Soil Conservation Service

Agriculture in the South: Conservation's challenge

By Robert G. Healy and Robert E. Sojka

As conservationists recall the beginnings 50 years ago of federal involvement in soil and water conservation, the dominant image for most undoubtedly is topsoil blowing off the Great Plains. Could it be otherwise, given the emotional power of film and newspaper accounts of the Dust Bowl and the stories of clouds of topsoil blown from the nation's midsection to the steps of the Capitol in Washington? Important though the Dust Bowl was, however, no region to that time had sustained such extensive, chronic, and severe erosion as the 11 states comprising the nation's southeastern quadrant: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Virginia.

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The South, particularly the rolling southern Piedmont stretching from Virginia to Alabama and the hill country of Mississippi, Kentucky, and Tennessee, suffered from an unfortunate conjunction of factors that made the region susceptible to rapid depletion of the soil. Many soils in the South were highly erodible by water. In a hard rain they "melted like sugar," the common description went.

The most profitable form of agricultural production was continuous cultivation of erosion-prone row crops, particularly corn and cotton (*4, 9, 21*). High rural population densities and low returns to labor encouraged the cropping of even the most marginal land. The prevailing land tenure system and burden of mortgage debt encouraged neither owner nor cultivator to be much concerned with conserving soil and water for the future.

By the 1930s the cumulative results of soil erosion had become dramatically apparent throughout the South. "Much land in the Piedmont section of the Southeast that once produced good crops of cotton," said the 1938 *Yearbook of Agriculture*, "is now so badly eroded as to be practically worthless for crop production." In many areas the topsoil had literally been washed away. Elsewhere, severe gullying made large areas impossible to cultivate.

In his classic book *Soil Conservation*, Hugh Hammond Bennett wrote that a survey of the old plantation belt in the southern Piedmont found that erosion had caused some degree of damage on 95 percent of the uplands and the process was "actively underway" on nearly all cleared uplands. Some 44 percent of the area studied—2.7 million acres—had reached the stage of gullying.

Anyone familiar with land use today in the South can appreciate how the present scene contrasts with the photographs of severely eroded and gullied fields featured so prominently in Bennett's book and other contemporary literature. Progress in soil and water conservation throughout the South since the 1930s is due as much to changes in southern agriculture as to at-

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tempts to control erosion, though such attempts have been considerable. Southern agriculture has changed dramatically over the last 50 years (*6, 8, 21*). So have conservation problems. Today, southern agriculture continues to change. This poses new challenges for soil and water conservation.

The problem of erosion-prone soils

Southern soils are as erosion-prone as ever, and southern rivers remain notoriously susceptible to siltation. The soils, mainly Ultisols (*3, 5*), are not very fertile because their clay mineral fraction is dominated by nonexpanding, amorphous clay silicates that do not retain nutrients. Ultisols are also relatively low in organic matter. The nonexpanding clay mineral fraction, coupled with moderately coarse to medium-textured topsoils, results in weak particle aggregation. This combination of soil properties, after years of cultivation, offers little resistence to dislodgement. Most southern Ultisols are thus extremely susceptible to water erosion (*28, 29*).

Erosion's impact on southern Ultisols is exacerbated because, as topsoil is lost, rooting depth declines and the rooting environment becomes more hostile. Subsoils tend to be dense, clay-enriched, acidic, and high in exchangeable aluminum. These properties are detrimental to plant growth. Moreover, the density of these horizons limits plant-available moisture and offers a poor medium for gaseous diffusion.

Rainfall averages 45 inches or more annually throughout the region (*26*). But rainfall is not distributed uniformly through the year. Short, intense storms occur frequently in spring and summer. These storms come when cultivated land is exposed to raindrop impact, unimpeded by a crop canopy. In all but the Delta and Coastal Plain, slopes are significant enough to accentuate the erosion process.

