Watershed Management/Water Quality

Project: **203 Vegetative Buffer Effects on Pathogens and Organic Carbon in Runoff**

Leader: *Kenneth W. Tate, Specialist*
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Objective: There are significant concerns about pathogen (e.g., Escherichia coli O157:H7, Salmonella, Cryptosporidium parvum, Giardia duodenalis), indicator bacteria (generic E. coli), and organic carbon levels within California's surface water drinking supplies. This project examines microbial and carbon pollutant transport from annual grasslands, and the efficacy of residual dry matter management and buffers to reduce transport of these pollutants from annual rangelands. This proposal is to renew this project for the purposes of: 1) completing our examination of the efficiency of vegetated buffers to attenuate microbial pollutants and organic carbon transported in surface runoff from annual rangelands; and 2) use of 32 of the 48 research plots for a collaborative study described by Dr. E. Laca (PI) in proposed project 702. In 2004, we received approval from the SFREC RAC to conduct a 4 year experiment to test the efficacy of rangeland vegetative buffers to reduce microbial and carbon pollutant transport from cattle fecal pats under natural storm-runoff conditions. We have 1 year of that experiment remaining, which can be completed in the 2007-08 or 2008-09 rainfall season, allowing implementation of treatment and data collection proposed by Dr. Laca in project 702 in the alternate year. With regard to water quality, this project is complimentary to project 401 which examines the efficacy of buffers and pasture management to reduce the transport of microbial pollutants from irrigated pastures. Collectively, these two projects examine critical best management practices intended to safe-guard drinking water quality in California's foothill annual grassland and irrigated pasture systems. State and federal water quality and food safety officials are continuing to examine the role of beef cattle production in this landscape as a risk factor for water and food crop contamination events.

Project: **401 Vegetative Buffer Effects on Pathogens and Organic Carbon in Irrigated Pasture Runoff**

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Objective: During 2004-2007 we made significant progress on the completion of this project's founding objectives. We completed 2 of the 3 experiments proposed in 2004, and have completed ~30% of the 3rd proposed experiment. Completed experiments examined: 1) the efficacy of 2 small wetlands at SFREC to attenuate microbial, sediment, and nutrient pollutants in runoff from irrigated pastures under various rates of tailwater

discharge; and 2) the impact of stocking rate, irrigation water application rate, and timing of grazing relative to irrigation on the transport of E. coli

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Project: **401 Vegetative Buffer Effects on Pathogens and Organic Carbon in Irrigated Pasture Runoff - Continued**

from 10 irrigated pastures. Results of the two completed studies have been accepted with minor revision in California Agriculture, and are under review in the J. Environmental Quality. Wetlands filtered from 40 to 90% of pollutants contrinuted to them with filtration efficiency decreasing as tailwater discharge rate increased and hydrologic residence time decreased. We also found that E. coli levels in tailwater increased as irrigation water application rate increased, stocking rate increased, and days rest between grazing and irrigation decreased. These results indicate that integrated pasture management best management practices and implementation of wetland filters can effectively reduce pollutant levels in pasture dishcarge. We will complete the remainder of the 3rd experiment during the next review period, which focuses on the efficacy of linear vegetative buffer strips to filter pathogens and organic C from pasture runoff.

Project: **403 Hydrologic Flowpaths in Oak Woodland Landscapes: Implications for Dissolved Organic Carbon and Nutrient Transport**

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Objective: Excess loads of dissolved organic carbon (DOC) and nutrients in the Sacramento River drainage system and Delta have been identified as a primary concern of CALFED Drinking Water Quality Program. One potential source of these pollutants originates from 7.5 million acres of rangeland in the Sacramento and San Joaquin River Basins of California. Water quality contaminants are communicated to surface water bodies via various hydrologic flowpaths across the landscape, although the timing and spatial organization of these conduits are poorly understood. There is great need to develop and test rangeland best management practices (BMPs) such as prescribed fire regime, buffer strips, and grazing intensity in a manner that accounts for landscape-scale transport of water quality contaminants. The goal of this project is to expand upon the existing soil-water monitoring infrastructure in watershed 1 at Sierra Foothill Research and Extension Center to identify the linkage between hydrologic flow paths (lateral flow, runoff, bypass flow, soil matrix flow and groundwater flow) and stream water quality. The second aspect of this study is to use the monitoring results from watershed 1 to apply a reconnaissance soil sampling strategy in watersheds 2 and 3 to understand the ability of landscapes to communicate water quality contaminants to streams. This information will be used to deliver information on how, when and where

best management practices can be implemented to achieve sustainable water resources.
