The Ohio Naturalist,

PUBLISHED BY

The Biological Club of the Ohio State University.

Volume XII. NOVEMBER, 1911. No. 1.

TABLE OF CONTENTS.

CLIMATIC CONDITIONS AND PLANT GROWTH IN SOUTHWESTERN OHIO IN 1908 AND 1909.

BRUCE FINK and VERNON LANTIS.

The spring of 1908 was cold, wet and backward, and it was almost impossible to plant early in fields or gardens. It rained or snowed nearly every day in April. The sky cleared before noon on the second day of May, and there was no further precipitation of moisture at Oxford, Ohio, where the observations given in this paper were made, until the twentieth of June, except two showers that barely laid the dust. July second, third and fourth gave showers, which altogether wet loose soil down one to two inches. Similar showers came on the fourth and fifth of August and again on the twelfth and seventeenth of the month, but at no time was loose soil wet down more than two inches. A rain on the twenty-eighth of September wet down one inch, and another like it came during the last week of October. From the middle to the last of November, we had several light showers that set the grass growing. The soil of cultivated fields was watched for three days after each shower or series of showers, and for six months, from the second of May to the middle of November, it was at no time wet by rain to a depth greater than two inches. The total number of light rains during the six months was nine. The drought that occurred during these six months was probably the most severe and disastrous known in this locality since its settlement.

The precipitation for March and April, 1908, was excessive, and the government Monthly Weather Review for both months put us in the area of four to six inches. We were also put in the area of four to six inches precipitation for May, 1908; but this is very likely an error of compilation from few stations for a large area, since so much precipitation probably did not occur before

*Contributions from the Botanical Laboratory of Miami University. VII.

noon of the second day of the month. For June we were put in the area of 2 to 4 inches, with a considerable area of 0 to 2 inches a short distance north of us, extending from Illinois to the Atlantic coast. This is an error, and we should have been included in the latter area. For July we were near the border of a small area marked 0.83 inches. We were in this area again in August and September; and the area gradually increased until it covered a large portion of the United States east of the Mississippi River, and there was inaugurated one of the most extensive and severe droughts ever experienced in the region. The area was still larger in October, extending from the Gulf of Mexico far north into Canada with precipitation ranging from 0 to 2 inches and marked about 0.25 inches for our area. The dry area changed form in November, the northern and southern portions of it receiving more precipitation, but we were still in the area with precipitation not exceeding one inch for the month. The map for December shows another change of form of this area, but our region is still included with 0 to 2 inches precipitation.

Putting together our local observations of showers, which were carefully recorded, and the government reports, it is certain that however the areas of drought changed from the first of May, 1908, until the first of January, 1909, our area where observations were made, at Oxford, was always included. In Chart XI of the Monthly Weather Review for May, 1909, our area is included in the only one in the Mississippi valley having a deficiency of precipitation as high as 10 inches for the year 1908. The area is a small one covering about one-fourth of southwestern Ohio and extending westward to Indianapolis. The Ohio portion of the area extends to the south boundary of the state at Cincinnati. This Review says that the Ohio valley experienced "one of the most disastrous droughts in the meterological history of the district. * * * The drying up of the streams and springs greatly inconvenienced farmers in procuring water for their cattle and domestic supplies, and the supplies to cities and towns were greatly reduced. * * * The occurrence of this drought rather late in the season of crop growth and development did not result in such widespread disaster to agricultural interests as might have resulted had it occurred slightly earlier." The above quotation expresses well the conditions in towns and in the country as seen in October and November, 1908, while botanizing in the Miami valley. However, the drought was on at Oxford, and at least in other portions of Butler County, by the last of May so that vegetation suffered more severely here than in most other portions of the country that suffered from drought in 1908. One of the writers visited northern Illinois the latter part of September, and central Kentucky a month later. All of the region covered was reported very dry, but the region of dead grass scarcely extended forty miles from Oxford, either southeast or northwest.

It is unfortunate that no record of precipitation of moisture is kept nearer Oxford than Cincinnati, 30 miles distant. However, the figures kept there are valuable for our purpose and are given below:

THE RECORD OF PRECIPIATTION AT CINCINNATI FOR 1908.

