Rangeland Water Quality—*Research and Education Update*

Leslie Roche, Ken Tate, Carissa Rivers, and Rob Atwill

Central Coast Rangeland Coalition Fall 2015 Meeting
October 15, 2015

10/15/2015

Today's Focus

California's rangeland water quality partnership
Where we've been and where we are now.

Key research findings
Livestock grazing and water quality conditions.

Future UC grazing and water quality activities
Where do we go now?

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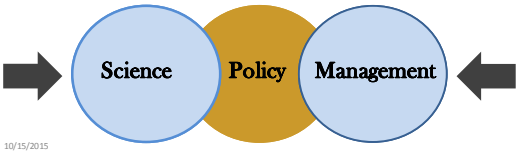
"*Partnerships among scientists, managers, and policymakers provide the most relevant knowledge...*"
Rangeland Conservation Effectiveness Assessment Project, 2011



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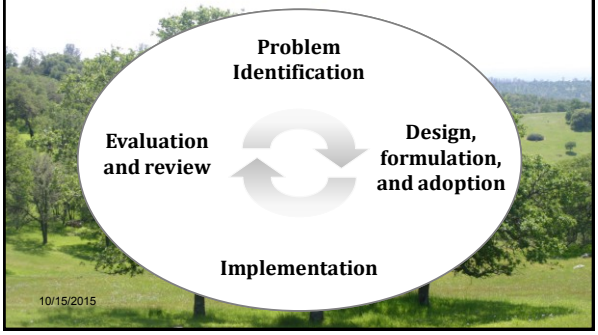
Rangeland Watershed Program

A 25 yr partnership to improve rangeland water quality—Agencies, Ranchers, UC, NGOs



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Rangeland Watershed Laboratory | University of California Agriculture and Natural Resources — Policy Brief *March 2015*

Rangeland Water Quality Planning, Education, and Science in California

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Issue

There is substantial concern that pollution from livestock on rangelands degrades water quality, threatening human and environmental health. For the past 25 years, the Rangeland Watershed Program (RWP)—a diverse partnership of rangeland stakeholders—has developed and implemented an integrated research, education, and planning program to proactively address this concern. Active partners include ranchers, the University of California, USDA Natural Resources Conservation Service, resource conservation districts, Board of Forestry and Fire Protection's Range Management Advisory Committee, conservation groups, and Regional Water Boards were founding partners of this process.

The initial outcome of the RWP partnership was California's Rangeland Water Quality Management Plan (CRWQMP). The Plan outlines science-based management strategies to prevent water quality impairments, and provides for educational programs to develop on-ranch water quality protection strategies. As a result, the Ranch Water Quality Management Planning Short Course was developed to provide comprehensive guidance and support for ranchers to develop on-ranch water quality plans. The Short Course and resulting ranch plans have been used to comply with State and

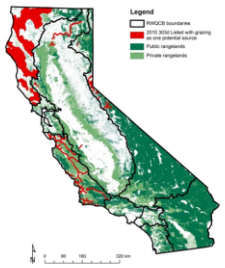

Figure 1: Map highlighting extent of California's public and private rangelands, and regional scope of water quality impairments with grazing listed as one potential source.

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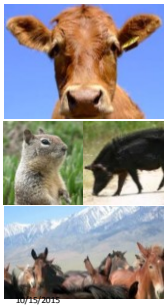
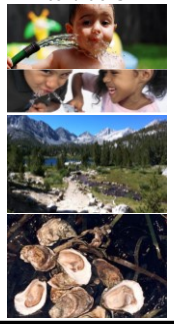
Scientific Evidence
20 years, >100 research papers

Pollutants of concern & sources



Fate & Transport

Water quality conditions



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Line of Research

Rangeland Water Pollutants of Concern
nutrients, microbes, hormones, pharmaceuticals

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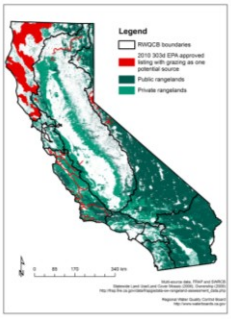
C.K. Rivers et al. In Prep.

What are the pollutants of concern?

Grazing as a *potential* source (n=324)



Pollutant of concern	% of 303d listings
Microbial	29
Nutrients	23
Sediments	16

2010 Clean Water Act Section 303(d) Impairments

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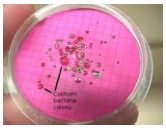
Microbial Pollutants

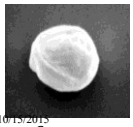
Indicators

Fecal coliforms
Indicator *E. coli*



Bacteria that when present in water indicate the presence of fecal material and pathogens.

