USGS
science for a changing world

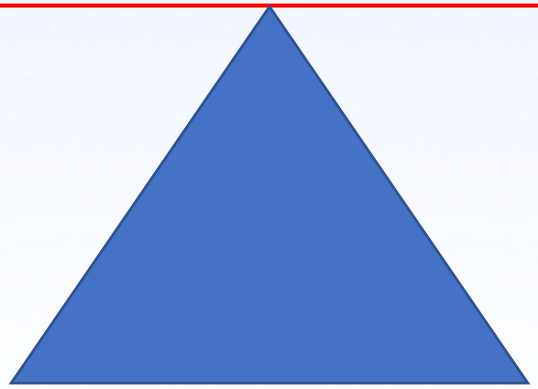
# Tidally-restricted coastal wetlands as a hotspot for carbon dioxide and methane emissions, and as a potent and untapped opportunity for anthropogenic emissions reductions

Kevin D. Kroeger, Steve Crooks, Serena Moseman-Valtierra, Jianwu Tang

photo: S. Baldwin

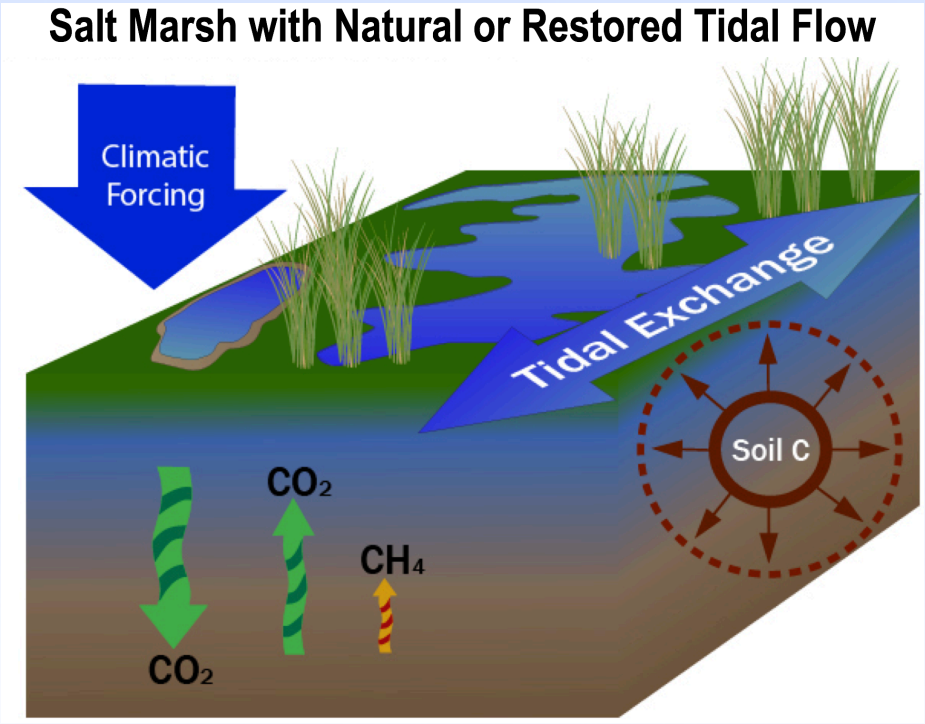
## Bottom line, provocative conclusions:

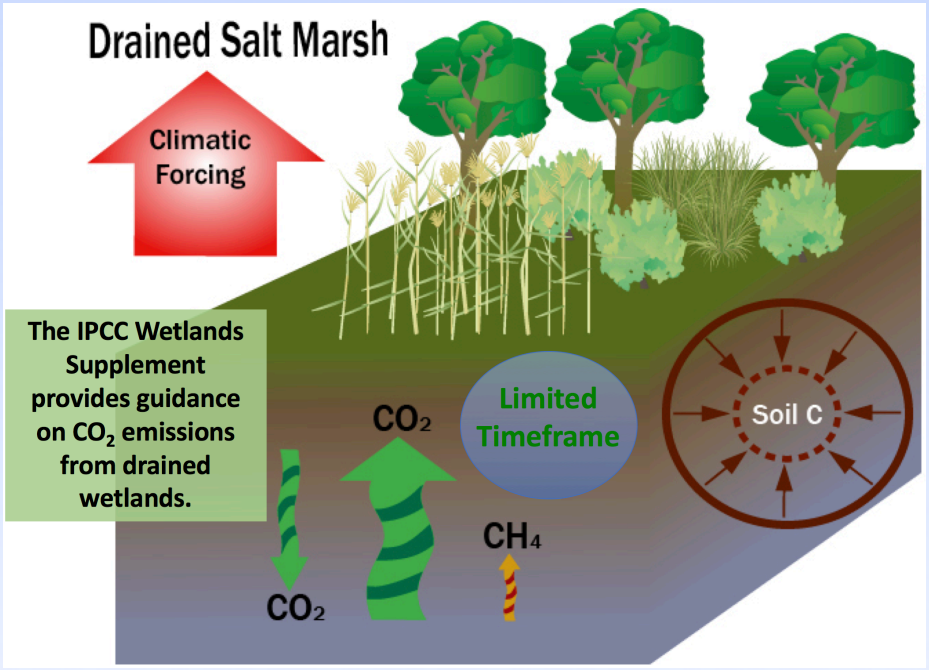
- For several centuries it has been widespread practice to both impound and drain coastal wetlands.
- Those altered wetlands produce substantial $CH_4$ and $CO_2$ emissions, equivalent to emissions from millions of automobiles.
- At present, there are no incentives to reduce those emissions, and so the situation is analogous to setting thousands of fires, allowing them to burn for decades to centuries, and then ignoring them in our attempts to reduce emissions.
- Inventorying the emissions and crediting reduction in the emissions can incentivize a new and potent form of blue carbon.

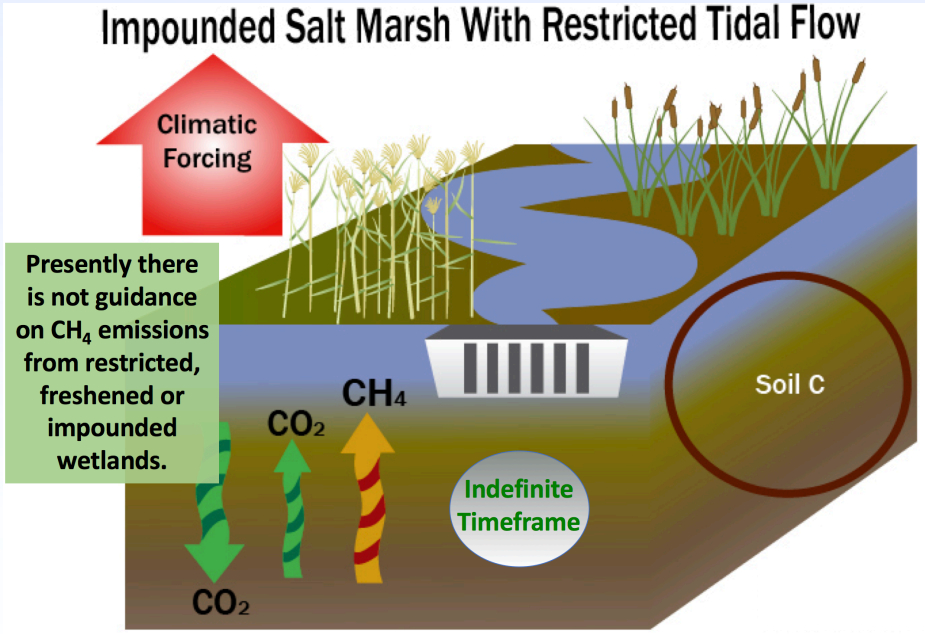


The Rest of the Story

**In many cases tidal restriction will enhance either $CO_2$ or $CH_4$ emissions, and will reverse the radiative forcing from net cooling to net warming.**



