

Ranch Water Quality Management



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Water Quality Questions

- What is the quality of runoff from **irrigated pasture**?
- How does pasture management effect runoff water quality?
- If there is a problem, what management could fix it?



Water Quality Concerns

- Microbial pollutants – *E. coli* and fecal coliforms

Human illness due to ingestion of waterborne fecal pathogens



Water Quality Concerns

- Microbial pollutants – *E. coli* and fecal coliforms
- Nutrients – nitrogen and phosphorus

Human illness due to ingestion of waterborne fecal pathogens



Eutrophication (low O₂) due to excessive nutrients and temperatures



Water Quality Concerns

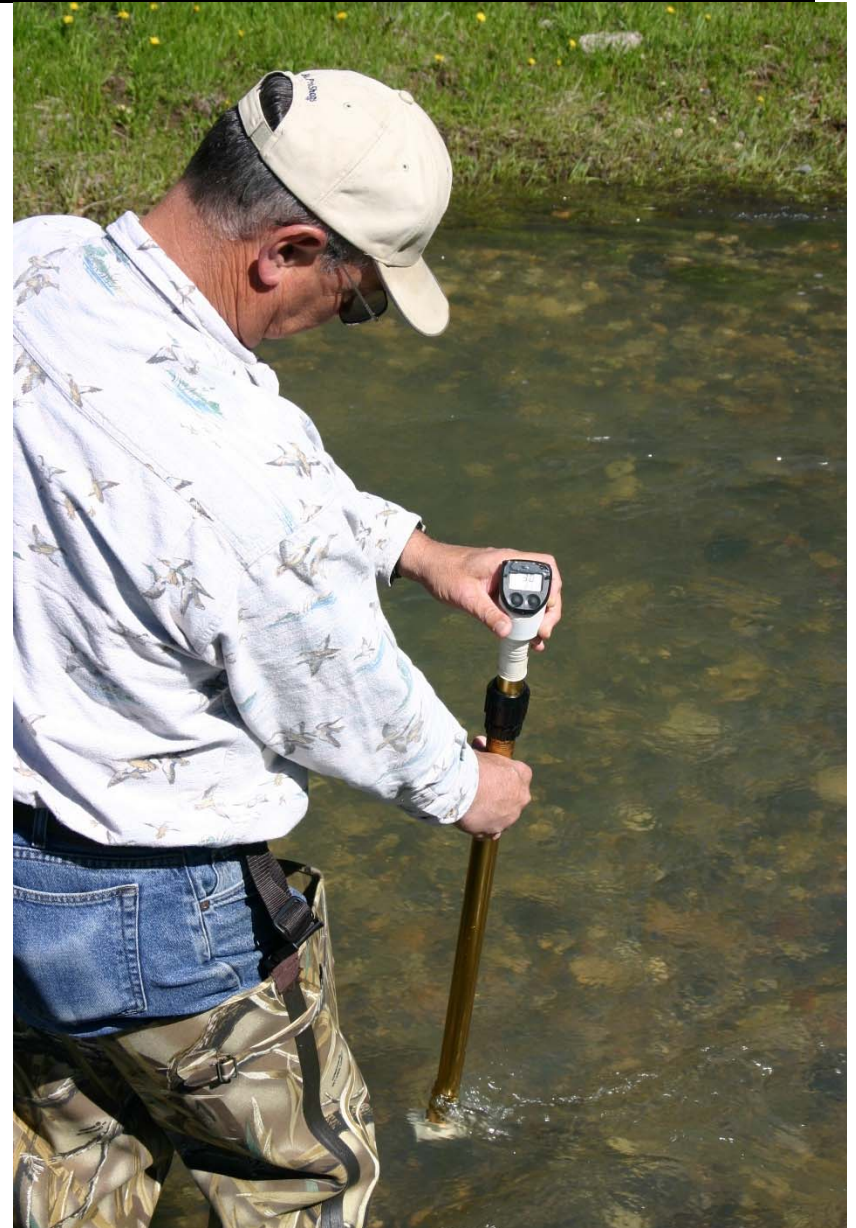
- Microbial pollutants – *E. coli* and fecal coliforms
- Nutrients – nitrogen and phosphorus
- Sediment – erosion, fish habitat