January	1.40	inches.	Relation to normal precipitation				—2.0	inches.
February	4.50	"	"	"	"	"	+1.2	"
March	3.66	"	"	"	"	"	0.0	"
April	4.07	"	"	"	"	"	+1.1	"
May	5.84	"	"	"	"	"	+2.3	"
June	2.00	"	"	"	"	"	—2.0	"
July	0.83	"	"	"	"	"	—2.7	"
August	1.69	"	"	"	"	"	—1.6	"
September	0.26	"	"	"	"	"	—2.0	"
October	0.35	"	"	"	"	"	—2.1	"
November	1.09	"	"	"	"	"	—2.1	"
December	1.60	"	"	"	"	"	—1.3	"
Total	27.29	inches.	Deficiency for the year,				11.13	inches.

Cincinnati does not fall within the area given by the government reports as having a deficiency as high as 10 inches for the year; but the precipitation for the year was only 27.29 inches, which is, according to the figures of the government observations, 11.13 inches below the normal 38.42 inches for the station at Cincinnati. The record of precipitation at Cincinnati for May very probably exceeds ours, and our deficiency for the year was almost certainly not less than 14 inches. Taking into account our lack of rain in May and the table for Cincinnati, which shows a deficiency of 13.80 inches for the last seven months of the year, it will be seen that our deficiency for the last eight months of the year was probably more than 16 inches.

We shall want to compare climatic and vegetation conditions for 1908 with those obtaining in 1909, and the precipitation record for Cincinnati for 1909 is given below to be used in these comparisons:

THE RECORD OF PRECIPITATION AT CINCINNATI FOR 1909.

January	2.50	inches.	Relation to normal precipitation				—0.8	inches.
February	5.65	"	"	"	"	"	+2.4	"
March	2.44	"	"	"	"	"	—1.2	"
April	3.62	"	"	"	"	"	+0.7	"
May	4.21	"	"	"	"	"	+0.7	"
June	6.05	"	"	"	"	"	+2.1	"
July	3.83	"	"	"	"	"	+0.3	"
August	1.82	"	"	"	"	"	—1.5	"
September	1.30	"	"	"	"	"	—0.9	"
October	3.20	"	"	"	"	"	+0.7	"
November	1.42	"	"	"	"	"	—1.8	"
December	2.40	"	"	"	"	"	—0.5	"
Total	38.44	inches.			Excess for the year		0.02	inches.

The figures for 1909 show the year to have been about normal for total precipitation, but to have had an excess of 4.4 inches for the four growing months, April, May, June and July. The

bearing of this excess on our studies of vegetation will be seen later. It is remarkable that, though the month of August showed numerous heavy storms in southern Ohio and the northern half of Kentucky, with rainfalls of more than 3 inches in twenty-four hours, and in two instances more than 4 inches, the station at Cincinnati showed a record below normal. In spite of this record, August, 1909, was a very wet month over the portions of Ohio and Kentucky named.

The year 1908 was regarded a very dry one for Ohio generally and the following year a wet one. In order that the conditions endured by vegetation in southwestern Ohio may be compared with the average conditions endured over the state, the precipitation records for the two years are given below:

PRECIPITATION RECORDS FOR OHIO IN 1908 and 1909.

	1908	1909
January	1.82 inches	3.24 inches
February	4.10 "	5.39 "
March	2.43 "	2.77 "
April	3.69 "	4.13 "
May	4.72 "	4.72 "
June	2.52 "	5.86 "
July	4.08 "	3.90 "
August	2.59 "	3.68 "
September	0.58 "	1.56 "
October	1.17 "	2.46 "
November	1.06 "	1.93 "
December	2.33 "	2.68 "
Totals	31.09 "	42.32 "

The mean annual precipitation for the state for twenty-seven years, according to the meteorological summaries published by the Experimental Station at Wooster is 37.56 inches. This makes 1909 little less above the average for total precipitation than was 1908 below, the deficiency for the latter year being 6.49 inches. This deficiency is to be compared with one of 10 to 12 inches or more endured by vegetation in southwestern Ohio in 1908.

The monthly mean temperatures for 1908 and 1909 are as follows in degrees Fahrenheit:

	1908	1909
January	29.1 degrees	32.2 degrees
February	26.6 "	34.7 "
March	45.5 "	37.3 "
April	51.7 "	49.1 "
May	62.2 "	58.7 "
June	69.2 "	70.1 "
July	73.9 "	66.4 "
August	71.2 "	72.1 "
September	68.0 "	63.7 "
October	54.1 "	49.2 "
November	41.7 "	40.4 "
December	33.1 "	26.1 "
Year	52.1 "	50.7 "

From the tabulation it is seen that the year 1908 was 1.4 degrees warmer than 1909; but what is more to the point, the warm growing months from April to September inclusive averaged 2.8 degrees warmer in 1908 than in 1909. This higher temperature made the drought more disastrous for plant life.

