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1980

Natural Resources
Research and Extension
Series No. 14

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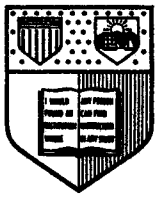

Department of Natural Resources
Cornell University Agricultural Experiment Station
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York 14853

A HISTORY OF CORNELL UNIVERSITY'S ARNOT FOREST

by

Amy L. Odell, James P. Lassoie, and Robert R. Morrow*

*The authors are, respectively, a Technical Assistant, an Assistant Professor and a Professor of Forestry in Cornell's Department of Natural Resources.

ACKNOWLEDGEMENTS

The authors wish to thank Professors Oliver Hewitt, Earl Stone, Richard Arnold, Cedric Guise, James Caslick, and many others for their help in obtaining information for this report. The Dewitt Historical Society of Tompkins County also provided important sources of information on local history. A special note of thanks is due to Mr. Alfred Fontana for his patience and time in answering our many questions on the Arnot Forest.

This study was funded in part by the Arnot Forest Teaching Account, the Adirondack Maple Syrup Fund, and Hatch Project NY(C) - 147420.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

What is the Arnot Teaching and Research Forest? To some it is 4,025 acres of forest in which to ski, hike, hunt, or bird watch. To others it is a unique ecosystem to be studied, analyzed, and at least partially understood. To still others it is the place they go to learn how to make maple syrup. Located twenty miles southwest of Ithaca, New York, the Arnot Forest has been owned by Cornell University since 1927. It is administered by the Department of Natural Resources and plays an important role in many of the Department's teaching, research, and extension programs. The forest is an outdoor laboratory where students learn the principles of such disciplines as forestry, ecology, and wildlife management and where both students and faculty have the opportunity to conduct original research.

The history of the Arnot Teaching and Research Forest is complex and involves both ecological and cultural factors. The physical characteristics of the forest and its current uses are the result of a long series of natural and human events. This report will outline the most important of these events and provide an understanding of what the Arnot Forest has been as well as what it is today.

HISTORICAL DEVELOPMENT

Geological History

The history of the Arnot Forest begins not with its acquisition by Cornell University, nor with the settlement of the area by pioneers, nor even with the Indians who first hunted there, but rather with the geologic forces that shaped

the topography of Central New York. The features of this area were formed by a combination of continental collision, uplift, and erosion millions of years ago and the more recent erosion, compaction, and deposition caused by the glaciers of the Ice Ages.

Current theory holds that eastern North America, including New York State, has been deformed several times by collision with the continents of Europe and Africa. The last of these collisions took place 350 million years ago and the resulting lateral force caused the eastern edge of the continent to be lifted and folded into a series of synclines and anticlines resulting in the formation of the Appalachian Mountains. Even the Central New York region shows slight folds in the rock strata. This area was raised to form a plateau which became eroded into a peneplain only to be uplifted again 30 million years ago and re-eroded (von Engeln, 1961). In the formation of a peneplain, the anticlines (upfolds) are eroded faster than the synclines (downfolds). Thus, the synclines may be left as hills when the anticlines are worn down to valleys. A good example of this phenomenon in the Central New York area and near the Arnot Forest is Connecticut Hill. This is the highest point in the area and is part of the Cayuta syncline (von Engeln, 1961).

It was into this region of plateaus, hills, and valleys that the glaciers flowed. There is evidence in Central New York of two advances within the last million years. No one knows exactly what caused the slight change in climate necessary for huge continental ice sheets to form. Everything from sunspots to reflection of solar radiation by volcanic dust in the atmosphere has been suggested. The glacier in eastern North America originated in the Labrador Plateau and reached as far south as Williamsport, Pennsylvania. In Central

New York it grew to be 2,500 feet thick and flowed at the rate of two to three feet per day (von Engeln, 1961).

The major erosional features in the Central New York area were carved out by the first glacial advance. The glacier tended to be funnelled into the valleys of the rivers which flowed northward where the Finger Lakes are today (von Engeln, 1961). The weight of the ice pressed down on the boulders and debris it carried, rounding the hilltops and gouging and deepening the valleys. The second glacier followed in the path carved by the first. As the glaciers retreated, eroded material was dropped to form the major depositional features of the area. The deposition was of two types: boulders and rocks released directly from the ice and gravel, sand, and clay carried by glacial melt water. These were deposited as moraines, outwash plains, and valley trains which form many of the lower ridges and knolls in the Arnot Forest area and all over Central New York.

An interesting example of such depositional features is the kame, or knob and kettle, topography of Lot 13 in the southeast corner of the Arnot Forest (Figure 1). Kame topography is a hummocky accumulation of glacial outwash produced when meltwater collects in channels under a stagnant glacier. Since the water is under pressure, it bursts through the end of the glacier and drops its load of sediment and debris burying the edge of the ice. When the ice melts, accumulations of debris form knobs. Kettles are formed where a block of buried ice melts and allows the sediments on top of it to settle.

Vegetational History

The climate in this area during the Ice Age was not necessarily one of arctic cold, but somewhat temperate and sometimes similar to that of today

Key to Symbols on Figure 1.

1. Cemetery
2. Christmas tree area
3. Wildlife marsh
4. Tree spacing research (R. Morrow)
5. Fall vs. spring tree planting demonstration
6. Furrow planting research
7. Fish ponds
8. Hosmer Memorial
9. A.B. Recknagel research and management area (R. Morrow)
10. Picnic areas
11. Guise Memorial Grove
12. Soil Conservation Service and water runoff research station
13. Maple syrup house
14. Sawmill
15. Charcoal kiln
16. Totem pole
17. Stream improvement structures
18. Overlook scenic area
19. Opalescent falls
20. Maple thinning demonstration (R. Morrow)
21. Scenic overlook maintained by vegetation control
22. Wildlife research and demonstration site (J. Caslick)

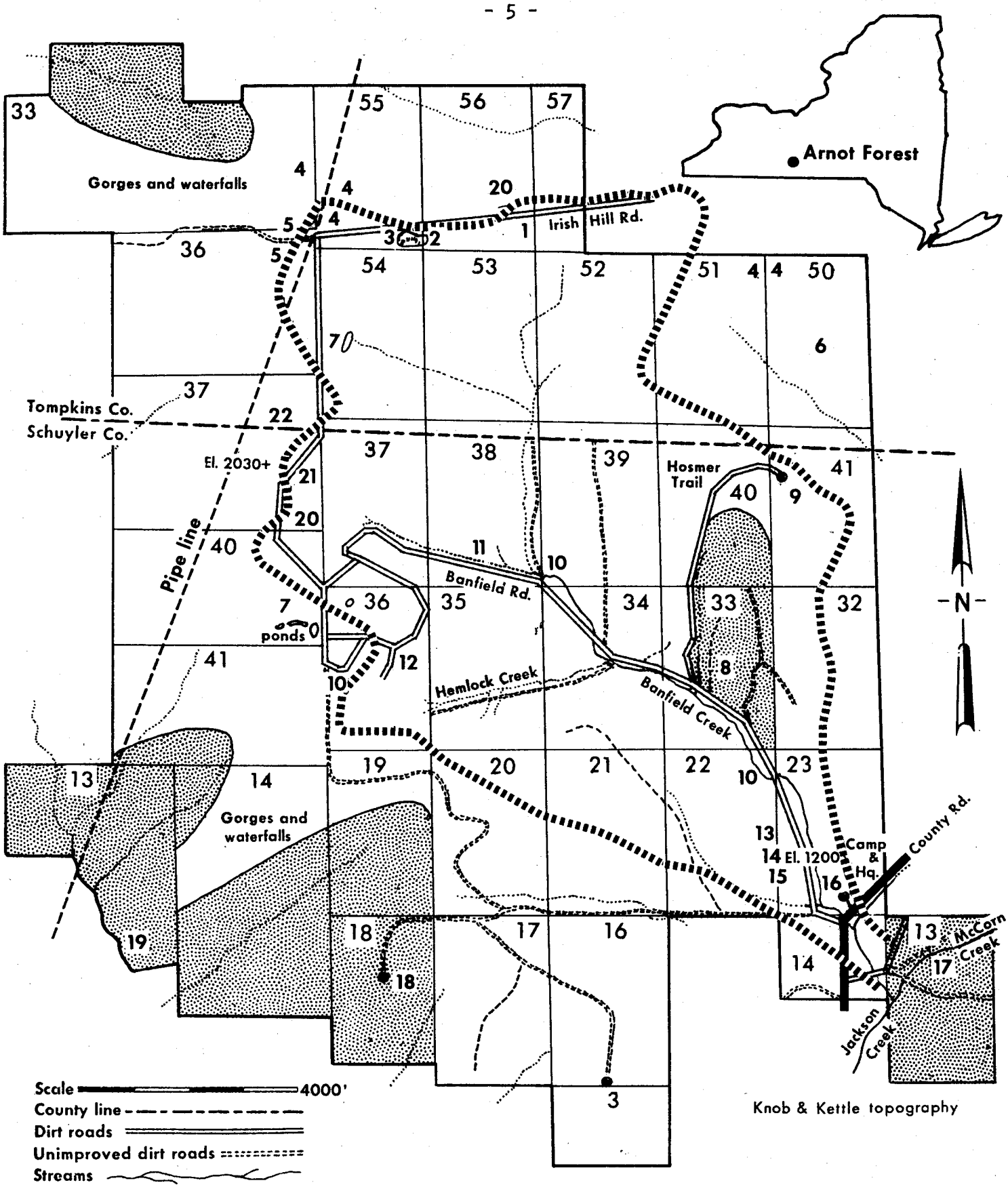

Figure 1. Arnot Forest location and points of interest.

