



SHAUNA ROSE HERMEL PHOTOS

# Lessons From the WATERSHED

*Nearly all human activity, including beef production, affects the environment.  
The issues surrounding watershed management are complicated, but  
helping protect our water resources isn't.*

BY BRAD PARKER

**Y**ou learned the lesson as a kid playing in the sandbox with a garden hose. Water likes to move. It likes to carry things. You don't always know what path it will take, but it always ends up in a big puddle somewhere.

This concept, all grown up, is called a watershed. As population densities and environmental awareness have increased, however, watersheds have become nothing

like a game; and the scientific principles behind managing and regulating them are anything but child's play.

A watershed is an area of land above some given point. All the land contributes water to that point and every point downstream from it.

"If you stand in a stream and look upslope, all the land area that is upslope of you from that point in the stream is your

watershed," explains Kyle Mankin, assistant professor of biological and agricultural engineering at Kansas State University in Manhattan. "That means all the water that falls on that land area is contributing to the water that is running past your feet."

It's not just the land, either, emphasizes Karl Wood, professor of watershed management in the department of animal and range sciences at New Mexico State University in Las Cruces. The soils, plants, animals, people and activities in or on that land are part of the watershed, too, he explains. They all contribute to the quality of the water — and, hence, the quality of life — from that point downstream.

## ■ Matter of concern

So, if the effects of your watershed are only felt downstream, why worry?

According to Maurice Baker, professor of agricultural economics at the University of Nebraska-Lincoln, most people weren't concerned until concentrations of economic activity, such as large cities and livestock-production operations, began to develop.

"When we start to concentrate a lot of activity in a small area, we begin to overload the system," he says. Nature often has a way of taking care of itself until artificial burdens become too great. That concentration is the first of three issues raising public concern for the environment, Baker explains.

Population growth, urban sprawl and increased population densities aren't just concerns for metropolitan areas. Those people get hungry, so the pressure on agriculture increases. Less land must produce more food, increasing the production concentration in rural areas.

In addition, Americans have become more conscious of the "spillover" effect. People realize what they do on their property affects their neighbors, and vice versa, Baker says. He adds that the concept of "common property" — resources that have value but cannot be captured, such as air and water — is the third issue shedding light on environmental matters like watershed management.

Although urban establishments like airports and golf courses present enormous consequences for their watersheds, public attention usually focuses on agriculture. Baker says the agricultural industry, in general, needs to emphasize that nature can handle the stress of food and fiber production as long as the concentration isn't too great.

Still, most producers feel an obligation to do something, although there's not a great deal of direct economic benefit.

“Anytime you tell producers they have to address environmental issues, you’re only affecting — increasing — the cost side of their profit equation,” Baker explains. Unless their drinking-water supplies are affected, the economist says the on-farm benefits of watershed management basically are long-term.

But the satisfaction from caring for the environment and maintaining goodwill with neighbors and consumers usually is the only incentive producers need to be aware of the effects their operations may have on their watersheds.

#### ■ Consequences of cattle

The effects of cattle operations can be numerous, and they may be positive or negative, Wood says.

The negative aspects of agriculture usually fall under the category of nonpoint-source (NPS) pollution, which results from diffuse sources rather than a single source of contamination, such as a waste outlet at a manufacturing plant. That’s the greatest challenge in monitoring and managing agriculture’s effects on water resources.

“Most of the nation’s nonpoint-source pollution comes from croplands,” Wood explains, adding that grazing lands contribute less pollution than cropland, but still more than forests.

“We’ve taken pastureland, or prairie, and we’ve plowed it up and planted annual crops. When you go from perennial grass to an annual crop, you don’t have as much watershed protection,” Wood says. Although that shifts some of the attention from graziers, the beef industry still must accept some responsibility for cropland erosion because a large share of annual crops are fed to cattle.

According to Frank Humenik, who coordinates animal-waste-management programs for the College of Agricultural and Life Sciences at North Carolina State University in Raleigh, beef production more directly affects watersheds when cattle are allowed into streams or when waste flows into them.

When cattle enter the finishing phase, they’re less likely to be on vegetative land and more likely to be heavily concentrated. Here animal-waste issues take on added importance.

“In grazing situations, [waste] is not the biggest concern because it’s spread out over so much area,” Mankin explains; but, he says, nitrogen and fecal bacteria become the big water-quality issues in confined feeding situations because higher concentration leads to greater potential for negative consequences.



**Riparian areas are the lands adjacent to streams that are enhanced by the waters of the streams. Grazing management within these areas depends upon your goals for the vegetation within them and applicable state regulations.**

While there are concerns associated with beef production, Wood says livestock can help watersheds, too. “The public perception is that it is always negative,” he says, “but it can be quite positive. . . . You don’t read about that much in the news.”

