appear to be as affected by surface- or near-surface nitrate sources as wells of shallower depth.

- Identifying and quantifying bottom-dwelling organisms in streams is useful for evaluating the health of the stream, but the results can vary greatly depending on the sampling techniques used. Potential biases resulting from the sampling technique can be reduced by using multiple sampling techniques.

- Soil sampling transects oriented perpendicular to rows of crops provide adequate spatial representation to conduct statistical analyses and compute reliable field averages for the concentration of agricultural chemicals in soils.

- The horizontal transport of aldicarb sulfoxide, a metabolite of aldicarb, within the soil profile was negligible for both the conventionally tilled and the no-tilled fields. Transport downward was minimal. About 85 percent of this metabolite was within the interval from 0 to 0.5 foot below the soil surface; none was detected below 2.5 feet. The shallow depth of transport is attributed to the low permeability of the silty-clayey soils and to the low rainfall and high rates of soil-water evaporation and plant-water transpiration during the summer months.

- Simple, natural, non-biological reactions appear to be important mechanisms for the degradation of aldicarb metabolites in the soil profile of both tillage systems. The calculated half-lives of aldicarb metabolites in the field were an order of magnitude shorter than those computed from laboratory experiments in which some of these reactions were absent.

- Two general patterns in the concentration distribution of aldicarb and its metabolites during and after storms were observed in the data collected at one of the monitoring stations. Each pattern can be expressed by a mathematical relationship, with the change from one relationship to the other taking place after the peak concentration occurs. This observation is significant for selecting a computer model that will simulate pesticide transport in the drainage system.

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Organizations involved in assessment studies in the Beaver Creek area:

U.S. Department of Agriculture, Natural Resources Conservation Service (formerly known as Soil Conservation Service)
U.S. Department of the Interior, U.S. Geological Survey
Tennessee Department of Agriculture
Tennessee Department of Environment and Conservation
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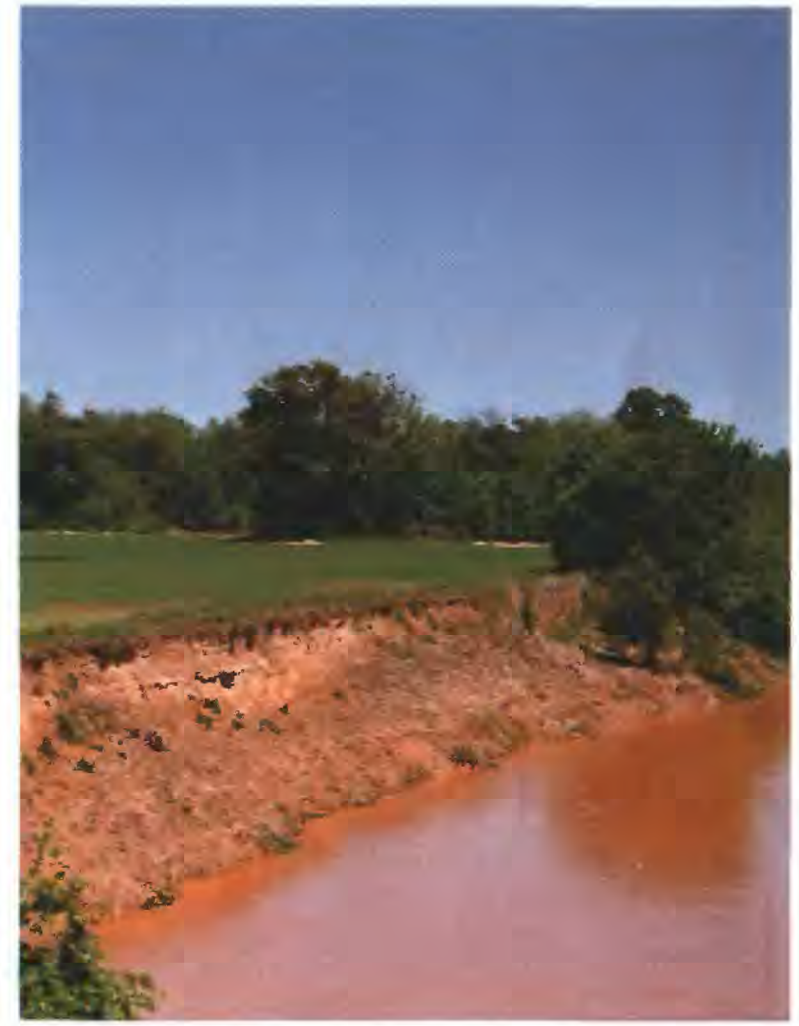
Open-File Report 95-312

