PCO2R Partnership
EERC Energy & Environmental Research Center®
UND University of North Dakota
Plains $CO_2$ Reduction (PCOR) Partnership
*Practical, Environmentally Sound $CO_2$ Sequestration*
USGS science for a changing world
Ducks Unlimited Canada

# Wetland Carbon Sinks in the Glaciated North American Prairie

## Do Prairie Wetlands Sequester Carbon?

Preliminary work by the U.S. Geological Survey (USGS) and Ducks Unlimited Canada (DUC) scientists for the Plains $CO_2$ Reduction (PCOR) Partnership suggests that restoration of prairie wetlands has great potential to sequester carbon.[1] Based on these findings, the most recent inventory (1990–2001) of greenhouse gases (GHGs) and sinks for the United States lists restored prairie wetlands as carbon sinks.[2] Hence, wetland restoration is an important terrestrial ecosystem-based approach to mitigate GHG emissions. Further, these restorations will provide many other concurrent benefits such as wildlife and fish habitat enhancement, water quality improvement, sediment and chemical filtration, erosion and nutrient transport reduction, floodwater retention, groundwater recharge, biological diversity conservation, and increased opportunities for education, scientific research, and recreation.[3]

## How Do Wetlands Reduce Atmospheric $CO_2$ and Other GHGs?

Previous research suggests that prairie wetlands traditionally functioned as net sinks for atmospheric carbon, but cultivation, the current principal land use, has shifted their function from net sinks to net sources of atmospheric carbon. Consequently, cultivation has resulted in the depletion of natural carbon stocks. Carbon stocks lost from cultivation are rapidly replenished at rates up to 3–5 metric tons per hectare (ha) per year when wetlands are restored.[1] Additionally, limited data suggest that restored wetlands emit less methane and nitrous oxide than farmed wetlands;[4] thus reduction in trace gas emissions is an expected additional benefit of sequestering GHGs.

## What Will Be Done?

As part of the PCOR Partnership, USGS and DUC are developing a database to project the potential of wetlands in the glaciated Prairie Pothole Region (PPR) to sequester carbon. The glaciated PPR of North America is approximately 900,000 $km^2$ and includes portions of Iowa, Minnesota, North Dakota, South Dakota, Montana, Alberta, Saskatchewan, and Manitoba (Figure 1).[5,6] This region may have contained over 20 million ha of wetlands prior to European settlement.[7,8]

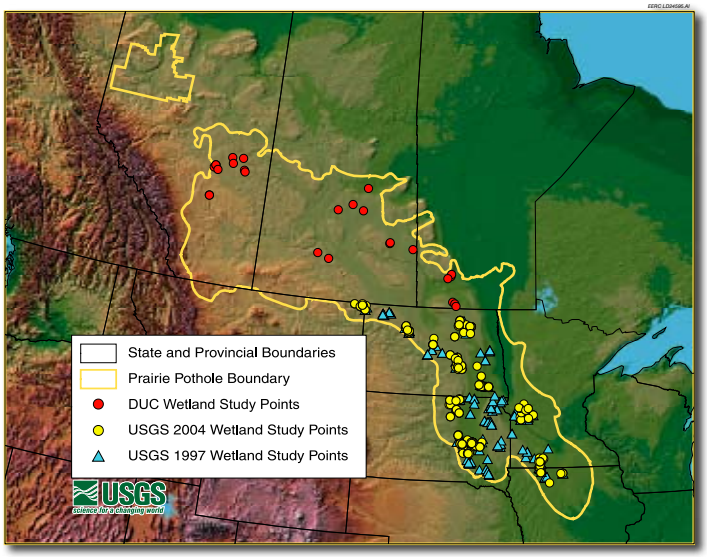


*Figure 1. Study sites in the Prairie Pothole Region.*

## How Will Projections Be Made?

USGS collected carbon sequestration data from approximately 480 wetlands in the U.S. PPR in 1997[9] and 2004,[10] and DUC collected similar data from approximately 100 wetlands in Canada during 2002–2003 (Figure 1). These data will be used to estimate existing carbon stocks and the sequestration potential from wetland restorations in both countries. Additionally, trace gas emissions from farmed wetlands and their potential offsets under restoration management will be estimated.

## What Is the Potential of Wetlands to Sequester Carbon?

Based on carbon data collected during 1997[9] and the 1997 National Resources Inventory[11] data on wetlands in cropland, over the next decade, restoration of cropland wetlands would result in the sequestration of more than 72 million metric tons of soil organic carbon in the U.S. PPR (Figure 2). This preliminary estimate is conservative and does not account for carbon stores in wetland vegetative communities or for other GHG offsets associated with reduction in methane and nitrous oxide emissions; both GHG benefits are expected to be significant.

