THE PHYTOECOLOGY OF BOONE FORK SPHAGNUM BOG

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ABSTRACT

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The purpose of this study was to determine the distributional and associational aspects of the macroscopic flora of Boone Fork Bog, a *Sphagnum* bog in the southern Appalachian Mountains.

After an initial taxonomic survey of the general area, during which 116 species representing 49 families were collected, thirty-nine 10 foot^2 quadrants were surveyed in detail. The data obtained from this vegetational analysis was tabulated to show relative abundance, sociability groups, percent frequency, presence groups, and habitat groups for all species recorded within the survey area.

Jackard's species area curve is applied to the cumulative plant list, and observations are made concerning area status, uncommon species recorded, and area plant-water relationships.

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INTRODUCTION

Boone Fork Bog, a *Sphagnum* bog in the Southern Appalachian Mountains, is a unique wetland habitat which presents an unusual set of biotic associations. The bog is of special interest considering that North American *Sphagnum* bogs characteristically occur in the more northern regions of the continent and are commonly considered to have resulted from Wisconsin, Illinoian, Kansan, and Nebraskan period glaciation (Niering, 1966).

Typical examples of these North American *Sphagnum* bogs are the tundra bogs of the Artic, the kettle-hole and muskeg bogs of southern Canada and the northern United States, and the smaller bogs of the North Eastern, North Western, and North Central United States. The bogs of Canada, Alaska, and the United States exhibit a vegetation pattern that is representative of the cool northern regions. Even the most southerly of the naturally occurring bogs contain common bog plants that are boreal in origin (Niering, 1966). For example, Boone Fork Bog supports several "northern plants," such as cranberries and blueberries--heaths commonly occurring in the bogs of New Jersey and Cape Cod (Deevy, 1958).

Generally, the typical *Sphagnum* bog has a cushion-like vegetation with floating or semi-floating mats of sedges, grasses, and mosses; submerged and emergent plants and some form of peat stratification (Rigg, 1940). The occurrence of these bog indicator species may be explained in part by the predominance of *Sphagnum* in the seral stages

of the bog (Niering, 1966). During the summer months the *Sphagnum* mat, which may hold twenty times its own dry weight in water, continually cools the bog by extensive evaporation. This cooling effect combined with local weather conditions (Table 1) contributes to the temperate "climate" of Boone Fork Bog and perpetuates this wetland habitat.

Because of the unusual synecological associations in Boone Fork Bog and the lack of information about this relatively unexplored area, a phytoecological survey was initiated to ascertain the distributional and associational aspects of the macroscopic life within the bog.

LOCATION AND DESCRIPTION

Boone Fork Bog (named during this study) is located 3.0 airline miles WNW of Blowing Rock, North Carolina, within mile number 297 of the Julian Price Memorial Park portion of the Blue Ridge Parkway. The bog is approximately 350 yards W of Price Park picnic area and and comfort station number 464, and approximately 500 yards NNE of Price Lake (Figure 1). Boone Fork Bog consists of eight acres of an 18 acre tract of land leased from the National Parks Service (Blue Ridge Parkway) by Appalachian State University on May 1, 1970. The area is designated for use by authorized persons as a field laboratory and environmental research area.

The bog, roughly rectangular in shape, may be reached by Boone Fork Trail, a Blue Ridge Parkway nature trail, which skirts the eastern perimeter of the bog. A second growth, mixed mesophytic, deciduous forest lies adjacent to the bog on the north, south and west, with Pig Pen Knob rising above the western edge of the bog (Figure 1). According to U. S. Department of Agriculture (1944), the soil type of the Knob is predominately Persinsville loam, rolling phase, and is derived mainly from low micaceous granite, and light colored, low micaceous, acidic schist and gneiss. Surface run off is medium and the internal drainage is moderate. The original vegetation (recent Epoch) was most probably a mixed hardwood forest of northern red, white, chestnut and black oak, yellow poplar, red maple, chestnut, sugar maple, and hickory; with some white pine and hemlock, and an undergrowth

