New York State College of Agriculture, a Statutory College of the State University, at Cornell University

Extension Bulletin 1207

The Arnot Forest:

A Natural Resources Research and Teaching Area

1970

compiled, written and edited by Lawrence S. Hamilton and Mary Margaret Fischer

Contents

The Story of the Totem Pole

The totem pole (cover illustration) was carved by the Salmon-Eaters, a clan of Tlingit Indians who live along the coast of southeastern Alaska. It is not an idol and was not worshipped by the Indians, but merely illustrates one of the ancient legends of the Salmon-Eater clan.

In the course of their migration southward along the North Pacific Coast, the Salmon-Eaters had several epic adventures. This totem recalls the story of Gunas, the nephew of the Head Chief who went out to swim in the ocean and was swallowed by the Supernatural Halibut. One of the crests of the Salmon-Eater clan was the Thunder Bird or Eagle. The figures on the pole are, from top to bottom: the Thunder Bird, the Supernatural Halibut, and Gunas.

This pole, which is very old, was removed from Cape Fox near the Alaska-Canada border by the Harriman Expedition which visited Alaska in 1899. It was presented to Cornell University on the return of the expedition by Prof. B. E. Fernow, a member of the expedition and at the time dean and director of the New York State College of Forestry at Cornell University. The pole was first erected on the campus at the northwest corner of the Old Armory, where it stood for more than 20 years. In 1934 it was erected in the Arnot Forest where the flagpole now stands. Ten years later it was moved to its present location.

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About 20 miles southwest of Ithaca between the villages of Newfield, Cayuta and Van Etten in Tompkins and Schuyler Counties, lies the 4,025-acre Arnot Forest, a tract that is fairly typical of some 6 million acres of hill land in the Southern Tier of New York State. Part of the Arnot Forest is second-growth hardwood resulting from commercial logging in the 1890's, part is burned over forest and part is former farmland reverting to forest vegetation or being planted with trees.

Owned by Cornell University, the Arnot Forest is managed by the Department of Conservation in the New York State College of Agriculture as a research, teaching and demonstration area in forestry, wildlife management, soil and water conservation and biological sciences.

Public use of the forest is permitted as long as it does not conflict with these primary management objectives. Picknicking, hiking, cross-country skiing, bird watching, nature study, fishing (in McCorn Creek only) and hunting are encouraged. Hunting is carried out under the Fish and Wildlife Management Act program, and the Arnot Forest is a Cooperator Hunting Area. It is also enrolled under the Forest Practice Act. The use of snowmobiles in the forest is prohibited.

A Forest Manager lives in the headquarters area of the forest. Since 1954 Fred Fontana has filled this key role in the operation and maintenance of the forest.

Physical Features

The Arnot Forest in general is the watershed for Banfield Creek which flows into Jackson Creek and ultimately into the Susquehanna River. McCorn Creek also flows through the southeast corner of the forest and joins Jackson Creek. The highest elevation is 2,030 feet. The lowest, on Jackson Creek, is about 1,150 feet. Rainfall averages about 35 inches a year. The soils are generally acid, medium-textured to fine-textured silt loams of glacial till. Most are either somewhat poorly drained or droughty because of shallowness to bedrock. They are primarily of the Lordstown-Mardin-Volusia association.

Plants and Animals

The forest stands are mainly second-growth northern hardwoods, the result of heavy cuttings from about 1870 to 1900. The beech, sugar-maple and hemlock type is the most prevalent. Commonly associated hardwoods include basswood, white ash and black cherry where clear-cuttings took place. There are some oak and hickory stands on the drier sites.

Fires in 1900 and 1911 ravaged half the forest. Aspen and fire cherry came in after the fires and although they have been largely replaced, dead and dying remnants may still be found.

Other native tree species in the forest include black birch, grey birch, white birch, chestnut, chestnut oak, sassafras, hop hornbeam, blue beech, yellow birch, American elm, red maple, black locust and white pine. Reforestation has added redpine, white spruce, Douglas fir, Scotch pine, European and Japanese larches, Norway spruce and Austrian pine.

The Arnot Forest also abounds with a profusion of wildflowers, ferns, mosses and shrubs.

It takes patience and quiet observation to glimpse animals other than chipmunks, red and grey squirrels and woodchucks, but they are there. Raccoons, foxes and cottontail rabbits live in both forest and fields. The most prized and spectacular animal is the white-tailed deer which is hunted in the fall by both gunners and archers. Though seldom seen, shrews, moles and white-footed mice leave signs of habitation. It was not known that coyotes prowled the forest in recent years until one was shot in 1966.

Birds can everywhere be heard if not seen. Permanent residents include the downy and hairy woodpecker, nuthatch, chickadee, great horned owl, ruffed grouse and crow. Migratory visitors are the robin, catbird, song sparrow, wood thrush, cardinal, scarlet tanager, indigo bunting, flicker, cedar waxwing, mourning dove, chipping sparrow, wood peewee, phoebe, towhee and

the red-shouldered hawk. Turkeys have re-established themselves in the forest, apparently from an artificial restocking made on the nearby Connecticut Hill Game Management Area.

Roads and Buildings

The road and trail network of the Arnot Forest is shown on the map (pp. 16–17). Secondary roads are not open to public vehicles, but they may be used for hiking or cross-country skiing. Entrance gates are closed at night and sections of the main road are closed during hazardous conditions. Only the lower section of Banfield Road remains open during the winter.

The forest is marked with a grid system of lots (see map) and the boundaries are well marked with paint, blazes and posts. The grid is the basis of a compartment card record system devised by Prof. Robert Morrow which gives descriptions and history of treatments on various stands and fields. The physiographic site types and land forms have been mapped to provide a basis for land use planning.

Buildings are clustered along Banfield Road in the southeast corner of the forest. Camp Arnot, dedicated in 1964, consists of 13 cabins, a sanitary building and a central camp building with kitchen, dining room and assembly room. A short distance from the camp is the pole type sap house for research in and production of maple syrup. Nearby are a metal charcoal kiln which utilizes products from thinnings and a sawmill which furnishes some of the lumber for building and maintenance. Also nearby is the residence of the forest manager.

History

Seneca Indians hunted deer and moose among the white pines, hemlocks and hardwoods, and they trapped beaver, otter and marten in the creeks of the area around what is now Arnot Forest when King James I of England granted the encompassing land to the Plymouth Company in 1606. But except for a few traders, trappers, explorers and Jesuit missionaries, Europeans did not venture into the forest for a hundred years.

Early in the Eighteenth Century the forest was a part of the immense empire of the Six Nations of the Iroquois Confederacy. Then came a struggle for territorial rights that embroiled the French, the British, Indians, colonists, Massachusetts and New York. By a treaty in Paris in 1754 the land was given to the British. In 1779 the Six Nations surrendered to the American Revolutionary Army general, John Sullivan, where the city of Elmira now stands.

At the end of the Revolutionary War New York secured title to the western lands and white men soon threaded their way through the wilderness in search of homesteads.

By 1794 the land had passed from state to private ownership. John W. Watkins, a new York City lawyer, Royal W. Flint, his associate, and others bought 363,000 acres of ungranted lands in western New York for 3 shillings, 4 pence an acre.

The purchase itself was divided into 12 townships, each of which was divided into quarters, called sections. Watkins and Flint sold a large tract in southern Tompkins County and northern Schuyler County to Robert C. Johnson. A speculator rather than a developer, Johnson turned his purchase over to the Pumpelly Real Estate office in Owego to find buyers.

It was to this land that Capt. Gabriel Ogden, the first settler in Cayuta, brought his family in 1798. Other settlers quickly followed. In 1816 Jess D. White erected the first sawmill. In 1824 the village of Cayuta was formally organized. The forest provided timber for houses, barns and other buildings in the growing settlements.

