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EARLY DEVELOPMENT OF THE LONGEAR SUNFISH, *LEPOMIS MEGALOTIS* (RAFINESQUE)

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ABSTRACTS

Eggs and larvae of the longear sunfish, *Lepomis megalotis,* were collected from nests in the Clinch River in Tennessee. Eggs averaged 1.7 mm in diameter and were demersal and adhesive. Larvae, devoid of pigment, hatched at 5.1 mm total length (TL). Lack of finfold development or stomodeum, a straight urostyle, and a large ovoid yolk sac characterized protolarval longear sunfish. Pectoral fin buds were present at hatching. The yolk sac was absorbed between 7.3 and 7.6 mm TL. The mesolarval phase began between 6.6 and 7.2 mm; the metalarval by 11.8 mm TL. Longear sunfish attained the juvenile period by 14.2 mm TL. Longear sunfish differed from other lepomids as to the size at hatching, swim up size, state of finfold differentiation at given sizes, and body depth.

INTRODUCTION

Previous life history studies of lepomids, as well as most other freshwater fishes, have omitted descriptions of larval stages. While Fish (1932), Morgan (1951), and Larimore (1957) provided the early accounts of lepomid larvae, Meyer (1970), and Anjard (1974), Taubert (1977), and Buynak and Mohr (1978) studied and compared the larvae of several lepomids. Taber (1969) provided the only original material on development of the longear sunfish, *Lepomis megalotis* (Rafinesque). The purpose of this study is to report posthatching development of the longear sunfish from the Clinch River in Tennessee.

MATERIALS AND METHODS

Between 2 June and 19 June 1978, eggs and larvae of the longear sunfish were collected from a backwater quarry located about 200 meters upstream of Norris Dam on the Clinch River in Tennessee. They were collected from nests with a slurp gun and transferred to plastic bags for transport. Nest guarding males were identified and photographed.

Eggs were hatched and larvae cultured in aquaria and in plastic mesh screen baskets suspended in a flow-through raceway supplied with aerated springwater. Water temperatures in aquaria were between 19.5 and 21.5 C. Raceway temperatures ranged between 22 and 25 C. Brine shrimp and wild zooplankton were offered daily as food. Specimens were collected daily, preserved in 10 percent formalin, and later transferred to buffered five percent formalin. A series of 398 specimens was catalogued as TV815, DS-19 in the reference collection of the Larval Fish Identification and Information Center, Tennessee Valley Authority, Norris, Tennessee.

Morphometric and meristic data were recorded utilizing a stereomicroscope equipped with an ocular micrometer and polarizers. Characters examined were: total length, urostyle length, preanal length, postanal length, head length, numbers of preanal and postanal myomeres, and number of fin rays. The method of counting myomers follows Hogue et al. (1976). Finfold development, pigmentation patterns, squamation, and body morphology were noted. Unless otherwise noted, all measurements (in MM) given in the text are total lengths. Terminology utilized is that of Snyder (1976) with reference to Hubbs (1943).

RESULTS

DEVELOPMENT

Eggs. Near hatching eggs averaged 1.7 mm in diameter (range 1.6 to 1.8 mm for five individuals). Eggs were demersal and slightly adhesive, and most were coated with fine debris. Live eggs were light yellow with a single oil globule.

Protolarvae. Selected meristic and morphometric data for larvae are given in Table 1. Larvae averaged 5.1 mm (range 5.0 to 5.2 mm) at hatching. The head of newly hatched larvae was decurved over the yolk sac, and no stomodeum was present. Otic vesicles were visible, but otoliths were not. The urostyle was straight. Larvae had a yellowish ovoid yolk sac with a single oil globule located posteriorly and dorsally near the forming gut. The lateral line placode had already migrated to the caudal fin base. At hatching the median finfold originated dorsally at the eighth preanal myomere and was present around the urostyle ventrally to the yolk sac. Pectoral finds were present.

By one day posthatching (5.5 to 5.9 mm), the head was in line with the body axis, mouth was open, and otoliths were forming (Fig. 1a). By 6.5 mm, the urostyle had upturned slightly and the hypural complex was forming. Pectoral fins were broad-based flaps on the anterior dorsum of the yolk sac.

Except for iridiphores around the eye lenses, larvae lacked pigment at hatching. By late protolarval stages, the dorsum of the yolk sac, tissue exterior to the cleithrum, cheek behind the eye, and gill arches were pigmented,

TABLE I. *Selected morphometric and meristic characters examined for the longear sunfish, Lepomis megalotis*

Size Class	Number of Specimens	Mean Total Length (Standard Error)		Percent Total Length (Range)						Modal Number (Range) Preanal Myomeres		Modal Number (Range) Postanal Myomeres	
				Preanal Length		Head Length		Greatest Body Depth					
5.00- 5.20	2	5.2	(.08)	46	(46)	14	(14-15)	26	(26)	14	(14)	18	(18)
5.50- 6.49	5	5.8	(.14)	44	(42-46)	15	(13-17)	29	(28-31)	14	(13-14)	18	(17-18)
6.50- 7.49	5	7.1	(.10)	45	(41-47)	22	(20-26)	19	(18-20)	14	(14)	16	(16-17)
7.50- 8.49	4	7.8	(.09)	44	(42-46)	23	(22-24)	20	(19-21)	14	(14)	16	(15-16)
8.50- 9.49	5	9.0	(.15)	45	(39-48)	25	(25-26)	22	(21-24)	14	(13-15)	16	(14-16)
9.50-10.49	5	10.0	(.13)	45	(45-46)	25	(22-27)	21	(20-23)	13	(13-14)	16	(14-16)
10.50-11.49	5	10.9	(.11)	46	(45-48)	27	(26-29)	23	(21-25)	13	(13)	15	(14-15)
11.50-12.49	5	12.1	(.11)	45	(44-47)	28	(27-29)	24	(23-24)	13	(12-13)	14	(14)
12.50-13.49	5	13.1	(.15)	45	(42-48)	28	(26-29)	24	(23-25)	13	(13-14)	14	(14)
13.50-14.49	5	14.1	(.09)	47	(42-46)	30	(29-33)	24	(23-24)	13	(13)	13	(13-14)
14.50-15.49	5	15.2	(.10)	44	(42-46)	28	(26-30)	25	(24-25)	13	(12-13)	13	(13)
15.50-16.49	5	15.7	(.08)	45	(44-45)	28	(26-31)	24	(23-25)	*		*	
16.50-17.49	5	17.1	(.09)	45	(44-46)	27	(25-29)	25	(24-26)	*		*	
17.50-18.49	5	18.1	(.11)	43	(42-44)	28	(27-29)	25	(24-26)	*		*	
18.50-19.49	5	18.9	(.13)	44	(43-45)	27	(25-28)	25	(24-26)	*		*	
19.50-20.49	5	19.8	(.13)	44	(40-46)	27	(25-27)	28	(28-30)	*		*	

Mesolarvae. The mesolarval phase began between 6.6 and 7.2 mm with the formation of caudal rays (Fig. 1b). By 8.0 mm, tte caudal fin became progressively truncated and was distinctly bilobed. An adult complement of caudal fin rays was present by 8.8 mm.

By 7.2 mm, local widenings of the median finfold revealed the positions of the dorsal and anal fins. Ray formation began in both fins between 7.2 and 7.6 mm (Fig. 1c). Dorsal and anal fins became completely separated from the caudal fin (Fig. 1d) between 8.8 and 9.1 mm.

By 8.8 mm, two anal spines and an opaque area revealing dorsal spine formation in the dorsal finfold were apparent. Between 11.5 and 12.2 mm, the third anal spine became discernible, and the spinous dorsal fin was completed. By 8.0 mm, pectoral fins were well developed, and rays were apparent by 8.8 mm. Pelvic fins appeared as crescents at 8.5 mm and as wide-based flaps by 8.8 mm. Three or four pelvic rays were present by 11.7 mm.

Larvae absorbed the yolk sac between 7.3 and 7.6 mm (six to seven days posthatching). Brine shrimp and zooplankton were present in the post gut well before all yolk was absorbed. When viewed from the ventral perspective, the gut was thick and muscular with a left hand bend. Gill rakers were blunt knobs on the arches. Well formed, recurved teeth were present on upper and lower jaws. The air bladder had begun to fill. Larvae were at the "swim up" stage.

The dorsum of the head had four or five large chromatophores by 7.4 mm (four days posthatching) and thereafter became densely pigmented. A double row of melanophores was present along the dorsum from the head to the middle of the soft dorsal fin by this length and to the caudal fin base by 8.8 mm. A dorsal spot was apparent at the base of the caudal fin by 9.9 mm.

Ventral pigmentation by 7.4 mm consisted of a double row of melanophores extending posteriorly along the peduncle from the anus. Two or three large chromatophores were situated on the dorsum of the gut at the anus. Between 7.8 and 9.1 mm (six to eight days posthatching), a distinct ventral patch of melanophores, varying from a triangular shape to an elongate concentration, formed and persisted into the metalarval phase. A midlateral line of chromatophores was present from the incipient air bladder to the caudal peduncle by 7.4 mm.