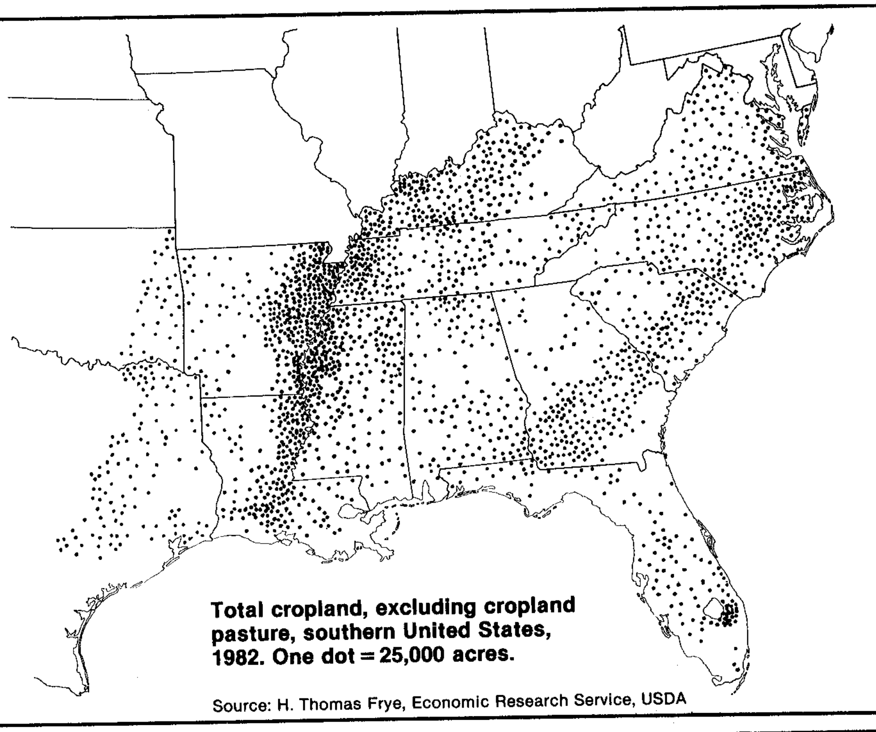
Data from the 1982 National Resources Inventory (NRI) quantify how erosion varies from one physiographic subregion of the South to another (*25*). Differences are dramatic. For example, 41 percent of cropland in the southern Piedmont is eroding at a rate greater than twice the soil loss tolerance (T-value). In the Mississippi Valley Silty Uplands, soil loss on 37 percent of the cropland exceeds 2T. But, in the Mississippi Valley Alluvium and the Atlantic Coastal Flatwoods only 3 percent of the cropland has a soil loss of 2T or more.

A changing crop mix

Perhaps the most striking change in southern agriculture over the past 50 years has been the decline in acreage of some of the region's most important traditional crops. Most dramatic has been the change in cotton acreage, which fell sharply from a peak of more than 23 million acres in the 1920s to only 2.9 million acres in 1982.

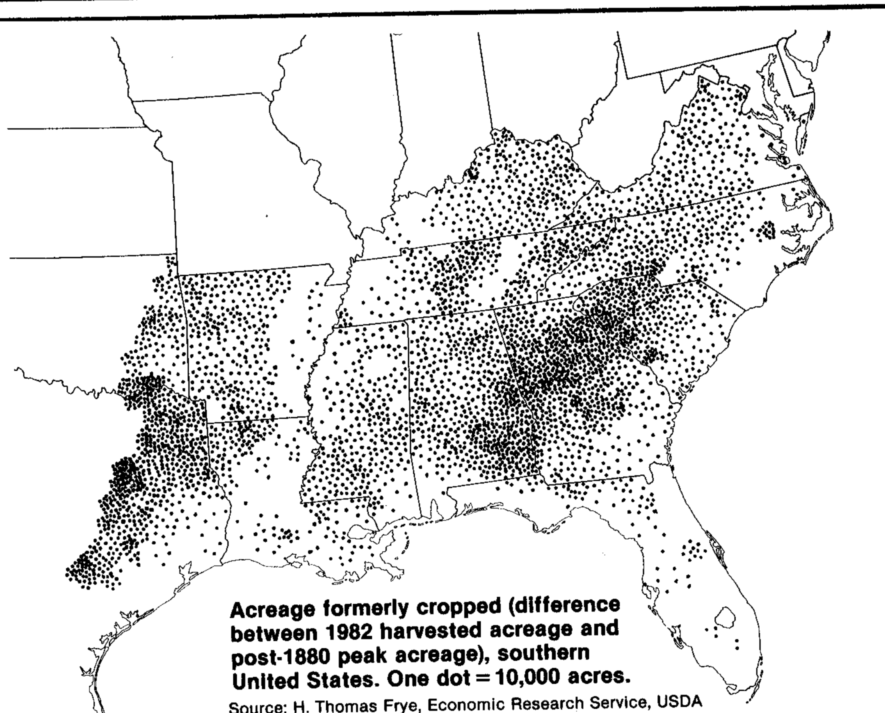
There are many reasons for cotton's decline in the South: loss of cotton fiber markets to synthetics; boll weevil depredations, which spread over the South by the 1920s; drastic acreage reductions required as a condition of federal price support; and severe depletion of continuously cropped soils by erosion. Perhaps the most important reason, however, has been the increase in cotton cultivation in areas of higher productivity or lower production cost outside the South, primarily on irrigated land in California and Arizona and on both irrigated and dryland farms in West Texas. In 1982 these areas produced over two-thirds of the nation's cotton.