The Civil War spurred industrial development in the North, and railroads built across the nation brought economic exploitation into the timbers of Schuyler and Tompkins Counties. Joseph Rodbourn, a skillful lumberman with a reputation for building large sawmills and producing excellent timber, began acquiring timberland in 1871. He built logging roads. He felled the white pine and the hemlock, and he took out the best of the hardwood. His mill at Swartwood sawed 2 million feet annually. Shipped out on the Elmira, Cortland and Northern Branch of the Lehigh Valley Railroad, the lumber was swallowed up by eastern manufacturers and builders.

The hemlock bark also found a waiting market. It was hauled 90 miles to a tannery at Bridgeport.

Once the tall timbers were gone, a small steam mill for cutting fuelwood was built on the tract in Banfield Hollow to use the remaining low quality hardwoods. A novelty mill using the same cull hardwoods was set up and operated profitably for several years.

Then a major recession struck the country. The novelty mill closed. Rodbourn mortgaged 1,641.23 acres of the forest to the Chemung Canal Bank of Elmira. The bank foreclosed the mortgage in 1910 and in 1914 sold the land by a quit claim deed to the Matthias H. Arnot estate.

The forest suffered its most severe damage just before the Arnots acquired it. Fires in 1900 and 1911 ravaged almost half of it. Whatever the cause — sparks from a railroad train, careless stump burning, thoughtless campers — the fires provided new cover types and new habitats which later became available for research in ecology.

In the same year that the Arnot estate bought the forest, Prof. Walter Mulford of the Department of Forestry at Cornell University wrote in his annual report, "The Department's greatest need is for an adequate demonstration and experimental forest. The need is imperative."

Another faculty member, Professor Moody, who had been scouting the countryside in search of such a forest, returned with so enthusiastic a description of the southwest corner of Township 6 that other faculty and students went to see it for themselves. Taking the Elmira, Cortland and Northern train from Swartwood was a comfortable all-day round trip from Ithaca.

The executors of the Arnot estate wanted to sell the forest, but the University had no money to buy it. So matters stood for the next decade, but the executors did allow classes to visit the property.

In 1926 the heirs of the Arnot estate gave the land to the University. The transfer was made by fee simple in 1927. Given the name Arnot Forest, the tract consisted of 1,641.23 acres divided into 17 lots or portions of lots in the southwest part of Township 6 of the Watkins and Flint purchase. As soon as the University received the title, William B. Timbrell, a surveyor from Elmira, located and marked all the boundaries. A total of 292.5 acres was bought later to consolidate the holdings.

Four professors have served as director of the forest. The first was Cedric H. Guise who served three different times: from 1927 to 1929, 1931 to 1937 and 1944 to 1954. Other directors have been J. Nelson Spaeth, who served from 1929 to 1931, Arthur Bernard Recknagel, who served from 1937 to 1944, and the present director, Lawrence S. Hamilton, who has served since 1954.

Under Professor Guise, plans were laid immediately to bring the forest under systematic management. Rodbourn's old lumber roads were repaired and re-opened. Three permanent bridges were built across Banfield Creek at the first three crossings on the main road up the valley.

In the summer of 1927, Professor Spaeth established and made the first measurements on 16 permanent sample plots to obtain exact data on the growth and yield of second-growth hardwoods. That fall and for the next 10 years, senior forestry students went to the Arnot Forest for a full day's work each week.

A gift from Archer M. Huntington of New York City in the summer of 1930 made other developments in the forest possible. His gift was soon followed by a gift of $1,000 from C. Frederick Schwarz of Boston to start a fund for a headquarters building.

But the Wall Street crash and depression began to complicate the management of the forest. University income was curtailed. Markets for products from the forest decreased, and they were further limited to avoid competition with neighboring farmers. The principal purchaser of sawlogs was L. R. Chaffee, owner of a small sawmill in the valley. The

Income from the timber sales provided much of the Arnot development capital in those difficult years.

Although the director was pleading for a permanent caretaker, the best he could get was a part-time watchman who was paid $10 a month.

Progress was made, however. By 1933 these projects were completed: establishment of "methods of cutting" permanent sample plots; study of stem form in the basswood, white ash and black birch; volume table for second-growth hardwoods; study of root habits of several important species; continuous record of environmental factors on burn and 45-year-old second growth; experimental planting on burn; experiments in poisoning undesirable trees; studies on wood utilization and markets; intensive studies of the burn type in relation to its further management.

In the same year these projects were underway: censuses of all plants, animals, tree diseases, forest insects; intensive research on basswood canker — probably the most serious disease problem in the forest; and classification of soils and preparation of an intensive soil map.

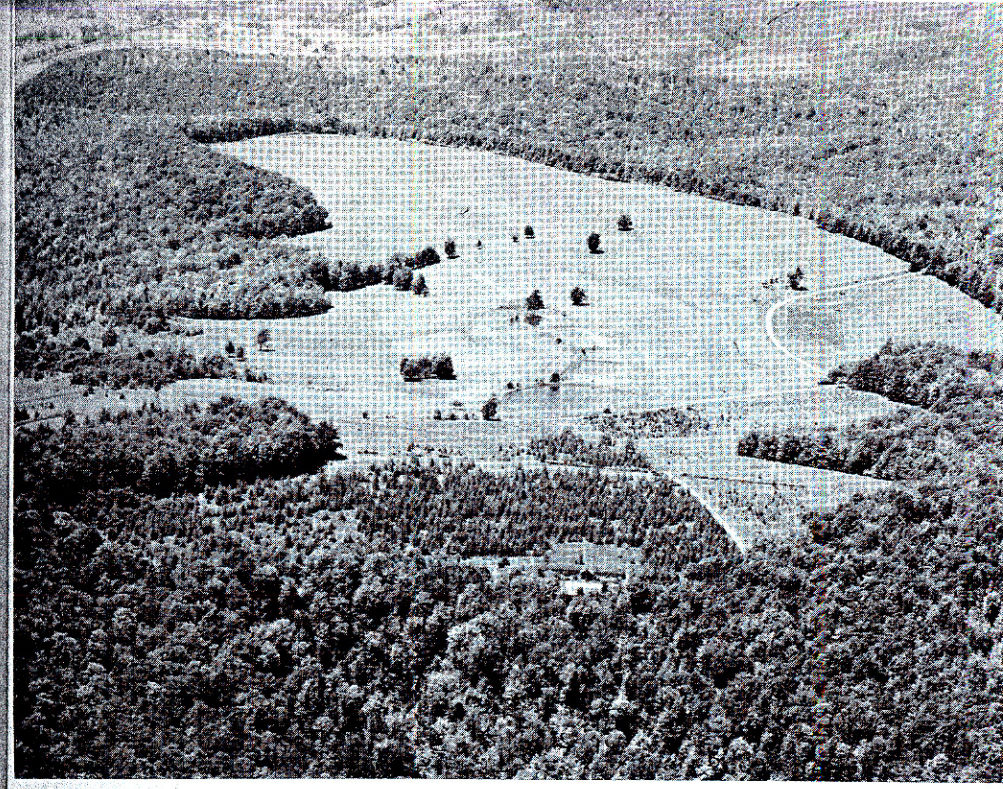
But again, events on the national scene were to reach into the Arnot Forest. A new president was elected, and new programs were begun to employ the millions of unemployed. They introduced a new phase in the history of the forest and became a major landmark in history of conservation.

Civilian Conservation Corps, was opened at the Arnot in 1933 and operated continuously until May 1937. The camp was under the direction of the U.S. Forest Service and administered by the New York State Conservation Department.