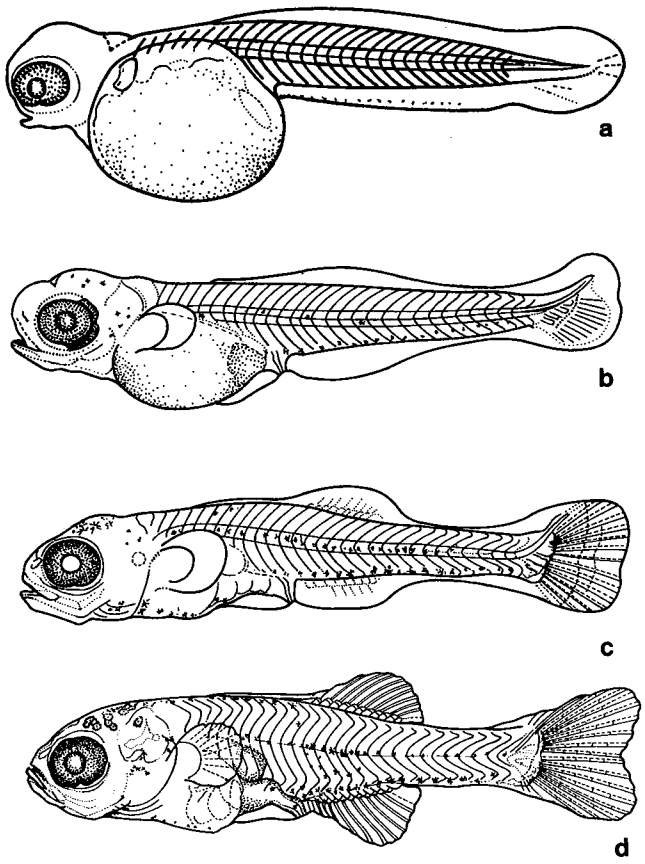

FIGURE 1. *Longear sunfish, Lepomis megalotis a. Protolarva 5.5 mm; b. Mesolarva 7.0 mm; c. Mesolarva 7.2 mm; d. Mesolarva 9.1 mm.*

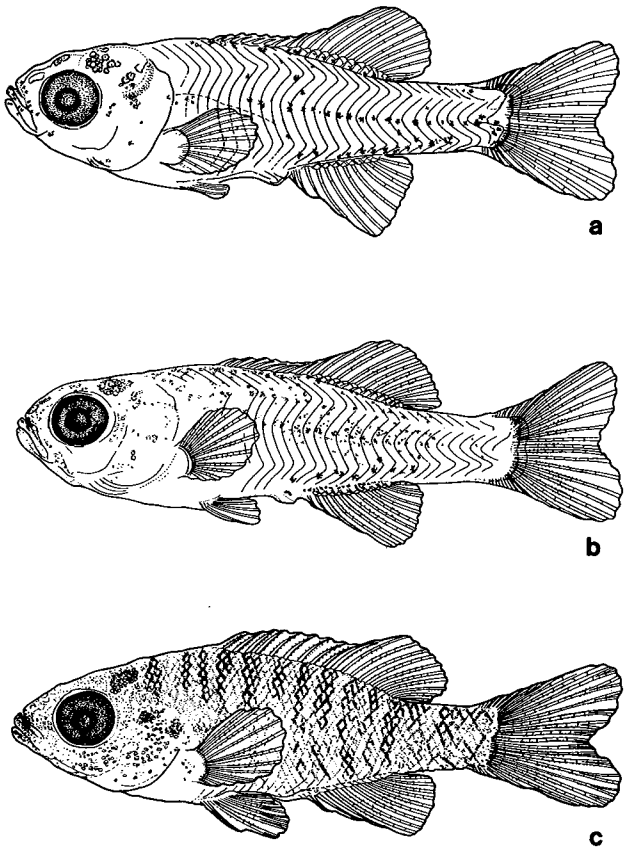

FIGURE 2. *Longear sunfish, Lepomis megalotis a. Metalarva 11.9 mm; b. Juvenile 14.2 mm; c. Juvenile 21.0 mm.*

Metalarvae. The metalarval phase began by 11.8 mm (Fig. 2a) when the adult complement of soft fin rays was attained in the dorsal (10-13) and anal (9) fins. At 12.4 mm the adult complement of pectoral fin rays (14) was attained. Pectoral fins remained blunt throughout development. The median finfold disappeared by 13.6 mm. Pelvic ray development was completed by 14.2 mm, marking the transition to the juvenile period.

Scattered melanophores were present along the flanks by 13 mm. Dorsal, anal, and caudal fins were pigmented to the edges, but the pectoral and pelvic fins were unpigmented at 11.7 mm. A forked patch of concentrated pigment was present on the opercle, posterior to and even with the ventral edge of the orbit by 11.9 mm.

Juveniles. During the juvenile period (Fig. 2b) the body depth increased, giving the already robust fish a deeper appearance. Between 17.8 and 18.3 mm, larvae began to assume the typical adult deep-bodied outline. The major body depth increase was from the nape to the posterior edge of the soft dorsal fin. Gill rakers on early juveniles (14.2 mm) were moderately long; length was at least two times the width. By 31 mm, the gill rakers were relatively short and wide in relation to the growing arch and were not yet the typical adult form. A wide based opercle flap was present by 17.5 mm. The flap did not elongate to adult form until the larvae were larger than 31 mm.

Squamation began at 15.7 mm along the midlateral line of the caudal peduncle and rapidly progressed forward along the posterior half of the lateral line. By 17.9 mm, scales were present forward to the cleithrum along the midline. The dorsum and ventrum of the peduncle were fully scaled. The belly began to develop scales by 21.3 mm. By 22.3 mm, the opercle and nape were completely scaled. The last body area to develop scales was the breast. Squamation of the breast proceeded from anterior to posterior, the first scales forming near the isthmus.

Lateral pigmentation increased throughout early juvenile development. Except on the breast, the largest cultured specimens examined (31 mm) were heavily pigmented everywhere. Nine to twelve lateral bands (Fig. 2c) were present by 17.3 to 21.0 mm. Bands first appeared dorsal to the midlateral line between the anus and posterior edge of the anal fin. Fusion of bands, especially below the spinous and soft dorsal fins, started dorsally. These lateral bands were in some instances narrower, while in other cases they were wider, than the intervening spaces. By 19.8 mm, a conspicuous dark

pigment spot was present on the opercle flap. Pectoral fins were "stitched" and the pelvic rays were only sparsely pigmented by 31 mm.

Discussion

Ten species of *Lepomis* occur in the Tennessee River system (D. A. Etnier, unpublished data). Complete larval series of six of these species (*L. auritus, L. cyanelius, L. gulosus, L. macrochirus, L. megalotis,* and *L. microlophus*) were obtained for comparative studies by the author. Reports concerning larval development of these species varies drastically in content. Werner (1966), Anjard (1974), Taubert (1977), and Buynak and Mohr (1978) discussed characters presently used to separate larvae of various lepomid species. However, some of the characters utilized (e.g. myomers counts, pigmentation patterns) are tenuous when applied to specific identifications of larvae from the Tennessee River system.

The species most closely resembling the longear sunfish in larval development is the redbreast sunfish, *L. auritus*. Several distinguishing characteristics of development are apparent. Anjard (1974) assumed a hatching size of 2.5 to 4.0 mm for longear sunfish. The length at hatching for this longear sunfish cohort averaged 5.1 mm (range 5.0-5.2 mm). This length is greater than the 4.6 to 5.1 mm reported by Buynak and Mohr (1978) for redbreast sunfish from the Susquehanna River in Pennsylvania, or the 4.3 to 4.8 mm for a series of redbreast sunfish reared by the author from broodstock collected in the Holston River in Tennessee. Green sunfish (Taubert 1977), warmouth (Larimore 1957), pumpkinseed (Anjard 1974), and bluegill (Morgan 1951) hatch at even smaller sizes. Larvae of the redear sunfish, *L. microlophus* cultured by the author hatched at 3.6 mm (range 3.3 to 3.8 mm).

"Swim up" length for the longear sunfish (7.3 to 7.6 mm)was less than that reported for the redbreast sunfish by Buynak and Mohr (1978), and B. L. Yeager (unpublished data), 7.6 to 8.2 mm and 7.6 to 7.8 mm, respectively. However, this length was larger than reported by Larimore (1957), Taubert (1977), and Meyer (1970) for other lepomid species. As Taubert (1977) recognized, "swim up" size may vary substantially within a species.

Prolarval longear sunfish are characterized by precocious caudal fin ray development (Taber 1969). The longear sunfish was more precocious in the development of all fins than the redbreast. Mesolarval redbreast sunfish have already absorbed the yolk sac. Late prolarval warmouth have weak fin ray development in the caudal fin (Larimore 1957); however, warmouth are mesolarvae by 5.3 mm. Redear sunfish are also mesolarvae by 5.3 mm, longear sunfish by 6.6 to 7.2 mm, and redbreast sunfish at 7.8 mm. Pelvic fins are also not apparent on warmouth until beyond 8.8 mm (Larimore 1957), by which size longear sunfish already had paddle-like pelvic fins.

Buynak and Mohr (1978) reported the presence of pelvic fin rays by 15 mm for redbreast sunfish from the Susquehanna River in Pennsylvania. Some specimens of redbreast sunfish from the Holston River, Tennessee, as small as 11.2 mm and most by 12.5 mm had pelvic fin rays. Pelvic fin rays appeared in the longear sunfish larvae by 11.7 mm. Because pelvic fin development was only slightly precocious in longear sunfish, this character is of little use in identifying longear or redbreast sunfish larvae in this length range.

From the late mesolarval phase to the early juvenile period, redbreast sunfish larvae are more robust than longear sunfish larvae. Differences in head, body, and peduncle depth were readily visible in metalarvae and early juveniles. Cultured laboratory specimens of both species showed this characteristic difference.

The gut of the mesolarval and metalarval longear sunfish was not as massive as that of the redbreast but was thick and muscular. Mesolarval and metalarval longear sunfish had an elongate patch of small melanophores along the venter similar to that of redbreast sunfish. This character superficially distinguishes these two species from other mesolarval and metalarval lepomids. Green and redear sunfish may also have pigmentation of this pattern, but it is less dense.

Longear sunfish attained the juvenile period at about 14.2 mm, a much shorter length than reported by Buynak and Mohr (1978) for the redbreast (19 mm) or by Larimore (1957) for the warmouth (15.7 mm), and a greater length than those reported by Taubert (1977) for the green sunfish (11.7 mm) or by Meyer (1970) for the redear sunfish (9.8 mm).

The use of gill raker characteristics (Pflieger 1975) or relative width of lateral bands to intervening spaces (Taber 1969) to distinguish early juvenile lepomids may lead to misidentifications. The gill rakers of longear sunfish are relatively slender and long until beyond 31 mm; thereafter, they assume the relatively blunter appearance of the adult. In general, the lateral bands of juveniles are wider than intervening spaces. However, many early juveniles less than 31 mm had lateral bands narrower than intervening spaces.

Acknowledgments

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HISTORY OF THE UNIVERSITY OF TENNESSEE ARBORETUM SOCIETY

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ABSTRACT

The following is a brief history of the University of Tennessee Arboretum Society from its inception through January, 1980, with some mention of the individuals who were instrumental in its development.

