Outline

- Background on carbon offsets
- Analysis based upon peer-reviewed data
- Quantification estimates
- Gaps and research needs
What is an Offset?

- An offset represents a reduction, avoidance, or removal of one metric ton of carbon dioxide equivalent emissions resulting from a specific project activity that is used to compensate for an equivalent emission occurring elsewhere.
Offset Criteria

- **Real**
  - It can be accurately measured
  - Can be accomplished without “leakage”

- **Permanent**
  - Will retain stored carbon for the life of the project.

- **Additional,**
  - Occurs outside a regulatory requirement
  - Would not have occurred but for the incentive provided by a GHG market

- **Verifiable**
  - It can be independently verified

- **Enforceable**
  - Its ownership is undisputed
  - No double counting
Terminology

- **Carbon Sequestration** – The removal of atmospheric CO$_2$ to mitigate CO$_2$ released during a project activity elsewhere (fossil fuels).

- **Terrestrial sequestration** – Capturing and storing carbon in plant and soil structures by modifying the management of forests, rangelands, agriculture lands and wetlands to either remove more CO$_2$ from the air or reduce CO$_2$ emissions from these ecosystems.
Louisiana Wetlands Are Unique!

- Coastal wetland (marsh and swamp) restoration provides the greatest potential for carbon offset opportunities.
- Enhanced carbon sequestration is associated with wetland restoration.
- Enhanced above ground biomass (swamps) and greater root production.
- Enhanced organic soil formation below ground.
Louisiana Wetlands Are Unique!

- The Mississippi delta naturally subsides.
- This is compensated by new sediment and organic matter accumulation.
- The result is carbon burial.
- Oxidation of wetland soils during wetland loss releases the carbon stored in soil organic matter.
Carbon Pools in Wetlands

1. Trees
2. Herbaceous vegetation
3. Forest floor litter
4. Dead wood
5. Soil

Sequestration Range:
0.8 – 26 tons CO2e/ac/yr

Emissions During Loss:
206 tons CO2e/ac/yr
(top 50 cm of wetland soil horizon)
Enhanced Accretion

Accretion (mm)

Year

Effluent application begins in the treatment site

Feldspar marker placed on the forest surface in all three sites

Control site

Ridgesite

(Rybczyk et al. 2002)
Wetland Restoration for Carbon Credits

- How much carbon is sequestered by wetlands?
- Timeframe?
- Emissions from wetland loss?
- Analysis based on peer-reviewed literature.
- 50 year timeframe.
Four Scenarios

- Central Wetland Unit Wetland Assimilation
- Caernarvon River Diversion
- Hypothetical Large Scale Diversion
  - Current submergence rate
  - Climate change submergence rate
- Various Rates of Wetland Loss
Primary Carbon Mechanisms

- C emitted during wetland loss
  - 13,911 g C/m² in the top 50cm of soil
    - 75% and 50% oxidation
- Burial = organic soil formation (roots)
  - 150 g C/m²yr⁻¹ and 450 g C/m²yr⁻¹
- Biosequestration = above ground wood
  - 750 g C/m²yr⁻¹
Cypress Restoration of Bayou
Bienvenue Central Wetland Unit
WETLAND ASSIMILATION

Sequestration rate = prevented wetland loss and planted cypress

22 tons CO2e/ac/yr

Central Wetland Unit 30,000 acres over 50 years

32,951,000-34,468,000 tons CO2e

Annual emissions of six million cars
Coastal Louisiana has lost an average of 34 square miles of land, primarily marsh, per year for the last 50 years. From 1932 to 2000, coastal Louisiana lost 1,900 square miles of land, roughly an area the size of the state of Delaware. If nothing more is done to stop this land loss, Louisiana could potentially lose approximately 700 additional square miles of land, or an area about equal to the size of the greater Washington D.C.-Baltimore area, in the next 50 years.

Data Sources:
1932-1946 Land Change Analysis
U.S. Army Corps of Engineers, New Orleans
1956-1968 Land Change Analysis
1973-2000 Land Change Analysis
U.S. Department of the Interior
U.S. Geological Survey
National Oceanic and Atmospheric Administration Research Center
Lafayette, LA
Prepared by:
U.S. Department of the Interior
U.S. Geological Survey
National Oceanic and Atmospheric Administration Research Center
Lafayette, LA
Map ID: USGS-NWRC-2005-18-0001
Map Date: December 9, 2004

For more information about the land loss analysis or to see an animated time series of wetland change, visit www.LaCoast.gov/LandLoss
LOUISIANA WETLAND LOSS

Carbon oxidized during wetland loss and lost degraded carbon sequestration capacity

1900 square miles 1932-2000

282 million tons of CO2e

24 square miles continue to be lost each year
700 square miles of marsh loss by 2050

91 million tons of CO2e
Wetlands and Climate Change

Wetland restoration measures that help wetlands to accrete at a rate to counter submergence due to sea level rise and subsidence will have increased rates of carbon sequestration.
Assumptions

- Extrapolations from peer reviewed studies
- CH₄ and N₂O have not been included in the model yet.
- Carbon sequestration is highly dependent upon the health and productivity of the wetland!
- Each site is specific and will require testing.
Other Greenhouse Gases

- The generation of methane and nitrous oxide can offset benefits (23 times and 310 times more powerful than carbon dioxide).
- The proportional release is variable and dependent upon many factors.
- Monitoring is required to quantify other GHG above background.
- Wetland restoration projects can be operated in a way that minimizes methane and nitrous oxide.
Features That Can be Controlled to Maximize Benefits

- Water levels
- Salinity (sulfate)
- Pulsing
- Nutrient form and loading rates
- Tree or plant species
- Available iron (precipitates sulfides and reduce $N_2O$) (River and ferrate disinfection)
- Nutria control
Value of Carbon Credits

- US 2-6 dollars per ton 2010-2015
- Up to 30 dollars a ton by 2020 (legislation)
- Central Wetland Unit Value Over 50 Years
  - 34,000,000 tons CO2e
  - 68-200 Million Current Market
  - 1 Billion Potential Market
- Other GHGs?
FUTURE SCIENCE NEEDS

Explain carbon pool interactions.

Quantify carbon mechanisms in wetlands.

Quantify the generation of other GHG.

Quantify avoided release due to alternative management strategies.

Fate and transport of C during wetland loss

Pulsing regimes

Chemical form of the nutrient

Loading rate

Salinity (sulfate)
CHALLENGES

Wetland offsets are not official: Wetlands restoration activities alone are not considered as an option for carbon offsets in domestic or international mitigation regimes. No existing protocols or “route to market”.

Barriers to entry:

- Regulatory in nature
- Psychological: land use based carbon sequestration perceived as not permanent
- Scientific: science to support the volume of carbon sequestered is limited.
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