Construction began October 3. At its completion 18 barracks and other buildings stood in the headquarters area. The main contingent of 200 CCC men between the ages of 18 and 25 arrived for duty November 29, 1933, under a staff of army officers. The superintendent of the work was H. W. Hobbs, an engineer. The technical foremen, who were mostly Cornell foresters, included W. E. Petty, Abraham George, W. B. Secor, A. D. Quick, W. A. Rieman and D. E. Curtice.

The men went to work immediately. Their projects in the first year were construction of 5.9 miles of truck trails, 1.9 miles of horse trails, 0.9 mile of a foot trail, 8 vehicle bridges, 2 foot bridges, 20.8 miles of boundary surveying, rerunning lines and painting blazed trees, topographic survey of 1,730 acres for a map, 321 acres of forest stand improvement, 2.2 miles of stream improvement, 100 acres of forest planting, 0.3 miles of fire breaks, and construction of gates and landscaping.

The impact of this enormous amount of work was stated in the annual report for 1933–1934: "It is doubtful if the engineering projects could under our ordinary circumstances have been completed in less



The open hill-top lands of the Arnot Forest. These pastures are leased for summer grazing until needed for research. Experimental ponds are in the center distance and the former S.C.S. barn is in the foreground.

than 20 to 25 years. . . . Now that the greater part of the engineering work has been completed, our efforts will be devoted to the problems of stand improvement and of protection of the existing forest."

In following years the CCC workers completed the system of roads and trails, fire breaks, flood-retaining walls and numerous other jobs. They also carried out stand improvement over the whole tract.

In the mid-1930's the Federal Resettlement Administration held large areas of marginal and sub-marginal farm land in Tompkins and Schuyler Counties. The land had gone out of production because it was too wet or too steep for farm machinery, and hay was almost the only crop it could produce. Some of the farmers were descendants of the original settlers and were reluctant to leave. But their sons and daughters found it easier to

get jobs in Watkins Glen and Elmira than to coax a precarious living from the land. The government found it cheaper to buy land and resettle the farm families than to provide mail delivery, road upkeep and school transportation.

Part of the land was needed for the soil erosion experiment station, but the rest offered opportunities for reforestation, a feature the Arnot Forest had lacked. The University applied for a transfer of some of the lands on a 99-year lease for forest planting and other conservation purposes. Negotiations started in 1935, but were not completed until a formal lease was signed February 18, 1939. The University was nevertheless permitted to start some of the development work in 1938.

In 1956 the federal land, a total of 2,092 acres, was permanently transferred to the University. Along with some other purchased land, the acquisition nearly doubled the size of the Arnot Forest to its present size of 4,025.73 acres.

Another accomplishment of the CCC workers was to repair, repaint and move the totem pole to the center of their camp at the southeast corner of the property where the flagpole now stands. The men promptly named their camp newspaper after it.

A project that had been put off for several years was finally undertaken in 1935, the construction of the Forester's Lodge, a building which now serves as the residence of the Forest Manager. The rustic, one-story structure was designed by a University architect and built with the use of CCC labor mostly with funding from the C. Frederick Schwarz bequest. In April 1939, Miss Ida T. L. Schwarz, a sister of C. Frederick Schwarz, gave $500 for the upkeep of the lodge.

In 1934 the University in cooperation with the Soil Erosion Service (later the Soil Conservation Service) established a soil erosion experiment station on Lot 36. The station was one of 17 established across the country for the study of water runoff and erosion in places typical of their area. In 1934 and 1935 plots were laid out in the open, under full forest cover and under partial forest cover to record runoff under varying conditions. Instruments were installed and 2 substantial buildings — one a headhouse for the erosion plots and the other a large equipment storage barn — were erected. In July 1934 the University bought the north half of Lot 36, the Rosak farm, to facilitate the soil erosion research. The purchase increased the acreage of the forest to 1,880 and gave access by road from the west.

While these negotiations affected the size of the Arnot Forest, a decision by the New York State Legislature was to have an equally important effect on the mission of the forest. When the legislature created the State College of Forestry at Syracuse, the Cornell University Board of Trustees ordered all instruction in undergraduate professional forestry discontinued after June 30, 1936.

Two major purposes for which the forest had been acquired — teaching and research in forestry — became minor purposes. The policy of the College of Agriculture was decided at an administrative conference at Schwarz Lodge in 1937: ". . . the Arnot Forest should be made a field station for various conservation works as part of the general conservation program at Cornell University and in particular of the State College of Agriculture."

Activity decreased at the Arnot. But not for long.

The CCC, which had left in 1937, returned in 1939 with a company of workers transferred from Rensselaer County. In the next 2 years, 7,000 man-days of work went into the forest in road maintenance, bridge repair and forest stand improvement valued at more than $22,000.

In 1940 the north half of Lot 14 — 52 acres — was added. It was a key area for the entrance to the headquarters and gave needed control of the area traversed by Banfield and Jackson Creeks just above their junction and of the junction of Jackson Creek with McCorn Creek.

In World War II the federal government requested the use of the CCC camp buildings to house 50 prisoners of war. But they had just arrived when victory was won in Europe and the prisoners were repatriated.

In 1948 the formation of the Department of Conservation within the College of Agriculture became a milestone in the development of the Arnot Forest. Emphasis shifted to multiple use of the forest for research, demonstration, teaching and resource management. Under these categories were 4 different fields of activity: forestry, fish and wildlife management, soil conservation experimentation and general conservation education.

The facilities that make the Arnot a teaching, research and demonstration center have made their impact on the landscape. Most conspicuous to a visitor and a key to its success as a training center are the buildings of "Camp Arnot." The beginning of this training center dates back to 1954 and the vision of several Niagara County sportsmen who were enthused by 4-H agent John Stookey. Under their stimulus the New York State Conservation Council formed a Camp Arnot Development Committee in 1955 with J. Victor Fitchlee as chairman. The camp today is a tribute to success of this committee.

Two special areas of the forest have been dedicated in honor of two former Arnot Forest Directors and outstanding United States foresters. The A. B. Recknagel Research and Management area in lot 51 was dedicated in 1964. Recknagel Road was opened up into this area and a permanent marker and an exhibit display were established. In 1966 a fine grove of managed hardwoods was dedicated in honor of Cedric Guise, the first director of the forest. This grove adjoins Banfield Trail in lot 38.

Many Come to Learn

Cornell Classes[1]

Forestry classes of the old department of forestry used the Arnot Forest extensively, and many Master's degrees theses have been written from Arnot projects. The students who study woodlot management in the current Department of Conservation also make ample use of the Forest. Four half-day field trips per year concentrate on plantation establishment, ecology management, weed or brush control, Christmas tree management, maple syrup production and the general problem of use of abandoned land.

Other classes using the resources of the Forest for field work, particularly, are ornithology and wildlife management.

4-H Leader Training Conservation Camp[2]

The Arnot Forest has been the scene of an unusual activity each August since 1948. This has been the annual 4-H Leader Training Conservation Camp operated as a joint activity of the Departments of Conservation and Agronomy and the State 4-H Club Office.

In keeping with the 4-H philosophy of "Learning by Doing," 4-H boys from all parts of the State have come to the Arnot to learn the theory and put into practice many of the conservation skills needed on their own farms or in their county.

