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EDITED BY

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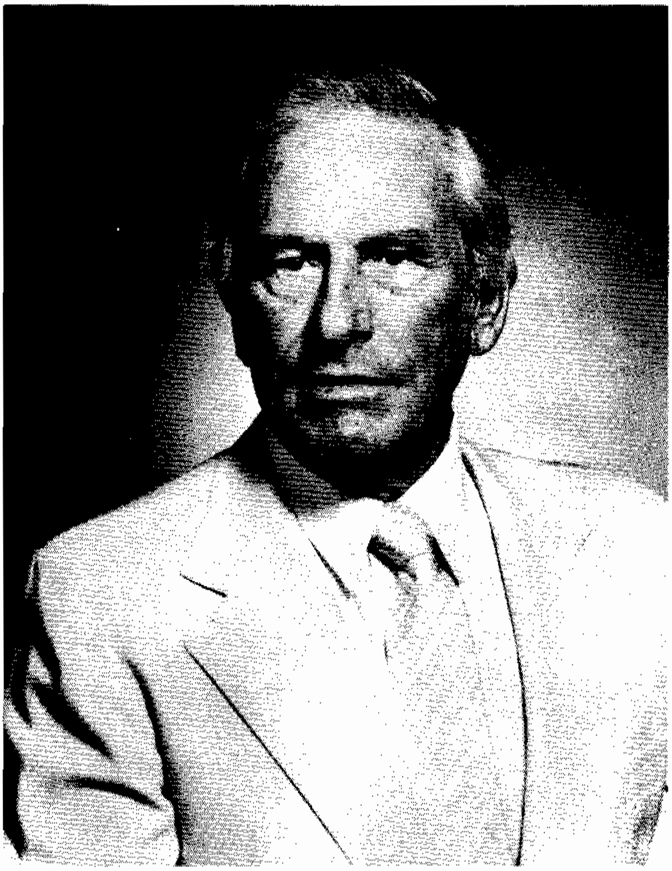
SOIL SCIENCE SOCIETY OF NORTH CAROLINA

ACHIEVEMENT AWARD FOR 1984



RAYMOND B. DANIELS

Raymond B. Daniels

Dr. Raymond B. Daniels was born and reared on a farm in S.W. Iowa. After graduation from Iowa State in 1950, he worked continously for USDA-SCS except for short interruptions for service in the Navy and completion of graduate training at Iowa State.

Ray made his first mark in soils research in Iowa where he participated in gully genesis studies. This work done in the 50's is still frequently referenced but because Dr. Ruhe was project leader for this work, Ray was still just a "promising researcher" when he came to North Carolina in 1960. It was on the Atlantic Coastal Plain where Ray truly distinguished himself. When Ray arrived, the 1 to 15 million year old geomorphic surfaces of the humid southeastern U.S. had been only superficially studied with respect to interaction between soil properties and soil forming processes. His work explored the interaction of stratigraphy and geomorphology with soil forming processes to develop working concepts of plinthite formation, E horizon formation, argillic horizon formation and water table behavior in these areas.

The most far reaching aspect of his work is that he has profoundly influenced soil scientists throughout the world to examine soils in a larger physical dimension than what was traditional before his research. He has clearly demonstrated that for field interpretations scientists can combine the traditional soil profile studies with information from geomorphic and stratigraphic investigations to produce the data needed by engineers, ecologists and agronomists in their quest for information relating to the hydrologic activities within land areas.

Ray did such an outstanding job in the field that he was transferred to Washington, D.C. as Soil Survey Investigation Leader. After four years in Washington, Ray decided that supervising field scientists was not as enjoyable as being one, so he retired and returned to North Carolina. Since he "retired", Ray has served as a leader in the writing of an outstanding new publication on North Carolina soils entitled "Soil Systems in North Carolina" which will be used extensively for many years by everyone interested in North Carolina soils. Ray is also attacking, with his usual vigor, the problem of relating soil erosion to soil productivity.

Ray's most outstanding professional characteristic is his contagious enthusiasm for the search of knowledge about soils. He has shared this with soil scientists from throughout the world and has served our profession with real distinction.

Ray is married to the former Irene Byles and they have two children which have parented grandchildren which bring a light to Ray's eyes.

The Soil Science Society of North Carolina is proud to present this award to Dr. Ray Daniels.

WINTER-ANNUAL LEGUMES AS NITROGEN SOURCES FOR CORN IN THE NORTH CAROLINA COASTAL PLAIN

J.R. Anderson Jr.

Most corn producers would prefer to reduce their labor, fuel and nitrogen fertilizer costs. Cultural practices that reduce soil erosion and conserve soil moisture are also high priorities among growers. One corn production system promises to help in all of these areas. No-tillage planting of corn into a legume cover crop mulch lowers labor and fuel requirements while providing a substantial amount of nitrogen for the crop. Moreover, the presence of a legume mulch reduces the hazards of erosion and may conserve sufficient soil moisture to increase yields in dry seasons. This type of corn production system appears to have considerable potential in the coastal plain of North Carolina where large acreages of corn are rotated with tobacco on soils that are low in organic matter, water-holding capacity and subject to wind and water erosion.

Since both the amount of mulch and the quantity of nitrogen produced by winter legumes is directly related to the accumulation of root and top growth achieved prior to corn planting, an excellent legume stand is essential. It follows that corn yields will be reduced in areas where legume stands are inadequate.

Soil pH and legume planting date greatly influence the establishment of legume stands. Most winter annual legumes are sensitive to soil acidity (Table 1). If soil pH is less than 5.8, it is best to postpone legume seeding until lime can be incorporated.

Another critical step in the establishment of vigorous, uniform legume stands is planting at optimum times (Table 2). Since the winter annuals are subject to varying degrees of winter kill, it is important to plant them as early as soil moisture conditions are favorable; this time is usually September in North Carolina. September-seeded legumes survive unseasonably cold winters better that those planted at later dates (this idea is especially important to those producers attempting to establish winter-annual legumes in the Piedmont sections of the state). For example, many commercial and research fields planted to winter annual legumes in September of 1983 survived while those seeded at later dates were completely killed by the low temperatures encountered shortly after Christmas.

An additional benefit derived from September planting dates is increased legume growth in the Spring. The additional growth is important because it could mean extra pounds of nitrogen will will be available for use by corn. It is not wise to delay corn planting in April to allow further legume growth; it is preferable to stimulate legume growth with early seeding dates and good management of the cover crop.

There are a number of legumes that may serve as nitrogen sources for corn (vetchs, clovers, alfalfas, Austrian winter peas, pigeon pea, etc.). Four have been evaluated in the Coastal Plain of North Carolina over the last three years. Hairy vetch, Cahaba White vetch, crimson clover (Tibbee variety), and Austrian winter pea have all exhibited some characteristics favoring their use as nitrogen sources.

The data (Tables 3 & 4) indicate that the highest yields and nitrogen production were obtained with hairy vetch. However, producers that grow small grains are often reluctant to use vetch in their rotations because of its reputation as a volunteer weed in wheat. An application of 2,4-D or dicamba effectively controls vetch in small grains. To date, producers using vetch as a winter cover have been able to chemically destroy it before seeds are produced. Volunteer vetch has not been a problem to those growers.

Vetch is the least difficult of the legumes to establish on sandy soils and, of the legumes tested, it is the best performer on poorly-drained soils. Hairy vetch was also the most winter hardy of the winter annual legumes tested.

Cahaba White vetch produced slightly lower corn yields and total above-ground nitrogen than hairy vetch and was not as winter hardy as hairy vetch. It was, however, easier to kill with paraquat and is resistant to nematode diseases that are often a problem in eastern North Carolina.

Austrian winter pea did not produce yields as high as the vetchs and generated the least amount of nitrogen among the legumes tested. It did, nevertheless, appear to be easy to establish on sandy soils and Austrian winter pea seed were less expensive than vetch seed in 1983. The winter pea also appeared to be more responsive to later seeding dates than Tibbee clover and Cahaba White vetch.

At one time, there were thousands of acres of Austrian winter peas in eastern North Carolina. They disappeared because they were not resistant to common nematodes and were susceptible to peanut diseases like Southern stem rot. Nematode sampling of plots in 1983 and 1984 suggested that the legumes tested neither aggrevated problem fields nor created new nematode infestations. This observation probably results from the fact that the winter annual cover crops are present in fields when nematode populations are dormant.

Crimson clover produced large quantities of nitrogen and dry matter (Table 4). However, no-tillage planting into crimson was difficult in our tests because the thick vegetation hampered efforts to obtain consistent seeding depths. Moreover, the dense canopy of vegetation remained standing for several days after glyphosate was applied preemergence. The failure of the crimson canopy to drop rapidly increased the incidence of rodent damage to germinating seed. For this reason, it appears advisable to use paraquat rather than glyphosate when chemically killing crimson clover.

The data from on-farm tests, to date, collectively suggest that winter annual legumes will provide corn with the equivalent of at least 100 pounds of fertilizer nitrogen. It is still necessary to apply about 50 pounds of supplemental nitrogen (Table 3) although legumes may provide all the necessary nitrogen in crop seasons characterized by periods of dry weather.

Legumes intended for use as nitrogen sources for corn are generally evaluated in terms of their potential nitrogen production. Often overlooked is the increasing evidence that mulches and crop residues may be managed to conserve soil moisture, thereby increasing corn yields. The winter annual legumes produce thick mulches that appear to retain soil water that normally would be unavailable for use by the crop. Also overlooked is the ability of the legume covers to take up and store nutrients such as potassium (Table 4). In effect, the legume mulches may serve as a reservoir of nutrients that are essentially "slow-released" as the corn crop develops.

The bottom line is that legume cover crops are more economical to establish than rye or wheat when the value of their nitrogen contributions are considered. They offer many opportunities to the corn producer who is willing to manage the legumes with the same care that he gives other crops.

Table 1. Management suggestions for various winter annual legumes.

Legume	Seeding Rate Brdcst	Seeding Rate Drilled	Seeding Depth	Optimum pH
	lbs/ac			
Hairy vetch	20-30	15-20	1/2-11/2	5.8-6.2
Cahaba White	20-30	15-20	1/2-11/2	5.8-6.2
A. winter pea	25-35	20-25	3/4-11/2	5.8-6.0
Crimson clover	20-25	15-20	1/4-1/2	6.0

Table 2. Suggested planting dates for selected winter annual legumes in North Carolina.

Legume	Coastal Plain Best dates	Coastal Plain Possible dates	Piedmont Best dates	Piedmont Possible
Hairy vetch	9/1-9/30	9/1-10/30	8/25-9/30	8/25-10/25
Cahaba white	9/1-9/30	9/1-10/30	not adapted	
A. winter pea	9/1-9/30	9/1-10/30	8/25-9/30	8/25-10/25
Crimson clover	9/1-9/30	9/1-10/25	8/25-9/15	8/25-10/25

Table 3. Effect of cover crop and nitrogen rate on corn yield.*

Legume	Nitrogen Rate 0	50	100	150
	(bu/ac)			
Hairy vetch	109	117	125	129
Cahaba white	89	109	106	115
Austrian w.pea	72	104	104	100
Tibbee clover	73	88	96	105
No cover	12	43	68	85

* Data represent the average of three experiments conducted during the 1983 & 1984 crop years. All legumes were planted in September following tobacco.

Table 4. Dry matter and nutrient content of legumes at corn planting.*

Legume	Dry matter	% N	Total N	Total K
	(lb/acre)		(lb/ac)	(lb/ac)
Hairy vetch	3916	4.04	159	117
Cahaba white vetch	3568	3.74	133	94
Austrian w. pea	2872	3.45	99	68
Crimson clover (Tibbee)	5816	2.59	151	98

* Data represent the average of three experiments conducted during the 1983 & 1984 crop years. All legumes were planted in September following tobacco.

The Effect of Cover Crops on Strip-Till Vegetable and Tobacco Production

G.D. Hoyt

Vegetable (cabbage, tomatoes, potatoes and broccoli) and tobacco acreage in North Carolina and the U.S. constitutes a smaller percentage of land in production than the typical row crops (corn, soybeans and wheat). Although land resources are small, production on this acreage is intensive and management practices usually disregard the probability of erosion. A tillage system designed to conserve soil and water resources on this acreage would benefit the producer by maintaining his valuable soil resource and increase the quantity of water available to the crop. Watershed quality would be improved by the reduction of sediment load in streams and reduced transport of pesticides by these sediments. This tillage system would provide an alternative management practice for transplanted crops grown on marginal sloping land.

A strip-till burley tobacco and vegetable management system was established in 1983 to develop cultural practices which would decrease erosion, increase water infiltration, retain soil moisture, and provide comparable yields to conventional tillage. This system utilized a fall planted cover crop that was spring killed, strip tilled with subsoiler-coulter combination and planted with regular transplant equipment. Cover crops were established in the fall of 1982 with previous summer crop residue and fertilizer P, K, and limestone incorporated at cover crop planting. Previous to tobacco and vegetable planting, the various cover crops were sampled for biomass and then killed with glyphosate. Approximately seven days later a subsoiler-coulter combination (Bush-hog Ro-till) was run through the field to establish rows. This equipment provided 6 to 10 inch wide tillage of the soil surface. Preplant - surface applied pesticides and required nitrogen were applied at this time.

The various cover crops produced surface soil coverage that ranged from 0 (bare) to 66% (barley) (Figure 1). Tobacco plants in plots with no-cover had a survival rate of 82%, whereas plants in plots with thick residues (barley & rye) had a survival rate greater than 97% (Figure 2). Apparently plots with grass or legume residues did influence the severity of transplant shock by providing soil conditions favorable for growth. Mid season flowering in tobacco also was influenced by the type of cover residue. Strip-till tobacco with cover crop residues flowered earlier than cultivated, and much earlier than strip-till tobacco with no winter cover (Figure 3).

Yield response to the various cover crop treatments was pronounced. At the Mountain Research Station (Figure 4), the rye cover crop strip-till tobacco yielded higher than the tobacco planted in the other cover residues. At this location, vetch cover residue resulted in the lowest tobacco yields. At the Buncombe Co. location, rye residue again gave the greatest response in strip-till tobacco yields (Figure 5). The cultivated treatment (barley cover turned in late spring) yielded similarly, with the other cover residues slightly lower. Plots with no winter cover (bare) had the lowest yields.

Strip-till potatoes were also tested in 1983. Cover crops of barley, rye, crimson clover, sub. clover, hairy vetch, and bare soil were evaluated to select the best cover for this form of conservation tillage potatoes. Both grass covers provided excellent residue management (72 and 71% soil coverage for barley and rye, respectively) (Table 1). Legume cover crops had considerably less soil coverage (30-43%), for spring growth was just starting when cover crops were desiccated. Plant emergence was delayed in plots where cover crop residues were used, but by flowering, a potato growth response in these residue plots had occurred (Table 1). Potato yield in grass cover plots exceeded those in the legume or bare plots (Figure 6). This was directly correlated with the amount of residues supplied by the grass cover plots, for as residue biomass increased, potato yield correspondingly increased (Figure 7).

Cultural practices for broccoli were similar to that for tobacco. Plants were set both in the spring and again in August for the fall crop. After harvest of the spring crop in July, the tilled area was again resubsoiled (+coulters) in the same area. Very little residue remained in the legume residue plots, but rye residue was clearly evident (rye soil coverage after spring tillage was 48%) and provided some soil coverage. Broccoli production was better than normal for the dry season in 1983. All legume residue plots produced yields of broccoli higher than bare or rye residue plots (Table 2). Highest yields from the spring crop (14.9 Mg/ha) were measured from hairy vetch residue plots; highest yields for the fall crop and for the spring plus fall crops were recorded in crimson clover residue plots (17.7 and 31.7 Mg/ha, respectively).