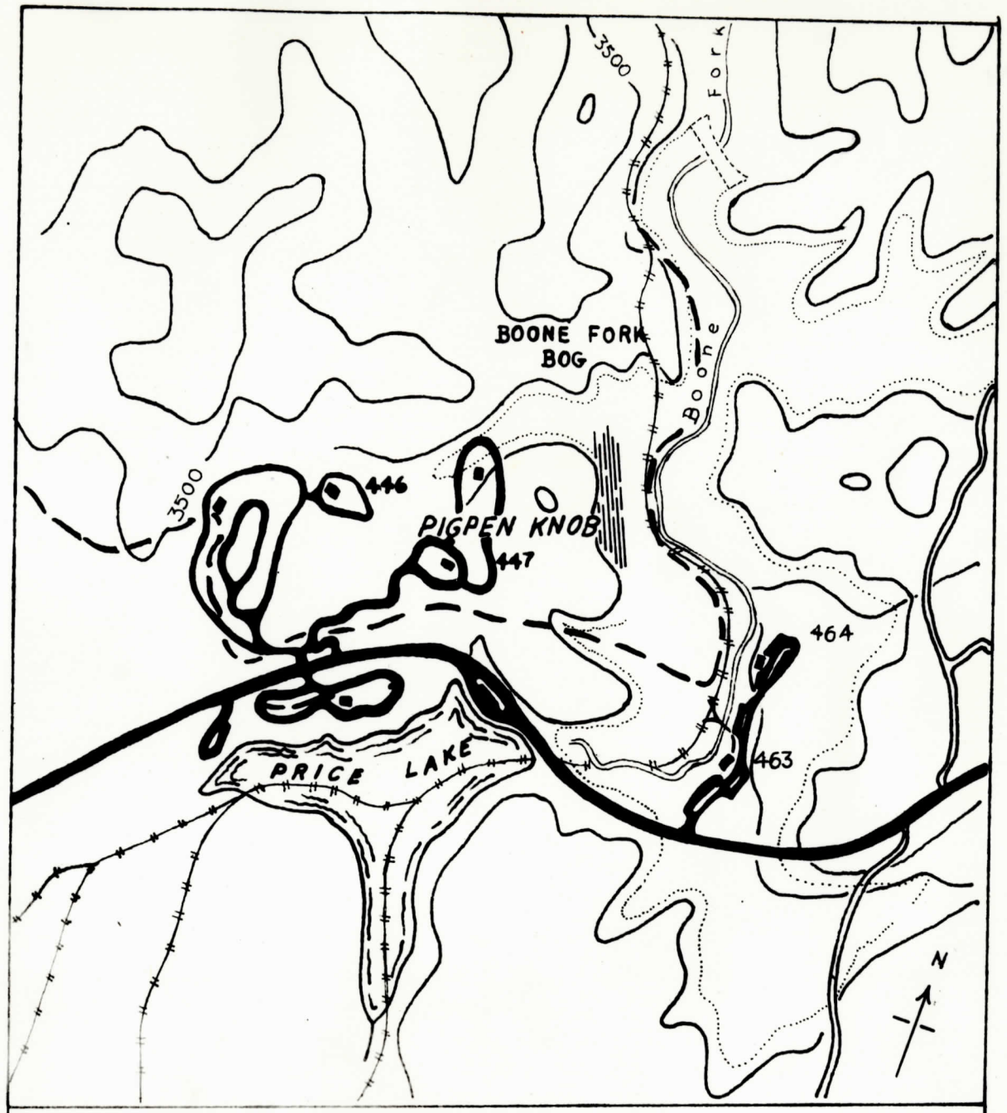
of rhododendron, mountain laurel, wild azalea, and galax (U. S. Dept. of Agriculture, 1944). Except for the absence of the American Chestnut, the vegetation of Pig Pen Knob and the surrounding ridges remains relatively unchanged.

The eastern perimeter of the bog is bordered by a relatively low field with soils of Wehadkee loam graduating into Chewaola loam. These soil types, originating chiefly from gneiss, schist, and granite, are found in nearly level or slightly depressed areas with slow surface run off and imperfect internal drainage. The original vegetation was mainly red maple, birch, hemlock, willow, and an undergrowth of rhododendron, laurel, and small hydrophytes, with bull rushes dominating open areas (U. S. Dept. of Agriculture, 1944). The present flora is similar to the original vegetation except for the absence of large hemlocks and the addition of extensive growths of goldenrods, ironweed, and black elderberry.

The bog itself is officially classified by the U. S. Department of Agriculture (1944) as consisting of Wehadkee loam, peaty phase. The peaty phase characteristically consists of a two to five inch layer of peat overlying a medium olive grey, slightly plastic loam a few inches thick, with the plastic layer grading into a layer of fine sand, coarse sand, or fine gravel. By the use of a one inch aluminum pipe for core sampling, it was found that in actuality the peat layer in Boone Fork Bog is four to five feet deep in many areas and does graduate into a grey plastic loam overlying a bed of fine white gravel.

The bog, with a naturally high water table, is fed primarily by a small stream (named Knob Branch during this study), and by several springs emerging from the eastern slope of Pig Pen Knob.

FIGURE 1



BOONE FORK BOG

Scale in feet 0 1000
Contour Interval 100 ft.

Map adapted from U.S. Dept. of Int. drawing no. Pky-Br-Jp 2053-C

LEGEND
Boone Fork Bog
Blue Ridge Pkwy.
Abandoned Tramway
Buildings
Foot Trail
Abandoned Price Lake Project

HISTORY

The Boone Fork Bog area has gone relatively undisturbed by man except for a period in the early 1900's when a systematic logging operation took place in the area. The W. S. Whiting Lumber Company began timber cutting in Watauga County in 1914 and continued extensive logging operations until 1926, when a spark from the Whiting logging train set fire to dried brush along the tram road (Figure 1) and burned over 1000 acres of virgin timberland. Boone Fork Bog, from which several large hemlocks had already been removed, was completely burned over as was much of the Boone Fork area.

During the same period local residents had indescriminately harvested the live *Sphagnum* from the bog to be used as a water absorbent packing material for *Galax aphylla* and other herbs collected in the area. This practice continued until the fall of 1953, when Blue Ridge Parkway officials realized that the area was being damaged and stopped all collection of the peat moss.

Julian Price, life insurance executive, financier, and conservationist, owned the 4200 acre estate until his death in 1946. He had intended to develop the area as a mountain retreat and pleasure area, and had begun core drillings and surveying for a 350 acre lake which would have completely covered Boone Fork Bog and the area that is now Price Park (Figure 1). Plans for the lake were halted by his death in 1946; and on July 1, 1951, his son and daughter donated the Price estate to the U. S. Department of the Interior to be used as a public recreation area.

