Understanding Dynamics of Microbial Contaminant Fate and Transport in Rural and Agricultural Lands

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Justification:
Estuarine and coastal water of North Carolina (NC) are adversely impacted by non-point source runoff, with astounding rates of loading of fecal indicator bacteria (FIB) of 10^{+11} *Enterococcus* or *E. coli* per average 24 hour storm from both residential and agricultural lands. The NPS runoff causes thousands of acres of shellfish beds and beach areas to be closed annually due to elevated levels of routinely monitored FIB. The mechanisms of delivery and fate and transport characteristics of fecal contamination, however, are poorly studied.

Objectives:
The objective of this research is to enhance the current understanding of the complex microbial contaminant fate and transport in storm water runoff in two similar watersheds with contrasting land use in Eastern NC. The microbial contaminant signature in each watershed will be characterized using conventional (e.g. FIB) and novel (e.g. *Bacteroides spp*.) indicators and fate and transport studies will be conducted during a range of storm events. Sources will be identified and mapped through a watershed assessment, and relative contributions to fecal loading will be made, with particular focus on contributions from onsite wastewater treatment systems vs. agricultural lands.

Progress to date:
In the Newport River Estuary in Eastern NC, which has been placed on the EPA's 303(d) list for exceeding the fecal coliform limit required for high priority shellfish harvesting waters, two watersheds have been identified. The main land uses in the Ware Creek watershed are residential (>100 homes utilizing onsite wastewater treatment systems) and agricultural (row-crop farm). In contrast, the main land uses in the Oyster Creek watershed are managed forestland and agriculture, with a small amount of residential development. Four sampling locations in an upstream to downstream transect along each creek have been selected, and initial sampling in Ware Creek found *E. coli* and *Enterococcus* concentrations up to 3.30×10^3 and 6.58×10^3 MPN/100 mL, respectively, and storm loading of 1.50×10^5 and 1.35×10^5 MPN/100 mL/10 minutes, respectively.

Impacts:
The results will be disseminated through peer-reviewed publications and a workshop at a national conference. Training and education materials will be developed for local government officials, planners, and watershed managers to aid in applying Best Management Practices for the reduction of fecal contamination in estuarine environments.