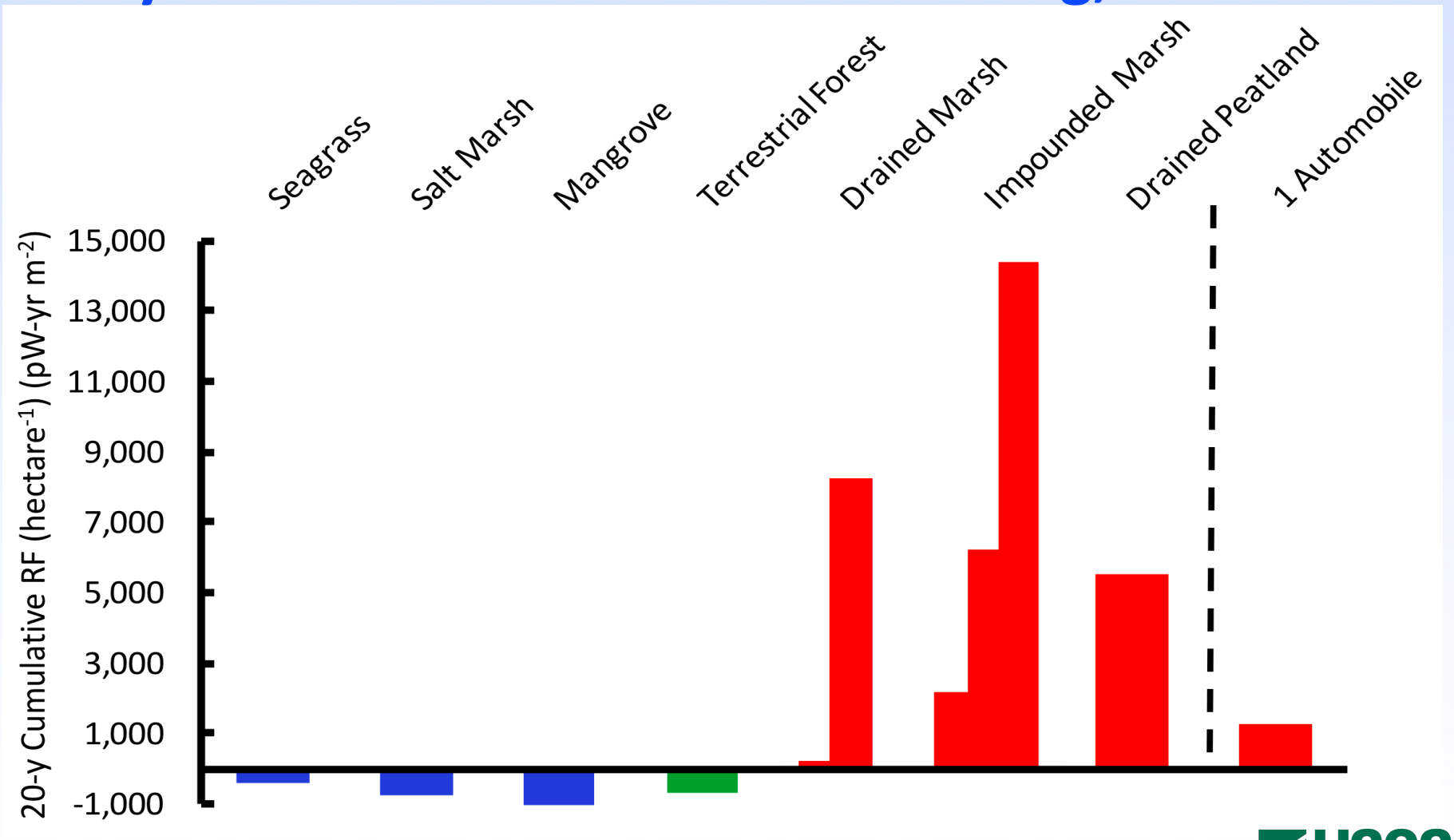




**Tidal restoration has the potential to reduce those anthropogenic emissions.**

Kroeger, et al. in review; Graphics, Jennifer O'Keefe Suttles

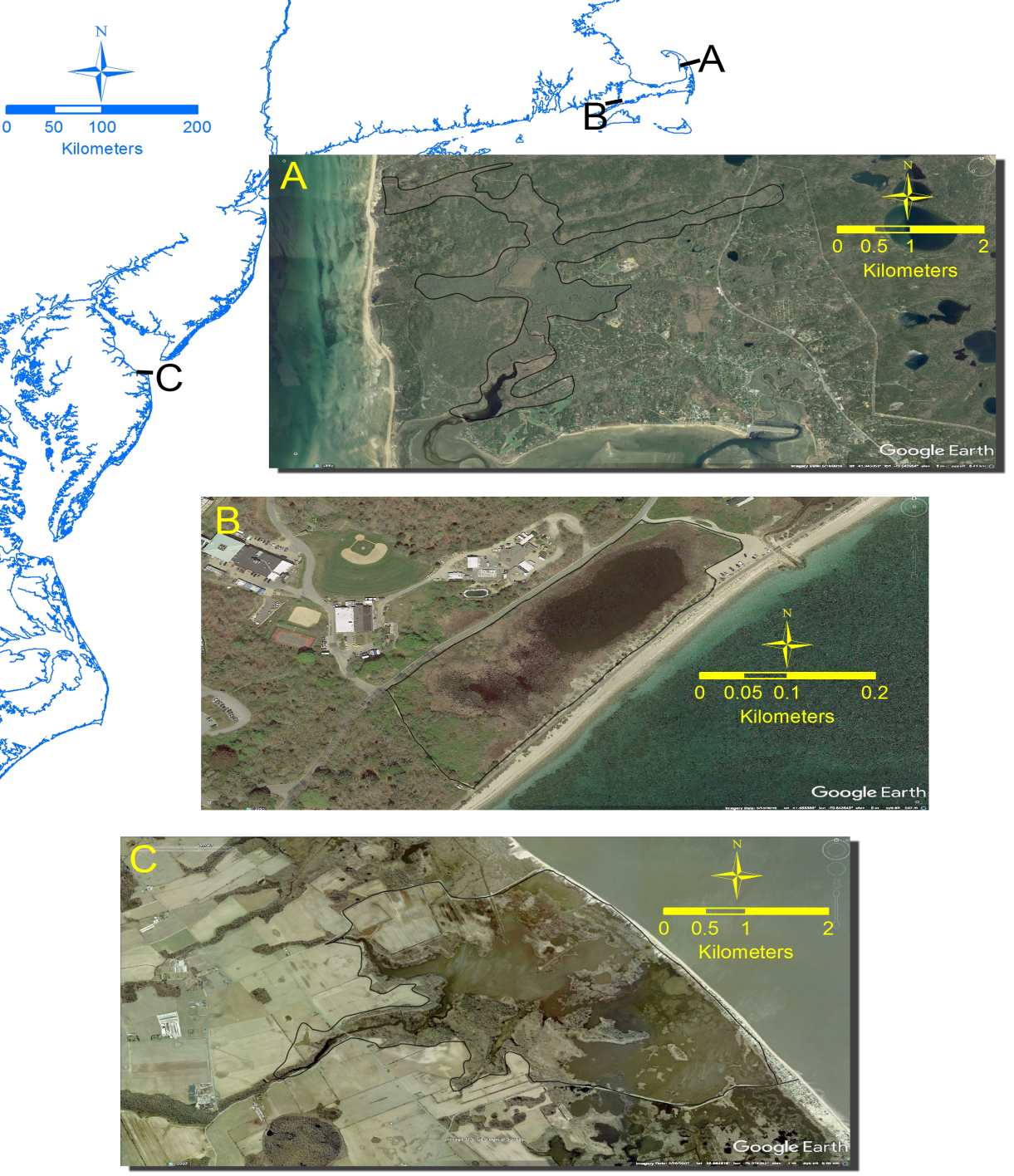
# Are the enhanced emissions in tidally-restricted wetlands significant?

## 20-year Cumulative Radiative Forcing, Tier 1 EF




Kroeger et al. In Review

USGS
science for a changing world




# Geography

**Features are difficult to quantify. Are spatially extensive, generally not mapped, and often no longer recognized as former salt marsh.**

**Examples:**

**A. Herring River, NPS ~400 hectares**

**B. Woods Hole pond**

**C. Prime Hook NWR ~1600 hectares**

Kroeger et al. In Review
Figure, Sandra Brosnahan

- ~2,700 $km^2$ impounded, freshened wetland on US Atlantic coast
- 28,000 to 145,000 tonnes enhanced $CH_4$ emissions per year
- Over a 20 yr period, radiative forcing equivalent to 20 yrs emissions from 0.6 to 3.1 M automobiles
- Significant potential for emissions reductions