Legume cover crop residue enhanced growth and yield of fresh market tomatoes. Tomato vine heights were stimulated by the legume residue (Figure 8). Total and marketable tomato yields (Table 3) both were higher in plots left bare. Yields from legume plots were excellent although slightly lower (no significant difference at the .05 level of probability) than the bare plots.

Summary

Conservation tillage systems for vegetable and tobacco production can be developed from current technology. Both strip-tillage and no-tillage (Worsham, 1984) techniques are being investigated by researchers at North Carolina State University, with yield potential equivalent to conventional methods. In comparison with strip-tilled tobacco, conventional tilled tobacco had a lower transplant survival rate, reduced growth rate as shown by lateness of flowering, but final yields were statistically the same as strip-tilled tobacco.

Comparing the type of cover crop for use with this form of conservation tillage in vegetable and tobacco production, it appears that grass residues do provide excellent soil coverage for erosion control and retension of soil water. If the summer crop is planted late enough for good spring growth of winter legumes, these residues too will provide soil coverage and increase the total amount of nitrogen recycled in the system (Hoyt, 1983). Vegetable crop response to legume residues were consistantly positive, with hairy vetch and crimson clover residue plot providing top yields in tomatoes and broccoli. The use of subterranean clover residues produced inconsistant results, with poor yield response in tomatoes and fair response in tobacco and potatoes.

Acknowledgement

Other cooperators involved in these projects are Drs. J.E. Shelton, T.R. Konsler, R.G. Gardner, and F.L. Haynes of the Soil Science and Horticulture Departments, NCSU.

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Table 1. The effect of cover crops on soil coverage and potato plant growth.

Cover Crop	Soil Coverage	Plant Emergence†	Plant Flowering*
	%	%	%
Barley	72	83	24
Rye	71	85	39
Crimson Clover	30	83	34
Sub Clover	43	79	39
Hairy Vetch	35	74	49
Bare	0	100	35

†At day 20 from planting

*At day 46 from planting

Table 2. The effect of cover crops on strip-tilled broccoli production.

Cover Crop	Spring	Fall	Total
	Mg/ha		
Bare	12.7	14.4	27.1
Rye	13.2	12.5	25.7
Sub. Clover	13.7	14.8	28.5
Hairy Vetch	14.9	13.9	28.8
Crimson Clover	14.0	17.7	31.7

Table 3. The effect of cover crops on strip-tilled fresh-market tomato production.

Cover Crop	Marketable Yield	Total Yield
	Mg/ha	
Bare	73.0	119.3
Hairy Vetch	68.7	113.5
Crimson Clover	62.3	106.7
Rye	48.8	107.0
Sub. Clover	46.6	96.2

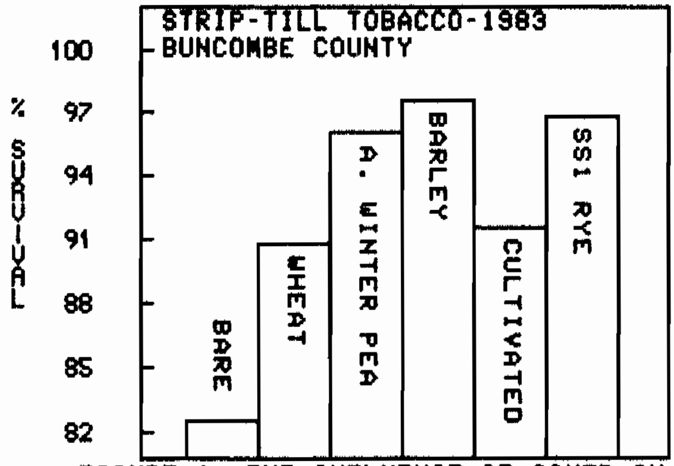

FIGURE 1. THE INFLUENCE OF COVER ON TRANSPLANT SURVIVAL

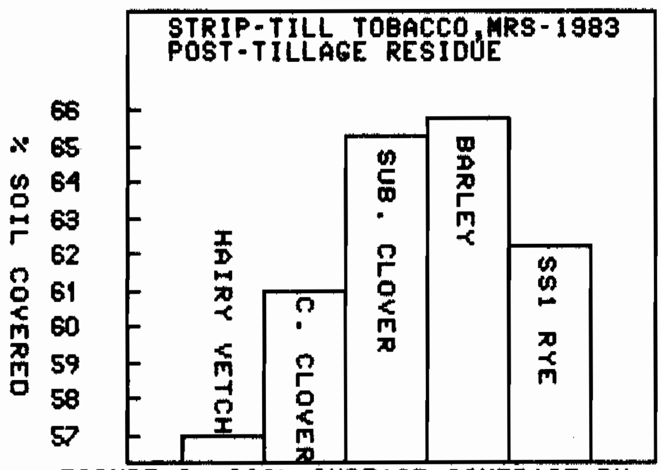

FIGURE 2. SOIL SURFACE COVERAGE BY VARIOUS RESIDUES

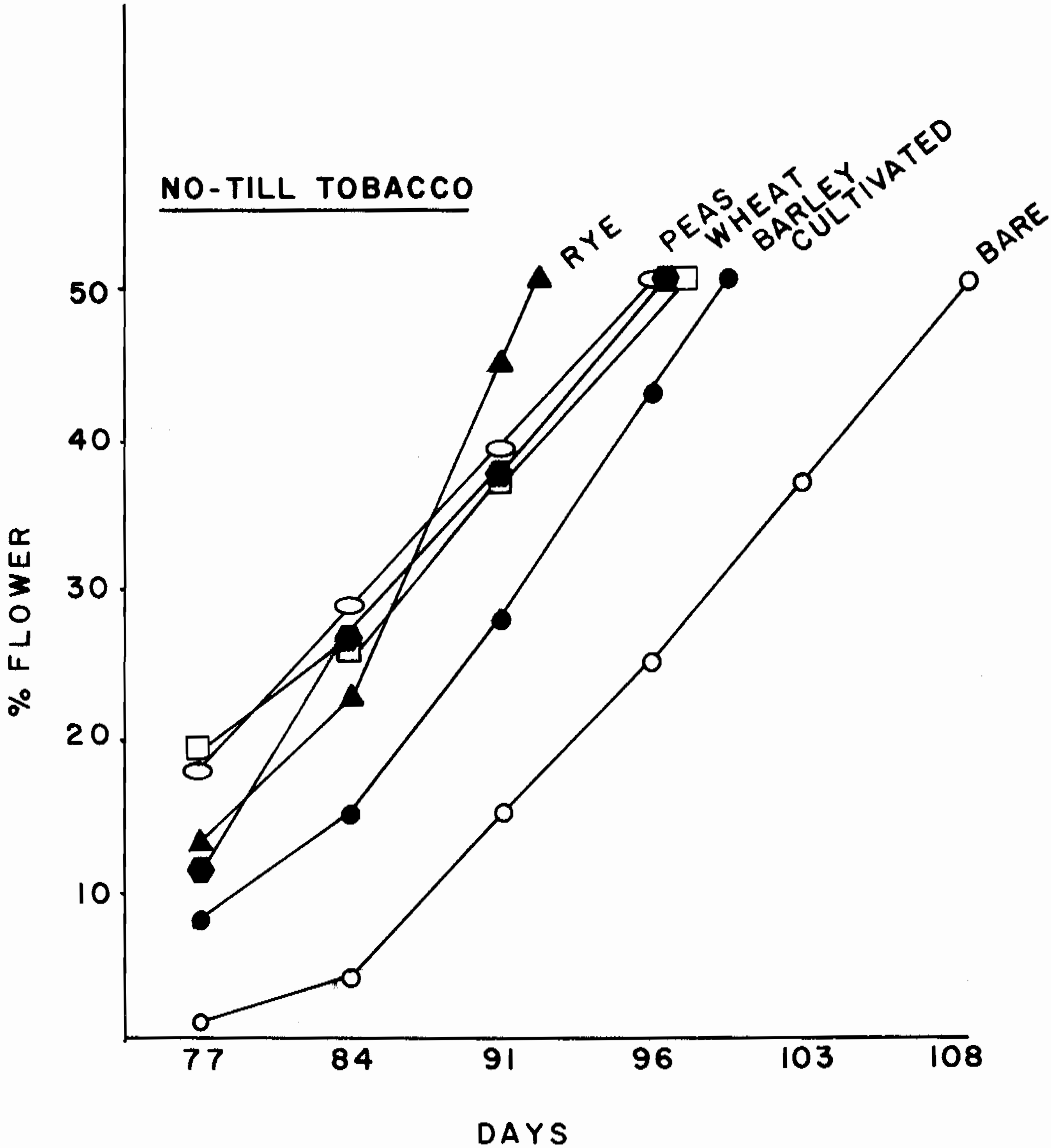

FIGURE 3. EFFECTS OF RESIDUE ON FLOWERING

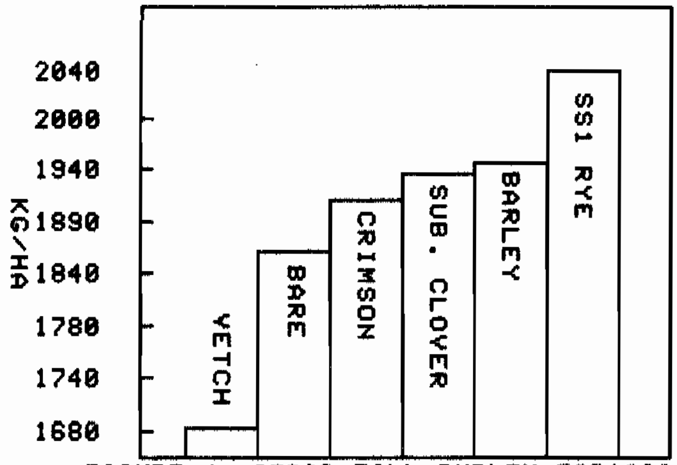

FIGURE 4. STRIP-TILL BURLEY TOBACCO
YIELD, MTN. RES. STA.1983

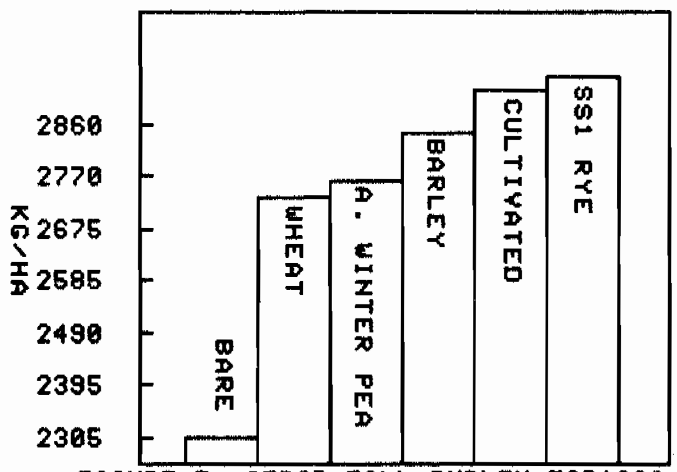

FIGURE 5. STRIP-TILL BURLEY TOBACCO
BUNCOMBE CO. 1983 - YIELD

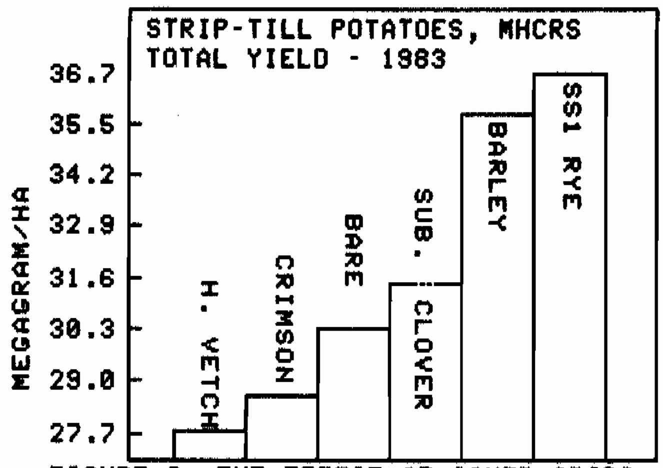

FIGURE 6. THE EFFECT OF COVER CROPS ON STRIP-TILLED POTATO PRODUCTION

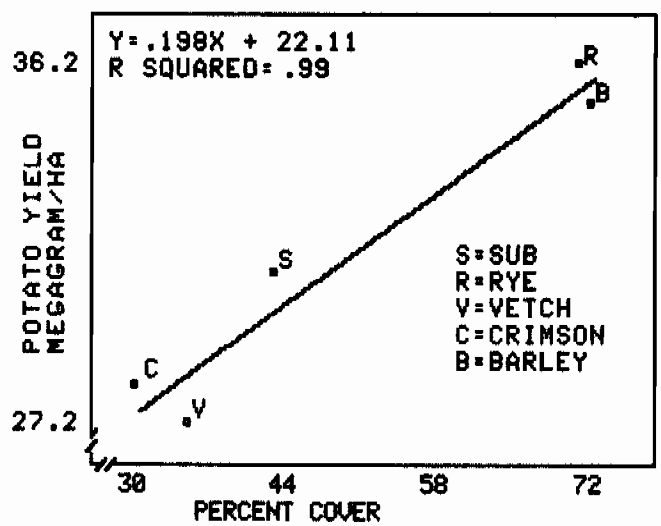

FIGURE 7. THE CORRELATION OF SOIL SURFACE COVERAGE WITH POTATO YIELD

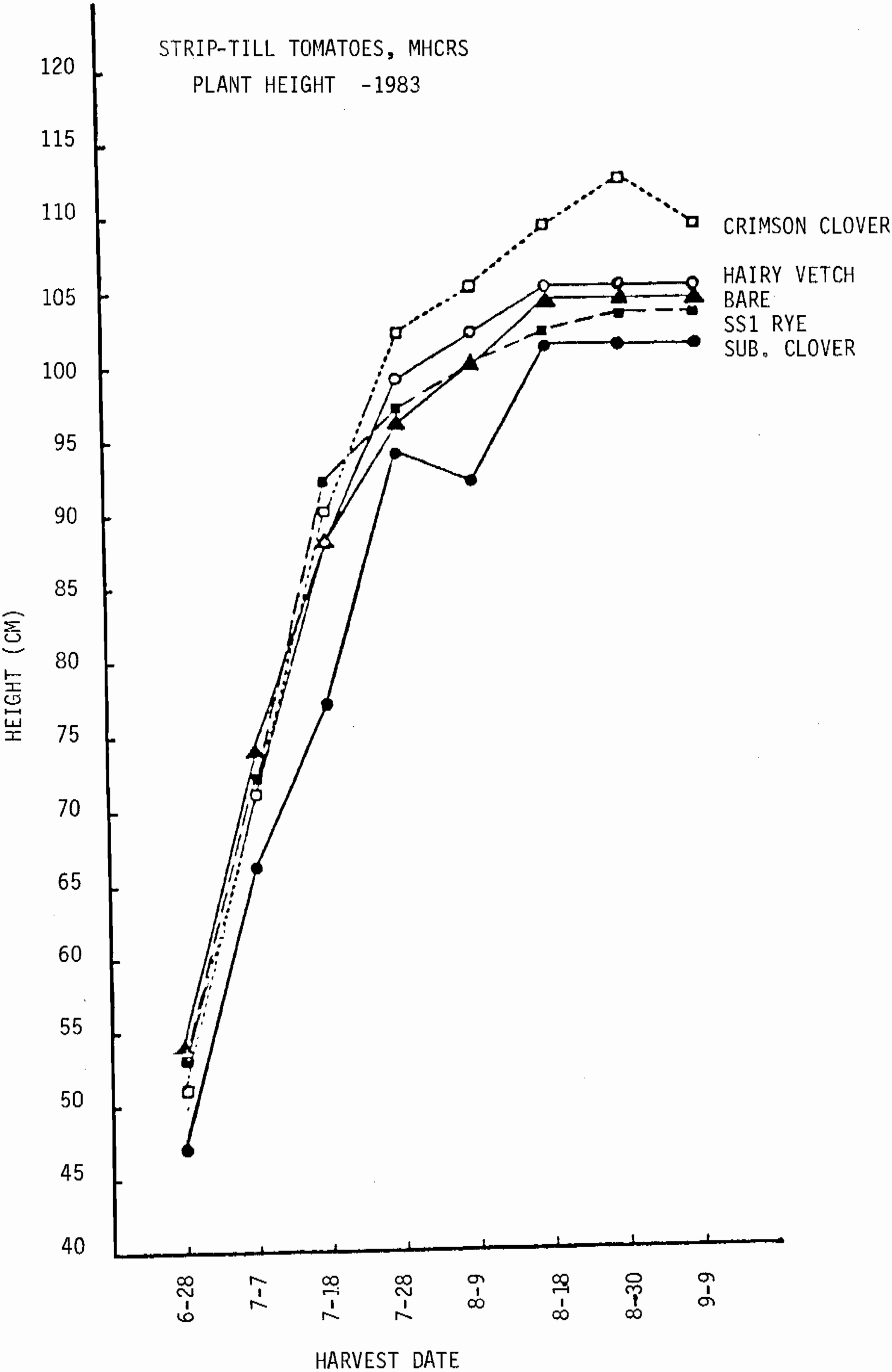

Figure 8. The effect of cover crops on tomato-vine height.