CLIMATE

Boone Fork Bog is located on the western slope of the Blue Ridge Mountains along the southern edge of Watauga County. The weather station nearest the survey area is 3.0 airline miles away in Blowing Rock, North Carolina. The Blowing Rock weather station is 3700 feet above mean sea level (Latitude 36° 09' N and Longitude 81° 42' W). Temperature and precipitation records have been maintained at the Blowing Rock station since 1944. The climatic information in this survey was compiled from United States Department of Commerce climatography publications 60-31, 20-31, and 1966-1971 annual weather summaries.

Blowing Rock, and Watauga County in general, is characterized by relatively cool summer weather with summer temperatures averaging 10 to 12 degrees lower than temperatures over the Piedmont and Costal Plain. The average highest daytime temperature at the warmest time of the year is in the seventies, with the temperature dropping to the fifties during the night (Table 1).

The average length of freeze-free growing season in Watauga County at elevations near 3500 feet is 150 days. The average date of the last spring occurence of a temperature as low as 32°F is May 10, and the average date of the first occurence of 32°F in Autumn is October 7.

During the winter months daily freezing temperatures are quite common, although the extremities of cold recorded at the Blowing Rock weather station during the past 30 years are only about 5 degrees colder than those of the coldest portions of the Piedmont and Costal Plain.

Weather station records (Table 1) show that the average distribution of precipitation around the year is extremely uniform, with slightly more rain falling in the warmer months during the growing season. The annual total amount of measurable rain or snow is similar to the more eastern and costal regions, but the seasonal variation is not as marked in Watauga County.

On the average, snow falls several times per month in winter. The average total amount of snowfall is three to five times greater than in the northern Piedmont and Costal Plain, and five to ten times greater than in southeastern North Carolina.

Table 1
Blowing Rock Station

AVERAGE TEMPERATURES AND TOTAL PRECIPITATION

1967-1971 Average	1971	1970	1969	1968	1967		
29.2	29.8	23.4	27.2	30.6	34.9	Temp.	JAN.
3.46	3.91	1.99	3.40	5.22	2.78	Precip.	
28.9	31.9	30.6	29.5	24.3	28.2	Temp.	FEB.
3.56	6.13	3.36	4.95	.48	2.91	Precip.	
39.4	34.0	38.5	31.7	39.5	43.2	Temp.	MAR.
4.91	4.23	4.53	4.59	5.73	5.63	Precip.	
49.8	48.9	50.3	49.4	49.0	51.5	Temp.	APR.
4.54	3.72	5.72	6.45	4.56	2.26	Precip.	
55.4	53.6	57.7	56.8	54.9	54.2	Temp.	MAY
5.38	8.54	3.45	5.38	4.05	5.49	Precip.	
63.4	65.8	62.3	65.1	63.2	60.8	Temp.	JUNE
5.40	2.70	3.69	10.38	5.49	2.94	Precip.	
66.4	66.5	66.7	68.7	67.3	62.9	Temp.	JULY
7.65	11.30	5.16	4.80	5.44	11.59	Precip.	
65.3	64.9	66.8	63.9	68.1	62.8	Temp.	AUG.
8.00	4.72	11.55	7.75	5.08	10.93	Precip.	
59.7	62.4	64.5	58.4	58.1	55.4	Temp.	SEPT.
4.69	5.49	1.99	5.38	3.91	6.71	Precip.	
51.1	55.1	52.0	49.3	50.3	49.0	Temp.	OCT.
7.23	8.30	10.08	4.32	8.45	5.02	Precip.	
38.8	39.8	39.2	37.9	40.1	37.1	Temp.	NOV.
4.68	4.23	5.12	6.76	4.29	3.03	Precip.	
34.1	40.9	36.3	27.8	28.7	37.8	Temp.	DEC.
4.42	4.53	1.59	6.21	3.65	6.12	Precip.	
46.4	40.4	49.0	47.1	47.8	48.2	Temp.	ANNUAL
63.63	67.80	58.23	70.37	56.35	64.41	Precip.	

MATERIALS AND METHODS

In a vegetational analysis it is first necessary to distinguish between a taxonomic and an ecological approach to plant study. According to Phillips (1966),

> "The taxonomist in studying an area makes a list of species which constitute the flora. The ecologist begins with the floristic list and by a series of sample plots or observations ascertains the qualitative and quantitative relationships of the various species in the flora leading to a concept of the vegetation."

Brief histories of the development of the ecological approach to vegetation analysis have been recorded by Daubenmire (1968), Kershaw (1964), Kuchler (1967), and Phillips (1959).

Because quantitative methods of vegetational analysis require an initial taxonomic listing of the area flora followed by a detailed study of the floral interrelationships, it is first necessary to define clearly the objectives of the study to insure that all pertinent data is collected at the time of the field survey. According to Greg-Smith (1957) the purpose or purposes for making quantitative vegetation estimates fall into one or more of three categories:

> (a) "an estimate of the overall composition of the vegetation within certain boundaries, with a view to comparison with other areas or with the same area at another time, (b) the investigation of variations within the area, or (c) correlation of vegetational differences with differences in one or more habitat factors."

By using multiple sample methods the author has attempted to apply each of these objectives to the Boone Fork Bog study. The survey was carried out in three general steps; the taxonomic survey, preparation of the study area for vegetation analysis, and the vegetation analysis itself.