He explains that heavy grazing can increase runoff where desired to increase municipal water supplies downstream. In addition, grazing cattle help recycle nutrients, increase surface roughness through trampling, compact soils (especially loose sandy soils) to increase their water-holding capacities and eliminate unwanted plants that negatively affect water resources.

As an example, Wood tells how a buildup of pine needles in a stream can make the water toxic for livestock. Grazing cattle help control small pine trees, heading off a water-quality problem decades in advance.

#### ■ Ways to help

There are several management strategies to protect or improve the quality of your watersheds. Those employed depend upon water-use goals and geographic and economic situations. Within the extremes of intensity (concentration of animals), management will determine the severity of the effects, Mankin explains.

Baker agrees managing concentration is key. He says size of the operation is less important than concentration,

management and character of the land.

He cites studies that show no economies of scale when evaluating the costs associated with watershed management. The costs per acre and per head seem to be independent of the size of the operation.

“Good managers will manage,” Baker says. Poor managers may be broken.

According to Wood, there are three major courses of action that can be employed to manage watersheds.

“Manipulating the animals is the cheapest, manipulating the vegetation is in between, and landforming is the most expensive,” he says. “And landforming is only temporary until you get the animals and the plants properly managed.”

Each state was charged with developing best management practices (BMPs) for beef producers in the late ’70s and early ’80s, Wood says. “They vary from state to state, but they’re generally good ranching practices: having the proper stocking rate, having good distribution, having rotation, having adequate water, seeding where needed and doing brush control.”

When assessing watersheds, Wood advises producers to look at runoff, erosion and pollutants.

The sediment problem, in particular, often compounds the effects of other pollutants. “They attach themselves to a

**Size of the operation is less important than concentration, management and character of the land, Baker says.**

CONTINUED ON PAGE 78

sediment particle,” Wood explains. “If you stop the sediment, then you stop the other problems, too.”

Mankin says low stocking rates help maintain ground cover, reducing runoff and erosion. “In terms of pasture situations, erosion and the associated nutrients and, in some cases, fecal coliforms are the primary pollutants,” the engineer states. Healthy grass slows runoff, allowing it to infiltrate the soil where it can be filtered before joining the water supply, becoming more concentrated and moving downstream.

“The health of the watershed is often indicated by the health of the vegetation,” Mankin continues. “Once pollutants get into flowing water, it’s harder to deal with them. Keeping those pollutants on the land is certainly the best option.”

Often, even with proper stocking rates, animals tend to congregate in a few locations, and distribution becomes the problem with heavy concentration in those spots. Wood says this can be solved with rotational grazing and by disbursing the locations of water, feed, supplement and mineral throughout the pasture.

“Too often a rancher will have his corrals,

his supplement, his salt and his water all down in the bottom,” he says. “It’s just a magnet for livestock.” He adds this becomes a prescription for water-quality problems where the location is near a stream and there are fewer chances for the runoff to be filtered.

Humenik recommends providing drinking water away from streams and protecting the area where water is offered to minimize runoff from there.

Scattering the attractions in a pasture will not only serve to protect your watersheds, it will help prevent overgrazing and save your forage base. As is often the case, what’s good for the environment is good for the productivity of your operation.

#### ■ In the zone

A particular set of management guidelines deals with a special area within watersheds. When a battle is to be fought among landowners, environmental activists and government regulators, these *riparian areas* usually are the front line.

A riparian area, or zone, is the land adjacent to a stream that is enhanced by the water of the stream, according to Wood. He says legal definitions of riparian areas are

often confusing, and regional perceptions add to the confusion.

While those in the East may think of a stream as running every day of the year (perennial), some folks in the West may consider a dry wash capable of conveying water as meeting the definition. “It may not need to be perennial water, but it ought to be intermittent, running much of the year anyway,” Wood proposes.

The watershed specialist also says confusion arises between what is a wetland and what is a riparian area. While wetlands are always in a riparian area, Wood says, not all riparian areas qualify as a wetland.

Regardless of the definition, the area closest to a waterway requires careful management, and it’s most important that vegetation growth be encouraged there. While some advocate removing livestock from riparian areas most or even all of the time, Wood feels that is seldom necessary.

“When you only have raw banks and no vegetation in the riparian zone, then you may want to take the cattle out, but you may have to do some other manipulations,” he says. “Taking livestock out altogether generally doesn’t do much because the livestock often are replaced by other animals.”

Wood says ungrazed riparian areas are inviting to such wildlife as elk, deer and gophers. “They often take over and eat just as much or more than when you had livestock in there,” he explains.

In a recent study in New Mexico, it was observed that when cattle were removed from riparian areas, gophers moved in, dug up the vegetation and converted the grassland into a “weedland.” Wood says the gophers dig up the grasses so the weeds that are the staple of their diet can grow. This “farming” and the loose soil in their mounds contribute to sedimentation in the nearby streams.