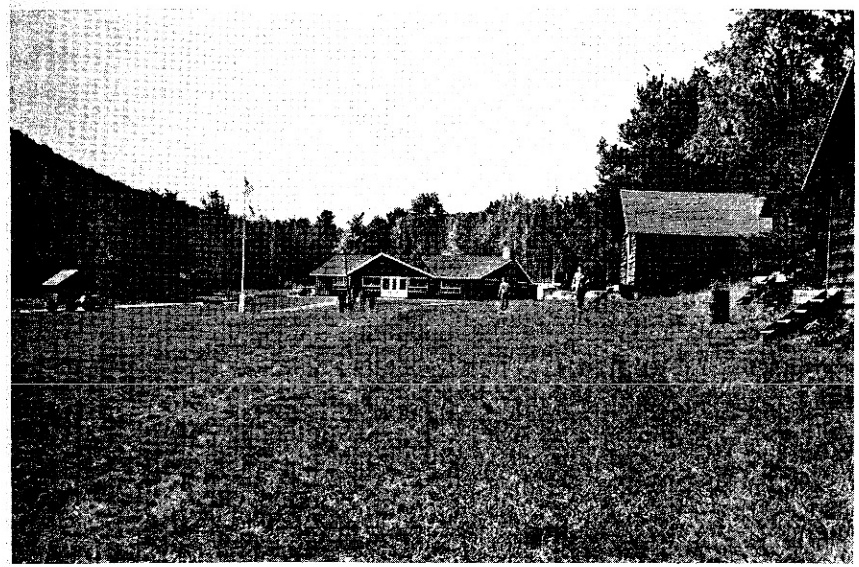
Before the first Conservation Training Camp could become a reality in 1948, the staff involved found themselves not only planning the program but building the camp, too. The old CCC Camp was sold in 1946 with the exception of two storage buildings and the site was bare and rough. Many hot July days were required to re-work existing buildings, re-organize water supplies and build basic facilities for campers. The Farm Labor organization supplied tents, tent platforms, showers, dishes and kitchen equipment — enough to house 50 boys and staff. Over the years, the tents served well until a reservoir of camp alumni and 4-H agents in the counties saw the desirability of developing a permanent camp with permanent buildings.

Educationally, the camp set out to offer three courses: (1) soil and water; (2) forestry; (3) wildlife based on the interest of the participants. Rather than taking a smattering of knowledge in general conservation, each participant chose his prime interest and studied intensively the whole week to learn the skills and theory in that particular field.

In *soils and water* broad studies of the Arnot and surrounding country were made and some years boys laid out, and constructed with heavy

[1] Prepared by Robert R. Morrow
[2] Prepared by Fred E. Winch, Jr.

The first Camp Arnot summer training session for 4-H boys, held under canvas in 1948.



Today the conservation education program has fine summer camp facilities including a central dining facility, 13 cabins, sanitary building, swimming pool, teaching shelters and sports areas.

equipment, diversion terraces needed on the Arnot for water control.

Foresters learned to identify trees, how to operate and care for equipment and to do the needed thinning, log scaling, pruning and other work needed in the normal forest operation.

Wildlife students learned to develop improved habitat for both fish and game, work with trees and shrubs and to trap and skin animals in fur projects.

One test of the education offered here is to see whether the boys, young men in their formative years, return another year for more course work; part is to look at what happens to these prospective leaders. Over the nearly 18 years the camp has been in existence a high percent return to take a course of second choice — forestry one year, soil and water the second. Nearly five percent of the boys attending have returned to take all three courses, some years as high as five have "graduated" from the Arnot Conservation Camp.

A further look at the effectiveness of the camp in developing leaders has been to follow these young men in their work after leaving the 4-H age class (20 years maximum age). Several are successful farmers and lay leaders in their community. Others have gone on for higher education, many in general agriculture, several in forestry and wildlife management. Among the alumni are several county agricultural agents, even more 4-H agents; several on teaching staffs at forestry and agricultural colleges.

The work of the 4-H Camp has involved many people, youths and adults, in contributing to the cause of conservation, and has also expanded the learning of a youngster to cover more than himself alone.

Teachers Conservation Workshop[3]

Teachers Conservation Workshops were first offered at the Arnot Forest in 1950 and they have been an annual occasion every year except 1962. The Workshop is a cooperative arrangement between the Departments of Rural Education and Conservation which along with the Department of Agronomy provide the staff. The normal complement of teachers is fifty per summer.

Field trips, demonstration, lectures, film screenings and evening speakers highlight the four-day Workshop. It is designed to provide teachers with a great many of the facts of conservation and methods for teaching them to others who are concerned about the conservation of our natural resources. The State Education Department granted two units of in-service training credit to participating teachers, until that system of recognition was terminated in 1961.

"School" starts at 8:30 a.m. with a three-hour field trip. After lunch, there is another three-hour field trip which terminates at 4:30 in the afternoon. After classes some of the teachers go fishing or swimming in the farm ponds while others get together for informal discussions of teaching problems. Many find their free time periods good opportunities to learn more about birds, amphibians, plants or how to conduct field trips. Some teachers make leaf, soil or rock collections.

[3] Prepared by Richard B. Fischer

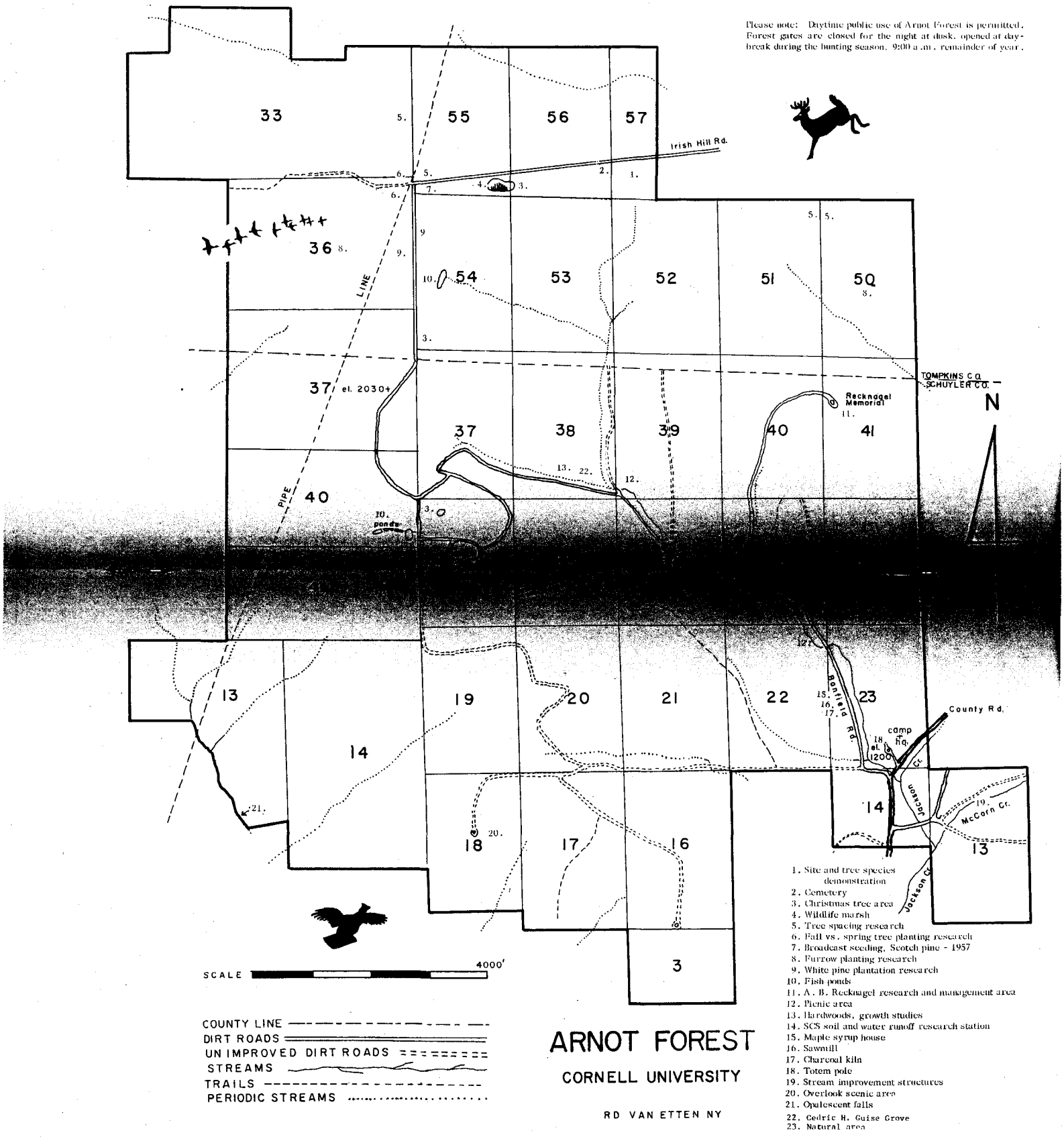
The Arnot Forest is an ideal setting for the Workshop. Its topography, soil associations, and waters, its fields and woodlands, indeed the whole story of man's impact on the area, are all spread out before the teachers to see and comprehend. The Workshop curriculum is divided into four areas: soil and water conservation, forest conservation, wildlife conservation and conservation teaching methods.