Sediment in spawning gravels and rearing pools for trout, steelhead, salmon

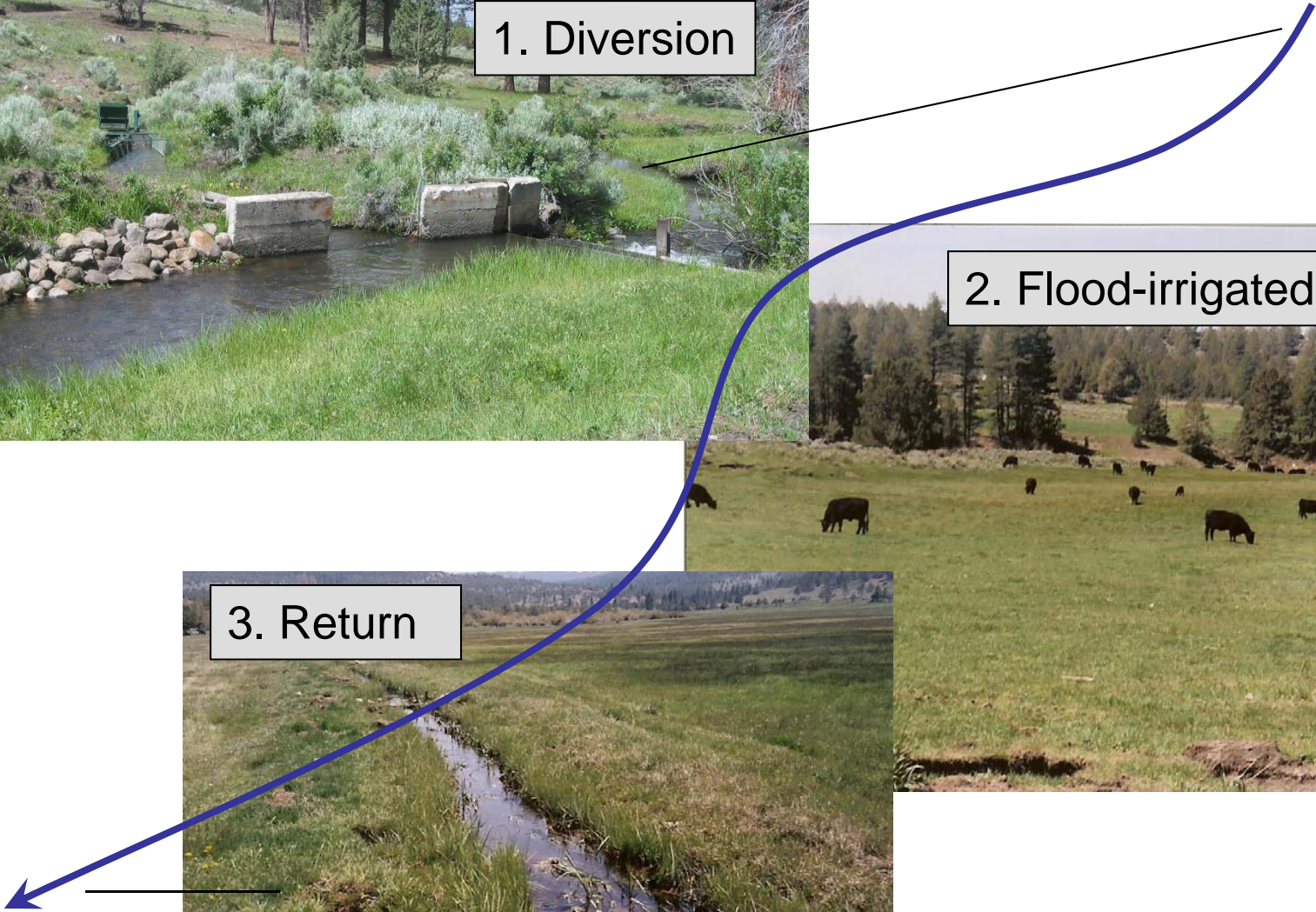
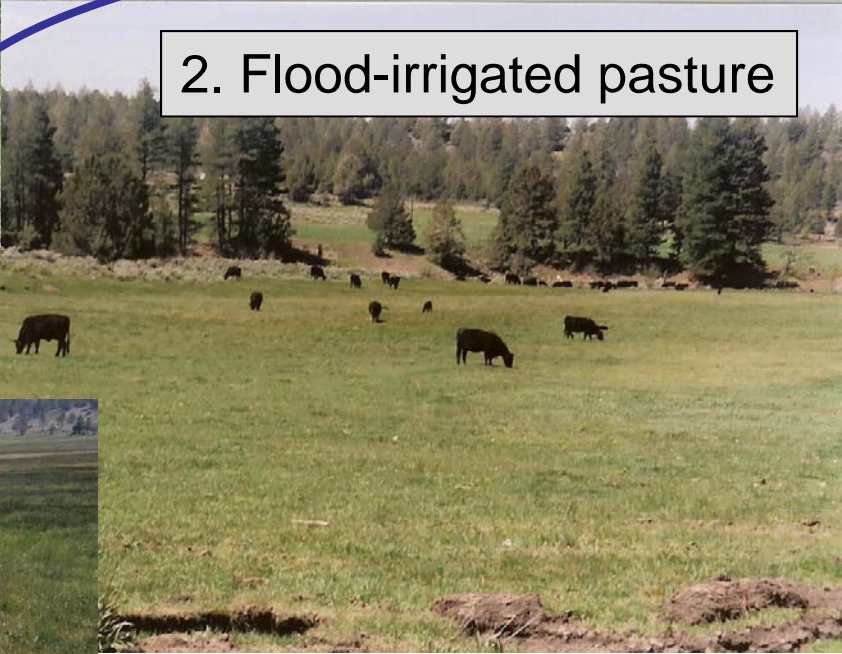