Upper Neuse River Erosion Study
John Garrett

Demands are being placed on the land and water resources in the Upper Neuse drainage area. These demands have resulted in the development of Falls of the Neuse Reservoir for water supply and recreation for Raleigh and the surrounding area. The development of Falls Lake now generates new pressures and new problems. The Secretary of the DNRCD has gone on record as to say the single most important natural resource problem in North Carolina is water quality. The completion of B. Everett Jordan Reservoir (about 2,000 acres) and Falls of the Neuse Reservoir (about the same size) has brought focus on protecting water quality sources now.

Erosion and sedimentation's effects on streams in this area were brought to the fore front in 1980 by the Tar-Neuse River Basin Study main report. This study was designed to:

- provide insight to present conditions
- project and predict future needs
- provide a basis for setting priorities and developing a time frame

The Upper Neuse River was among the most severely eroded areas in North Carolina. To address these problems, the Upper Neuse River Basin Erosion Study was undertaken to:

- determine the magnitude and specific location of water and related land resource problems;
- forcast the effects of the problems on the area's resources;
- develop alternatives to reduce soil and water resource problems; and
- present implementation strategies

The Upper Neuse is the drainage area above Falls of the Neuse Lake.

It covers 493,196 acres or 771 square miles. Portions of Durham, Franklin, Granville, Orange, Person, and Wake counties are involved. Urban areas include Durham, Hillsborough, Creedmoor, and Butner. The Eno, Little, and Flat Rivers form the headwaters of the Neuse River. Land use in the Upper Neuse is predominantly cropland and forestland. These areas are dependent on a farm, forest and agriculturally-related economy. Therefore, the continued viability of local economics depends on the availability and quality of the land and water resources in the area. Erosion has been greatly accelerated by our land disturbing activities. Erosion from cropland, forestland, urban areas, mines and construction sites contribute to erosion problems. Rainfall runoff becomes the vehicle to transport soil particles to another location in the field or is delivered to an offsite location. Because nutrients and chemicals attach to soil particles, they are transported in the runoff as well.

Erosion takes several forms. Sheet and rill erosion occur simultaneously. Gully erosion is distinguished from rill erosion by the number and size of channels. Soil loss is measured in tons per acre per year. When erosion rates exceed the soil loss tolerance or T value of about 5 tons per acre per year, the productive capability of the land is threatened. On the average, 25% of the eroded soil reaches a water course. High sediment levels can alter a stream's physical and biological character. Sunlight transmission is reduced, channels are clogged and reservoirs are filled in. Photosynthesis is reduced, fish spawning beds are covered, and organisms vital to the food chain are reduced. In addition, sediment removal from water supply sources, like the Falls of the Neuse, increases water treatment costs. Sediment often carries pesticides, nutrients, and other potential pollutants. These absorbed materials may be released into the water and adversely impact water quality.

In the Upper Neuse cropland accounts for 67% of gross erosion. The major cause of cropland erosion is the lack of conservation systems on cropland. Rows running up and down the hill, large fields on sloping land and plowing through natural drainage ways all contribute to cropland erosion problems. Average annual cropland erosion rates are 9.5 tons per acre in the Upper Neuse. Erosion rates can go as high as 50 tons per acre per year. Erosion in the area has already greatly reduced the soil resource base and will continue to do so in the future. Both short- and long-term adverse impacts occur when soil loss is greater than 5 tons per acre per year. Short-term effects are mainly production cost related. Long-term effects are primarily related to reduction in yields. For each 225 tons of soil loss, tobacco yields are reduced by 11%, corn yields by 15.6%, soybeans by 4 bushels per acre, and small grain by 10.5%. On the average, tobacco yields are being reduced by 10% every 20 years and in some cases as early as 5 years. Soil productivity has decreased and will continue to decrease on all lands eroding in excess of 5 tons per acre per year. The off-site impacts of erosion are primarily caused by sediment.

In the Upper Neuse, 257,000 tons of sediment are delivered to the stream system annually. The amount of sediment delivered to Falls of the Neuse Lake each year would fill a swimming pool 40 feet long, 25 feet wide, and 5 feet deep 2½ times each day. Phosphorus has been determined to be the limiting nutrient in the eutrophication process of Falls Lake. The Division of Environmental Management, Water Quality Section has currently assigned phosphorus level contribution by different sections of the community. Thirty-one percent has been allocated to agriculture. Further allocation has been made to assign values to each county contributing in the drainage area.

Chlorophyll A has been selected as an indicator to be monitored for tracking algae growth. Creedmoor Road will be used to divide the lake system. The upper part of the lake is wide and shallow while the lower part is deep and narrow. A goal level of 35 has been selected for the lake water. Algae blooms on the Chowan River have been caused by chlorophyll A levels exceeding 70.

Sound land use and conservation can keep erosion within acceptable limits. Because cropland accounts for such a large portion of the erosion problem, controlling cropland erosion is the key to maintaining long-term productivity.

The effectiveness of resource management systems can best be demonstrated with the results of an Agricultural Task Force effort. This task force included members of many state and federal agencies, other groups and was coordinated by the North Carolina Soil and Water Conservation Commission. A major activity of the task force has been to assess the effectiveness of <u>Best</u> <u>Management</u> Land Treatment <u>Practices</u> (BMP's). Two privately owned farms, located north of Raleigh in the Neuse River Basin, are being monitored. One farm serves as a control site with cropping of continous soybeans straight up and down the slopes. The other farm utilizes soil and water conservation practices that include field borders, waterways, parallel terraces, no-till planting and winter cover crop. During 1982, the loss of water, sediment, nutrients and organic matter from each farm was measured. Although the research is on-going, preliminary findings on BMP effectiveness in reducing pollutant losses are very pronounced. The following results have been accomplished:

1. Water runoff has been reduced from 176,000 gal/ac to 93,000 gal/ac - a 45% reduction.
2. Sediment loss reduced from 14.7 tons/ac to 0.05 tons/ac - a 99% reduction.
3. Loss of organic material reduced from 1,370 lbs/ac to 82.1 lbs/ac - a 94% reduction.
4. Total nitrogen loss reduced 76%.
5. Total phosphorus loss reduced from 12.6 lbs/ac to 2.4 lbs/ac - an 81% reduction.

The test farm utilizing BMP is one of the leading state producers in terms of yields per acre. These farms are serving as an excellent demonstration that both efficient production and clean water are both possible. Conditions within these test farms probably represent conditions found on 80% of the cropland and in the Neuse River Basin.

Land Treatment Watersheds

William H. Farmer, Jr.

Historically, Public Law 83-566 watershed projects have been flood control projects. The standard trademarks of such projects are channel improvements and dikes in Eastern N.C. and flood impoundments or flood-water storage reservoirs in the rolling topography of Western North Carolina. Federal monies are used to help finance these projects on a cost-share basis with local sponsors.

Recent developments, including a national response to the Resource Conservation Act survey completed two years ago, created a renewed interest in erosion control on cropland. As a result, the "targeting" of funds and personnel to severe problem areas has come about. A land treatment watershed project is actually a "targeted" effort under PL-566 guidelines to respond to soil erosion problems in a watershed area. The first land treatment watershed project in North Carolina was the Buffalo-Muddy Fork Watershed in Cleveland, Lincoln, and Gaston Counties. This 8 year accelerated land treatment project consists of targeting 30 man-years of technical assistance and approximately $900,000 of financial cost-share monies to treat soil erosion problems on this 73,000 acre watershed. As with all PL-566 projects, basic steps in planning and implementation were followed. These steps include:

(1) Identification and assessment of the problem
(2) Formulation of alternatives to resolve the problem
(3) Determination of cost-effectiveness
(4) Plan selection by the sponsors
(5) Implementation of the plan

Step 1 of the program was a problem identification and assessment stage began in June, 1981. Two assessment teams, each consisting of a conservationist or technician, a soil scientist, and a member of the Water Resources

Planning Staff, collected data on all cropland and pasture areas. A staff geologist completed a critical area and roadside erosion survey. Data collected from cropland areas included erosion rates (USLE, sheet and rill), soil type, existing crop, depth of topsoil, ephemeral gully erosion, and conservation treatment needs. Field data was then entered into a computer at Land Resources Information Service. Summaries and digitized maps showing either separate or a combination of conditions were generated. The following analysis was made:

(1) USLE (sheet and rill) erosion was greater than 15 tons/acre/year.
(2) 96% of the cropland had less than 4 inches of topsoil remaining.
(3) Less than 4% of the cropland had greater than 6 inches topsoil remaining.
(4) Over 35% of the cropland fields had ephemeral gullies.
(5) 91 acres of critical areas in cropland, roadbanks, and pasture were identified.
(6) Off-site problems included the delivery of over 154,000 tons of sediment into the stream system.
(7) Over 320,000 tons of sediment had accumulated in a single "head areas" of the King's Mountain City Reservoir in a 7-year period, or the equivalent of losing over 9 million gallons of reservoir volume each year.

Step 2, formulation of alternatives was relatively easy. With the problems identified and a computerized summary of treatment needs to resolve the erosion problem, treatment level options were evaluated on the basis of effectiveness, cost, and sponsor objectives.

Step 3, the determination of cost-effectiveness, which is a required action on all PL-566 projects, was a little difficult. In the typical flood control project, the flood level can be measured and damages counted, a more or less straight forward evaluation - it's either under water or not. However, it's more difficult to get data and research that says if you reduce erosion by x tons you reduce damages by y dollars. Erosion and productivity studies, economic interviews, and published data provided the following basis for benefits:

(1) Reducing crop production losses by retaining topsoil and related soil moisture benefits with land treatment practices.
(2) Retaining nutrients in the field by reducing erosion and sediment.
(3) Reducing fuel costs by retaining topsoil, tilling on the contour, etc.
(4) Retaining cropland in agricultural production with treatment versus these areas reverting to idle cropland.

Off-site benefits included extending the useful life of the city reservoir and increasing fishing man-days along the creeks by reducing sediments and improving water quality.

Step 4, the sponsors played the key role. At these meetings and interviews, the sponsors were "reading" the potential response from watershed farmers. Seventy percent of the farmers indicated strong interest in participating in the project. A 70% treatment level was evaluated to be cost-effective and became the selected plan.

Step 5, plan implementation began in the spring of 1982 and will last for 8 years. According to Jim Boggs, the SCS District Conservationst in the watershed, response from the farmers has been excellent and the project is ahead of implementation schedule. When implemented, this accelerated land treatment watershed project may reduce soil losses and associated natural resource and economic damages by 70 percent. Remaining erosion problems will continue to occur at a much more manageable rate.

Comparison of Corn Biomass Yields in 1983 by Erosion Class and Landscape Position

R.B. Daniels

The 1983 growing season resulted in a nearly total failure of corn for grain. About the only valid comparison we have on the effect of past soil erosion on productivity is biomass. Typical biomass production by erosion class and landscape position is given in Tables 1 and 2.

Considering only erosion class, the slightly eroded plots had the highest yields in all Cecil fields, and in one of the three Georgeville fields. Lowest yields were recorded in the moderately eroded plots 3 times and once in the severely eroded plots in the Cecil soil. Slightly and moderately eroded plots of Georgeville soils produced the lowest yields (Table 2). One-half of the highest yields in the slightly eroded plots were in head slopes. The lowest yielding plots in Cecil soils were on shoulder, linear and foot slopes, and in Georgeville soils on foot slopes and interfluves.

Yields within an erosion class across all landscape positions (Wake County, for example) had almost as much variability as yields across erosion classes within the same landscape position. The only valid comparison of yields is across erosion class within one landscape position. The head and foot slopes seldom have severely eroded soils in large enough areas to establish the number of plots needed for valid comparison. When one eliminates the head and foot slopes from the comparison (Table 3) the slightly eroded sites had the highest yields six times, moderately eroded 3 times, and the severly eroded 7 times. Many of the differences are not statistically significant at the 95% level, but these data do indicate some of the problems of comparing yields across erosion classes when landscape position is ignored.

Table 1. Percent of maximum biomass yields, 1983.

Landscape Position	Erosion Class			Maximum Yield
	Slight	Moderate	Severe	
	------------ % of maximum --------------			kg/ha
		Guilford Co.		
I		83	79	
S		69	71	
L	91	80	85	
H	100			9456
		Rockingham Co. 1		
I	100	78	75	6923
S	94	84	80	
L				
H	97	83		
		Rockingham Co. 3		
I			78	
S			81	
L	84	78	86	
H	100	93		7526
F		97		
		Wake Co.		
I	90	81	92	
S	100	87	97	6709
L	89	88	88	
H	88			
F	87	85		

I = Interfluve, S = Shoulder, L = Linear, H = Head, F = Foot

Table 2. Percent of maximum biomass yields, Orange Co. Georgeville soils.

Landscape Position	Erosion Class			Maximum Yield
	Slight	Moderate	Severe	
	----------- % of maximum -------------			kg/ha
		Field #1		
I		97	100	14972
S		81	90	
L		81	78	
F	72	76		
		Field #2		
I	66	66	100	13771
		Field #3		
I	79	59		
S	99	63		
L	77	77	96	
F	100			7681

I = Interfluve, S = Shoulder, L = Linear, F = Foot

Table 3. Number Times Maximum Yield Occurred Within Each Erosion Class When Compared by Landscape Positions.

Cecil Soils

Moderate	Severe	Slight	Moderate	Severe
1	1	5	0	2

Georgeville Soils

Slight	Moderate	Moderate	Severe	Slight	Moderate	Severe
1	1	1	2	0	0	2

FUTURE TRENDS OF AGRICULTURE IN NORTH CAROLINA

W.D. Toussaint

Tobacco has been and continues to be the dominant commodity in North Carolina's agricultural economy. Livestock and poultry incomes have increased to 40 percent of N.C. agricultural income as compared to 20 percent three decades ago. Tobacco accounts for 30 percent of all agricultural income and about one-half of the total crop income.

