily	Nuphar variegatum.		C
Wild Calla	Calla palustris.		C
Pickerelweed	Pontederia cordata.		A
Broad-leaved Arrowhead	Sagittaria latifolia.		U
Watershield	Brasenia schreberi.		C
Larger Blue Flag	Iris versicolor.		C
Sedges	Carex sp.		C

Submergent Vegetation

Coontail	Ceratophyllum demersum.	A
Ribbonleaf Pondweed	Potamogeton epihydrus.	C

Vegetation Along Shore of Pond

Great Rhododendron	Rhododendron maximum.		A
Mountain Laurel	Kalmia latifolia.		A
Eastern Hemlock	Tsuga canadensis.		A
Red Maple	Acer rubrum.		A
Shadbush	Amelanchier sp.		C
Red Oak	Quercus rubra.		C
American Chestnut	Castanea dentata.		C
Balsam Fir	Abies balsamea.		C
Spotted Touch-me-not	Impatiens capensis.		C
Bugleweed	Lycopus virginicus.		U
Mad Dog Skullcap	Scutellaria laterifolia.		U
Nodding Bur-marigold	Bidens cernua.		U
Leafy-bracted Beggars Tick	Bidens comosa.		U
Nightshade	Solanum dulcamara.	C	Near the dam
Closed Gentian	Gentiana andrewsii.	U	Near the dam
Stinging Nettle	Urtica dioica.	S	Near the dam
Common Smartweed	Polygonum hydropiper.		U

Other species previously mentioned for the second growth woods and floating islands are also found growing around the pond.

FLOATING ISLANDS

Woody Plants

Dwarf Cassandra, Leather-leaf	*Chamaedaphne calyculata.*	A
Speckled Alder	*Alnus rugosa.*	C
Red Maple	*Acer rubrum.*	U
Meadowsweet	*Spiraea alba.*	C
Yellow Birch	*Betula lutea.*	U
Shadbush, Juneberry	*Amelanchier* sp.	S
Marsh St. Johnswort	*Hypericum virginicum.*	C
Large Cranberry	*Vaccinium macrocarpon.*	U

Herbaceous Plants

Sphagnum Moss	*Sphagnum* sp.	A
Marsh Fern	*Thelypteris palustris.*	A
Spotted Touch-me-not	*Impatiens capensis.*	C
Larger Blue Flag	*Iris versicolor.*	C
Sensitive Fern	*Onoclea sensibilis.*	C
Marsh Skullcap	*Scutellaria epilobiifolia.*	C
Pitcher Plant	*Sarracenia purpurea.*	C
Bulb-bearing Water Hemlock	*Cicuta bulbifera.*	C
Bugleweed	*Lycopus virginicus.*	U
Nodding Bur-marigold	*Bidens cernua.*	U
Round-leaved Sundew	*Drosera rotundifolia.*	U
Spatulate-leaved Sundew	*Drosera intermedia.*	S
Purple-leaved Willow Herb	*Epilobium coloratum.*	U
Wild Calla	*Calla palustris.*	C

COPE POND

Mammals

Muskrat - Onodatra zibethica. P.R. Uncommon today, they were seen frequently in 1931.

Raccoon * - Procyon lotor. P.R. Tracks observed near the remains of yellow perch pulled out of holes in the ice, and empty clam shells along the shore attest that the masked bandit is active both winter and summer at the Cope Pond.

Beaver * - Castor canadensis. Occasional visitor. Several resided at the pond about six to eight years ago and were not considered desirable inhabitants by some because of the damage they caused to the older trees in the area. Before the game warden had a chance to live-trap the beavers and remove them elsewhere, they were found dead near the highway in a ditch, their deaths unexplained. One was observed on several occasions last spring (1978) but it did not remain at the pond.

White-footed Mouse - Peromyscus leucopus. P.R. Abundant. Live-trapped under the rhododendron only a few feet from the pond. Either this species or the following one has removed considerable stuffing from the naturalists' life jackets in the boathouse. Mice have been building nests in this building at least since 1932.

Deer Mouse * - Peromyscus maniculatus. P.R. Common near edges of pond.

Striped Skunk * - Mephitis mephitis. P.R. Uncommon. Tracks observed on pond in the winter.

Eastern Flying Squirrel * - Glaucomys volans. P.R. Status uncertain. T. Cope picked up a dead flying squirrel near the boathouse on March 1, 1977 which had blood and small teeth marks on top of its skull.

Woodland Jumping Mouse - Napaeozapus insignis. P.R. On one of the early morning bird walks in May, 1976, this observer believed she saw a jumping mouse leap across the trail west of the boathouse. Live traps which were

set out in the vicinity one-and-a-half years later produced only Peromyscus species. Theodora Cope's spaniel caught two specimens in 1930 in the virgin woods section.

Mink, mentioned in Cope's thesis, have been observed at the lower pond and probably still exist at the Cope Pond but their tracks have not been seen on the infrequent trips the author has made in the winter to this area.

Chipmunks, red and gray squirrels, and short-tailed shrews are also found along the edges of the pond but exist more commonly in the second growth woods.

* Species not mentioned for this habitat in Cope's thesis.

COPE POND

Birds

Red-winged Blackbird	Agelaius phoeniceus. S.R. Common. Nests on islands.
Mallard	Anas platyrhynchos. S.R. Uncommon. Nests on islands.
Wood Duck	Aix sponsa. S.R. Uncommon.
Great Blue Heron	Ardea herodias. S.R. Common.
Barn Swallow	Hirundo rustica. S.R. Common
Eastern Phoebe	Sayornis phoebe. S.R. Uncommon.
Black-capped Chickadee	Parus atricapillus. P.R. Common.
Song Sparrow	Melospiza melodia. S.R. Common.
Veery	Hylocichla fuscescens. S.R. Common. Nested 12 feet from pond.
Blue Jay	Cyanocitta cristata. P.R. Common.
Common Crow	Corvus brachyrhynchos. P.R. Common.
Belted Kingfisher	Megaceryle alcyon. S.R. Uncommon.
Louisiana Water-thrush	Seiurus motacilla. Migrant. Uncommon.
Solitary Sandpiper	Tringa solitaria. Occasional visitor.
Yellow-shafted Flicker	Colaptes auratus. S.R. Uncommon.
Common Yellowthroat	Geothlypis trichas. S.R. Common near edges of pond.

COPE POND

Amphibians

Bull Frog	Rana catesbeiana. Common.
Red-spotted Newt	Notophthalmus viridescens. Uncommon.
Red-backed Salamander	Plethodon cinereus. Uncommon.

Reptiles

Eastern Painted Turtle	Chrysemys picta picta. Common.
Water Snake	Natrix sipedon. Uncommon.

Cope mentioned other reptiles and amphibians for the Cope Pond which this author has observed in other habitats. Some of these species such as the spring peeper and the tree frog may still visit the pond but their voices have not been heard on the occasions the author has visited the area at night.

Fish

Yellow Perch	Perca flavescens. Abundant.
Blacknose Dace	Rhinichthys atratulus. Abundant.
Pumpkinseed Sunfish	Lepomis gibbosus. Common.
Brown Bullhead	Ictalurus nebulosus. Common. Introduced from neighboring Elk Lake in 1880.
Chain Pickerel	Esox niger. Common.
White Sucker	Catostomus commersoni. This species was listed in the 1932 thesis but it has not been observed in the last few years.

WOODED PASTURES

WOODED PASTURES

Two areas of wooded pasture land have been identified on the Habitat Map. The smaller area, paralleling the lower pond outlet stream west of Main's Road, includes an old apple orchard and a few large black cherry and sugar maple trees. For the most part, however, it has become wooded with hawthorne, nearly the only woody plant species which consistently escapes cattle browsing enough to thrive and spread into actively used pastures in this region.

The larger wooded pasture parallels the western edge of the nature trail section. As can be observed on the Habitat Map, it is about one-half mile long and as wide as 400 feet in some places. According to Edward Bush, a local farmer since 1923 whose property adjoins Woodbourne's, the Cope family used this larger pasture woods for their herd of 60 fine milkers for as long as he could remember. In 1946 Mr. Bush rented out the pasture woods and pastures, first from Mr. Cope and later from the Woodbourne Management Committee. Bush grazed about 35 heifers in these areas which was a sufficient number to keep the fields open without the need to mow them each year which is currently the practice. In the last few years, James Delp has rented Bush's dairy farm and has grazed about 20 young cattle in the Woodbourne pastures. From this information, it appears that the larger wooded pasture has been used continuously by cattle for at least the past 55 years.

The southern portion of the large wooded pasture has always served as a travel lane for the cattle to get from one

open pasture to another. The effects of cows pasturing this travel lane for so many years is pointed out to visitors traversing this section on the nature trail. There is almost a complete lack of understory growth here and the ground cover is sparse. Except for hawthorne, Japanese barberry and multiflora rose bushes, the reproduction of all other trees and shrubs is very poor.

Another effect of this forest having been converted to pasture woods is that it has encouraged the entry of many alien plants. One of the concerns for studying the pasture woods was to determine how many foreign plants had established themselves in this area, and of those, how many had spread to the nearby climax woods sections. The author's study revealed that one-third or twelve of the thirty-six species of herbaceous plants growing in this area are foreign. Many of these species have made their way from the open fields down into the pasture woods. In these open woods whose soil is frequently disturbed by cow hooves, these alien plants are more successful than native ones. However, in the climax woods only one barberry plant and a few stinging nettle plants have entered one blowdown area which shows that these woods still remain a nearly pure example of North American flora!

Just north of where the nature trail crosses the pasture woods stands an old spring house with a small stream flowing from it. The strip of woods from here northward to the lower pond inlet stream is almost as low in elevation as the swamp, and is thus very moist throughout the year. The cattle churn

up the soft earth here and leave droppings which are carried by runoff into the adjacent swamp. Moving the fence line about 150 feet up the hill to the west would keep cattle out of this wet area and avoid much of this pollution problem. Jim Delp agrees that the wooded pasture area does not need to be so large especially for his small herd of cattle and feels that it is probably not a good practice either to have his cows standing in this wet area which they seem to do. If the pasture woods were decreased in size, the former forest could regenerate itself and the native flora characteristic of old growth woods would return. The chances of alien species invading the blowdown areas within the climax woods would be lessened as well.

WOODED PASTURES

Woody Plants

Red Maple	*Acer rubrum.*	A
Hawthorne	*Crataegus* sp.	A
Black Cherry	*Prunus serotina.*	C
Bitternut Hickory	*Carya cordiformis.*	C
White Ash	*Fraxinus americana.*	C
Domestic Apple	*Pyrus malus.*	C
Multiflora Rose *	*Rosa multiflora*	C
Partridgeberry	*Mitchella repens.*	C
Tartarian Honeysuckle	*Lonicera tatarica.*	C
Sugar Maple	*Acer saccharum.*	C
American Beech	*Fagus grandifolia.*	C
Japanese Barberry *	*Berberis thunbergii.*	C
Red Raspberry	*Rubus idaeus.*	U
American Basswood	*Tilia americana.*	U
Eastern Hop Hornbeam	*Ostrya virginiana.*	U
Shadbush, Serviceberry	*Amelanchier laevis.*	U
Red Elderberry	*Sambucus pubens.*	U
Garden Red Currant *	*Ribes sativum.*	U
Common Witch-hazel	*Hamamelis virginiana.*	U

* Alien Plants

WOODED PASTURES

Herbaceous Plants

Hay-scented Fern	Dennstaedtia punctilobula.	C
Spotted Touch-me-not	Impatiens capensis.	A
Common Buttercup *	Ranunculus acris.	A
Heal-all *	Prunella vulgaris.	A
Arrow-leaved Tearthumb	Polygonum sagittatum.	A
Swamp Beggar-ticks	Biddens connata.	A
Dwarf Cinquefoil	Potentilla canadensis.	C
Common Strawberry	Fragaria virginiana.	C
Common Speedwell *	Veronica officinalis.	C
Canada Mayflower	Maianthemum canadense.	C
Common Smartweed, Water Pepper	Polygonum hydropiper.	C
Enchanter's Nightshade	Circaea quadrisulcata.	C
Smaller Enchanter's Nightshade	Circaea alpina.	C
Nodding Bur-marigold	Bidens cernua.	C
Bugleweed	Lycopus virginicus.	C
American Brooklime	Veronica americana.	U
Trout-lily	Erythronium americanum.	C
Spring-beauty	Claytonia virginica.	C
Foam Flower	Tiarella cordifolia.	U
Woodland Jack-in-the-pulpit	Arisaema atrorubens.	U
Starflower	Trientalis borealis.	C
Twisted-stalk	Streptopus amplexifolius.	U
White Avens	Geum canadense.	C
Pennsylvania Bittercress	Cardamine pensylvanica.	U
Common Blue Violet	Viola papilionacea.	U
Common Chickweed *	Stellaria media.	U
Basil *	Satureja vulgaris.	U
Shinleaf	Pyrola elliptica.	U
Yellow Wood Sorrel *	Oxalis europaea.	U
Hemp-nettle *	Galeopsis tetrahit.	U
Winter Cress *	Barbarea vulgaris.	C