Research Address the Questions

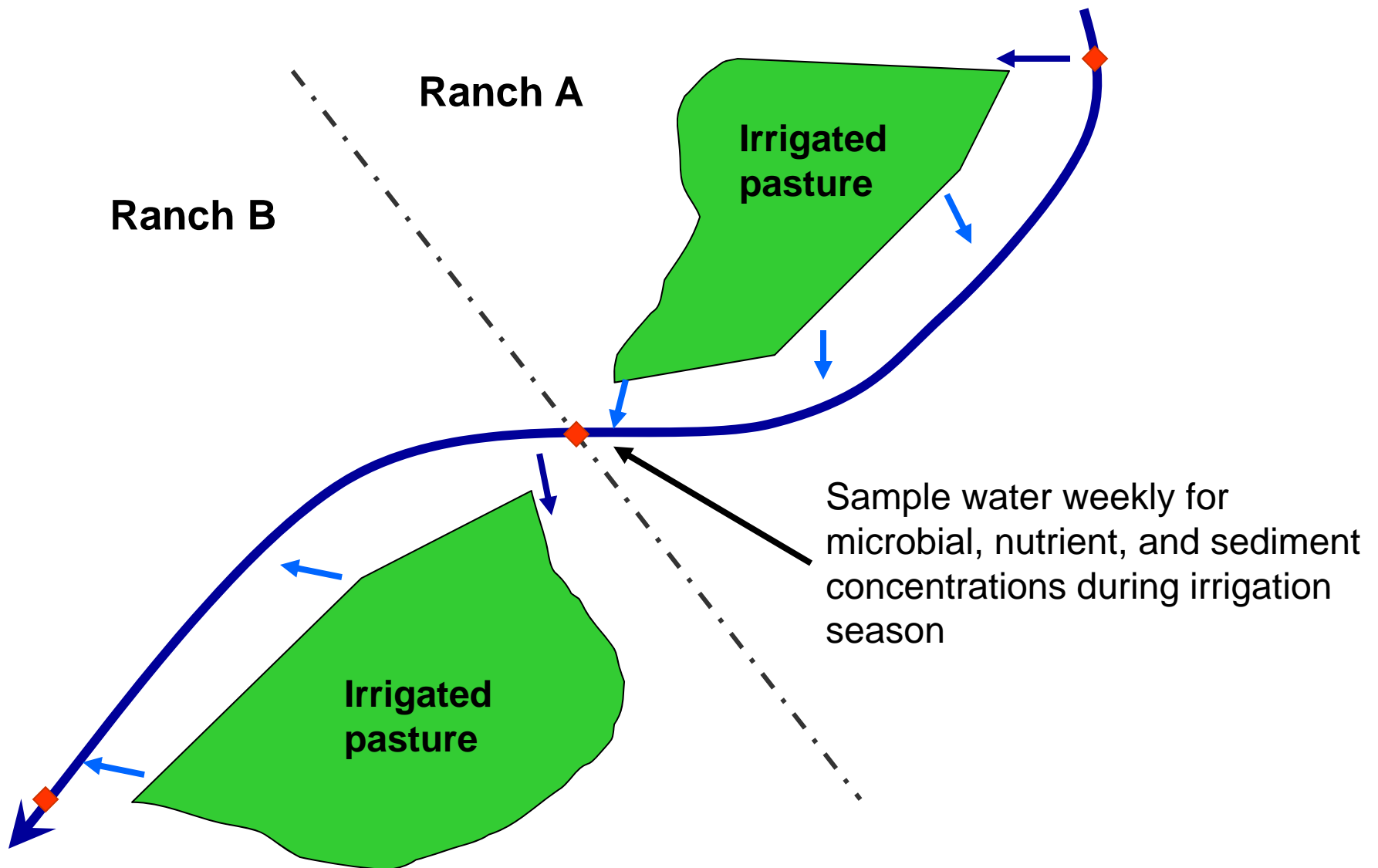
- Surveys of water quality on and off pastures.
- Water quality response to grazing and irrigation management.
- Vegetative buffers and wetlands as tail-water filters.