Tobacco production has a vital bearing on the direction of North Carolina agriculture in the years ahead. Vegetable and fruit production may expand slightly if tobacco production is reduced or eliminated, but growth will be and should be slow. Elimination of tobacco from the enterprise mix would most likely mean a very large increase in acres per farm, reduced farm numbers and increase in grain production.

Elimination of the tobacco program would have far-reaching effects on North Carolina agriculture. Tobacco prices could fall by 25 to 30 percent; production of tobacco would increase -- at least at first, and flue-cured tobacco production would move south and east.

Trends seen over the last few decades may continue as farms become larger and more mechanization and irrigation occurs. Management will be critically important.

SOIL CLASSIFICATION IN WESTERN NORTH CAROLINA

Mike Sherrill

Western North Carolina is the last frontier for soil classification in this state. This region of the state has large holdings of federally owned land that has never been soil mapped or classified. The U.S. Forest Service, the Bureau of Indian Affairs, the National Park Service and various county governments are actively involved in the National Cooperative Soil Survey to provide a published soil survey report of these areas.

Soil classification is an integral part of the National Cooperative Soil Survey effort, but classification is not the primary objective. The primary objective of a soil survey is to produce soils information that people can use to guide themselves in making wise soil management decisions. The primary intent of the soil survey maps are for intrepretations even when it is impossible to be 100% correct taxonomically.

Soil scientists in Western North Carolina are using geologic maps to make soils maps more accurate for both soil management and soil classification (2, 3). Some rock formations such as granite or gneiss form soils that are relatively stable. Phyllite and other thinly bedded metasedimentary rocks form soils that are unstable and undesirable for road construction. Mica schist also produce soils that are unstable due to a high mica content. Geology maps also help classify and map soils over unique and valuable ore deposits. Western North Carolina and especially Jackson County is the largest producer of olivine in the Eastern United States. Olivine deposits give the field soil scientist a rare opportunity to study and classify soils high in talc and serpentine. In addition, these olivine deposits produce rare plant communities.

Investigations of soils in the mountain region are on three different primary landforms: high mountains (elevations> 4500'), intermediate mountains (3000' to 4500' in elevation) and low mountains (< 3000' in elevation). This division of landforms helps simplify the soil classification task.

The high mountains are dominated by coarse loamy mixed frigid typic haplumbrepts. We must carry the soil classification process to the series level to provide users with needed information. Wayah is the proposed series for typic haplumbrepts formed in high mountains from stable formations such as granite or gneiss. Oconaluftee is the proposed series for typic haplumbrepts in high mountains formed from unstable metasedimentary rock (mainly phyllite). Tanasee is the typic haplumbrept formed in high mountain coves from colluvial debris.

Soil classification on intermediate mountains is dominated by coarse loamy mixed mesic typic haplumbrepts on north and east facing slopes. Cheoah is the new proposed typic haplumbrept formed from unstable metasedimentary rock (primarily phyllite). There is currently an unnamed typic haplumbrept formed from mica schist on north and east facing slopes. The west and south facing slopes are dominated by coarse loamy mixed mesic typic dystrocrepts. Perkinsville and Waterville are the proposed series formed from unstable metasedimentary rocks (primarily phyllite). Chestnut is the proposed series formed from stable formations composed mainly by granite or gneiss.

Low mountains are dominated by fine loamy mixed mesic typic hapludults. Cowee is the new proposed soil series formed from stable rocks composed mainly by granite or gneiss. Junaluska has been proposed for typic hapludults formed from unstable metasedimentary rocks (mainly phyllite).

Soil surveys in Western North Carolina are also trying some innovative approaches by using these new series in devising mapping units.

Wind damage appears to be a major factor in forest productivity on some high mountain and intermediate mountain landscapes. Wayah stony loams 30% to 50% slopes windswept, or Chestnut and Edneyville stony loams 30 to 50% slopes, windswept, are examples of mapping units showing wind damage on some landscapes. Jackson and Macon Counties have high rainfall areas that commonly receive 80 to 100 inches of rainfall per year. This high rainfall has a profound effect on relatively poor soils. The Chandler series is productive in an 80 inch rainfall area and very unproductive in a 40 inch rainfall area. A proposed mapping unit might be Chandler stony loams 30 to 50% slopes, high rainfall area.

Table 1 shows laboratory data including particle size and percent organic matter for these proposed series.

Summary

(1) The primary purpose of soil surveys in Western North Carolina is to make maps that can be used. Soil classification is just one part of this process.

(2) Soil classification at the series level is based on the degree of stability in the underlying geology.

(3) High mountains greater than 4,500 feet are dominated by coarse loamy, mixed, frigid, Typic Haplumbrepts.

(4) Intermediate mountains, 3,000 to 4,500 feet in elevation, are dominated by coarse loamy, mixed, mesic, Typic Haplumbrepts on the north and east sides of mountains. The south and west facing slopes are dominated by coarse loamy, mixed, mesic, Typic Dystrocrepts.

(5) Low mountains less than 3,000 feet in elevation are dominated by fine loamy, mixed, mesic, Typic Hapludults.

(6) Mapping units are devised to show important climatic features such as wind damage or excessively high rainfall.

Acknowledgement

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Table 1. Laboratory data for proposed soil series.

SERIES	HORIZON	PARTICLE SIZE TEXTURE	SAND	SILT	CLAY	% ORGANIC MATTER
PERKINSVILLE	A	L	48.8	43.7	7.5	7.0
	BW1	L	46.3	36.1	17.6	
	BW2	SL	66	24	10	
WATERVILLE	A	SL	58.5	31.5	10	9.0
	BW	SL	58.5	26.5	15	
OCONALUFTEE	A	L	44	36	20	13.9
	AB	SL	62	27.5	10.5	
	BW1	L	47.7	36.8	15.5	
	BW2	SL	57	35.5	7.5	
WAYAH	A	SL	56.6	30.9	12.5	12.4
	BW	SL	64.8	20.2	15	
TANASEE	A	L	51	30.5	18.5	12
	BW	SCL	52	26.5	21.5	
CHEOAH	A	L	40.2	47.3	12.5	9.6
	BW	L	39.	45	16	

Georgraphic Information Systems
For
Soil Survey Publication and Interpretation

B. Burton Floyd

Many are familiar with the field work involved in making a soil survey. If not, most have worked with, or are familiar with a published soil survey report. The process of taking the materials and information gathered during a soil survey and transforming them into a publication is known as compilation. This process can be broadly divided into two catagories, manuscript compilation, and map compilation.

Three main areas contribute to the North Carolina soil survey: the process of map compilation; digitizing as a part of that process; and interpreting the digitized information. During the mapping phase of a soil survey, the county's soils resources are deleniated on aerial photographs. In order to publish soils information depicted on those photographs, information must be transformed into a press ready product. Rather than describe the many alternative procedures for getting to the finished product, a description of the method currently used here in North Carolina will be given.

First the field photographs are reproduced on a special translucent film called a mylar one half tone film positive. This material is made of a mylar base material and will not shrink or swell with changes in temperature and humidity. The field photographs are reproduced on this translucent material to make it easier to transpose the information to a format more suited to publication. In mapping soils, it is easier to work with photographs that cover a relatively small area (2,000 to 10,000). However, when making a publication it is impractical to have so many small photographs; therefore, one additional function of compilation is to reformat the soils information.

In N.C. the seven and one half minute quad is used as the standard format. This scale (1:24000) is the same one used by the USGS on their topoquads.

A 7 ½ minute quadrangle covers approximately 40,000 acres. Reformation is achieved by transferring lines from the 1/2 tone film positives onto another ½ tone film positive which is the desired size and format for publication. The last format is called a 1/2 tone photobase film positive. All line information needed for publication (ie. roads, streams, and soil lines) is transferred to this sheet. After care has been taken to ensure that the transfer is clear and accurate, the lines are traced again on mylar which can be used as a negative in the final printing process. This material is called scribe coat.

Scribe coat is another mylar material similar to the other mylar materials already mentioned, except it is covered with a special opaque substance which can be removed with a special hand tool called a scribbing blade. This removal allows light to pass through only where the sheet is scribed. Thus, when finished, this sheet can be used as a negative to photograph the linework for a soil survey publication. This can be combined with the other information and imagery for printing. Thus, three layers of information (imagery, line-work, and text) are combined to make the finished maps for a soil survey.

However, getting the soils information to publication is really only the first step. The true objective is to better utilize the soils resources of the state by drawing on the information contained in a soil survey. This is often difficult because the information is usually better understood and utilized when used in conjunction with other layers of pertinant information. This combination of interpretations for several layers of information is very time consumming and cumbersome when performed manually. But these multilayered combinations of information are comparatively easily handled by sophisticated computer systems. In order for a computer to be able to manipulate any type of information, the information must first be in a form recognized by the computer. This is where the digitizing process comes in.

Digitizing is a process by which geographic information is entered into the computer. It is a drafting operation in which a curser is moved across a digitizing table. A curser is a hand tool which has a pair of wires running through it which can be used with a digitizing table for data capture. This table has a grid of wires running through it which are used by the computer to determine the exact location of the curser at any given moment. By repeatedly reading and storing a series of points the computer can save the shape of a line. By doing this thousands of times and you have the linework of a soils map stored in a computer. These coordinate values can later be used by the computer to cartographically reproduce the map. More importantly, however, the information can also be processed so that individual areas can be given attributes. By giving geographic areas attributes, it is possible to access the utility of an area for a particular land use. Then by comparing the utility of several alternative land uses, it is possible to rank the suitability of various areas for various land uses. One potential utility of digitizing soil surveys is to better utilize soils information to help resolve conflicts between competing land uses.

In order to help offset the expense of digitizing the existing manual, a compilation process was combined with digital techniques. When completed, this product can then be used for publication and the computerized soils data can be used for making computer generated interpretations. This is what has been done for Buncombe County, North Carolina.

Digitizing a county for publication is the same as manually compiling it except that any information to be computerized is digitized instead of being scribed. This involves several cycles of data capture, computer processing, plotting, and editing. Eventually the information is plotted by the computer in a press ready form. This reproduction is then combined with other manually prepared parts for subsequent publication.

As mentioned earlier, having the information in a digital format suitable for subsequent computer manipulation is the real purpose of digitizing. By giving the individual soil mapping units a rating for a particular use it is then possible to rank areas of soils for one or several uses. This ranking can most easily be done for single criteria interpretations, e.g. suitability for roads, without regard to crop production, or suitability for a particular crop without regard to housing needs, and so on. The Soil Conservation Service routinely includes ratings of soils for numerous interpretations. It is a relatively simple process to generate an interpretation for one particular use.

It is the combination of several different interpretations that make computerization so desirable. An example of an area interpreted for both septic tank suitability and agricultural production follows. Although comparatively simple and therefore by no means exemplifing the full potential of this type of analysis, this example does represent a starting point and demonstrates a technique for utilizing a geographic information system and information contained in a soil survey to help give potential answers to tough land use questions, based on scientific criteria and methods.

Residential development and farming are often in competition for the same lands. This is because land well suited to one is generally well suited to the other. However, by examining the characteristics of various soils it can be found that there are soils which are well suited to residential development, but which are not well suited to agricultural production. These would be areas where residential development could be encouraged. It would be useful if areas with this non-conflicting characteristic could be identified. To illustrate how a geographic information system can be used to serve this purpose, I have used the Buncombe County Soil Survey data to generate a series of interpretive maps.

I would like to emphasize that this is not a comprehensive study of the best use of the area in question, but rather a simple example of how soils information and a geographic information system can be used to enhance our perspective of one of our natural resources, and by so doing improve the utility of the soil survey, and potentially the utility of the resource itself.

Figures 1 - 4 show an area of the Asheville quadrangle in Buncombe County, North Carolina. Figure 1 shows the soils map of the area, and the other three computer generated figures (Figure 2,3,4) show interpretations of the soils for the same area. The Soil Conservation Service's list of Prime and State and Locally Important farmland for Buncombe County was used to identify land well suited to agricultural production. To identify land suited to residential development, the criteria outlined in the Ground Adsorption Sewage Disposal System Act of 1973 for ground adsorption of sewage effluent was used. An attempt was made to show that soils well suited to agricultural production are also well suited to residential development. By carefully examining the soil characteristics it can be found that there are some soils which are reasonably well suited to residential development which are not prime farmland. By identifying these soils we can identify areas where residential development would not impact on present or future agricultural production needs.

Figure 1, as mentioned, shows the soil types found in this area. The area is located just west of Asheville and is already developing. As an orientation aid note the interchange of US 40 and 26 at the left of the figure and a portion of the French Broad River on the right. Hence any shaded area pattern would show areas where residential development could take place without the need for extensive site modification, or great financial outlay for a sewage treatment plant. The areas identified would not be areas best suited to agricultural production. Therefore a map of this type could be used as a tool to help identify those areas where development can take place without increased development cost due to the need for treatment plants, while not taking those lands best suited to agricultural production out of production.

Continual progress is being made in digitizing soils information for a soil survey publication and subsequent interpretive uses. To date, two county's have been digitized. The first is undergoing the final in state edit prior to publication. At present the most economical approach is to combine the manual and computerized techniques. However, the process is likely to become more computerized as more efficient procedures are developed. This work has shown that it is possible to use digitized data for a soil survey publication, and suggests that the economical justification will be realized by the enhanced utility of the soils information through the use of computer generated interpretive maps.

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Figure # 1   scale 1:24000   ^ north

BMA	Biltmore fine sandy loam,	0 to 3 percent slopes
BOB	Braddock loam,	2 to 8 percent slopes
BRC	Braddock-Urban land complex,	2 to 15 percent slopes
DEB	Dillard loam,	2 to 8 percent slopes
ESE	Evard-Porters-Urban land complex,	15 to 30 percent slopes
FAE	Fannin loam,	15 to 30 percent slopes
FEC	Fannin-Urban land complex,	2 to 15 percent slopes
FRA	French loam,	0 to 3 percent slopes
HAB2	Hayesville loam,	2 to 8 percent slopes
HAC2	Hayesville loam,	8 to 15 percent slopes
HAE2	Hayesville loam,	15 to 25 percent slopes
HUC2	Hayesville-Urban land complex,	2 to 15 percent slopes
IOA	Iotla loam	0 to 2 percent slopes
KNB	Kinkora loam,	0 to 8 percent slopes
SSF	Saluda and Fannin soils,	30 to 50 percent slopes
TFC	Tate and French soils,	2 to 15 percent slopes
TMC	Tate-Urban land complex,	2 to 15 percent slopes
TOA	Toxaway silt loam,	0 to 2 percent slopes
UR	Urban land	
W	Water	

Figure # 2 scale 1:24000 ^ north

Prime Farmland

State & Locally Important Farmland

Other

Water

Figure # 2, shows the soils rated for prime and state and locally important farmland. Approximately 100 acres of this area is classified as prime, and approximately 982 acres are of state and local import. The remaining 2,232 acres are not particularly well suited to agricultural production. Assuming that this is representative of the county as a whole you can see that good farmland is in short supply and should therefore should probably be protected.

