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Farming carbon: Study reveals potent carbon-storage potential of manmade wetlands

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This shows co-authors Blanca Bernal and Bill Mitsch taking soil cores in the Okavango Swamp in Botswana, Africa. Credit: Bill Mitsch

After being drained by the millions of acres to make way for agriculture, wetlands are staging a small comeback these days on farms. Some farmers restore or construct wetlands alongside their fields to trap nitrogen and phosphorus runoff, and research shows these systems can also retain pesticides, antibiotics, and other agricultural pollutants.

Important as these storage functions of wetlands are, however, another critical one is being overlooked, says Bill Mitsch, director of the Everglades Wetland Research Park at Florida Gulf Coast University and an emeritus professor at Ohio State University: Wetlands also excel at pulling carbon dioxide out of the air and holding it long-term in soil.

Writing in the July-August issue of the *Journal of Environmental Quality*, Mitsch and co-author Blanca Bernal report that two 15-year-old constructed marshes in Ohio accumulated soil carbon at an average annual rate of 2150 pounds per acre—or just over one ton of carbon per acre per year.

The rate was 70% faster than a natural, "control" wetland in the area and 26% faster than the two were adding soil carbon five years ago. And by year 15, each wetland had a soil carbon pool of more than 30,000 pounds per acre, an amount equaling or exceeding the carbon stored by forests and farmlands.

What this suggests, Mitsch says, is that researchers and land managers shouldn't ignore restored and man-made wetlands as they look for places to store, or "sequester," carbon long-term. For more than a decade, for example, scientists have been studying the potential of no-tillage, planting of pastures, and other farm practices to store carbon in agricultural lands, which cover roughly one-third of the Earth's land area.

Yet, when created wetlands are discussed in agricultural circles, it's almost always in the context of water quality. "So, what I'm saying is: let's add carbon to the list," Mitsch says. "If you happen to build a wetland to remove nitrogen, for example, then once you have it, it's probably accumulating carbon, too."

In fact, wetlands in agricultural landscapes may sequester carbon very quickly, because high-nutrient conditions promote the growth of cattail, reeds, and other wetland "big boys" that produce a lot of plant biomass and carbon, Mitsch says. Once carbon ends up in wetland soil, it can also remain there for hundreds to thousands of years because of water-logged conditions that inhibit microbial decomposition.

"And carbon is a big deal—any carbon sinks that we find we should be protecting," Mitsch says. "Then we're going even further by saying: We've lost half of our wetlands in the United States, so let's not only protect the wetlands we have remaining but also build some more."

At the same time, he acknowledges that wetlands emit the powerful greenhouse gas (GHG), methane, leading some to argue that wetlands shouldn't be created as a means to sequester carbon and mitigate climate change. But in a new analysis that modeled carbon fluxes over 100 years from the two constructed Ohio marshes and 19 other wetlands worldwide, Mitsch, Bernal, and others demonstrated that most wetlands are net carbon sinks, even when methane emissions are factored in. And among the best sinks were the wetlands in Ohio, possibly due to flow-through conditions that promoted rapid carbon storage while minimizing methane losses, the authors hypothesize.

The concerns about methane emissions and even his own promising findings point to something else, Mitsch cautions: It's easy to undervalue wetlands if we become too focused on just one of their aspects—such as whether they're net sinks or sources of GHGs. Instead, people should remember everything wetlands do.

"We know they're great for critters and for habitat, that's always been true. Then we found out they cleaned up water, and could protect against floods and storms," he says. "And now we're seeing that they're very important for retaining carbon. So they're multidimensional systems—even though we as people tend to look at things one at a time."

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