Stream diversion based irrigated meadows and pastures



Classic above v. below monitoring



Survey of 10 Irrigated Meadow Systems

Phosphorus and Nitrogen in Tail-Water (ppm)

	Tail-Water	Goal
Phosphate (PO ₄)	0.02	<0.05
Nitrate (NO ₃)	0.04	<0.30

- Consistently find nutrient concentrations in pasture and rangeland runoff to be well below levels of concern
- Most irrigated pastures and meadow systems are sinks for N and P, as well as sediment

rangelands.ucdavis.edu/ipnmp



Irrigated Pasture Nitrogen Management & Planning

This application is a nitrogen management planning tool for irrigated pastures and an educational tool for assisting California growers in completing a Nitrogen Management Plan. [More information for members of agricultural water quality coalitions here.](#)

Brief Instructions: The first step requires entering various pasture management and herd information. After filling in the applicable information, click the submit button to provide results that can be used for the Nitrogen Management Plan Worksheet.

Please send your feedback and comments to djeastburn@ucdavis.edu

Pasture Characteristics and Management

Area of pasture irrigated.*

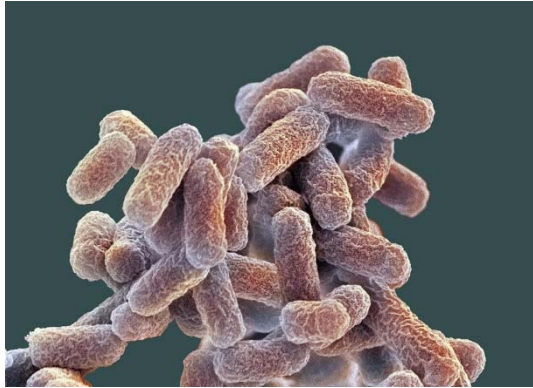
(units: acres)

Would you like to include nitrogen from irrigation water in your nitrogen management plan?

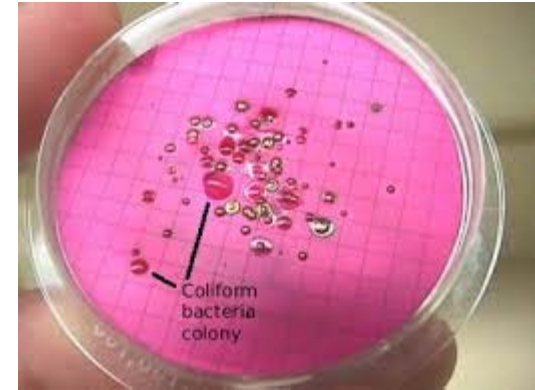
Would you like to include available soil nitrogen in your nitrogen management plan? [More information about soil nitrogen click here](#)

Fecal Indicator Bacteria

Indicators

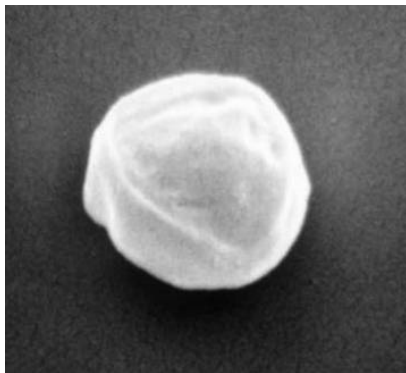


Fecal coliforms
Indicator *E. coli*

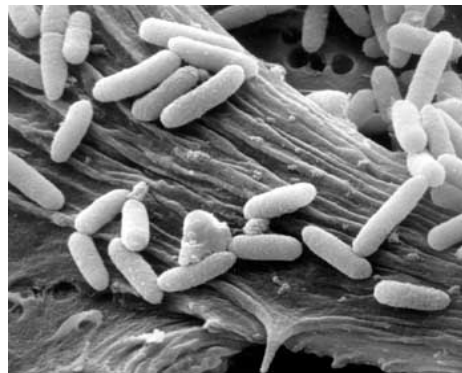


Bacteria that when present in water **indicate** the presence of fecal material and pathogens.