(von Engeln, 1961). The summer temperatures at the interior of the ice sheet were frigid, but not at its edges. Vegetation may have grown to the margin of the glacier but was stripped off and killed under it. Thus when the ice melted, it left a barren land that would have been gradually reinvaded by different vegetation through the process of primary succession.[1]

The end result of this succession was the primeval forest that grew in the area of the Arnot Forest before it was invaded by Europeans. The original forest cover consisted mainly of northern hardwoods (beech, birch, and maple[2]) and hemlock with large quantities of white pine in some areas (Hosmer, 1954). Smaller amounts of elm, ironwood, musclewood, white ash, basswood, red oak, and black cherry were also present. Tulip poplar, cucumber, oaks, and chestnut could be found on southern and western exposures. In open areas there were long grasses and a variety of shrubs such as honeysuckle, gooseberries, and huckleberries (Bartram, 1751). The lowlands tended to be swampy with very thick vegetation (Dudley, 1886).

The white pine played an important role in the history of this region even before its exploitation by lumbermen in the nineteenth century. In the sixteenth century, when the Iroquois Confederacy was organized, the white pine was made their Tree of Peace. As a symbol of worldwide peace and unity, its branches represented shelter for the war weary, and its roots extended to the four corners of the earth (Leder, 1956). Eighteenth century explorers were impressed with the abundance and density of the white pine. According to John Bartram, a botanist who traveled through this area in 1743, the pines

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[1] Primary succession is the initial development of a plant community and subsequent changes in the type of vegetation present in an area not previously occupied by plants, for example bare soil or a sand dune.

[2] Scientific names are given in Appendix 1.

were sometimes so close together that the sun could barely shine through. However, the abundance of this species could have been overemphasized in the accounts of early travelers since it tended to occur in valleys along main transportation routes as well as on hilltops (Marquis, 1975).

The written accounts left by Bartram and other early explorers gave the impression of a vast, dense forest stretching uninterrupted for miles. However, this was not always the case. Fire and windthrow created natural openings in the forest, and long before the arrival of Europeans on this continent, the Indians were clearing areas for their villages. They also cut trees for firewood and girdled trees and burned forests in order to create fields for agriculture, increase berry production, facilitate travel, and improve hunting (Marquis, 1975). Groups of Indians relocated frequently as the soil and available firewood in an area became depleted, thus leaving behind their clearings to be filled in through secondary succession[3] and creating new openings in other areas.

The rate of vegetation change in this region has been much greater since the fairly recent arrival of European settlers than that experienced over many hundreds of years of Indian occupancy. In addition to extensive clearing for farms, most remaining land was logged in the nineteenth century. There was some logging in the early 1800s, principally for white pine, especially along large streams where rafting and log driving were possible. Many hilly portions of the Plateau remained forested through the 1850s and 1860s because of their inaccessibility. About this time, steam powered locomotives made it possible to reach previously remote areas. At first, only small areas of trees were cut, the main species taken being white pine. Hemlock, first cut only for its bark which was used in tanning, was increasingly cut

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[3]Secondary succession is the series of vegetational changes occuring in an area that was previously occupied by a well-developed plant community then disturbed, for example, by fire or logging.

for lumber as the white pine stands were depleted. By the 1880s and 1890s, specialized logging railroads could reach even the most remote areas and clearcutting became commonplace (Marquis, 1975).

The Arnot Forest itself was cut over during a 14-year period beginning in 1873. Three major cover types were present in the early twentieth century as a result of a combination of this logging and wild fires which followed. Second growth hardwoods came in on areas that were clearcut without burning. Hemlock was present to a limited extent in these areas, but the predominant species were basswood, sugar maple, and beech (Beatty, 1929). A second cover type was mature hemlock and hardwoods. This resulted from areas of hemlock, beech, and maple that were left standing because of their poor quality (Hosmer, 1954). A third cover type resulted from two severe wild fires that burned over half of the forested area of the Arnot Forest. These fires were started by locomotive sparks from the Lehigh Valley Railroad in 1900 and 1911. Secondary succession following these fires resulted in a burn coyer type consisting of bigtooth aspen, quaking aspen, pin cherry, and red maple. The understory contained beech, black birch, yellow birch, basswood, white ash, red oak, and black cherry (Hosmer, 1954). Other acres (some 2,000 acres) that are now part of the Arnot Forest were agricultural lands at the beginning of this century. As a consequence of the past history of logging, fire and agriculture, most of the Arnot Forest now contains relatively even-aged stands of trees.

By comparing the vegetation maps found in Beatty (1929) (Figure 2) with those found in Moen and Marrone (1976) (Figure 3), the change in vegetative cover over the past 50 years can be determined. Moen and Marrone list five major plant communities at the Arnot Forest. The first of these is mixed hardwoods.

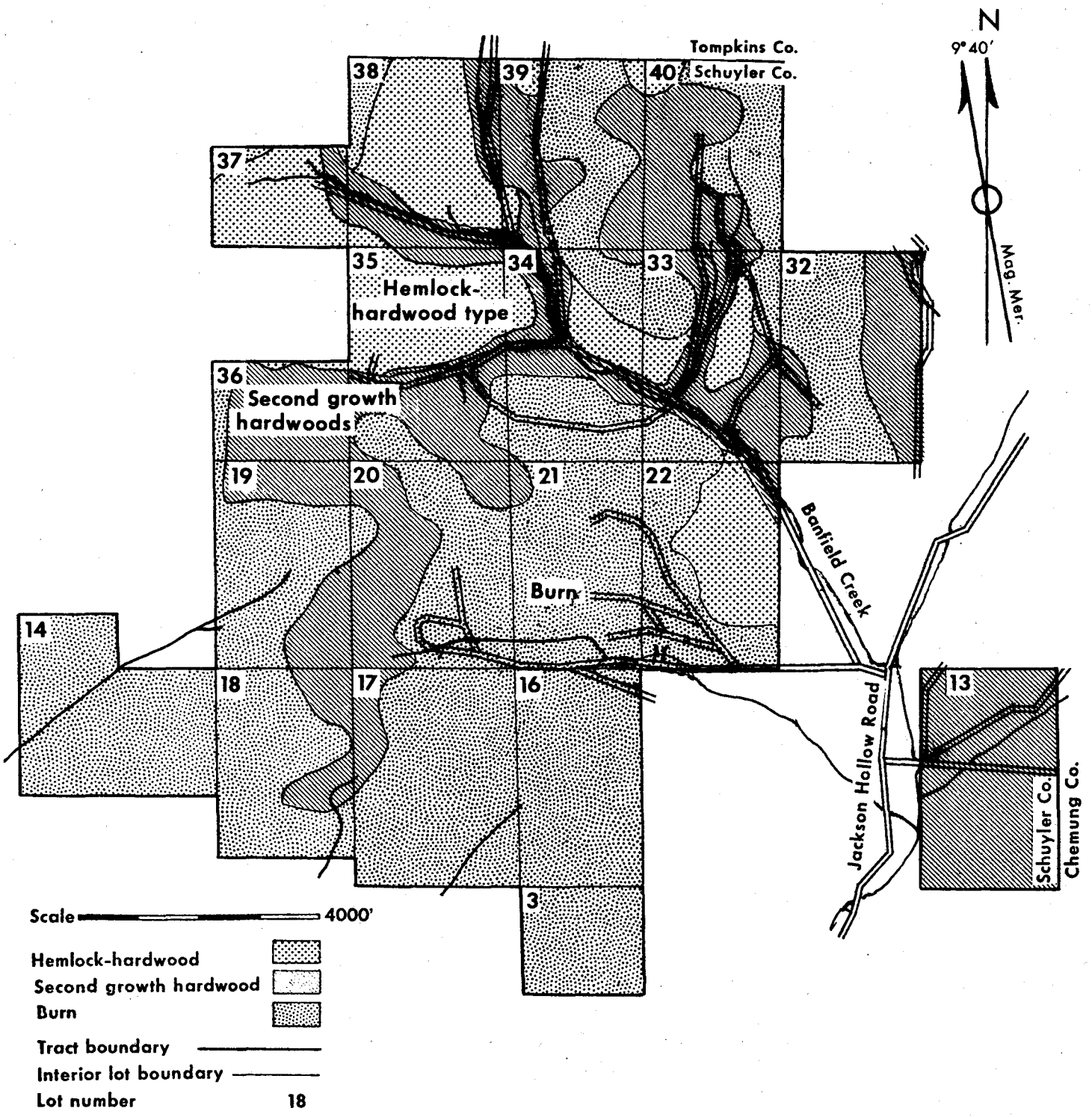

Figure 2. Forest type map of the Arnot Forest (from Beatty 1929).

