

# **History of Soil Survey in North Carolina**

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## **Abstract**

The Raleigh to New Bern survey, published in 1900, at a scale of 1 inch per mile is the oldest known soil survey in North Carolina. Milton Whitney, then chief of the Bureau of Soils, had been the first superintendent of the research farm in West Raleigh before being appointed to the Federal position. In 1909, W. E. Hearn completed a unique soil survey of approximately 50,000 acres in Lake Mattamuskeet while it was under water, later to be pump drained in the 1920s only to become a lake again in 1933–34 when the pumping was abandoned. Hugh H. Bennett entered the soil survey of his native state in 1903, became an inspector in 1910, and spearheaded the formation of the Soil Erosion Service in 1933. Of the 100 counties in the state, 98 have published soil surveys, and the remainder have completed surveys awaiting publication. Fifty-six counties have two published soil surveys and five have three published surveys. Tales of 'bacca spittin', moonshin', and "ya'll can't get there from here" have contributed to the soil surveys of the "Old North State."

## **Introduction**

Perhaps it would be a bit presumptuous to claim that North Carolina was where soil survey in the United States started, but it is a fact that in 1886, Dr. Milton Whitney was appointed the first superintendent of the research farm in West Raleigh. While the research farm was to become North Carolina State University, Dr. Whitney was to become the first Chief of the Bureau of Soils in the USDA and establish the soil survey program and the first systematic classification of soils in the United States (McCracken 1989).

Whitney was well known for his ever present cigar and his allegations that he could determine the kind of soil in which a tobacco was grown by the aroma of the smoke

(Simonson 1986). His contention that the content of sand, silt, and clay had more to do with soil productivity than the soil's nutrient status or fertility put him at odds with the chemists and soil fertility specialists of that day (McCracken 1989). Also, oral history indicates that not all of his associates shared his enthusiasm for cigars.

### **Early Soil Survey Program in North Carolina**

North Carolina became one of the first six states to begin a program of systematic classification and mapping its soils, with accompanying interpretations of use potentials. The USDA soil survey program began as a cooperative effort with the North Carolina Agricultural Experiment Station (now North Carolina State University) and the State Board of Agriculture (now the North Carolina Department of Agriculture). The first soil survey in North Carolina was the "Raleigh to New Bern Area," started in 1900 (Lee 1984). The survey was to be used as the basis for systematic investigation of the fertilizer requirements of different crops through a series of substations to be established on some of the principal soil types. The first surveyor was William C. Smith, a USDA employee. With the U.S. Geological Survey base maps previously prepared along the railway right-of-way, he mapped 1000 square miles in eight months. This is a rate of 5.6 square miles per day traveling by foot, horse- or mule-back, cart, buggy, or train. The cost of the survey was \$1.10 per square mile.

In 1901, a second soil survey was started in the Statesville area. This survey was in one of the most eroded areas in the state. The report stated that farming practices resulted in "washing and small gullies . . . with many fields having gullies with a depth of greater than 40 feet" (Lee 1984). The remedy suggested was that "gullied fields in a few years would be entirely reclaimed by a judicious use of ditch and terraces and the filling in of the larger gullies by means of pine boughs and logs" (Lee 1984). The fast-growing area around Cary was surveyed in one summer month in 1901. The survey area covered 63 square miles and included the present site of N.C. State University. The Mt. Mitchell area was mapped to find soils suitable for apple orchards in 1903. Other area soil surveys are listed in Table 1.

**Table 1.** Soil surveys by area

Year Published	Name of Survey
1900	Raleigh to New Bern area
1901	Statesville area
1901	Cary area
1902	Mt. Mitchell area
1902	Hickory
1903	Craven
1903	Asheville
1904	Greenville
1909	Lake Mattamuskeet
1977	Outer Banks [1" = 1000 feet]

Alamance County was selected, because it was alphabetically first among the counties, for a survey in 1901. Duplin County was surveyed to consider land suitable for vegetable and grape production. Chowan County soil survey marked the first State Department of Agriculture employee, G. M. MacNider, to join with USDA soil scientist W. Edward Hearn. These two men also mapped Transylvania County at the same time. The state contributed \$188.10 to the Chowan County survey and \$737.80 to the Transylvania County survey. From 1900 to 1910, the base maps were 1-inch-per-mile U.S. Geological Survey (USGS) maps, many of which were 15 to 25 years old and out of date due to new roads, etc. Soil surveyors were geologists or chemists with little training in agriculture (Lee 1984).

In 1904, Hugh Hammon Bennet joined the North Carolina soil survey, became an inspector in 1910, and in 1933 formed the Soil Erosion Service, later to become the Soil Conservation Service and the Natural Resources Conservation Service.

In 1910, Professor Curtis Marbut was placed in charge of the Bureau of Soils, USDA. Base maps were then made with a plane table (15- x 15-inch board) equipped with compass and mounted on a tripod. An alidade was used to sight and measure. Transportation was by mule- or horse-drawn carts. An odometer fastened to the front wheel served to measure distances along roads. Churches, schools, cemeteries, and dwellings along the road were carefully identified on the base maps. About 1905, a 36- to 42-inch-long screw auger became the standard tool to examine soils.