Corn acreage also has declined in the South, from 24 million acres in 1929 to 19 million in 1949 and only 7.4 million acres at its low point in 1973. Since then, acre-



Total cropland, excluding cropland pasture, southern United States, 1982. One dot = 25,000 acres.

Source: H. Thomas Frye, Economic Research Service, USDA



Acreage formerly cropped (difference between 1982 harvested acreage and post-1880 peak acreage), southern United States. One dot = 10,000 acres.

Source: H. Thomas Frye, Economic Research Service, USDA age has risen slightly, to almost 9 million in 1980 and 1981, though it dropped again to only 7.4 million in 1982.

Changing human dietary patterns and a drastic fall in the number of draft animals kept on farms played a major role in reducing the demand for corn. But also important has been the severe competition that southern farmers have faced from corn shipped in from the large, efficient farms of the Midwest.

Paralleling the decline in cotton and corn has been a dramatic increase in the amount of southern land devoted to soybeans. Over the last 50 years the soybean has changed from a minor crop used more for forage than as an oilseed to an agricultural staple. Today, soybeans are the leading crop, acreagewise, in almost every southern state. In 1929 the South had only 1.3 million acres in soybeans; by 1964 there were 8.8 million acres; and by 1982 there were more than 25 million acres.

Wheat cultivation has also expanded rapidly in the South. Traditionally, wheat was grown on a relatively small scale in various parts of the upland South. Today, wheat is grown in virtually every part of the South, but nearly always as a part of a multiple-cropping system, most frequently before soybeans. Some 9.6 million acres of wheat were planted in the South in 1982. This amounted to 11 percent of the nation's wheat plantings.

Acreage in principal crops, southern states (millions of acres)

	1929	*1949*	*1969*	*1982*
Cotton	23.4	13.0	4.7	2.9
Soybeans	1.3	2.6	13.9	25.6
Corn	23.9	20.4	7.9	7.4
Wheat	1.7	2.2	1.9	9.6
Hay	6.4	10.9	7.3	7.9
Rice	.6	1.0	1.2	2.2
Peanuts	2.2	2.3	1.1	1.0
Tobacco	1.7	1.4	.8	.8

Source: U.S. Department of Agriculture, *Agricultural Statistics* (various issues); U.S. Census Bureau, *Census of Agriculture, 1930*. Figures do not add to total cultivated area because of multiple cropping and minor crops.

Current and potential cropland (thousands of acres)

	Current Cropland	*High and Medium Potential Cropland*	*Potential/ Current*
Alabama	4,510	5,135	1.138
Arkansas	8,102	3,446	.425
Florida	3,557	4,491	1.263
Georgia	6,568	4,848	.738
Kentucky	5,934	3,306	.557
Louisiana	6,409	3,402	.531
Mississippi	7,415	3,510	.473
North Carolina	6,695	6,548	.978
South Carolina	3,579	1,742	.487
Tennessee	5,592	3,964	.709
Virginia	3,397	3,377	.994
South	61,758	43,769	.709
United States	421,402	152,974	.363
Corn Belt	92,394	17,878	.193
Lake States	43,924	10,716	.244

