Forage Harvest to Remove Nutrients from Public Waters

Too much of a good thing, as the old saying goes, is not always so—because sometimes, you can get too much of a good thing. Fertilizers have made agriculture and ranching possible on the nutrient-poor sandy soils of Florida and today's best management practices aim to ensure that no more fertilizer is applied than needed. However, in the period between the late 1940s through until the 1980s, heavy use of fertilizers have created a phosphorus issue in our soils that still affects our water quality today. Hilary Swain, Archbold's Executive Director, explains "In a study conducted from 1998-2003 at Archbold's Buck Island Ranch it was found that pastures that had been fertilized in earlier years and then not fertilized with phosphorus since 1986, still had 5-7 times the amount of phosphorus in ditches draining the pastures compared to pastures that had never been fertilized. In a study using chemical isotopes, it was found that 85% of phosphorus leaving the pastures was derived from fertilizers and not the phosphorus that naturally occurred in the soils, even though these pastures had not been fertilized for 12 years. The fertilizer-phosphorus still remaining in these soils is known as 'legacy phosphorus'."

Why is phosphorus of special concern in Central and South Florida? Florida has one the world's largest geological deposits of phosphorus formed under earlier marine conditions that is excavated and mined for fertilizer. However, Florida's freshwater ecosystems such as the Everglades evolved with extremely low levels of available phosphorus in surface lands and waters. Many native plants that evolved under low phosphorus conditions are not able to take up 'excess phosphorus' delivered from fertilizer. In contrast, algae and several invasive plant species can grow fast under high phosphorus conditions and then take over. There are large amounts of legacy phosphorus in Florida's soils and waters all the way from Orlando to the Everglades, with concentrations in water often 10-20 times greater than the government-recommended maximum limit of 10 parts per billion.

State and federal agencies, the water management districts, not-for-profits and research institutes have been trying for decades to reduce phosphorus levels in water. With the objective of reducing runoff from grazing lands Florida Department of Agriculture and Consumer Services has worked with ranchers to adopt Best Management Practices, only applying fertilizer using University of Florida recommendations that require plant and soil tests demonstrating the need for phosphorus fertilizer. The South Florida Water Management District has built large storm water treatment areas where water is retained and wetland plants and soils take up some phosphorus.

Ranchers are thinking of innovative ways to address Florida's legacy phosphorus issue. Gene Lollis, Buck Island Ranch Manager, comments that "What if the vegetation is cut and removed from an area? That could be a net removal of phosphorus in forage." This is being examined in a collaborative project between South Florida Water Management District and Archbold at Buck Island Ranch. This nutrient removal project is part of the district's Dispersed Water Management program. Water is pumped into a fallow field from the Harney Pond Canal (C-41 Canal), a large public canal that has high phosphorus levels draining from surrounding lands. This project is a flow-through system where water is used to irrigate and grow forage grasses such as Limpo Grass (*Hemarthria altissima*). Limpo Grass, a common pasture grass in ranchlands throughout Highlands and Glades counties, can tolerate flooded conditions in the rainy season. Lollis continued. "The idea behind the project is that grass growth will take up phosphorus, incorporate it into plant tissue and when harvested and baled as feed for cows, will result in net removal of phosphorus. Last year 1.5 million pounds of forage grass was harvested from the 180-acre field, containing almost 3,800 lbs of phosphorus. The other benefit of this project is because we are harvesting some of our own forage, we do not need to import as much supplemental winter feed such as molasses that contains phosphorus into the ranch. To date, it's not a cost-saving to us, because of the expense of harvesting, but we can measure the public benefit of phosphorus removal."

The project is in its early stages and we are just beginning to learn whether this might be an effective way to remove phosphorus from off-site water. Archbold is tracking the amounts of water and phosphorus being pumped in and out, rainfall, and grass harvest to estimate removal efficiency, and water samples are analyzed at Archbold, district and university labs. Just like a personal bank account, balancing the ins and outs, understanding the phosphorus budget at Buck Island Ranch may allow more efficient use of this nutrient and at the same time, solve a pressing environmental issue.

Photo 1: Instruments measure water inflows/outflows and phosphorus concentrations in water used for grass growth on Buck Island Ranch. Photo credit: Amartya Saha

Photo 2: Grass growth over 3 months using nutrient-rich canal water at Buck Island Ranch Nutrient Removal Project.

Photo credit: Amartya Saha