

*Study Dispels Negative Claims about Agriculture's Impact on the Environment.*

BY KORINA A. WILBERT

# Beaver Creek's



"This big booming business, agriculture, is also killing the world. I mean that literally."

That statement made by Jay Hair, president of the National Wildlife Federation, appeared in the June 1990 issue of *Progressive Farmer* magazine. Shortly after the issue hit the newsstands, a lone farmer, infuriated by that quote, set out on a mission to find the truth. His mission sparked what became an unprecedented \$7.5 million, five-year government study on the effects of agriculture on water quality in the Beaver Creek Watershed. The study, begun in 1991, wrapped up early last year. The results? Hair was apparently up Beaver Creek without a paddle.

Which puts him in a serious bind, considering the size of Beaver Creek.

Beaver Creek and its tributaries drain 95,450 acres, or 149 square miles, spanning four West Tennessee counties: Fayette, Haywood, Shelby, and Tipton. Some of the most productive, intensively farmed, and highly erodible soils in the nation lie in the watershed. Over two-thirds of the

area supports row crops. Cotton-an internationally big pesticide user-is the predominate crop; soybeans, small grains, and corn are also planted.

Excessive soil erosion occurs on one-third of the cropland in the watershed. The deep, silty soils in the area, developed from thick layers of loess deposited millions of years ago, now dissolve like sugar when it rains, washing into Beaver Creek and its tributaries, dumping into the Loosahatchie River, and eventually into the Mississippi.

Aside from diminishing valuable topsoil, erosion threatens water quality, stream stability, and the recreational value of Beaver Creek. Eroding soil particles can carry pesticides and fertilizers downstream, where they can then percolate into the groundwater and contaminate the water supply. Silt deposits can reduce the stream channel size, increasing the frequency and severity of floods, and can alter the delicate environmental balance that aquatic insects, invertebrates, and fish need to survive.

What this means is if a farming area had a potential for agricultural

chemical pollution problems, the Beaver Creek Watershed would be it. And if a study were going to dispel or enforce negative claims about the impacts of agriculture on the environment, the Beaver Creek Watershed study would do it. So, for five years the agricultural community collectively held its breath, waiting to learn if the inflammatory statement of one very loud voice was to become a documented fact or the wildest fish story ever heard this side of Beaver Creek.

## Waiting to Exhale

Enter John Charles Wilson, a cotton, soybean, corn, wheat, and 30head beef herd producer in Arlington, Tennessee. Wilson was incensed by Hair's undocumented accusation and wasn't about to let it go unchallenged. So he got involved and wound up spearheading what became the most intensive, long-term, comprehensive study of the impacts of agricultural chemicals on a U.S. watershed to date.

"It really made me angry," said Wilson of Hair's comments. "He didn't have any facts to back up what

*No-till and other Best Management Practices contribute significantly to soil conservation and water quality.*



*John Charles Wilson (right), Progressive Farmer magazine's Man of the Year in Service to Tennessee Agriculture and a 1972 UT ag alumnus, spearheaded the Beaver Creek Watershed project. Here he speaks to a group touring the watershed area.*

# REDEMPTION



he was saying. But then, I realized neither did I. So I got fired up to find out the real facts about chemical runoff, pollution of our water table, erosion all those things farmers are accused of contributing to."

Wilson went to officials at the United States Geological Survey (USGS), a federal agency with no regulatory power, and asked them for a way to get at the facts. It was only a matter of time before this one man's mission snowballed into a multifaceted project that united local, state, and federal individuals and agencies for a common goal.

"He was like an evangelist for Beaver Creek," said Harry Doyle, chief of the Memphis subdistrict of the USGS. "It was a pretty gutsy thing for him to do, because it could have easily turned out to show that his farm was a culprit."

A rare cooperation between a team of unlikely partners evolved, including the USDA/Natural Resources Conservation Service, Farm Service Agency, Department of the Interior/USGS, Tennessee Department of Agriculture, Tennessee Department of Environment and Conservation, the

Water Environment Federation, the University of Tennessee Agricultural Extension Service, and the Tennessee Valley Authority.

In addition, six farmers along Beaver Creek voluntarily signed up to include their farms in the study. "This project is somewhat different from any other in the U.S. in that it started with the farm and with the farmer," said Wilson. "But without cooperation of all those people, we wouldn't have been able to accomplish what we did."