Source: *National Resources Inventory, 1982.*

A changing land base

The explosive growth of soybean cultivation in the South and some expansion of other crops has not been sufficient over the past 50 years to offset the abandonment of cropland by corn and cotton. Between 1935 and 1969 cropland area (excluding cropland pasture) in the South dropped from 73.8 million acres to 51.0 million acres. Much of the land going out of crops reverted to forest or was used as pasture for the South's growing number of beef cattle. After the agricultural crop export boom of the early 1970s, however, the continued growth in soybean acreage and the modest revival in corn acreage caused additional land to be brought into production. Between 1969 and 1982, cultivated cropland in the South rose by 11.5 million acres, partly by planting idle cropland, partly by plowing up pasture, and partly by bringing entirely new land into cultivation.

Changing crop mix and, particularly, the changing total acreage in crops have had a direct effect on soil erosion in the region (*10, 21*). Extensive research has shown that maintenance of crop residue or vegetation on the soil surface is the most effective means of controlling soil loss (*28, 29*). Changes in erosion occurring with the South's changing crop mix or cropping practices have generally been due to this principle.

Much of the land "worn out" by the intensive, conventional cultivation of cotton and corn was abandoned when the land no longer supported profitable farming. The natural canopy of weeds, brush, and forest that became established on these abandoned fields effectively arrested erosion. Large areas of former cropland were converted to pasture with similar results.

Change in land cover has some obvious impacts on expected erosion rates. In Tennessee, for example, erosion from cultivated land (1982) averages 11.5 tons per acre per year, more than twice the T-value and the highest statewide average in the South. In some cropped areas of that state erosion rates of 100 tons per acre per year are not uncommon. But Tennessee pasture land averages only 1.3 tons per acre of soil loss annually, grazed forest land 2.2 tons, and ungrazed forest land 0.4 ton (*25*).

In recent years, although cultivated acreage is again on the rise, much of the South's most erosion-prone land remains in pasture and forest. Moreover, soybeans have replaced much of the acreage once occupied by cotton, thereby lowering annual C-factors (expected erosion due to cropping system). C-factors have also been lowered to acceptable levels by improved management and technology (better varieties, new herbicides, narrow-row culture, reduced tillage, higher fertilization) that provide for earlier and more complete protection of the soil surface by growing vegetation and surface residue. Multiple cropping also contributes positively to erosion control; vegetation and crop residue protect the soil through much of the year in multiple-cropping systems.

Also significant for erosion rates has been a change in the location of cultivated cropland within the South. The great outmigration of agricultural labor from the South during the period from 1935 to 1960 removed much of the pressure to cultivate small parcels of marginal land. Mechanization of row-crop agriculture favored large fields in relatively flat terrain. And the drop in total land requirement, as well as federal acreage set aside programs, caused farmers to concentrate their efforts on the better land. The net result of these forces has been to move agriculture onto the South's more productive land, which also tends to be the region's least erodible land. The exceptions are cropland in the loessal hills of West Tennessee, Mississippi, and Kentucky.

The movement toward better land has occurred on individual farms, for example, when farmers let their hillsides grow in timber or pasture, while continuing to cultivate their bottomlands or less rolling, interfluvial lands. It has also occurred on a regional scale, with a general shift of crop agriculture away from the Piedmont and uplands and toward the Delta and Coastal Plain. The latter shift has not been without conservation problems other than soil erosion, however. Much of the land newly brought into production, though less erodible, was obtained by draining wetlands, sometimes on a large scale (*11*, *17*).

Erosion control efforts

Part of the reduction in soil erosion in the South has, of course, been due to state and federal erosion control efforts (*10*, *20*, *21*). Some of the region's worst soil-depleting cropping practices were associated with the technological backwardness (and lack of resources) of many small farming enterprises. Technical assistance in conservation as well as general farm extension work have helped to close the technological gap between southern agriculture and that in the rest of the country, as well as the gap between agricultural research and on-farm practices. So have improved communications and the rising educational level of southern farmers.