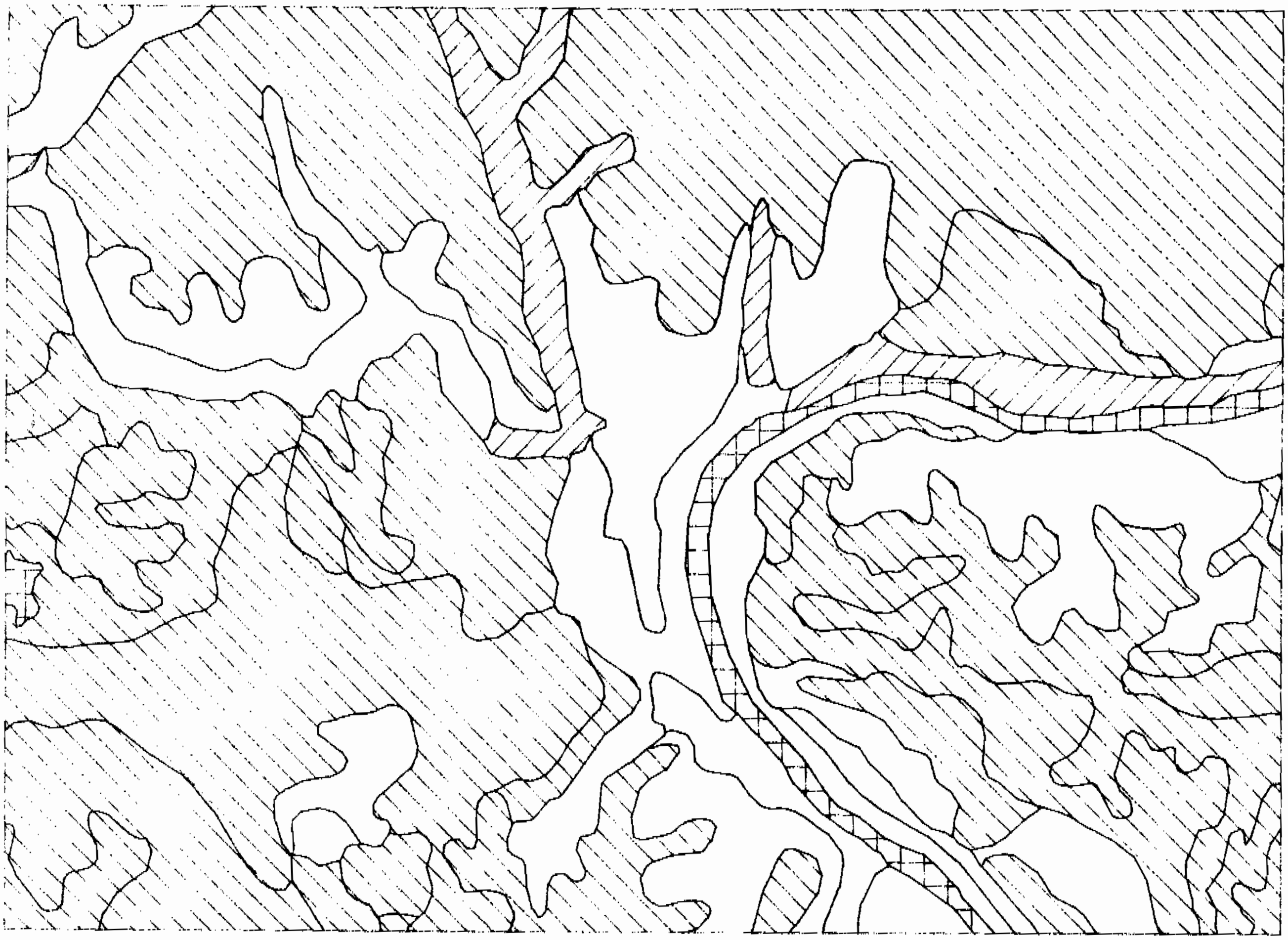

Figure # 3 scale 1:24000 ^ north

▨	Suited	☐	Other
▧	Provisionally Suited	⊞	Water

Figure # 3, is the same area rated for septic tank filter field. Of the 3,214 acres on this map only 130 acres are currently suited to use as an area for septic tank filter fields (ie. without modification). 2,148 acres are provisionally suited (ie. suitable provided certain minimal improvement criteria are met).

Figure # 4 scale 1:24000 ^ north

- Suited and neither Prime nor State & Locally Important Farmland
- Suited and not Prime but State and Locally Important Farmland
- Provisionally Suited and neither Prime nor State & Loc. Imp. Far.
- Provisionally Suited and not Prime Farmland but St. & Loc. Imp. Far.
- Other
- Water

Figure # 4, is a combination of the first two interpretations. It identifies those areas which are to varying degrees, suited to residential development and agricultural production.

THE NORTH CAROLINA WETLANDS INVENTORY PROGRAM

Julie H. Moore

A wetlands mapping program was initiated in North Carolina in October, 1983, by the Department of Natural Resources and Community Development's Division of Soil and Water Conservation through a cooperative agreement with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. The Corps is providing initial funding while the Fish and Wildlife Service is providing in-kind services including steroscopic mapping equipment, aerial infrared photography, cartographic training and cartographic services for draft and final map production.

Wetlands are identified according to the methodology developed by the National Wetlands Inventory Project which was established in 1975 by the Fish and Wildlife Service. The intent of the National Wetlands Inventory is to produce and disseminate scientific information on the characteristics and extent of wetlands in the United States in order to promote appropriate use of these valuable resources. In order to have a wetlands system based on ecological units sharing basic natural attributes while providing uniformity of concepts and terminology for use through the country, it was necessary to develop a new classification scheme to replace the well known and widely used "Circular 39" produced by the Fish and Wildlife Service in 1954. The new system was developed by a committee of scientists and published in 1979 as Classification of Wetlands and Deepwater Habitats of the United States (1).

It should be emphasized that this approach defines wetlands according to ecological characteristics and not according to administrative or regulatory programs. Three parameters are used to determine if a site is a wetland: the presence of wetland plants (hydrophytes), the presence of wet soils (hydric soils), and soil saturation or flooding. Computerized listings of wetland plants and wetland soils are currently being developed and reviewed for the entire country, and in time such listings will be developed for North Carolina.

The classification is hierarchical (see Figure 1) with wetlands divided into five major systems at the broadest level: marine, estuarine, riverine, lacustrine and palustrine. The system is further subdivided by subsystems which reflect hydrologic conditions (e.g., subtidal vs. intertidal or limnetic vs. littoral). Below subsystem is the class level, which describes the appearance of the wetland in terms of vegetation (e.g., emergent, aquatic bed, forested) or substrate where vegetation is inconspicuous or absent. Each class (e.g., streambed, rocky shore) is further divided into subclasses (e.g., broad-leaved deciduous, needle-leaved deciduous, needle-leaved evergreen, etc.) The classification also includes modifiers to describe hydrology or water regime (e.g., temporary, saturated, semipermanent, permanent, regularly flooded, irregularly exposed, etc.). Water chemistry (pH, salinity and halinity) and special modifiers relating to man's activities (e.g., impounded, partly drained, farmed, or artificial) can also be added. The topographic cross-sections in Figure 2 illustrate several wetland habitats in North Carolina and appropriate classification terminology.

The methodology used in wetlands mapping consists of initial field reconnaissance surveys during which data on vegetation, soils and water regime or hydrology are recorded on standardized field sheets, followed by preliminary mapping, more ground truthing, and map revisions as necessary. Mapping is done by using steroscopic pairs of infrared photographs (1:58,000) taken in the late winter of 1982 or 1983. Consequently, photo-interpretation is tied to the date of photography and not conditions observed in the field in 1984. Delineations are made directly on mylar overlays. Wetland determinations are cross-referenced with available soil surveys, topographic maps, and other pertinent materials. When the first iteration of mapping is completed, the maps are sent to the regional Fish and Wildlife Service coordinator for inspection. If corrections need to be made, the maps are returned to the Raleigh office; otherwise, the photos with overlays are sent on to the National Wetlands Inventory office in Saint Petersburg, Florida where the delineations are checked, the overlays are enlarged so that they match USGS quadrangles, and draft maps are produced for review by any and all interested agencies and individuals. Production time for draft maps is about six months. Maps are finalized for public distribution following review and correction. In many states a state-run map distribution point has been set up.

Prior to the cooperative agreement last fall (1983), preliminary wetlands mapping had been performed at selected areas in eastern North Carolina with a large portion of the Pamlico-Albemarle peninsula being mapped by a private contractor through funding by the Corps of Engineers.

Update

From the tentative beginning last October, the wetlands inventory in North Carolina has gained momentum. During the summer session of the General Assembly, a permanent position for a Wetlands Inventory Specialist within the Division of Soil and Water Conservation was approved and Steve Leonard will assume responsibility for the inventory. Corps of Engineers funding doubled and field work has begun at Camp Lejeune for the Department of Defense. Another project, funded by the Department of Energy, will provide wetlands mapping in the vicinity of proposed hazardous waste disposal sites in the piedmont and mountains. EPA has also funded a small project for selected mountain quadrangles.

As the wetlands inventory in North Carolina progresses, interest in the project is broadening, and includes information requests from many State and Federal agencies, and university and private industry personnel. As the demand increases and as funds are available, technical staff will be added.

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1. Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe, 1979. Classification of wetlands and deepwater habitats of the United States. Supertendent of Documents, U.S. Government Printing Office, Washington, D.C. 103 pp.

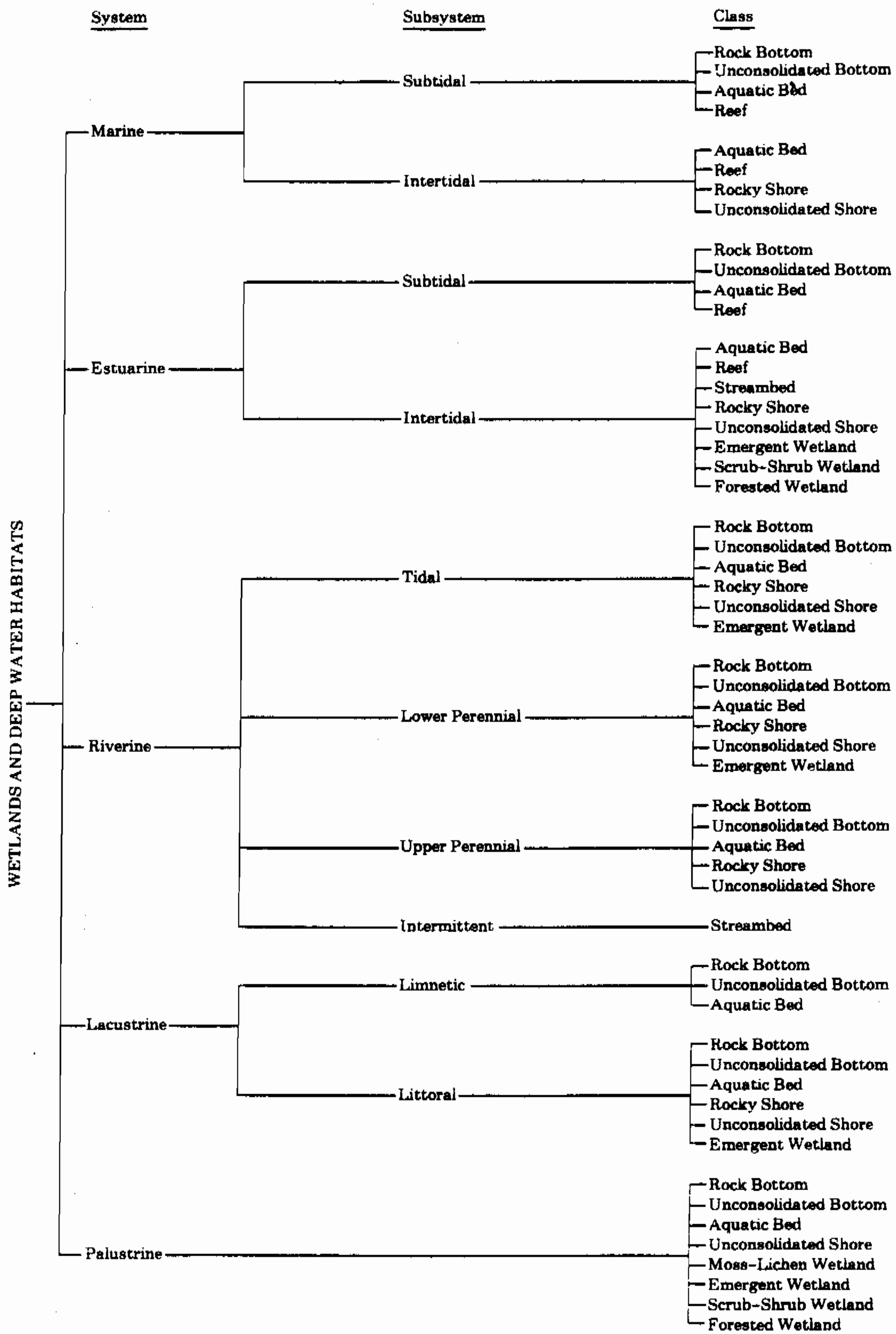

Fig. 1. Classification hierarchy of wetlands and deepwater habitats, showing systems, subsystems, and classes. The Palustrine System does not include deepwater habitats. Reprinted from Cowardin et al., 1979.

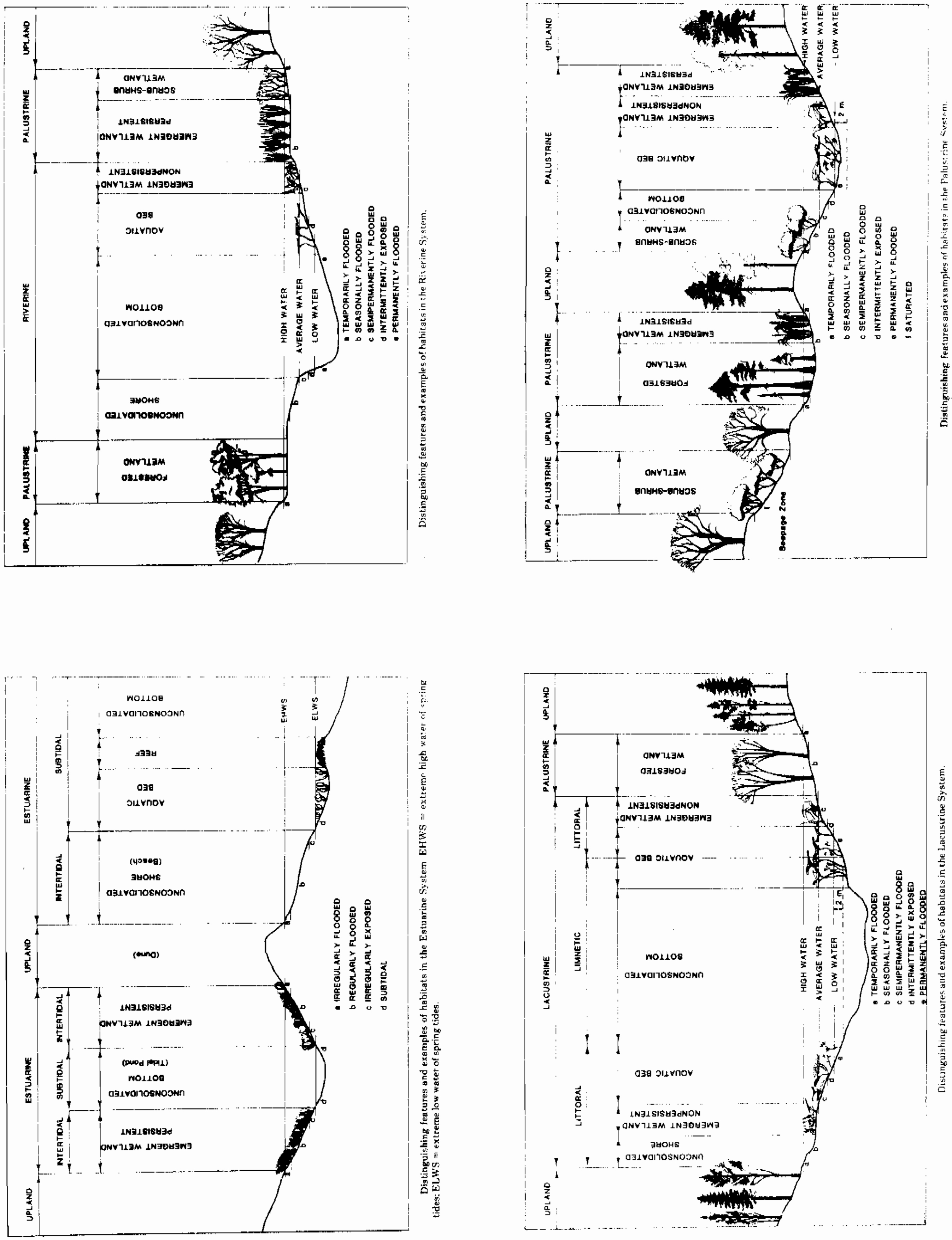

Fig. 2. Distinguishing features and examples of wetlands habitats.
From: Classification of Wetlands & Deep Water Habitats of the United States.