Just what did they set out to accomplish? The two primary goals of the project were to (1) protect and improve surface and groundwater quality by reducing non-point source pollution from agricultural sources and (2) provide farmers and conservationists with the information needed to grow crops economically without degrading water quality.

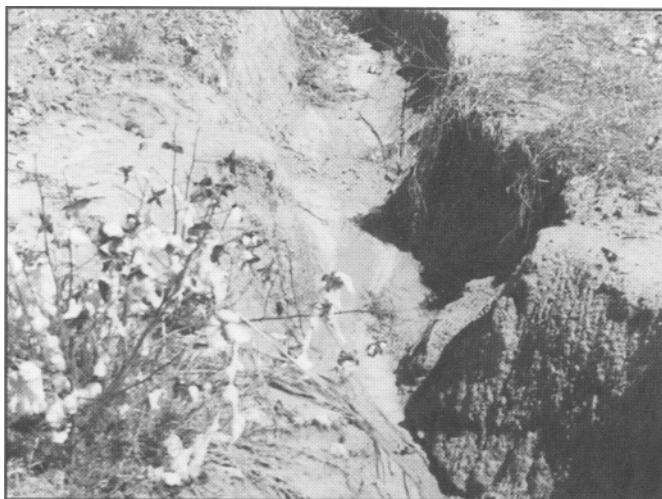
## A Collective Exhale

When the final results were in, a collective exhale resonated from deep

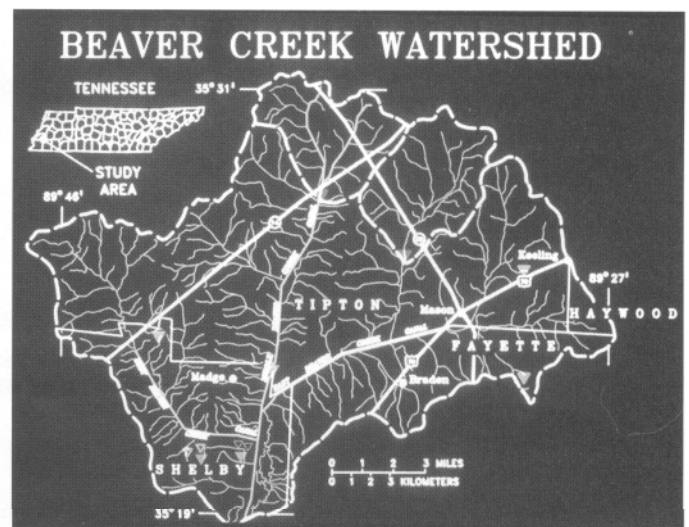
West Tennessee and spread throughout the nation. The study showed that the number one problem in the Beaver Creek Watershed is *not* contamination of water by pesticides and fertilizers, but suspended sediment from erosion. Clean water coming off the fields is contaminated with sediment eroded from the stream channel itself. Excessive suspended sediment is a concern because it interferes with biological habitat and normal decomposing of nutrients and pesticides in the streams.

But this is less a reflection of current agricultural practices, and more a reflection of flood control measures that were taken 30 years ago. The rivers in the Beaver Creek watershed were once shallow, winding, and slow-moving. During rain events, flooding occurred and the water was slow to drain off roads and fields. So the streams were channelized, deepened and straightened, and the water moved out of the area quickly.

With this modification, however, the streams have become unstable, unpredictable, and no longer have the ability to deal with organic matter. The organisms that once



Erosion, shown here in a West Tennessee cotton field in 1994, claims valuable topsoil and threatens water quality and stream stability.



processed the organic matter either can no longer live in the rivers or can no longer process organic matter as they once did, thus causing scouring and continued deepening and widening of the streambeds as well as failing bridges and roads.

But today, farmers along Beaver Creek are voluntarily adopting new methods of farming to help decrease the problem of sedimentation in the streams. The focus of the past few years of the project was assisting these farmers in adopting best management practices (BMPs). BMPs govern nutrient and pesticide management, vegetative and tillage practices, and structural practices, and are designed to minimize sedimentation in the streams. They also minimize chemical use and lower production costs. Some examples of BMPs adopted along Beaver Creek are no-till planting and the encouragement of shrubbery and woody plant growth along the stream banks. The implementation of such BMPs at some sites reduced the concentrations of suspended sediment in the watershed's streams tenfold.

"I think this good neighbor policy in agriculture is a critical issue. We all have to live in the same neighborhood,"

said Bob Whitworth, UT Extension leader in Tipton County. "The fact that these farmers are adopting best management practices voluntarily to improve the environment means a lot."