The Taxonomic Survey

A taxonomic survey of Boone Fork Bog and 100 feet of the bog perimeter was made from June through September, 1971. Representatives of each species observed were collected and mounted for reference during the quadrant surveys. The vouchers along with a completed flora list for the bog are maintained at the Appalachian State University Department of Biology. Phylogeny and nomenclature as expressed in the plant list (Table 6) follow the treatment of Radford, Ahles, and Bell (1968), with the exception of all mosses, which follow the form of Conrad (1956).

Preparation of the Study Area

Because further vegetation and succession studies are planned for Boone Fork Bog, an accurately reproducible method of vegetation study was necessary. Consequently, a system combining the quadrant and transect methods of vegetation analysis was devised.

Using a camera compass, three line transects; (1) South 4° West, 130 feet in length, (2) South 34° West, 140 feet in length, (3) South 64° West, 120 feet in length, were struck through the central portion

of the bog. A grid of 10^2ft. quadrants was measured off along each of the transects and permanently marked with five foot locust stakes sunk four feet at the corners of each quadrant. This combined quadrant-transect method allowed the survey of a large number of quadrants (39) within a relatively small area, which, according to Kuchler (1967) significantly increases the survey validity. This quadrant-transect method also allows the analysis of the transition of vegetational zones and communities, and according to Greg-Smith (1957) is more representative of variations over the survey area than a purely random method of sampling.

The plots were constructed with dimensions of 10^2feet so that the entire plot could be viewed without much shifting of the eyes to minimize personal error (Daubenmire, 1968). In addition to limiting quadrant size each plot was divided into fourths using calibrated bamboo poles to aid in the accurate location of species representatives on quadrant maps.

Vegetation Analysis

Thirty-nine vegetation maps were made showing the precise location of individual plants when feasible and contagious populations when species number precluded an actual count. Relative abundance and sociability groups were recorded at the time of the survey (Tables 2, 3, and 4), and the K&E plane table alidade was used to make relative elevational determinations for each quadrant and for

individual species or plant communities of special interest. From this data the following information was tabulated:

Presence.....Table 6

Frequency.....Tables 2,3,4 (individual strip frequency)
Table 5 (total % frequency)

Relative abundance.....Tables 2,3,4

Sociability.....Tables 2,3,4

Habitat groups.....Table 5

PRESENCE

Presence may be defined as the occurrence of a species in the sample area. Three presence categories were used for this study:

a= those plants occurring within the survey plots.
b= those plants occurring within the bog perimeter, but not recorded within the survey quadrants.
c= those plants occurring within 100 feet of the bog perimeter.

(Table 6)

Of a total of 116 species identified in Boone Fork Bog, only 51 species occurred within the survey quadrants. This relatively limited number of species, a common occurrence in a typical bog, may be explained by the harsh bog conditions: high acidity, lack of phosphorus and nitrogen, low bacterial activity, and extremely high water table (Niering, 1966).

The validity of the survey area size in relation to the number of species recorded may be tested by applying Jackard's species area curve. According to Jackard, as the study area increases in size the total list of species in the aggregate sample increases rapidly to a point, after which very few species are added as more area is included (Daubenmire, 1968). In applying Jackard's species area curve to the Boone Fork Bog study (Figure 2), it can be seen that a significant increase in new species recorded occurred in plots 1 through 39, but in plots 28 through 39 only three species were recorded. Since these three species; *Habenaria clavellata*, *Impatiens capensis*, and *Carex scoparia* had already been recorded in the general survey, it may be

assumed that from the standpoint of presence a survey of as few as 26 sample plots would have given a representative profile of the bog flora (Phillips, 1959).

Figure 2. Species-Area Curve. Rate of species list enlargement with the number of samples studied taken into consideration.

Frequency

Frequency figures express the percentage of sample plots in which a given species may occur. Frequency figures may be used to determine the uniformity of distribution of a species or community without taking into consideration the actual number or size of species represented (Daubenmire, 1968). The accuracy of frequency values, determined from plots of uniform size in a homogeneous stand, may be increased to any desired degree by increasing the number of sample plots (Greg-Smith, 1957). This is illustrated by comparing frequency values in Tables 2, 3, and 4 (showing percent frequencies for individual survey strips 1, 2, and 3) with Table 5 (showing total percent frequency for all 39 survey plots).

For this study frequency determinations were made on the basis of rooted frequencies.

Abundance

Due to the nature of the bog vegetation, i.e. a large number of representatives of certain species having a small basal area, actual counts of species representatives for density determinations was impossible in many cases. Consequently, abundance, the mean density within occupied quadrants, was determined using a modified Tansley and Adamson scale (Phillips, 1959). The scale used is as follows:

D = dominant
Va = very abundant
A = abundant
F = frequent
O = occasional
R = rare
Pr = present

(Tables 2,3,4).

Sociability

In contrast to frequency and abundance figures, which express the relation of individuals and numbers of individuals to definite spacial areas, sociability expresses the relation of individual plants to each other (Daubenmire, 1968).

The scale used is as follows:

Soc. 1 = growing singly
Soc. 2 = slightly grouped
Soc. 3 = in small patches
Soc. 4 = in large patches or carpets
Soc. 5 = in essentially continuous populations

(Tables 2,3,4)

Since actual random distribution is uncommon in natural plant communities, sociability determinations are useful in identifying plant communities and associations. Plants representing a species tend to be definitely grouped, resulting from a variety of physiological, morphological, and environmental factors (Daubenmire, 1968). The sociability groups assigned in Tables 2, 3, and 4 are valid only when interpreted in conjunction with their specific, and in many cases unusual, habitat - Boone Fork Bog.

