The relationships among biogeochemical properties, nitrification, and associated microbial assemblage composition of Santa Fe river tributary sediments

Haryun Kim, Andrew Ogram and Ramesh Reddy

Tributary sediments are transitional gradients between terrestrial and aquatic ecosystems, and thus may exert environmental controls over microbial community structure and functions. Agricultural activities and vegetation types can affect the environmental characteristics controlling the microbial assemblage compositions in tributary ecosystems, which in turn could impact microbial function in various ecosystems. Therefore, our research investigated the relationships among biogeochemical properties determined by agricultural activities and vegetation types, nitrification activity, and *Archaeal amoA* nitrifier assemblage compositions in tributary sediments using *Archaeal amoA* functional gene sequence analysis. Tributary sediments affected by N fertilization and woody plants exhibited a lower pH than tributary sediments affected by ranch activity and herbaceous plants. A positive relationship between diversity indices for *Archaeal amoA* nitrifiers (Simpson, Shannon and Cho1 indices) and pH (regression analysis, $p<0.05$) was observed, and was likely due to increased competition in the low pH system. Mantel tests suggested that pH was a significant factor affecting microbial assemblage structure for *Archaeal amoA* nitrifiers (Mantel $r=0.53$, $p=0.028$). The system with the less diverse *Archaeal amoA* exhibited decreased nitrification activity. This may indicate that low pH selects for an exclusive group of nitrifiers, which reduced *Archaeal Amoa* nitrifier diversity, resulting in a decrease in nitrification activities. Therefore, tributary sediments whose pH is affected by agricultural activity and vegetation types could influence the community assemblage of *archaeal amoA* nitrifiers, resulting in a change in nitrification activity in tributary sediments.