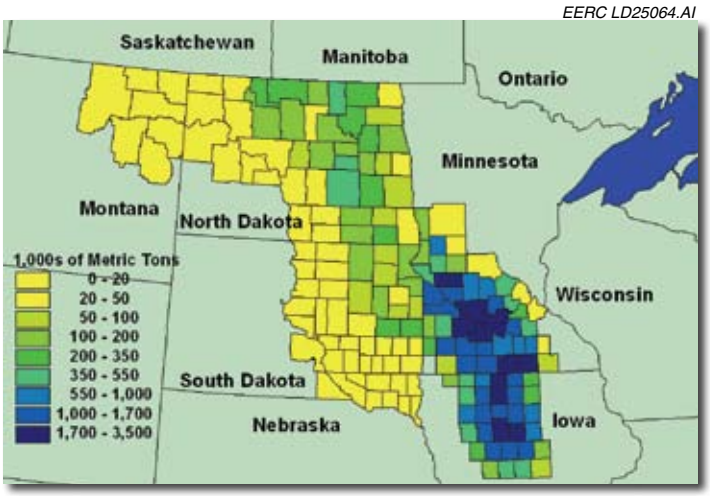


*Figure 2. Potential of wetlands to sequester carbon in the U.S. PPR.*

## Are Landowners Willing to Restore Wetlands for Carbon Sequestration?

The importance of prairie wetlands to sequester carbon is a recent development, and wetland restoration has not been targeted by industry to offset its emissions. However, numerous wetland and grassland habitats on private lands have been restored in the PPR through programs sponsored by federal, state, and private entities. The most notable restoration programs in the PPR include the U.S. Department of Agriculture Farm Bill Conservation Reserve Program and Wetlands Reserve Program, the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program, and conservation activities of DUC. Collectively, these programs have enabled restoration of >2 million ha of habitats in the U.S. PPR (Figure 3). Thus private landowners have been willing to restore wetlands and grasslands. Given proper incentive, landowners are likely to partner with industry to offset GHG emissions.

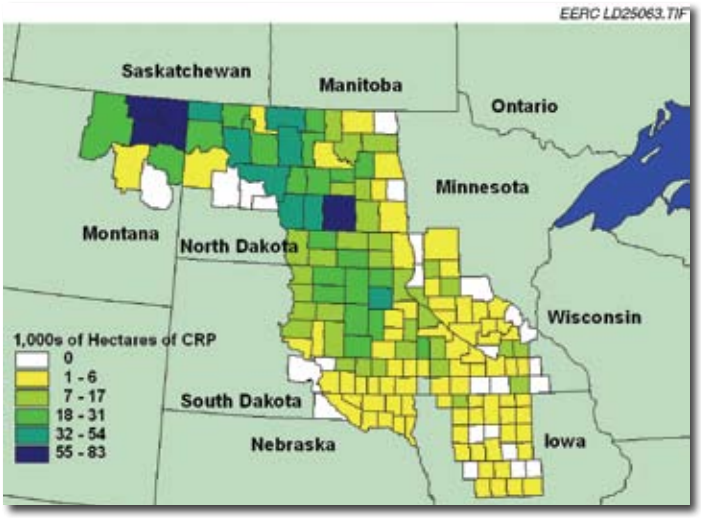


*Figure 3. Hectares of land enrolled in Conservation Reserve Program in 1997 by county in the U.S. PPR.*[11]

## What's next?

USGS, DUC, and the PCOR Partnership will continue to develop and refine the database for estimating the potential of prairie wetlands to sequester carbon. However, research is needed to quantify methane and nitrous oxide flux from wetlands. Methane and nitrous oxide are very potent GHGs with global warming potentials of 21 and 310 (i.e., $CO_2$ equivalents), respectively.[12] Hence, future work will focus on understanding how land use affects processes linked to emission of methane and nitrous oxide in wetlands.

## References and Notes

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The Plains $CO_2$ Reduction (PCOR) Partnership is a group of public and private sector stakeholders working together to better understand the technical and economic feasibility of sequestering $CO_2$ emissions from stationary sources in the central interior of North America. The PCOR Partnership is managed by the Energy & Environmental Research Center (EERC) at the University of North Dakota and is one of seven regional partnerships under the U.S. Department of Energy's National Energy Technology Laboratory Regional Carbon Sequestration Partnership Initiative. To learn more, contact:

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