Herbaceous Plants

Stinging Nettle &	*Urtica dioica.*	U
Tumble Mustard *	*Sesymbrium altissimum.*	U
Elecampane *	*Inula helenium.*	U
Gall-of-the-earth	*Prenanthes trifoliata.*	U
Moneywort *	*Lysimachia nummularia.*	U

* Alien Plants

WOODED PASTURES

Birds

Blue Jay	Cyanocitta cristata.	P.R.	Common
Robin	Turdus migratorius.	S.R.	Common
Wood Pewee	Contopus virens.	S.R.	Common
Eastern Bluebird	Sialia sialis.	S.R.	Uncommon
Scarlet Tanager	Piranga olivacea.	S.R.	Common
Wood Thrush	Hylocichla mustelina.	S.R.	Common
Great Crested Flycatcher	Myiarchus crinitus.	S.R.	Common
Black-capped Chickadee	Parus atricapillus.	P.R.	Common
Ovenbird	Seiurus aurocapillus.	S.R.	Uncommon
Red-eyed Vireo	Vireo olivaceus.	S.R.	Common

Cedar Waxwing — Bombycilla cedrorum. Uncertain if it nests here. Observed eating the hawthorne apples in the fall. Uncommon.

Indigo Bunting — Passerina cyanea. S.R. Uncommon

Blackburnian Warbler — Dendroica fusca. Has not been observed nesting in the sanctuary the last four years. Uncommon migrant.

Olive-backed Thrush — Hylocichla ustulata. Spring migrant. Uncommon.

Mammals

Raccoon	Procyon lotor.	P.R.	Common
White-tailed Deer	Odocoileus virginianus.	P.R.	Common
Eastern Chipmunk	Tamias striatus.	P.R.	Common
White-footed Mouse	Peromyscus leucopus.	P.R.	Common
Skunk	Mephitis mephitis.	P.R.	Uncommon
Gray Squirrel	Sciurus carolinensis.	P.R.	Common

Amphibians

Red-backed Salamander	Plethodon cinereus.	Common
Wood Frog	Rana sylvatica.	Uncommon

EVERGREEN PLANTATIONS

EVERGREEN PLANTATIONS

Woodbourne Sanctuary contains approximately 71 acres of plantations of which 15 areas of different species composition and/or planting dates have been identified and numbered on the Habitat Map. A key to the species planted in each area and the dates planted, if available, follows this description. The Habitat Map and the key are based on information supplied by John F. Stanwell-Fletcher on a map which he had prepared of the sanctuary in 1940. Other data regarding the plantations was subsequently added on the map by Francis Cope. (This map is presently contained in the Woodbourne cottage files.) Carmen Mazzotti more accurately mapped out in his 1967 Forest Management Plan where these plantations were situated and this information was incorporated into the Map as well as on-site observations.

Species composition varies considerably from area to area. Area #4 is black locust which was identified on the 1940 map as "planted from seed" with no planting date given. With the exception of this one area, all are conifer plantations. Some evergreen plantations such as numbers 8, 10b and 12 contain single species such as balsam fir, red pine, and arborvitae. Most areas contain at least two and as many as six species of evergreens.

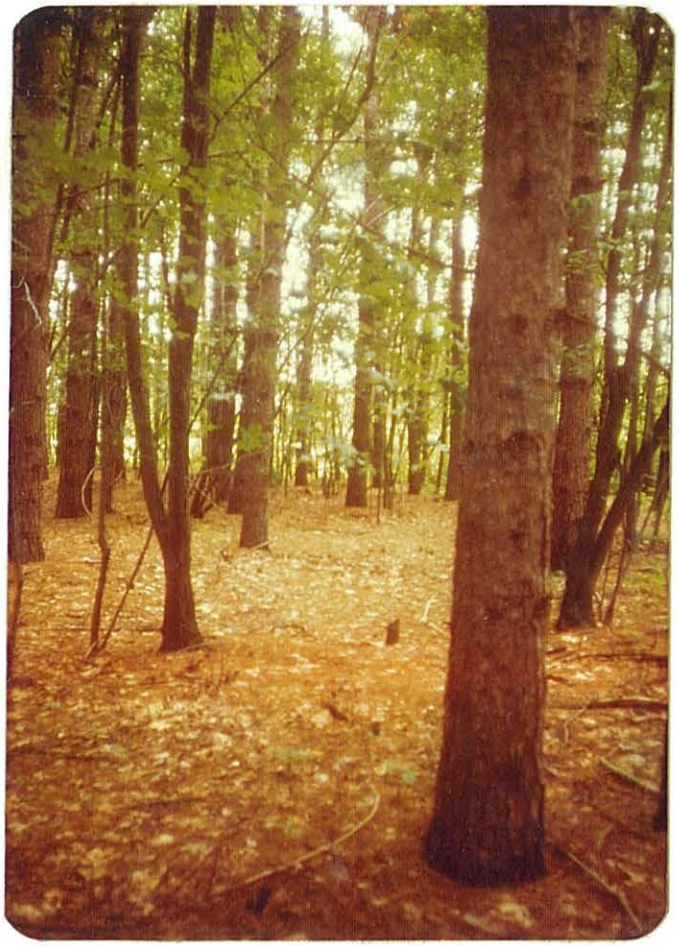
Ages of the conifer plantations vary from 28 to 72 years. The oldest, located southwest of Cope's Pond and containing a mixture of species, was planted in 1906 and 1908 on land cleared by fire a decade earlier. The remaining areas planted between

1926 and 1950 were reforested over a period of time probably as previously cropped or pastured land was abandoned.

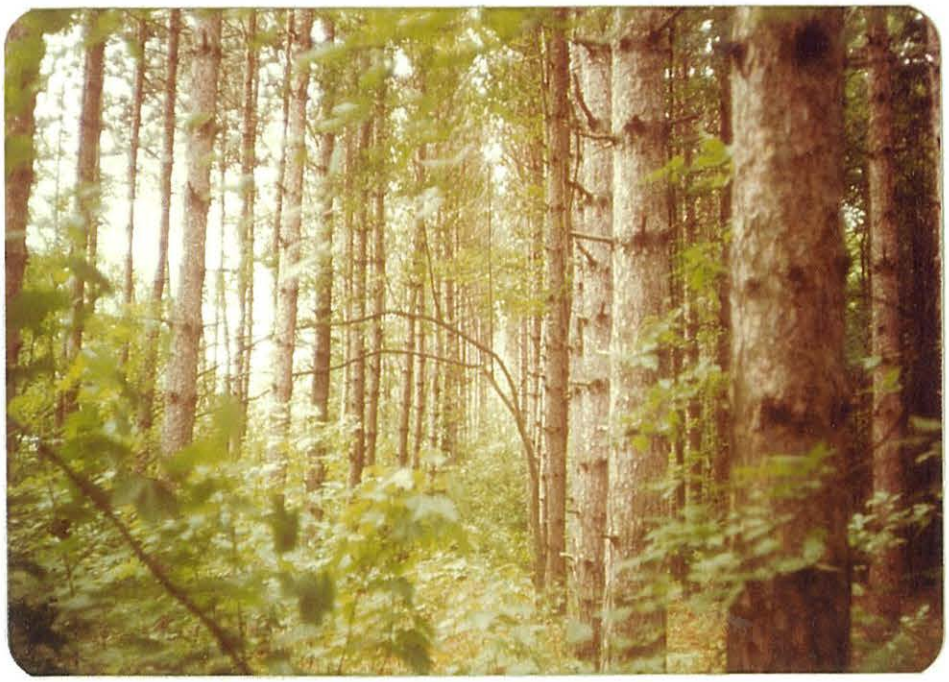
To the best of our knowledge the conifer plantations have never been managed or harvested. The County Extension Forester recommended two years ago that the red pine plantation #2, located along Route 29, especially needed thinning. Because they've been allowed to become spindly, should a heavy wind, snow, or ice storm occur, one pine could fall over upon another in a domino fashion, devastating the stand.

When these red pines which were planted in 1931 were younger, they helped to conceal the Cope Pond from travelers driving by and from possible intruders. Though still an asset to the overall scenery, their value for providing protection for the pond or shelter for wildlife other than for birds has been diminished. A younger understory composed mostly of sugar maple and black cherry is becoming established beneath the pines and would quickly "take over" the area should the red pines topple. Probably due to the lack of herbaceous vegetation, no mammals were captured in the fall of 1977 when small, live-animal traps were set out in this plantation.

Forty-six years ago T. Cope believed that the white spruce plantations increased the magnolia warbler population and that the animal life in general had increased since various plantations had been started. Today, however, the white spruce plantations are so dense that hardly a plant can be found growing within them. They're good examples of ecological deserts which are nearly void of plant and animal life.



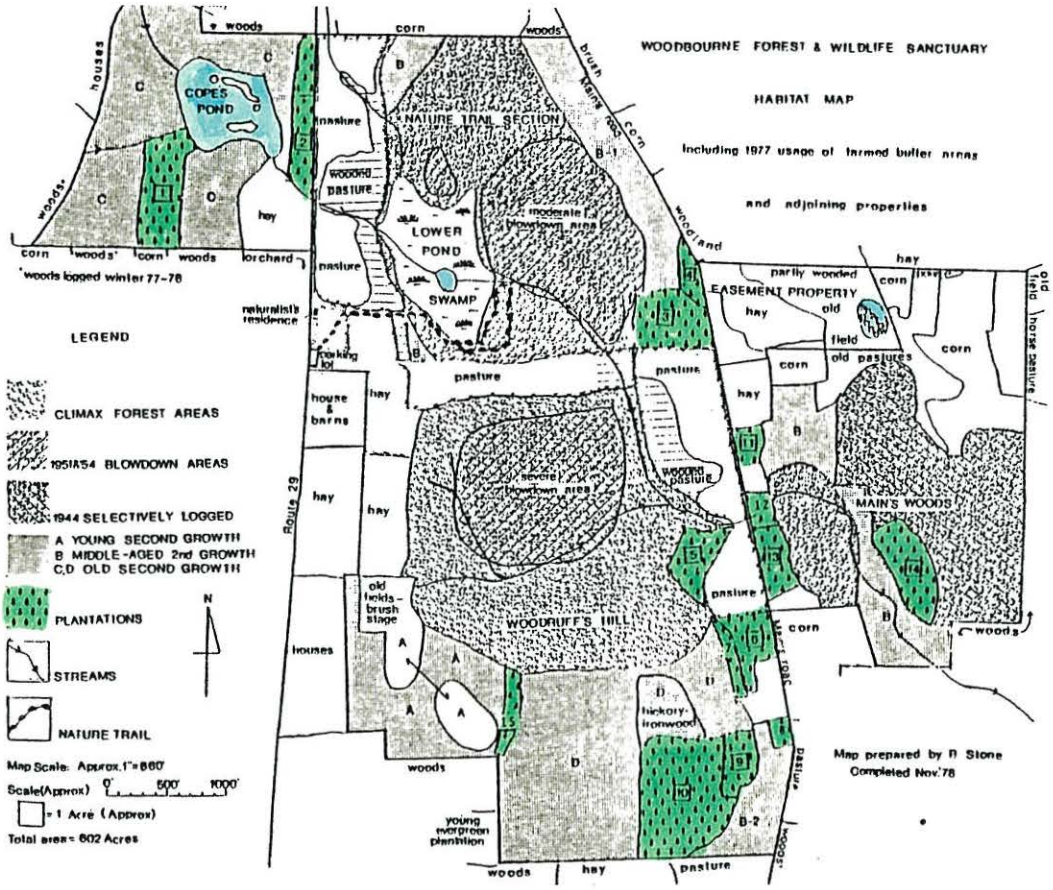
Plantation Site #2 Summer, 1977
Showing lack of Ground Vegetation
in Red Pine Stand
Looking north from Cope Pond Outlet



Plantation Site #2 Summer, 1977
Same Position as above but closer
to the Cope Pond

Those evergreen plantations which still possess needles on the lower branches of the trees, and which are not quite so dense, do provide some shelter for deer and other forms of wildlife. Evening grosbeaks, purple finches, crossbills and other birds which visit this region in the winter do eat the seeds from these cone-bearing trees also.

