An unseen carbon sink

Wetlands store vast amounts of carbon, but efforts to make them eligible for credits under a global climate treaty could prove tricky. **Melanie Lenart** reports.

Cattails and marsh grasses fringe a kidney-shaped pond in Ohio's Olentangy River Wetlands Research Park. In the distance, a blue heron takes wing. This 50-acre site — created 15 years ago from bulldozed land — is now a thriving ecosystem, home to migratory and resident birds, as well as fish, amphibians and plants. As a reconstructed wetland, it's also a man-made sink for carbon dioxide.

While the Olentangy site has been sequestering CO_2 since its creation, other sites have been doing so for thousands of years. Globally, wetlands store an estimated 300 to 700 billion tons of carbon[1]. "The existing storage of carbon in wetlands approaches the amount of carbon you have in the atmosphere," says Jon Kusler, associate director of the Association of State Wetland Managers, a US-based non-governmental organization. "We have a lot of carbon storage there and we're not paying any attention to it at all." Most of this is locked up in peatlands, a subtype of wetland that are best known for their ignitable end products: peat and, given enough time, coal. By some estimates, peatlands alone hold some 550 billion tons of carbon[2].

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Wetlands store an estimated 300 to 700 billion tons of carbon globally.

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It's this capacity for carbon storage that is now drawing the attention of the international community to wetlands. Leading experts, as well as entire nations, say that wetlands — and peatlands in particular — should be made eligible as official sources of carbon credits in a global climate treaty, a move that would keep these ecosystems intact as well as mitigating climate change. William Mitsch, creator of Olentangy River Wetlands Research Park, is one proponent of the idea. "All of the carbon that we're burning now originally came from wetlands," says Mitsch during a tour of the Olentangy site, which is situated near the University of Ohio campus in Columbus, where Mitsch holds a faculty position. "So intellectually, it makes sense that wetlands are probably the best ecosystem on the planet to sequester carbon."

THE REAL DEAL

Policymakers are, in the next year, expected to sign a new treaty to reduce greenhouse gas emissions that will replace the Kyoto Protocol from 2012. Unlike the Kyoto Protocol, the new treaty will probably include an international agreement on reducing emissions from deforestation and forest degradation, known as REDD[3]. The REDD agreement will tackle the estimated 12-20 per cent of global emissions that arise from the chopping and burning of forests[3,4]. Currently, the agreement lacks any reference to the destruction of wetlands. Yet peatland degradation alone is now a major source of carbon dioxide emissions, averaging 2–3 billion tonnes a year — equivalent to roughly ten per cent of global carbon dioxide emissions[5]. Most of these emissions originate in Southeast Asia, primarily as a result of draining land for reclamation, development and plantation of crops such as palm oil, which can lead to deliberate or accidental fire. Clearance for fuel is also common.

Unless wetlands are included in a scheme such as REDD, "it could mean that a country gets credit for protecting their forests while they have ongoing emissions," says Susanna Tol of Wetlands International, a global conservation organization. Inclusion of wetlands in the REDD agreement would pay developing nations to keep these ecosystems intact and would allow other nations to purchase credits for the sequestered carbon to offset their own emissions.

Wetlands International is now working with several other environmental groups to support Indonesian and Icelandic officials who are seeking to have the issue recognized in upcoming negotiations in Copenhagen. Indonesia is one nation that

would benefit financially if wetlands were recognized in the REDD deal. Iceland, on the other hand, could receive credits for restoring previously drained peatlands under a separate proposal known as Land Use, Land-Use Change and Forestry (LULUCF) that applies to developed countries. With the negotiations already bogged down in an excess of detail, getting wetlands included in the Copenhagen negotiating text will be a challenge. But proponents of the idea consider it essential to at least insert some phrasing that will leave the door open to including wetlands in a future deal. "Preferably I would rather have text now," says Tol. "But if there's text that allows [us] to put it in later, then that would also be a relatively good outcome." Just tagging on a phrase such as "other land uses" in the REDD agreement could allow this concept to be refined at a later stage, she says.

