**GASEOUS CARBON EMISSIONS (METHANE AND CARBON DIOXIDE) FROM WETLAND SOILS IN A RE-CREATED EVERGLADES LANDSCAPE**

Bradley R. Schonhoff1,2, Leonard J. Scinto1,2, Alexandra Serna2,3, Eric Cline3, Thomas Dreschel3, and Fred Sklar3

1Southeast Environmental Research Center, Florida International University, Miami, FL
2Department of Earth & Environment, Florida International University, Miami, FL
3South Florida Water Management District, Everglades Systems Assessment Section, West Palm Beach, FL

---

**Carbon, Climate Change, and the Florida Everglades**
- Increasing methane (CH₄) and carbon dioxide (CO₂) emissions represent a global environmental issue.
- Wetlands (especially peatlands) are recognized as important components in the global carbon cycle, for both sequestration and emission potential.
- Over the last 130 years, land development and agriculture have severely impacted the Everglades.
- As part of restoration efforts, increasing water inputs to Everglades soils can stall decomposition and reduce CO₂ emissions, but increase CH₄ emissions.

**Greenhouse Gases (GHGs) and Global Warming Potential (GWP)**
- Trapped solar radiation in atmosphere has a warming effect on the planet.
- Recent increases in the atmospheric concentrations of both CO₂ and CH₄ (linked to industrial revolution)

**LIFETIME AND GLOBAL WARMING POTENTIAL OF HUMAN-GENERATED GREENHOUSE GASES**

**Objectives**
- To quantify emission rates for CH₄ and CO₂ under prolonged wet and dry conditions in a recreated, peat-based Everglades wetland with varying topographic features; tree island, ridge and slough.
- To determine the effects of water levels and elevation on overall CH₄ and CO₂ emissions.
- To compare CO₂/CH₄ emission ratios across five main Everglades landscape components.

**Hypotheses**
- Areas of lower elevation – and therefore higher water levels over longer periods – were predicted to exhibit the highest concentrations of CH₄ (as anaerobic conditions lead to CH₄ production).
- The highest CO₂ concentrations were expected to occur at the highest elevations, which experience the least flooding (and the greatest exposure).
- CO₂/CH₄ ratios were likewise hypothesized to be highest at higher elevations.

---

**Study Site**
- Large-scale physical model
- Elevation gradient important for flooding, and CH₄ production

---

**Discussion**
- Flooding influenced the production of both CH₄ and CO₂ in this re-created Everglades landscape.
- Significant differences were found primarily between the two end-points along the elevation gradient; between the Tree Island Head High and the Deep Slough sites (Figure 3).
- Flooding and drying had an inverse relationship with average CO₂ efflux rates (Figure 6).
- Stage (water levels), inundation (depth of flooding), and Days Flooded correlated as expected with Redox Potentials, CH₄ and CO₂ concentrations, and CO₂/CH₄ ratios (Figure 7).
- The average CO₂/CH₄ ratio across all sites within a macrocosm: 22 (mol:mol). Given the GWP of each GHG, CH₄ had a disproportionally greater impact than CO₂ for at least a 100-year span.
- Water management in wetlands should therefore consider the disproportionate GHG effect of CH₄ compared to CO₂ in these areas.
- Future study of carbon inputs would give a sense of the overall carbon balance of the system.

---

**RESULTS**

**Fig. 1. LILA Hydrograph with Sampling Events**

**Fig. 2. Cross-section of LILA macrocosm with pore-water sippers installed**

**Fig. 3: CH₄ Concentrations Across Sites**

**Fig. 4: CO₂ Concentrations Across Sites**

**Fig. 5: CH₄/CO₂ Ratios, with GWP markers**

**Fig. 6: Average CO₂ Efflux Rates (LICOR)**

**Fig. 7: Statistical Correlations**

---

**REFERENCES**