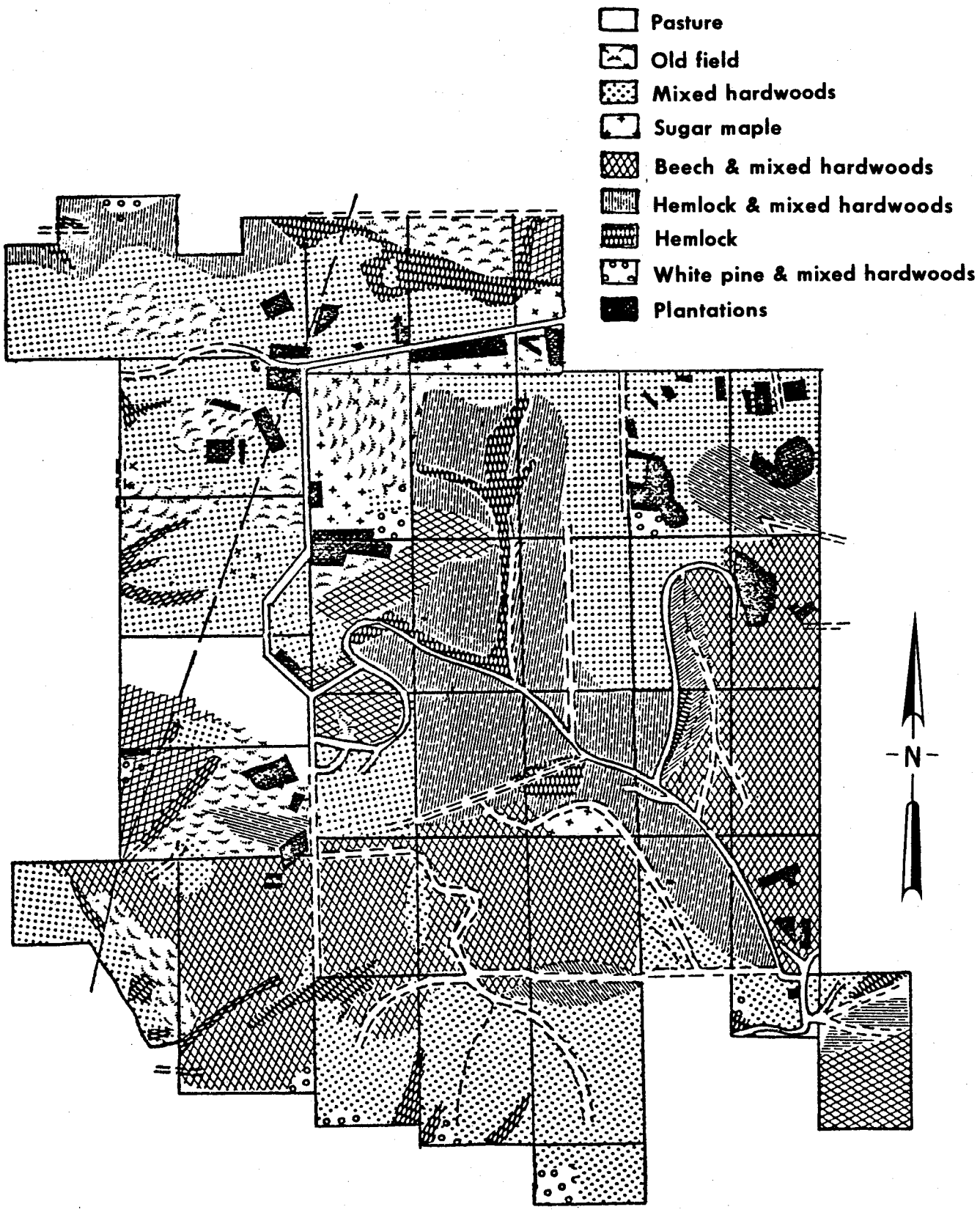

Figure 3. Major vegetation units at the Arnot Forest (from Moen and Marrone 1976). Road trails are shown with solid lines and old trails with dashed lines.

There is no single dominant species in this community, but a variety of hardwoods are present with scattered white pine and hemlock. The second community is beech and mixed hardwoods. These areas are mostly beech with some maple, ash, birch, hickory, aspen, oak, musclewood, and cherry. The mixed hardwoods with hemlock community contains many mixed hardwood species and may grade into nearly pure hemlock near streams. Most of the area that Beatty (1929) classified as second growth hardwoods is now contained in the first two communities. Much of Beatty's mature hemlock and hardwoods cover type now comprises the third community. However, this type has changed considerably as selective logging removed most of the sound mature hemlock and some hardwoods in the 1940s and 1950s. Many of these trees were remnants of the earlier forest, but were considered inferior to the trees then harvested. Beatty's burn communities and many old fields have gradually evolved to be included in all three mixed hardwood communities in various areas. The fourth plant community consists of pure hemlock stands, usually found within the numerous gorges where increased soil moisture helped protect them from wild fires. The remaining old fields make up the fifth plant community of the Arnot Forest. These are remnants of land in agriculture in the 1800s and early 1900s. These fields, some of which had complete grass cover into the 1950s, now contain a variety of early successional species such as aspen, red maple, sumac, and raspberries. Some white pine is also present (Moen and Marrone, 1976).

Recently, small openings in the forest cover have been created by two windstorms of hurricane force: one in 1950 and the other in 1954. According to Adams (1953) the 1950 storm resulted in many trees being blown down, especially on south and east facing slopes. Most of the openings from this storm occurred

in Lots 36 and 37 and along the steep slopes of Banfield Creek (Figure 1). These areas contained many beech, maple, hemlock, and yellow birch. Rapid growth of young trees and subdominant species such as striped and mountain maple occurred in these blowdown areas (Adams, 1953).

A professional timber cruise survey of the Arnot Forest was done between 1974 and 1976 by Adirondack Forestry, Inc. in order to determine forest types and the amount of harvestable timber present. Twenty-one lots in the forest were found to have at least 2,000 board feet of merchantable timber per acre, the amount necessary to make logging profitable. A forest management plan to include harvesting may be developed sometime in the future. However, most of these areas lie within the Banfield Creek watershed and will not be harvested until certain basic data on the watershed have been gathered and the effects of logging can be incorporated into a research framework (Lassoie and Moen, 1977).

Wildlife History

The history of the vegetation in the Arnot Forest region has had a marked effect on the faunal population. Early travelers through this region reported an abundance of wildlife. Bartram (1751) states that the area abounded with bear, deer, elk, and wolves. Although these species may have been present, they were probably less prevalent than these early accounts suggest. In much of the area the forest would have been too mature to support very large wildlife populations. The presence of a variety of predators, for example wolves and cougars, would also tend to limit the populations of such species as the white-tailed deer. Wildlife would have been more abundant where there were openings in the forest, such as the clearings made by the Indians. The Indians realized this and cleared some areas expressly for the purpose of improving hunting (Marquis, 1975). Clearing of small areas by European settlers probably also

increased wildlife populations at first. The settlers sometimes took advantage of this with organized hunts. A hunting club in Newfield held such an expedition in December, 1825 to track down bears, foxes, wolves, deer, and cougars (Goodwin, 1853). Otter, beaver, and marten inhabited this area and were trapped for their furs (King, 1847). A variety of birds were also present. According to Father Pierre Raffeix, a Jesuit missionary to the Cayuga Indians, flocks of ducks, geese, and swans could be seen on area lakes in the spring and fall, and whole flocks of pigeons were sometimes trapped by the Indians (Dudley, 1886). Rattlesnakes also inhabited Central New York but were virtually annihilated by the early settlers (King, 1847). Over-hunting and trapping combined with habitat destruction from human activities eventually resulted in a decrease in many of these wildlife species.

The white-tailed deer was one animal in this area that was, and still is, greatly affected by human activities. During the 1800s, market hunting greatly lowered the population. By 1890 deer were only seen on rare occasions. In 1887 a law was passed in New York limiting each hunter's take to two deer per season and outlawing the use of dogs, boats, and night lighting in hunting. A "bucks-only" law was passed in 1912. By the 1930s and 1940s the deer population in the Southern Tier of New York State had greatly increased. This was partly due to these hunting restrictions, but mainly due to the abandonment of farmland (Smith, 1951). Once the abandoned land began to grow young trees, it supplied a better habitat for deer, and the population increased. Deer moved into this range from Pennsylvania and the Adirondacks (Smith, 1951). The increased food supply also increased the reproductive capacity of the deer and this, coupled with a decrease in predators, allowed the population to rise to a level where forests and farm crops were damaged by overbrowsing. Overpopulation also increased wintertime deer mortality due to starvation.

The establishment of the party permit system in 1960 to allow hunters to take deer of either sex has since brought the population under better control.

Indian Activities

All of these preceding activities that have so greatly affected the natural environment of this region have occurred in the relatively short period of about 200 years. However, the history of the Indian in this region goes back much further. The most popular theory holds that they crossed the Bering Sea from Asia 5,000 years ago and made their way southeast, settling along the rivers (Ellis and others, 1957). The Algonkians were the first group to dominate New York State. They ruled for about three hundred years but were defeated and driven out around 1300 when the Iroquois invaded upstate New York from the Mississippi River Valley region. The Cayugas, the major Iroquois tribe in the area of the Arnot Forest, most likely traveled up the Ohio and Allegheny Rivers. The exact reasons for the invasion are unknown; but famine, wars, and internal strife probably encouraged the Iroquois to look for new hunting grounds (Ellis and others, 1957).

The Iroquois had a matriarchal and agricultural society. The line of descent was through the mother, and a group of women elected and removed chiefs from their council (Abt, 1926). The women of the village cultivated maize, squash, pumpkins, beans, and tobacco while the men hunted and fought the wars. The forest influenced the way of life of the Iroquois. They lived in villages because it was safer than living as separate families in the forest (Ellis and others, 1957). They also worshipped nature and had many festivals of thanksgiving to the Great Spirit.

The famous Iroquois Confederacy, or League of Five Nations, was organized around 1570 by Hiawatha. He had been converted to the peaceful ways of the Great Spirit by Deganawidah, a Huron (Ellis and others, 1957). Some sources say the purpose of the League was universal peace. Others support the idea that the Iroquois wanted peace with themselves as the master race; or that they formed the League not for peace, but to make war more efficiently on other tribes. Whatever its original purpose, the League made the Iroquois one of the most powerful societies ever to rule on the North American continent. They made war and conquered tribes all the way from the Mississippi River to New England.

There were originally five tribes in the Iroquois Confederacy: the Senecas, Cayugas, Onondagas, Oneidas, and Mohawks. The Cayugas were the last of the five to join the League, and thus were called "The Youngest Brothers" (Pierce and Hurd, 1879). The Iroquois also gave asylum to displaced tribes from other areas. One of these tribes was the Tuscaroras, relatives of the Iroquois from North Carolina and Virginia. They had been defeated and virtually driven out by European settlers who kept moving farther and farther west (Johnson, 1881). There is some disagreement as to whether they joined the League voluntarily or were forced to join. Whatever the reason, the Tuscaroras migrated north and became the sixth nation of the Iroquois Confederacy about 1713. They settled on land north of the Susquehanna River. Several other tribes came north with the Tuscaroras. Among these were the Tutelos and Saponis, who settled south of Ithaca (Abt, 1926). The land near the Arnot Forest was probably settled by the Saponis. No villages have been found at this location, although it is more than likely the Indians hunted in the region.