THE BEGINNING

The ideas of an arboretum for Oak Ridge existed in the minds of several people long before it became a reality. One such person was Alexander Hollaender of the Biology Division, Oak Ridge National Laboratory. As early as 1948 when Hollaender, Charles Congdon, Don Foard, and others hiked in the Cumberlands on Sunday mornings, they discussed the possibility of an arboretum for Oak Ridge where hiking and a scientific study of plants could be combined. The Biology Foundation had some money received from fees for consultation and lecturing and Hollaender hoped to interest the University of Tennessee in supplementing this money and establishing an arboretum. The Biology Division, however, did not involve itself in an arboretum and the Biology Foundation money was not used toward the purchase of land. But an effort had been made and the idea of an arboretum had crystallized.

At about this time, another group working on the same idea was composed of University of Tennessee officials. Subsequently in August, 1961, the specific basis for action occurred when the University acquired 2,260 acres of forested land near Oak Ridge from the United States Department of Health, Education and Welfare for use in teaching, research and demonstration. The site on which an arboretum was to become established was accurately described in an early brochure published by UT before the Arboretum was opened to the public. It says, in part . . . "Prior to the early 1940's . . . the area was heavily farmed. Virginia Pine and Shortleaf Pine now cover most of the old fields, but Yellow Poplar and some Black Walnut are found on sites in these fields where the soil is better. The rest of the Arboretum is laregly second-growth Oak and Hickory forest in what was originally Oak and Chestnut forest".

A COMMITTEE IS FORMED

In April 1962 a committee from the University met for the purpose of establishing an arboretum; at that time a recommendation was made by A. J. Sharp that the committee request a portion of the University of Tennessee Oak Ridge property to be designated for arboretum use. Committee members B. S. Pickett, Royal Shanks, Nathan Hall, Walter Herndon, J. S. Kirby-Smith, Evvind Thor, and Merrill Bird unanimously approved Sharp's recommendation. Accordingly, in December 1962 a proposal for development of an arboretum was forwarded to John Ewing, Dean of the UT Agricultural Experiment Station. The proposal outlined certain objectives ". . . To establish a collection of woody plants adapted to the climate of Tennessee . . . to utilize and expand existing plant groups and preserve such areas as have special values for ecologic study . . . to provide space for a collection of mutants of woody plants . . . Development of the arboretum should be in the hands of one individual directly responsible to the Director of the Experiment Station. A satisfactory office, laboratory and assembly building with the necessary herbarium space and library should be erected . . ."

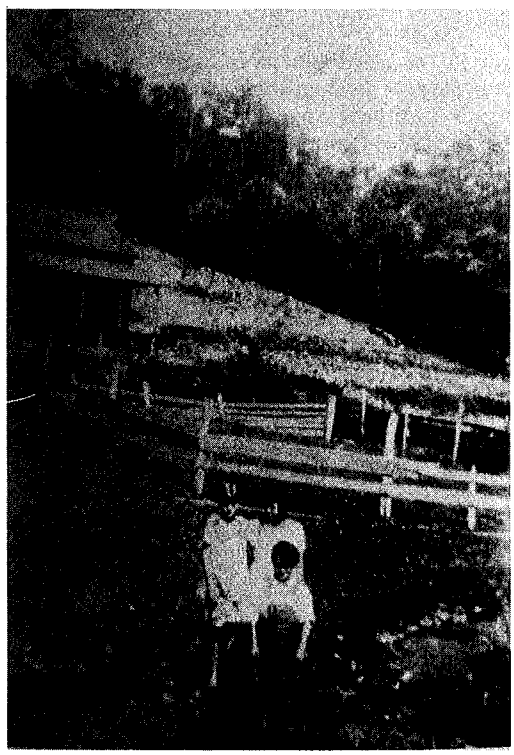

FIG. 1. *Old homestead once located in the present Magnolia breeding orchard area.*

So, the idea of an arboretum did actually become fact, as noted in The Oak Ridger of April 1964, "The UT Forestry Department has started work on an Arboretum, a place where trees and shrubs are grown for scientific and educational purposes." At this time the UT Forestry Department expanded from a two-year to a four-year program and John Barrett became head of Forestry. Robert MacDonald, assistant professor in Forestry, became Arboretum Director. His first office was an abandoned guardhouse near Solway Bridge.

Now that the Arboretum was a reality, the time was right

for an arboretum society in the community, a friends-of-the-arboretum group similar to the groups supporting other arboreta in this country.

In February 1965 efforts were underway to form an active, non-profit organization for the purpose of furthering the development of an arboretum. At the suggestion of Bob MacDonald, Director, a committee was formed to set up such an organization. A meeting for this purpose was held on February 27, 1965. Acting as coordinator was Alexander Nowicki, City Planner for Oak Ridge. Those in attendance were: Evan Means, Clinch-Powell Valley Association; F. R. Bruce and H. D. Smith, Boy Scouts; David Campbell, Anderson County Conservation Board; B. M. Robinson, AEC; Robert P. Ball, Oak Ridge Memorial Park; Eleanor DuBois, Helen K. Lewis, Julia Moore, members, and C. M. DuBois, President of the Smoky Mountain Hiking Club; Ruth Davis, Oak Ridge Garden Clubs and Girl Scouts; L. R. Phillips, Kiwanis; Julia Hoppe, Campfire Girls; John Clark, Oak Ridge Chamber of Commerce; A. R. Nowicki, City Planner; A. A. Foster, Grace Foster, John Selfridge, and J. D. Amundson, interested citizen. UT personnel in attendance were: B. S. Pickett, Horticulture Department; E. E. C. Clebsch and H. R. DeSelm, Botany Department; Robert MacDonald, Forestry Department. A. R. Nowicki was appointed temporary chairman; Evan Means, temporary secretary.

Naming the Society

At the next meeting, March 20, 1965, the purpose and goals of an arboretum society were discussed. The Society was to be named the University of Tennessee Arboretum Society (UTAS); proposed goals were to be the following: Publication of an Arboretum Bulletin; establishment of undergraduate scholarship funds; establishment of graduate assistantships; organization of work and/or study groups to develop certain areas of the Arboretum; fund-raising; information service. Eugene Joyce was appointed chairman of charter and by-laws; Don McKay, nominating chairman; and A. R. Nowicki, promotional chairman.

A meeting was held on April 20, 1965, to receive the charter of incorporation as a non-profit organization and to elect officers. Those elected to office were: Alex Nowicki, President; Charles Mahoney, Vice-president; Eleanor DuBois, Secretary; George Gerhart, Treasurer. Recognition was taken of the Society's primary purpose for which specific actions and goals had already been established, namely: to promote interest and participation in the study and enjoyment of trees, shrubs, and other plants. Membership at this time was eighty people. A complete list of Arboretum officers from 1965 through the present is found in Table 1 in the Appendix.

The beginning years of UTAS in 1965-66 were active ones. The Society began many programs which have continued to the present time. In March 1966 a Newsletter was sent to the membership; the first of twenty-two subsequent Newsletters designed to keep each member informed of UTAS activities. It carried news of the first general meeting, open to the public, which was followed by guided tours of the Arboretum. Over two hundred eighty five people came. Another program was begun when the first of thirteen Bulletins was published and sent to the members in the summer of 1965. The first Plant Sale was held on June 18, 1966, as a fund-raising project. The Plant Sale funds were to become the means of financing the summer student employment program. In 1966, David Rugh, a Maryville College student, became the first of ten students who have participated in this program.

The period of 1965-66 brought many encouraging developments at the Arboretum. Better office space than the guardhouse became available when Robert Ball, UTAS Trustee and a stockholder in the Memorial Park Cemetery, offered temporary use of half of the cemetery building; a 1955 half-ton pickup truck was bought with UTAS funds; plant materials valued at over a thousand dollars were donated to the Arboretum by the Tennessee Nurseryman's Association. A system for maintaining a computerized list of plants in the Arboretum was introduced by UTAS research assistant, Margaret Olson.[1]

The Legislature Appropriates Funds

June 1966 was especially eventful for the Arboretum. The UT Board of Trustees asked the state legislature to appropriate $200,000 for an Arboretum and Agricultural Conference Center with provision of money to upgrade and improve roads, construct bridges, and build a residence for the Arboretum Director.

Arboretum progress during 1966-67 included the construction and planting of a Muscadine Grape arbor which was designed and planted by Bob and Mary Smith and sponsored, in part, by the Oak Ridge Pilot Club; the construction of a plastic greenhouse; and of a foundation for a potting shed. The nucleus of a collection of rare dwarf plants was acquired when Bob MacDonald[2] brought them back from a tour of arboreta he made in conjunction with his presentation of an invited paper to the International Horticulture Congress. A dwarf conifer house was designed at this time by Shirley Yuille,[3] who also supervised the plantings.

UTAS activities in 1966-67 and the principal members who participated were the following: work on the grounds—Bruce Lamond, Margaret Peterson, Louise Taylor, Helen Warren, and Donny Williams; welcome to visitors; Charles Mahoney, Helen Lewis, Bob and Mary Smith, and Katherine Stelzner. The second Plant Sale was pronounced a "rousing success . . . some $200 worth of plants were sold." Summer students, financed, in part, by plant sale funds were Allen Coggins, Mike Countess, Carol Macklin, and David Rugh.

July 1967 stands out in UTAS history. At that time, a policy change with regard to the Arboretum was announced by the UT Agricultural Experiment Station officials. Formerly, the project outline for the Arboretum (1964) had made provision for a broad, interdisciplinary program incorporating the objectives applicable to botany, forestry, and horticulture. The new policy limited the objectives of the Arboretum program to one which was forestry-oriented. This raised a question concerning what would be the future role to be filled by UTAS.

Another important date in the Society's early history was February 1968. It was then that UTAS president, Ed Clebsch, announced to the Board of Directors that effective March 15, Bob MacDonald was resigning as UT Arboretum Director to accept the Directorship of the John J. Tyler Arboretum at Lima, Pa. A month later, March 1968, James S. Kring, UT Forest Manager, was placed in charge of the Arboretum.

By June 1968 some of the growth and transition problems for the Society began to be resolved. This was reflected at the annual meeting when John Barrett read a memo from John Ewing, Dean of the Agricultural Experiment Station. Ewing's memo stated the objectives of the Arboretum to be the following: to establish a collection of trees, including mutants and those plants having commercial value as forest species from which materials may be obtained for breeding and propagation; to provide a place open to the public where individuals or groups may study the forest associations which are adapted to the environment of Tennessee. The memo outlined the ways by which the Society could support the effective operation and contnuing development of the Arboretum. These ways were principally that of providing personnel to keep the Arboretum open to the public on Saturdays and Sundays and to guide visitors on tours of the Arboretum. The Society also could provide scholarships for graduate students; aid in the preparation of a National Science Foundation grant proposal; give assistance with the dwarf conifer house and with the two nurseries.