The soils of the Arnot, like those of the rest of the State, are glaciated and fall into a variety of categories. As a result of the Ice Age, entirely different types of soil may be found adjacent to one another. This provides unusual teaching demonstrations. Since soil and water conservation have always been acute problems at the Arnot, the various conservation measures that have been put into practice make it possible for the teachers to see conservation in action.

The waters of the Arnot Forest range from swampy areas to ponds and streams and offer unique teaching opportunities. For example, the artificial wildlife marsh suggests the enormous wildlife potential of such a habitat and ponds teeming with interesting aquatic life demonstrate the important role farm ponds play in soil and water conservation. A small stream — McCorn Creek — adds another dimension for instruction. There the teachers see the conservation improvement practices that have been put in by the 4-H youth working under the Cornell staff.

The forested areas of the Arnot Forest are typical of many cut-over unmanaged woodlands of New York and Eastern United States. The big problem is how to improve such forest stands and how to develop them to reach a sustained yield operation. Thinning, cutting, and actual logging are all carried out at the Arnot and teachers who come to the Workshop have an opportunity to see how important these silvicultural practices are in producing good forests. The forest research activities are equally interesting to the teachers since they involve such a range of investigations, including site studies, growth studies, Christmas tree plantations and maple syrup production. The great variety of forest trees on the Arnot Forest aids in teaching tree identification.

The variety of wildlife at the Arnot ranges from the very smallest of mammals to some of the very large ones and includes both the game and non-game species. All the problems of wildlife — food, cover, water and breeding places — are there. Not only do the teachers get a good grasp of the problems of wildlife, but they learn at the same time how man is able to manipulate their habitats in


Please note: Daytime public use of Arnot Forest is permitted. Forest gates are closed for the night at dusk, opened at daybreak during the hunting season, 9:00 a.m., remainder of year.
33
55
56
57
Irish Hill Rd.
36
54
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LINE
37 el. 2030+
TOMPKINS CO.
SCHUYLER CO.
N
Recknagel Memorial
37
38
39
40
41
PIPE
40
10. ponds
13
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21
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Bentley Rd.
County Rd.
camp rd.
el. 1200
14
21.
18
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17
16
14
Jackson Cr.
McCorn Cr.
13
3
SCALE
4000'
COUNTY LINE
DIRT ROADS
UNIMPROVED DIRT ROADS
STREAMS
TRAILS
PERIODIC STREAMS
ARNOT FOREST
CORNELL UNIVERSITY
RD VAN ETTEN NY
1. Site and tree species demonstration
2. Cemetery
3. Christmas tree area
4. Wildlife marsh
5. Tree spacing research
6. Fall vs. spring tree planting research
7. Broadcast seeding, Scotch pine - 1957
8. Furrow planting research
9. White pine plantation research
10. Fish ponds
11. A. B. Recknagel research and management area
12. Picnic area
13. Hardwoods, growth studies
14. SCS soil and water runoff research station
15. Maple syrup house
16. Sawmill
17. Charcoal kiln
18. Totem pole
19. Stream improvement structures
20. Overlook scenic area
21. Opalescent falls
22. Cedric H. Guise Grove
23. Natural area

order to increase their numbers. The teachers develop new understandings of such matters as management versus stocking, why certain forms are present and others are not. In addition, they learn how to tell what kinds of animal life are present by interpreting the various signs and traces that animals leave.

Other Groups[4]

A wide range of groups, other than teachers and 4-H conservation leaders, have used the facilities of this unique outdoor laboratory. A list of them would include public school and college classes, Scout troops and 4-H Clubs, sportsmen, camp counselors, lay leaders in a host of natural resource-related organizations, and professional workers in numerous fields. The past 15 years has been a time of marked growth in the use of the property for education, general and highly specific, formal and informal. This growth is in direct response to widening interest in natural resource conservation and has been intensified by the steady increase in the variety and quality of Arnot demonstrations and improvements in essential facilities required to accommodate visitors. This period has also been a time rich in experimentation in educational programs and activities that offer strong evidence of the truly exceptional quality of teaching resources and opportunities available at the Arnot Forest.

Land-use change in New York State, particularly in the post-World War II years, has brought the opportunity to enlarge the Extension Service's educational programs in the natural resources fields. This expansion has been occurring steadily and in many counties county agents devote a significant amount of time to programs in woodlot forestry, wildlife conservation and soil and water management for both commercial farmers and non-farm audiences. As a result, a concerted in-service training effort was called for and has come about to strengthen the background of the agents. Field instruction at the Arnot Forest figures prominently in this program.

Currently, training programs for county agents of several days duration are held at the Arnot at least every two years. In intervening years, 4-H Club agents are present for a session patterned to meet their needs to lead and teach in what also is an expanding aspect of their total program. Groups of new county agents who now routinely come to Cornell for a three-week subject matter training program for their first three years of employment, are also brought to the Forest for portions of the natural resources segment of their school.

The field demonstrations relating to woodlot forestry are used most often, particularly an especially effective demonstration of the varying influence of internal soil drainage on the survival and growth among the several species of conifers used here in reforestation and Christmas tree production. Some types of training schools may be conducted more efficiently on a regional basis, but no other location in the State has such a wealth of natural resource demonstration and research at one site, or so many professional instructors only a short distance away.

The Arnot Forest in 1951 was the site of the initial three-day session of New York's Sportsmen's Conservation Workshop. This marked the beginning of applying the concept of in-depth field-oriented training for the informal leaders of our statewide sportsmen's organization, the N.Y.S. Conservation Council, and its county and local affiliates. The concept has also been applied in numerous one-day regional or county workshops and is enjoying parallel success in the Province of Ontario.

This State workshop, an event which purposely is held in a different location each year, convened at the Arnot Forest in 1951, 1955, 1964, 1969 and 1970. The wealth of teaching situations, both on the Forest, and within easy touring distance, made it possible to present an entirely different program each year. Important timely topics included: small watershed management, lake trout fisheries, trout stream problems, public and commercial outdoor recreation development, woodlot forestry topics, plant succession on retired farmland and many more.

Since about half of the 50 or more sportsmen attending the workshop each year are repeaters, and unusually well informed leaders, planning has been underway for some time toward a different event to serve the newcomer to responsibility in a conservation organization; a basic program to be repeated annually for a different audience. September 1963 marked the start of a new program — a two-day lay-leader training event emphasizing ecological principles basic to natural resource management. Attended by 30 leaders from sportsmen's clubs, soil conservation district boards, planning bodies and other groups, it promises to become another of the annual educational offerings at the Arnot Forest.