High Yield Trials

E. James Dunphy

In 1980 a trial in Wilson county was established to determine what maximum yield of corn and soybeans could be obtained on a Norfolk soil with the existing technology available to farmers. It was anticipated that this trial would not only help answer these questions directly, but also serve as a useful vehicle to generate discussions about yield limiting factors and to help train agents and growers about corn and soybean production on Coastal Plain soils. Drought conditions occur regularly in this area. Poor soil structure also reduces root penetration to the subsoil. Consequently, irrigation has been a treatment variable each year, and all plots have been subsoiled each year.

The treatment variables used in 1980 are outlined on Table 1. Comparisons of planting no-till corn into standing rye stubble with discing and planting in a clean seed bed were used, both with and without irrigation. The irrigation system used was overhead sprinklers, with one sprinkler set in each corner of an irrigated block. The sprinklers overlapped enough that each portion of the plot was being irrigated by at least two sprinklers.

The response to irrigation was much greater for corn, either measured as grain yield or as silage yield, than it was for soybeans. With both crops, two varieties were grown, but each averaged together for Table 1 since the pattern for response to the treatment variables did not differ substantially. The rye cover crop appeared to help corn grain yields when used in conjunction with irrigation, but did not appear to help corn silage yields or soybean yields, either with or without irrigation, or corn grain yields in the absence of irrigation. This kind of response for corn would probably be profitable, while the soybean response would not likely be large enough to justify the cost of irrigating nine times.

In 1981 the crops were rotated so that all soybeans were following corn and all corn was following soybeans. This rotation was included to maximize yields. As shown in Table 2, the treatment variables were changed somewhat for 1981. The comparison of clean tillage versus no-till into rye was omitted in favor of comparing nitrogen added at two different times, which was called split nitrogen on the table, to adding the nitrogen at four different times, which was called multiple nitrogen on the table. A difference in response between the two hybrids was measured, so yields are shown individually.

In the absence of irrigation, yields were essentially the same for the two nitrogen management treatments for both varieties. With irrigation, however, the split nitrogen application produced substantially higher yields with one variety but not with the other. The highest yield obtained overall was with Funk's G-4507 under irrigation with nitrogen applied at two different times.

The soybean treatment variables were also changed to replace the conventional versus no-till with Benlate foliar fungicide versus no fungicide (Table 3). Neither variety responded much to the foliar fungicide, either with or without irrigation, but this was also a season where very little disease pressure was observed. Again, the soybean response to irrigation was not as large as a grower might hope it to be to cover the cost of owning and operating an irrigation system. At least with this years treatments, one goal, which was to get yields over sixty bushels per acre on a Norfolk soil was achieved (Table 3). While this goal was achieved with the Forrest variety but not with Ransom, it reflects how the two varieties adapted to the particular season and not that Forrest is a higher yielding variety than Ransom.

In 1982 the variables were changed again in an attempt to utilize what was learned in previous years and move on to looking at other variables. The corn variables used in 1982 were population (20,000 versus 28,000 plants per acre), both uniformly spaced and non-uniformly spaced. It was decided that at high yield levels there may be more yield potential with uniformly distributed plants than with non-uniform spacings (Table 4).

Moisture was not nearly so limiting in 1982 as in the previous two years, and the yield response to irrigation was very minimal. The corn was irrigated only two times during the season. Somewhat surprisingly, the lower population yielded as well as the higher, and in every case, the non-uniform spacing outyielded the uniform spacing. This may be related to the abnormally cloudy weather experienced during June and July, which may have in fact made sunlight a yield limiting factor. A goal of corn yields in excess of 200 bushels per acre was again achieved (Table 4).

The only variable besides irrigation used on soybeans in 1982 was the four different varieties, ranging in maturity from Deltapine 105 as the earliest to Coker 237 as the latest in maturity (Table 5). As was the case with corn, irrigation improved yields very little, if at all. The Coker 237 yielded higher than the other three varieties both because of its later maturity, thus enabling it to utilize more of the growing season, and the fact that this variety lodged the least of any of the varieties in the test this year.

The 1983 corn yields are not completely summarized yet. The variables investigated included irrigation, population and lodging, in conjunction with the influence of stalk rot organisms, European cornborer and an insecticide treatment. Yields as high as 233 bushels per acre were achieved on some of the irrigated plots.

The soybean variables were very similar to 1982, except two of the varieties were changed; again they range in maturity from earliest to latest in the order shown on Table 6. The other difference between 1983 and 1982 was that for 1983, wheat was also introduced into the test, so that these 1983 soybean yields are not full season beans but double-cropped beans behind wheat. As might be expected from the dry weather experienced in 1983, the response to irrigation was substantial. The soybeans needed to be irrigated thirteen times to achieve that yield increase. It would be interesting to speculate on what the yields might have been had temperatures in late August not exceeded 100 degrees at this location, for high temperatures were the major yield limiting factor in 1983.

In conclusion, these tests are accomplishing most of the goals that were hoped for. The tests have gotten yields in excess of 200 bushels per acre for corn and 60 bushels for soybeans on a Norfolk soil, which was one of the original targets. There have also been useful discussions at the site about what does or might be limiting corn and soybean yields in North Carolina. These tests have also been useful at encouraging growers to think in terms of higher yield potential on their own farms, and some of the production factors that they might need to consider to raise their yield levels profitably.

Table 1. 1980 YIELDS

Treatment	Corn Bu/A	Corn T/A	Soybeans Bu/A
Not Irrigated Rye	88	12.3	44.7
" Disc	74	11.9	42.0
Not Irrigated Rye	166	21.5	54.1
" Disc	138	21.9	55.3

Table 2. 1981 CORN YIELDS

	Bu/A	
Treatment	G-4506	XL-394
Not Irrigated Split N	83.8	78.7
" Mult. N	89.8	73.3
Irrigated Split N	194.3	161.0
" Mult. N	169.3	164.4

Table 3. 1981 SOYBEAN YIELDS

	Bu/A	
Treatment	Alone	+Benlate
Not Irrigated Forrest	52.8	55.9
" Ransom	43.4	43.7
Not Irrigated Forrest	60.9	61.1
" Ransom	51.7	49.7

Table 4. 1982 CORN YIELDS (Bu/A)

Treatment	Stands	
	Uniform	Not Uniform
20,000 pl/A, not irrigated	198	205
20,000 pl/A, irrigated	188	201
28,000 pl/A, not irrigated	179	196
28,000 pl/A, irrigated	202	219

Table 5. 1982 SOYBEAN YIELDS (Bu/A)

Variety	Not Irrigated	Irrigated
Deltapine 105	59.2	59.1
Coker 156	59.4	61.6
AP 71	56.8	59.8
Coker 237	62.3	66.8

Table 6. 1983 SOYBEAN YIELDS

Variety	Yield - Bu/A	
	Not Irrigated	Irrigated
RA 604	34.6	50.9
Coker 156	36.7	52.8
Coker 237	37.8	55.7
GaSoy 17	36.6	49.1

Soils and Sediments of a Carolina Bay Near Wilson's Mills, North Carolina

D. J. Bliley, S.W. Buol and R. Rebertus

Carolina bays are shallow elliptical, oriented depressions that are formed on undissected Coastal Plain surfaces. Studies have shown these landforms to be relic lake basins that were ponded during wet climatic conditions and oriented by the influence of strong directional winds. These conditions likely existed during late pleistocene. Studies of bay sediments can provide more precise information about the age of bays and also reveal how and why the classification of bay soils can differ significantly from interbay soils.

The Carolina bay in this study is located near Wilson's Mills in Johnston County. The bay was formed in thin Coastal Plain sediments that overlaid saprolite. The southeastern end of the bay cuts into a saprolite knoll. A poorly drained silty soil was mapped in the bay and was found to overlay a buried soil. Longitudinal and transverse transects describing the bay were made from auger hole spacings placed 15 to 90 m apart and up to 3 m deep. Descriptive soil profiles were recorded from a 3 m dug pit. Soil samples were collected for mineralogy and particle size analysis. Wood samples from the buried soil were collected for C14 analysis.

The stratigraphy revealed that the bay had undergone two or more periods of activity and deposition. The most recent phase was represented by a silty surfacial sediment. This unit is dominantly silty but becomes somewhat coarser near the edge and also becomes coarser with depth. There is a distinct basal sandy member that adjoins the basins edge. These relationships suggest that depositional energy was highest near the edge of the basin and that initial stages of bay formation involve higher energy levels than final stages.

The perimeter of the buried soil surface was mapped in relation to the existing bay. The current bay had expanded about 125 m longitudinally and about 75 m transversely from the original basin size. The existance of other organic enriched layers below the buried surface suggest that the pre-existing basin had a complex history.

A well developed soil profile is formed in the silty surfacial sediment. Distribution of sand, silt, and clay in the profile appears to be due to stratification of the sediments. An argillic horizon is not present. Petrographic examination of the very fine sand fractions revealed that quartz is the dominant mineral present. Feldspars are present in small amounts (less than 4 percent) as are other minerals. Petrographic examination of the very fine sand from a saprolite sample taken at the bay's edge revealed that feldspar content was low in the saprolite. It appears that saprolite is the most likely source for the upper bay sediment.

The buried soil layers are dense, compact and have a bulk density estimated at greater than 2.0 g/cm^3. These buried layers contained numerous cypress roots that could be from modern trees or from trees related to the buried surface. The dense upper layers have protected the roots from decomposition. Root age estimates will be made by C_{14} analysis.

The detailed description of the buried layers shows that they vary in the degree of darkness and presumably in organic matter content. It appears that two profiles are present. The lower profile may have partly formed in saprolite.

GENESIS OF SOILS FORMED FROM MICA GNEISS AND SCHIST

R. A. Robertus

Dystrochrepts and Hapludults are the most extensive soils in the Blue Ridge and Piedmont Provinces of the eastern United States (2). Parent material for many of these soils is foliated rocks resulting from regional metamorphism. Rocks resulting from this type of metamorhism include the common schists and gneisses. Schists are strongly foliated as a result of the prevalence of platy phylloscilicate grains, chiefly micas. Mica schist is a common type of schist that consists essentially of quartz and mica (1). The mica is the prominant component occurring in irregular layers and foliated masses. Gneisses differ from schists in having thicker layers, the result of compositional banding of quartz and feldspar alternating with bands of darker minerals, often biotite or hornblende.

In North Carolina mica gneiss and schist occur over wide areas and the former underlies more of the state than any other rock type. The two rocks often occur together with bands and lenses of one commonly interlayered with the other (3). The secondary minerals formed from such rocks will be chiefly the alteration products of micas and feldspars. Quartz, the other principal rock-forming mineral, is resistant to weathering and persists in the sand fraction.

The purposes of this paper are to summarize the major mineralogical transformations and pedogenic processes occurring in residual soils formed from mica gneiss and schist in North Carolina.

Materials And Methods

Ten Typic Dystrochrept and Typic Hapludult pedons were selected from the Blue Ridge and Piedmont Provinces to represent a range in degree of profile development and biotite and muscovite contents of soils formed from mica gneiss and schist (Table 1). Nine of the ten pedons were judged to represent residual soils as indicated by lithologic continuity between the solum and saprolite, and absence of stone lines or abrupt particle-size changes not attributable to compositional banding of the rock. Only Pedon 8 appeared to have formed in colluvium. All pedons had a north to west aspect.

The degree of development of the pedons sampled ranged from a Typic Dystrochrept with firm saprolite present at 48 cm to a clayey Typic Hapludult where the solum extends to a depth of more than 2 m and is underlain by soft C horizon material with a high clay content.

Results And Discussion

The soils, formed from similar parent materials and under a relatively narrow range in climate, represent a developmental sequence where soil development increases with surface stability and hence is related to slope and landform. Slope and landform influence the degree of soil development through their control of the processes of weathering and erosion. Soil development is manifested by a change in particle-size class of soils from coarse-loamy→ fine-loamy→ clayey, increased solum thickness, and increased weathering of primary minerals. The Dystrochrepts, found on very steep sideslopes, have a coarse-loamy or fine-loamy particle-size class. Clayey Hapludults occur on landscapes of subdued relief where processes of weathering exceed rates of removal. Fine-loamy Hapludults usually occur on slopes of intermediate stability. Thickness of saprolite is positively related to degree of soil development and may range from less than 0.3 m in areas of extreme relief to greater than 30 m over strongly foliated rocks in areas of subdued relief (4).

Mineralogical Transformations

Sand-sized kaolinite is common in the soils studied and is the result of the pseudomorphic alteration of biotite and feldspars. The biotite is the chief contributor to sand-sized kaolinite contents. The degree of biotite alteration is related to degree of soil development (particle-size class, solum thickness, and degree of weathering of other primary minerals) as would be predicted since soils showing greater morphologic development have usually had a longer time to weather. In shallower Dystrochrepts biotite is relatively fresh in the upper saprolite (Fig. 1). On the more stable landscape positions where deeper Dystrochrepts and fine-loamy Hapludults occur, biotite is largely kaolinized in the sand fraction. The result may be the predominance of kaolinite in all size fractions (clay, silt, and sand) in all horizons (Fig. 2). The sand-sized kaolinite is less elastic and tenacious than fresh biotite. As a result, on the most stable landscape positions, kaolinite from biotite is in the process of physically breaking apart to form smaller particles, thus providing clay for the evolution of clayey soils. In the most developed clayey soils sand-sized kaolinite is absent from the solum (Fig. 1).

Kaolinization of biotite occurs isomorphically (pseudomorphically) and isovolumetrically. Kaolinite retains the same optical and crystallographic orientation as the biotite progenitor; the kaolinite pseudomorphs can therefore be considered as single crystals of kaolinite. The biotite to kaolinite transformation occurs through a hydroxy-Al interlayered vermiculite intermediate. The transformation results in a marked anti-gibbsite effect. Gibbsite forms in the low acidity environment that occurs near rock weathering and persists into the saprolite and solum of shallower Dystrochrepts (Fig. 1). In the strongly acid soil environments in which biotite begins to alter, Al released during weathering is deposited as hydroxy interlays in weathering biotite. Previously formed gibbsite is resilicated. Once the biotite has completely altered to hydroxy-interlayered vermiculite and kaolinite, gibbsite again begins to form. The result is an abundance of gibbsite in the more highly developed clayey soils (Fig. 1). The distribution of gibbsite in these profiles suggests formation from solution or as a dissolution product of previously formed kaolinite.

The mineralogy of sand and clay fractions of soils formed from schists and gneisses in North Carolina is not only a function of degree of profile development, but also of depth. Figure 3 represents the major mineralogical alterations observed in the soils studied and presents a means of estimating the mineralogy of sand and clay fractions by taxa and by depth. In coarse-loamy soils there is little clay and sand predominates. In well-developed clayey soils all ferromagnesium primary minerals have weathered and only quartz, microcline and muscovite remain in any abundance in sand fractions. Clay is the dominant size fraction and typical clay minerals and their progenitors are indicated in Fig. 3.