An Overview of the Beaver Creek Study in West Tennessee



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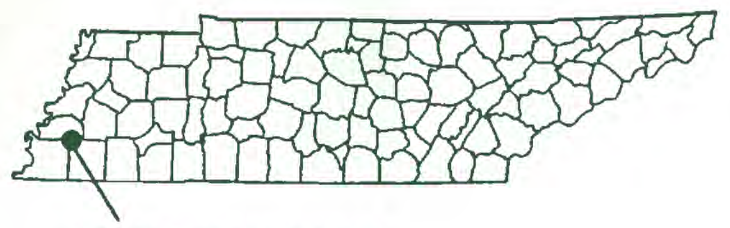
INTRODUCTION

Agricultural activities are recognized as a major contributor to nonpoint-source water pollution—that is, pollution that can not be traced to a single point of origin. In Tennessee, agriculture has been cited as one of the five leading causes of water impairment (U.S. Environmental Protection Agency, 1994). Attempts have been made to reduce the extent of impairment in some areas by implementing conservation-related measures termed "best management practices" (BMP's).

In 1989, the U.S. Geological Survey began a long-term project to evaluate the effect of agricultural activities on water quality and the effectiveness of agricultural BMP's in the Beaver Creek watershed of West Tennessee. This watershed of about 95,000 acres



includes some of the Nation's most productive farmland and most highly erodible soils. The project is being conducted jointly with other Federal, State, and county agencies, the farming community, and academic institutions, in support of the U.S. Department of Agriculture Hydrologic Unit Area program. This fact sheet summarizes the goals of the project, what has been and is being done, and some of the more important findings to date.

OBJECTIVES

The goal of this project is to provide scientific information needed by resource-management agencies to implement effective conservation practices. Specific objectives include the:

(1) development and evaluation of chemical and biological sampling procedures;

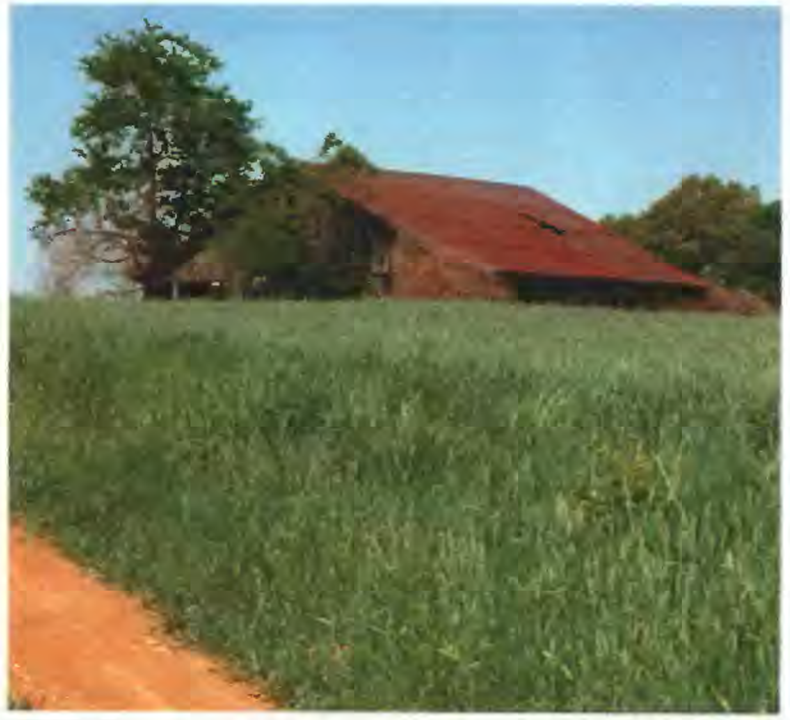
(2) evaluation of the extent to which agricultural activities affect water quality and threaten environmental soundness;

(3) identification and quantification of processes and factors that control the transport and degradation of such agricultural pollutants as sediment, fertilizers, and pesticides; and

(4) evaluation of BMP's implemented both in the field and along drainages.