Extension activities, he said, included a variety of teaching methods: farm visits, demonstrations, field days, and the use of mass media to promote BMP implementation and to generally educate producers as well as the public.

The study also found that, even with BMPs in place, agricultural chemicals sometimes get in the water. If rainfall occurs very close to the time pesticides are applied, there are some rare pulses of pesticides in streams that are at levels above limits proposed by the U.S. Environmental Protection Agency.

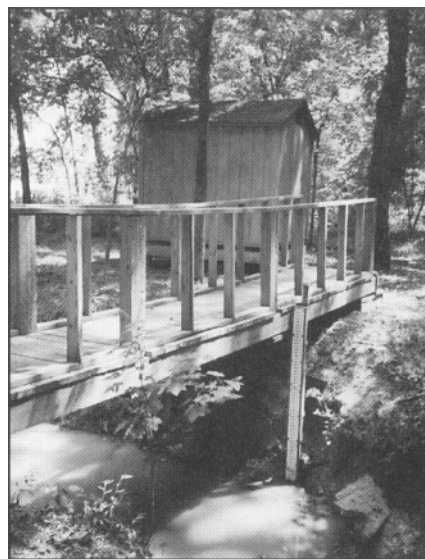
However, researchers discovered errors in computer models used to evaluate the seriousness of pesticide runoff. The models tended to overstate the concentrations. According to Angel Roman-Mas, research hydrologist for the U.S. Geological Survey, the equations in those models have been reconfigured.

Whitworth added that upgrades in the accuracy of Doppler radar weather forecasting down-linked by satellite into the home helps farmers predict with greater precision the right times to apply agricultural chemicals to avoid runoff during heavy rains.

### Lasting Implications

Perhaps Beaver Creek's greatest long-term contribution to science, and ultimately to improving public perception about agricultural chemicals in the environment, has been to improve the accuracy of water sampling. What scientists learned at Beaver Creek could change how water is sampled in studies across the nation.

*The accuracy of water sampling techniques was improved significantly during this study. Six monitoring stations throughout the Beaver Creek area housed the sampling equipment.*



Researchers on the Beaver Creek Watershed project spent the first year of the study designing a monitoring program that can accurately measure the amount of chemicals and sediment in runoff. They found that water sampling methods commonly used to gauge the effects of agricultural chemicals on water quality are inaccurate. During storm events, 11 sampling stations automatically tested the water along Beaver Creek and its tributaries every five minutes. Sampling once every 60 minutes, as researchers did in past studies, was found to increase error in the estimated amount of contamination by 25 percent to 125 percent.

"A great deal of enthusiasm and interest has developed since this is the only research program of its kind," said Wilson. "And it appears that it may serve as the prototype for other testing sites throughout the country."

The study gained national attention when it was mentioned in the 1994 Farm Bureau national policy. The policy statement underscored the importance of basing agricultural policy on the results of sound scientific studies like the Beaver Creek Watershed Project. "I think we've really told a story here in West Tennessee and it's good news," said Whitworth. "We're going to ride this horse a long way."

"Our partnership with USGA and others in Beaver Creek has been very rewarding," said Dr. D. Ray Humberd, associate Extension dean. "USGA has the scientific capability to identify and evaluate sources of water contamination and track changes over time. Extension can use this kind of information in our educational programming to better target public investments and assist farmers as they implement economic, environmentally beneficial management systems. Our cooperative program in Beaver Creek has benefitted farmers, taxpayers, and the environment."



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## Looking Ahead

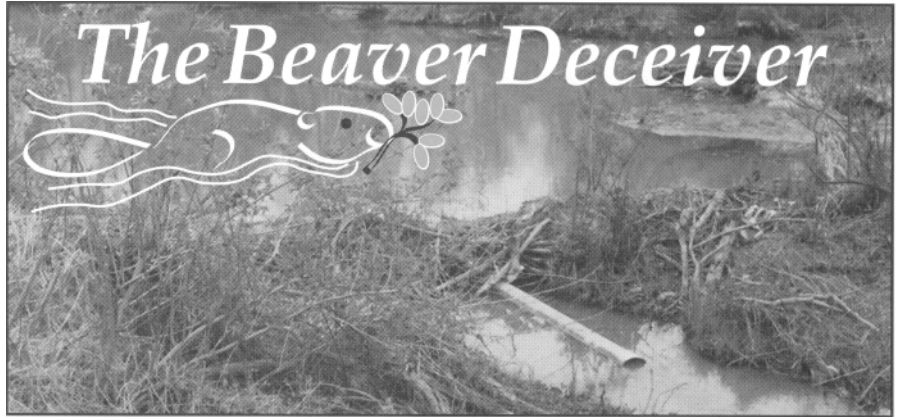
Although the watershed project is over, the need for study at Beaver Creek is not. The eroding streambeds and banks are a continuing source of sediment pollution in the streams, in spite of the most responsible modern agricultural practices. Over a long period of time, the streams will stabilize. But until then, the soil consistency in the Beaver Creek area will remain highly erodible, the streams will remain high-energy streams, the scouring will continue, the streams will move, and erosion will continue on farmland, roads, bridges, and foundations of homes and businesses throughout the Beaver Creek area.

