

# From Prairie to Market: TERRESTRIAL CARBON SEQUESTRATION



With increasing levels of greenhouse gases (GHGs) in the atmosphere and concerns over their effects on climate and weather, a momentous surge in interest in the various methods of carbon sequestration is occurring. Terrestrial carbon sequestration, if done properly, can offer an immediate response to the threat of global climate change, while other methods (i.e., geologic sequestration) are further refined and proven. Terrestrial sequestration involves the process of removing carbon dioxide (CO<sub>2</sub>) from the air and storing it in biomass and soils.

As part of the Energy & Environmental Research Center (EERC) Plains CO<sub>2</sub> Reduction (PCOR) Partnership Program, Ducks Unlimited, Inc.; the U.S. Geological Survey Northern Prairie Wildlife Research Center; and North Dakota State University are currently demonstrating optimal practices for sequestering CO<sub>2</sub> in native, restored, and cropland wetlands and surrounding grasslands at multiple sites located in the Prairie Pothole Region (PPR) of North America. Project results have supported the development of protocols for terrestrial carbon credit trading with the launch of the Ducks Unlimited Carbon Credit Program and are intended to serve as a model to promote and implement terrestrial sequestration across the PPR.

## Demonstration

As part of this project, PCOR Partnership partners sampled grasslands and wetlands throughout Montana, North and South Dakota, Minnesota, and Iowa. In an effort to realize the true net carbon benefit, samples were collected not only to determine carbon uptake and storage, but also to quantify methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) gas flux.

Few, if any, attempts have been made to evaluate the effects of specific land management practices (e.g., grazing, haying, restoration) on the global warming potential (GWP) of all major GHGs (i.e., CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) simultaneously with carbon sequestration potential in both wetlands and associated upland catchments in the PPR. Work conducted (monitoring of GHG emissions from native [grazed and nongrazed] and restored [hayed and nonhayed] wetland catchments) addressed these needs.

## Carbon to Market

The efforts of the terrestrial field validation test provided the research and data to give landowners a revenue stream novel to the agricultural economy of the plains — sequestered carbon. Through the aforementioned Ducks Unlimited Carbon Credit Program, landowners sign perpetual grassland easements while, at the same time, conveying carbon rights to be bundled and sold on the open market. Initial sample results from this project have provided the “science” needed for aggregators and investors to advance and prosper in this rapidly emerging market.

Carbon sequestration is a winning opportunity for all. Landowners have the opportunity to generate income by implementing land use best management practices (BMPs); industry receives carbon offsets for meeting an environmental challenge; and the general public gets cleaner air and water, flood protection, and more wildlife habitat.

## Project Goal

- To develop the technical capacity to systematically identify, develop, and apply alternate land use management practices to the prairie pothole ecosystem (at both a local and regional scale) that will result in carbon sequestration and provide the scientific underpinnings that may lead to the monetization of carbon offsets.

## Objectives

- Emission offsets achieved by defining BMPs for sequestering carbon and reducing GHGs in restored wetland/grassland complexes.
- Assessments of both the socioeconomic and physical/chemical environment.



## Sampling Efforts

- Soil samples were collected on 13,970 acres of native grassland, restored grassland, and cropland to date (2794 soil samples collected). Sample sites are located in North and South Dakota, Montana, Iowa, and Minnesota.
- Gas emissions were collected from 17 wetlands in north-central South Dakota on a biweekly basis (11,625 individual gas flux samples collected).
- An economic model is being constructed to examine land units affected by various wetland restoration actions.

## Terrestrial Path Forward

- The development of process-based biogeochemical models that can be used to forecast the influence of climate and land use change scenarios on GWP and associated ecosystem services.
- Improved monitoring, mitigation, and verification (MMV) systems, methods, and protocols. This will include the refinement of direct measurement technologies for critical GHGs and address leakage concerns.
- Carbon market policy and protocol development that improve the recognition and marketability of prairie grassland carbon credits in voluntary and future regulated markets in the United States.



Enhancing the natural processes that remove CO<sub>2</sub> from the atmosphere is thought to be one of the most cost-effective means of reducing atmospheric levels of CO<sub>2</sub>.

Prairie Pothole Region



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