European Settlement

The first Europeans to enter the area of the Arnot Forest were French explorers. Etienne Brule, a young Frenchman who sailed with Champlain when he founded Quebec, was probably the first European to pass through this region. Champlain wanted to gain the friendship of the Montagnais Indians of Quebec and their allies, the Hurons, and at the same time explore Central New York (Norris, 1961). In order to accomplish both these goals, he promised to help the Montagnais fight the Iroquois and sent Brule to the region of the Susquehanna River where he was to encourage the Andaste Indians to join the attack against the Iroquois (Norris, 1961). On their way north from the Susquehanna region to fight the Iroquois, Brule and his party of Andastes passed just east of the Arnot Forest. Although he did explore this region, he failed in the rest of his mission because they did not reach the appointed site of the attack in time to take part in the battle (Norris, 1961).

Following the explorers, the traders and the French missionaries pushed through the wilderness to Central New York. The traders bargained with the Indians and sold them liquor and manufactured products for furs, while the missionaries tried to convert them and win their friendship for France. Missionaries first came to the area surrounding Cayuga Lake in the 1660s. Father Stephen de Carheil established the Mission of St. Joseph at the foot of Cayuga Lake in 1668 and remained there until 1671. At that time he was replaced by Father Pierre Raffeix, who wrote one of the first complete descriptions of the flora in this region (Abt, 1926).

The French were not alone in having claims to the land and wanting to influence the Indians in the Central New York region. The British took

New York from the Dutch in 1664, and from then on the Iroquois were caught up in the power struggle between Great Britain and France. Between 1660 and 1680 the French influenced the Iroquois through their missionary work. They made converts among the Onondagas and Oneidas, and thus damaged the unity of the League of Five Nations (Ellis and others, 1957). To counter this move, Governor Thomas Dongan of New York offered protection to the Iroquois. The French then tried to conquer the Indians. Le Febvre de la Barre and the Marquis de Denonville, each while serving as governor general of Canada, tried and failed to overpower the Iroquois in 1683 and 1687, respectively. Count de Frontenac also failed in 1697 (Pierce and Hurd, 1879). The power struggle between the British and French did not officially come to an end until 1754 when the French recognized British authority.

The withdrawal of the French from Central New York opened the way for the British and American colonists to make peace with the Iroquois. The famous botanist, John Bartram, was on such a peace mission to the Onondagas with Conrad Weiser, a colonial agent, when he passed just east of the present location of the Arnot Forest in 1743. During this excursion, he wrote in his journal a detailed description of the land, plants, animals, and his party's encounters with the Indians. Missionaries from the colonies also tried to convert the Iroquois as the French had done. The Moravian missionary, David Zeisberger, made several trips from his home in Pennsylvania to the Central New York region in the 1740s and 1750s. His route took him past the present site of Waverly and west of Van Etten[4] (Norris, 1961). He also recorded a description of his trip in his journal.

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[4] See Appendix 2 for the locations of the towns mentioned.

When the American Revolution broke out, both the British and Americans wanted an alliance with the Iroquois. The Indians tried to remain neutral at first, but this angered both governments (Graymont, 1972). Finally, the British persuaded the Iroquois to remain loyal to the king and fight against the Americans. The Indians took part in several raids against frontier settlements, including the famous Cherry Valley Massacre in 1778 (Graymont, 1972).

In order to stop these Indian attacks, George Washington ordered Major General John Sullivan to lead an attack against the Iroquois in 1779. This expedition passed up the Susquehanna River and into Central New York. There they proceeded to totally destroy the Indian villages and crops. Lieutenant Colonel William Butler and Colonel Henry Dearborn devastated the villages of the Cayuga Indians around Cayuga Lake (Graymont, 1972). The Saponis' settlements south of Cayuga Lake were also destroyed, even though the Saponis had not fought against the Americans. The Indians who were not killed fled to Niagara and the protection of the British. That winter was a particularly hard one, and many of them died from starvation and disease.

The Sullivan expedition stopped the large scale attack of the Iroquois on the Americans, but it did not break them. It only made them more dependent on the British and deepened their dislike for the Americans (Graymont, 1972).

THE LAND OWNERSHIP PERIOD

State Ownership

After the Revolution, pioneers began to push westward, and it became important to settle the rival claims to the lands that are now New York.

Massachusetts had a claim dating back to 1606 when James I gave the Plymouth Company title to lands that included part of New York State and the area of the Arnot Forest. The state of Connecticut also claimed land in New York. The dispute between New York and Massachusetts was settled at a meeting in Hartford, Connecticut on December 16, 1786. New York was given sovereignty and the right of jurisdiction of the entire territory, while Massachusetts was granted the right of pre-emption of land from the Indians, west of a line from Pennsylvania to Lake Ontario passing through Seneca Lake. Massachusetts was also given ten townships between the Owego and Chemung Rivers (Hotchkin, 1848). The dispute between New York and Connecticut was settled in 1800 when Connecticut gave up all claims to land in New York State and, in turn, was granted a part of Ohio called the Western Reserve (Hotchkin, 1848).

Private Ownership

Following the Revolution, New York had not only land problems, but also money problems. They were short of funds with which to run the state government (Colburn, 1948). A Board of Land Commissioners was set up and in 1791 was given the right to administer and sell public lands. This board sold several large parcels of land, including one which contained the area of the Arnot Forest. This was bought by a group of seven men from New York City, members of the "commercial class" who had money to invest and wanted to make a profit on a land deal (Colburn, 1948). The group was headed by John W. Watkins, a lawyer, and Royal Flint. Thus, the parcel of land became known as the Watkins and Flint Purchase.

In 1791 the group applied to the Board of Land Commissioners to buy 363,000 acres at the rate of three shillings four pence (about 42¢) per acre.

They hoped to be able to quickly sell the land to settlers for a profit (Colburn, 1948). Simeon DeWitt, one of the founders of Ithaca, was at that time Surveyor General of the State of New York. He was ordered by the Commissioners to survey the land and determine exact boundaries and acreage. This took three years, and the official return of survey was made in April, 1794. Title to the land was transferred to Watkins on June 25, 1794, Flint having sold his interest to Watkins in 1792 (Colburn, 1948).

The purchase was divided into 12 townships, each of which was subsequently divided into four quarters, called sections. The associates of Watkins drew lots to determine who got which sections. One of the associates was Robert C. Livingston, a member of the aristocratic Livingston family of the Hudson Valley. Livingston drew, among other parcels, the southeast section of township six. This section contained the land which is now the Arnot Forest.

Livingston and his family sold parts of his land to individual settlers. All the associates had difficulty selling and making a profit because the settlers had no ready cash and the land was not very good for farming (Colburn, 1948). The Livingstons turned what they did not sell over to James Pumpelly who owned a real estate office in Owego. Over the years Pumpelly and his relatives sold most of the land in small lots to private individuals.

In 1871 Joseph Rodbourn began buying up parcels of land in the area. Rodbourn and his brother James had been teamsters in the town of Erin. During the Civil War, they contracted out and built the infamous prisoner-of-war camp at Elmira (Recknagel, 1939). Having made a large profit on the prison, they began acquiring woodlands in the southeast section of township six.

They initiated logging operations on the land in 1873, cutting the white pine, hemlock, and some hardwoods and sawing the logs into lumber at their mill in Swartwood. They also had a small steam mill and a novelty mill in Banfield Hollow (Hamilton and Fischer, 1970). They shipped the lumber on a railroad they built from Van Etten to Elmira, which later became part of the Elmira, Cortland and Northern Branch of the Lehigh Valley Railroad (Recknagel, 1939). The Rodbourns also sold hemlock bark to a tannery in Bridgeport. They ran logging operations in this area for a period of 14 years, ending in 1887.

Having made a fortune, the Rodbourns invested heavily in timberland in Tidewater, Virginia (Recknagel, 1939). About this time a recession hit the country and they began to lose money. In 1893 they mortgaged their land in the southeast section of township six to the Chemung Canal Trust Company in Elmira, a private bank owned by the Arnot family (Hamilton and Fischer, 1970). John Arnot, an immigrant from Boston, had come to this area on foot in 1827. He bought a six square mile tract of land from the New England Land Company and logged the area for white pine which he sent down the Susquehanna River in lumber rafts. Arnot made his fortune in the lumber business and branched out to found the Chemung Canal Trust Company. His son Matthias carried on the business, and in 1910 the bank foreclosed on the mortgage of the Rodbourn Tract. Four years later the tract was sold to the Matthias H. Arnot Estate.

THE CORNELL OWNERSHIP PERIOD

Acquisition

Around 1914, the Department of Forestry at Cornell University was realizing the need for a research and demonstration forest. The executors of the Arnot

estate were willing to sell the Rodbourn Tract, but Cornell had no funds available for such a purchase. In 1926, after Matthias Arnot died, the heirs of the Arnot estate were persuaded to give the land to Cornell, and the official transfer was made in 1927. The land consisted of 1,641.23 acres divided into 17 lots (Figure 4).

In later years additional lands were added to the Arnot Forest. In 1927 Lot 21 was bought from Schuyler County after it had reverted to the county due to unpaid taxes. This acquisition, along with the purchase of Lot 23 in 1930, filled in the gaps in the original Rodbourn Tract. In 1940 the north half of Lot 14 was purchased, giving the University control of the area at the entrance to the forest and the junctions of Banfield, Jackson, and McCorn Creeks (Figure 4).

By far the largest area of land added to the original Arnot Forest was the 2,092 acres acquired from the Federal Resettlement Administration. These lands lie to the north and west of the original forest and consist of marginal and sub-marginal land that could no longer be farmed economically. Partially because of typical poor drainage of many of the hill soils, the only suitable crop was hay; with the advent of the automobile, there was little market for this product. Much land was also too steep or too wet for modern farm machinery, so the owners sold or exchanged for better land under a program of the Federal Resettlement Administration. On February 18, 1939, the University obtained a 99 year lease on this land which became known as the Arnot Addition. It was turned over to Cornell permanently in 1956, thus bringing the total size of the Arnot Forest to 4,025.73 acres, more than double the original size. This acquisition also gave the University almost complete control of Banfield Creek watershed (Lassoie and Moen, 1977).