The Scientists Search for Answers

Soil and Water Conservation[5]

The year 1934 marked the start of cooperative soil and water conservation research at the Arnot. Equipment for measuring run-off and erosion was established on plots under widely different vegetative cover and cropping systems. Some of these measuring structures still stand.

Cooperators in this new research venture were the Soil Erosion Service, U.S. Department of the Interior and the Cornell University Agricultural Experiment Station. All Federal activities pertaining to erosion research and demonstrations on agri-

[4] Prepared by Harlan B. Brumsted

[5] Prepared by George R. Free

cultural lands were soon to be brought together under the Soil Conservation Service, U.S. Department of Agriculture. Years later, most of the research functions were transferred to the Bureau of Plant Industry, and finally into the Agricultural Research Service, U.S. Department of Agriculture.

The Arnot area is typical of millions of acres of the Allegheny Plateau in southern New York and northern Pennsylvania. The erosion plots, mostly 1/100-acre in size, were located on the hill-top far above the present conservation campsite. The soil is Bath very channery (meaning many thin, flat stones) silt loam. Many other plots and a few watersheds were soon made a part of a comprehensive research program in the Arnot area.

A substantial part of the labor for plot and watershed installations was furnished by WPA and CCC workers.

The first plots were ready to collect runoff in May 1935. On July 7 and 8, 1935, a flood-producing storm of eight to ten inches over a wide area in Central New York caused many tragic and expensive demonstrations of erosion and flood damage. The Arnot was on the southern fringe of this storm, with a rainfall of about three inches.

The selective nature of erosion on the stony Bath soil was soon evident. About 95 percent of the soil washed from the plots was fine enough to pass through a ¼-inch screen, whereas only one-third of the plow layer would pass through the same screen.

Emphasis during the early days was on erosion and its control, but it was soon apparent that crop yields benefited from moisture conserved by erosion control practices such as contouring and strip cropping.

With an increasing interest in water resources and efficient water management, there was a need for data on peak flows and water yields on a small watershed basis. Complete year-round records were obtained from two 18-acre watersheds during the years 1941–47, and peak flow data were obtained over a somewhat longer period. More than 50 percent of the average annual runoff from this somewhat poorly drained soil occurred during March, April and May. This contrasted sharply with the time of maximum erosion which invariably occurred later in the season during thunderstorms of high rainfall intensity.

The first farm pond at the Arnot was constructed in 1944, and by 1949 there were eight ponds of various sizes. These were soon stocked with either trout or bluegill and bass. With water stored in ponds, and with aluminum irrigation pipe, it became possible to start experiments to determine the benefits of supplemental irrigation for potatoes and pasture.

Yields for well fertilized, nonirrigated and irrigated potatoes averaged 400 and 452 bushels per acre, respectively. Pasture plots were irrigated at different levels of fertilizer and lime. While irrigation was of some benefit, it was concluded that

for this soil and climate, fertility was the most important factor limiting pasture yields. Yields of forage at the Arnot were raised to an average of four tons of dry matter per acre by fertilizer and lime alone.

Among the research activities undertaken on a limited and less formal basis was the construction of diversion terraces at one or two locations on larger cropped areas. Another was the planting of various old and new varieties of shrubs to furnish food for wildlife. Survival, growth and production were evaluated periodically.

The original erosion control plot studies were not terminated until 1954. In 1946–47, corn yields on the stony Bath soil, despite liberal fertilization under uniform treatment, ranged from 17 to 88 bushels per acre, depending upon past management and erosion during the preceding 11 years. Even in 1954, the ninth year of continued uniform good management, including fertilization, rotation, and low rate of additional erosion, corn yields ranged from 71 to 93 bushels per acre, with the yield pattern still definitely associated with differences in past management and erosion.

Wildlife Conservation[6]

The Arnot Forest has been an area of major interest for wildlife research to the New York State Conservation Department and to Cornell University, because it is in the Southern Tier of New York. Historically, the Arnot property is typical of Southern Tier hilly forest and farmland which has been heavily used, and then abandoned for half a century. Cornell's foresters have used the "old Arnot" which has been entirely lumbered and burned over for the development of the best methods for transforming a poor second-growth forest into a productive one.

Ruffed grouse. Likewise the Arnot is invaluable for studies on the relationships between forest and wildlife management in this section of the State. During the mid-thirties the State Conservation Department conducted a very intensive ruffed grouse research program on Connecticut Hill, almost adjacent to the Arnot property. To compare winter populations of grouse on two adjacent areas, the first wild game inventory of the Arnot was made in 1936 by Frank C. Edminster. Throughout January 1936 Edminster, using manpower available from the CCC camp, carried out a complete ground census of ruffed grouse over the 21 lots (1900 acres) of the "old Arnot." Notes were kept on other wildlife species, particularly white-tailed deer, predators and minor game species. The results of this survey are available in an unpublished report. They indicate that at that phase of its history, the Arnot Forest was rich in grouse and potentially was highly productive of deer. Deer were just beginning to increase in suitable habitat throughout the Southern Tier, after being almost

[6] Prepared by Oliver H. Hewitt

eliminated because suitable habitat was lacking. The report states that the ruffed grouse population on the Arnot was approximately 105 birds, and that the deer population consisted of about 16 animals.

Studies of the wildlife populations and their use by sportsmen were initiated in 1948. Lawrence S. Smith, a graduate student in wildlife management using a sampling method called the "King strip census" estimated that a grouse population on the "old Arnot" increased from about 140 in midsummer to 300 in early October. Since this study wildlife classes at Cornell have used the same method for annual estimates of grouse numbers. The results from early October counts have varied from 60 (1953) to 300 (1960), and have shown that grouse populations fluctuate over a rather wide range and with a fair degree of predictability.

White-tailed deer. The white-tailed deer, a species which traditionally has attracted a very high concentration of hunters, has also attracted the researchers' attention. In 1936 Edminster's estimate of deer at the Arnot was about 16 animals (five or six per square mile). Fourteen years later the harvest of deer in the same area was about 16 per square mile. The deer population from which this harvest was obtained was probably twice this figure. To reduce this high and rapidly increasing deer herd, the State permitted the harvest of anterless deer on the last day of several seasons, beginning in 1950. Each "doe day" has brought hundreds of hunters, both expert and novice, to the Arnot. On the last day of the 1956 season, when anterless deer could be legally taken, members of the wildlife management class kept individual notes on the number of shots heard throughout the day. Checking stations at the two points of entrance to the Arnot permitted accurate figures on number of hunters and harvest. A total of 300 hunters, operating on about six square miles throughout the day, harvested 74 deer, but fired the incredible total of 2,150 shots.

Techniques are still developing to provide information on density of deer populations in relation to food available. These are particularly needed in late winter, when the capacity of the habitat is at its lowest. During the CCC period, the lot boundaries had been marked by posts placed at all lot corners, and at intervals of five chains along boundaries. These posts helped in establishing transect lines for grouse census, and in locating plots for study of vegetative changes.

Selective browsing. In 1951–52, research by another graduate student, Warren H. McKeon, provided data on the effects of selective browsing by deer. His experimental plots were located in lot corners, so that it was possible in 1955 for another student, Anne LaBastille, to secure similar data in the same plots. She then compared the long-time effects of browsing by deer on reproduction of forest trees and shrubs and related

these observations to a program of forest-wildlife management. The contrast was sharply drawn. In 1951 the browse was heavily eaten, indicating a deer population far too great for the capacity of the range. By 1955, however, the effects of the several "doe day" hunting seasons in reducing the population were evident. A reasonable balance between deer and their food production had been established.