The year 1970 was one of consolidation and progress. The Arboretum at that time was comprised of several miles of foot trails and roads maintained for public use, and of over 2000 labeled plants representing 600 species. The office was moved from the cemetery to the Arboretum grounds. The new office was a potting shed salvaged by Bob and Mary Smith from the old guardhouse that had been the first Arboretum office.

UTAS volunteers kept the Arboretum open to the public on weekends during May, June, and July; guided tours were led by Lenore Gundlach, Margaret Peterson, Bill Rainey, and Mary Smith; UTAS funds provided for UT graduate students to keep the Arboretum open on Fall weekends. Two successful plant sales were held in March and in May with Bob and Mary Smith as chairmen. UTAS history achieved a milestone in 1970 with the publication of the Children's Trail Guides. The material for the guides had been compiled by Carol Macklin, summer student; edited by UT professors, Ed Clebsch and A. M. Evans and by Bessie Huffman, Principal of Elm Grove School; illustrated by Caroline Weaver; and printed by Mary Ann Gibbons.

The year 1971 was a quiet, progressive year for UTAS. The

history of the Society was requested by the Oak Ridge Historical Society for inclusion in the Archives list at the Public Library where histories of all the major organizations are to be found. The Arboretum was kept open to the public on weekends by Allen Coggins, who also gave talks to several garden clubs, as did Bill Rainey.

A Plan For a New Office Building

The year 1972 brought a number of items of good news. In the summer, John Barrett announced that UT representatives had selected the Knoxville firm of Cooper and Perry, architects, to draw up plans for an Arboretum office building. The UT Forestry Department in cooperation with the University Engineer were developing detailed floor plans for the building. September brought a change in administration for the Arboretum. Richard M. Evans became Superintendent of the Oak Ridge Forestry Stations and Arboretum upon the retirement of James S. Kring. Also at this time, a reorganization at UT placed the forestry experimental property under the management of the Forestry Experiment Stations within the UT Agricultural Experiment Stations. In November, when Richard Evans met with UTAS Board of Directors, he reported on plans for the new building and for construction of new roads.

Public recognition of the Arboretum came in two forms in the Spring of 1973. Arboretum Trails were designated as part of the Tennessee Recreation Trail System and public visits to the Arboretum were encouraged by the Knoxville Arts Festival and the Melton Hill Council of Garden Clubs. Arboretum projects completed during 1973 were the development of a rock garden and the publication of a visitor's guide to birds in the Arboretum. These were the work of James Morton, summer student.

The UTAS Summer Bulletin of 1974 carried good news: "The most exciting thing now happening at the Arboretum is the construction of a new Forestry Stations and Arboretum Headquarters building."

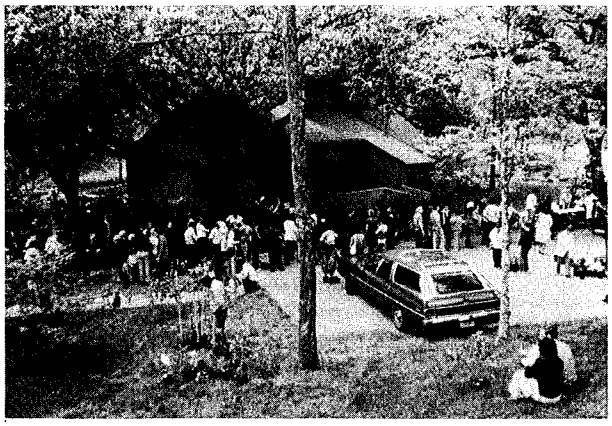

FIG. 2. *The Forestry Experiment Stations and Arboretum headquarters building constructed in 1975 was an immense improvement in services to visitors. The building is shown here with the annual UTAS spring plant patrons.*

The Arboretum in October 1974 was designated for the first time as the location for the annual Forestry and Arboretum Field Day. This event is held every fall by the UT Agricultural Experiment Station at one of the six Forestry Field Stations. 1974 brought development of another trail to the Arboretum. Robin Hitner, 1974 summer student, designed and constructed the Lost Chestnut Trail which is built around the life and death of American Chestnut trees. The major UTAS program for members was a special Bonsai presentation held in cooperation with the Tennessee Valley Bonsai Society. Bill Rainey coordinated the program which was open to the public.

Dedication of A New Arboretum

The year 1975 was really outstanding in the history of UTAS. The official dedication of the new Arboretum and Forestry Headquarters building was held on November 19, with UTAS providing refreshments. Principal speakers at the ceremonies were E. J. Boling, UT President; Webster Pendergrass, Vice-President of UT Institute of Agriculture; and Keith Bissell, Floterial Representative. Speeches briefly reviewed the history of the Arboretum and reminded those present that an arboretum is "a place where native and exotic trees and shrubs are cultivated for scientific and educational purposes." Richard Evans conducted visitors through the new building and UT vans carried visitors around the grounds. Tour guides from UT were J. Barrett, Head of Forestry; E. Buckner, Associate Professor of Forestry; D. B. Williams, Head of Ornamental Horticulture and Landscape Design; Hendrik van de Werken, Associate Professor of OHLD; and A. J. Sharp, Professor of Botany.

Arboretum development at this time included some 250 acres, with 80 to 85 acres mapped for public visitation. There were nearly eight miles of roads and two and a half miles of trails maintained for public use. Over two thousand plants had been labeled; these represented 750 species and varieties. The new building, landscaped by the Arboretum staff according to a design proposed by D. B. Williams and Hendrik van de Werken, was a demonstration of effective use of native plants in the home landscape.

FIG. 3. *Visitors brave the elements to participate in the many programs at the Arboretum. Over 20,000 people annually visit the Forestry Experiment Station and Arboretum.*

This was indeed an eventful time in the history of UTAS! The Society had raised funds by means of plant sales and membership dues in order to supply furniture for the library, superintendent's office, and conference room in the new building. In addition, the Society had provided books for the Arboretum library.

The years 1976-77 brought a number of changes to UTAS. The Spring-Summer Bulletin, with its cover picture of the dedication of the new building, was the last of the UTAS Bulletins to be published. The Society had found them beyond the resources available. The Plant Sale became the responsibility of Lenore Gundlach upon the retirement of Bob and Mary Smith who had been associated with the sale since 1966 and chairmen since 1970. For the first time, UTAS shared the cost with UT of a graduate assistantship. The recipient was Roberta Patey. The investigation for her thesis, "Identification of Preferred Landscape as an Initial Step in Developing Guidelines for Mapping the Scenic Quality of Forest," was performed at the Arboretum under the direction of Richard Evans. Roberta was also a summer student employee in 1975 and again in 1976 along with Roger Steed. In these years the tours were conducted by UTAS volunteer guides Jane Akers, Lois Good, Betts Higgins, and Margaret Peterson. This successful program was reduced by UTAS when the revised Trail Guides published by UT made self-guiding tours possible. On special requests UTAS volunteers continue to conduct guided tours. In 1976-77 UTAS sponsored a series of public lectures. D. B. Williams presented lectures on the problems encountered in landscaping home grounds in Tennessee. A. J. Sharp gave an illustrated lecture on the

subject of endangered plants. Another change for UTAS in 1977 came with the retirement of Bob Smith after almost ten years as treasurer of the Society, and eleven years as a member of the Board of Directors.

March 1978 brought the initiation of a new UTAS program when the first issue of a News Bulletin was published with Lois Good as Editor. This new publication combined the former publications of Newsletter and Bulletin into a short form designed to keep UTAS members informed, on a regular basis, of activities and business of the Society. The public lecture program was continued in 1978 with Duncan Callicott, Director of the Tennessee Botanical Gardens at Cheekwood, speaking about public gardens and arboreta. The 1978 Plant Sale offered a new feature; D. B. Williams was present to help the public with questions of plant identification, with problems concerning plant culture, and suggestions for use of plants in the landscape. UTAS was unable this year to finance the summer student program. It was fortunate that the TVA Young Adult Conservation Corps (YACC) program was able to provide personnel to help at the Arboretum. Another new event was initiated in 1978. The first annual Fall Walk was cosponsored by UTAS and the UT Arboretum. It included guided walks to observe birds and other wildlife, trees and shrubs, landscape plants and wildflowers. UTAS served refreshments.

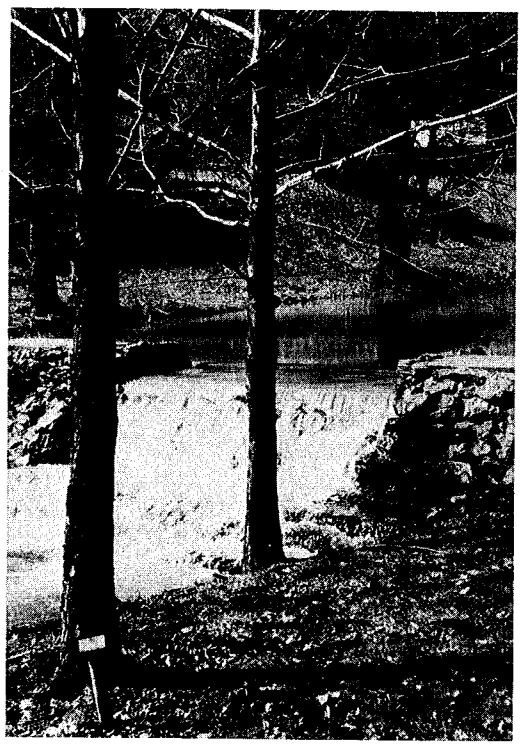

FIG. 4. *The hills, woods, streams and other natural features of the property provide an attractive setting to which the plant collections were carefully added.*

The Municipal Airport Threat

The year 1978 held much tension because the Arboretum area was being threatened by developers wanting the site for a municipal airport! During the summer of 1978 public forums were held to discuss possible sites in the Oak Ridge area where an airport could be built, but in September the Oak Ridge City Council announced its choice of the Chestnut Ridge site on the UT Forestry Experiment Station and Arboretum. UT announced its refusal to sell the land and emphasized the importance of the research being conducted on the area. UTAS President, George Eckerd, sent an urgent letter[4] to all UTAS members alerting them of the threat that an airport would be to the Arboretum. A public forum was held in April 1979 on the issue of an airport on the UT research land. The meeting was sponsored by the Tennessee Citizens for Wilderness Planning. Tennessee Native Plant Society Representative Bob Farmer spoke against locating an airport on the Chestnut Ridge site; Richard Evans, Superintendent of the Forestry Station and Arboretum, said that "an airport at Chestnut Ridge would disrupt the University's education program there, and even threaten its existence."