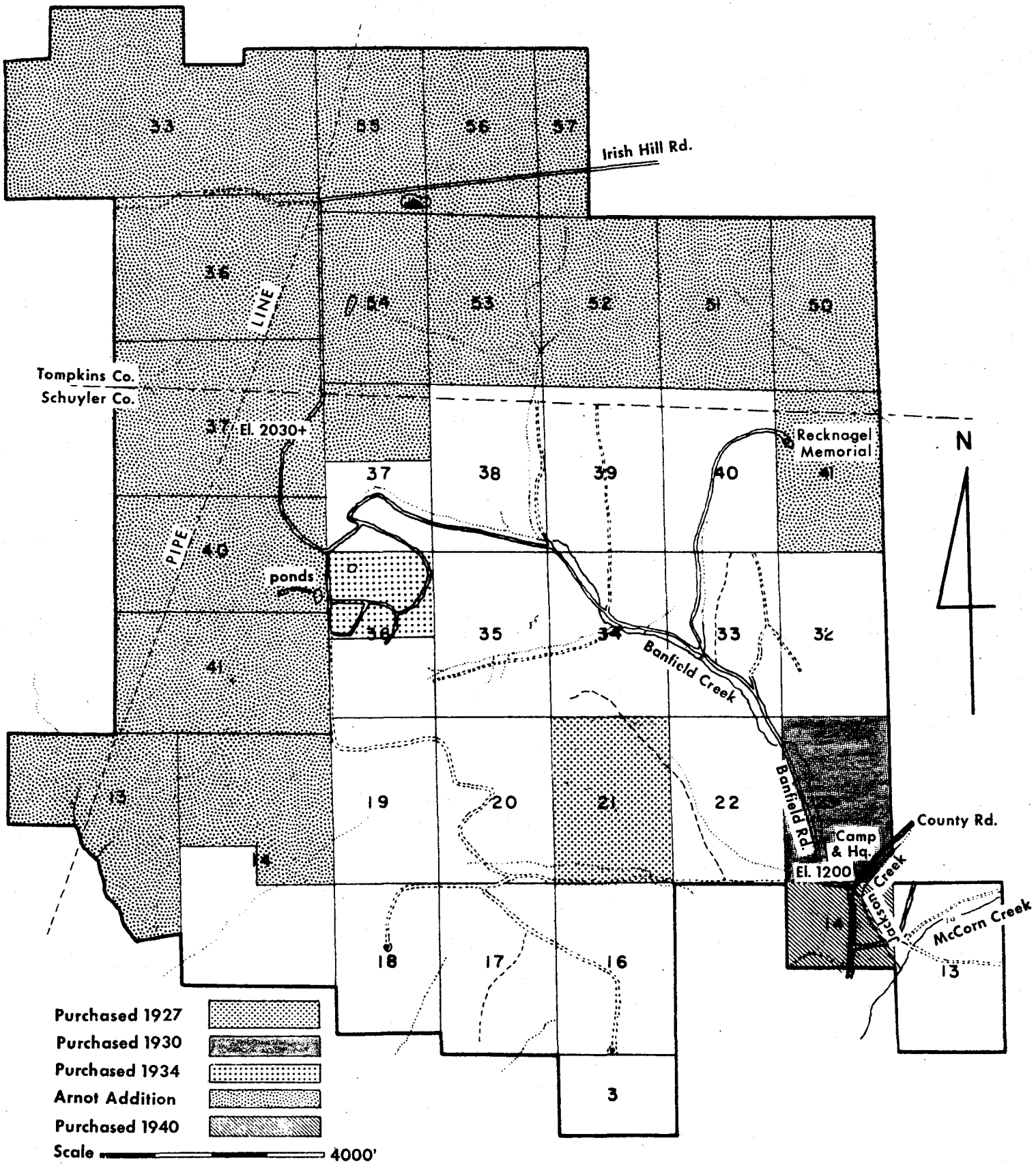

Figure 4. Additions to the Arnot Forest.

Cornell's Forestry Programs

Throughout its history, the Arnot Forest has been greatly influenced by the status of forestry at Cornell. In 1898 the New York State College of Forestry was established at Cornell, the first forestry college in the United States. The State also purchased 30,000 acres of forest land near Saranac Lake, in the Adirondacks, and gave it to the newly formed college. Dr. Bernard E. Fernow, director of the College, decided to use the area as an example of good commercial forestry practices, so he began clearcutting the hardwoods and replanting with conifers. Unfortunately, wealthy landowners in the area throught he was destroying the forest and the game, so they started a campaign against Cornell (Bishop, 1962). As a result, in 1903 Governor Benjamin B. Odell vetoed financial support for the College, effectively killing it. The faculty was let go and students either transferred to other colleges or switched majors.

However the demise of the College of Forestry was not the end of forestry at Cornell. In 1910 the Department of Forestry in the New York State College of Agriculture was established. It soon became one of the nation's best schools for professional forestry.

It was when forestry at Cornell was at a peak that the staff of the Department began looking for a tract of land to use as a research and teaching forest. Professor Frank B. Moody found the Rodbourn Tract and began using it for demonstrations, experiments, and class work in 1914. That same year, Professor Ralph S. Hosmer secured the option on the land, but could not purchase it because of lack of funds. As mentioned earlier, the Rodbourn Tract was finally acquired by Cornell in 1927 when the heirs of the Arnot estate gave it to the University.

In 1933, however, New York State decided that the instruction in forestry at Cornell was a duplication of that being offered at the State College of Forestry at Syracuse (Hosmer, 1950). Undergraduate instruction in professional forestry was discontinued with the graduation of the Class of 1936.

In 1948 the Department of Conservation was formed and included the few remaining faculty of the old Department of Forestry. Emphasis at the Arnot Forest was changed to the multiple use of forests and to conservation education. However, many people did not understand the full meaning of the word "conservation". In order to obtain better recognition of its activities, the Department of Conservation, in 1971, became the Department of Natural Resources. This enhanced the Arnot Forest as a place to study the management of natural resources. Several years later, on March 5, 1974, the faculty of the Department approved a proposal changing the official name of the Arnot Forest to the Arnot Teaching and Research Forest, thus emphasizing the two major uses of the area.

The Early Years

Upon acquiring the Rodbourn Tract in 1927, the first task at hand was to organize its administration. Professor Cedric H. Guise was appointed the first director of the forest and served from 1927 to 1929, from 1931 to 1937, and again from 1944 to 1954.[5] One of Professor Guise's first acts as director was to commission William B. Timbrell to survey the exact boundaries of the forest. This was done using money donated by Charles Lathrop Pack. That same year Professor Guise began maintenance and repair of the system of old logging roads traversing the forest. Some of these roads were cleared, streams were diverted from them, and bridges were constructed.

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[5] Other directors have been Professor J. N. Spaeth, serving from 1929 to 1931; Professor A. B. Recknagel, serving from 1937 to 1944; Professor Lawrence S. Hamilton, serving from 1954 to 1973; and Professor James Caslick, director from 1973 to 1976. Presently, Professors James P. Lassoie and Aaron N. Moen are serving jointly as education director and research director, respectively.

The original plans for use of the forest included supplementing field instruction of students in professional forestry, use as an outdoor laboratory and forest experiment station, and use as a demonstration forest. Activities in the first two categories began soon after the acquisition of the forest. In 1927 forestry classes ran the interior lot lines as part of their field work. This was very important in making the forest ready for administration in the early years. Beginning in the fall of that year, the senior class in forestry began making weekly trips to the forest for a day's work in silviculture, utilization, and management. They made the trip on the Elmira, Cortland, and Northern branch of the Lehigh Valley Railroad (Hosmer, 1950). After professional forestry instruction was discontinued, classes in farm forestry made field trips to the Arnot Forest.

Use of the forest as an outdoor laboratory and forest experiment station also began soon after its acquisition. In the summer of 1927 Professor J. N. Spaeth established 16 permanent sample plots to gather data on the growth and yield of second growth hardwoods. Professor Guise researched methods to convert cull or burned second growth stands into high quality timber. Other research completed in the early years included work on basswood canker, stem form and root habits of several species, experimental plantings and management of the burn cover type, a report on the forest with data for a management plan, studies of wood utilization and markets in counties adjacent to the Arnot, and a census of plants occurring on the Lordstown soil series (Hosmer, 1954).

One of the largest research projects initiated in the early years at the Arnot Forest was the work done by the Soil Erosion Service (later the Soil Conservation Service). From 1934 to 1954 they operated a soil erosion experiment station on

Lot 36 (Figure 1) and developed erosion control techniques using vegetative covers, contour cultivation, and strip cropping. This was one of 17 such stations throughout the country. Much of the work was carried out on the land leased from the Federal Resettlement Administration, and Cornell also bought the north half of Lot 36 in order to facilitate the research. Two buildings, a headhouse for erosion plots and a storage barn, were erected; and seven weirs for the study of watersheds were built. The two major ones were on Banfield and Hemlock Creeks with five smaller ones being located in the north end of the forest.

The director of the experiment station was Dr. John Lamb, Jr. He was aided by Professor Spaeth in setting up plots to study water runoff in open areas, areas with partial cover, and in areas with full forest cover. The effect of woodlands in delaying runoff was graphically demonstrated during a severe storm on August 13, 1942. Three inches of rain fell in one hour, and over six inches fell during the entire storm, washing out parts of the main road through the forest and damaging several bridges. Data collected at this time showed that by the end of the storm three times as much runoff had occurred on the idle as compared to the forested land. Twenty-four hours after the storm the woodland area had lost almost as much water as the idle land, but the delay in runoff could reduce the crest of floods (Lamb and others, 1944).