The flora and fauna existing in these evergreen plantations is generally representative of the surrounding fields or second growth areas.



1 . White Pine, Arborvitae, Red Pine, European Larch: 1906
Norway Spruce, Red Spruce, American Larch: 1908

2 . Arborvitae, White Spruce, Red Pine, Douglas Fir, Hemlock: 1931

3 . Scotch Pine, Douglas Fir: 1950

4 . Black Locust from seed.

5 . White Fir (Concolor), Hemlock, White Spruce, Douglas Fir, Balsam Fir, Red Pine: 1936-43

6 . Balsam Fir, Engleman Spruce: No date available

7. Balsam Fir, White Spruce, European Larch: 1942-43

8 . Balsam Fir: No date

9 . Red Pine, Norway Spruce, European Larch, Douglas Fir, Paper Birch: 1926

10a. Red Pine, Scotch Pine

10b. Red Pine: 1926-1930

11. Red Pine, Scotch Pine, European Larch, Arborvitae (Northern White Cedar)

12. Arborvitae (Northern White Cedar)

13. White Spruce, Douglas Fir: 1949-50

14. Red Pine: 1934-35

15. Scotch Pine, Engleman Spruce, Douglas Fir, Paper Birch

Appendices

Mammals

Observed During This Study

Virginia Opossum	*Didelphis virginiana*
Hairytail Mole	*Parascalops breweri*
Masked Shrew	*Sorex cinereus*
Shorttail Shrew	*Blarina brevicauda*
Little Brown Bat	*Myotis lucifugus*
Black Bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Longtail Weasel	*Mustela frenata*
Mink	*Mustela vison*
River Otter *	*Lutra canadensis*
Striped Skunk	*Mephitis mephitis*
Red Fox	*Vulpes fulva*
Bobcat	*Lynx rufus*
Woodchuck	*Marmota monax*
Eastern Chipmunk	*Tamias striatus*
Red Squirrel	*Tamiasciurus hudsonicus*
Eastern Gray Squirrel	*Sciurus carolinensis*
Northern Flying Squirrel	*Glaucomys sabrinus*
Beaver	*Castor canadensis*
Deer Mouse	*Peromyscus maniculatus*
White-footed Mouse	*Peromyscus leucopus*
Meadow Vole	*Microtus pennsylvanicus*
Woodland Jumping Mouse	*Napaeozapus insignis*
Porcupine	*Erethizon dorsatum*
Muskrat	*Ondatra zibethica*
Snowshoe Hare	*Lepus americanus*
Eastern Cottontail Rabbit	*Sylvanicus floridanus*
Whitetail Deer	*Odocoileus virginianus*

* Observed a year or two before this study began by Philip Gray.

Birds Observed at Woodbourne Sanctuary

1961 - 1979

Pied-billed Grebe
Great Blue Heron
Green Heron
Canada Goose
Mallard
Black Duck
Wood Duck
Ring-necked Duck
Buffle-head
Turkey Vulture
Goshawk
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Osprey
American Kestrel
Ruffed Grouse
Bob-white
Ring-necked Pheasant
Turkey
Killdeer
American Woodcock
Spotted Sandpiper
Solitary Sandpiper
Rock Dove
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Screech Owl
Great Horned Owl
Snowy Owl
Barred Owl
Long-eared Owl
Saw-whet Owl
Whip-poor-will
Common Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Common Flicker
Pileated Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher
Eastern Phoebe
Yellow-bellied Flycatcher
Alder Flycatcher
Least Flycatcher
Eastern Wood Pewee
Olive-sided Flycatcher
Horned Lark
Tree Swallow
Bank Swallow
Barn Swallow
Purple Martin
Blue Jay
Common Crow
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Carolina Wren
Mockingbird
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Hermit Thrush
Swainson's Thrush
Gray-cheeked Thrush
Veery
Eastern Bluebird
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet
Cedar Waxwing
Northern Shrike
Starling
Yellow-throated Vireo
Solitary Vireo
Red-eyed Vireo
Black and White Warbler
Blue Winged Warbler
Tennessee Warbler
Nashville Warbler
Northern Parula Warbler
Yellow Warbler
Magnolia Warbler
Cape May Warbler
Black-throated Blue Warbler

Yellow-rumped Warbler
Black-throated Green Warbler
Blackburnian Warbler
Chestnut-sided Warbler
Bay-breasted Warbler
Black-poll Warbler
Prairie Warbler
Palm Warbler
Ovenbird
Northern Waterthrush
Louisiana Waterthrush
Common Yellowthroat
Yellow-breasted Chat
Wilson's Warbler
Canada Warbler
American Redstart
House Sparrow
Bobolink
Eastern Meadowlark
Red-winged Blackbird
Northern Oriole
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Evening Grosbeak
Purple Finch
House Finch
Pine Grosbeak
Common Redpoll
Pine Siskin
American Goldfinch
Red Crossbill
White-winged Crossbill
Rufous-sided Towhee
Vesper Sparrow
Dark-eyed Junco
Tree Sparrow
Chipping Sparrow
Field Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Swamp Sparrow
Song Sparrow

Total Species 146

Amphibians Observed During This Study

American Toad	*Bufo americanus*
Wood Frog	*Rana sylvatica*
Green Frog	*Rana clamitans*
Bull Frog	*Rana catesbeiana*
Pickerel Frog	*Rana palustris*
Spring Peeper	*Hyla crucifer*
Gray Treefrog	*Hyla versicolor*
Red-spotted Newt	*Notophthalmus viridescens*
Northern Dusky Salamander	*Desmognathus fuscus*
Two-lined Salamander	*Eurycea bislineata*
Purple or Spring Salamander	*Gyrinophilus porphyriticus*
Red-backed Salamander	*Plethodon cinereus*

Reptiles

Eastern Painted Turtle	*Chrysemys picta*
Snapping Turtle	*Chelydra serpentina*
Water Snake	*Natrix sipedon*
Eastern Garter Snake	*Thamnophis sirtalis*
Eastern Milk Snake	*Lampropeltis doliata*

Ferns Observed During This Study

Maidenhair Fern	*Adiantum pedatum*
Lady Fern	*Athyrium Felix-femina*
Silvery Spleenwort Fern	*Athyrium thelypteroides*
Rattlesnake Fern	*Botrychium virginianum*
Fragile Fern	*Cystopteris fragilis*
Hay-scented Fern	*Dennstaedtia punctilobula*
Boott's Fern	*Dryopteris Boottii*
Clinton's Fern	*Dryopteris Clintoniana*
Crested Fern	*Dryopteris cristata*
Marginal Woodfern	*Dryopteris marginalis*
American Shield Fern, Common Wood Fern	*Dryopteris spinulosa*
Oak Fern	*Gymnocarpium Dryopteris*
Sensitive Fern	*Onoclea sensibilis*
Cinnamon Fern	*Osmunda cinnamomea*
Interrupted Fern	*Osmunda claytoniana*
Royal Fern	*Osmunda regalis*
Christmas Fern	*Polystichum acrostichoides*
Bracken Fern	*Pteridium aquilinum*
Broad Beech Fern	*Thelypteris hexagonoptera*
New York Fern	*Thelypteris noveboracensis*
Marsh Fern	*Thelypteris palustris*
Long Beech Fern	*Thelypteris Phegopteris*

Index of Flora

1.	Abies balsamea	Balsam Fir, Intro.
2.	Abies concolor	White Fir, Concolor Fir, Intro.
3.	Acer rubrum	Red Maple
4.	Acer pensylvanicum	Striped Maple
5.	Acer saccharum	Sugar Maple
6.	Acer spicatum	Mountain Maple
7.	Achillea millefolium	Yarrow
8.	Actaea pachypoda	White Baneberry
9.	Actaea rubra	Red Baneberry
10.	Adiantum pedatum	Maidenhair Fern
11.	Agrimonia hirsuta	Tall Hairy Agrimony (B. & B.)
12.	Allium tricoccum	Wild Leek
13.	Alnus rugosa	Speckled Alder
14.	Ambrosia artemisiifolia	Common Ragweed
15.	Amelanchier laevis	Shadbush, Juneberry
16.	Amphicarpa bracteata	Hog Peanut
17.	Anaphalis margaritacea	Pearly Everlasting
18.	Anthemis coyula	Mayweed
19.	Apocynum androsaemifolium	Spreading Dogbane
20.	Aquilegia canadensis	Columbine
21.	Aralia nudicaulis	Wild Sarsaparilla
22.	Arctium minus	Common Burdock
23.	Arisaema stewardsonii *	Northern Jack-in-the Pulpit
24.	Arisaema triphyllum	Woodland Jack-in-the Pulpit
25.	Asclepias purpurascens	Purple Milkweed
26.	Aster acuminatus	Whorled Wood Aster
27.	Aster divaricatus	White Wood Aster
28.	Aster novae-angliae	New England Aster
29.	Aster prenanthoides	Crooked-stemmed Aster
30.	Aster puniceus	Purple-stemmed Aster
31.	Aster simplex	Panicled Aster, Tall White Aster
32.	Athyrium Felix-femina	Lady Fern
33.	Athyrium thelypteroides	Silvery Spleenwort
34.	Barbarea vulgaris	Winter Cress
35.	Berberis thunbergii	Japanese Barberry
36.	Betula lenta	Black Birch
37.	Betula lutea	Yellow Birch
38.	Betula papyrifera	American White Birch
39.	Bidens cernua	Nodding Bur-marigold
40.	Bidens comosa	Leafy-bracted Beggar-ticks
41.	Bidens connata	Swamp Beggar-ticks
42.	Bidens frondosa	Beggar-ticks
43.	Boehmeria cylindrica	False Nettle, Bog Hemp
44.	Botrychium virginianum	Rattlesnake Fern
45.	Brasenia schreberi	Water-shield

*Named after Francis Cope's cousin, Stewardson Brown, who discovered the plant in the Pocono Mt. swamps.

46.	Calla palustris	Wild Calla
47.	Caltha palustris	Marsh-marigold, Cowslip
48.	Campanulua rapunculoides	Creeping Bellflower
49.	Cardamine pensylvanica	Pennsylvania Bittercress
50.	Carex sp.	
51.	Carex sp.	
52.	Carpinus caroliniana	Ironwood, Blue Beech
53.	Carya cordiformis	Bitternut Hickory
54.	Carya ovata	Shagbark Hickory
55.	Castanea dentata	American Chestnut
56.	Caulophyllum thalictroides	Blue Cohosh
57.	Celastrus scandens	American Bittersweet
58.	Cephalanthus occidentalis	Buttonbush
59.	Cerastium vulgatum	Mouse-ear Chickweed
60.	Ceratophyllum demersum	Coontail
61.	Chamaedaphne calyculata	Dwarf Cassandra, Leather-leaf
62.	Chelidonium majus	Celandine
63.	Chelone glabra	Turtlehead
64.	Chrysanthemum leucanthemum	Ox-eye Daisy
65.	Chrysanthemum parthenium	Feverfew
66.	Chrysosplenium oppositifolium	Golden Saxifrage, Water Carpet, (B. & B.)
67.	Cicuta bulbifera	Bulb-bearing Water-hemlock
68.	Circaea alpina	Smaller Enchanter's Nightshade
69.	Circaea quadrisulcata	Enchanter's Nightshade
70.	Cirsium vulgare	Bull Thistle
71.	Claytonia virginica	Spring-beauty
72.	Clintonia borealis	Blue-beaded Lily
73.	Coptis groenlandica	Gold Thread
74.	Corallorhiza striata	Striped Coralroot
75.	Cornus alternifolia	Alternate-leaf Dogwood
76.	Crataegus spp.	Hawthorn
77.	Crepis capillaris	Smooth Hawksbeard
78.	Cypripedium acaule	Pink Lady's slipper, Moccasin Flower
79.	Cystopteris fragilis	Fragile Fern
80.	Dalibarda repens	Dew Drop, False Violet
81.	Daucus carota	Queen Anne's Lace, Wild Carrot
82.	Dennstaedtia punctilobula	Hay-scented Fern
83.	Dentaria diphylla	Pepperwort, Toothwort
84.	Dentaria laciniata	Cut-leaved Toothwort
85.	Dicentra canadensis	Squirrel-corn
86.	Dipsacus sylvestris	Teasel
87.	Dirca palustris	Leatherwood
88.	Drosera intermedia	Spatulate-leaved Sundew
89.	Drosera rotundifolia	Round-leaved Sundew
90.	Dryopteris Boottii	Boott's Fern
91.	Dryopteris Clintoniana	Clinton's Fern
92.	Dryopteris cristata	Crested Fern