In 1917, S. F. Davidson became the first college-trained soil scientist to join the soil survey, followed in 1918 by W. A. Davis. In 1918, the automobile entered the survey to transport the soil surveyor and his plane table.

The first airplane entered the survey in North Carolina in 1920. W. B. Cobb, a World War I pilot, assisted by W. A. Davis, flew over the swamps of Tyrrell County to locate points later to be traversed on foot. A few photos from the plane were used to aid the ground work, but total photo coverage was not used at that time. Complete aerial photo coverage was not used for soil survey in North Carolina until 1934 (Lee 1984).

## **A Few Statistics**

North Carolina contains 100 counties. In recent years, soil surveys have been made and published by county or, in some cases, two counties.

As of this writing (June 1998), 182 county soil surveys in North Carolina have been published (Table 2). These surveys cover all 100 counties. More than half of the counties have two published soil surveys, and seven have three published surveys (Table 3).

By 1911, B. W. Kilgore had written *A preliminary report of mountain soils* based on soil surveys and field experiments. In 1915, C. B. Williams wrote a report on the piedmont soils, and in 1918, he wrote a report on coastal plain soils.

**Table 2.** Number of soil surveys published in each decade (USDA-NRCS 1995).

<b>Decade</b>	<b>No. Published</b>
1900–1909	22
1910–1919	33
1920–1929	31
1930–1939	10
1940–1949	8
1950–1959	11
1960–1969	4
1970–1979	14
1980–1989	26
1990–1997	23
<b>total</b>	<b>182</b>

**Table 3.** Coverage of the 100 counties in North Carolina [excluding the area surveys listed in Table 1].

<b>No. Times Published</b>	<b>No. Counties</b>
1	31
2	62
3	7

Three North Carolina Agricultural Experiment Station bulletins have been published that have summarized the soil survey data for the entire state (Williams and others 1934, Lee 1955, Daniels 1984).

The estimated cost for conducting soil survey field work in North Carolina is \$1.50 per acre (September 1995). In 1995, 14 counties were contributing a total of more than 1.6 million dollars in cost-sharing funds for soil surveys. Most county cost-share agreements call for the county to contribute one-third of the survey cost for the privately owned land in the county. For their cost-share support, local governments receive both a published and a digital version of the modern soil survey. It should be noted that this support is perhaps strongest in, but not limited to, some of the least wealthy counties in the mountains of the state. Twelve counties in the sparsely settled mountain area have cost-shared surveys at a scale of 1:12,000. At first glance, the need for increased resolution in mountainous areas may not appear justified. However, soil suitable for home sites, horticultural crops such as Christmas trees, apples, ginseng, and tobacco are often in very small units that are not possible to delineate on smaller scale maps. This is but one indication that the soil survey program in North Carolina has been, and is still, serving the people.

In addition to the support from the North Carolina Agricultural Research Service at North Carolina State University and North Carolina A&T University at Greensboro, the state of North Carolina presently supports nine N.C. Department of Environment and Natural Resources soil scientists active in field mapping. This support has been ongoing since about 1975 and several of the state supported soil scientists are party leaders in our present surveys. Although they receive their paychecks from the State of North Carolina, they work side by side with federally funded soil scientists of the Natural Resources Conservation Service and the Forest Service.

In 1994, a major reorganization in the USDA resulted in the formation of a Major Land Resource Area (MLRA) office in Raleigh. This office is responsible for providing assistance to nine states, which include parts of North Carolina, New York, Alabama, Georgia, Florida, New Jersey, Delaware, Maryland, and all of South Carolina.

There is a professional bond among the soil scientists in North Carolina that is strengthened by almost universal membership in the Soil Science Society of North Carolina, which meets annually. With strong leadership from among the soil scientists that work in the National Cooperative Soil Survey, a North Carolina Registry of Certified Professionals in Soils was formed and recently has succeeded in their efforts to establish State licensing of soil scientists in North Carolina.

### **Some Unusual Surveys**

Perhaps the most unusual soil survey was conducted in North Carolina. In 1909, some wealthy individuals had the bright idea that a shallow body of water known as Lake Mattamuskeet could be drained with the aid of pumps, and the lake bed could be used to produce crops. The lake was approximately 1 to 5 feet deep and covered about 50,000 acres. The surface of the lake was only 30 inches above sea level and is located approximately 10 miles from Pamlico Sound. A base map at a scale of 1 inch per mile was compiled by the Office of Experiment Stations and the USDA. Mr. W. Edward Hearn, one of the most experienced soil surveyors, was placed in charge of surveying the lake and surrounding area for a total of 112,640 acres.