The 1930s were a period of great accomplishment at the Arnot Forest. Activities had slowed in 1929 with the stock market crash, but in 1933 the Department of Forestry applied for and was granted a Civilian Conservation Corps (CCC) Camp. Construction of the camp started on October 3 of that year, and 18 buildings were put up in Lot 23 near the site of the present forest headquarters (Figure 1). The camp opened on November 3 with an initial program

consisting of work for 200 men for six months. H. W. Hobbs was superintendent of the camp and several graduates of Cornell's Forestry Department served as technical foremen.

Professor Cedric Guise planned the projects for the CCC crews. In 1933 and 1934 alone they completed 5.9 miles of truck trails, 1.9 miles of horse trails, 0.9 miles of foot trails, eight vehicle bridges and two foot bridges. They also ran 20.8 miles of the forest boundary, repainting blazed trees, and completed a topographic survey of the forest. Other projects included 320 acres of forest stand improvements, 2.2 miles of stream improvements, 100 acres of forest plantings, and 0.3 miles of fire breaks. In later years the CCC men completed the excellent system of roads, many of which still exist in the forest. They also completed additional trails and built fire breaks and stream retaining walls for flood control. In 1935 the CCC men also built Schwarz Lodge, the present home of the forest manager, with funds donated by G. Frederick Schwarz of Boston, a close friend of Professor Ralph S. Hosmer.

The men of the CCC Camp participated in other activities,in addition to work projects, during their stay at the Arnot Forest. They printed a camp newspaper which was named after the totem pole that was given to Cornell by Dr. Bernard E. Fernow, Director of the old College of Forestry at Cornell. Dr. Fernow "found" the pole, which may be over 125 years old, in a deserted Indian village at Cape Fox, Alaska, while on an expedition with E. H. Harriman in 1899. The pole belonged to the Salmon-Eaters, a clan of Tlingit Indians, and illustrates the story of Gunas, the nephew of the Head Chief, who was swallowed by the Supernatural Halibut while swimming in the ocean. The three figures on the totem pole are the Thunder Bird (which was one of the crests of the Salmon-Eaters), the Supernatural Halibut, and Gunas (Hamilton and Fischer, 1970).

The totem pole, which was originally 34 feet tall, was first set up on campus, north of the old armory, the present site of the engineering quadrangle. It was later moved inside a campus museum, at which time a 14-foot section was cut off the pole because it was too long to fit in the building. In 1934 it was moved to the forest and set up near the driveway to the Arnot Forest Headquarters. This was its location when it became the center of an initiation ritual for the men of the CCC Camp. When a group of new men arrived at the Camp, they were awakened at three o'clock in the morning by the other men. Given candles and made to kneel in a circle around the totem pole, they had to bump their foreheads on the ground in order to appease the gods of the pole (Bishop, 1962). In later years the pole was moved to a location in front of the Schwarz Lodge and then, in the early 1970s, to its present location behind the new camp lodge.

The CCC Camp closed in May, 1937, but a new camp was established in October, 1939. Much of the work done by this company was at the Connecticut Hill Game Preserve rather than at the Arnot Forest.

With the outbreak of World War II, the government found new uses for the old CCC buildings at the Arnot Forest. In the early fall of 1943 the army took over the buildings and used them to train military police until December of that year. In the summer of 1944 the decision was made to build a prisoner of war camp at the Arnot Forest. A barbed wire stockade and guardhouses were constructed, and in mid-August 200 German prisoners taken at Normandy were moved in. The local residents tell of how the Germans could be heard singing as they were marched up and down Jackson Hollow Road for exercise. Security at the camp seems to have been at a minimum. When a college forester visited the camp, he found the gates open and unguarded. Upon inquiry, he was told that the prisoners were too well fed and comfortable to want to leave. Their comfortable stay did not last long, however. Half of them were moved out two weeks after they arrived and the other

half a week later, apparently because of a poor water supply and bad sanitary arrangements and anticipated difficulty in heating the buildings in winter. Administration may also have been a problem since there were three different commanding officers in the three weeks the camp was in operation. The camp was used again for a short time early in 1945, but the army released it in April of that year. The site was liquidated and ownership of the buildings transferred to Cornell on June 16. The University auctioned off the buildings on July 14.

The Post-War Years

The post-war years saw a great deal of activity at the Arnot Forest. Cedric Guise was once again serving as the Director and, with growing use, he saw the need for a resident manager. In 1952 James Suddaby was hired as the first resident manager of the Arnot Forest. He was replaced in 1954 by Alfred Fontana, who is still serving in this post. Among Mr. Fontana's many duties are road and building maintenance and supervision of many of the educational operations at the forest. He is also responsible for the maple syrup operation each spring and, at other times of the year, for other maintenance and forest work. He has been ably assisted in these activities since 1962 by Donald Campbell. Mr. Fontana has been a dedicated employee for the many years he has worked for the University. In 1974 he received an award for 20 years of service. He has put in many hours of overtime and on several occasions performed "beyond the call of duty".

The post-war uses of the Arnot Forest included much activity in the area of research.[6] Professor Robert R. Morrow served as Assistant Director under Professor Guise and was in charge of forestry research. He developed a record system, based on compartment cards, for the entire forest. Each management

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[6] Publications and theses resulting from research done at the Arnot Forest are listed in Appendix 3.

unit or compartment has a card that contains information on the history, management, topography, soil types, and forest types of the unit and is useful in planning future management or research. Professor Morrow also began a longterm maple syrup research project in 1950.[7] In 1955 an evaporator was purchased, and in 1956 a sugar house was built. Dr. Morrow became a leader in the development and use of plastic tubing for gathering sap, and over six miles of tubing is now used to harvest 20,000 gallons of maple sap each spring at the Arnot Forest. Other phases of the research included analysis of costs of production; changes in syrup quality due to sugar percentage, sugar sand, and micro-organisms; and establishing procedures to improve sap quality. The operation has expanded to include teaching and demonstration functions. The sale of maple syrup also provides an important source of revenue for the Arnot Forest.

Another longterm research project was begun in 1955 by Professor Lawrence S. Hamilton. This involved testing various treatments as preservatives for fenceposts. Fourteen species of trees were used, and each post was tested for strength annually by pulling on it with 50 pounds of pressure. Many of the posts are still standing.

Dr. Hamilton also started research in the early 1960s on the economic feasibility of improvement cuttings in hardwood stands, using the wood to make charcoal. A kiln was set up that produced five to six thousand pounds of charcoal yearly, for sale. The project also included demonstrations on the operation of the charcoal kiln. Charcoal production at the Arnot Forest was discontinued in recent years.

Many other research projects have been done at the forest. Some of those conducted by Dr. Morrow include studies of thinning in conifer plantations,

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[7] Accounts of the first season and the 1979 season of maple syrup research are given in Appendix 4.

the effects of initial plantation spacing, and chemical means of deadening hardwoods to facilitate noncommercial thinning. Twenty-five year results of larch spacing tests were recently published. Other forestry research includes longterm studies of tree nutrition and moisture requirements by Professor Earl Stone, research on growing Christmas trees by Professor Alex Dickson, and hybrid poplar research and demonstration plantings by Professors Aaron Moen and James Lassoie.

In the area of wildlife, studies of white-tailed deer and ruffed grouse were done in the 1950s and 1960s under the direction of Professor Oliver Hewitt. The deer population had increased several fold since a 1936 survey. In 1949 and 1950, ground and aerial surveys were conducted to study winter habitat conditions and the population of white-tailed deer. The range, cover, nesting, and food habits of ruffed grouse have also been studied. In recent years the production of forage that could be utilized by white-tailed deer has been studied under the direction of Professor Aaron Moen. Dr. Moen has also collected data on many of the physical aspects of the Arnot Forest such as vegetation, cover type, soil type, slope and aspect of subwatersheds, precipitation, solar radiation, and stream flow. This data is being stored in a computer program for resource analysis and management.[8]

Professors Alfred Eipper and Dwight Webster were leaders in studying the management of fish ponds at the Arnot Forest. A total of eight experimental ponds were built at the forest by the Soil Conservation Service as part of their research. The first was constructed in 1946 on Lot 54, and seven others were built by 1949 in Lots 36 and 40 (Figure 1). These ponds were later used by Professors Eipper and Webster for their research on the influence of environmental factors (thermal, chemical, aquatic plants) on fish populations and for fish reproductive studies.

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[8] A complete record of recent research projects at the Arnot Forest is on file at Dr. Moen's Wildlife Ecology Laboratory.

The Arnot Forest has been used not only for scientific research but also for educational functions. The first annual 4-H Conservation Leadership Training Camp was held in 1948 to teach boys the rudiments of forestry, soil and water conservation, and wildlife conservation. In later years girls' camps were also held. The camps gave the participants a chance to work on projects in the forest with instruction given by Cornell faculty members. The 4-H camp was discontinued in 1970 and reintroduced the following year with some changes in format. The program became coed, and the emphasis changed from just teaching conservation to teaching the participants to be leaders of conservation activities in their own 4-H clubs. The Teen Leadership Program was conducted by Professor John Kelley in the early 1970s and is presently under the leadership of Professor Ron Howard.

In addition to the 4-H camp, teacher and sportsman conservation workshops were started in the summers of 1949 and 1950, respectively. The purpose of these workshops was to train leaders in conservation. Professors Fred Winch, Harlan Brumsted, and Harry Kerr were early and longtime teachers of forest conservation, wildlife conservation, and soil and water conservation; respectively. The teachers' workshop was conducted annually through 1972, and the sportsmen's workshop was also held periodically for a number of years.