The year 1979, nevertheless, saw UTAS continuing its activities while the fate of the Arboretum remained in balance. Once again the Plant Sale was a success and again the public was offered advice on plants and on landscaping. UTAS was again able to help with the summer student program; the student selected with Jenny Mercer, a UT graduate in wildlife and fisheries. A new fund-raising project was initiated with the sale of Arboretum T-shirts. In October the Arboretum was again the location for the UT Annual Forestry and Arboretum Field Day; UTAS served refreshments for this event as well as for the second annual Fall Walk.

In the closing days of 1979, petitions were circulated among the voters of Oak Ridge in an effort to give the citizens of Oak Ridge an opportunity to vote for or against the building of an airport. The effort was initiated by the UT Arboretum Society, The Tennessee Citizens for Wilderness Planning, and the Tennessee Native Plant Society. These organizations also made public a map pointing out the impact of the proposed airport on the research programs of the UT Forestry Experiment Station and Arboretum. Thus 1980 began with the future of the Arboretum very much unsettled, although a hopeful note appeared in January when UTAS sponsored the premier of Richard Evans' program, "The Arboretum—A Place for all Seasons."

Appendix

TABLE 1. *Officers of the University of Tennessee Arboretum Society 1965-80*

Year Elected	President	Vice-president	Secretary	Treasurer
1965	Alex Nowicki	Charles Mahoney	Mrs. Charles Dubois	George Gerhart
1966	Charles Mahoney	Edward Clebsch	Nancy Ellis	George Gerhart
1967	Edward Clebsch	Lenore Gundlach	Catherine Johnson	Catherine Johnson
1968	Harold Byck	Lenore Gundlach	Emogene Pate	Bob Smith
1969	Harold Byck	Bill Rainey	Emogene Pate	Bob Smith
1970	Bill Rainey	Betsy Ellertson	Emogene Pate	Bob Smith
1971	Bill Rainey	Betsy Ellertson	Jo Ann Hall	Bob Smith
1972	Mike Countess	Larry Landau	Jo Ann Hall	Bob Smith
1973	Leone Gengozian	Mark Robinson	Jo Ann Hall	Bob Smith
1974	Leone Gengozian	George Eckerd	Jo Ann Hall	Bob Smith
1975	Leone Gengozian	George Eckerd	Jo Ann Hall	Bob Smith
1976	Ed Phares	Mark Robinson	June Peishel	Bob Smith
1977	Ed Phares	George Eckerd	Larry Landau	Anne George Dobbins
1978	George Eckerd	Larry Landau	Betts Higgins	Anne George Dobbins
1979	George Eckerd	Larry Landau	Lois Good	Anne George Dobbins

Members who have served one or more terms on the Board of Directors:
Ben Adams, Howard Adler, Jane Akers, Stanley Auerbach, Robert Ball, Eunice Begun, Aubrey Bradshaw, Allen Coggins, H. R. DeSelm, A. Murray Evans, Rima Farmer, Frank Galyon, Jack Gibbons, Ralph Hall, Jo Henderson, John Hill, Tom Hill, Lennie Jeffreys, Mary Beth Klepper, Jody Krause, Hugh Long, Joe Marasco, John Million, George Moore, Ruth Moore, David Novelli, Margaret Peterson, B. S. Pickett, Herman Postma, Richard Raridon, Sam Shoup, Mary Smith, Ed Struxness, D. B. Williams.

The following people were honorary members of UTAS by virtue of their offices: Governor Buford Ellington 1965, Frank Clement 1966, Winfield Dunn 1971, Ray Blanton 1976, Lamar Alexander 1978, President of UT Andrew Holt 1965, Edward Boling 1971, Dean of the College of Agriculture Webster Pendergrass 1965, W. W. Armistead 1979.

The following people were Trustees of UTAS: Robert Ball, 1966; Carl Koella, 1967; Jack Gibbons, Bob MacDonald, William Pollard, John Brennan, 1969.

Footnotes

1—Margaret Olson's contribution to computerization of plant records for the International Plant Records Committee was done in cooperation with Bob MacDonald.

2—Bob MacDonald, as chairman of the International Plant Records Committee, presented papers on the subject of electronic data processing of plant records at the American Horticultural Congress, the annual meeting of the American Association of Botanical Gardens and Arboreta, and the International Symposium on Information Problems in the Natural Sciences.

3—Shirley Yuille, a UTAS volunteer, holds the Royal Horticultural Society Diploma in Horticulture.

4—Excerpts from the letter follow: "this tract of land now known as the UT Forestry Experiment station and Arboretum was deeded to the University of Tennessee on August 21, 1961 by the Dept. of Health, Education & Welfare. Allowances within the deed stipulate that the University must use the land for educational purposes which benefit the public. Examples of educational usage of the land in question are the following research programs which are presently in progress: 1. A nationwide cooperative study which aims to provide genetically improved seeds for producers of white pine. 2. a 10-year study of the effects of fertilization and irrigation on the growth of sweetgum, loblolly pine and yellow poplar. 3. A yellow poplar heritability test. 4. A Douglas fir seed orchard. 5. A white pine seed orchard. 6. A forested watershed study. 7. An American chestnut progeny test to develop blight resistant strains. The direct and immediate result of the proposed airport will be the loss of these projects. The construction of an airport on the proposed site would necessitate the re-evaluation of the entire UT Forestry Experiment Station and Arboretum program of research, development and education." On December 5, 1978 the University of Tennessee announced its refusal to sell the land.

ACKNOWLEDGMENTS

The author wishes to thank the following people for help in preparing the manuscript for publication: Lois Good, Lenore Gundlach, and Richard Raridon.

FIG. 5. *Change of seasons only serve to highlight the natural beauty in the Arboretum that is captured in an audiovisual program "The Arboretum—A Place for all Seasons."*

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A CHECKLIST OF THE VASCULAR PLANTS OF CHICKAMAUGA AND CHATTANOOGA NATIONAL MILITARY PARK

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ABSTRACT

Vascular plants were collected from 1972-1975 in Chickamauga and Chattanooga National Military Park. The Park habitats are varied and include cedar glades, hardwood forests, and mowed fields. The area has 100 known families, 340 genera, and 585 species on a total of 3,403 ha. Numerous range extensions and several rare, endangered, or threatened plant species occur.

INTRODUCTION

Chickamauga and Chattanooga National Military Park is composed of many different units, of which three were visited during the study period. The largest unit is Chickamauga Battlefield with 2,268 ha and an elevation range of 109 to 229 m above sea level. It is low and hilly with many fairly flat sites. The Battlefield is in Catoosa and Walker Counties in northwest Georgia. The area is in the Great Valley of the Ridge and Valley province (Fenneman, 1938). The second largest unit is Lookout Mountain Park with 1,130 ha and an elevation range from 194 to 651 m. This unit includes the northern extremity of Lookout Mountain, having a small area on the top and with the majority of the Park on the west slope of the mountain. The Park extends from the top of the mountain down to Lookout Creek on the western side. There are small sections on the eastern slope of the mountain. Lookout Mountain Park is in Dade Co., Georgia and Hamilton Co., Tennessee. A much smaller unit is Signal Point Park. Located in Hamilton Co., Tennessee, it has an elevation range of 451 to 518 m and only encompasses five ha. This area extends from slightly above to slightly beliow a bluff, and has a southern exposure. Both Lookout Mountain Park and Signal Point Park are part of

the Cumberland Plateau (Fenneman, 1938). All three units have a drainage system that leads into the Tennessee River. Lookout Mountain Park is about ten km south of Signal Point Park and about ten km west of Chickamauga Battlefield. All of the sites are within ten km of Chattanooga.

The Park is floristically interesting. Some of the species are rare, endangered, or threatened, and some collections extend known distributions. The floristic diversity is due to the variety of habitats. Mesophytic hardwood forests, mowed fields, and cedar glades are present. The forests are present in the Battlefield and in a much more developed condition, on the slopes of Lookout Mountain and Signal Mountain where there is a steep bluff aspect.

There are few cedar glades in Georgia, so it is fortunate that some cedar glades were fortuitously located in an area of historical interest where they were inadvertenly preserved. The cedar glades of the Park are all located in the eastern portion of Chickamauga Battlefield. They all end abruptly at the edge of forest. Common woody plants at the edge of the cedar glades are *Quercus stellata, Quercus rubra, Rhamnus caroliniana, Cercis canadensis, Pinus echinata, Pinus taeda,* and *Carya glabra.* Herbaceous species of cedar glades previously unreported from Georgia have been noted (Van Horn, 1980).

Chickamauga Battlefield has been extensively disturbed. Much of Chickamauga Battlefield was farmed for about thirty years before a major battle of the Civil War took place at that site in 1863. After the war the area was again under cultivation until 1890, when it was established as a National Military Park. From 1898 to 1945 a part of Chickamauga Battlefield was used as an U. S. Army Post, that had over 8,000 horses and mules in addition to 71,000 men. Large tracts of the Battlefield were planted for pasture. More details concerning past disturbance on the Battlefield have been published (Van Horn, 1981). Although there has been some disturbance at both Lookout Mountain Park and Signal Point Park, it has not been as extensive as, or as prolonged as, that at the Battlefield.

The bedrock of the Battlefield is Chickamauga limestone that is Ordovician in age. The hills upon which Lookout Mountain Park and Signal Point Park are formed have an uppermost layer of sandstone that is mid-Carboniferous (Pennsylvanian) in age. Beneath the sandstone in both Parks is a sandstone and shale layer of early Carboniferous (Mississippian) age. The lowest portion beneath Lookout Mountain Park is cherty limestone of early Carboniferous age (Cressler, 1963, 1964; Croft, 1964; Tennessee Division of Geology, 1979). Since the boundary of Signal Point Park does not extend as low as that of Lookout Mountain Park, Signal Point Park lacks the cherty limestone layer.