One program that proved particularly important for erosion control in the South was the Soil Bank, which during the late 1950s and early 1960s paid farmers an annual fee for converting marginal cropland to pasture and forest. Not only did this reduce erosion, but it contributed significantly to the availability of pine timber, the basis of the region's important lumber and paper industries.

The future

Many factors will determine what happens next in the development of southern agriculture. Not the least of these are the region's agricultural development potential and position in the market relative to the rest of the United States and the relative benefit the region can expect from advancing technology. In general, these considerations hold forth favorable, long-term prospects for southern agriculture.

Many foreseeable developments in southern agriculture stem from some inherent advantages enjoyed by the region—abundant potential cropland and available water, a long growing season, favorable location for exporting, and expanding local markets.

Recently compiled statistics indicate that the South has a large capacity for expanding its cultivated land base (*25*). While the South has only 14.7 percent of the nation's current cropland, it contains 28.6 percent of the land with "high or medium potential" for conversion to cropland. Potential cropland is defined by the U.S. Department of Agriculture's Soil Conservation Service (SCS) as land not now being cropped that has the capability of being converted to cropland and managed as cropland on a sustained basis. Other major agricultural areas have much less room for expansion than does the South (*25*). In the Corn Belt and the Lake States, for example, for each acre now in cropland there are, respectively, .193 and .244 acres of potential cropland. In the South each acre of cropland is joined by .709 acres of potential cropland. In Florida, Alabama, North Carolina, and Virginia current cropland could roughly be doubled.

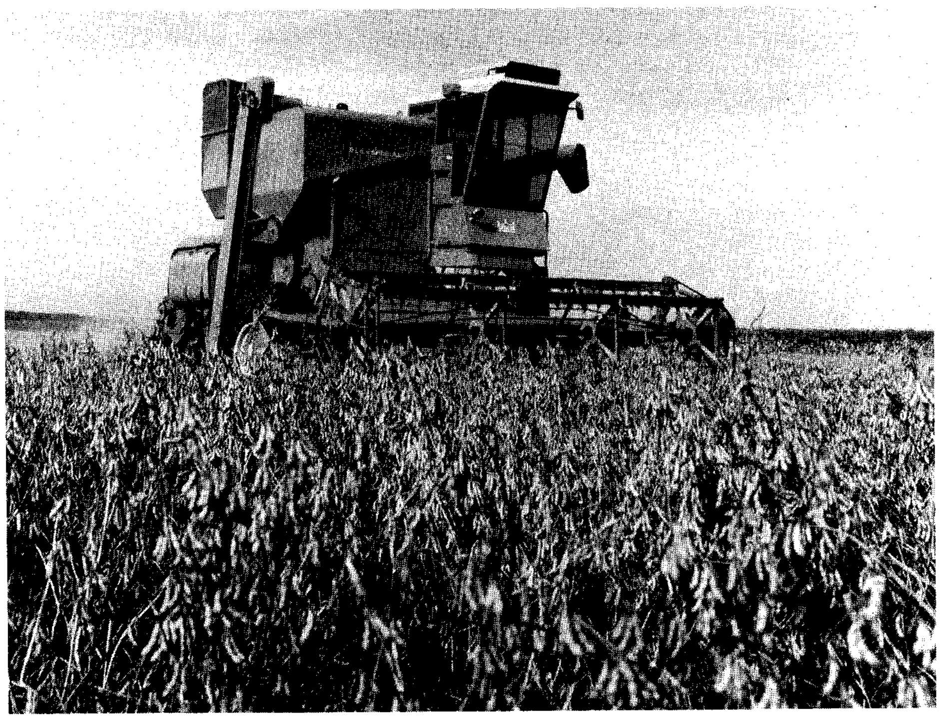
A number of areas in the South currently produce more than one crop a year, and with improved technology multiple cropping is possible on a much larger scale. As a result, the "effective" cropping potential in the South may be even higher than acreage figures suggest. In 1982 some 20.4 percent of cultivated cropland in the South was double-cropped, compared to an average of only 2.2 percent elsewhere in the United States (*25*).

Expansion of cropland acreage in the South could threaten a resurgence of erosion, though probably not as severe as that experienced in the region's early history. Some 53 percent of the potential cropland in the South is considered subject to an erosion hazard (*25*). If this land were cultivated and subject to the same level of erosion control as practiced on current cultivated cropland in the same SCS land capability class, erosion on that land would average more than 13 tons per acre per year. This is more than double the level generally considered tolerable without long-term damage to soil productivity.