Pathogens



C. parvum



E. Coli O157:H7

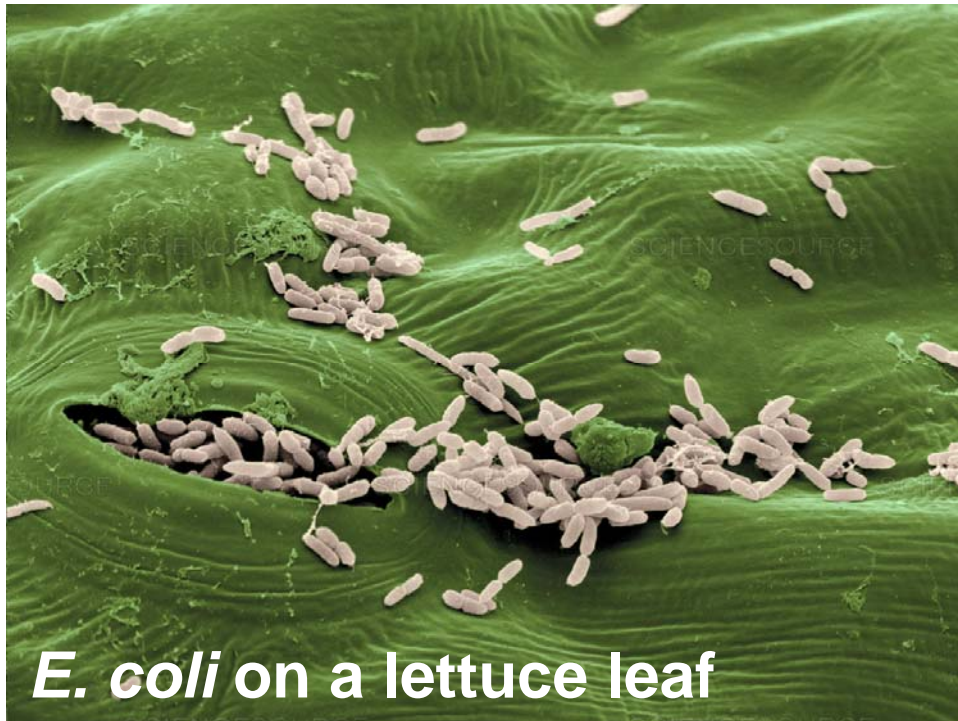


Salmonella

Indicator *E. coli* in beef Cattle

Indicator *E. coli*:

1,000,000+ per gm feces



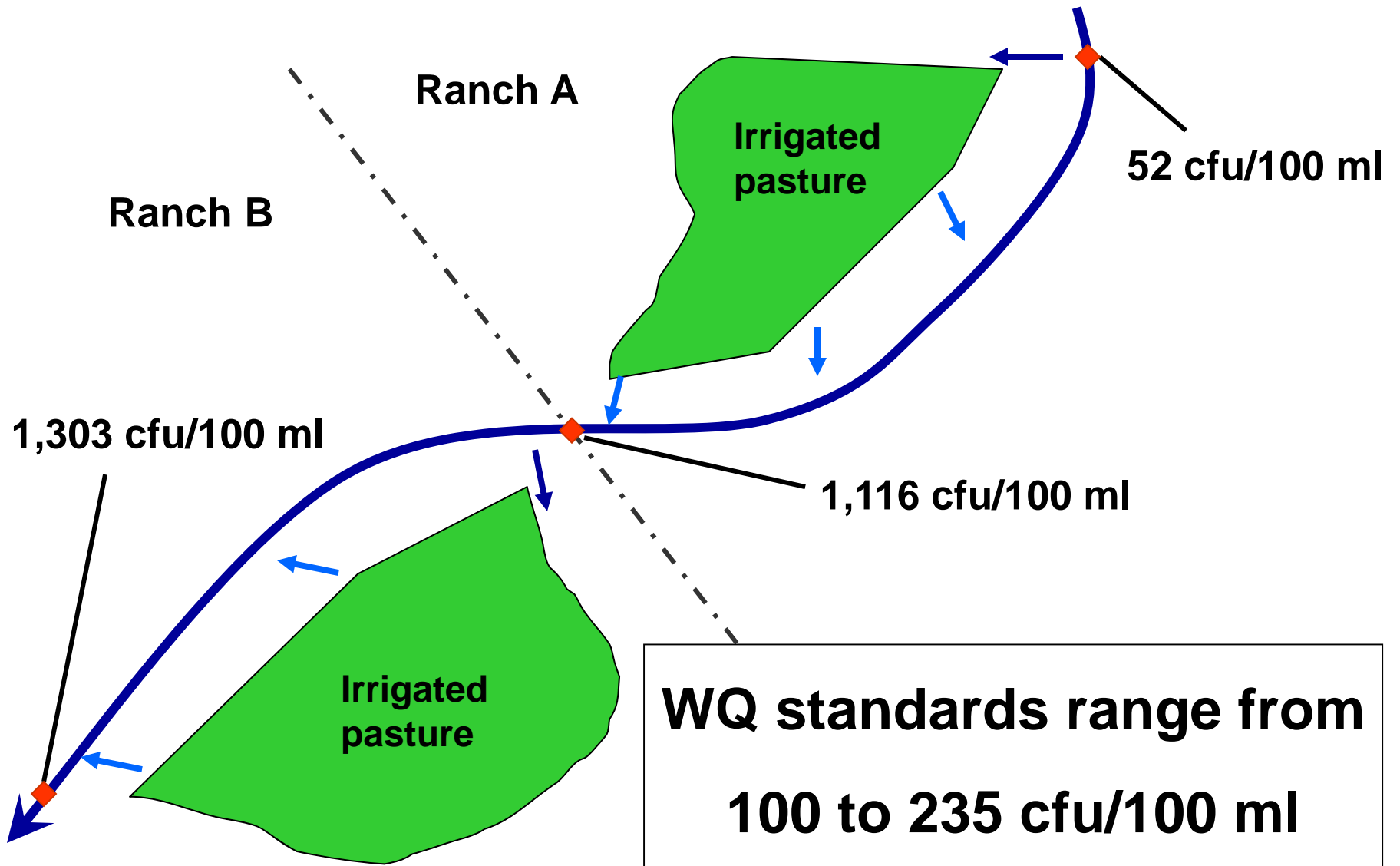
Prevalence of *E. coli* O157:H7 Wildlife and Beef Cattle CA Central Coast, 2008-10



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%)