Depending on your management goals, there are specific times of the year when grazing stock can benefit the riparian areas. Wood advises keeping cattle on those areas when the grass is lush if the goal is to encourage more shrubs and trees. If the grass needs the competitive advantage, graze when it is dormant and the trees and shrubs are more inviting for the cattle.

Mankin agrees that some low-intensity uses are allowable within the riparian areas, which often are considered “buffers” along a stream. Although his definition of a buffer does not equal zero activity, he says the area must be wide enough to allow runoff to

## NUTRIENTS NEED MANAGEMENT

**Discussions about watershed management usually turn to the concept of nutrient management. According to Karl Wood, professor of watershed management at New Mexico State University, this refers to keeping elements and compounds that are nutrients at some levels from reaching toxic levels.**

**“Not all nutrients going into a stream are bad. Not all sediment going into a stream is bad,” he says. “A lot of that is useful for downstream irrigation and for downstream in-stream growth.”**

**He explains that if all nutrients and sediments were kept from streams, there wouldn’t be much life in them. What’s allowable depends upon the goals for that water. Bodies used for swimming, fishing or drinking all require different levels of protection.**

**Frank Humenik, coordinator of animal-waste-management programs at North Carolina State University, says that, in some situations, nutrient management will include using the nutrients in collected waste. Some feedyards may develop nutrient-management plans that prescribe putting the waste on cropland to provide deficient nutrients. The key to such plans, he emphasizes, is to apply the nutrients at agronomic rates.**

**Producers also should investigate nutritional strategies that reduce the volume of waste and harmful constituents on their operations, Humenik advises. “Research shows improved housing and nutritional strategies show great potential for waste and odor reduction,” he says. “Cattle producers ought to be looking at that, keeping pace with that and trying to implement those recommendations as soon as they can.”**

infiltrate the soil rather than flow directly into the stream.

Humenik says decisions regarding riparian areas must be site-specific. "The closer the cattle are to the stream and the higher their density, the more opportunity there is for direct runoff of waste and other materials into the stream. And that's what we're trying to minimize," he explains.

The easy answer is not to graze there, Mankin says; but if it's necessary, manage it carefully so the benefits of the buffer aren't lost.

"You wouldn't want to treat that just like any type of pasture. It'd need to be lower intensity," he emphasizes. "That's probably more-careful management than most people have time for, so it's probably easiest just to exclude them from a buffer. That's probably why that recommendation would be made."

Wood explains that in some instances, however, the increased management may be the better option because zero grazing is impractical. "If you've got lots of riparian area and you take [the cattle] out, then you're losing a lot of forage base," he says.

Baker offers an alternative when discussing riparian buffer zones. "Those things wouldn't have to decrease profit because they could be hayed," he says.

Humenik advises producers to do their homework before making decisions about their riparian areas as many states are developing laws to define and regulate riparian- or buffer-zone distances and allowed activities within those zones.

#### ■ Out of the water

Naturally, managing the area adjacent to the stream includes managing the stream itself. Mankin explains that avoiding overgrazing is second only to keeping cattle out of the water. "For grazing land, those two things alone are going to take you most of the way home," he says of efforts to protect surface waters.

Moving cattle a few tens or hundreds of feet from the stream can make a big difference in the amount of pollutants that reach the water. "The things that aren't a problem when they're disbursed across the land become a problem when they're put directly into the stream," he states. "So even a small number of head can cause a problem if they're allowed direct access to a stream."

Whether you establish restricted stream access or off-stream watering depends on



**Frank Humenik, coordinator of animal-waste-management programs at North Carolina State University, recommends providing drinking water away from streams. That strategy is part of keeping cattle from wading in the stream and spreading out attractions in the pasture to avoid overconcentration in spots.**

the lay of your land, Mankin says. "Restricted access doesn't mean that the cattle can't get access to the stream; you just don't let them wade in it," he explains.

#### ■ Measurements of progress

There may be reason for producers to determine their operations' effects on their watersheds. Wood says there is no fast, easy and accurate way to measure such things.

The best first step, however, is to determine how much runoff and erosion is occurring. He says he knows of ranchers in Montana who collect sediment samples from their streams on a weekly, biweekly or monthly basis and send them to a water-testing laboratory. In those cases, Wood encourages producers to negotiate a special pricing schedule with the lab.

Wood reminds producers each time to

measure and to record the depth and width of the stream where the sample was collected.

Such complete data from throughout the year provides solid evidence of what happens within the watershed upslope from that point. Therefore, taking regular samples where a stream enters and exits your property will provide the information needed to determine if and how its condition changes while there.

If producers are collecting data on their streams, what do they do with it?

The intended uses for that water downstream and the contributions of other parts of the watershed will determine how you should react to the data. It all comes down to whether you are loading the stream with more than your fair share to

CONTINUED ON PAGE 80

ensure that the water meets its required standards when it gets to where it's going.