As well as the annual workshops, other educational activities have been held at the Arnot Forest. For example, the Natural Resources Institute, a four-day workshop for vocational and agricultural teachers, was held several times in the late 1960s and early 1970s. These workshops covered a variety of topics such as wildlife management taught by Professor Harlan Brumsted. Another year a workshop on the operation of a sawmill was conducted by Extension Specialist Dave Taber and Mr. Alfred Fontana. The mill at the Arnot Forest was transferred there in 1958 from Cornell's field station at Shackleton Point on Oneida Lake. Another major educational activity at the Arnot Forest was a field ecology course taught by Professors Douglas Gilbert and Ray Oglesby in 1970 and by Professors John Kelley and Fred Winch in 1971. Students

spent three weeks at the Arnot Forest learning the principles of terrestrial ecology then another two weeks at Shackleton Point studying aquatic ecology. Other educationa activities at the Arnot Forest have included one-week and three-week courses in ecolog taught by Professor Aaron Moen in 1978 and 1980, respectively; field collecting trips for mammalogy classes; orientation sessions for new students in natural resources; and field work for the maple syrup class taught by Professor Robert Morrow.

Conditions at the early conservation workshops were far from modern. Housing consisted of surplus army tents set on platforms, and the old supply house from the CCC Camp served as dining room and kitchen. A primitive wash area and shower were set up at one end of this building. Flush toilets were unavailable and outhouses served in their place. Some prospective participants in the workshops took one look at these primitive conditions, got back in their cars, and left.

The situation improved in the mid-1950s when the decision was made to develop new facilities at Camp Arnot. In May, 1954, the first of 13 new cabins to house campers was built by the Niagara County Federation of Sportsmen's Clubs and 4-H youth. In the fall of 1954 a second cabin was built by the Tonawanda Sportsmen's Club. Five more cabins were built in the spring and summer of 1955 by other 4-H and sportsmen's clubs. In October, 1955, the Arnot Development Campaign was boosted by the appointment of the New York State Conservation Council of the Arnot Development Committee, chaired by Victor Fitchlee. The efforts of John Stookey, Niagara County 4-H Agent, were extremely important in the formulation of this committee. The committee started a county-by-county fund-raising campaign; the goal of which was to raise $60,000 for a new central camp building (a lodge). Personal letters, phone call visits, paper drives, and lectures and movies on conservation were used in an all-out fund-raising effort. By 1956, almost 20% of the money had been raised and a total of nine cabins had been built. In the following year, two more cabins, a sanitary building, and pumphouse were built and, by the end of the year, nearly a third of the money had been raised for the central camp buidling, which was completed in 1963.

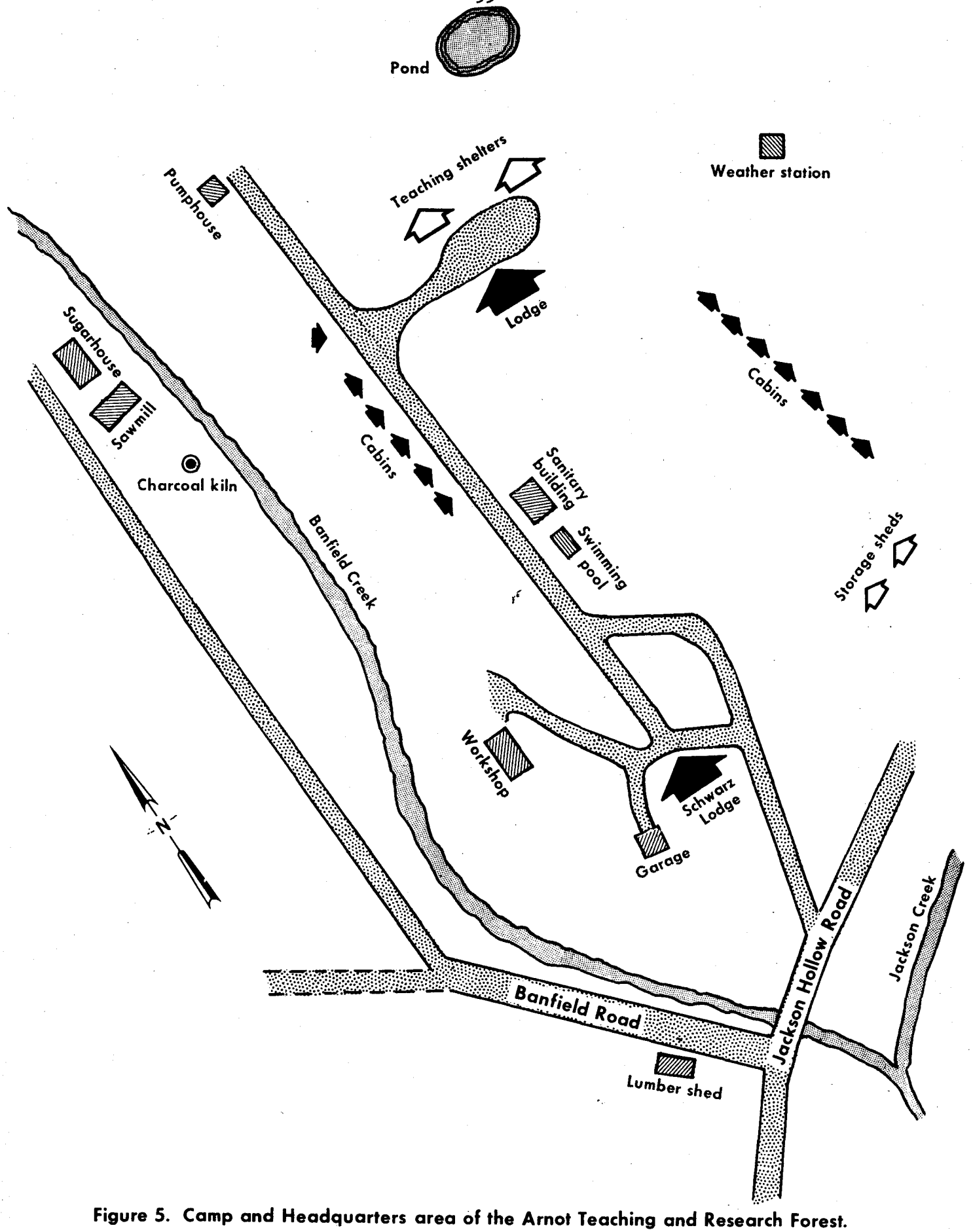

Figure 5. Camp and Headquarters area of the Arnot Teaching and Research Forest.

The campaign ended in 1964 with the dedication of the camp as a conservation leadership training center. Two years later the swimming pool was constructed, two of the cabins were winterized, and the teaching shelters were built (Figure 5). Three more cabins were winterized in 1977, 1978, and 1979; one to be used as a research cabin and two for dormitory space.[9] The sanitary building was winterized in 1979, and one end of the lodge was wintered by January, 1980. The camp now has overnight accomodations for 25-30 people in the winter and 80 in the summer.

Gifts and Memorials

In addition to the numerous donations to provide teaching facilities, the Arnot Forest has benefited from several other generous gifts. Just after the acquisition of the forest by Cornell in 1927, Charles Lathrop Pack, President of the American Tree Association, donated $5,000 to be used for the administration of the forest. In 1930 Archer M. Huntington of New York City donated $5,000 for the development of the forest and for research. That same year G. Frederick Schwarz gave $1,000 (that was later used to build Schwarz Lodge), and in 1939 Ida T. L. Schwarz donated $500 for the upkeep of the lodge. The Cabot Arboretum Fund was established in 1939 with a gift of $1,000. This fund was used for a variety of silvicultural purposes aimed at improving the forest growing stock.

Several memorials have been erected at the Arnot Forest in honor of faculty members and outstanding conservationists. Two of the cabins were built as memorials. One, the Townsend Memorial Cabin, was built in 1956 by the Cornell Conservation Club in memory of Ted Townsend, a conservationist. The money was donated by the Southern New York Fish and Game Association. Another cabin was built in 1957 as a memorial to Professor Joshua A. Cope who originated the idea of a 4-H conservation camp. One of the larger memorials is in honor of A. B. Recknagel who was a Professor of Forestry from 1913 to 1944 and Director of the Arnot Forest from 1937 to 1944. In 1940 Professor Recknagle established a red pine plantation on a ten-acre open area in the

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[9] Construction was partially funded by Cornell's class of 1920.

Arnot Forest. Upon his death in 1962, memorial money was used to build an access road and exhibit shelter, and the area was dedicated as the A. B. Recknagel Memorial Research and Management Area on August 30, 1964. On May 15, 1966, a hardwood grove was dedicated in honor of Cedric Guise, Professor and Administrator at Cornell for 38 years. Professor Guise was the first director of the Arnot Forest and also did much work in the areas of forest management and forest education. Another memorial was dedicated to Ralph Sheldon Hosmer, one of the early pioneers of American forestry. Professor Hosmer served in the United States Department of Agriculture, Division of Forestry, under Gifford Pinchot from 1898 to 1904, when he became the first Superintendent of the Division of Forestry in the Territory of Hawaii. He was responsible for the establishment of a system of forest reserves in Hawaii. In 1914 he became head of the Department of Forestry at Cornell, a position he held until his retirement in 1942.

CONCLUSION

The Arnot Forest was a very important addition to Cornell University. It provides a place for the faculty and graduate students of not only the Department of Natural Resources, but other departments as well, to carry out research in an area typical of the forest land found in south Central New York. This forest resulted from a long history of changing land use patterns, and therefore presents an opportunity to study the longterm consequences of these patterns. The continuing owernship of the forest by Cornell University allows the accumulation of an extensive data base for the area, particularly for the Banfield Creek watershed. This will be extremely useful in future research. The Arnot Teaching and Research Forest also serves increasingly as an outdoor laboratory for students seeking knowledge in many aspects of natural resources. It is hoped that through its three major uses (teaching, research, and extension), the forest will continue to help a large number of people to better understand the complexities of the forest ecosystem.[10]

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[10] A contemporary management plan governing the use of the Arnot Teaching and Research Forest is available from the Department of Natural Resources.