Farm ponds.[7] Although there are now some 20,000 farm ponds in New York, one of the first to be constructed anywhere in the State was the one-acre Boyce pond, built at the Arnot Forest in 1944. It is a long, narrow pond that sits off by itself near the bottom of a hill in Lot 54. Between 1947 and 1950 seven more ponds were built, all in Lots 36 and 40.

Each of the ponds was stocked with fish soon after it was built. By 1950 the Arnot ponds figured prominently in a farm fish pond research program, by Cornell's Department of Conservation, with financial assistance from the New York Conservation Council, the State Conservation Department and several Federal agencies.

The objectives of this research were to meet the rapidly increasing public demand for practical methods of managing New York farm ponds for producing trout, bass, and other species for fishing and eating, and bait minnows for sale to fishermen. A series of research projects that spanned 15 years and eventually included some 200 farm ponds in Central New York State fulfilled these objectives. The results have been published in series of articles for popular consumption, extension bulletins for pond owners, and scientific papers for biologists.

Over the years, the eight Arnot ponds have been involved in nearly all of the different kinds of fish experiments conducted, and in demonstration and instruction for the various groups of youths and adults who come to Camp Arnot each year. Collectively, experimental histories of these ponds give a representative panorama of the entire farm fish pond research program. Several of them have been used to assess the growth and survival of various kinds of trout (including brook x brown trout hybrids), the possibility of gravel beds placed in spring seepage areas to permit trout spawning in ponds, and the life span of trout in these impoundments. One brown trout in the Pine Tree pond attained the relatively advanced age of six years. He was measured at 18½ inches and weighed three pounds. Because of their high elevation, Arnot ponds maintain cool summer water temperatures and as a result tend to have better-than-average trout survival.

Five of the ponds have been used principally for experiments involving warmwater species or combinations such as largemouth bass, or bass in combination with golden shiners or

[7] Prepared by Alfred W. Eipper

bluegills. One of the string of four small quarter-acre ponds, stocked in 1952 with a three-way combination of bass, bluegills and yellow perch, made ecological history by its stability. All three species grew and reproduced throughout the ensuing seven years of observations. Yellow perch are often notorious "weeds," yet in this pond, while they were always present in moderate numbers, the total weight of perch never exceeded five pounds.

Another of the quarter-acre ponds was used successfully in a test of commercial minnow-raising. It was stocked with 500 adult silvery minnows in May 1955. In late September of the same year two hauls of a fine-meshed seine yielded 7,500 minnows, including a large portion of salable size.

Forest Conservation

In addition to those forestry research projects already mentioned as part of history, there are a number of more current projects.

Forest pathology.[8] The Arnot Forest provides an exceptional opportunity for the investigation of certain types of tree diseases. As an example, the so-called "Nectria Canker" of basswood was found to be present and destructive in the forest at the time it was acquired by the University. Little was known at that time about this disease of forest trees, especially about the relation between cut wood and stumps from diseased trees and infection of healthy trees.

Basswood trees with canker infections were cut at intervals throughout the year, and monthly examinations were made of the cut parts to determine the behavior of the fungus pathogen. At the end of the two-year study it was possible to predict how the treatment of cankered trees, by felling, lopping of branches, leaving in place or removal from the area, might reduce the hazard of this disease in the remaining trees.

More recently, studies on "Maple Decline" have involved artificial defoliation, the manipulation of environment to produce drought conditions, and other treatments calculated to shed light on the cause and nature of this obscure malady. Evidence obtained in this work has supported the theory that the maple trouble is due to a peculiar combination of environmental factors rather than to a single agent or pathogen.

Both of the above studies required that trees of considerable size be sacrificed in order to obtain the desired results. It was also necessary that experiments once started should be undisturbed for many months. Such ideal conditions were found in the Arnot Forest.

Forest plantations.[9] Most of the northern part of Arnot Forest is abandoned farm land. Too poor for agriculture, what about tree plantations? Research both on and off the Forest has shown that much of this land is also too poor for economic tree growth either because of poor drainage or too much brush. Often the poorer land is also the most brushy since it was abandoned first. Nevertheless, some land is potentially good for trees with proper management techniques and brush control. Thus the prerequisite for a good plantation is selection of a site suitable for the species desired, as well as knowledge of the growth potential of each species.

Many experimental plantings were made at Arnot Forest in the early 1950's. Larch, red pine and Norway spruce often were planted in adjoining rows or blocks on similar soils. The difference in early growth of these species is most striking. In one typical experiment near the cemetery in lots 56 and 57, eleven-year-old Japanese larch, red pine and Norway spruce were respectively 29, 15 and 10 feet tall on a good deep soil. On an eroded soil of medium depth they were respectively 28, 10 and 3 feet tall, and on a very poorly drained soil only spruce survived well. It is apparent that all three species need deep soils, while the spruce also needs a soil fairly rich in nutrients. It is also apparent that larch is much the fastest grower in youth; the best larch tree is 37 feet tall at age 13.

Once the proper species is matched to the proper site, the spacing of the trees is most important. Close spacing of 6 × 6 feet improves quality somewhat, but planting and thinning costs may be excessive. A number of accurately spaced plantings of larch, pine and spruce were made in 1950 and 1951, and the following guide for planting in medium and good soils was made partly as a result of these plantations.

Species	Markets available for		
	Lumber, poles pulp, posts	Lumber, poles	Lumber only
	Spacing in feet for planting		
Larch	6 × 10	8 × 12	10 × 12
Red pine	6 × 10	8 × 10	8 × 12

Management of the plantation doesn't stop here, however. Weeding out of hardwoods, pruning of selected crop or sawlog trees, continuous thinning as needed throughout the life of the plantation, and finally harvest of useful crops of pulpwood, poles and logs follow in order.

The Recknagel Memorial Management Forest dedicated on August 29, 1964, has already contributed information on management. A grassy knoll when Professor Recknagel selected it as a planting site 25 years ago, the forest now has some trees 45 feet tall and 10 inches in diameter.

[8] Prepared by Donald S. Welch

[9] Prepared by Robert R. Morrow

Five plots in Lot 41 have been marked out in this stand of planted red pine, the crop trees have been identified with a band of blue paint and pruned, and various degrees of thinning have been done in the different plots.

Maple syrup. The year 1956 marked the beginning of a new and most successful enterprise at the Arnot Forest — maple syrup. Although maple trees were small and scattered on steep hillsides, it was reasoned that new research might show the way for a profitable operation. The sugarhouse was completed in 1956 and sap was first collected and boiled into syrup in 1957.

That first year was a memorable one for those who gathered the sap by hand and carried it either to a dumping station on the hillside or down the bank to the waiting truck. They became strong and fit from the hard work, even though the wage returns for their labor was only a little over a dollar an hour.

Sap from 700 tap holes was boiled in the wood-fired evaporator. The first year's production matched the State's average of one quart of syrup per tap hole, but syrup quality sometimes suffered because of inexperienced workers. Nevertheless hundreds of people were attracted to this "new" and fascinating operation, and the Arnot was then committed to continued research and demonstration in maple production.

Plastic tubing was first used in large amounts in 1958, a year of extremely heavy snowfall. Because most of the tubing was in place before the heaviest snowfall and in time to collect the earliest runs, Arnot production exceeded the State average by about 50 percent. The tubing greatly reduced the most difficult job of gathering sap and provided the first big breakthrough toward a profitable operation.

In later years tubing was used more abundantly and more efficiently. Four hundred more tap holes were added from areas accessible only with tubing. In 1960 vacuum pumps were first used to keep the sap flowing through tubing on uneven slopes and during "weeping flows" on warm days. Now 90 percent of the sap is collected through tubing and two-thirds of it under vacuum.