The climate of the three study areas is very similar to that of Chattanooga due to their close proximity. The following climatic data is from records noted at Chattanooga (U. S. National Oceanic and Atmospheric Administration, 1978). The mean annual precipitation is 133 cm with a monthly low of 7.5 cm in October and a monthly high of 14.3 cm in March. January, February, and December also have more than 13 cm of precipitation as well as does July, so rainfall is fairly well distributed throughout the year. The mean annual relative humidity is 56 percent. The mean annual temperature is 15.4°C, with January as the coldest month (4.5°C) and July the warmest month (26.0°C). Seventy-five days of the year have a minimum temperature of 0°C or less.

Methods

Collecting trips were made to various areas of the Park from 1972-1975. An attempt was made to visit each basic type of habitat during every season. Collections were made on 47 days in Chickamauga Battlefield, 32 days in Lookout Mountain Park, and on ten days in Signal Point Park. The Battlefield was visited the greatest number of times due to its larger diversity of habitants as well as overall size. In all, 1,143 specimens were collected. In addition, specimens in the herbarium at the University of Tennessee at Chattanooga were examined since Eleanor McGilliard, who collected in Lookout Mountain Park, deposited her material there.

Standard references were used to identify the plants (Bailey, 1971; Correll and Johnston, 1970; Cronquist, 1980; Fernald, 1950; Gleason, 1963; Hitchcock and Chase, 1950; Mahler, 1970; Radford, Ahles and Bell, 1973; Small, 1933). Voucher specimens have been deposited in the herbarium of the University of Tennessee at Chattanooga (UCHT). No attempt was made to include each cultivated species near the Park buildings, but a few cultivated specimens were collected.

Results and Discussion

The specimens collected represent 100 families, 340 genera, and 585 species. Many of the species are listed as rare, endangered, or threatened, and some species are at the limit of their distribution. Some collections represent new distribution records. No records are noted for any species that did not appear to be reproducing or that are not native.

Seven species are listed as threatened by various authors. *Panax quinquefolium, Psoralea subacaulis, Petalostemum gattingeri,* and *Viola egglestonii* are listed by Ayensu and DeFillips (1978), the Committee for Rare Tennessee Plants (1978), and the Tennessee Heritage Program (1977). *Cardamine rotundifolia* and *Silphium laciniatum* are noted by the Tennessee Committee for Rare Plants (1978) and the Tennessee Heritage Program (1977). *Onosmodium molle* is listed as threatened by Ayensu and DeFillips (1978). With the exception of *Panax quinquefolium,* all the threatened taxa were collected in Georgia. Although none of the species were listed as threatened by McCollum and Ettman (1977) for Georgia, *Onosmodium molle* and *Cardamine rotundifolia* were not known to be in Georgia when their publication was being prepared. A paper mentioning *Viola egglestonii* in Georgia was published in 1975 (Baskin and Baskin).

Lilium philadelphicum is listed as endangered by the

Committee for Rare Tennessee Plants (1978) and the Tennessee Heritage Program (1977). Eleanor McGilliard collected it in Lookout Mountain Park in 1931 but I did not find it during this study.

The specimens collected in Georgia were matched against the *Georgia Plant List* (Jones and Coile, 1979) for possible new records. Native species that appear to be new records for Georgia are *Matelea obliqua, Rhododendron cumberlandense, Sedum pulchellum,* and *Silphium laciniatum*. The only species found that appears to be unreported from Tennessee is *Liatris squarrulosa*. It was not noted to be in Tennessee by either Sharp et al. (1960) or Cronquist (1980).

For distributional purposes, the county in which each species was collected is coded after the scientific name. The code is Catoosa Co., GA (1), Walker Co., GA (2), Dade Co., GA (3), and Hamilton Co., TN (4).

LIST OF TAXA

PTERIDOPHYTA

ASPIDIACEAE
Athyrium asplenioides (Michaux) A. A. Eaton 4
A. pycnocarpon (Spreng.) Tidest. 4
Dryopteris marginalis (L.) Gray 4
Polystichum acrostichoides (Michaux) Schott 4
Thelypteris hexagonoptera (Michaux) Weatherby 4

ASPLENIACEAE
Asplenium montanum Willd. 4
A. platyneuron (L.) Oakes 1, 4

OPHIOGLOSSACEAE
Botrychium virginianum (L). Swartz 4
Ophioglossum engelmanii Prantl 1

OSMUNDACEAE
Osmunda claytoniana L. 4

POLYPODIACEAE
Polypodium polypodioides (L.) Watt 2, 4

PTERIDACEAE
Adiantum pedatum L. 3, 4
Dennstaedtia punctilobula (Michaux) Moore 4
Pellaea atropurpurea (L.) Link 4
Pteridium aquilinum (L.) Kuhn 4

GYMNOSPERMAE

CUPRESSACEAE
Juniperus virginiana L. 1, 2, 4

GINKGOACEAE
Ginkgo biloba L. 2

PINACEAE
Pinus echinata Miller 1, 2, 3
P. strobus L. 4
P. taeda L. 1, 2
P. virginiana Miller 1, 3, 4

MONOCOTYLEDONAE

AMARYLLIDACEAE
Agave virginica L. 1
Hypoxis hirsuta (L.) Coville 3, 4
H. micrantha Pollard 1
Narcissus incomparabilis Miller 1
N. poeticus L. 1
N. pseudo-narcissus L. 1, 2, 3

ARACEAE
Arisaema triphyllum (L.) Schott 4

COMMELINACEAE
Commelina communis L. 2, 4
Tradescantia subaspera Ker 4
T. virginiana L. 4

CYPERACEAE
Carex caroliniana Schweinitz 1
C. cherokeensis Schweinitz 1
C. crawei Dewey 1
C. grayii Carey 4
C. leavenworthii Dewey 1
C. retroflexa Muhl. ex Schkuhr. 1
Cyperus flavescens L. 2
C. lancastriensis Porter 1
C. ovularis (Michaux) Torrey 1, 3
C. polystachyos var. *texensis* (Torrey) Fernald 1
C. strigosus L. 2
Eleocharis tricostata Torrey 1
Scirpus atrovirens Willd. 1, 2
S. lineatus Michaux 1

DIOSCOREACEAE
Dioscorea batatas Dcne. 4
D. villosa L. 4

IRIDACEAE
Iris cristata Aiton 4
Sisyrinchium albidum Raf. 1, 4
S. angustifolium Miller 4
S. mucronatum var. *atlanticum* (Bichnell) Ahles 1

JUNCACEAE
Juncus bufonius L. 2
J. dudleyi Wieg. 1
J. tenuis Willd. 3, 4
Luzula campestris (L.) DC. 1, 4

LILIACEAE
Allium canadense L. 1, 4
A. cernuum Roth ex Roemer 1, 3
A. vineale L. 4
Asparagus officinalis L. 1, 2
Chamaelirium luteum (L). Gray 3, 4
Disporum lanuginosum (Michaux) Nicholson 4
D. maculatum (Buckley) Britton 4
Erythronium americanum Ker 4
Hemerocallis fulva L. 1
Lilium philadelphicum L. 4
Medeola virginiana L. 4
Nothoscordum bivalve (L). Britton 1, 3, 4
Polygonatum biflorum (Walter) Ell. 4
Smilacina racemosa (L.) Desf. 4
Smilax bona-nox L. 1, 4
S. glauca Walter 4
S. herbacea L. 4
S. hispida Muhl. 4
S. rotundifolia L. 4
S. walteri Pursh 1
Trillium cuneatum var. *luteum* (Muhl.) Ahles 1, 4
Uvularia perfoliata L. 4
U. sessilifolia L. 4
Yucca filamentosa L. 1, 4

ORCHIDACEAE
Corallorhiza odontorhiza (Willd.) Nuttall 4
C. wisteriana Conrad 4
Cypripedium calceolus var. *pubescens* (Willd.) Correll 4
Goodyera pubescens (Willd.) R. Brown 4
Spiranthes gracilis (Bigelow) Beck 1
Tipularia discolor (Pursh) Nuttall 1

POACEAE
Agrostis elliottiana Schultes 4
Andropogon gerardii Vitman 1
A. scoparium Michaux 4
A. virginicus L. 2
Arundinaria gigantea (Walter) Muhl. 1, 4
Brachyelytrum erectum (Schreber) Beauvois 4
Bromus commutatus Schrader 1
B. purgans L. 1, 4
Cynodon dactylon (L.) Persoon 1, 2
Dactylis glomerata L. 1, 4
Danthonia spicata (L.) Beauvois ex R. & S. 1, 4
Digitaria filiformis (L.) Koeler 4
D. ischaemum (Schreber) Schreber 2
Elymus virginicus L. 1, 3, 4
Eragrostis capillaris (L.) Nees 1
Erianthus alopecuroides (L.) Ell. 1
Festuca myuros L. 1

Hordeum pusillum Nuttall 1, 3
Melica mutica Walter 1, 4
Panicum agrostoides Sprengel 1
P. anceps var. *rhizomatum* (Hitchcock & Chase) Fernald 1
P. boscii Poiret 1, 4
P. flexile (Gattinger) Scribner 1, 2
P. lanuginosum Ell. 1
P. laxiflorum Lam. 1, 4
Paspalum dilatatum Poiret 1, 2, 4
P. floridanum Michaux 2
Phleum pratense L. 1
Poa annua L. 3
P. autumnalis Muhl. ex Ell. 4
P. chapmaniana Scribner 1
P. lanuginosum Ell. 1.
P. laxifloum Lam. 1, 4
Paspalum dilatatum Poiret 1, 2, 4
Phleum pratense L. 1
Poa annua L. 3
P. autumnalis Muhl. ex. Ell. 4
P. chapmaniana Scribner 1
P. cuspidata Nuttall 4
P. pratensis L. 1, 4
Secale cereale L. 1
Setaria geniculata (Lam.) Beauvois 1, 2
Sorghum halepense (L.) Persoon 1
Sphenopholis intermedia (Rydberg) Rydberg 1, 4
S. nitida (Biehler) Scribner 1
Stipa avenacea L. 4
Tridens flavus (L.) Hitchcock 1
Triticum aestivum L. 1
Uniola latifolia Michaux 1, 3, 4

TYPHACEAE

Typha latifolia L. 2

DICOTYLEDONAE

ACANTHACEAE

Ruellia caroliniensis (Walter) Steudel 1, 4
R. humilis Nuttall 1, 4
R. strepens L. 1, 4

ACERACEAE

Acer negundo L. 2, 4
A. rubrum L. 2, 3, 4
A. saccharum Marshall 1, 4

ANACARDIACEAE

Rhus aromatica Aiton 1
R. copallina L. 1, 4
R. glabra L. 1, 4
R. radcians L. 1, 4
R. toxicocendron L. 1, 4

