**Spatial and temporal variability in methane and carbon dioxide exchange at three coastal marshes along a salinity gradient in a northern Gulf of Mexico estuary**

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**Plan I Master's Defense**
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**Location: Shelby 1093**

Carbon fluxes in tidal marshes vary spatially and temporally because of vegetation cover, subsurface biogeochemical processes, and environmental forcing. The objective of this study was to examine how ecosystem carbon exchange changes along an estuarine gradient. I measured greenhouse gas fluxes ($CO_2$ and $CH_4$) from three marshes along a salinity gradient (0-32 ppt) in the Mobile Bay estuary, Alabama, USA. $CH_4$ flux ranged from 14.9 to 28.5 mg C $m^{-2}$ $d^{-1}$ with no significant differences across sites. Soil temperature and dissolved inorganic nitrate and nitrite, not salinity, were correlated to $CH_4$ flux. Midday net ecosystem exchange indicated each marsh acted as a $CO_2$ sink and with the greatest flux at the most fresh site (-5.0 ± 0.4 g C $m^{-2}$ $d^{-1}$), followed by the saline (-2.9 ± 1.1 g C $m^{-2}$ $d^{-1}$) and brackish (-1.4 ± 0.6 g C $m^{-2}$ $d^{-1}$) sites. However, net ecosystem exchange integrated over a diurnal time period revealed each marsh to be a net $CO_2$ source as a result of high ecosystem respiration with no difference across the fresh (1.4 ± 0.2 g C $m^{-2}$ $d^{-1}$), brackish (1.2 ± 0.2 g C $m^{-2}$ $d^{-1}$), and salt marsh (0.9 ± 0.3 g C $m^{-2}$ $d^{-1}$) sites. The extent to which sedimentation from tidal deposition contributes to carbon input to these ecosystems remains unknown, but, over long time periods, it must balance the carbon losses measured over the study period. Without this subsidy, marshes in the study area will not be able to keep up with sea level rise.