- Working to include in the Inventory of US GHG Emissions and Sinks and on C market feasibility

| Location | Tidal Wetland in Study Area ($km^2$) | Wetland Area Affected ($km^2$) | Fraction of wetland area affected (%) |
|---|---|---|---|
| **Transportation-Related Restrictions:** | | | |
| Southern Maine[24] | 32 | 9 | 28 |
| New Hampshire[24] | 26 | 5 | 20 |
| Massachusetts[46] | 212 | 58 | 27 |
| North Shore[47] | 113 | 6 | 5 |
| Cape Cod[48] | 70 | 20 | 28 |
| Buzzards Bay[49] | | 33 | |
| Rhode Island[52] | 16 | 11 | 70 |
| Total Transportation | 286 | 84 | 29 |
| **Diked and Impounded for Waterfowl or Mosquito Management:** | | | |
| N. Carolina[9] | 643 | 21 | 3 |
| S. Carolina[9] | 2,041 | 285 | 14 |
| Georgia[9] | 1,590 | 32 | 2 |
| Florida (Atlantic)[9] | 778 | 143 | 18 |
| Total Diked | 5,053 | 482 | 10 |
| Total impounded tidal wetlands U.S. Atlantic coast, Transportation + Diked | 9,710[10] | 3,787 | 39 |
| **Total area impounded and freshened:** | | | |
| U.S. Atlantic coast | 9,710 | 2,650 | 27 |