Example Indicator *E. coli* results



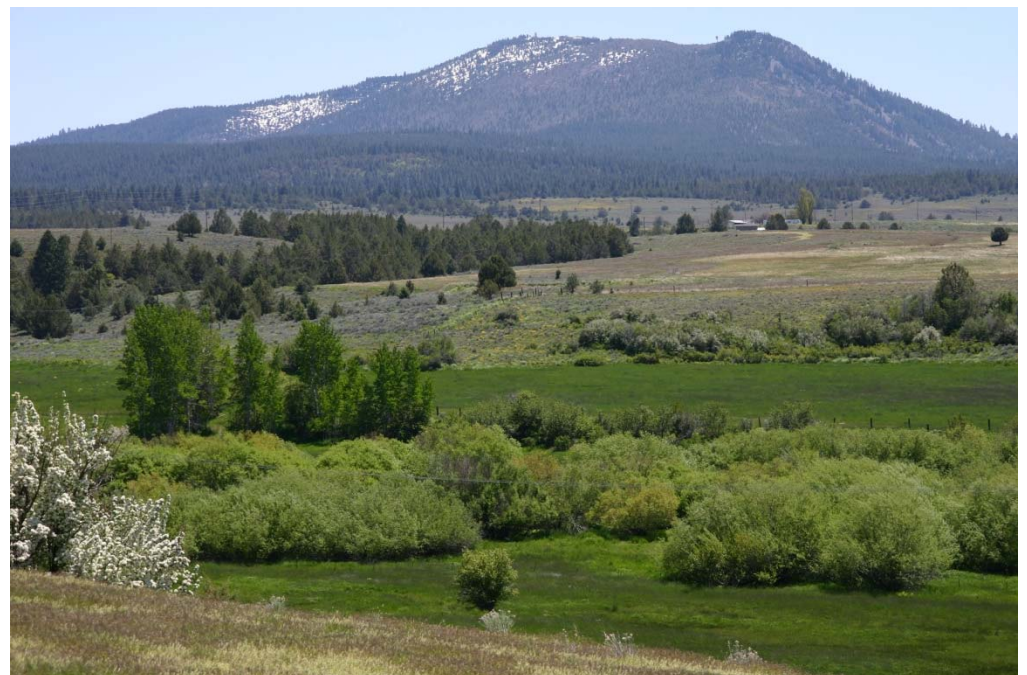
Change: below - above

Stream	<i>E. coli</i>
1	-1036
2	-233
3	-182
4	10
5	11
6	12
7	21
8	88
9	230
10	1064