APIACEAE

Angelica venenosa (Greenway) Fernald 3
Chaerophyllum tainturieri Hooker 1, 4
Daucus carota L. 1, 2, 4
D. pusillus Michaux 4
Eryngium yuccifolium Michaux 1
Sanicula canadensis L. 1, 4
S. smallii Bicknell 4
Taenidia integerrima (L.) Drude 4
Thaspium trifoliatum (L.) Gray 4
Torilis arvensis (Hudson) Link 1
Zizia aptera (Gray) Fernald 4
Z. aurea (L.) W. D. J. Koch 1, 4

APOCYNACEAE

Amsonia tabernaemontana Walter 4
Vinca major L. 4
V. minor L. 1, 4

AQUIFOLIACEAE

Ilex opaca Aiton 1, 4

ARALIACEAE

Aralia spinosa L. 4
Hedera helix L. 2, 4
Panax quinquefolium L. 4

ARISTOLOCHIACEAE

Hexastylis arifolia Jacquin 4

ASCLEPIADACEAE

Asclepias amplexicaulis Smith 4
A. quadrifolia Jacquin 4
A. syriaca L. 1
A. tuberosa L. 1, 2, 4
A. variegata L. 3, 4
A. viridiflora Raf. 1
Cynachum laeve (Michaux) Persoon 1
Matelea gonocarpa (Walter) Shinners 4
M. obliqua (Jacquin) Woodson 1

ASTERACEAE

Achillea millefolium L. 4
Ambrosia artemisiifolia L. 1, 4
A. bidentata Michaux 3
A. trifida L. 1
Antennaria plantaginifolia (L.) Richardson 1, 3, 4
Arctium minus (Hill) Bernh. 4
Aster divaricatus var. *chlorolepis* (Burgess) Ahles 4
A. dumosus L. 1
A. infirmus Michaux 4
A. paludosus Aiton 1
A. patens Aiton 4
A. paternus Cronquist 4
A. pilosus Willd. 1
A. sericeus Vent. 1
Bidens bipinnata L. 1, 4
Cacalia atriplicifolia L. 4
Chrysanthemum leucanthemum L. 1, 4
Chrysopsis graminifolia (Michaux) Elliott 4
C. mariana (L.) Elliott 1
Cirsium altissimum (L.) Sprengel 1
C. carolinianum (Walter) Fernald & Schubert 1, 4
C. vulgare (Savi) Tenore 1
Coreopsis major Walter 4
C. tinctoria Nuttall 2
Echinacea purpurea (L.) Moench 1
Elephantopus tomentosus L. 1, 4
Erigeron annuus (L.) Persoon 1, 4
E. philadelphicus L. 1
E. pulchellus Michaux 4
E. strigosus Muhl. ex Willd. 1, 3, 4
Eupatorium aromaticum L. 4
E. coelestinum L. 1
E. fistulosum Barratt 1, 2
E. purpureum L. 4
E. serotinum Michaux 2, 4
Galinsoga quadriradiata Ruiz & Pavon 4
Gnaphalium obtusifolium L. 1
G. purpureum L. 4
Helenium autumnale L. 1
Helianthus divaricatus L. 4
H. hirsutus Raf. 1
H. microcephalus T. & G. 4
H. mollis Lam. 1
H. strumosus L. 4
Hieracium paniculatum L. 4
H. venosum L. 4
Hypochoeris radicata L. 4
Krigia biflora (Walter) Blake 4
Lactuca canadensis L. 4
L. floridana (L.) Gaertner 1, 2
Liatris squarrosa (L.) Michaux 1
L. squarrulosa Michaux 4
Parthenium integrifolium L. 1
Ratibida pinnata (Vent.) Barnh. 1
Rudbeckia fulgida Aiton 1, 2
R. hirta L. 2, 3, 4
Senecio anonymous A. Wood 1, 4
S. glabellus Poiret 1, 4
S. obovatus Muhl, ex Willd. 1, 4
Silphium compositum Michaux 1, 4
S. dentatum Elliott 3
S. laciniatum L. 1, 2, 4
S. trifoliatum L. 1
Solidago caesia L. 4
S. juncea Aiton 4
S. ptarmicoides (Nees) Boivin 1
S. rigida L. 1
Sonchus asper (L.) Hill 4
Taraxacum officinale Weber 1, 4
Verbesina virginica L. 1, 2
Vernonia flaccidifolia Small 1

V. gigantea (Walter) Trelease 1

BALSAMINACEAE

Impatiens capensis Meerb. 4

BERBERIDACEAE

Berberis thunbergii DC. 4
Podophyllum peltatum L. 1, 4

BETULACEAE

Betula lenta L. 4
Carpinus caroliniana Walter 3

BIGNONIACEAE

Anisostichus capreolata (L.) Bureau 1, 3, 4
Campsis radicans (L.) Seemann 1, 4

BORGINACEAE

Cynoglossum virginianum L. 4
Heliotropium tenellum (Nuttall) Torrey 1
Lithospermum arvense L. 1
L. canescens (Michaux) Lehmann 1, 4
Myosotis macrosperma Engelm. 1, 4.
Onosmodium molle var. *occidentale* Johnston 1

BRASSICACEAE

Arabidopsis thaliana (L.) Heynhold 4
Arabis canadensis L. 4
A. laevigata (Muhl. ex Willd.) Poiret 4
Barbarea verna (Miller) Ascherson 2
B. vulgaris R. Brown 1, 4
Brassica napus L. 1, 4
Capsella bursa-pastoris (L.) Medicus 2
Cardamine angustata var. *multifida* (Muhl.) Ahles 1, 4
C. bulbosa (Schreber) BSP. 1, 3
C. hirsuta L. 1, 3, 4
C. parviflora L. 4
C. rotundifolia Michaux 2
Conringia orientalis (L.) Dumortier 4
Draba verna L. 1, 2
Hesperis matronalis L. 4
Lepidium campestre (L). R. Brown 1
L. virginicum L. 1, 4
Sisymbrium officinale (L.) Scopoli 4

BUXACEAE

Buxus sempervirens L. 1

CACTACEAE

Opuntia compressa (Salisbury) Macbride 1

CALYCANTHACEAE

Calycanhtus floridus L. 4

CAMPANULACEAE

Campanula americana L. 4
C. divaricata Michaux 3
Lobelia cardinalis L. 1
L. nutallii R. & S. 1
L. puberula Michaux 4
L. spicata Lam. 1, 3, 4
Specularia perfoliata (L.) A. DC. 1, 4

CAPRIFOLIACEAE

Lonicera fragrantissima Lindley & Pax 2
L. japonica Thunberg 1, 4
L. sempervirens L. 1, 4
Sambucus canadensis L. 2, 4
Symphoricarpos orbiculatus Moench 1
Triosteum perfoliatum L. 1
Viburnum acerifolium L. 4
V. rufidulum Raf. 4

CARYOPHYLLACEAE

Arenaria patula Michaux var. *patula* 1
A. serpyllifolia L. 1
Cerastium nutans Raf. 4
Dianthus armeria L. 1, 4
Holosteum umbellatum L. 2
Silene rotundifolia Nuttall 4
S. stellata (L.) Aiton F. 4
S. virginica L. 4
Stellaria media (L) Cyrillo 2, 4

CELASTRACEAE

Eunonymus americanus L. 2, 4
E. atropurpureus Jacquin 1
E. bungeanus Maxim. 2

CONVOLVULACEAE

Calystegia sepium (L.) R. Brown 1
Ipomoea hederacea (L.) Jacquin 4
I. lacunosa L. 4
I. pandurata (L.) G. F. W. Meyer 1, 4

CORNACEAE

Cornus florida L. 1, 4

CRASSULACEAE

Sedum pulchellum Michaux 1
S. sarmentosum Bunge 4
S. ternatum Michaux 4

EBENACEAE

Diospyros virginiana L. 2, 4

ELAEAGNACEAE

Elaeagnus pungens Thunberg 1

ERICACEAE

Chimaphila maculata (L.) Pursh 1, 4
Epigaea repens L. 4
Kalmia latifolia L. 4
Monotropa uniflora L. 4
Oxydendrum arboreum (L.) DC. 4
Rhododendron calendulaceum (Michaux) Torrey 4
R. cumberlandense Braun 3
R. nudiflorum (L.) Torrey 3
Vaccinium atrococcum (Gray) Porter 3, 4
V. stamineum L. 3, 4

EUPHORBIACEAE

Croton capitatus Michaux 1
C. monanthogynous Michaux 1
Euphorbia corollata L. 1, 4
E. dentata Michaux 4
E. maculata L. 1, 2
E. mercurialina Michaux 3

FABACEAE

Albizia julibrissin Durazzini 2, 4
Amorpha fruticosa L. 1, 2, 4
Amphicarpa bracteata (L). Fernald 1
Baptisia australis (L.) R. Brown 1, 4
Cassia fasciculata Michaux 1
C. marilandica L. 1
C. nictitans L. 1, 4
Centrosema virginianum (L.) Bentham 1
Cercis canadensis L. 1, 4
Desmanthus illinoensis (Michaux) MacM. 1
Desmodium glabellum (Michaux) DC. 1
D. gultinosum (Muhl. ex Willd.) Wood 4
D. nudiflorum (L.) DC. 4
Gleditsia triacanthos L. 1, 2
Lathyrus latifolius L. 4
Lespedeza cuneata (Dumont) G. Don. 1
L. intermedia (Watson) Britton 4
L. stipulacea Maxim. 1
L. virginica (L.) Britton 1
Medicago lupulina L. 1, 4
Melilotus alba Desr. 1, 4
M. officinalis (L.) Lam 1, 4
Petalostemum gattingeri (Heller) Heller 1
Psoralea subacaulis T. & G. 1
Pueraria lobata (Willd.) Ohwi. 4
Rhynchosia tomentosa (L.) H. & A. 1
Robinia hispida L. 4
R. pseudo-acacia L. 4
Schrankia microphylla (Solander ex Smith) Macbride 4
Strophostyles umbellata (Muhl. ex Willd.) Britton 1
Stylosanthes biflora (L.) BSP. 1, 4
Tephrosia virginiana (L.) Persoon 1, 4
Trifolium campestre Schreber 1, 4
T. incarnatum L. 1
T. pratense L. 1, 4
T. repens L. 1, 4
Vicia angustifolia Reichard 1
V. caroliniana Walter 4
V. dasycarpa Tenore 2
V. villosa Roth 4

