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Conservation Effects Assessment Project

Key Findings from CEAP-Wetlands Regional Assessments: Mitigating Greenhouse Gas Emissions in the Great Plains

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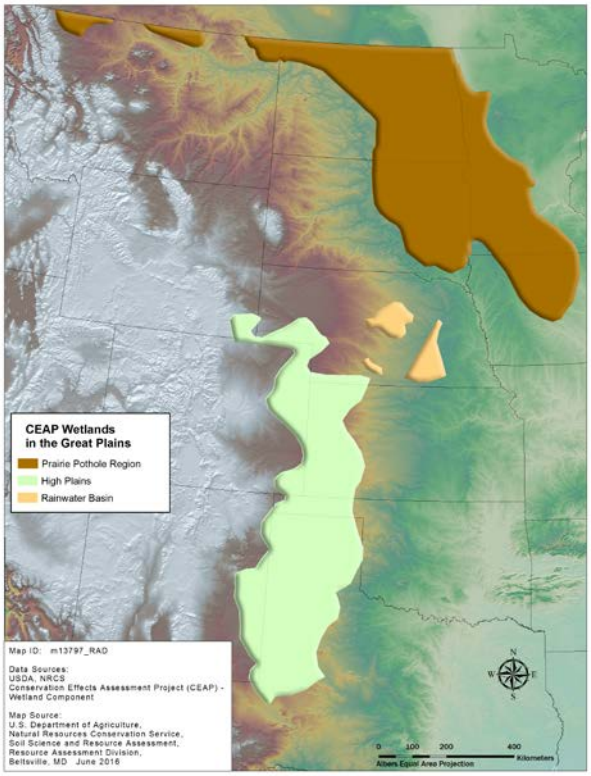
Voluntary, Incentives-Based Conservation Influences Greenhouse Gas Emissions and Carbon Sequestration in the Great Plains. Studies of greenhouse gas emissions and soil organic carbon storage were conducted on playa wetlands in the Rainwater Basin and western High Plains of Nebraska, as well as on prairie pothole wetlands in the Dakotas, Minnesota, and Iowa. The Wetlands Reserve Program (WRP; currently Agricultural Conservation Easements Program – Wetlands Reserve Easements, ACEP - WRE) is the principal USDA conservation program affecting wetlands in the Rainwater Basin, and the Conservation Reserve Program (CRP) is the dominant program in the western High Plains. While the CRP is the dominant conservation program in the Prairie Pothole Region, WRP is also significant and growing in its regional influence. Here we highlight key results of research conducted by the CEAP-Wetlands High Plains and Prairie Potholes Regional Assessments related to these two USDA conservation programs and their effects on wetland greenhouse gas emissions and carbon sequestration in the Great Plains.

Figure 1. Work described in this summary was conducted in the High Plains and Prairie Pothole regions (see map on right) as part of CEAP-Wetlands Regional Assessments. The High Plains assessments of greenhouse gases and soil organic carbon were conducted in the Rainwater Basin and western High Plains of Nebraska. The Prairie Pothole Region assessments were conducted in North Dakota, South Dakota, Minnesota, and Iowa.



The Rainwater Basins and WRP

- Most WRP projects in the Rainwater Basin involve sediment removal from playas and restoring some amount of adjacent watersheds.
- Net CO_2-equiv emissions are about 25% lower in WRP playas and uplands than in cropland playas and uplands.
- Removing 6–12 inches of sediments from playas also removes accumulated nutrients and plant material, resulting in 29% lower surface carbon and nitrogen levels. However, on an area basis, restored WRP playas have similar carbon levels beneath the surface compared to carbon levels of playas in cropland and or in the reference condition, indicating sediment removal does not have a negative impact on carbon sequestration.
- A suite of ecosystem services can be improved, beyond the benefits seen for climate change mitigation alone, by removing accumulated eroded sediments from wetlands. These include increased floodwater storage, biodiversity benefits, and contaminant mitigation.
- Soil organic carbon is about 20% higher in playas than in adjacent watersheds, demonstrating the importance of wetlands to carbon sequestration in the agricultural landscape.