Significance to Classification

Many complex weathering indices have been devised to graphically represent chemical weathering. In soils formed from regional metamorphic rocks with high contents of mica, a simple ratio, dithionite extractable iron (free iron) to total iron, is a sensitive indicator of soil development. In Fig. 4 the ten pedons are ranked based on particle-size class and solum thickness into a developmental sequence and their iron ratios plotted. The ratio reflects the degree of Fe-bearing primary mineral alteration (principally biotite). The B horizons are much better indicators of relative soil development than either C or A horizons. Free iron/total iron ratios in A horizons appear to be influenced by downslope movement of surficial material, the low extractibility of iron oxides of large particle size, and clay content differences unrelated to soil development. Free iron/total iron ratios of C horizons are dependent on sampling depth, the amount of clay formed in that horizon, and the degree of illuviation that has occurred below the solum. The B horizons, closely corresponding to mineralogic control sections, not only reflect release of iron from primary minerals upon weathering and concentration of free iron with increased soil weathering, but also the pedogenic process of illuviation.

In Fig. 5, the 10 pedons are again ranked into a developmental sequence as was done in Fig. 4. In this graph, however, the ordinate of the oxidic ratio (%Fe_2O_3 + %gibbsite/%clay) of B horizons most closely corresponding to the control section. The resultant plot has no predictive value based on mineralogical observations and data, or the degree of soil development. The oxidic mineralogy class serves no useful organizational purposes nor does it elucidate any relationships, principles, or properties in the classification of these soils. Therefore, the spatial relationships of oxidic class soils are impossible to predict in the Piedmont and Blue Ridge Provinces of North Carolina. The simple free iron/total iron ratio in B horizons, which is systematically related to the degree of weathering of primary minerals and the degree of morphological soil development, better serves as soil family criteria than the %Fe_2O_3 + gibbsite/%clay ratio presently used in Soil Taxonomy.

Acknowledgments

Appreciation is expressed to Mike Ortosky, Roy Mathis, Steve Bristow and Chip Smith of the Soil Conservation Service who aided in locating sampling sites and with excavation and sampling of soil pits.

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2. Soil Survey Staff. 1975. Soil taxonomy. USDA Agric. Handb. 436. U.S. Govt. Printing Office, Washington, D.C.

3. Stuckey, J.L. 1965. North Carolina: Its geology and mineral resources. Dept. of Conserv. and Develop., Raleigh.

4. Sumsion, C.T., and R.L. Laney. 1967. Geology and groundwater resources of the Morganton area, North Carolina. Ground Water Bull. 12. N.C. Dept. of Water Resources, Raleigh.

Table 1. Synoptic outline of pedon identification and location

Pedon No.	Soil Type	Classification	Parent Rock	County	Elevation (m)
1	Unnamed series	Typic Hapludult, clayey, oxidic, mesic	Paragneiss	McDowell	491
2	Unnamed Series	Typic Hapludult, clayey, mixed, mesic	Mica gneiss	Ashe	939
3	Unnamed Series	Typic Dystrochrept, coarse-loamy, micaceous, mesic	Biotite-muscovite gneiss	Ashe	847
4	Fannin loam	Typic Hapludult, fine-loamy, micaceous, mesic	Biotite gneiss	Ashe	860
5	Unnamed series	Typic Hapludult, clayey, kaolinitic, mesic	Mica-hornblende gneiss	McDowell	530
6	Chandler sl	Typic Dystrochrept, coarse-loamy, micaceous, mesic	Biotite-muscovite-hornblende gneiss	McDowell	492
7	Fannin loam	Typic hapludult, fine-loamy, micaceous, mesic	Biotite gneiss	McDowell	475
8	Chandler cl	Typic Dystrochrept, coarse-loamy, micaceous, mesic	Biotite-microcline gneiss	McDowell	597
9	Madison fsl	Typic Hapludult, clayey, kaolinitic, thermic	Mica schist	Wake	84
10	Cecil fsl	Typic Hapludult, clayey, kaolinitic, thermic	Felsic gneiss	Wake	98

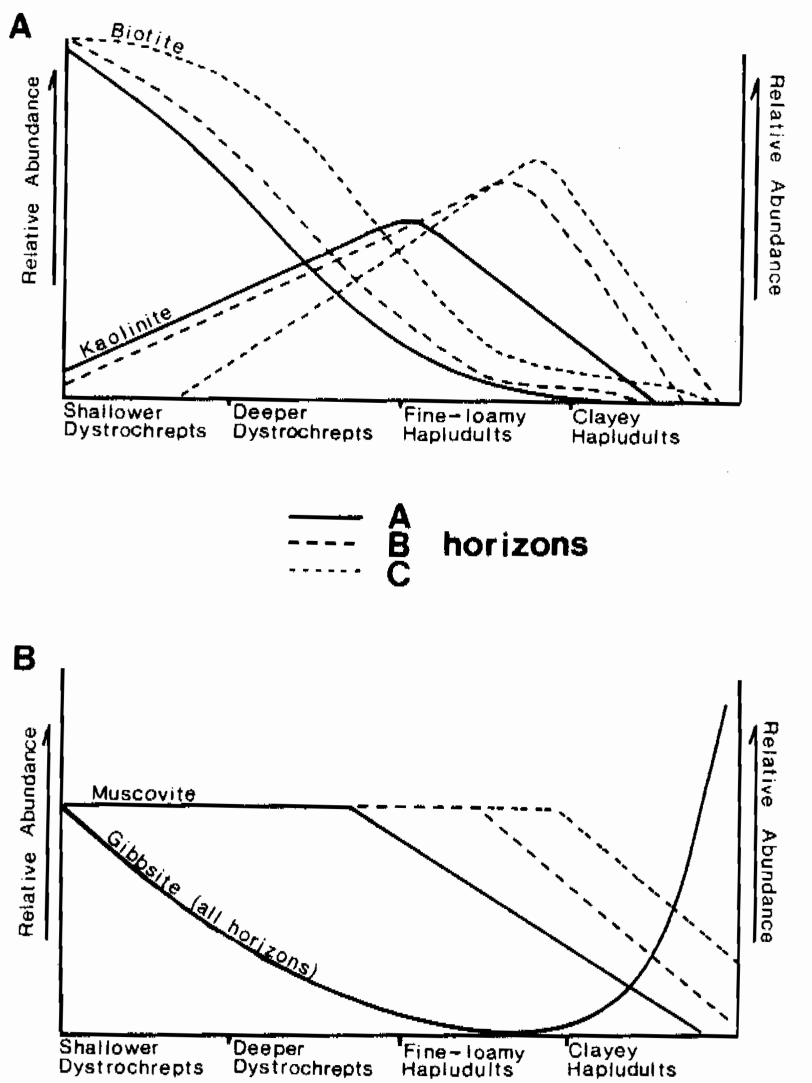

Figure 1. Idealized schematic of (A) sand-sized biotite and kaolinite contents, and (B) sand-sized muscovite and clay-sized gibbsite by horizon and across developmental sequence of soils formed from mica gneiss and schist.

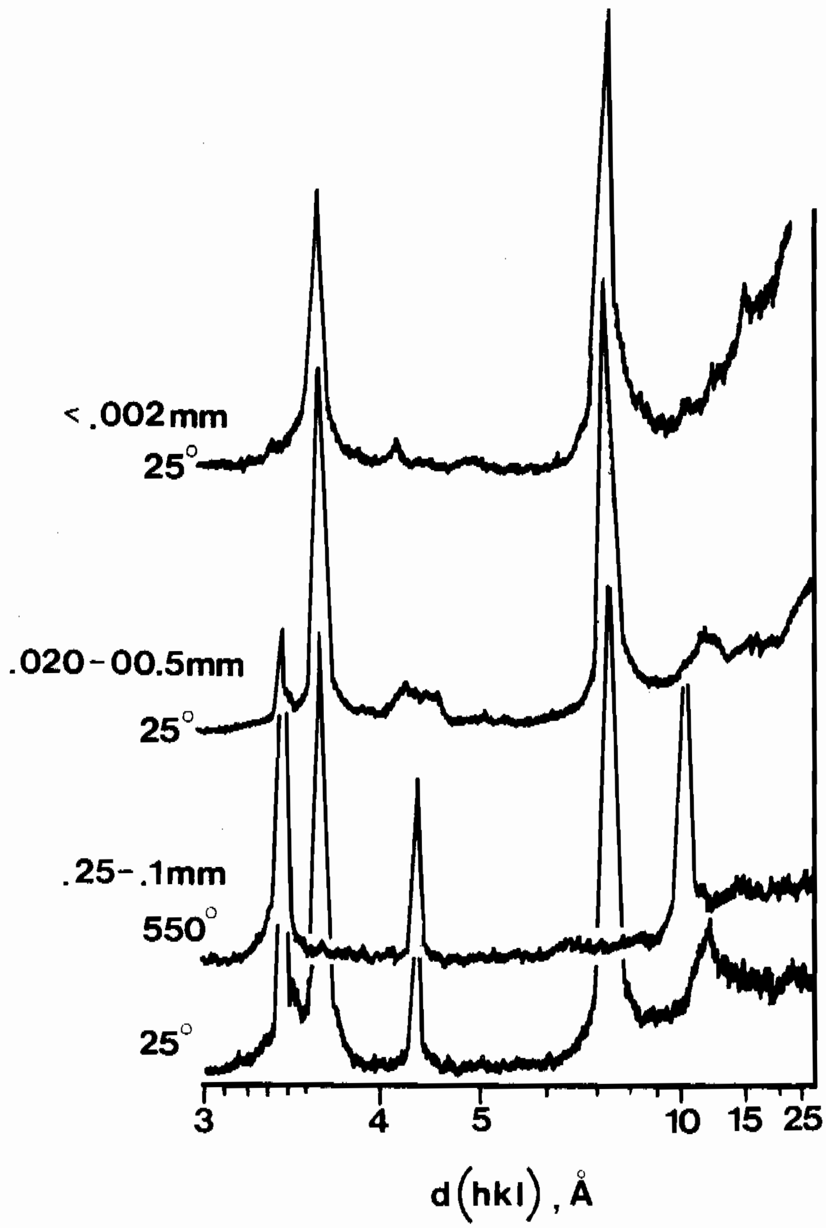

Figure 2. X-ray diffractograms of clay (K^+ saturated, unheated), medium silt (Na^+ saturated, unheated), and fine sand (Na^+ saturated) fractions from Bt2 horizon of a fine-loamy Hapludult (Pedon 4).

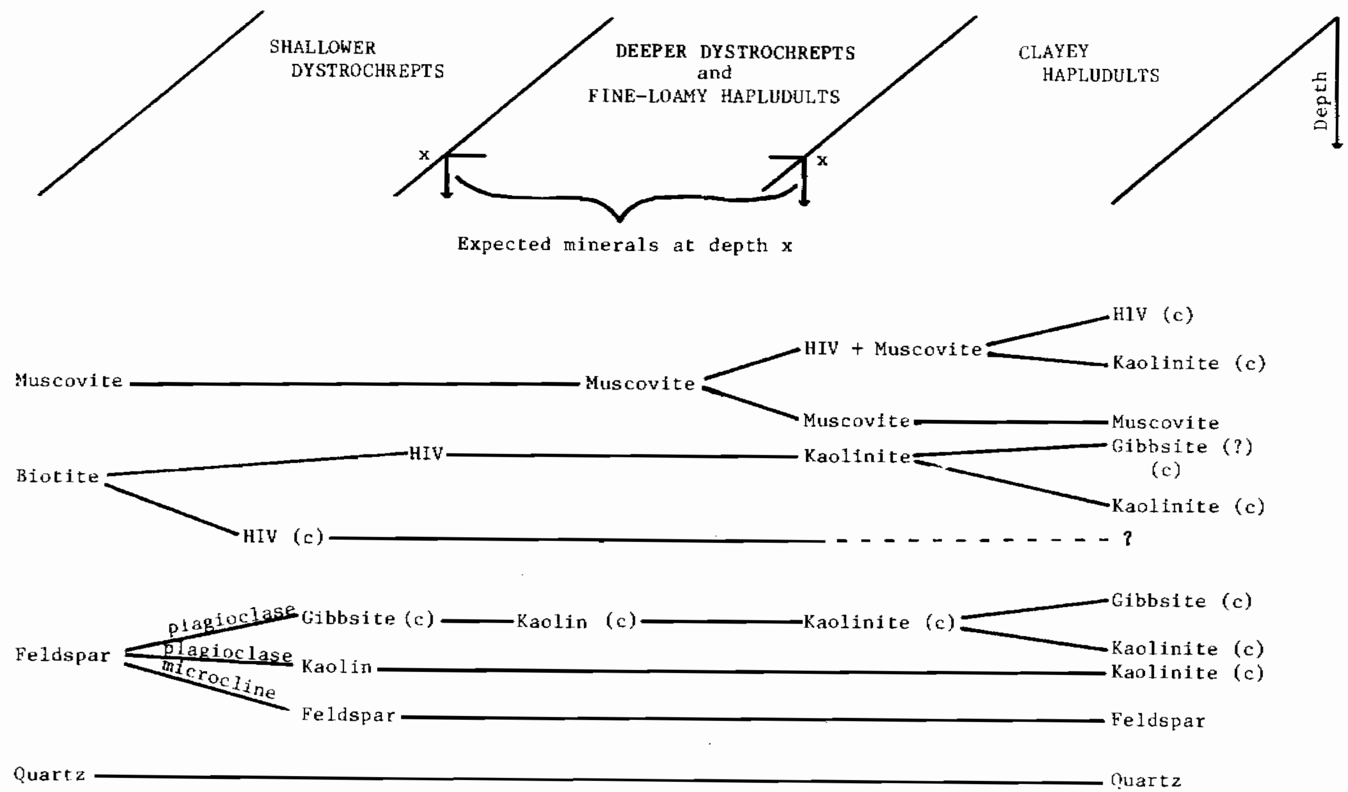

Figure 3. Transformations of the dominant minerals in a developmental sequence of residual soils formed from mica schist and gneiss in the Blue Ridge and Piedmont Provinces of North Carolina.

