



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003CA40B

Title: Evaluating the effectiveness of vegetated buffers to remove nutrients, pathogens, and sediment transported in runoff from grazed, irrigated pastures

Project Type: Research

Focus Categories: Water Quality, Surface Water, Management and Planning

Keywords: buffer, irrigated pasture, water quality, BMP, grazing

Start Date: 03/01/2002

End Date: 02/28/2003

Federal Funds: \$22206.00

Matching Funds: \$ 35427.00

Congressional District:44

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Abstract:Irrigated pastures serve a critical role in the economic stability of California's livestock industry by providing low cost, high quality summer forage. Surface water runoff from irrigated pastures can transport pollutants to nearby waterbodies. There is limited information on the trapping efficiency or nutrient holding capacity of vegetated buffers within these systems, making it difficult to make informed recommendations for size and long-term management of buffers. Rather than one-size-fits-all, buffer recommendations should be based upon an understanding of the relationships between pollutant loading, buffer trapping efficiency, and buffer capacity over time for the suite of pollutants common to pastures. We propose to:

A. Quantify the effectiveness of non-grazed buffers to attenuate NO₃, NH₄, total N, PO₄, total P, fecal coliforms, E. coli, and sediment in surface water runoff from grazed, flood-irrigated pastures over two years.

B. Employ the N isotope method to quantify nitrogen dynamics within pastures, buffers and runoff water, as well as to determine whether buffer capacity for nitrogen decreases over time as buffer vegetation matures and plant species composition changes in the absence of grazing.

C. Extend the results of this research to ranchers, UCCE advisors, natural resources agency staff and water resource regulators.

This project will be conducted on an existing grazed, irrigated pasture–buffer research infrastructure at the UC Sierra Foothill Research and extension Center near Browns Valley, allowing for the immediate implementation of this project once funded. Study design is completely random with 3 treatments applied to 9 pastures for 3 replicates. Buffer treatments are a 3:1 pasture area (240 m²) to buffer area (80 m²) ratio, a 6:1 pasture (240 m²) to buffer are (40 m²) ratio, and a no buffer control. The 3:1 and 6:1 ratio treatments have buffer widths of 16 and 8 m, respectively. Irrigation water is equally applied to the top of each plot and surface water runoff is collected and measured at the base of each plot. Six to 7 irrigation trials will be conducted each summer for a total of 12-14 repeated trials during the 2-year project period (2002 and 2003). ¹⁵N-labeled KNO₃ will be applied and sampled across all 9 plots, allowing us to quantify how much N is lost as runoff, accumulated by the pasture, and attenuated by the buffers. Surface water runoff will be measured and water samples collected at 0, 15, 30, 60, 90, and 120 minutes following commencement of runoff during each trial. Samples will be analyzed for concentration of pollutants (mg L⁻¹ or cfu per 100 mL). Load (kg ha⁻¹) of each pollutant lost per irrigation will be calculated from runoff amount and concentration data. Repeated measures ANOVA will be used to determine buffer trapping efficiency for each pollutant. To determine if buffer N capacity decreases with increasing maturity of vegetation, a second set of 8 non-grazed, non-fertilized buffer plots (80 m²) will be established in the first year of this project. Four plots will be allowed to develop to full maturity and four will be cut regularly to stimulate growth. In the second year, ¹⁵N will be applied to the plots to determine if forage harvesting within the buffer increases the demand for N, thus improving the efficacy of the buffers to trap N in runoff. Results of this project will be extended through regularly scheduled short courses, news releases and conferences of the UCCE Rangeland Watershed Program. Target audiences will include ranchers, natural resource agencies, UCCE advisors, and water resource regulators.

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