To keep located during the survey of the lake, the surveyors first ran guide strings across and then followed the strings in wide, flat-bottomed boats to make the auger borings. Obtaining auger samples from under water was a severe problem. A 60-inch auger was used. The auger was inserted in a bicycle inner tube that had been severed at the valve. This “waterproof” casing was carefully fastened to the auger in such manner that the soil samples could be drawn and retained from any depth to 3 feet below the lake bottom.

Although the survey was completed and published in 1909, it was not until the 1920s that a definite attempt was made to drain the lake completely. This was done with huge pumps and the digging of a network of canals and ditches. Extensive tracts were cultivated

with large machinery and used to grow corn, soybeans, and oats. Smaller areas were used for white potatoes and some vegetables. According to observers, yields were “fair” but despite the rather sandy nature of most lake bottom soils, they apparently did not achieve uniform drainage, and some sections of crops often “drowned out” rains. By 1933–34, the owners decided that it was not possible to crop the area of the former lake; the pumps were removed; nature took its course; and today Lake Mattamuskeet contains some fine bass fishing and hosts vast flocks of migratory waterfowl (Lee 1984).

As development of beach homes and a boom in recreation demand greatly increased population and waste disposal problems on the Outer Banks of North Carolina, there was an urgent request for a special soil survey. With strong support from all cooperators, mapping the soils of the coastal strip from Virginia to South Carolina was completed in 1977. A special report for each of the seven counties that have land on the Outer Banks was released to provide information on soil suitability and limitations for development. The map scale was 1 inch per 1000 feet (1:12,000) with many of the published sheets containing more water than land.

In 1984, the U.S. Environmental Protection Agency initiated a multi-level research project to address concerns regarding potential soil and water acidification by atmospheric deposition. During this study, 13 watersheds covering 53,000 acres were surveyed by North Carolina soil scientists. In addition to mapping, pedon data were collected on 80 statistically selected transects and complete laboratory characterization was provided on 54 pedons. The work provided several unique experiences such as helicopter transport of samples from remote mountaintop locations.

### **All in a Day's Work**

W. D. Lee (1984) reported that in the early days dogs, bulls, wild boars and snakes occasionally objected to a soil surveyor's passage. However, the most disturbing incidents occurred when an irate farmer appeared with a pitchfork or shot gun and vehemently proclaimed he “didn't want no gov'm't men messing on his land” and “get the blankety-blank outer here.”

In the early days when soil surveys were being made with a plane table and alidade base map, there was a soil surveyor by the name of Red Stryker. Red was able to take care of himself and was known for punching out any farmer who challenged him for crossing the farm. Because soil surveyors had to move frequently in those, they would rent a room in a house and take their breakfast and supper in the local restaurant. Seems Red ate a lot of bran flakes washed down with prune juice and had to relieve himself at frequent intervals. He had the practice of picking up napkins at breakfast. In one place, one of the waitresses caught on to what he was doing. One morning she asked Red why he always was taking napkins with him, to which he replied that they were to wipe his alidade. The waitress laughed and said she had never heard it called that before. During the rest of the stay, she would routinely ask if he was able to keep his alidade clean — shouldn't he take more napkins?

Then there was the legendary Billy Ligon. Billy was the principal correlator while the surveys were being made of the mountain counties of the state. If any comment was made about his driving on inspection trips, he would slam on the brakes and turn over the driving to the individual making the comment. One soon learned not to sit in the back seat on the same side of the car where Billy was driving on a hot day because tobacco juice frequently drenched that position.

While making reviews of the area, the review parties usually stayed in Waynesville, N.C. In Waynesville, there was one exceptionally good restaurant for breakfast each morning. In this restaurant worked an exceptional waitress. This lady would never take a note and was able to remember and correctly return with several orders. Billy, like all of us, was greatly impressed with her ability. Upon returning a year after one of these reviews, he inquired if they would eat at the same restaurant and remarked how he remembered the waitress. Billy always ordered eggs over easy, grits, and biscuits for breakfast. Louie Aull, party chief and outstanding joker, made it a point to catch the waitress before she took the order from the several soil scientists at their table. Being duly armed with Louie's coaching, she approached the table and received the verbal order from each, leaving Billy until last at which time she declared, "Oh, I remember you . . . you always order eggs over easy, grits, and biscuits," leaving Billy with his mouth open in amazement at her ability.

Ralph McCracken reports his personal account of a rather frequent scenario experienced by soil surveyors in the mountains of North Carolina. One day when Ralph was walking down a dirt path in the woods, a person stepped out from behind a tree and asked where he was "started for"? Being astute and acquainted with the locale, Ralph concluded immediately that he was a representative of the local moonshin' industry. Seizing the opportunity to teach a potential student, he carefully explained how he was surveying the soils and making a map. Upon receiving Ralph's excellent lecture, the fella' replied, "I'll save you some trouble . . . ain't no soils down this way so you can turn about and go back." Being a firm believer in the wisdom of indigenous people, Ralph accepted the help and, to this day, there is a map unit delineation in North Carolina entitled "Ain't No Soil."

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