Elevational Distribution--Habitat Groups

Because of a combination of factors including extremely high water table, drainage from Pig Pen Knob, dissapation of water from Knob Branch, and the temperate climate, noticable drying of the upper *Sphagnum* mat in Boone Fork Bog was not observed during the course of this study. In many areas standing water can be observed in conjunction with the *Sphagnum* mat, and in those areas where standing water is not visible the water table may be reached by digging from 4 to 9 inches. As a result of this extremely wet habitat an increase in elevation within the bog of 6 inches or less produces marked changes in plant communities and speciation. For example, 6 to 9 inch hummocks originally cuased by fallen logs or clustered roots of dead Scirpus and Juncus support typically "dryer" species such as *Polytrichum juniperinum* and *Dryopteris cristata*.

In an attempt to group the flora of the bog in relation to the average level of the *Sphagnum* mat (0 point), a survey of the bog was made using the plane table alidade and a specially designed level. Elevational measurements were made for each quadrant and for individual species representatives and plant communities of interest. The elevations were interperted in relation to (a) the point of origin of line transects 1, 2, and 3, and (b) the average height of the *Sphagnum* mat at the center of the bog (considered the 0 point).

On the basis of these measurements the plants occurring within the survey plots were grouped as follows:

0- = Those plants occurring at negative elevations, that is, in depressions below the average level of the *Sphagnum* mat.

0 = Those plants emerging from the *Sphagnum* mat at 0 elevation.

\+ = Hummock dwellers, those plants occurring on hummocks, +4 inches to +9 inches.

++ = "Dry" forms, those plants occurring at elevation inches.

I = Indescriminate forms, those plants that were observed with some regularity at all elevations.

These groupings reflect the actual occurrence of species within the survey plots. No attempt is made to place species into groups in which they "could" have occurred. Those species occurring in more than one habitat with some regularity but not considered indescriminates are so grouped.

Table 2. Relative abundance, sociability, and percent frequency groups for Survey Strip 1.

SURVEY STRIP 1

Species Present	Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	Sociability Group	% Freq.
Number of Species	16	12	13	9	11	10	8	11	13	11	16	9	13		
Scirpus expansus	F	F	A	A	A	A	Va	D	A	Va	O	F	A	5	100%
Agrostis perennans	F	A	Va	F	F	A	O	O	O	F	F	F	A	5	100%
Carex leptalea	F	A	Va	Va	F	A	F	O		A	F	F	Va	5	100%
Polygonum sagittatum	O	A	A	A	A	A	A		A	A	F	A	Va	5	92%
Juncus effusus	F	A	A	O			A		A	O	F	I	A	3	85%
Rubus allegheniensis	F	F	F	F	O	A	O	O	O		R	I	A	3	77%
Galium tinctorium		A	A	A	F	A	F	O	F	F	F		A	3	77%
Viola macloskeyi var. pallens	O		R	R	O		R	A	A	F			I	3	69%
Salix nigra	Pr		Pr											1	62%
Acer rubrum	Pr	O					O	O	Pr	A				1	54%
Viburnum cassinoides				O	A	A	A	Pr	O	A				1	54%
Polytrichum juniperinum	O	R	Pr	Pr										1	46%
Dryopteris cristata		F	F											1	31%
Sambucus canadensis	O	O		O										1	31%
Solidago patula	R		R											1	15%
Kalmia latifolia	Pr													1	15%
Ilex laevigata	O	O												1	15%

Table 3. Relative abundance, sociability, and percent frequence groups for Survey Strip 2.

SURVEY STRIP 2 Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Soc. Group	% Freq.
Number of Species	8	12	10	9	11	10	10	14	17	21	22	20	17	12		
Species Present																
Viola macloskeyi var. pallens	R	A	A	A	A	A	A	A	O	O	O	A	A	F	1	100%
Polygonum sagittatum	F	A	F	F	A	O	A	F	O	A	A	A	A		2	93%
Galium tinctorium	F	A	A	F	A	F	A	F		O	F	A	A	A	1	93%
Agrostis perennans		R	O	F	O	O	O	F	O	O	O	Pr	O		2	86%
Carex leptalea		O	F	A	F		F	F	O	O	O	A	F		2	79%
Scirpus expansus	Va	A	A	Va	Aa	A	A	O				O	O		5	71%
Rubus allegheniensis	F	F	F	F	O	O	F	F	O	R					1	71%
Acer rubrum	F	R	F	R					O	O	R	Pr	O		2	64%
Viburnum cassinoides					O		O	F	F	O	F	O	O	O	1	64%
Betula lutea						Pr	O	R	F	F	R	F	Pr	F	1	64%
Dryopteris cristata	O	F	F	F	O		O			O	O				1	57%
Kalmia latifolia								O	O	O	O	Fr	Pr	Pr	2	50%
Osmunda cinnamomea						Pr				F	R	O	O	F	2	43%
Rhododendron maximum									O	F	A	F	Pr	Pr	2	43%
Polytrichum juniperinum		R	O					O	F		F				3	36%
Juncus effusus						F				R		O	Va	O	2	36%
Amelanchier arborea var. laevis		O							O	O	O				1	29%
Solidago patula					R	Pr						Pr	Pr		1	29%

Table 2. (Continued)