WILLIAM MITSCH / OLENTANGY RIVER WETLAND RESEARCH PARK

William Mitsch is director of Olentangy River Wetland Research Park in Ohio, a site of ongoing research into emissions from wetlands.

CUT AND DRY?

While the rationale for including wetlands in a climate treaty might be obvious for Indonesia and Iceland, for others the case is less clear-cut. For one thing, there's no established method yet for evaluating the amount of carbon stored deep below ground in peatlands or for measuring the full suite of greenhouse gases that they exchange with the atmosphere. "From the scientific point of view, you'd want any regime to take account of the true carbon balance, not [to be] just some artificial accounting that ignores that," says Colin Prentice, a professor of earth sciences at the University of Bristol, UK.

Scott Bridgham at the Center for Ecology and Evolutionary Biology at the University of Oregon in Eugene is "certainly in favour of conserving and restoring wetlands", but is "concerned the science doesn't provide a strong basis" for making wetlands eligible for carbon credits. This is particularly true for freshwater, mineral-soil wetlands — in other words, those that are not peat-based. Part of the issue here is what Mitsch calls "the M-word", referring to methane, a short-lived greenhouse gas with 25 times the warming potential of carbon dioxide. In breaking down plant matter, microbes in peatlands release methane, which partly counteracts the positive climatic effects of CO_2 sequestration[6]. The extent to which this happens varies from site to site, and measurements of both methane emissions and CO_2 sequestration are rare, especially in the tropics.

Back at Olentangy River, Mitsch has found that some of the wetlands draw down enough CO_2 that they are net carbon sinks despite their methane emissions. But while restoring wetlands can help protect their current carbon stores and improve their ability to sequester more, it also increases the amount of methane released, because anaerobic microbial activity increases as water level rises. According to the Intergovernmental Panel on Climate Change's approach for estimating the balance[7], which some challenge, methane releases from intact wetlands typically appear to swamp out their carbon dioxide drawdown. In peatlands, though, the threat of losing some or all of the existing carbon stores trumps concerns about methane, which is why they are the favourite in the bid for credits.

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Supporters of getting wetlands on the Copenhagen agenda also argue that the move would inspire the development of an approved methodology to measure their emissions. Iceland, for instance, expects to spend the next few years not collecting credits but taking inventory of existing and drained peatlands, setting up an incentive system and collecting better data, says Hugi Olafsson, director of policy and international affairs at Iceland's environmental ministry. Standing on a bridge overlooking the Olentangy wetlands, Mitsch agrees that this is the way forward. Measurements from his graduate students' research in Costa Rica and, soon, Botswana will help fill in the data gap from the tropics. "We're making lots of decisions based on less than the amount of information we should really have," he says. "That's why you have to go back to basic principles — wetlands produce carbon like crazy and they hang on to a lot of it."

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References

1. Bridgham, S. D. *et al. Wetlands* **26,** 889-916 (2006).
2. *Agence France-Press* 11 April 2009; http://bit.ly/wetlands
3. Schrope, M. *Nature Rep. Clim. Change* doi:10.1038/climate.2009.78 (2009).
4. Van der Werf, G. R. *et al. Nature Geosci.* **2,** 737-738 (2009).
5. Kaat, A. & Joosten, H. *Fact Book for UNFCCC Policies on Peat Carbon Emissions* (Wetlands International, Wageningen, The Netherlands, 2009); http://bit.ly/wetlands5
6. Frolking, S. *et al. J. Geophys. Res.* **111,** G01008 (2006).
7. *IPCC Guidelines for National Greenhouse Gas Inventories* (eds Eggleston, H. S., Buendia, L., Miwa, K., Ngara, T. & Tanabe, K.) (IGES, Hayama, Japan, 2006); http://bit.ly/wetlands7

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