93.	Dryopteris marginalis	Marginal Woodfern
94.	Dryopteris spinulosa	American Shield Fern, Common Wood Fern
95.	Epifagus virginiana	Beechdrops
96.	Epilobium coloratum	Purple-leaved Willow-herb
97.	Epipactis helleborine	Helleborine
98.	Erigeron strigosus	Daisy Fleabane
99.	Erythronium americanum	Trout-lily, Adder's-tongue
100.	Eupatorium perfoliatum	Boneset
101.	Eupatorium rugosum	White Snakeroot
102.	Euphorbia cyparissias	Cypress Spurge
103.	Fagus grandifolia	American Beech
104.	Fragaria virginiana	Common Strawberry
105.	Fraxinus americana	White Ash
106.	Galeopsis tetrahit	Hemp-nettle
107.	Galinsoga ciliata	French Weed
108.	Galium asprellum	Rough Bedstraw
109.	Galium triflorum	Fragrant Bedstraw
110.	Gaultheria procumbens	Wintergreen, Checkerberry
111.	Gentiana andrewsii	Closed Gentian
112.	Geranium robertianum	Herb Robert
113.	Geum canadense	White Avens
114.	Glechoma hederacea	Gill-over-the-ground
115.	Gymnocarpium Dryopteris	Oak Fern
116.	Hamemelis virginiana	Witch-hazel
117.	Hepatica acutiloba	Sharp-lobed Hepatica
118.	Hesperis matronalis	Dame's Rocket
119.	Hieracium aurantiacum	Orange Hawkweed
120.	Hieracium pilosella	Mouse-ear Hawkweed
121.	Hieracium pratense	King Devil Hawkweed, Field Hawkweed
122.	Hydrocotyle americana	Water-pennywort
123.	Hydrophyllum virginianum	Virginia Waterleaf
124.	Hypericum perforatum	Common St. Johnswort
125.	Hypericum virginicum	Marsh St. Johnswort
126.	Ilex verticillata	Common Winterberry Holly
127.	Impatiens capensis	Spotted Touch-me-not
128.	Impatiens pallida	Pale Touch-me-not, Jewelweed
129.	Inula helenium	Elecampane
130.	Iris versicolor	Larger Blue Flag
131.	Juglans cinerea	Butternut, White Walnut
132.	Juglans nigra	Black Walnut
133.	Kalmia latifolia	Mountain Laurel
134.	Lapsana communis	Nipplewort
135.	Larix decidua	European Larch, Intro.
136.	Linaria vulgaris	Butter-and-eggs
137.	Lindera benzoin	Common Spicebush
138.	Lobelia inflata	Indian Tobacco
139.	Lonicera canadensis	Fly-Honeysuckle
140.	Lonicera sempervirens	Trumpet Honeysuckle
141.	Lonicera tatarica	Tartarian Honeysuckle

142.	Lotus corniculatus	Birdfoot Trefoil
143.	Lycopodium annotinum	Stiff Clubmoss
144.	Lycopodium clavatum	Staghorn Clubmoss
145.	Lycopodium complanatum	Running Pine, Ground Pine
146.	Lycopodium lucidulum	Shining Clubmoss
147.	Lycopodium obscurum	Tree Clubmoss
148.	Lycopus virginicus	Bugleweed
149.	Lysimachia nummularia	Moneywort
150.	Lysimachia terrestris	Yellow Loosestrife, Swamp Candles
151.	Maianthemum canadense	Canada Mayflower
152.	Malva neglecta	Common Mallow
153.	Matricaria chamomilla	Wild Chamomile
154.	Medeola virginiana	Indian Cucumber-root
155.	Medicago sativa	Alfalfa
156.	Mitchella repens	Partridge Berry
157.	Monotropa uniflora	Indian Pipes
158.	Nemopanthus mucronata	Mountain-holly
159.	Nuphar variegatum	Bullhead-lily
160.	Nymphaea odorata	Fragrant Water-lily
161.	Oenothera biennis	Evening Primrose
162.	Onoclea sensibilis	Sensitive Fern
163.	Osmorhiza claytoni	Sweet Cicely
164.	Osmunda cinnamomea	Cinnamon Fern
165.	Osmunda claytoniana	Interrupted Fern
166.	Osmunda regalis	Royal Fern
167.	Ostrya virginiana	Eastern Hop Hornbeam
168.	Oxalis europaea	Yellow Wood Sorrel
169.	Oxalis montana	Wood Sorrel
170.	Panax trifolius	Dwarf Ginseng
171.	Parthenocissus quinquefolia	Virginia Creeper
172.	Phytolacca americana	Pokeweed
173.	Picea abies	Norway Spruce, Intro.
174.	Picea engelmanni	Engelmann Spruce, INtro.
175.	Picea glauca	White Spruce, Intro.
176.	Picea rubens	Red Spruce
177.	Pinus resinosa	Red Pine, Intro.
178.	Pinus strobus	White Pine
179.	Pinus sylvestris	Scotch Pine, Intro.
180.	Plantago major	Common Plantain
181.	Podophyllum peltatum	May-apple, Mandrake
182.	Polygonatum biflorum	Solomon's-seal
183.	Polygonum arifolium	Halberd-leaved Tearthumb
184.	Polygonum hydropiper	Water Pepper, Common Smartweed
185.	Polygonum persicaria	Lady's-thumb, Redleg
186.	Polygonum sagittatum	Arrow-leaved Tearthumb
187.	Polystichum acrostichoides	Christmas Fern
188.	Polytrichum commune	Common Hair-cap Moss
189.	Pontederia cordata	Pickerelweed
190.	Populus grandidentata	Bigtooth Aspen
191.	Populus tremuloides	Quaking Aspen
192.	Potamogeton epihydrus	Ribbonleaf Pondweed

193.	Potentilla candensis	Dwarf Cinquefoil
194.	Potentilla recta	Rough-fruited Cinquefoil
195.	Prenanthes altissima	Tall White Lettuce
196.	Prenanthes trifoliata	Gall-of-the-earth
197.	Prunella vulgaris	Heal-all
198.	Prunus pensylvanica	Fire Cherry, Pin Cherry
199.	Prunus serotina	Black Cherry
200.	Prunus virginiana	Choke Cherry
201.	Pseudotsuga taxifolia	Douglas Fir, Intro.
202.	Pteridium aquilinum	Bracken Fern
203.	Pyrola elliptica	Shinleaf
204.	Pyrus malus	Apple Tree
205.	Quercus rubra	Red Oak
206.	Ranunculus acris	Common Buttercup
207.	Ranunculus repens	Creeping Buttercup
208.	Ranunculus septentrionalis	Swamp Buttercup
209.	Rhododendron maximum	Great Rhododenron
210.	Rhus radicans	Poison Ivy
211.	Rhus typhina	Staghorn Sumac
212.	Rhus vernix	Poison Sumac
213.	Ribes glandulosum	Skunk Currant
214.	Ribes sativum	Garden Red Currant
215.	Robinia pseudo-acacia	Black Locust
216.	Rosa carolina	Swamp Rose (B. & B.)
217.	Rosa multiflora	Multiflora rose
218.	Rubus allegheniensis	Blackberry
219.	Rubus hispidus	Bristly Dewberry
220.	Rubus idaeus	Red Raspberry
221.	Rubus occidentalis	Black Raspberry
222.	Rumex acetosella	Sheep Sorrel, Common Sorrel
223.	Rumex crispus	Curled Dock
224.	Sagittaria latifolia	Broad-leaved Arrowhead
225.	Salix discolor	Pussy Willow
226.	Sambucus canadensis	Common Elderberry
227.	Sambucus pubens	Red Elderberry
228.	Sanguinaria canadensis	Bloodroot
229.	Sarracenia purpurea	Pitcher-plant
230.	Satureja vulgaris	Basil
231.	Saxifraga pensylvanica	Swamp Saxifrage
232.	Scutellaria epilobiifolia	Common or Marsh Skullcap
233.	Scutellaria laterifolia	Mad Dog Skullcap
234.	Sedum telephium	Live-forever, Orpine
235.	Selaginella apoda	Meadow Spikemoss
236.	Shortia Galacifolia, Intro. in 1950, Endangered in S. Carolina	
237.	Silene cucubalus	Bladder Campion
238.	Sisymbrium officinale	Tumble Mustard
239.	Sisyrinchium mucronatum	Blue-eyed Grass
240.	Smilacina racemosa	False Solomon's-seal
241.	Solanum carolinense	Horse Nettle
242.	Solanum nigrum	Common Nightshade

243.	Solidago caesia	Blue-stemmed or Wreathe Goldenrod
244.	Solidago canadensis	Canada Goldenrod
245.	Solidago graminifolia	Lance-leaved Goldenrod
246.	Solidago juncea	Early Goldenrod
247.	Solidago rugosa	Rough-stemmed Goldenrod
248.	Sparganium spp.	Branching Bur-reed
249.	Sphagnum	Sphagnum Moss, Peat Moss
250.	Spirea alba	Narrowleaf Spirea, Meadowsweet
251.	Spirea latifolia	Broadleaf Spirea, Meadowsweet
252.	Spirodela polyrhiza	Duckweed
253.	Stellaria graminea	Lesser Stitchwort
254.	Stellaria media	Common Chickweed
255.	Streptopus amplexifolius	Twisted-stalk
256.	Taraxacum officinale	Dandelion
257.	Taxus canadensis	American Yew
258.	Thelypteris hexagonoptera	Broad Beech Fern
259.	Thelypteris noveboracensis	New York Fern
260.	Thelypteris palustris	Marsh Fern
261.	Thelypteris Phegopteris	Long Beech Fern
262.	Thlaspi arvense	Field Pennycress
263.	Thuja occidentalis	Northern White Cedar, Arbor Vitae, Intro.
264.	Tiarella cordifolia	Foamflower, False Mitterwort
265.	Tilia americana	American Basswood
266.	Tovara virginiana	Virginia Knotweed
267.	Tragopogen pratensis	Yellow Goat's-beard
268.	Trientalis americana	Star Flower
269.	Trifolium agrarium	Hop Clover
270.	Trifolium hybridum	Alsike Clover
271.	Trifolium pratense	Red Clover
272.	Trifolium repens	White Clover
273.	Trillium erectum	Purple Trillium, Wake Robin
274.	Trillium grandiflorum	White Trillium
275.	Trillium undulatum	Painted Trillium
276.	Tsuga canadensis	Eastern Hemlock
277.	Tussilago farfara	Coltsfoot
278.	Ulmus americana	American Elm
279.	Urtica dioica	Stinging Nettle
280.	Uvularia sessilifolia	Wild Oats, Sessile Bellwort
281.	Vaccinium corymbosum	Common Highbush Blueberry
282.	Vaccinium macrocarpon	Large Cranberry
283.	Vaccinium vacillans	Early Low Blueberry
284.	Veratrum viride	False Hellebore
285.	Verbena hastata	Blue Vervain
286.	Veronica americana	American Brooklime
287.	Veronica officinalis	Common Speedwell
288.	Viburnum acerifolium	Mapleleaf Viburnum
289.	Viburnum alnifolium	Hobblebush, Witch Hobble
290.	Viburnum cassinoides	Witherod, Wild Raison
291.	Viburnum lentago	Nannyberry
292.	Viburnum recognitum	Northern Arrowwood

293.	Viola blanda	Sweet White Violet
294.	Viola canadensis	Canada Violet
295.	Viola cucullata	Marsh Blue Violet
296.	Viola pallens	Northern White Violet
297.	Viola papilionacea	Common Blue Violet
298.	Viola pubescens	Downy Yellow Violet
299.	Viola renifolia	Kidney-leaved Violet
300.	Viola rotundifolia	Round-leaved Yellow Violet
301.	Vircia cracca	Cow Vetch
302.	Vitis novae-angliae	New England Grape
303.	Waldsteinia fragarioides	Barren Strawberry

GLOSSARY

Description of frequency of plant species

A -	Abundant	An abundant plant exists in large numbers in the habitat and would likely be seen each time a person visited the habitat.
C -	Common	A common plant exists over most of the habitat in smaller numbers and would be seen most of the time a person visited the habitat.
U -	Uncommon	An uncommon plant would only be found in certain parts of the habitat and in small numbers.
S -	Scarce	A scarce plant is one of which only a few individuals have been located over the entire habitat. Without specific instructions as to the exact whereabouts of a scarce plant, it would require considerable time for an individual to locate this species.