APPROACH

Towards accomplishing this goal, nine surface-water monitoring sites have been established in the watershed. The climatic, hydrologic, chemical, biological and/or channel-evolution data collected at these sites are being used to determine the effects of BMP's upon surface-water quality. Samples have been collected during both stormflow and base flow and analyzed for various forms of nitrogen and phosphorous, suspended sediment, and selected pesticides and their *metabolites* (by-products that result by chemical breakdown). Statistical analyses of the data have been made to determine the frequency of sampling that accurately represents periods of (1) stormflow and (2) base flow. Biological samples have been collected to evaluate various sampling methods and to determine standards that reflect water-quality conditions and environmental soundness.



A ground-water-quality reconnaissance was conducted during 1992 to statistically relate water quality to land use. A network of about 100 shallow wells was established in 1993 to further evaluate ground-water quality. The wells were sampled five times during 1994 to determine major properties, nutrients (nitrite, nitrate, and phosphate from manure, applied fertilizers, and agricultural products), and fecal bacteria in ground water.

A 0.8-acre wetland was constructed to evaluate its potential as a BMP. The wetland will be monitored to determine its effectiveness in assimilating or modifying the sediment, nutrient, and pesticide content in cropland runoff, and to identify and quantify the processes responsible for immobilizing and metabolizing selected constituents within the wetland. If the wetland is successful, information obtained from this study will be useful for developing design criteria for other constructed wetlands to treat cropland runoff.

No-tillage of fields also is being evaluated as a potential BMP. No-tillage has been shown to be effective in reducing soil erosion. However, because no-tilled fields have greater permeability than tilled fields, concern exists that this practice may enhance chemical transport through the unsaturated zone and increase the potential for ground-water pollution. The rate and distance of pesticide transport through the soil profile have been studied to evaluate this possibility.

In addition, a series of experiments have been conducted to (1) develop a soil-sampling strategy that accurately characterizes the distribution of agricultural chemicals in the soil profile with time, (2) evaluate the degradation of agricultural chemicals in the soil profile, and (3) compare the behavior of agricultural chemicals in conventionally tilled and no-tilled cotton fields.

SIGNIFICANT FINDINGS

- Sediment transport resulting from soil erosion is the major water-quality problem in the watershed. In addition to being a pollutant, sediment interferes with other environmental processes that assimilate nutrients and pesticides.
- An optimal sampling strategy for characterizing chemicals and suspended sediment in agricultural runoff with time includes frequent sampling of streams during stormflow and less frequent sampling after passage of the storm and during periods of dry weather. One strategy evaluated was a sampling interval equal to 5 percent of the stormflow duration. Later, the frequency of sampling was reduced because changes in water quality occur less rapidly.
- Some preliminary findings about nitrogen in runoff are: (a) about 80 percent of the total nitrogen exported in runoff from crop fields is attributable to crop residue at various stages of decomposition; (b) the chemical form of nitrogen and the distribution of nitrogen with time are not directly related to fertilizer application; (c) about 75 percent of the suspended organic nitrogen exported annually occurs during late winter and early spring storms;
(d) 80 percent of the inorganic nitrogen (nitrite plus nitrate) exported annually occurs during late spring storms; and (e) less than 10 percent of the inorganic nitrogen exported annually occurs during storms in the growing season.
- Significantly higher nitrate concentrations were measured in water from wells near septic tanks and confined animal facilities than wells near fertilized fields. Wells deeper than about 150 feet do not