Applying knowledge to improve water quality
Pacific Northwest
Regional Water Program
A Partnership of USDA NIFA
& Land Grant Colleges and Universities

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Using Vegetated Buffers or Setbacks to Reduce Fecal Coliform Bacteria Runoff from Dairy Pastures

Photo by Scott Bauer, USDA-ARS. Used with permission.

For years, producers and water quality specialists have had concerns about fecal coliform bacteria runoff from dairy pastures into rivers and estuaries. "Best Management Practices" (BMPs) have been developed to reduce the transport of bacteria after manure application to pastures. Data shows producers are making progress on reducing runoff into some rivers throughout the Northwest.

A major practice to reduce possible impacts of manure application on bacterial loading to waterways is a setback of the application area from the body of water. However, while this seems like an obvious recommendation to most, the distance of the setback and the benefits gained in water quality are not that clear.

A number of studies have looked at the use of vegetative buffers or setbacks to reduce bacterial movement. The studies show a variety of results at different distances, from 100 percent filtering to almost no improvement, depending on the study. This is further complicated by differences in bacterial loading, soil conditions, microbial die off, rainfall intensity and amount, sunlight, and vegetation and soil organic matter.

A research project was conducted recently in Tillamook County, Oregon to help understand the fecal coliform bacteria removal efficiencies of grass buffers of various sizes. This project involved the work and ideas of many, but was led by Dr. Tim Sullivan with E&S Environmental in cooperation with Oregon State University. The main concept tested the theory that for every incremental increase in buffer width, there should be a decrease in bacterial movement. Obviously, increasing the buffer width has major economic implications to the forage production on the farm so there is a cost/benefit relationship to the producer and to the environment. These researchers set out to determine the edge of field buffer widths that would simultaneously protect water quality and require the smallest loss of forage land.

The study consisted of 18 treatment plots, each 45 feet wide and 100 feet long. The plots had grass growing on them and were setup to test buffer widths of 0, 3, 10, 25, 50, and 80 feet. These plots had not received manure for several years and were sloped with a gentle slope (3.8 percent) and a moderate slope (7.0 percent). Treatment plots were isolated from one another by ditches. At the lower end of each plot was a sampling device that captured surface runoff and shallow soil water movement through each plot. The project was conducted over 9 major storm events during a two year period. Manure was applied prior to a forecasted major storm event at different distances from the sampling device, simulating different manure setbacks. During the first storm, no manure was applied to test the sampling devices and monitor background bacterial information.

Results from experimental treatment plots during nine rainstorms indicated that only 10 percent of the runoff samples had bacteria

Pacific Northwest Regional Water Quality Coordination Project Partners

Land Grant Universities

Alaska
Cooperative Extension Service
Contact Fred Sorensen:
907-786-6311
http://www.uaf.edu/ces/water/
University Publications:
http://www.alaska.edu/uaf/ces/publications/

Idaho
University of Idaho
Cooperative Extension System
Contact Bob Mahler: 208-885-7025
http://www.uidaho.edu/wq/wqhome.html
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Oregon State University
Extension Service
Contact Mike Gamroth: 541-737-3316
http://extension.oregonstate.edu/
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Washington
Washington State University
WSU Extension
Contact Bob Simmons:
360-427-9670 ext. 690
http://wawater.wsu.edu/
University Publications:
http://pubs.wsu.edu/

Northwest Indian College
Contact Charlotte Clausing:
360-392-4319
cclausing@nwic.edu or
http://www.nwic.edu/

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The Pacific Northwest
http://www.epa.gov/r10earth/

Office of Research and Development, Corvallis Laboratory
http://www.epa.gov/wed/

For more information contact
Jan Seago at 206-553-0038 or
seago.jan@epa.gov

The Project
Land Grant Universities, Water Research Institutes, and EPA Region 10 have formed a partnership to provide research and education to communities about protecting or restoring the quality of water resources. This partnership is being supported in part by the USDA's National Institute of Food and Agriculture (NIFA).

Our Goal and Approach
The goal of this Project is to provide leadership for water resources research, education, and outreach to help people, industry, and governments to prevent and solve current and emerging water quality and quantity problems. The approach to achieving this goal is for the Partners to develop a coordinated water quality effort based on, and strengthening, indivudual state programs.

Our Strengths
The Project promotes regional collaboration by acknowledging existing programs and successful efforts; assisting program gaps; identifying potential issues for cross-agency and private sector collaboration; and developing a clearinghouse of expertise and programs. In addition, the Project establishes or enhances partnerships with federal, state, and local environmental and water resource management agencies, such as by placing a University Liaison within the offices of EPA Region 10.

concentrations > 200 colony forming units (cfu)/100 ml, and the median runoff concentration for all plots was only 6 cfu/100 ml. If the manure soaked into the soil, bacteria did not leave the plots, even if the buffer was only three feet wide.

The presence of a vegetated buffer of any size generally reduced the median bacteria concentration in runoff by more than 99 percent. Manure applications with no buffers averaged as high as 164,627 cfu/100 ml in the gentle slope plots. Authors concluded this result was largely due to the observed high rate of infiltration of precipitation, even during large storms. They also concluded that contamination of runoff from manure-treated pasture lands is strongly associated with specific field or management conditions, such as soils that have low water infiltration rates and generate larger volumes of runoff. Soil is highly effective at trapping and immobilizing bacteria if the manure application and consequential rainfall can infiltrate the soil surface.

Current manure application recommendations are: 1) Make manure application schedules that account for cropping needs and site specific field characteristics; 2) Fields with poorer drained soils (lower infiltration rate) and fields prone to flooding should be scheduled for multiple manure applications early in the growing season during dry weather; 3) Fields that have higher infiltration rates and ones that are farther away from water ways should be the ones used during months with the potential for higher rainfall; and 4) Lighter, more frequent applications to fields with enough air space in the soil for the application to move into the soil profile is most desirable.

A copy of the whole report can be downloaded at http://www.esenvironmental.com/download_site.htm.

National Water Quality Program Areas

The four land grant universities in the Pacific Northwest have aligned our water resource Extension and research efforts with eight themes of the USDA's National Institute of Food and Agriculture.

1. Animal Waste Management
2. Drinking Water and Human Health
3. Environmental Restoration
4. Nutrient and Pesticide Management
5. Pollution Assessment and Prevention
6. Watershed Management
7. Water Conservation and Management
8. Water Policy and Economics

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