Rangeland Water Quality—Research and Education Update  
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Central Coast Rangeland Coalition Fall 2015 Meeting  
October 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?

Partnerships among scientists, managers, and policymakers provide the most relevant knowledge...

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

Scientific Evidence  
20 years, >100 research papers

Rangeland Water Quality Planning, Education, and Science in California  
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Policy Brief: March 2015

Legend
Red = Rangeland Water Quality Planning, Education, and Science in California
Blue = Other
Green = Research, Education, and Extension
Black = Water Quality

Issue

There is substantial concern that pollution from livestock on rangelands degrades water quality, harming livestock and environmental health. For the past 25 years, the Rangeland Watershed Program (RWP)—a dynamic partnership of motivated stakeholders—has been developed and implemented as an improved research, education, and planning program to proactively address this concern. Active partners include ranchers, the University of California, USDA Natural Resources Conservation Service, state and local agencies, Board of Forestry and Fire Protection’s Range Management Advisory Committee, conservation groups, and regional and state water agencies.

The initial origin of the RWP partnership was California’s Rangeland Water Quality Management Plan (RWQMP). The Plan identified key management strategies to prevent water quality impairments, and provided the educational program to implement the plan. As a result, the RWQMP is a policy document that promotes and encourages the adoption of practices to develop riparian vegetation, and the MDC’s Rangeland Water Quality Planning (RWQP) was developed to provide a comprehensive and consistent approach to reduce and control pollution from livestock to develop a riparian vegetation plan. The MDC and California partnerships provide the most relevant knowledge in rangeland water quality.
Line of Research

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

Presented to Central Coast Rangeland Coalition

What are the pollutants of concern?

Grazing as a potential source (n=324)

<table>
<thead>
<tr>
<th>Pollutant of concern</th>
<th>% of 303d listings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial</td>
<td>29</td>
</tr>
<tr>
<td>Nutrients</td>
<td>23</td>
</tr>
<tr>
<td>Sediments</td>
<td>16</td>
</tr>
</tbody>
</table>

2010 Clean Water Act Section 303(d) Impairments

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 0157:H7
Salmonella

Microbial – potential grazing impairment

29% of 324 listings

<table>
<thead>
<tr>
<th>Indicator</th>
<th>% of microbial listings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal coliforms</td>
<td>41</td>
</tr>
<tr>
<td>E. coli</td>
<td>29</td>
</tr>
<tr>
<td>“Pathogens”</td>
<td>23</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>5</td>
</tr>
<tr>
<td>Total coliforms</td>
<td>2</td>
</tr>
</tbody>
</table>

2010 303d Impaired Water Bodies

Nutrients – potential grazing impairment

23% of 324 listings

- Nitrogen
- Phosphorus

Line of Research

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

Sources
Bay Area – Cryptosporidium

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

<table>
<thead>
<tr>
<th>Cryptosporidium</th>
<th>No. Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. ryanae</td>
<td>61/81 (75%)</td>
</tr>
<tr>
<td>C. bovis</td>
<td>19/81 (24%)</td>
</tr>
<tr>
<td>C. andersoni</td>
<td>1/81 (1%)</td>
</tr>
<tr>
<td>C. parvum</td>
<td>0/81 (0%)</td>
</tr>
</tbody>
</table>

- 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.

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

<table>
<thead>
<tr>
<th>Animal</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feral pig</td>
<td>100% (5%)</td>
</tr>
<tr>
<td>Coyote</td>
<td>2/95 (2%)</td>
</tr>
<tr>
<td>Am. crow</td>
<td>5/93 (5%)</td>
</tr>
<tr>
<td>Cowbird</td>
<td>2/60 (3%)</td>
</tr>
<tr>
<td>Rabbit</td>
<td>0/108 (0%)</td>
</tr>
<tr>
<td>Skunk</td>
<td>0/63 (0%)</td>
</tr>
<tr>
<td>Tule elk</td>
<td>3/150 (2%)</td>
</tr>
<tr>
<td>Deer</td>
<td>0/447 (0%)</td>
</tr>
<tr>
<td>Rodents</td>
<td>2/1043 (0.2%)</td>
</tr>
</tbody>
</table>

Beef cattle 68/2715 (2.5%)

Fate and transport

- >90% of pollutants trapped at fecal pat
- 30-99% trapped each additional 1 yard
- 30-80% trapped in riparian areas

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

- >90% of pollutants trapped at fecal pat
- 30-99% trapped each additional 1 yard
- 30-80% trapped in riparian areas

*Similar findings for: Pharmaceuticals and Hormones*

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**Range management that reduces water pollution risk: Principles and practices**

- **Moderate stocking**
  - Set stocking rate in balance with forage production and site resiliency to reduce impacts to soil and vegetation.

- **Manage livestock distribution**
  - Distribute grazing and waste across the landscape, and actively manage grazing intensity in critical hydrologic zones.

- **Manage wet season grazing**
  - 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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**Line of Research**

**Management Solutions**

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

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**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

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

**Pollutants of Concern and Sources**


Li, X. et al. 2010. Effect of daily temperature fluctuation during the cool season on the infectivity of Cryptosporidium parvum. Applied and Environmental Microbiology. 76:989-993.

**Management Solutions**


**...literature continued**

**Fate and Transport**


Li, X. et al. 2010. Effect of daily temperature fluctuation during the cool season on the infectivity of Cryptosporidium parvum. Applied and Environmental Microbiology. 76:989-993.

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

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**Thank you!**