"From an agricultural standpoint, we've done about all we can do," said Dr. George Smith, a UT Extension resource development specialist. "We must move into the streams and see what can be done within the streambed itself."

Because of varying soil types and other conditions, the results of the Beaver Creek study should not be extrapolated beyond West Tennessee, but the study methodologies can be applied to other parts of the country.

"What we have learned about agricultural runoff in the Beaver Creek watershed is particular to Beaver Creek," said Doyle. "Now we need to go to other settings and study the same processes there. While the physical processes are the same, the responses of each system may be different." Smith echoed Doyle's remark, adding that a similar study should be conducted with livestock farming systems.

Clearing misconceptions about the impact of agricultural chemicals on the environment will be a long and costly task. But studies like the Beaver Creek Watershed Project have blazed a trail toward the goal of substantiating claims with valid scientific documentation. Hopefully, similar projects will follow the lead and help reveal which undocumented accusation is fact and which is, well, the one that got away.



*A pipe installed in a beaver dam allows water to flow through the dam and controls flooding while preserving the beaver habitat,*

Once upon a time there was a family of beavers living on Beaver Creek. The Cleaver beavers had a happy life felling trees, hauling them down the bank, adding onto their home, diving around the neighborhood, and snacking occasionally on soft poplar bark. The Cleavers were a simple multigenerational beaver family with strong family values. No one in their family had an engineering degree, and flood insurance was unheard of at the time.

Unbeknownst to the Cleavers, the Beaver Creek Watershed had been designated as the site for a big government study. The ponds created by their dams were frowned upon by the scientists and the people in the area. The ponds flooded cropland, washed out roads and bridges, threatened timber and hardwood trees, and were generally considered a nuisance by all.

Now, the scientists did not speak beaverese, nor did the beavers speak geek. So, when the scientists came and laid dynamite in their dam, they could not communicate to try to work out a solution. The Cleavers hid in a neighbor's house and shivered when the water shook with a blast. Little Johnny "Bucktooth" Cleaver sneaked out and watched his dam fall out of the sky like an overturned box of toothpicks.

But beavers are a tenacious bunch, and when they swam out from their hiding places, they assessed the situation, and quickly went back to work. Trees were felled, old trees were gathered, and soon the Cleaver dam was bigger and better fortified than ever before. But all the while they remained vigilant for tail slaps (to warn of danger) and dynamite blasts that

could be felt up and down the creek. The Cleavers were saddened to hear that many families lost their dams. But beavers, for rodents, have highly developed brains, so they called a watershed meeting to see what could be done.

Meanwhile, the scientists and farmers were perplexed. Blasting the dams wasn't working; the beavers just kept rebuilding, and no one on hand seemed willing to ask the beavers to leave. Trapping and relocating was just too much trouble. Who would want the beavers anyway? It seemed like a hopeless situation. But scientists, for people, have highly developed brains, so they called a watershed meeting to see what could be done.

About that time a young buck-toothed scientist burst onto the scene with an idea. "Let's work with the beaver," he said, "instead of against him. If we cut a notch in the dam and lay a pipe through, the beaver keeps his dam and the water flows, too."

Everyone nodded and clucked and liked the idea. And so the scientists and farmers worked with some people at Clemson University to design and install the "beaver deceivers." The beavers suffered a minor irritation at having to patch up the notch in their dams, but they didn't notice the water flowing through the pipes and left them alone. The scientists' study was a huge success, the farmers' cropland was spared, the water level was controlled, and the Cleavers continued their happy beaver life of chiseling, gnawing, felling, hauling, diving, mating, and occasionally snacking on soft poplar bark.