FAGACEAE

Castanea dentata (Marshall) Borkh. 4
C. mollissima Blume 1
Fagus grandifolia Ehrhart 1, 3
Quercus alba L. 4
Q. bicolor Willd. 4

Q. falcata Michaux 2
Q. lyrata Walter 1
Q. marilandica Muenchh. 1, 4
Q. meuhlenbergii Engelm. 2
Q. nigra L. 1
Q. phellos L. 1, 4
Q. prinus L. 1, 4
Q. rubra L. var. *rubra* 1, 4
Q. shumardii Buckley 1
O. stellata Wang. 1, 2

GENTIANACEAE
Sabatia angularis (L.) Pursh 1
Swertia caroliniensis (Walter) Kuntze 4

GERANIACEAE
Geranium carolinianum L. 1, 4
G. dissectum L. 1
G. maculatum L. 4
G. molle L. 4

HALORAGACEAE
Proserpinaca palustris L. 1

HAMAMELIDACEAE
Liquidambar styraciflua L. 1, 4

HYDROPHYLLACEAE
Hydrophyllum macrophyllum Nuttall 4

HYPERICACEAE
Hypericum cistifolium Lam. 1
H. dolabriforme Vent. 1
H. hypericoides (L.) Crantz 1, 4
H. cf. *sphaerocarpum* Michaux 1

JUGLANDACEAE
Carya cordiformis (Wang.) K. Koch 2, 4
C. glabra (Miller) Sweet 1, 4
C. laciniosa (Michaux f.) Loudon 4
C. ovalis (Wang.) Sargent 2
C. ovata (Miller) K. Koch 1
C. tomentosa (Poiret) Nuttall 4
Juglans nigra L. 1, 2

LAMIACEAE
Collinsonia canadensis L. 4
Dracocephalum virginianum L. 1
Glecoma hederacea L. 4
Isanthus brachiatus (L.) BSP. 1, 4
Lamium amplexicaule L. 2, 4
L. purpureum L. 1
Monarda fistulosa L. 1
Nepeta cataria L. 2
Prunella vulgaris L. 1, 4
Pycnanthemum incanum (L.) Michaux 4
Salvia lyrata L. 1, 4
S. urticifolia L. 1, 3
Satureja calamintha var. *nepeta* (L.) Briquet 2
Scutellaria elliptica Muhl. 4
S. ovata Hill 4
S. parvula Michaux 4

LAURACEAE
Lindera benzoin (L.) Blume 4
Sassafras albidum (Nuttall) Nees 1, 4

LINACEAE
Linum sulcatum Riddell 1

LOGANIACEAE
Cynoctonum mitreola (L.) Britton 1
Spigelia marilandica L. 4

LORANTHACEAE
Phoradendron serotinum (Raf.) M. C. Johnston 1

LYTHRACEAE
Lagerstroemia indica L. 1
Lythrum alatum Pursh 1
L. lanceolatum Ell. 1

MAGNOLIACEAE
Liriodendron tulipfera L. 4
Magnolia grandiflora L. 1

MALVACEAE
Hibiscus moscheutos L. 1
H. syriacus L. 2
Sida elliottii T. & G. 1
S. rhombifolia L. 1

MENISPERMACEAE
Calycocarpum lyonii (Pursh) Gray 4

MORACEAE
Maclura pomifera (Raf.) Schneider 1, 2
Morus rubra L. 1, 2

NYSSACEAE
Nyssa sylvatica Marshall 2, 4

OLEACEAE
Chionanthus virginicus L. 4
Forsythia viridissima Lindley 4
Fraxinus americana L. 1, 4
Ligustrum sinense Lour. 1, 4

ONAGRACEAE
Gaura filipes Spach 1
Ludwigia microcarpa Michaux 1
Oenothera biennis L. 2, 4
O. speciosa Nuttall 1, 4
O. tetragona Roth 1, 3

OROBANCHEAE
Conopholis americana (L.) Wallroth 4

OXALIDACEAE
Oxalis dillenii Jacquin 1, 4
O. stricta L. 4
O. violacea L. 4

PAPAVERACEAE
Stylophorum diphyllum (Michaux) Nuttall 4

PASSIFLORACEAE
Passiflora lutea L. 4

PHRYMACEAE
Phryma leptostachya L. 4

PHYTOLACCACEAE
Phytolacca americana L. 2, 4

PLANTAGINACEAE
Plantago lanceolata L. 1, 4
P. major L. 2
P. rugelli Dcne. 4
P. sparsiflora Michaux 1
P. virginica L. 1, 4

PLANTANACEAE
Platanus occidentalis L. 1, 2, 4

POLEMONIACEAE
Phlox amoena Sims 1, 3, 4
P. carolina L. 4
P. divaricata L. 3, 4
Polemonium reptans L. 3, 4

POLYGONACEAE
Polygonum aviculare L. 2
P. caespitosum var. *longisetum* (DeBruyn) Stewart 1
P. lapathifolium L. 2
P. punctatum Ell. 2
Rumex acetosella L. 1, 4
R. crispus L. 1, 2
R. obtusifolius L. 4

PORTULACACEAE
Claytonia virginica L. 4

PRIMULACEAE
Lysimachia ciliata L. 1
L. quadrifolia L. 3
L. tonsa (Wood) Knuth 4

RANUNCULACEAE
Anemone quinquefolia L. 1
A. virginiana L. 1
Aquilegia canadensis L. 4
Cimicifuga racemosa Nuttall 4
Clematis glaucophylla Small 4
C. maximowicziana Franchet & Savatier 4
C. virginiana L. 1
Delphinium carolinianum Walter 1
D. tricorne Michaux 4
Hepatica nobilis var. *acuta* (Pursh) Steyermark 4
Ranunculus abortivus L. 1, 4
R. bulbosus L. 1, 2
R. fasicularis Muhl. ex Bigelow 4
R. hispidus Michaux var. *hispidus* 1
R. sardous Crantz 1, 3
Thalictrum dioicum L. 1, 3, 4

T. thalictroides (L.) Boivin 1, 3, 4

RHAMNACEAE

Berchemia scandens (Hill) K. Koch 1
Ceanothus americanus L. 1
Rhamnus caroliniana Walter 1, 4
R. lanceolata Pursh 1

ROSACEAE

Agrimonia grypsosepala Wallroth 4
A. parviflora Aiton 1, 2
A. rostellata Wallroth 4
Amelanchier arborea (Michaux f.) Fernald 3, 4
Aruncus dioicus (Walter) Fernald 3, 4
Crataegus spathulata Michaux 2
Fragaria virginiana Duchesne 1
Geum canadense Jacquin 4
Gillenia stipulata (Muhl) Baillon 4
Malus angustifolia (Aiton) Michaux 4
Potentilla canadensis L. 4
P. norvegica L. 1
P. recta L. 1
P. simplex Michaux 1, 4
Prunus angustifolia Marshall 1, 2
P. avium L. 4
P. pensylvanica L. f. 3
P persica (L.) Batsch 4
P. serotina Ehrhart 1, 4
P. virginiana L. 4
Pyrus communis L. 1
Rosa carolina L. 1, 3
R. multiflora Thunberg 2, 4
Rubus allegheniensis Porter 1, 4
R. flagellaris Willd. 4
Sorbus arbutifolia (L.) Heynold 4
Spirea prunifolia Siebold & Zuccarini 1
S. thunbergii Siebold 1, 4

RUBIACEAE

Diodia virginiana L. 1, 2
Galium aparine L. 1, 4
G. pilosum Aiton 3
Houstonia caerulea L. 3, 4
H. longifolia Gaertner 1
H. minima Beck 1, 4
H. purpurea L. 4
H. tenuifolia Nuttall 4
Mitchella repens L. 4
Sherardia arvensis L. 1

RUTACEAE

Poncirus trifoliata (L.) Raf. 1
Ptelea trifoliata L. 3, 4

SALICACEAE

Populus alba L. 3
Salix nigra Marshall 3

SAXIFRAGACEAE

Deutzia magnifica Rehd. 4
Heuchera americana L. 1, 4
H. hirsuticaulis (Wheelock) Rydb. 4
Hydrangea arborescens L. ssp. *arborescens* 2
H. arborescens ssp. *discolor* (Seringe) McClintock 3, 4
Philadelphus hirsutus Nuttall 4
P. inodorus L. 4
Saxifraga virginiensis Michaux 3, 4

SCROPHULARIACEAE

Agalinus setacea (Walter) Raf. 1
A. tenuifolia (Vahl) Raf. 1
Aureolaria laevigata (Raf.) Raf. 2
A. virginica (L.) Pennell 4
Chelone lyonii Pursh 4
Cymbalaria muralis Gaertner, Meyer & Scherbius 4
Linaria vulgaris Hill 2
Mecardonia acuminata (Walter) Small 1
Mimulus ringens L. 1
Paulownia tomentosa (Thunberg) Steudel 4
Pedicularis canadensis L. 4
Penstemon camenscens Britton 4
Verbascum thapsus L. 1, 2, 3
Veronica agrestis L. 1
V. arvensis L. 1, 3, 4

SOLANACEAE

Solanum carolinense L. 1
S. eleagnifolium Cav. 2

STAPHYLEACEAE

Staphylea trifolia L. 4

ULMACEAE

Celtis occidentalis L. 1, 4
Ulmus alata Michaux 1, 4
U. americana L. 4
U. rubra Muhl. 1

URTICACEAE

Boehmeria cylindrica (L.) Swartz 4

VALERIANACEAE

Valerianella radiata (L.) Dufr. 1, 4

VERBENACEAE

Callicarpa americana L. 1
Verbena simplex Lehmann 1, 4
V. urticifolia L. 1

VIOLACEAE

Viola affinis LeConte 4
V. cucullata Aiton 1, 4
V. egglestonii Brainerd 1
V. eriocarpa Schweinitz var. *eriocarpa* 4
V. pedata L. 4
V. rafinesquii Greene 1, 3, 4
V. tripartita Elliott var. *tripartita* 4

VITACEAE

Parthenocissus quinquefolia (L.) Planchon 1, 4
Vitis aestivalis Michaux 2, 4
V. labrusca L. 4
V. rotundifolia Michaux 1, 4
V. vulpina L. 1

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