STRIP 1. Continued Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	Soc. Group	% Freq.
Hygrohypnum eugyrium										Pr	Pr			3	15%
Betula lutea											O		O	1	15%
Lycopodium obscurum	O													1	7%
Vernonia noveboracensis	O													1	7%
Eupatorium sessilifolium		Pr												1	7%
Eupatorium perfoliatum			Pr											1	7%
Carex baileyi			R											2	7%
Rhododendron maximum						Pr								2	7%
Tsuga canadensis									Pr					1	7%
Lycopus virginicus									Pr					1	7%
Vaccinium vacillans											R			2	7%

Table 3. (Continued)

STRIP 2. Continued

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Soc. Group	% Freq.
Pinus pungens														Pr	1	7%

Table 3. (Continued)

STRIP 2. Continued

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Soc. Group	% Freq.
Tsuga canadensis									Pr	Pr	R		Pr		1	29%
Epilobium leptophyllum											O	A	O	O	2	29%
Aster accuminatus									O	O	O	O			1	29%
Bidens vulgata								R		O	O				2	21%
Lycopus virginicus												F	F	F	2	21%
Sambucus canadensis									R	R					1	14%
Vaccinium vacillans										R	R				2	14%
Salix nigra												Pr		F	1	14%
Aster puniceus												Pr		O	2	14%
Thelypteris noveboracensis								R	O						1	14%
Panicum clandestinum	O														2	7%
Hypericum virginicum					R										1	7%
Magnolia fraseri								Pr							1	7%
Trillium erectum									Pr						1	7%
Athyrium asplenoides		Pr													1	7%
Nyssa sylvatica										Pr					1	7%
Berberis thunbergii											Pr				1	7%
Mitchella repens											O				3	7%
Ivonia lingustrina											R				2	7%
Clethra acuminata												Pr			1	7%

Table 4. (Continued)

STRIP 3. Continued

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	Soc. class	% Freq.
Vernonia noveboracensis											Pr	O	1	17%
Panicum clandestinum								O	F				2	17%
Salix nigra						Pr	Pr						1	17%
Nyssa sylvatica										Pr	Pr		1	17%
Impatiens capensis										Pr			1	8%
Carex scoparia											R		2	8%
Lyonia linpustrina											Pr		2	8%
Lycopodium obscurum											R		1	8%
Carex normalis												A	2	8%
Habenaria clavellata										O			1	8%
Eupatorium perfoliatum												Pr	1	8%

Table 4. Relative abundance, sociability, and percent frequency groups for Survey Strip 3.

SURVEY STRIP 3

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	Soc. class	% Freq.
Number of Species	11	7	9	9	9	11	11	10	10	17	18	10		
Species Present														
Polygonum sagittatum	O	O	A	A	A	A	Va	Va	A	A	A	F	2	100%
Galium tinctorium	A	F	A	A	A	Va	Va	A	F	F	F	F	1	100%
Scirpus expansus	Va	Va	Va	D	Va	A	D	D	Va	O	O		5	92%
Rubus allegheniensis	A	A	A	A	F	F	F	F	F	A	F		1	92%
Viola macloskeyi var. pallens		A	A	A	A	A	Va	A	Va	A	A	F	1	92%
Dryopteris cristata	Pr	F		F	F	A	F	F	F				1	67%
Viburnum cassinoides	R			F		Pr	Pr	O		Va	Va		1	58%
Epilobium leptophyllum					O	P	F		O	O	O	O	1	58%
Carex leptalea	O	O	A	F	Va							Va	2	50%
Solidago patula			R				O	Pr	F	R	O		1	50%
Agrostis perennans	O		O	O	O			R		O			2	50%
Juncus effusus	R					R	O						2	25%
Acer rubrum	R		Pr			Pr							1	25%
Betula lutea									Pr	A	O		1	25%
Vaccinium vacillans	P									Va	Pr		1	25%
Lycopus virginicus										O	F	F	1	25%
Bidens vulgata										R	A	A	2	25%
Polytrichum juniperinum										F	R		3	17%

Table 5. (Continued)

	Total Frequency		Habitat Group 0-	0	+	++	T
Vaccinium vacillans	15%			x	x	x	
Sambucus canadensis	15%				x	x	
Lycopus virginicus	15%		x	x			
Bidens vulgata	15%			x			
Tsuga canadensis	13%				x	x	
Aster accuminatus	10%					x	
Amelanchier arb. var laevis	10%				x	x	
Vernonia noveboracensis	8%			x	x		
Nyssa sylvatica	8%			x	x		
Panicum clandestinum	5%						x
Holcus lanatus	5%				x	x	
Aster puniceus	5%						x
Lycopodium obscurum	5%				x	x	
Ivonia linguistrina	5%			x	x	x	
Eupatorium perfoliatum	5%					x	
Thelypteris noveboracensis	5%					x	
Hygrohypnum eugyrium	5%				x		
Hypericum virginicum	3%			x			
Magnolia fraseri	3%				x		
Trillium erectum	3%					x	

Table 5. Total percent frequency and habitat groups for Survey Strips 1,2, and 3.