Description of frequency of vertebrate species

A -	Abundant	An abundant mammal, reptile, amphibian or bird exists in large numbers in the habitat and would likely be seen or heard each time a person visited the habitat.
C -	Common	A common vertebrate ranges over most of the habitat in smaller numbers as has been observed by droppings, tracks, etc., but would most likely not be seen due to the animal's nocturnal or secretive habits.
U -	Uncommon	An uncommon vertebrate exists only in certain parts of the habitat in small numbers as has been evidenced by sightings, droppings, tracks, etc.
S -	Scarce	A scarce or rare vertebrate is one which has been observed only one to three times over the past several years.
	Blank	A blank space under a frequency listing indicates the absence of the species.
P.R.		Permanent Resident
S.R.		Summer resident

dbh	Diameter at breast height
Intro.	An intentionally introduced species
(B. & B.)	The species was found only in An Illustrated Flora of the Northern United States, Canada, and the British Possessions by Britton and Brown, 1897.
sp.	Denotes that the exact species of the genus could not be identified.

BIBLIOGRAPHY

Bjorkbom, John and Larson, Rodney, The Tionesta Scenic and Research Natural Areas, U.S. Department of Agriculture Northeastern Forest Experiment Station, Upper Darby, PA. 1977.

Conversation with Ralph Taylor, Head of U.S. Weather Station in Montrose, PA., June, 1978.

Cope, Francis R., "The Summer Birds of Susquehanna County," Proceedings of the Academy of Natural Sciences of Philadelphia, pp. 76-88, 1898.

Cope, Theodora Morris, "Observations on the Vertebrate Ecology of Some Pennsylvania Virgin Forests," PhD Thesis, Cornell University, Ithaca, N.Y., 1936.

Cope, Theodora Morris, "Some Observations on the Vertebrate Ecology of a Pennsylvania Mountain Farm," M.S. Thesis, Cornell University, Ithaca, N.Y., 1932.

Doutt, J. Kenneth and others, Mammals of Pennsylvania, The Pennsylvania Game Commission, Harrisburg, 1973.

Forbes, Reginald D., Letter written to Francis R. Cope on October 19, 1943 regarding the commercial forestry possibilities of Woodbourne Farm. One of many interesting letters by Forbes contained in the Woodbourne files.

Gordon, Robert B., The Primeval Forest Types of Southwestern New York, New York State Museum, Albany, NY, April, 1940.

Gould, Walter,"The Ecology of Viburnum Alnifolium," PhD Thesis, Syracuse University, Syracuse, N.Y., June, 1966.

Hough, A. F. and Forbes, R. D., "The Ecology and Silvics of Forests in the High Plateaus of Pennsylvania," Ecology Monographs 13: 299-320, 1943.

Krajewski, Steven and others, Prospecting for Pennsylvania Bluestone, Pennsylvania State University, September, 1971.

Mazzotti, Carmen B., Woodbourne Conservancy Forest Management Plan, contained in the files of the Woodbourne Cottage, 1967.

Northeastern Forest Experiment Station, U.S. Department of Agriculture, Map of Woodbourne Forest, Dimock, PA. Contained in the Woodbourne Cottage files, 1947.

Smithsonian Institution, "Report on Endangered and Threatened Plant Species of the United States," Serial No. 94-A, U.S.G.P.O., House Document No. 94-51, 1975.

Soil Conservation Service, U.S. Department of Agriculture, Soil Survey, Susquehanna County, Pennsylvania. Washington, D.C., August, 1973.

Stanwell-Fletcher, John F., and Cope, Francis, Survey Map of Woodbourne Farm. Contained in the Woodbourne Cottage, 1940.

Watres, Arthur, Description of the Geology of Woodbourne Sanctuary prepared for the Trail Guide. Contained in Woodbourne Cottage files, 1978.

NOTES ON MAPS

It is easier to change the scale of topographic maps than to change the scale of photographic prints. Consequently we chose the 1:8000 scale of existing aerial photographs as our standard working scale. This resulted in maps of a useful size that could contain the desired information and were easy to read. While our work maps are at a scale of 1:8000 (1.5" = 1000') some of the maps in this inventory have had their scale changed for publication purposes.

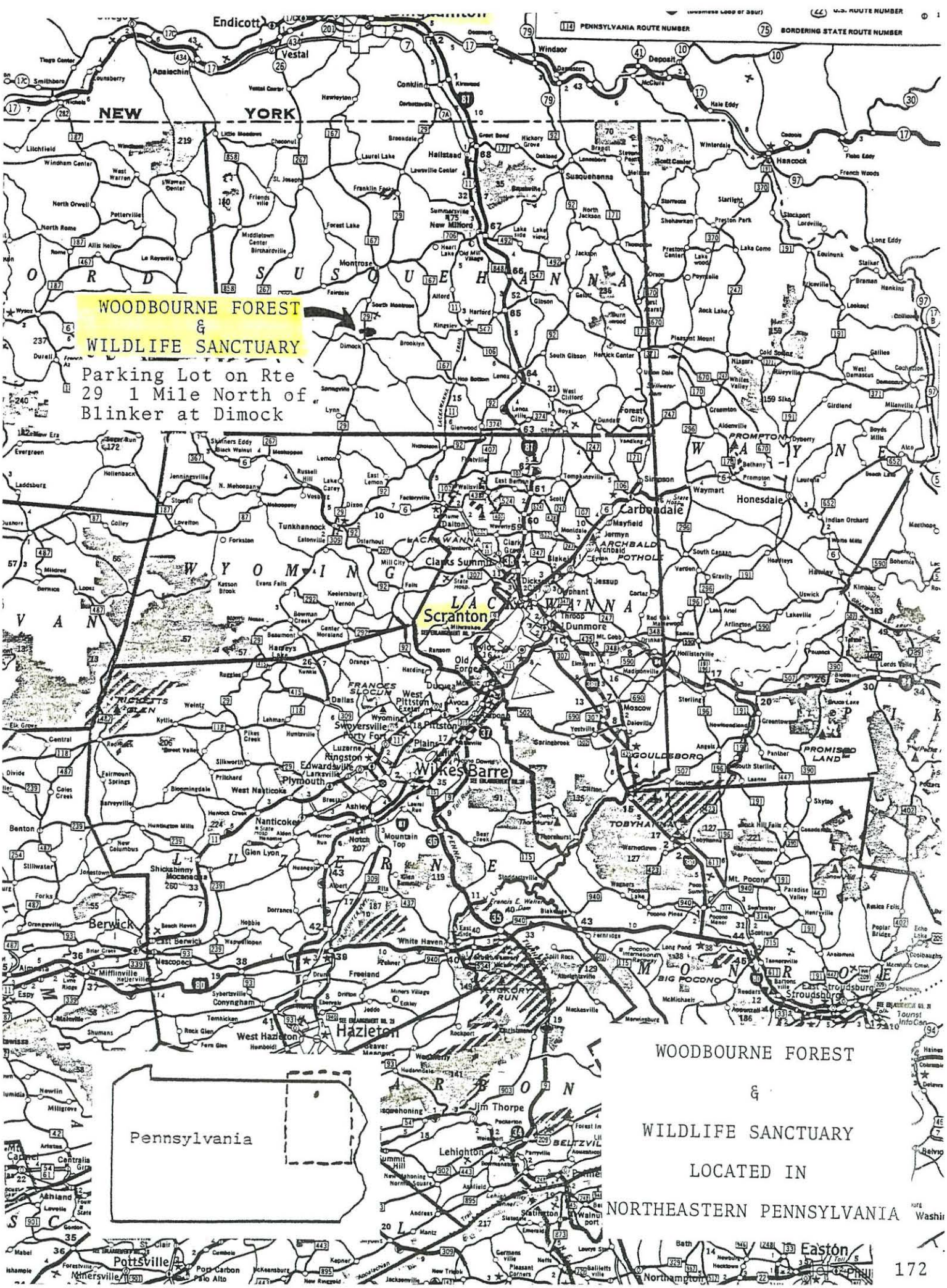
The topographic map was photographed and then reproduced on a diazo master at the scale of 1:8000. The preserve boundary was plotted on a map of this scale using data from the various deeds. Because it was positively located on the topographic map, the junction of the north boundary of the preserve with Route 29 was selected as the starting point. The plot failed to close by about 300 feet. When the survey map was checked, it was determined that the surveyor had taken liberties in order to make the boundary close. There was no apparent rhyme or reason to his adjustments. Therefore by using other landmarks on the map such as the edge of a field at the southern boundary it was possible to make judicious changes to close the plot as it is shown on our maps. In view of the fact that the accuracy of the topographic map may also be questioned (e.g. the stream draining the swamp pond does not show on the original topographic map while a stream is shown draining the Gray pond where none exists) we cannot say for sure where the truth lies. The habitat map and other maps included in the inventory show a reasonably accurate picture of the preserve.

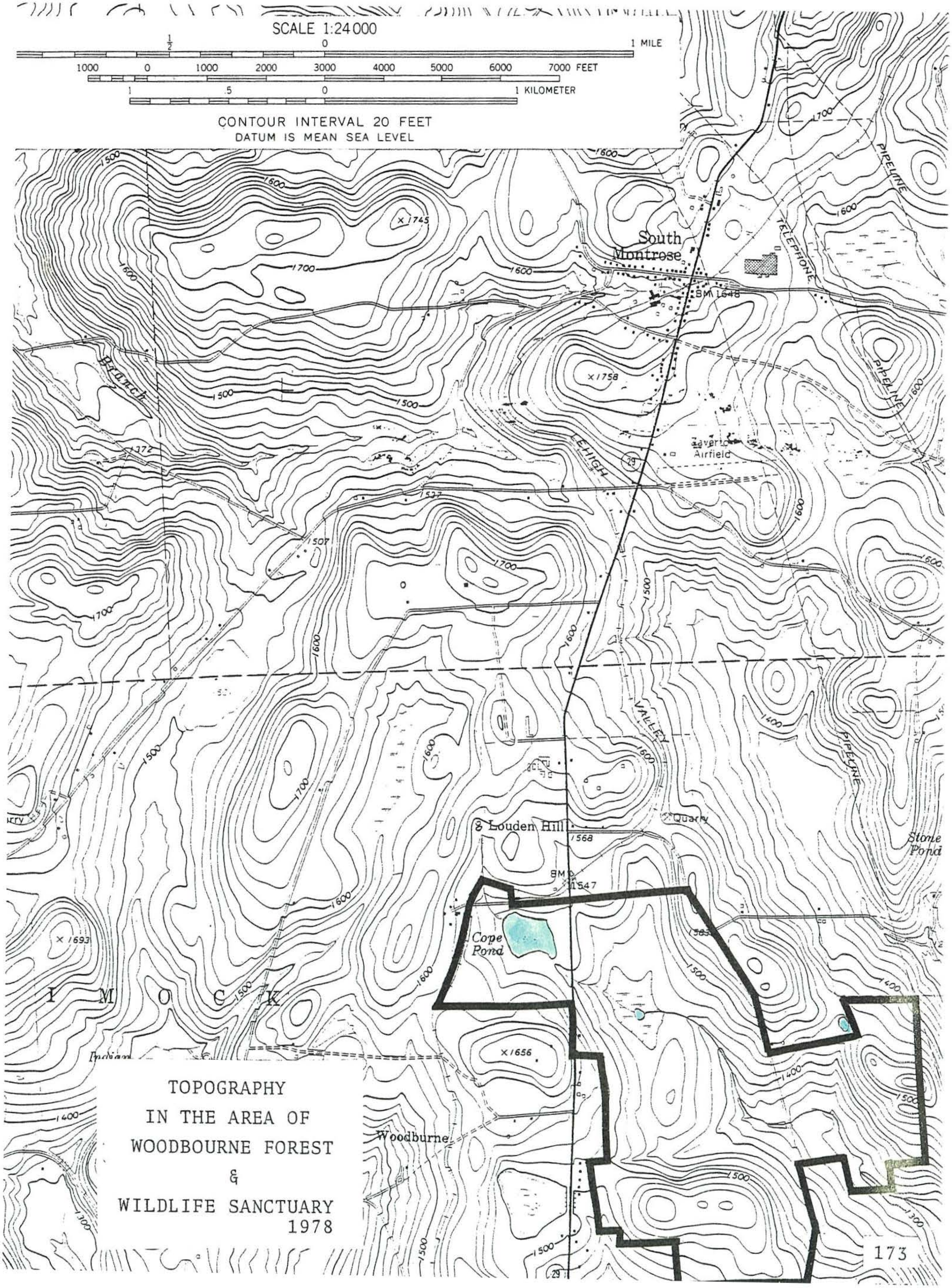
In the course of map making it was found that the various means of reproduction resulted in slight changes in scale. For example, many Xerox copiers have a small enlargement built in to reduce shadowing. We also found some changes with the diazo process. Therefore it will be found that all maps do not necessarily match exactly.