■ **Determine the load**

One attempt to set limits on contributions to surface waters has come in the form of total maximum daily loads (TMDLs), which are based on the suspended and dissolved constituents in the water and define the maximum load that can go into a stream and still maintain a given water-quality standard.

Originally developed for municipal water-treatment plants, scientists are still trying to find the best way to apply TMDLs to agriculture, Mankin says. The challenge is in balancing the effects of single-day storms with long-term accumulations.

"Most of the year, there's no contribution of pollution from grazing lands because there's no runoff," he explains. "In parts of Kansas, we average maybe 10 runoff events per year, and some places, quite a bit less. Those are the only times we're going to have any contribution."

Since some days will see much more runoff than the average and some days won't see any, the concept of a maximum daily load may not be appropriate for agriculture, Mankin believes. "Maybe we need to talk in terms of monthly, season or annual loads," he offers.

Wood agrees using the concept within the framework of agriculture is difficult. "We find that the natural variability from day to day is great. The variability from season to season is great. The variabilities from year to year and decade to decade and century to century are great," he explains.

The NMSU professor says land owners can try to use the TMDLs for their watersheds by first mapping the watershed and determining how water is getting to the stream. If it is indeed coming from your land, capture your runoff and determine the levels of constituents in it. If you're not where you want to be, incorporate management that will control the factors in question.

Producers should remain aware of the TMDLs, Wood says, because regulatory agencies are using them. "We've got to live with them," he adds. "We've got to realize what they mean and what they don't mean."

Humenik also encourages producers to

know what is allowable since each state is required by the Environmental Protection Agency (EPA) to develop TMDLs for its watersheds. That means knowing how much of the total contribution is being made by your operation, he continues. If all the contributions exceed the government's limits, despite the use of BMPs throughout the watershed, regulatory problems are bound to arise.

■ **Challenges of regulation**

The government's limits on certain activities within a watershed are based on data from models of how watersheds are expected to work. "This is where we're having difficulty," Humenik admits, "with the state of the art being able to give reliable

numbers for those types of activities."

Wood agrees descriptive models and infrequent observations aren't enough upon which to base regulations. He says data must be generated from sediment samples taken where the amount of runoff entering a stream is measured. And the data must be collected on an ongoing basis.

"Most regulators take a mayonnaise jar, go out there once a year — or once every 10 years — and it happens to be the day that it's raining hard and they've got a flood going. And they take a scoop of water out of the stream and try to characterize the whole year by that one bottle," he says.

Another shortcoming in current regulations is that they are based on natural rates of erosion, Wood believes. "There will always be sediment coming off land," he explains. "If soil is forming faster than it's eroding away, then you're under tolerance. So the accelerated erosion can still be OK if it's under tolerance."

He stresses that the tolerable level of sedimentation (or any form of pollution) should be the focus. When the actual, or accelerated, level is less than the tolerable limit, even though it may be greater than the natural level, nature can handle it. When the tolerable level is exceeded, action should be required.

"They say accelerated erosion is bad," Wood says of regulators. "Well, it may or may not be, depending on what the tolerable level is." That level, he adds, is determined by the rate of soil formation,

which requires complex soil science and long-term studies to calculate.

For these reasons, Wood urges producers to question the reliability of TMDLs and how they were established. "Often times, watersheds are large. They're complicated. There's lots of different land ownership and lots of different land uses going on, and a rancher can't get tagged with causing all the problems."

He further encourages cattlemen to learn about water laws through educational opportunities provided by their state associations or Extension services. He says it's also important to get to know who the real experts are, especially if they find themselves in a legal confrontation.

Water law is complicated, conflicting and evolving, he explains. "Ranchers should not go to the local divorce lawyer and try to hire him to do water law. You need to go to a water lawyer."

■ **Fear not; get involved**

Of course, avoiding litigation is the preferred alternative. For that reason, producers should become involved in the regulatory process to ensure their viewpoints and experiences are considered.

Baker advises that any producer informed enough to be concerned is informed enough to take part. "Producers really thinking about the environment are the ones who need to get involved and have their views expressed to establish reasonable regulations," he says.

In Nebraska, the economist points out, producers are a majority of the directors for the natural-resource districts, which are responsible for monitoring NPS pollution in the state. "It's an opportunity to address situations unique to their locations," he adds. "I think they've worked well to balance agricultural and nonagricultural communities."

Humenik also advises cattlemen to get associated with their states' water-quality agencies and whatever else is happening in the development of water regulations. He says problems can result if agencies set their own standards without input from those affected. That's why producers should call those agencies and ask how they can get involved.

Wood points people toward public hearings on water issues. "You can't turn your back and avoid it. It's not going to go away," he says.

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