	Total Frequency		Habitat Group 0-	0	+	++	T
Spaghnum squarrosum	100%		x	x			
Polygonum sagittatum	92%		x	x			
Galium tinctorium	92%		x	x			
Scirpus expansus	87%		x	x			
Viola mac. var. pallens	87%		x	x			
Rubus alleghoniensis	79%			x	x	x	
Agrostis perennans	79%				x	x	
Carex leptalea	74%				x	x	
Dryopteris cristata	59%				x		
Viburnum cassinoides	59%			x	x	x	
Acer rubrum	49%				x	x	
Juncus effusus	46%		x	x			
Betula lutea	36%				x	x	
Solidago patula	36%			x	x		
Polytrichum juniperinum	33%				x	x	
Salix nigra	31%						x
Epilobium leptophyllum	28%		x	x			
Kalmia latifolia	23%				x	x	
Osmunda cinnamomea	21%			x			
Rhododendron maximum	18%				x	x	

TABLE 6

PLANT LIST	Presence Group		
	a	b	c
SPHAGNACEAE			
Sphagnum squarrosum	x		
POLYTRICHACEAE			
Polytrichum juniperinum Hedw.	x		x
DICRANACEAE			
Dicranium scoparium Hedw.		x	
HYPNACEAE			
Hygrohypnum eugyrium (Bry. Eur.) Loeske		x	
LESKEACEAE			
Thuidium delicatulum (Hedw.) Mitt.		x	
LYCOPODIACEAE			
Lycopodium obscurum L.	x		
Lycopodium flabelliforme (Fern.) Blan.		x	
Lycopodium lucidulum Michx.			x
OSMUNDACEAE			
Osmunda cinnamomea L.	x		
Osmunda regalis var spectabilis (Willd.) Gray		x	
SCHIZAEACEAE			
Lygodium palmatum (Bernh.) Swartz		x	
PTERIDACEAE			
Dennstaedtia punctilobula (Michx.) Moore			x
Pteridium aquilinum (L.) Kuhn			x

Table 5. (Continued)

	Total Frequency		Habitat Group 0-	0	+	++	I
Athyrium asplenoides	3%					x	
Berberis thunbergii	3%			x			
Mitchella repens	3%					x	
Clethra acuminata	3%					x	
Eupatorium sessilifolium	3%			x	x		
Carex baileyi	3%			x			
Pinus pungens	3%			x			
Impatiens capensis	3%			x			
Carex scoparia	3%		x	x			
Carex normalis	3%			x	x		
Habenaria clavellata	3%					x	

TABLE 6 (Cont.)

JUNCACEAE				
Juncus effusus L.		x		
Juncus diffusissimus Buckley			x	
LILIACEAE				
Mianthemum canadense Desf.				x
Trillium erectum L.		x		x
IRIDACEAE				
Sisyrinchium mucronatum Michx.				x
ORCHIDACEAE				
Goodyera pubescens (Willd.) Brown				x
Habenaria orbiculata (Pursh) Torrey				x
Habenaria clavellata (Michx.) Sprengel		x		x
Spiranthes cernua (L.) Richard				x
SALICACEAE				
Salix nigra Marshall		x		x
BETULACEAE				
Betula lutea Michx.		x		x
POLYGONACEAE				
Polygonum sagittatum L.		x		
Rumex acetosella L.				x
PHYTOLACCACEAE				
Phytolacca americana L.				x
CARYOPHYLIACEAE				
Dianthus armeria L.				x

TABLE 6 (Cont.)

ASPIDIACEAE				
Polystichum acrostichoides (Michx.) Schott			x	
Dryopteris spinulosa (Mull.) Watt			x	
Athyrium asplenioides (Michx.) Eaton			x	
Thelypteris noveboracensis (L.) Nieuwland	x		x	
Dryopteris cristata (L.) Gray	x		x	
BLECHNACEAE				
Woodwardia aerolata (L.) Moore		x		
PINACEAE				
Pinus strobus L.	x		x	
Pinus pungens Lamb.		x		
Tsuga canadensis (L.) Carr.	x		x	
POACEAE				
Agrostis perennans (Walter) Tuckerman	x		x	
Glyceria melicaria (Michx.) Hubbard		x		
Panicum dichotomum L.	x		x	
Panicum clandestinum L.	x		x	
Holcus lanatus L.	x		x	
Dactylis glomerta L.		x	x	
CYPERACEAE				
Scirpus expansus Fern.	x			
Carex lurida Wahlenberg		x		
Carex crinata Lamb		x		
Carex baileyi Britton		x	x	
Carex leptalea Wahlenberg	x		x	
Carex vulpinoidea Michx.		x		
Carex scoparia Schkuhr	x			
Carex normalis Mackenzie	x			

TABLE 6 (Cont.)

HYPERICACEAE			
Hypericum virginicum L.	x		
VIOLACEAE			
Viola macloskeyi var. pallens (Banks ex DC.) Hitchcock	x		
ONAGRACEAE			
Oenothera fruticosa L.			x
Epilobium leptophyllum Raf.	x		
APIACEAE			
Daucus carota L.			x
NYSSACEAE			
Nyssa sylvatica Marshall	x		x
CLETHRACEAE			
Leucothoe axillaris var. editorium (Fern. & Schu.) Ahles			x
Clethra acuminata (Michx.)	x		
ERICACEAE			
Gaultheria procumbens L.			x
Kalmia latifolia L.	x		x
Oxydendrum arboreum (L.) DC.		x	x
Chimaphila maculata (L.) DC.		x	
Vaccinium macrocarpon Aiton - Introduced		Introduced	
Lyonia lingustrina (L.) DC.		x	
Monotropa uniflora L.			x
Vaccinium vacillans Torrey	x		x
DIAPENSIACEAE			
Galax aphylla L.			x
ASCLEPIADACEAE			
Asclepias syriaca L.			x

TABLE 6 (Cont.)