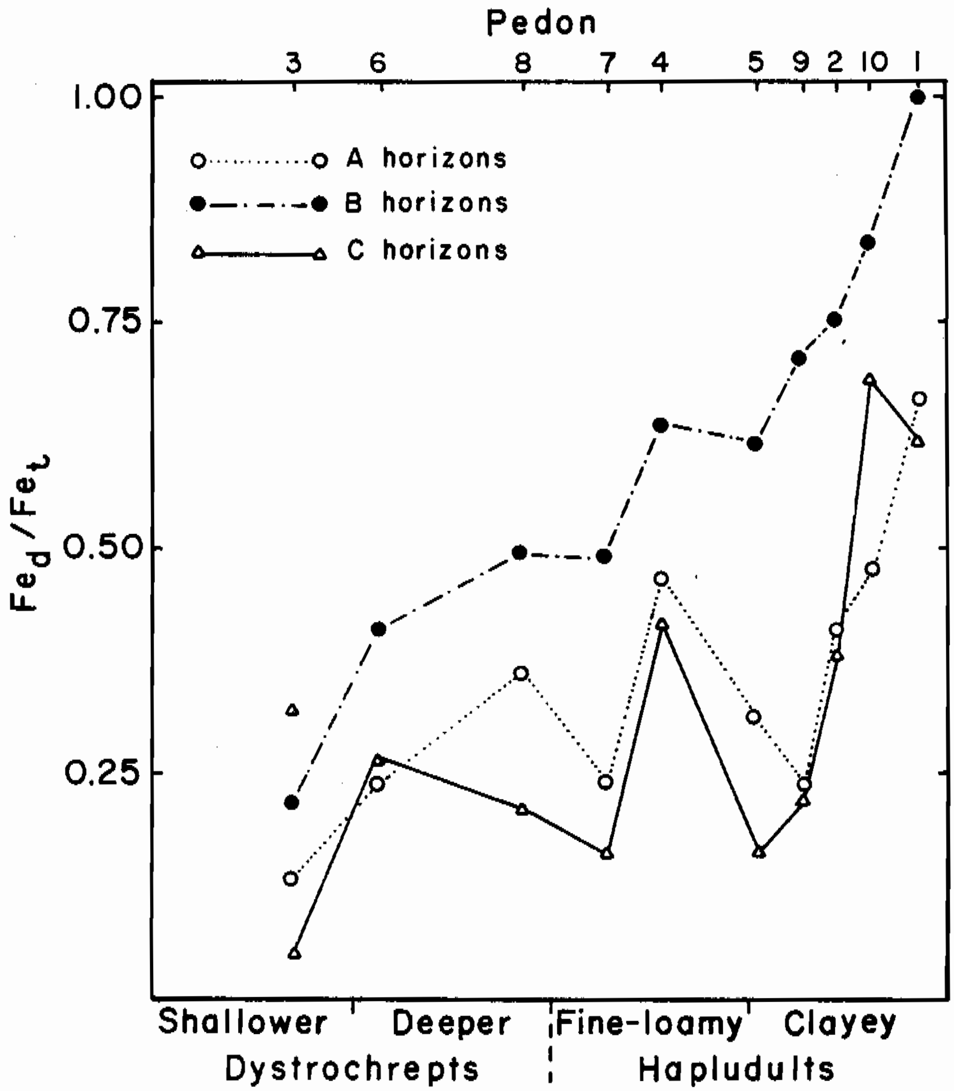

Figure 4. Relationship of free iron (Fe_d) to total iron (Fe_t) ratios to the degree of profile development. (Pedons ranked in increasing order of profile development.)

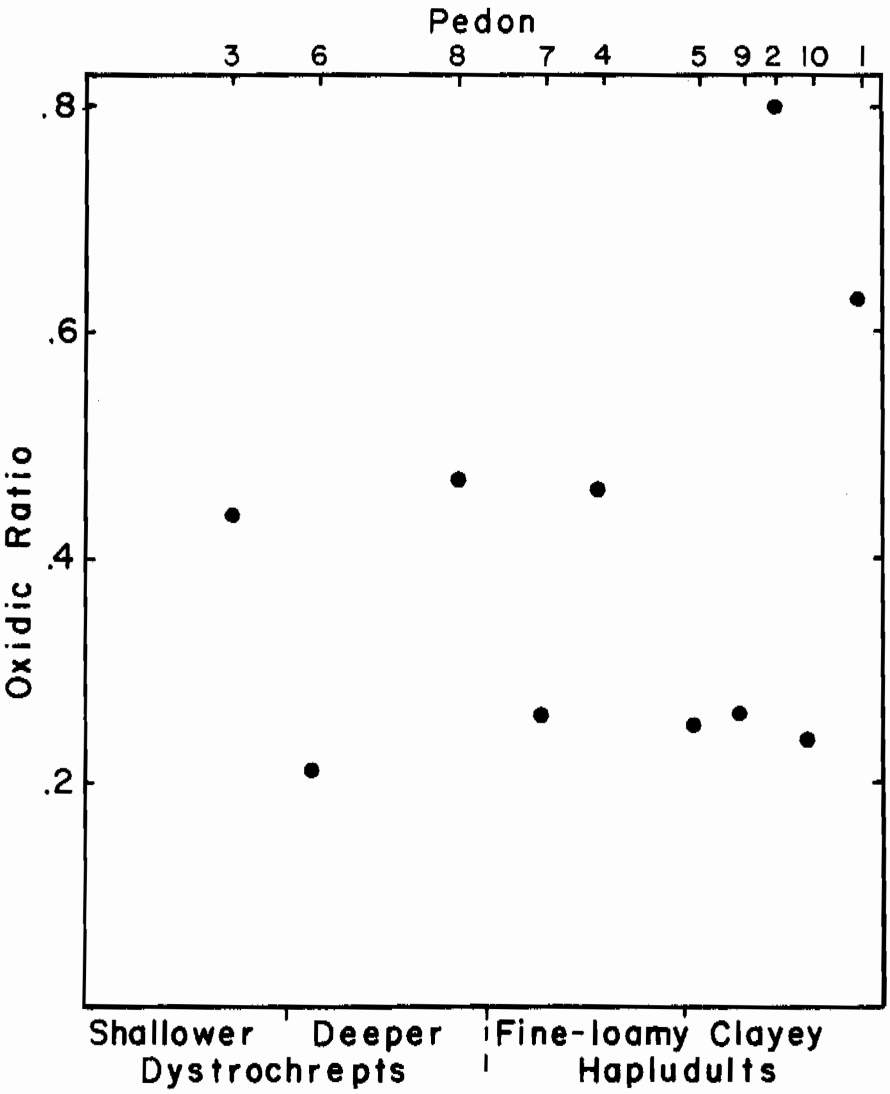

Figure 5. Relationship of the oxidic ratio to the degree of profile development. (Pedons ranked in increasing order of profile development.)

SOIL SCIENCE SOCIETY

OF

NORTH CAROLINA

BUSINESS

MINUTES OF THE TWENTY-SEVENTH ANNUAL SESSION OF THE SOIL SCIENCE SOCIETY OF NORTH CAROLINA JANUARY 17-18, 1984

The twenty-seventh annual session of the Soil Science Society of North Carolina was held January 17-18, 1984 at the McKimmon Center, North Carolina State University. Registration began at 12:30 p.m.; the meeting was called to order at 1:50 p.m. by President Paul Blizzard.

The annual business meeting of the Society was called to order at 4:00 p.m. on January 17, by Paul Blizzard. The minutes of the previous annual meeting were approved as printed in the 1983 Proceedings. Paul Lilly gave a treasury and audit report which stated that as of January 13, 1984, the Society had a balance of $2,342.89. Mr. Lilly stated that his audit of the Treasurer's books showed them to be acceptable. Darwin Newton moved that the Treasurer's and audit report be accepted. These reports were approved as read.

Glen Simpson gave a brief report of the printing of the Proceedings - stating that the typing, printing, and copying amounted approximately to $900. He noted that the registration list for the 1983 meetings was added.

Eugene Kamprath reported that 29 persons had been recertified as Soil Scientists, that 4 new persons were certified as Soil Scientists, one person has been certified as a Soil Scientist in training and 3 have applied for certification, pending approval by the Certification Committee. Dr. Kamprath reported that the new Chairman of the Certification Committee is Dr. Chuck Sopher. Sopher stressed that there is a stronger need for separation of funds resulting from certification activities and from the Society's funds. This will be taken under advisement by the new Committee.

Joe Kleiss gave a report from the Nominations Committee and election was held. The President-Elect is Keith Cassel, Department of Soil Science and the new member of the Executive Committee is Dr. Bob Uebler, Division of Health Services.

Joel Cawthorne gave a report regarding affiliation of the Society with ARCPACS. He added that 21 states are now affiliated with this organization. He stated that one can be certified as a Soil Scientist by the Soil Science Society of North Carolina and not by ARCPACS. He further responded to a question indicating that there is no charge to the individual if the Society would subscribe to the ARCPACS. It was moved and passed that the Society subscribe to the code of ethics of ARCPACS and affiliate with this organization.

President Blizzard read a letter from soil judging coach Joe Kleiss requesting additional financial support for travel to and participation by the collegiate soil judging team in the national contest in California. It was moved and seconded that $200.00 be transferred to this group for supplementation of travel to this event. The contest will be held April 13, 1984.

President Blizzard said that he had a report from Mr. W.D. Lee on the history of soil survey in North Carolina, from 1900-1952. After considerable discussion about its value to the society and the Soil Science profession, Blizzard asked that Joe Kleiss chair a committee for development of a publication format and means for renumeration of publication costs. It was the concensus that such information would be a valuable addition to the understanding of soil survey in North Carolina.

Bob Uebler asked that a "call for papers" be issued to the membership prior to the next annual meeting. Perhaps a deadline be established for submission of titles. It was suggested that Paul Blizzard and members of the Executive Committee take this procedure under advisement.

President Paul Blizzard turned the meeting over to the incoming president, Darwin Newton. The meeting was adjourned at 4:40 p.m.

Respectfully Submitted,

Jack V. Baird

Jack V. Baird, Secretary-Treasurer
Soil Science Society of North Carolina

Soil Science Society of North Carolina

Report of the Auditing Committee, January 16, 1984

We have examined the financial records of the Society as maintained by Jack V. Baird, Treasurer, and found them in order as follows:

Balance on Hand, 7/1/82		
-General Funds	1693.94	
-Certification Funds	530.87	
Receipts 7/1/82 to 6/30/83		
-General Funds	2599.00	
-Certification Funds	85.00	
Itemized Disbursements 7/1/82 to 6/30/83		
-Typing: 1982 Proceedings		215.00
-Postage: General		59.60
-Postage: Certification		20.00
-Printing: 1982 Proceedings		812.74
-Printing: Programs, etc.		114.82
-McKimmon Center		512.50
-University Food Services: Coffee		74.25
-1983 Banquet and Social		626.25
-Awards		12.48
-Soil Judging Team		100.00
-Tax		2.31
-Returned Check		15.00
		2564.95
Balance on Hand 7/1/83		
-General Funds		1747.99
-Certification Funds		595.87
	4908.81	4908.81

J.P. Lilly
Auditing Committee

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K. Cassel (President-Elect)
P. Blizzard (Past President)
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Cawthorn, Joel W.
Chancy, Henry
Clapp, David C.
Clark, George B.
Clary, Kent
Clayton, G. Steve
Clements, William Clary
Coates, Everett L.
Collins, W.K.
Cook Maurice C.
Cox, F.R.
Cummings, George A.
Daniels, Raymond B.
Davey, Charles B.
Denton, H.P.
Dickens, Wallace J.
Dunlop Jr., (Bill) W.R.
Dunn, Samuel J.
Dunphy, E. James
Eaddy, Don
Edwards, Bob
Evans Jr., Forrest F.
Evans, Steven T.
Franklin, Carolina E.
Gagnon Jr., John A.
Gentry Jr., Howell
Gilliam, J.W.
Gomez, E.N.
Goodwin, Andy
Gregory Dr., James D.
Gurley, Steve R.
Hansard, Roger
Harold, Owen
Hawks Jr., S.N.
Hayes Jr., W. Allen
Hayhurst, Ernest N.
Hinton, Joseph A.
Hoag, Robert E.
Hoover, Michael
Hopkins, David R.
Horton Jr., R.E.
Horton, Robert E.
Howard, Lynn
Hoyt, Greg D.
Hudson, Berman D.
Hudson, Mark S.
Jackson, Leroy
Jackson, W.A.
Jenkins, Van S.
Kamprath, Eugene
Karnowski, Ed
Kays, Barrett L.
Keenan, Scott C.
Kelley, Pat H.
King, Larry
Kleiss, Joe
Knight, David
Lamm, William S.
Lea, Russ
Leab, Roger J.
Lee, William Daniel
Lewis, Vincent E.
Lilly, Paul J.
Lynn, Everette
Lyon III, Joseph T.
Mallard III, L.L.
Manley, C.B.
Manning, Dan M.
Martin, Cliff
Mathis Jr., Roy L.
McCachren, Clifford M.
McCants, C.B.
McCoy, Dennis E.
Mellette, Francis

Miller, Robert H.
Mills Jr., Albert S.
Miner, Gordon S.
Monds, L. Darlene
Nelson, Lydia C.
Newman, James B.
Newton, Darwin L.
Nicholaides III, John J.
Ortosky, Mike
Osborne, Dennis
Peedin, Gerald F.
Peele, David M.
Philen, Don
Ragland, Barney Wayne
Ranson Jr., Robert H.
Ransone III, W.A.
Reich, Richard C.
Rider, R. Bruce
Robarge, Wayne P.
Rouse, Michael
Salvo, Stephen K.
Sanchez, P.A.
Schoeneberger, Philip J.
Shaffer, Karl
Sherrill, Michael L.
Simpson, Glen
Sink, Larry T.
Skaggs, Wayne
Smith, Chip
Smith Fred D.
Smith, John W.
Sneed, Ronald E.
Sopher, Charles
Spangler, Daniel G.
Steinbeck, Steve J.
Stimpson, Jerry V.
Stokes, Steven F.
Strickland, Terry L.
Sugg, Norfleet L.
Tant, Phil
Templeton, Deborah
Tucker, M. Ray
Turner, G. Craig
Tuttle, John W.
Uebler, Dr. Bob
Vepraskas, Mike
Volk, Dr. R.J.
Vrana, Jon D.
Walton, S. Dennis
Watts, J.B.
Woodhouse Jr., W.W.
Woody, William E.
Wyatt, Perry W.
Young, Edwin J.

NORTH CAROLINA SOIL SCIENCE SOCIETY ANNUAL MEETING

Tuesday Afternoon
January 17, 1984

12:30 Registration
Soil Texture Contest
1:40 Call to Order and Announcements
PRESIDING - Paul Blizzard
1:50 Role of Winter Cover Crops To Conservation Tillage
-- John Anderson
2:10 Cover Crops for Strip-Till Vegetable and Tobacco Production
-- Greg Hoyt
2:30 Water Table Management in The Coastal Plain
-- Wayne Skaggs
2:50 Future Trends Fertilizer and Chemical Production
-- Hank Bauer
3:15 Discussion
3:30 Completion of Soil Texture Judging Contest
4:00 Business Session and Election of Officers
- Paul Blizzard
- Jack Baird
5:30 Social Hour
- McKimmon Center
6:30 Banquet
PRESIDING - Paul Blizzard
ENTERTAINMENT - A return engagement by poplar demand the "Wake County Ramblers". Featuring Luke Warmwater and a trio of our own Soil Scientists

Wednesday Morning
January 18, 1984

PRESIDING - Darwin Newton
8:25 Land Treatment Watersheds
-- John Garrett
8:45 Land Treatment in the Jordan Lake and Falls of the Neuse Watersheds
-- Bill Farmer
9:05 Research on Eroded Piedmont Soils
-- Ray Daniels
9:25 Future Trends of Agriculture in North Carolina
-- William Toussaint
9:45 Discussion
10:00 Break
10:30 Update Session
N.C. Department of Agriculture
-- James A. Graham
Soil Science Department
-- Robert H. Miller
Soil Conservation Service
-- Coy A. Garrett
Division of Soil & Water, DNRCD
-- Maurice Cook
Industry
-- Leroy Jackson
12:00 Lunch

NORTH CAROLINA SOIL SCIENCE SOCIETY ANNUAL MEETING (cont.)

Wednesday Afternoon
January 18, 1984

PRESIDING - Jack Baird

1:00 Trends in Conservation Tillage Equipment
-- Leo Hardin

1:20 Classification of Soils Western North Carolina
-- Mike Sherrill

1:40 Update - Farmland Protection Policy
-- Mitchell Clary

2:00 Digitizing Soils
-- Burton Floyd

2:20 Wetlands Mapping Program
-- Julie Moore

2:40 High Yield Trials
-- Jim Dunphy

3:00 Soils of Carolina Bays
-- Dan Bliley

3:20 Genesis of Soils Formed From Mica Gneiss and Schist
-- Russ Rebertus

3:40 Discussion and Adjournment