Pathogens



C. parvum

E. Coli O157:H7

Salmonella

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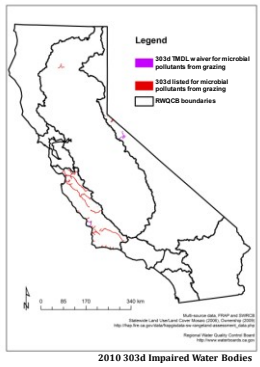
Microbial – *potential* grazing impairment

29% of 324 listings

Indicator	% of microbial listings
Fecal coliforms	41
E. coli	29
"Pathogens"	23
Enterococcus	5
Total coliforms	2



2010 303d Impaired Water Bodies

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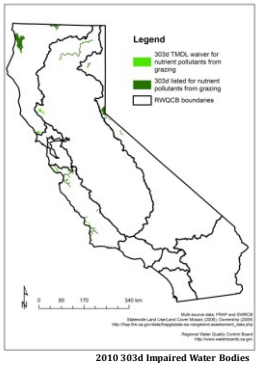
Nutrients – *potential* grazing impairment

23% of 324 listings

- ***Nitrogen***
- ***Phosphorus***



2010 303d Impaired Water Bodies

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Line of Research

Rangeland Water Pollutants of Concern
nutrients, microbes, hormones, pharmaceuticals

Livestock Sources | Background & Other Sources

- ***Sources***

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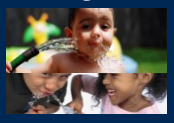
C.K. Rivers et al. In Prep.

Bay Area – *Cryptosporidium*

Livestock → *Pathogens* → *Drinking Water*



C. parvum



Contra Costa Ti
Tiny parasite has water districts, cattle ranch
Parasite
Scientists seek watery solut to halt 'mystery spore' outb
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San Francisco water district targets cattle


Water district backs away from cattle grazing ban around lake

Crytposporidium in wildlife and livestock
Initial Findings

Animal	% infected
Range beef cow	< 5
Range beef calf < 4 mo	10 - 20
Back country pack stock	0
Feral pig	4 - 13
Ground squirrel	7 - 15



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Key New Finding: Survey >450 range cattle
Cryptosporidium in range cattle low risk to humans

Crytposporidium	No. Observations
C. ryanae	61/81 (75%)
C. bovis	19/81 (24%)
C. andersoni	1/81 (1%)
C. parvum	**0/81 (0%)**

E.R. Atwill et al. In Prep.

- Species and subtypes identified in cattle have low to no infectivity for humans.
- Protozoal contamination by cattle may not be the public health threat once thought.

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Prevalence of *E. coli* O157:H7 wildlife and beef cattle CA Central Coast, 2008-10


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E. coli O157:H7		
Feral pig	10/200	(5%)
Coyote	2/95	(2%)
Am. crow	5/93	(5%)
Cowbird	2/60	(3%)
Rabbit	0/108	(0%)
Skunk	0/63	(0%)
Tule elk	3/150	(2%)
Deer	0/447	(0%)
Rodents	2/1043	(0.2%)
Beef cattle	68/2715	(2.5%)

E.R. Atwill et al. In Prep.

Line of Research

Pollutant Transport and Environmental Fate Dynamics

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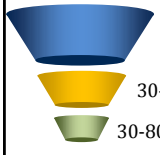
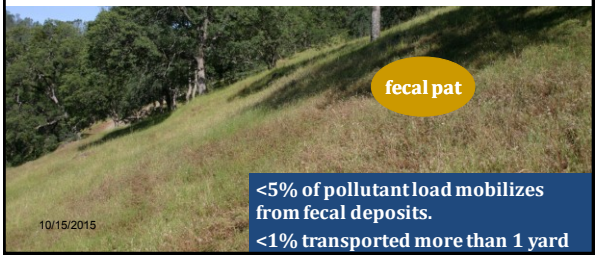
C.K. Rivers et al. In Prep.

Fate and transport


>90% of pollutants trapped at fecal pat

30-99% trapped each additional 1 yard

30-80% trapped in riparian areas



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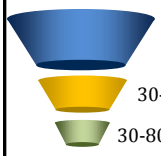
<5% of pollutant load mobilizes from fecal deposits.
<1% transported more than 1 yard

Fate and transport



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Similar findings for: Pharmaceuticals and Hormones

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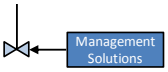
Line of Research



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C.K. Rivers et al. In Prep.

Range management that reduces water pollution risk: Principles and practices

Moderate stocking	Manage livestock distribution	Manage wet season grazing
Set stocking rate in balance with forage production and site resiliency to reduce impacts to soil and vegetation.	Distribute grazing and waste across the landscape, and actively manage grazing intensity in critical hydrologic zones.	Distribute livestock to non-critical hydrologic zones during saturated conditions.

Prescribed grazing, cross fencing, off-stream drinking water, targeted supplemental feeding, riparian pastures, herding, vegetative buffer strips

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Management Solutions

Cross fencing **Riparian planting** **Off-stream drinking water**

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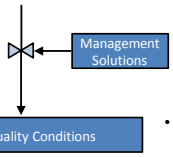
Line of Research



- ***With good management – clean water, recreation, and grazing can be compatible.***

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C.K. Rivers et al. In Prep.

UC Next Steps

Synthesis of research and existing information

- *Peer-reviewed synthesis paper*
- *Series of 1-2 page policy briefs*
- *One-stop online information page*

Grazing Water Quality Workgroup

- *Continuing the partnership*
  - *Build on existing successes and collaborations*
- *Assessment of effectiveness and needs for the future*
  - *Remaining research gaps*

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Literature…

Pollutants of Concern and Sources

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…literature continued

Fate and Transport

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Microbial Water Quality Info Center: rangelandwatersheds.ucdavis.edu/MWQIC

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