One map shows the preserve on a grid so areas can be established. This map indicates the preserve to contain 655 acres instead of the 602 noted in the deeds. It is not uncommon to find discrepancies such as the two different areas and the failure to close on rural surveys in this area.

Fred Studer

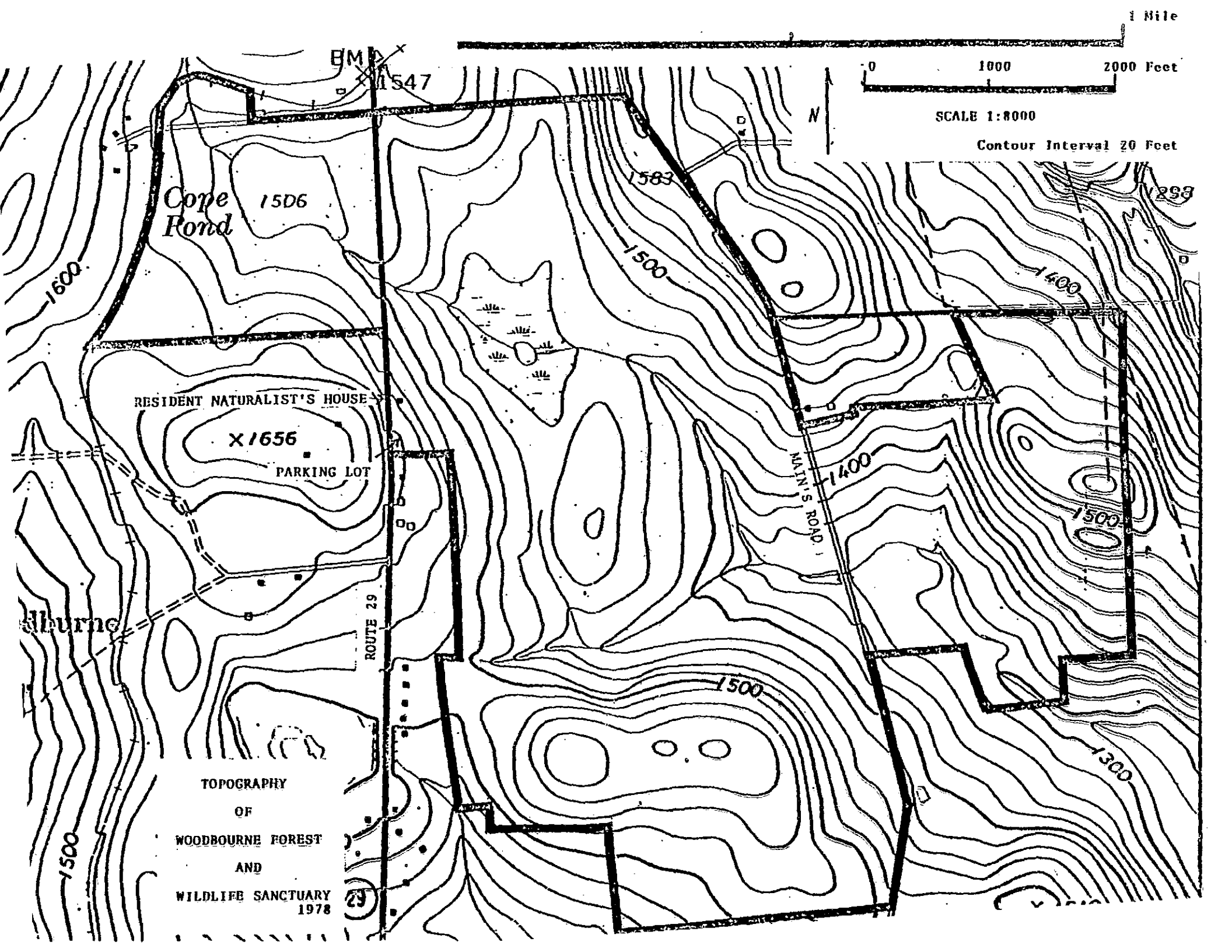
All the maps included in this Inventory other than the Habitat Map and the Surrounding Landowners Map were prepared and reproduced by Fred to whom the author acknowledges her grateful appreciation.

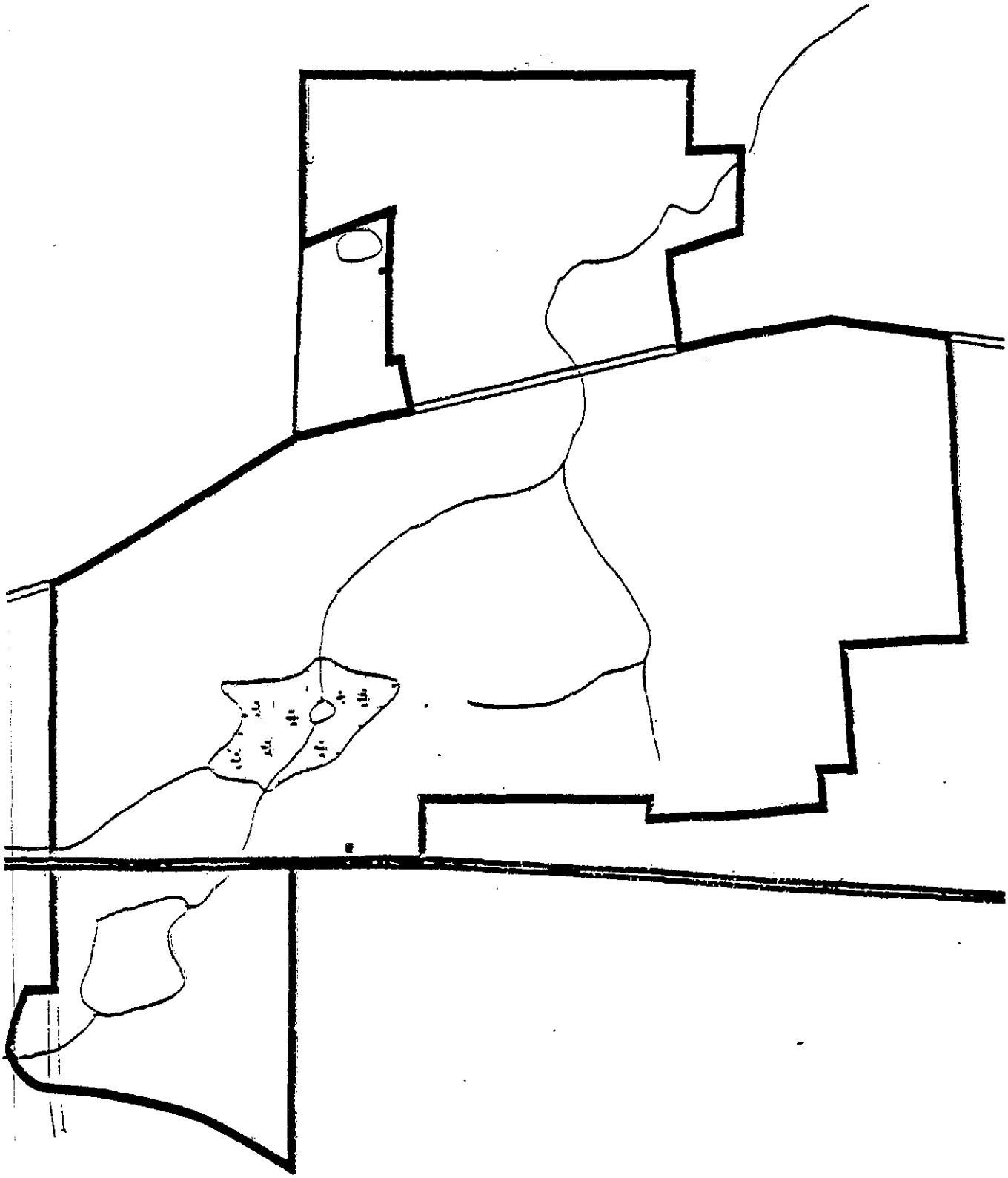

WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
Parking Lot on Rte 29 1 Mile North of Blinker at Dimock
Scranton
Wilkes-Barre
Hazleton
Carbondale
Honesdale
Stroudsburg
Pennsylvania
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
LOCATED IN
NORTHEASTERN PENNSYLVANIA

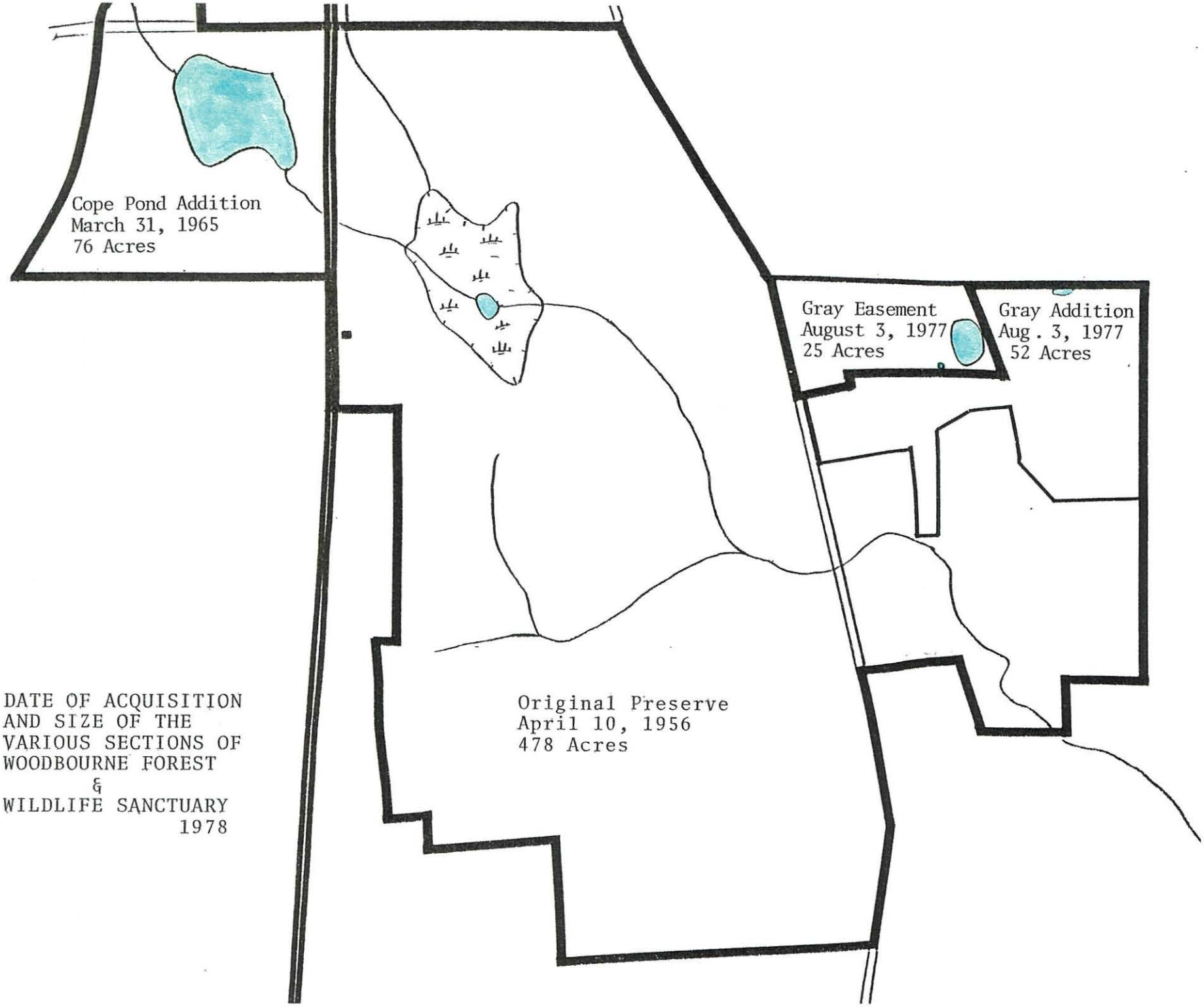


TOPOGRAPHY
IN THE AREA OF
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
1978

