Managing Beef Cattle To Protect Lakes and Rivers

PEGGY GREB (D1025-1)

Soil scientist Gilbert Sigua uses a probe to measure levels of salinity, dissolved oxygen, conductivity, and temperature in Spring Lake, in Brooksville, Florida. The lake is located near forage-based cow-calf operations.

Beef cattle browse more than 11 million acres of grazinglands in the State of Florida. In fact, Florida is 11th among U.S. beef-producing states, and 4th among those with herds of more than 500 brood cows. Florida producers run 4 of the nation's 15 largest ranches, the largest of which grazes over 35,000 brood cows on more than 300,000 acres.

Such large herds naturally generate large quantities of manure and other waste. Because of this, forage-based livestock systems have been blamed as a major cause of deteriorating water quality in Florida and other cattle-producing states. Particularly problematic, over time, has been phosphorus runoff from both manure and the fertilizers applied to enhance forage production.

Despite widespread concern, however, very limited data has been available to measure nutrient losses to adjacent bodies of water from pastures managed for grazing and hay production.

That's where the Beef Cattle Research Unit—part of ARS's Subtropical Agricultural Research Station (STARS)—in Brooksville, Florida, comes in. There, in west-central Florida, soil scientist Gilbert C. Sigua and colleagues examined changes in soil fertility of bahiagrass-based beef cattle pastures from 1988 to 2002. The pastures were managed for grazing in spring and haying in late summer. Soil analysis has shown declining nutrient levels, especially of phosphorus.

The three major pasture units had a combined total area of about 3,800 acres, with 3,200 acres in permanent pasture. Cattle used for nutritional, reproductive, and genetic research on the station include about 500 head of breeding females with a total inventory of about 1,000 head of cows, bulls, and calves.

"Overall," says Sigua, "we've found no spatial or temporal buildup of soil phosphorus or other crop nutrients—despite the annual application of fertilizers and daily in-field loading of animal waste."

Everything Goes Together

How pasture management and hydrology interact to affect nutrient dynamics and water quality has become an issue of increasing importance to environmentalists, ranchers, and public officials. So, since phosphorus has been found to be the culprit in nutrient pollution, or eutrophication, in many Florida aquatic systems, the STARS scientists and collaborators have launched several studies on reducing phosphorus runoff.

Long-term monitoring of changes in soil nutrients, especially phosphorus, helps the STARS soil scientists to predict soil chemical buildup or physical deterioration that could occur under continuous forage-livestock cultivation and to adopt measures to prevent them from happening.

TSI—for Total Water Quality

Using what's called the "trophic state index" (TSI), Sigua and colleagues followed trends in the quality of water in three lakes near Brooksville from 1993 to 2002. TSI is an indicator of the overall condition of a body of water, including its biological, chemical, and physical characteristics. According to Florida Water Quality Standards, a TSI score between 0 and 59 is considered "good"; 60 to 69 is "fair"; and 70 to 100 is "poor."

The lakes tested are either next to beef cattle pastures or within a 5- to 10-mile radius of STARS. Measures of water chemistry made during the 1990s in Lake Lindsey proved similar to what had been found 30 years before. Spring Lake samples showed clear, medium-hard water

PEGGY GREB (D1028-1)

Technician Kirstin Foulks prepares groundwater samples for analysis. Water samples were taken from a forage-based pasture in a cow-calf operation.

High-Quality Forage for Hay and Grazing

Long-term study results show that the current recommendation for phosphorus may, in fact, be too low to adequately maintain growth of rhizoma peanut, *Arachis glabrata.* This perennial forage legume is well adapted to the warm, humid climate of central Florida, where it's grown alongside bahiagrass.

The high nutritional value of rhizoma peanut makes it an excellent feed for both ruminant and nonruminant animals. Periodic application of additional phosphorus and other micronutrients may be necessary to meet the forage peanut's agronomic needs and to offset the nutrients lost because of animal production.

For the next 5 years, Sigua and other collaborators will be integrating the environment, plants, and animal genetic resources into a sustainable beef cattle agroecosystem for the subtropical United States. They will continue their research endeavors with the goal of optimizing forage-based cow-calf operations both to improve pasture sustainability and to protect water quality.—By **Alfredo Flores,** ARS.

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with a low concentration of total nitrogen and total phosphorus. Water in Bystre Lake was characterized as moderately colored and medium-hard.

The TSI scores for all 3 lakes were in the "good" range: 35 for Lake Lindsey, 30 for Spring Lake, and 46 for Bystre Lake.

Those findings indicate that current fertilization recommendations for bahiagrass-based pastures in central Florida offer little potential for harming the environment. They suggest that livestock operations might not be major contributors to excess loads of nutrients—especially phosphorus—in nearby surface waters, as long as the operations are properly managed. If the phosphorus is not showing up in the local system, it may be moving farther off site via groundwater flow.

PEGGY GREB (D1026-1)

Gilbert Sigua and Kirstin Foulks take groundwater samples from a forage-based pasture in a cow-calf operation at the Subtropical Agricultural Research Station at Brooksville, Florida.