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APPENDICES

Appendix 1. Species List Referenced In Text

TREES AND SHRUBS

- ash - *Fraxinus spp.*
  - white ash - *F. americana*
- aspen - *Populus spp.*
  - big tooth aspen - *P. grandidentata*
  - quaking aspen - *P. tremuloides*
- basswood - *Tilia americana*
- beech - *Fagus grandifolia*
- birch - *Betula spp.*
  - black birch - *B. lenta*
  - yellow birch - *B. lutea*
- cherry - *Prunus spp.*
  - black cherry - *P. serotina*
  - pin cherry - *P. pensylvanica*
- chestnut - *Castanea dentata*
- cucumber tree - *Magnolia acuminata*
- elm - *Ulmus spp.*
- gooseberry - *Ribes spp.*
- hemlock - *Tsuga canadensis*
- hickory - *Carya spp.*
- honeysuckle - *Lonicera spp.*
- huckleberry - *Gaylussacia spp.*
- ironwood - *Ostrya virginiana*
- maple - *Acer spp.*
  - mountain maple - *A. spicatum*
  - red maple - *A. rubrum*
  - striped maple - *A. penslvanicum*
  - sugar maple - *A. saccharum*
- musclewood - *Carpinus caroliniana*
- oak - *Quercus spp.*
  - red oak - *Q. rubra*
- pine - *Pinus spp.*
  - white pine - *P. strobus*
- raspberry - *Rubus spp.*
- sumac - *Rhus spp.*
- tulip poplar - *Liriodendron tulipifera*

Appendix 1. (cont.)

MAMMALS

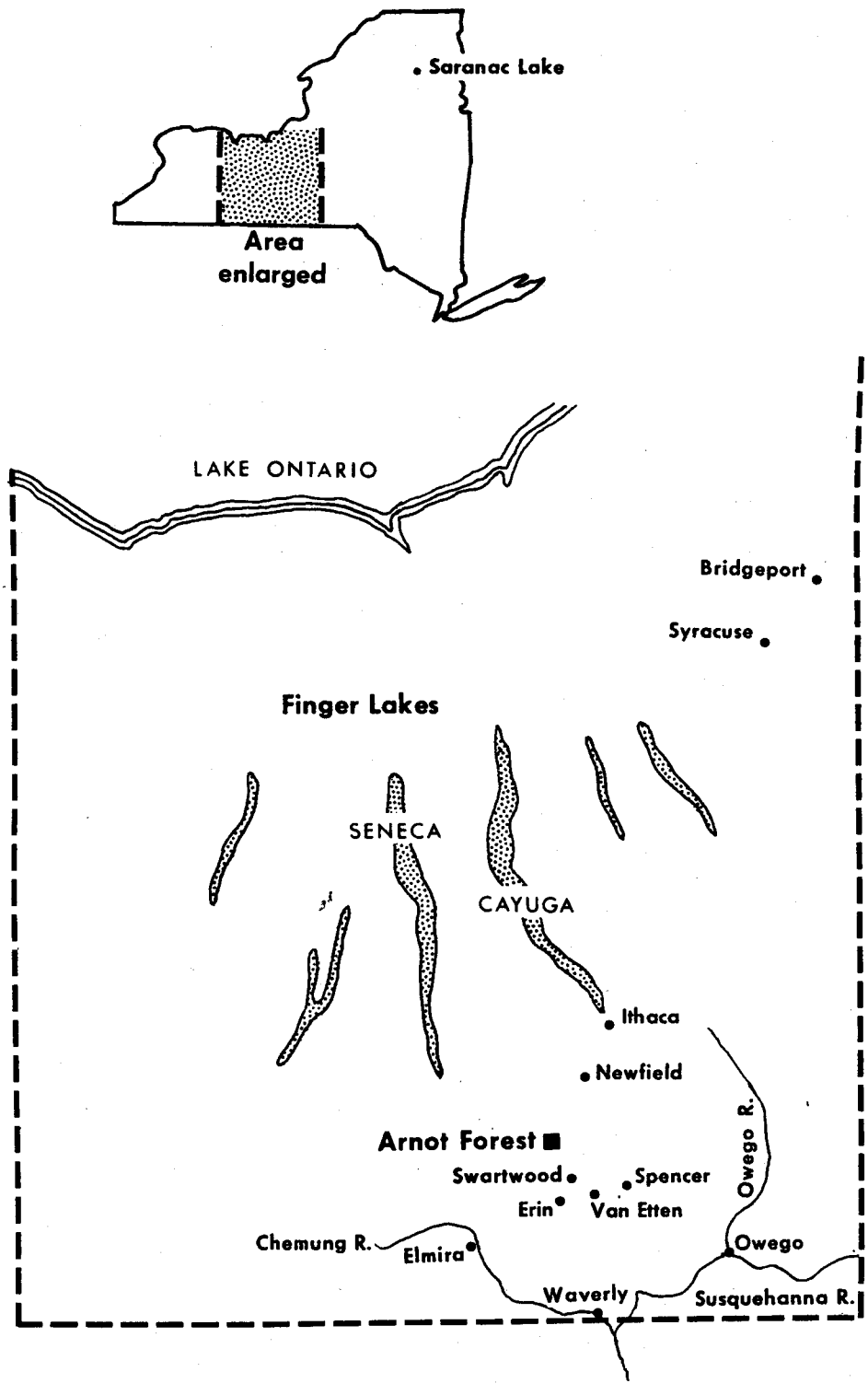
bear (black) - Ursus americana
beaver - Castor canadensis
cougar - Felis concolor
deer (white-tailed) - Odocoileus virginianus
elk - Cervus canadensis
fox (gray) - Urocyon cinereoargenteus
fox (red) - Vulpes vulpes
marten - Martes americana
otter (river) - Lutra canadensis
wolf (timber) - Canis lupus

BIRDS

ruffed grouse - Bonasa umbellus

REPTILES

rattlesnake (timber) - Crotalus horridus horridus



Appendix 2. Locations of towns and physical features.

Appendix 3. Publications and Theses Based on Research at the Arnot Forest[11]

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[11]Many of these are on file in the Department of Natural Resources.

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Appendix 4. Arnot Maple Syrup: The First Thirty Years

The First Season

by Robert R. Morrow

From 1950 through 1955, Professor Robert Morrow studied maple sap flow, using trees at Arnot Forest as well as those in other woodlands. Upon approval of his 1955-56 sabbatic leave, he made plans for building a sugar house for expanded research, using his allotment of Hatch research money.

In 1955 a three-year-old, reconditioned Vermont evaporator (4 x 10') was purchased for $250. Richard Howard was hired in 1956 to build the 20 x 20' sugar house with attached 20 x 16' wood storage shed. He took 40 days to complete the building, spending $730 for materials. Another $1300 was spent later for buckets, tanks, and other needed equipment. Mr. Fontana cut and stored 10 cords of fuelwood. Another cord of dry-kilned flooring ends was purchased from Cotton Hanlon.

Since no one had experience with an evaporator, Morrow and Fontana decided on a test run in the fall of 1956. Using creek water in the evaporator and some of the dry-kilned wood, they lit the fuel. Soon the water was nearly gone, but the fuel in the fire box burned vigorously. With visions of the whole place going up in smoke, they rushed to the creek for more water, and managed to replace it faster than it was evaporated. Starting with this experience, Mr. Fontana went on to a long career of making excellent maple syrup, most of which was sold to the Cornell community.

In the spring 725 tap holes were made, producing 225 gallons of syrup. Only 20 gallons was scorched or buddy; the rest was marketable. The selling price was $5.50 per gallon. During Cornell's Farm and Home Week, one-gallon gift packages were presented to Governor Averell Harriman, President Deane Malott, and Dean William Myers. It was at this time that President Malott thundered "I don't see anything about Cornell University on the label." Needless to say, current labels were rushed back to the printer, and all future labels carried Cornell's name.

Appendix 4. (cont.)

The most noteworthy memory of the first season was the constant scrambling up and down roadside banks and other rough terrain to gather the sap. This was done primarily by George Scherrer, aided by Fontana and Morrow, and a total of 200 hours of near back-breaking work was recorded.[12] A few crude plastic lines were used during this first season. Eventually Professor Morrow developed many of the recommendations that have made plastic tubing and pipelines so successful today.

The 1979 Season

by Robert Morrow and

Alfred Fontana

In the spring of 1979 the best syrup season on record was experienced at the Arnot Forest. Six hundred and fifty gallons of syrup were produced using a total of 1355 taps. At $16 per gallon this brought a ~~net~~ gross income of over $10,000. Season averages per tap hole follow:

Sap flow (gallons)	23
Mean sugar content (percent)	1.80
Syrup (gallons)	0.48

Note that the high production came in spite of low sugar content. The sap flow of 23 gallons per tap and syrup production of nearly a half gallon per tap from the small-crowned, slow-growing trees at Arnot Forest is phenomenal. Average production for the previous 10 years was a good 0.31 gallons of syrup per tap hole, attributed partially to our tight aerial tube lines, vacuum pumping, and transfer of vacuum in separate pipes to dumping units located near the tapped trees.

The year's weather was especially suitable for good sap flow at Arnot Forest. The first 10 days of March were 8°F warmer than usual and led to flows of nearly six gallons per tap. On the other hand the first 12 days in April were more than

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[12] The April 20, 1957, Ithaca Journal carried a full-page picture story of the first year of operation. Several copies are on file in the Natural Resources Department.

Appendix 4. (cont.)

6°F colder than usual and prolonged both sap flow and syrup quality. In fact mean daily temperatures changed little during most of the season, leading to high production. The table below gives dates, mean daily temperatures, and amount of flow for the major flow periods:

	Mean Temperatures (°F)			
Date (1974)	Max.	Min.	Daily	Sap Flow (Gallons)
Mar. 1-2	42	29	36	2-
5-10	41	30	35	4
17-23	52	24	38	6+
28-30	56	30	43	4-
Apr. 8-12	42	23	33	4+

Note the absence of prolonged warm weather, and that good flows occurred when mean daily temperatures were in the midthirties. Of 10 daily flows that exceeded a gallon per tap hole, eight came on sunny days. But the biggest flow of all occurred during intermittent showers throughout the day of March 29, with little or no freezing the previous night. Even with vacuum pumps, how do you figure that?