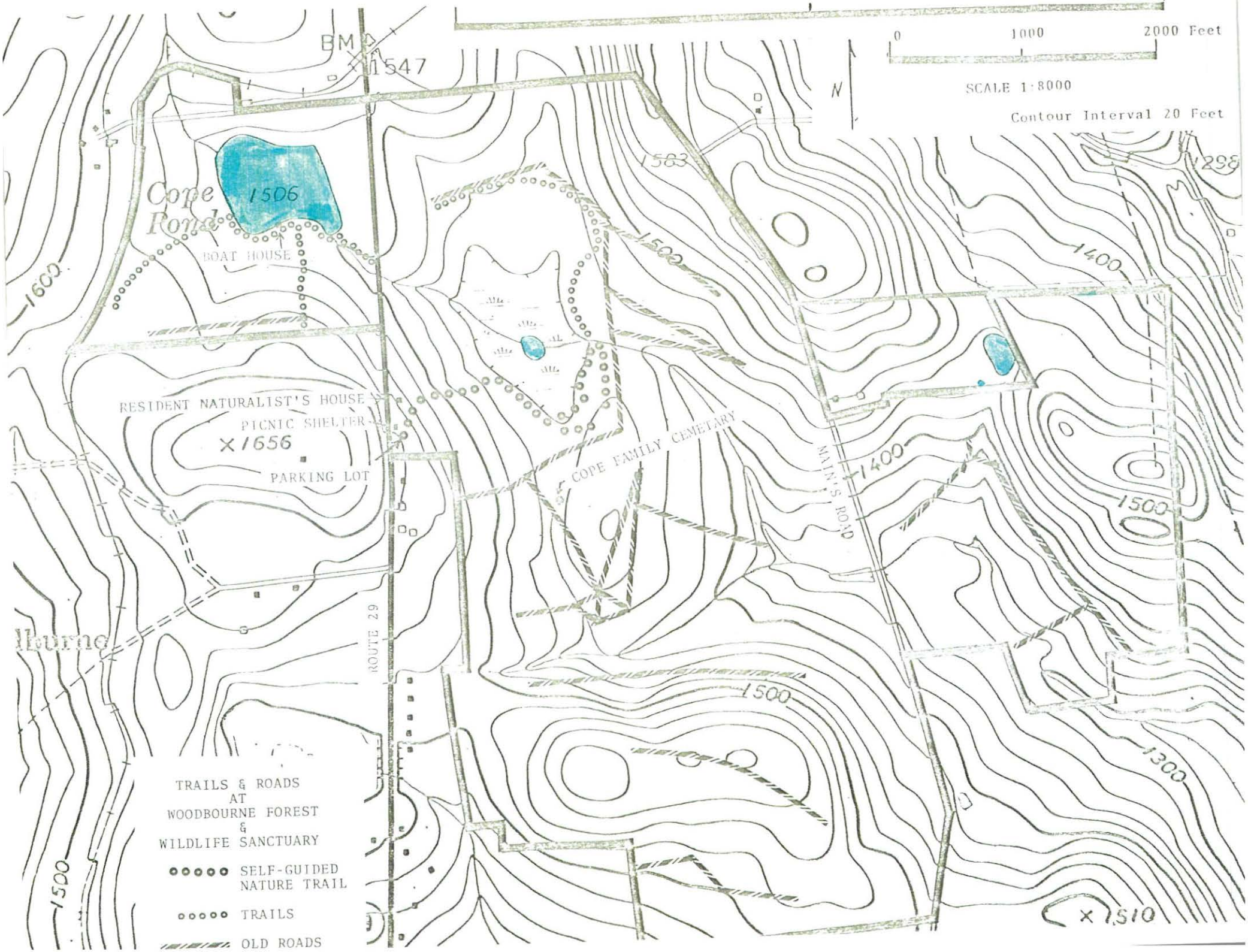

WOODBOURNE FOREST & WILDLIFE SANCTUARY
HABITAT MAP
Including 1977 usage of farmed buffer areas
and adjoining properties
COPE'S POND
NATURE TRAIL SECTION
LOWER POND
SWAMP
moderate blowdown area
severe blowdown area
WOODRUFF'S HILL
MAIN'S WOODS
EASEMENT PROPERTY
naturalist's residence
parking lot
house & barns
old fields - brush stage
young evergreen plantation
hickory-ironwood
Route 29
Main's road
brush
woodland
old field
horse pasture
*woods logged winter 77-78
LEGEND
CLIMAX FOREST AREAS
1951&'54 BLOWDOWN AREAS
1944 SELECTIVELY LOGGED
A- YOUNG SECOND GROWTH
B MIDDLE-AGED 2nd GROWTH
C,D OLD SECOND GROWTH
PLANTATIONS
STREAMS
NATURE TRAIL
N
Map Scale: Approx. 1" = 660'
Scale(Approx) 0' 500' 1000'
= 1 Acre (Approx)
Total area = 602 Acres
Map prepared by B. Stone
Completed Nov.'78

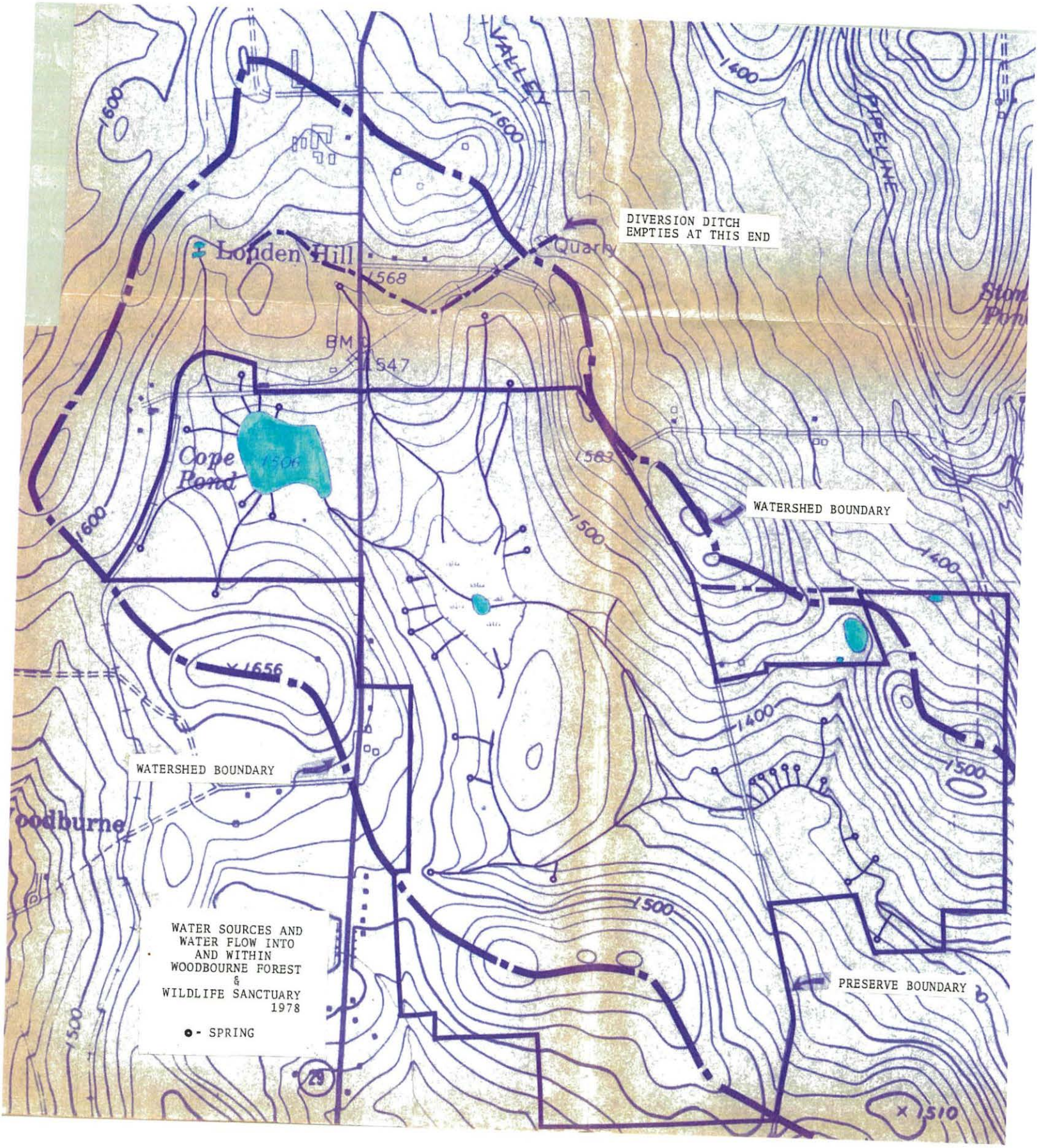

1 Mile
0 1000 2000 Feet
SCALE 1:8000
Contour Interval 20 Feet
N
BM
1547
Cope Pond
1506
1583
1600
1500
1400
RESIDENT NATURALIST'S HOUSE
X1656
PARKING LOT
MAIN'S ROAD
ROUTE 29
1300
TOPOGRAPHY
OF
WOODBOURNE FOREST
AND
WILDLIFE SANCTUARY
1978





DATE OF ACQUISITION
AND SIZE OF THE
VARIOUS SECTIONS OF
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
1978


0 1000 2000 Feet
SCALE 1:8000
Contour Interval 20 Feet
N
BM 1547
1583
1298
Cope Road
1506
BOAT HOUSE
1600
1500
1400
RESIDENT NATURALIST'S HOUSE
PICNIC SHELTER
X1656
PARKING LOT
COPE FAMILY CEMETERY
MAIN'S ROAD
ROUTE 29
Ilburne
1300
X1510
TRAILS & ROADS
AT
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
SELF-GUIDED
NATURE TRAIL
TRAILS
OLD ROADS