RANUNCULACEAE				
Clematis virginiana L.				x
BERBERIDACEAE				
Berberis thunbergii DC.	x			
MAGNOLIACEAE				
Magnolia fraseri Walter	x			x
Liriodendron tulipifera L.				x
ROSACEAE				
Fragaria virginiana Duchesne				x
Rubus allegheniensis Porter	x			x
Rosa multiflora Thunberg				x
Amelanchier arborea var. laevis (Wiegand) Ahles	x			x
Malus M. angustifolia (Aiton) Michaux		x		
FABACEAE				
Trifolium pratense L.				x
OXALIDACEAE				
Oxalis grandis Small				x
AQUIFOLIACEAE				
Ilex ambigua var montana Ahles				x
Ilex opeca Aiton		x		
ACERACEAE				
Acer rubrum L.	x			x
BALSAMINACEAE				
Impatiens capensis L.		x		

TABLE 6 (Cont.)

Eupatorium fistulosum Barratt			x
Helenium autumnale L.	x		
Rudbeckia hirta L.	x		x
Aster accuminatus Michx.	x		
Aster pilosus Willd.		x	x
Aster puniceus L.	x		
Chrysanthemum leucanthemum L.			x
Cardus lanceolatus L.			x
Achillea millefolium L.			x
Taraxacum officinale Wiggers			x
Bidens vulgata Greene	x		
Vernonia noveboracensis (L.) Michx.	x		x
Solidago patula Muhl. ex Willd.	x		x
Solidago juncea Aiton		x	x

TABLE 6 (Cont.)

PHYRMACEAE				
Prunella vulgaris L.				x
Scutellaria integrifolia L.			x	
Lycopus virginicus L.	x			
LAMIACEAE				
Monarda didyma L.				x
Monarda clinapodia L.				x
SOLANACEAE				
Solanium carolinense L.				x
SCROPHULARIACEAE				
Chelone glabra L.			x	
Pedicularis canadensis L.				x
Mimulus ringens L.			x	
RUBIACEAE				
Mitchella repens L.	x			x
Galium tinctorium L.	x			
Houstonia serpylliofolia Michx.				x
CAPRIFOLIACEAE				
Viburnum alnifolium Marshall				x
Viburnum cassinoides L.	x			x
Sambucus canadensis L.	x			x
CAMPANULACEAE				
Specularis perfoliata (L.) DC.				x
ASTERACEAE				
Eupatorium rugosum Houttuyn				x
Eupatorium sessilifolium L.	x			
Eupatorium perfoliatum L.	x			x

SUMMARY

A phytoecological survey of Boone Fork Bog was carried out to determine the distributional and associational aspects of the macroscopic plant life present within the bog.

After an initial taxonomic survey of the general area, during which 116 species representing 49 families were collected, thirty-nine 10^2 foot quadrants were surveyed in detail. This vegetational analysis included the construction of plant maps for each quadrant, determination of relative abundance and sociability groupings for each species represented and an elevational survey of each quadrant.

The data obtained from this survey was tabulated to show relative abundance, sociability groups, percent frequency, presence, and habitat groups for all species recorded within the study area. Based on this information the following observations are made:

1. Boone Fork Bog, floristically impoverished because of the harsh bog conditions, is dominated by typical bog species.

2. In addition to typical bog plants, Boone Fork Bog supports several wetland species uncommon to this area, including *Epilobium leptophyllum* (very rare), *Lygodium palmatum*, and *Osmunda regalis* var. *spectabilis*.

3. Two bog indicator species, common to other *Sphagnum* bogs of this area, are conspicuously absent from Boone Fork Bog: *Vaccinium macrocarpon* (now introduced in controlled plots), and *Drosera rotundifolia* L.

4. The woody vegetation of the bog exists in predominately stunted forms and much early die-back is evident. Core sample studies for age determinations are warranted.

5. There has been no evident regression or expansion of the bog perimeter of change in general area wetness during the past 70 years (that period for which there are verifiable records).

6. The bog is actually a series of microhabitats created by area water relations.

7. The bog flora may be placed into habitat groups on the basis of immediate area water relations.

8. Paleoecological and successional investigations of the bog are warranted.

APPENDIX

The Boone Fork Bog study has resulted in the identification of 16 plants which are county records. These species, not previously recorded in Watauga County, are as follows:

OSMUNDACEAE
Osmunda regalis var. *spectabilis* (Willd.) Gray

SCHIZAECEAE
Lygodium palmatum (Bernh.) Swartz

PTERIDACEAE
Pteridium aquilinum (L.) Kuhn

BLECHNACEAE
Woodwardia areolata (L.) Moore - Ident. by R. M. Osborne

POACEAE
Panicum clandestinum L.

CYPERACEAE
Carex crinata Lam
Carex baileyi Britton
Carex leptalea Wahlenberg

JUNCACEAE
Juncus diffusissimus Buckley

BERBERIDACEAE
Berberis thunbergii DC.

HYPERICACEAE
Hypericum virginicum L.

VIOLACEAE
Viola macloskeyi var. *pallens* (Banks ex DC.) Hitchcock

ONAGRACEAE
Epilobium leptophyllum Raf.

PHYRMACEAE
Scutellaria integrifolia L.

SCROPHULARIACEAE
Chelone glabra L.

ASTERACEAE
Eupatorium sessilifolium L.

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VITA

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Upon completion of his undergraduate program Terry accepted an assistantship for graduate study at Appalachian State University, and began work toward the Master of Science degree in September 1970. He was married to Barbara Bruno on September 18, 1970.