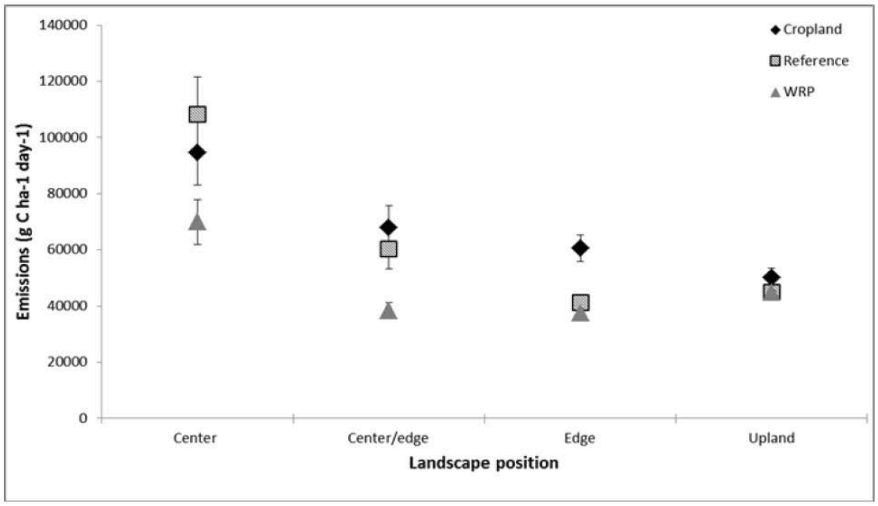


Figure 2. Mean (±SE) net CO2-equiv emissions (g C ha-1 day-1) for playas and adjacent uplands in the Rainwater Basin of Nebraska. Playas were sampled at their center, mid-distance between the center and wetland edge, and at the wetland edge.

The Western High Plains and CRP

- Most CRP projects in the Western High Plains do not occur in the wetland but in the catchment or immediate adjacent watershed. These projects usually involved planting exotic grasses on highly erodible croplands.
- Net CO_2-equiv emissions were 30 to 40% lower in playas embedded in CRP versus those in cropland or native grassland. However, there were no differences in emissions from the corresponding adjacent uplands among the three land-use types.
- Dense exotic grasses planted in uplands surrounding playas decrease water runoff and frequency of playa inundation by about 50%, resulting in lower CH_4 and N_2O emissions. CRP land also sequesters 15 to 20% more soil carbon than cropland.
- There are CRP benefit tradeoffs to climate mitigation, floodwater storage, and contaminant amelioration in that the playas in CRP grasslands are inundated less frequently, decreasing biodiversity metrics. Planting grasses native to the region rather than exotics should improve the suite of all services.

The Prairie Pothole Region

- Carbon dioxide is released to the atmosphere when relatively undisturbed wetland catchments in the Prairie Pothole Region are converted to agricultural crop production. Conversely, when perennial cover is reestablished, CO_2 is removed from the atmosphere and sequestered as organic carbon in the soils and vegetation.
- Upland and wetland perennial cover established under the CRP in the U.S. Prairie Pothole Region sequesters approximately 11 million Megagrams of organic carbon. This organic carbon, if instead released into the atmosphere as CO_2, would have estimated societal costs in excess of $1.8 billion.
- CRP and WRP plantings also have reduced nitrogen inputs, resulting in decreased N_20 emissions from pothole wetlands and their surrounding catchment areas.
- Prairie pothole wetlands can be significant sources of CH_4 emissions (up to 3.9 g m^{-2} day^{-1}), which increase when drains are plugged to restore wetland hydrology.
- While increased CH_4 emissions from restored pothole wetlands may partially offset climate benefits of carbon sequestration and reduced N_2O emissions, the degree of the offset is variable and sometimes nonexistent.
- Habitat improvement and enhancement of other ecosystem services are additional benefits associated with wetland and grassland restoration practices of the CRP and WRP.