A porous cup atmometer was operated near Oxford, by Professor S. R. Williams, through the months from June to September, 1908, inclusive. The work was done for Messrs. Burton E. Livingston and Forrest Shreve, who have kindly given us the figures for use. Without correcting for depth, the figures are valuable in showing the atmospheric conditions under which vegetation existed here for these months, and in making possible comparisons with those obtaining in other portions of the country. The porous cup atmometer records the evaporating power of the air as this affects the water layer covering the moist clay surface of the cup. This surface is in many respects comparable to that offered by transpiring foliage under the influence of air conditions. The cups were operated during the same months at a large number of selected stations in various portions of North America, and the results obtained near Oxford may be compared readily with those found elsewhere. The average weekly evaporation in the vicinity of Oxford was as follows: June, 132 cc.; July, 182 cc.; August, 211 cc.; September, 212 cc. The evaporation for June over the region east of the 100th meridian was somewhat more than 100 cc. per week. In July there was a local area covering northeastern Ohio, eastern Michigan and a large part of Pennsylvania and New York that showed a weekly average of about 200 cc. The conditions remained about the same over this area during August. Comparison proves that we were, during all of this time, in a region of very dry atmospheric conditions where the evaporation was high, compared with records for other portions of eastern North America.

The evaporation from the porous cup atmometer is independent of soil moisture and depends upon the atmospheric conditions. Therefore, conditions of soil moisture can not be deduced from evaporation figures, but must be worked out separately. Our study of soil moisture conditions began early in October, 1908, when the drought was at its height and the cumulative effect on the soil was marked. The study was continued for nine months, extending into July, 1909. The results would have been more valuable, had the study begun five months earlier. Below is given the table of soil moisture:

TABLE OF SOIL CONDITIONS.

Soil	Can	Dates 1908–1909	Location	Depth in cm.	Weights in Grams			Water per cent moist	Water per cent dry
					First	Second	Can		
Red Clay	No. 1	Oct. 8	Campus two rods west of Brice Hall. Station No. 1.	36	853.00	787.61	125.05	8.98	9.87
"	No. 2	Oct. 8		36	833.76	769.85	125.10	9.02	9.91
"	No. 3	Oct. 8		56	869.19	786.96	126.39	11.07	12.45
"	No. 4	Oct. 8		56	961.00	867.75	120.42	11.09	12.48
"	No. 5	Oct. 8		81	885.20	805.28	121.65	10.47	11.69
"	No. 6	Oct. 8		81	935.10	850.00	125.70	10.51	11.75
Red Clay	No. 1	Oct. 15	Campus south of Main Building by old flag pole. Station No. 2.	41	985.62	871.74	125.12	13.23	15.25
"	No. 2	Oct. 15		41	905.85	803.38	125.89	13.14	15.12
"	No. 3	Oct. 15		56	955.93	833.69	126.45	14.74	17.28
"	No. 4	Oct. 15		56	1006.07	875.00	120.60	14.80	17.37
Red and White Clay	No. 5	Oct. 15		13	855.80	816.31	122.00	5.38	5.69
" " "	No. 6	Oct. 15		13	825.90	787.97	125.90	5.42	5.73
Loam and White Clay	No. 7	Oct. 21	Bruce Fink's young orchard. Station No. 3.	26	895.80	799.96	122.35	12.39	14.14
" " "	No. 8	Oct. 21		26	866.45	775.19	125.61	12.32	14.05
" " "	No. 9	Oct. 21		50	788.05	708.03	125.46	12.08	13.74
" " "	No. 10	Oct. 21		50	840.79	749.59	125.33	12.75	14.43
Loam	No. 1	Nov. 6	Bruce Fink's garden. Station No. 4.	36	832.52	704.57	124.70	18.08	22.06
"	No. 4	Nov. 6		36	833.87	720.78	120.30	15.84	18.84
"	No. 5	Nov. 6		53	941.34	795.50	121.98	17.80	21.65
"	No. 10	Nov. 6		53	772.32	657.00	125.83	17.84	21.71
Loam and White Clay	No. 2	Nov. 6	Bruce Fink's young orchard. Station No. 3.	38	982.11	864.80	125.00	13.69	15.86
" " "	No. 7	Nov. 6		38	865.65	763.46	122.50	13.75	15.94
" " "	No. 3	Nov. 6		53	1033.52	930.70	125.75	11.33	12.77
" " "	No. 6	Nov. 6		53	806.65	728.00	125.83	11.55	13.06
Loam	No. 1	Dec. 23	Bruce Fink's garden. Station No. 4.	27	876.50	785.23	124.86	12.14	13.82
"	No. 2	Dec. 23		27	903.40	816.42	124.88	11.17	12.58
"	No. 3	Dec. 23		48	769.13	689.86	126.00	12.32	14.06
"	No. 4	Dec. 23		48	866.24	775.29	120.25	14.28	17.43