It is conceivable, though, that a major production expansion in the South could proceed with a reduction in soil loss. Two factors would be important in this case: concentration of future expansion in the Coastal Plain, where erosion rates are generally low compared to those on Piedmont's sloping land, and greater use of multiple cropping to boost output per acre on the less erodible land.

Multiple cropping has a dual advantage from the standpoint of erosion control. First, a crop canopy is in place over the field for a greater portion of the year. Even after the multiple-cropping sequence ends, the residue of more than one crop is in

Soybean production nearly tripled in the South over the past two decades, at the expense of wetlands and forests in many parts of the region.



Forest Service

Pine production, which may prove as profitable as the use of land for crops or pasture, could also help reduce severe soil erosion.

place on the soil surface or incorporated into the soil. Second, multiple-cropping systems frequently involve conservation tillage methods for one or both crops. Conservation tillage saves soil moisture and energy, but its principal advantage is that it makes possible the planting of the second crop more quickly after the first is harvested. After June 15, the time saved can be worth as much as a half a bushel per day in additional output of a second soybean crop (*15*). The reduction in soil loss due to conservation tillage may be incidental in the farmer's decision-making, but it can be important for soil conservation.

The South may also have some future production advantages because of its physical and seasonal position in the marketplace. The region's many ports are favorably situated for commodity movement to export markets, and many of its crop production areas are only a short overland haul to a port. This factor could become even more important if rises in fuel prices cause transport costs to rise, increasing shipping costs for regions less favorably situated. Moreover, as U.S. population continues to shift to the Sunbelt, there will be a growing demand for locally produced commodities for local consumption and processing, again to save on transportation cost. Demand for grain in the South seems likely to rise with continued expansion of feeding enterprises, such as poultry production and aquaculture. Finally, the South's ability to adjust planting and harvest dates more flexibly than other regions can allow its producers the advantage of timing their deliveries to coincide with seasonably favorable pricing.

Irrigation is being used more to grow row crops in the South, mainly in the Delta and lower Coastal Plain, in an effort to offset late summer drought that often occurs even in areas with high average rainfall. In many instances irrigation will be the key to ensuring the success of multiple cropping, and concomitantly, multiple cropping will be needed to provide the cash flow to support the high capital cost of an irrigation system. By ensuring timely crop development and high biomass production and by encouraging production on the region's flatter, less erodible lands (which tend to be the most cost-effective to irrigate), well-managed irrigation has the potential to reduce soil erosion further.

One final factor supports a relatively optimistic view of future erosion control in the South. The region seems well suited to the "targeting" approach that is getting attention in public policy. Although the South has some of the nation's most notable examples of uncontrolled erosion, these areas occupy but a fraction of the region's total cropland base. According to the 1982 NRI, 18 percent of the cropland in the South contributes 59 percent of the total annual soil loss from cropland. Annual soil loss from this highly erodible land averages more than 20 tons per acre.

An effective targeting program that would either introduce effective erosion control measures or remove some of this land from production could have a tremendous impact on the overall erosion problem in the South. And because of the region's reservoir of uncultivated but nonerosive land, particularly in the Coastal Plain, this could be done even in the context of an overall expansion of crop production.

One way of dealing with the South's pockets of severe erosion might be to link soil conservation with another looming problem in the region—an increasing scarcity of pine timber. A recent study by the U.S. Department of Agriculture identified 17 million acres of cropland in nine southern states (6 million currently used for crops) that were marginal for crop production and, in many cases, highly erodible. The study found that this land could yield a higher economic return if put into pine plantations than if it continued in crop or pasture use (*24*).

Developing Issues

The general direction of agricultural development in the South seems relatively favorable to further progress in erosion control, but that direction presents some important difficulties from the standpoint of other conservation objectives. One potential problem is water, both in terms of quantity and quality. Irrigation now accounts for 58 percent of total consumptive use of water in the South, and that use is increasing rapidly.

