ABSTRACT OF THE DISSERTATION

Controls affecting methane fluxes in restored and natural tidal wetlands

By RAJAN TRIPATHEE

Dissertation Director:

Karina V.R. Schäfer

Natural wetlands emit one third of global methane (CH_4), the second most important greenhouse gas after carbon dioxide (CO_2). However, there is a huge uncertainty about regional and global methane (CH_4) emission estimates, because of the estimation of CH_4 emissions for large areas based on the CH_4 flux measurement made in highly heterogeneous, poorly mapped small areas. But, within a small area of wetland, there can be a huge spatial variation in CH4 flux due to spatial heterogeneity. Therefore, for better understanding of CH_4 dynamics of a wetland, CH_4 flux measurement should be made in a variety of microsites of a wetland covering different scales, vegetation and covering the heterogeneity of the sites. Our two-year CH_4 flux measurements from two microsites from each of three wetlands of New Jersey Meadowlands will help to refine CH_4 budget of low salinity marshes, which have a large uncertainty about their CH_4 budget. The annual CH_4 flux in a restored high marsh site varied from 1.8 (*Spartina patens* marsh) - 26.6 (*Phragmites australis* marsh) g CH_4 m^{-2} yr^{-1}. The *S. alterniflora* marsh and mud flat area of another restored low marsh, emitted 15.6 and 7.5 g CH_4 m^{-2} yr^{-1}, respectively. The annual emission of CH_4 for a *S. patens* marsh and a *P. australis* marsh at a natural high marsh site were 2.7 and 12.6 g CH_4 m^{-2} yr^{-1}, respectively. We also investigated relationships between CH_4 flux and various physical factors including air and soil temperature, net radiation, and vapor pressure deficit (VPD). Presence of most of the belowground biomasses close to the soil surface suggests that most of the effect of belowground biomass on CH_4 dynamics occurs close to soil and atmosphere interface. Investigations of belowground biomass distribution, root and rhizome characteristics as well as leaf area index (LAI), in this study aid modeling CH_4 and other greenhouse gas transport. There was higher CH_4 emission during incoming tide than in outgoing tide in a mud flat microsite, however, we did not find a relationship between tidal water depth difference and CH_4 flux in vegetated areas. The weak, but positive relationship between CH_4 flux and VPD in vegetated areas suggest stomatal control on CH_4 flux.