" " "	No. 7	Dec. 23	Station No. 5.	40	991.14	912.26	122.92	9.09	9.99
" " "	No. 8	Dec. 23		40	1001.50	928.00	123.80	8.37	9.14
Loam and White Clay.....	No. 1	Feb. 12		48	787.50	655.62	124.87	19.90	24.85
" " "	No. 2	Feb. 12	Lower Campus.	48	834.30	691.09	124.90	20.19	25.29
" " "	No. 3	Feb. 12	Station No. 5.	66	848.00	737.30	125.85	15.33	18.11
" " "	No. 4	Feb. 12		66	912.70	788.36	120.30	15.69	18.61
Loam and White Clay.....	No. 5	April 19		53	857.03	700.92	121.82	21.23	26.96
" " "	No. 6	April 19	Lower Campus.	53	812.45	663.66	125.86	21.67	27.67
" " "	No. 7	April 19	Station No. 5.	35	837.25	684.31	122.20	21.39	27.21
" " "	No. 8	April 19		35	827.02	677.24	124.29	21.31	27.09
Loam.....	No. 1	July 8	Bruce Fink's	30	902.28	733.80	125.30	21.68	27.69
"	No. 2	July 8	garden.	30	857.50	699.80	125.57	21.55	27.46
Loam and Clay.....	No. 3	July 8	Station No. 4.	54	880.00	717.25	126.40	21.60	27.55
" "	No. 4	July 8		54	794.51	650.00	120.38	21.44	27.09
Loam and White Clay.....	No. 5	July 8	Bruce Fink's	28	972.20	798.37	122.24	20.45	25.71
" " "	No. 6	July 8	young orchard.	28	808.70	665.92	126.08	20.92	26.45
Yellow Clay and Sand.....	No. 7	July 8	Station No. 3.	62	873.12	762.50	125.20	14.79	17.36
" " "	No. 8	July 8		62	822.13	703.00	124.63	17.08	20.60

In the soil studies, two samples were taken from the same place and the same depth at the same time in order that each might serve as a check upon the other. In order to compare soil moisture for different locations, determinations were made of soil taken from both places on the same day and at about the same depth. In order to decrease the chances of error, a considerable amount of soil was taken in each sample. The drying process was continued until several weighings made at intervals of four or five hours, gave exactly the same results. In no case was the temperature allowed to rise to 100° C. The instruments used were a shovel, a hoe, a meter rule, a number of quart tin cans, and an oven. The geotome was not used because the amount of soil taken for each sample made this instrument impracticable.

The location of a station once decided upon, all the soil was quickly removed to the depth at which the two samples were to be taken. If any loose soil rolled into the excavation before the samples were secured, it was carefully removed, so that the samples would be entirely of the soil at the depth decided upon. The excavations were made large enough so that a surface of about two square feet would be exposed. Then a layer of soil not exceeding one inch in depth was loosened carefully so as not to get any soil from a higher level mixed with it, put into the cans, and the lids tightly sealed. The cans were taken to the laboratory, where they were weighed. The lids were then removed and the drying process begun. In some instances the drying extended over a period of four days, the cans being kept where they would be undisturbed and at a temperature below 100° C. so that no humus would be burned. After the drying was completed, the cans were weighed again and the percentage of moisture for both moist and dry soil calculated. For instance in the first sample in the table (853—787.61)÷(853—125.05) gives the proportion of moisture relative to the weight of the moist soil. This reduced to per cent gives 8.98. For getting the per cent dry soil weight for the first sample we used (853—787.61)÷787.61—125.05). The five stations were selected mainly to represent different types of soil, as the red clay of station number one, the mixture of red and white clay of station number 2, the loam and white clay of station number 3 and the loam of station number 4. Stations numbers 1 and 2 were in the open and heavily sodded. A large elm stood 16 feet from the first station. There were no trees within 100 feet of the second station. Station 3 was among apple trees planted in April of the same year. A poor crop of oats had been harvested; and the ground had been seeded to clover and timothy, which failed because of drought. The ground was hard and dry at the surface, and had not been stirred since sowing the grain in April. Station 4 was a rich, black loam that had been carefully worked all summer, up to the time when

the first samples were taken. Station 5 was of the beech forest type. The surface is nearly level at all of the stations. Stations 1 and 2 are 35 rods apart, and stations 3 and 4 are 15 rods apart. Stations 3 and 4 are 656 feet lower than stations 1 and 2, and about one-third of a mile distant. Station 5 is a few rods distant from station 2.