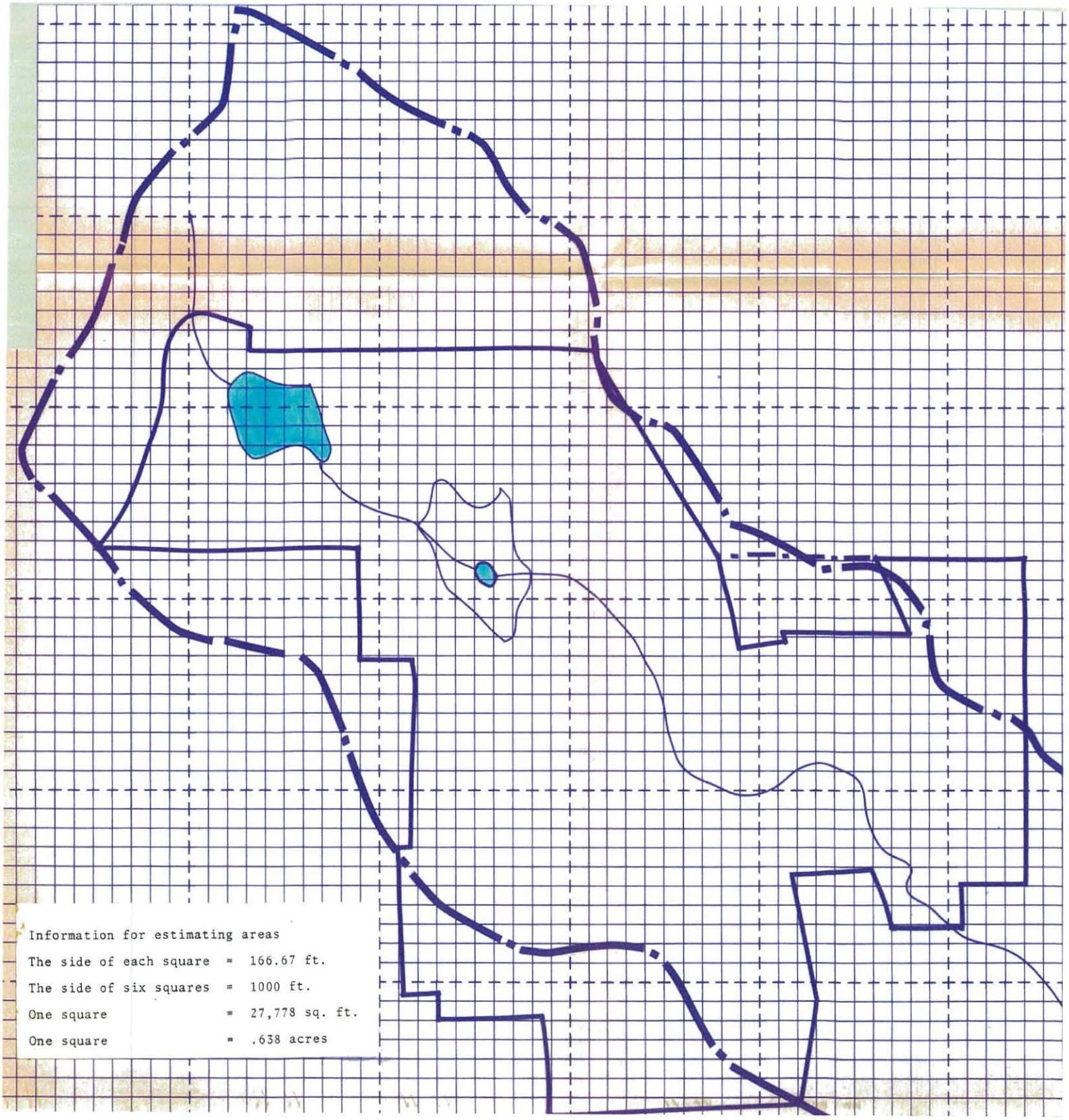

DIVERSION DITCH
EMPTIES AT THIS END
WATERSHED BOUNDARY
WATERSHED BOUNDARY
PRESERVE BOUNDARY
WATER SOURCES AND
WATER FLOW INTO
AND WITHIN
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY
1978
- SPRING
Loaden Hill
Quarry
Cope
Pond
BM
1547
1568
1506
1583
1656
1510
VALLEY
PIPELINE
1600
1500
1400

CODE FOR NUMBERED LOTS

1. LOUIS CHARLES
2. DONALD CHARLES
3. DONALD WOOD
4. WILLIAM RHINEVAULT
5. JOHN McCORMICK
6. BURTON WARD
7. CHARLES PRENTICE
8. THOMAS ROSS
9. GEORGE CONLEY
10. FRED WALPOLE
11. WILLIAM RICE
12. OTTIE McGRAW

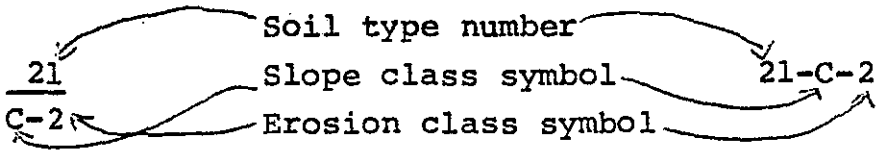
LANDOWNERS OF PROPERTY ADJACENT TO WOODBOURNE FOREST & WILDLIFE SANCTUARY

PREPARED BY B. STONE 197


Information for estimating areas
The side of each square = 166.67 ft.
The side of six squares = 1000 ft.
One square = 27,778 sq. ft.
One square = .638 acres


SOIL MAP
WOODBOURNE FOREST
&
WILDLIFE SANCTUARY

MEANING OF SYMBOLS ON SOIL MAP



Soil - Number above line or first part of three part symbol

Slope - Letter below line or letter in three part symbol

- A Level or nearly level
- B Gently sloping
- C Moderately sloping
- D Strongly sloping
- E Steep
- F Very steep

Erosion - Number below line or last number of three part symbol

- 1 Slight erosion
- 2 Moderate erosion
- 3 Severe erosion
- 4 Very severe erosion

DESCRIPTION OF THE SOIL MAPPING UNITS

6-A-1 Holly Silt Loam. Deep, somewhat poorly to poorly drained, dark brown, moderately productive, medium textured, slightly eroded soil, developed on acid recent alluvium from areas dominated by gray sandstone and shale. It is on nearly level slopes. It has a problem of excess moisture. Its main use is pasture.

6-B-1 Holly Silt Loam. Deep, somewhat poorly to poorly drained, dark brown, moderate productivity, medium textured, slightly eroded soil, developed on acid recent alluvium from areas dominated by gray sandstone and shale. It is on gentle slopes. It has a problem of excess moisture. Its main use is pasture.

7-A-1 Papakating Silt Loam. Deep, very poorly drained, frequently flooded, medium to moderately heavy textured soils on stream floodplains from acid uplands. They are level and are suitable only for poor pasture or wildlife.

12-B-1 Barbour Gravelly Loam, Fan. Deep, well drained, coarse textured, productive soil and gravel deposited in the major stream valley by tributary streams from the uplands. It is gently sloping, seldom flooded, of low moisture holding capacity, and is adapted to all but very shallow rooted crops.

25-B-2 Culvers Channery Silt Loam. Deep, moderately well drained, medium textured, productive soils on brown acid glaciated uplands. It is gently sloping, moderately eroded, of moderate moisture holding capacity and is suited to all but deep rooted farm crops, if drained and protected from erosion.

25-C-2 Culvers Channery Silt Loam. Deep, moderately well drained, medium textured, productive soils on brown acid glaciated uplands. It is moderately sloping, moderately eroded, of moderate moisture holding capacity, and is suited to all but the deeper rooted farm crops, if protected from erosion.

26-B-2 Culvers Flaggy Silt Loam. Deep, moderately well drained, medium textured, flaggy soils on brown acid glaciated uplands. They are gently sloping, moderately eroded, of moderate moisture holding capacity and are suited to hay or pasture and limited cultivation, if drained and protected from erosion.

26-C-2 Culvers Flaggy Silt Loam. Deep, moderately well drained, medium textured, flaggy soils on brown acid glaciated uplands. They are moderately sloping, moderately eroded, of moderate moisture holding capacity, and are suited to hay or pasture and limited cultivation, if protected from erosion.

27-AB-1 Culvers Very Stony Silt Loam. Deep, moderately well drained, medium textured, very stony soils on brown acid glaciated uplands. They are nearly level to gently sloping and are suited to woodland, wildlife or occasionally, permanent pasture.

27-CD-1 Culvers Very Stony Silt Loam. Deep, moderately well drained, medium textured, very stony soils on brown acid glaciated uplands. They are moderately to strongly sloping and are suited to woodland, wildlife or occasionally, permanent pasture.

28-B-2 Culvers Channery Fine Sandy Loam. Deep, well drained, somewhat coarse textured, productive soils on brown acid glaciated uplands. They are gently sloping, of moderate moisture holding capacity and are suited to all but the deeper rooted farm crops, if drained and protected from erosion.

28-C-2 Culvers Channery Fine Sandy Loam. Deep, well drained, somewhat coarse textured, productive soils on brown acid glaciated uplands. They are moderately sloping, moderately eroded, of moderate moisture holding capacity and are suited to all but the deeper rooted farm crops, if drained and protected from erosion.

31-B-2 Morris Channery Silt Loam. Deep, somewhat poorly drained, very dark gray, medium productivity, medium textured, moderately eroded soil, developed on firm brown and red sandstone and shale glacial till, gently sloping, moderate moisture holding capacity, best suited to shallow rooted crops.

31-C-2 Morris Channery Silt Loam. Deep, somewhat poorly drained, very dark gray, medium productivity, medium texture, moderately eroded soil, developed on firm brown and red sandstone and shale glacial till, moderately sloping, moderate moisture holding capacity, suited to shallow rooted crops.

32-B-2 Morris Flaggy Silt Loam. Deep to bedrock, shallow to hardpan, somewhat poorly to poorly drained, medium textured soils on brown acid glacial till from sandstone and shale. They are flaggy, gently sloping, moderately eroded, and suitable for hay or pasture and limited cultivation, if drained and protected from erosion.

32-C-2 Morris Flaggy Silt Loam. Deep to bedrock, shallow to hardpan, somewhat poorly to poorly drained, medium textured soils on brown acid glacial till, from sandstone and shale. They are flaggy, moderately sloping, moderately eroded, and are suitable for hay or pasture and limited cultivation, if drained and protected from erosion.

33-AB-1 Morris Very Stony Silt Loam. Deep, somewhat poorly drained, very dark gray, medium productivity, medium textured, slightly eroded soil, developed on firm, brown and red sandstone and shale glacial till, nearly level to gently sloping, moderate moisture holding capacity, best suited to woodland or wildlife.

33-CD-1 Morris Very Stony Silt Loam. Deep, somewhat poorly drained, very dark gray, medium producing, medium textured, slightly eroded soil developed on firm, brown and red sandstone and shale glacial till. It is moderate to moderately steeply sloping, has a moderate moisture holding capacity and is best suited to woodland or wildlife.

37-AB-1 Norwich Very Stony Silt Loam. Deep, very poorly drained, red, very stony, medium textured, slightly eroded soil developed on glacial till. It is level to gently sloping, is high in available moisture, has

moderate inherent fertility and is best adapted to trees.

41-B-2 Oquaga Channery Silt Loam. Moderately deep, well drained, dark reddish brown, medium productivity, medium texture, moderately eroded soil developed from red or mixed red and gray shale and sandstone glacial till, gently sloping, low moisture holding capacity, suited to most common crops, hay, pasture or woodland.

41-C-2 Oquaga Channery Silt Loam. Moderately deep, well drained, dark reddish brown, medium productivity, medium texture, moderately eroded soil, developed from red or mixed red and gray shale and sandstone glacial till, moderately sloping, low moisture holding capacity, suited to most common crops and to hay, pasture or woodland.

42-B-2 Lordstown Flaggy Silt Loam. Shallow to moderately deep, well drained, medium textured, grayish brown, flaggy soils glaciated on acid sandstones and shales of the uplands. They are gently sloping, of low moisture holding capacity, and are suitable for hay or pasture and limited cultivation for all except intertilled crops.

42-C-2 Oquaga Flaggy Silt Loam. Shallow to moderately deep, well drained, stong brown, medium textured soils on glaciated acid sandstone and shale ridges. They are moderately sloping, flaggy, moderately eroded, and are suitable for hay or pasture and limited cultivation, if protected from erosion.

43-AB-1 Oquaga Very Stony Silt Loam. Moderately deep, well drained, dark reddish brown, low productivity, medium texture, slightly eroded soil, developed from red or mixed red and gray shale and sandstone glacial till, nearly level to gently sloping, low moisture holding capacity, suited to pasture, woodland or wildlife.

43-CD-1 Oquaga Very Stony Silt Loam. Moderately deep, well drained, dark reddish brown, low producing, medium textured, slightly eroded soil developed from red or mixed red and gray shale and sandstone glacial till. It is on moderate to moderately steep slopes, has a low moisture holding capacity, and is suited to pasture, woodland or wildlife.

43-EF-1 Oquaga Very Stony Silt Loam. Moderately deep, well drained, dark reddish brown, low producing, medium textured, slightly eroded soil developed from red or mixed red and gray shale and sandstone glacial till. It is on steep and very steep slopes, has a low moisture holding capacity, and is best suited to woodland or wildlife.

47-CD-1 Lordstown Very Stony Silt Loam. Moderately deep, well drained, very dark gray to dark grayish brown, low productivity, medium textured, slightly eroded soil, developed on glacial till derived from gray sandstone and shale, moderately to strongly sloping, low moisture holding capacity, suited to pasture, woodland or wildlife.

57-EF-1 Mardin Very Stony Silt Loam. Deep, moderately well drained, medium textured, very stony soils on gray-brown acid glaciated uplands. They are steep to very steep and are suitable only for woodland and wildlife.