Regionwide, water is abundant in the South. In 1980, total consumptive use as a percentage of renewable water supply was estimated at 1 percent for the Tennessee Valley, 2.4 percent for the South Atlantic-Gulf water resource region (which includes most of the Piedmont and Coastal Plain) and 9 percent for the Mississippi River region (entire basin) (*27*). Yet one of the South's leading experts on water law told a recent conference on southern water policy that "across the South we have localized water shortages that in some instances approach crisis proportions" (*12*).

In several of the region's principal irrigated areas, increased rates of groundwater pumping have lowered subsurface water levels anywhere from 50 to several hundred feet. In the Grand Prairie area of eastern Arkansas, for example, irrigation pumping since the 1930s has caused water level declines of more than 60 feet in the Mississippi River Alluvial Aquifer (*27*). Drops in water tables or at least "cones of depression" (of reduced water pressure) around individual wells have been reported in irrigated areas of southeastern Alabama, in northern and southern Florida, in Mississippi, and in southwestern Georgia.

Water quality may be an even more serious problem. Insecticide use in the South has always been heavy, partly due to cotton, vegetable, and fruit production (which tend to be particularly prone to pest damage) and partly due to the pest buildups encouraged by the region's mild winter climate. Off-site transport of agricultural chemicals adsorbed on soil particles has long been a problem in the South, as elsewhere in the country. Effective erosion control, however, could significantly reduce this problem.

Recently, the attention of policymakers has turned to a problem that has long been ignored—groundwater pollution, including aquifers used as sources of drinking water. The problem received national attention in 1983 and 1984 when the nematicide EDB, a suspected carcinogen, was found in about 400 of 3,500 wells sampled in central Florida. About 300 of the wells were contaminated to the point that their 50,000 users were advised not to drink or cook with the water (*7*). Another nematicide, aldicarb, was suspended for use on Florida citrus in 1983 after it too was found in drinking water.

Pesticides have been found in wells in other agricultural areas in the South, and given the limited survey work that has been done, it is reasonable to suspect that many instances of such groundwater pollution have not yet come to light. It remains to be seen whether increased pesticide applications needed to manage conservation tillage systems will result in the infiltration of chemicals into groundwater (*1*).

Yet another conservation problem in the South is the continuing destruction of the region's freshwater wetlands by drainage for conversion to agricultural use. The process is well advanced in the lower Mississippi Valley, where floodplain and bottomland forests that once extended over as much as 25 million acres have been reduced to 5.8 million acres (*13*). Much of this drained land is now in soybeans.

Drainage of upland or "pocosin" wetlands has occurred on a large scale in eastern North Carolina, sometimes thousands of acres at a time (*18*), and small areas of bottomland and other wetlands are regularly being cleared by individual farmers throughout the Coastal Plain. Although cleared wetlands can be productive agriculturally, they represent a major loss of wildlife habitat. For some coastal wetlands, clearing can also interfere with the estuarine systems vital for the maintenance of commercial and sport fisheries (*16*).

A final though local problem is the destruction of highly organic "muck" soils in South Florida. Although these areas are extremely fertile, their conversion to cropland leads to rapid oxidation of the organic matter and consequent subsidence of the land. Of the 700,000 acres of organic soils in Florida's Everglades Agricultural Area, 99 percent initially had a depth exceeding 36 inches (*14*). Largely because of oxidation, however, only 13 percent of those acres will retain a depth of more than 36 inches by the year 2000, while 45 percent will have a depth of 12 inches or less. Says one University of Florida expert, "We have a vegetable industry worth hundreds of millions of dollars a year that is based on an exhaustible resource of muck soils."

Conservation challenge

Agriculture in the southern United States has experienced dramatic and often unappreciated changes in the 50 years since the Great Depression. The region's natural production advantages, combined with new cropping systems, afford exciting opportunities for continued agricultural expansion.

Soil erosion, of course, has been a significant and chronic problem for the region, although the direction of agricultural change seems to offer some promise of continued progress in erosion control. The existence of a large area of highly erodible land that could be brought into production provides reason for caution, however. Aside from the soil erosion problems, perhaps the greatest challenge for conservationists is to see that the South's agriculture continues to develop without damaging the region's water and wetland resources.

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