The difficulties of studies of soil moisture are very great owing to daily variations of temperature, of evaporation rate at different hours, and other variable factors. While we have given the per cents of water based both on moist soil and dry soil, we shall use in the discussion only the former. A given per cent of water in one soil may mean a very different condition for the plant than the same per cent in another soil, and a given per cent in any soil affects different plants differently. Clay soils will hold approximately 40 to 50 per cent of water; and most land plants can not secure water from clay when the per cent falls below 9 or 10, while few if any can secure water from such soil containing less than 6 per cent. Loams and humus will hold approximately 50 to 65 percent of water; and most plants cannot extract water when the percent falls below 10, and few if any when it falls below 6. Sand will scarcely hold more than 15 per cent of water, but most plants can still obtain water from sand when the per cent falls below one. Plants that can obtain sufficient water only when the per cent is high are hydrophytes, those that can obtain it when the per cent is moderate are mesophytes and those that can still obtain it when the per cent is low are xerophytes.

It will be seen from the table above that the soil moisture on October 8, 1908, at station number 1 had reached the point where mesophytes, which include most of the land plants of the region, whether wild or cultivated, would have great difficulty in securing water from the clay at a depth of 36 cm. At station number 2 on October 15, 1908, mesophytes could secure water from the clay at depths of 56 and 41 cm., but not at a depth of 13 cm., where even xerophytes might fail utterly to secure soil moisture. At station number 3, on October 21, 1908, mesophytes could secure soil moisture at 50 and 26 cm. deep, but with some difficulty. But at the same station, on July 8, 1909, mesophytes would have no difficulty in securing abundant soil moisture at these depths. At station number 4, on November 6, 1908, garden plants should be able to obtain soil moisture, though probably with some difficulty. But in this station, on July 8, 1909, garden plants would have no difficulty in securing sufficient soil moisture. At station number 5, in the heavy beech woods, most plants would not be able to secure soil moisture from the clay soil at depths of 29 and 40 cm. on December 23, 1908, while moisture could be secured easily at such depths on April 19, 1909. Hundreds of stations and daily testings throughout the season would be neces-

sary to give results as accurate as possible, but our figures indicate that most plants would fail to secure soil moisture or would secure it with difficulty at the depths tested on the dates on which the samples were taken in 1908. Our data are valuable only when correlated with the observations below regarding the character of plants that were able to remain green above ground throughout the season of 1908.

Related to the lack of rain after May 2, 1908, stands the fact that corn planted after the middle of May came up very unevenly and in some fields scarcely at all. Much of the corn failed to produce ears and dried up in August. Other fields, often near the poor ones, made a good showing of ears. The difference was due in part to difference in tending as well as to local climatic and soil conditions. The crop reports probably overestimate the amounts harvested in Butler County in 1908; but the bushels per acre reported for some of our principal crops for 1908 and 1909 respectively, are winter wheat, 16.2 and 16, oats 10.4 and 33, corn 28.1 and 34, potatoes 44.6 and 73. Winter wheat was a very unpromising crop in the fall of 1908, and much that was sown did not germinate until the following February. In some fields the seed failed completely in the fall. But a heavy snow came in January, 1909, and when this disappeared early in February, the seed had germinated; and in many places the fields were green with wheat about an inch high. Frost killed much of this, and the prospects were very poor. But the spring rains came, and the wheat stooled so that 25 and 30 stalks from one kernel were reported by reliable agriculturists. Thus, fields that were so thin in early spring that it seemed scarcely worth while to let them stand produced about a normal amount of straw, but too many stalks from a single kernel for a good yield. So the effect of the drought of 1908 was felt in the wheat crop of 1909 as well as in that of 1908. Of the other three crops, the average for 1908 was little more than half that for 1909, according to the statistics for the two years.

