

Title: Microbial indices of soils and water associated with vegetated treatment areas (VTAs) from five animal feeding operations (AFOs) in South Dakota

Project Type: Research

Focus Categories: a. Water quality
b. Surface water
c. Wastewater

Research Category: Water Quality

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Principal Investigators:

Bruce Bleakley; Professor; Biology/Microbiology & Plant Science Departments; South Dakota State University; Brookings, SD
e-mail: bruce.bleakley@sdstate.edu ; phone 605-688-5498

Todd Trooien; Associate Professor; Agricultural and Biosystems Engineering; South Dakota State University; Brookings, SD
e-mail: todd.trooien@sdstate.edu ; phone 605-688-5677

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Abstract:

Problem: Nutrient and sediment loads from animal feeding operations (AFOs) can negatively impact the quality of surface waters and groundwaters. One accepted way to reduce nutrient and sediment loads from AFOs is by use of basin technologies, which are effective but can be costly, and lead to air quality problems due to unpleasant odors. The potential for development and implementation of alternative non-basin technologies interests a variety of groups, including the South Dakota Cattlemen's Association, South Dakota Farm Bureau, South Dakota Association of Conservation Districts, South Dakota State University, South Dakota Department of Agriculture, Natural Resources Conservation Service, South Dakota DENR, and cattle producers. The Iowa Cattlemen's Association (ICA) is also interested.

An EPA funded grant, "Evaluating the Performance of Vegetated Treatment Areas," (Dr. Todd Trooien, P.I.), is in progress. Its goal is evaluation

of the technical and financial feasibility of vegetated treatment areas (VTAs) as a non-basin alternative for reducing nutrient and sediment loads from AFOs having less than 1,000 animal units. Each of five AFOs in different areas of South Dakota have had or will have VTAs established. Performance of each VTA will be measured by sampling inflows and outflows from vegetated areas. The samples will be analyzed for nutrients (N and P), salts, sediment, and numbers of fecal coliform bacteria. Data from these measurements will allow calculation of water and salt balances, loss or gain of nutrients, removal of sediment, and fecal coliform numbers. Data will be entered in a basin model to simulate basin performance, that will be compared to measured VTA performance. Samples have been obtained during 2005, and will continue to be obtained during 2006 and 2007.

For the EPA project, only numbers of *Escherichia coli* other than *E. coli* O157:H7 are being measured. Other aspects of the microbiology of the inflow and outflow areas associated with the VTAs are not addressed, which will be the focus of this proposal.

Objectives: Differences in the microbiology of soils in the inflow and outflow areas associated with VTAs will be assayed by measuring the following microbial indices: (a) Soil respiration; (b) oxidation/reduction potential; (c) heterotrophic microbial activity; (d) soil bacterial diversity; (e) numbers of total culturable fecal coliforms (including non-pathogenic *E. coli* but including other culturable fecal coliforms as well); and (f) numbers of culturable pathogenic *E. coli* O157:H7. Work outlined in this proposal would obtain data on these microbial indices, and add it to the data sets from the EPA project, to get a better idea of the number and activity of microbes in soils associated with inflow and outflow areas.

Methods: Soil respiration will be measured in the field with a portable soil respirometer. Oxidation/reduction potential of wet soils will be assayed in the field with a portable meter fitted with an oxidation/reduction electrode. Heterotrophic microbial activity will be assayed in the laboratory by assaying ability of soil samples to hydrolyze fluorescein diacetate. Soil bacterial diversity will be assayed in two ways: (1) by use of Biolog EcoPlates that assay the ability of a soil microbial community to utilize 96 different carbon sources; and (2) by molecular methods, using polymerase chain reaction (PCR) and denaturing gradient gel electrophoresis (DGGE). Numbers of total culturable fecal coliforms and *E. coli* O157:H7 will be obtained by use of selective and differential culture media.