Other studies were concerned with labor and equipment costs, the efficiency of hardwood fuel and quality control. A lot of equipment is needed and a lot of labor is expended before a drop of syrup can be made. Therefore, it is important to catch every run and make top quality syrup. Early tapping and the use of vacuum have increased the amount of syrup. In 1962 paraformaldehyde "pills," placed in the tap hole in the tree, were first used to reduce growth of microorganisms which are the principal cause of dark color and poor flavor in syrup, as well as the cause of premature drying of the tap holes. Also, sap flows are boiled within 24 hours when possible and equipment is continuously cleaned throughout the season.

The evaporator was first fired by oil in 1964 and the steady heat helped produce a better quality syrup. Aluminum covers and a special steam pipe now eliminate steam and keep the sugarhouse clean and dry. All of these steps have so improved quality that by 1964 over 90 percent of the syrup was graded light amber — the best. This was accomplished even though the sugar in the sap averaged less than two percent and 47 gallons of sap were needed to make a gallon of syrup.

In less than a decade of syrup making at Arnot Forest, research has made possible the following gains:

- Number of trees tapped increased by about half
- Production per tap hole increased by nearly a quarter
- Syrup quality increased by about a third
- Labor per tap hole halved
- Wage returns nearly doubled

Even more important, many maple producers in the State have made similar gains by application of new ideas and techniques from research. As a result, New York now rivals Vermont as the leader in maple syrup production.

Wood preservation.[10] In Lot 23, behind the central camp building and in Lot 14, across the Jackson Hollow Road are a series of five fence post "graveyards." Various types of artificial wood preservatives are being tested. The posts are installed in test plots on soils with different drainage characteristics and include untreated posts as checks. The first posts were set out in 1955 to test a series of preservatives known as Osmosalts. Additions help to evaluate other preservatives or new ways of putting the chemicals into the wood. Each year a 50-pound pressure is applied to these posts, 18 inches above groundline, and the extent of wood failure noted.

Woodchucks provided an interesting sidelight to this investigation when they began to gnaw on some of the posts. So tasty did they find copper sulphate and sodium hydroxide in a double diffusion process that it was eliminated from the test. (This method of treatment was developed by Dr. John Ayers of the Department of Conservation as a successful way of rendering wood resistant to marine borer attack). In other treatments woodchuck damage varies with species, and is not serious.

Wood utilization. The Arnot Forest consists primarily of immature second-growth hardwood stands originating from cutting or fire, and young plantations planted on former farm land. As such, it is typical of some seven million acres of forested Allegheny Plateau. Possibly the major forestry problem facing the owners of this plateau forest is the lack of profitable outlets for the trees which should now be removed from these second-growth stands and plantations in thinnings and improvement cuttings. Consequently, some attention has been devoted to ex-

[10] Prepared by Lawrence S. Hamilton

ploring methods of utilizing these immature trees at the Arnot Forest.

Wood chips, fireplace wood, charcoal and fence posts, picnic tables and benches, and Christmas trees were among the outlets tried for the thinnings. A wood-chipping machine converts tops, saplings and young pole-sized trees up to six inches in diameter into fragments which are useful as mulch, livestock bedding, poultry litter and soil amendment at costs ranging from $3 to $13 per ton depending on the type of material and efficiency of wood handling.

Strapping and bundling one-half cord units did not increase the efficiency of this operation significantly because of (a) problem of bundles loosening during the seasoning process necessitated extra labor in retightening, (b) the round bundles reduced the payload capacity of the truck used for delivery.

Production of charcoal from seasoned hardwood thinnings in a small, portable kiln has proved profitable. After poor experience with a cinderblock kiln, a metal kiln was fabricated, patterned on one designed by Stuart Wheeler, county forester at Cooperstown. This has been in operation since the spring of 1963. Production is averaging 572 pounds of high quality charcoal per cord of wood. This material is bagged and sold locally. The wholesale price is so low that there is no large margin of profit left over to assign to stumpage value for the trees, but it does cover the costs of making the thinning so that the benefits from thinning "ride free."

Larger immature trees suitable for sawing have been processed in the Arnot sawmill and used for bridges and miscellaneous construction on the Forest. Some of the material has been made into the rustic benches and picnic tables which are seen on the property. Plans for these benches and tables are available.

Many landowners in New York have become producers of plantation Christmas trees as a hobby or a service business venture. They have sorely needed management advice from the Extension Service. Consequently a few plantations of Douglas-fir, white and Norway spruces, Scotch and Austrian pines have been devoted to Christmas tree management demonstration. One particularly interesting plantation of Scotch pine at the intersection of Auger Hole and Irish Hill Roads originated from direct seeding.

Tree improvement. In 1956, in cooperation with researchers at Rutgers and Penn State, a search of the three states of New York, New Jersey and Pennsylvania was made for "mother" trees of Scotch pine having markedly desirable or occasionally undesirable characteristics as Christmas trees. Seed was collected from these to form the basis for a one-parent progeny test to be established at nine locations throughout the various forest regions of the three states.

One of these locations is a well-drained hillside on the Arnot Forest

near the site of the old Rozak farmstead. The plantation was established in 1959 and contains 35 seed source offspring, replicated three times, with the final evaluation occurring in 1964 for needle length, needle color, height growth, branch angle, lammas shoots, number of branches per whorl, branch overlap, stem form, taper, male and female flowering and needle retention. The relative influence of environment and heredity is becoming apparent from information from all locations. This plantation will be converted to a seed orchard of trees with desirable characteristics for Christmas tree farming.

A second seed source study was established in the spring of 1964 involving 12 known sources of Douglas-fir from collections made in the American and Canadian West. The experimental design and measurements are similar to those for the Scotch pine, and this plot has a counterpart at Cornell's Biological Field Station on Oneida Lake.

Chemical debarking. The earliest work in chemi-peeling in New York State was conducted at the Arnot Forest. In 1951 tests were begun to find chemicals and methods of application to ease bark removal over an extended peeling season, and to test the response of various species to such treatment. It was soon apparent that sodium arsenite was the most effective chemical and that the "hatchet-and-oil-can" technique was best suited for most situations. Subsequent investigations of the insect and fungi hazard following chemi-peeling were conducted and reported on. Most of the work in chemi-peeling and other tests of arsenicals using different methods of application for simply chemi-thinning have been conducted in Lot 33 east of Birch Road.

Chemoforestry.[11] With the widespread use of 2, 4-D and 2, 4, 5-T starting in the early 1950's, chemoforestry has come into its own. Much research, principally in chemi-thinning hardwoods, has been done at Arnot Forest starting in 1949. In 1959 the Forest was the scene of research and demonstration of chemoforestry techniques for the annual meeting of the Society of American Foresters. The day's most spectacular demonstration was the actual airplane spraying of brush in a ten-acre pine plantation in a matter of minutes.

The principal knowledge gained from the Arnot chemi-thinning research is that, unlike oaks and most southern hardwoods, our beech, maple and most other hardwoods require a complete frill of overlapping axe cuts for good kill. In recent years good results have been obtained in plantation weed control by mistblowing hardwoods in August when pine and spruce needles are relatively dormant and little affected by the spray. In 1963 and 1964 the new chemical Tordon was tested extensively. Preliminary results indicate it to be so superior to 2, 4, 5-T that the latter

[11] Prepared by Robert R. Morrow

may soon be like the old Model T Ford. However, Tordon is very harmful to conifers and probably will find little use in Christmas tree or other plantations. Thus progress continues in chemoforestry and the Arnot Forest will continue to play its part.