The pastures were brown and the grass dead above ground from the middle of June until late in November. The timothy and blue grass of the hay fields were dead above ground soon after the hay was cut. From the middle of August until November, the country, except cultivated fields, presented the appearance of a desert with scattered vegetation consisting of xerophytes with succulent stems, deeply penetrating roots, tough exteriors, or milky juice. In open fields, along roadsides and in yards and gardens were seen conspicuously resisting the drought, dandelion (Taraxicum officinale), mullein (Verbascum thapsus), moth mullein (Verbascum blattaria), wild carrot (Daucus carota), milk purslanes (Euphorbia maculata and E. preslii), amaranths (Amaranthus retroflexus, A. blitoides and A. graecizans), asters

(species of Aster), sunflowers (species of Helianthus), goldenrods (Solidago canadensis and S. nemoralis), plantains (Plantago major, P. rugelii and P. lanceolata), yard grass (Polygonum aviculare), docks (species of Rumex), goosefoots (Chenopodium album and C. urbicum), milkweeds (Asclepias cornuti), lettuces (Lactuca scariola and L. canadensis), purslane (Portulaca oleracea), evening primrose (Oenothera biennis) and crab grass (Panicum sanguinale). Some of the above ripened or succumbed sooner than others. In woods, in low meadows and along streams grasses and sedges were able to persist in good quantity, but on higher open ground wild grasses and sedges were for most part dead and brown above ground by the middle of August.

The leaves of many trees, especially maples and ashes, became dry and brown before the middle of September, and it was suspected that a considerable number of these would die the following season. The many planted trees of the campuses of Miami University and The Western College for Women, at Oxford, were carefully watched through the season of 1909. The campus of the former institution has a shallow soil, the solid limestone rocks being within three to six feet of the surface, while rocks have not been reached on the campus of the latter institution in digging, except in very low places. Many large, planted trees have died on the campus of Miami University since the summer of 1908; but only two planted trees have died on the campus of The Western during the same years, and these two were badly injured by *Cenangium abietis*. Of 213 maple trees on the campus of Miami University before the drought, 9 were dead in the fall of 1909; and 38 more were in a dying condition as shown by thin foliage or more frequently by more or less of the crown of the tree being dead. Of 90 planted ashes, 9 showed a larger or smaller number of dead branches, and 7 died before the summer of 1911. Of 10 spruces, 4 were in a dying condition in 1909. About 35 other trees died or were in a dying condition in 1909; but these were scattered through many genera, and while the number is large, great damage was not shown by any of the genera involved. Trees have been dying on the campus of Miami University in considerable numbers since 1908, and the dying is largely confined to the trees that showed the injurious effects of the drought of 1908. The superintendent of grounds for Miami University informs us that not a single large, planted tree on the campus died from 1898 to 1908, but that dying has been going on constantly since the latter date.

The contrast in crop conditions between 1908 and 1909 has been given above. Other contrasts in vegetation conditions were also very marked. In 1909, all kinds of herbaceous vegetation of the region was green and luxuriant throughout its natural cycle, and trees not considerably injured by the drought of the

previous year showed abundant foliage. *Botrydium wallrothii* and *Cyathus vernicosus* appeared on black loam of gardens and fields in such abundance as is seldom seen. In 1908 *Botrydium* and *Anthoceros* could not be found in sufficient quantity for class use; but in 1909, the latter, like the former, was remarkably abundant. It could be found in the average woods of the region, wherever soil was bare, in five minutes. This is remarkable since in ordinary years, *Anthoceros* is rarely seen here and only along shaded clay banks. The fleshy fungi were also very abundant in 1909. At "Beechwood Camp," in August, students brought in such an array of *Russulae*, *Lactariae*, *Amanitae*, *Boleti*, and other forms as is seldom seen in these days of depleted forest lands. Contrasted with this, there was almost a total absence of these fungi during the same month in 1908. Of the *Boletaceae*, only a few specimens of *Suillellus luridus* were seen in 1908, while *Gyroporus castaneus*, *Tylopilus felleus*, T. *indecisus*, *Ceriomyces auriporus*, C. *retipes*, C. *miniato-olivaceus*, C. *bicolor*, C. *fumosipes*, C. *communis*, *Suillellus luridus*, *Strobilomyces strobilaceus* and *Boletinellus merulioides* were all collected in 1909.

To have accomplished results of great ecologic value, it would have been necessary to keep several operators at work during two years, obtaining data regarding precipitation, temperature, light, evaporation, soil, and vegetation conditions in a limited area and at the level of vegetation. Though it was not possible to carry out the work with such detail and accuracy, it is believed that our results are valuable for record for the locality and the state.