Sink

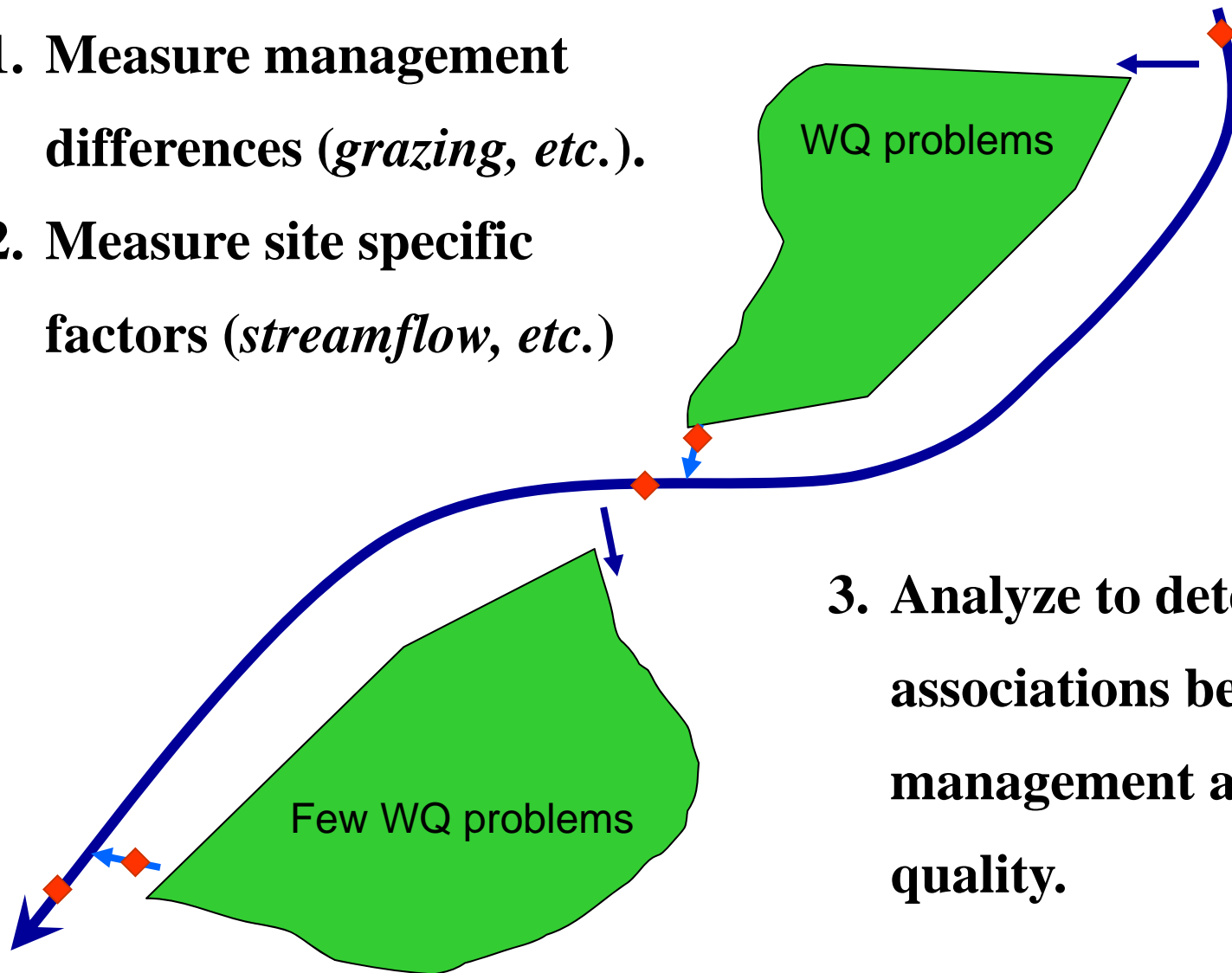
No change

Source



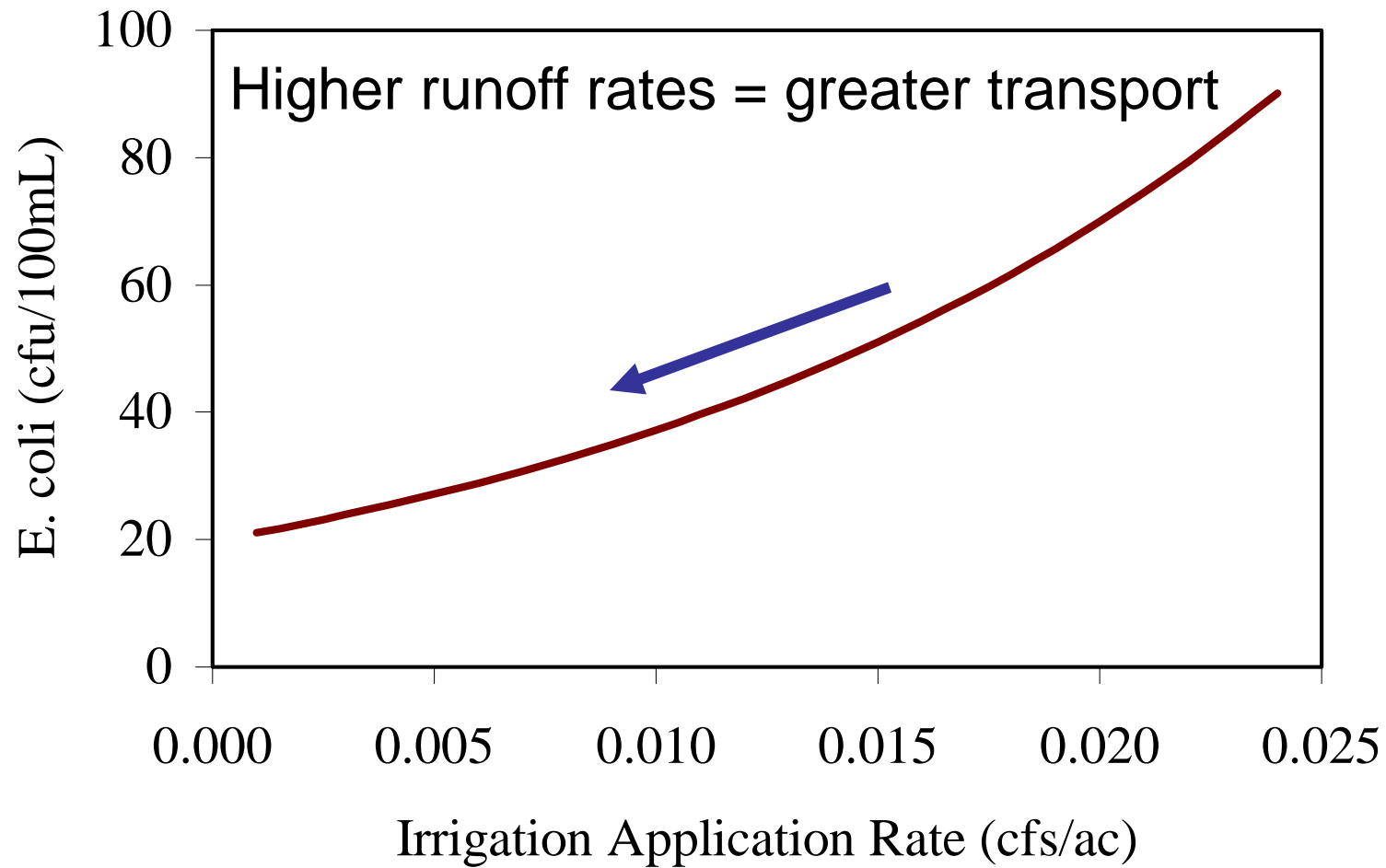
Why does one pasture increase concentrations, while another does not?

1. Measure management differences (*grazing, etc.*).
2. Measure site specific factors (*streamflow, etc.*)

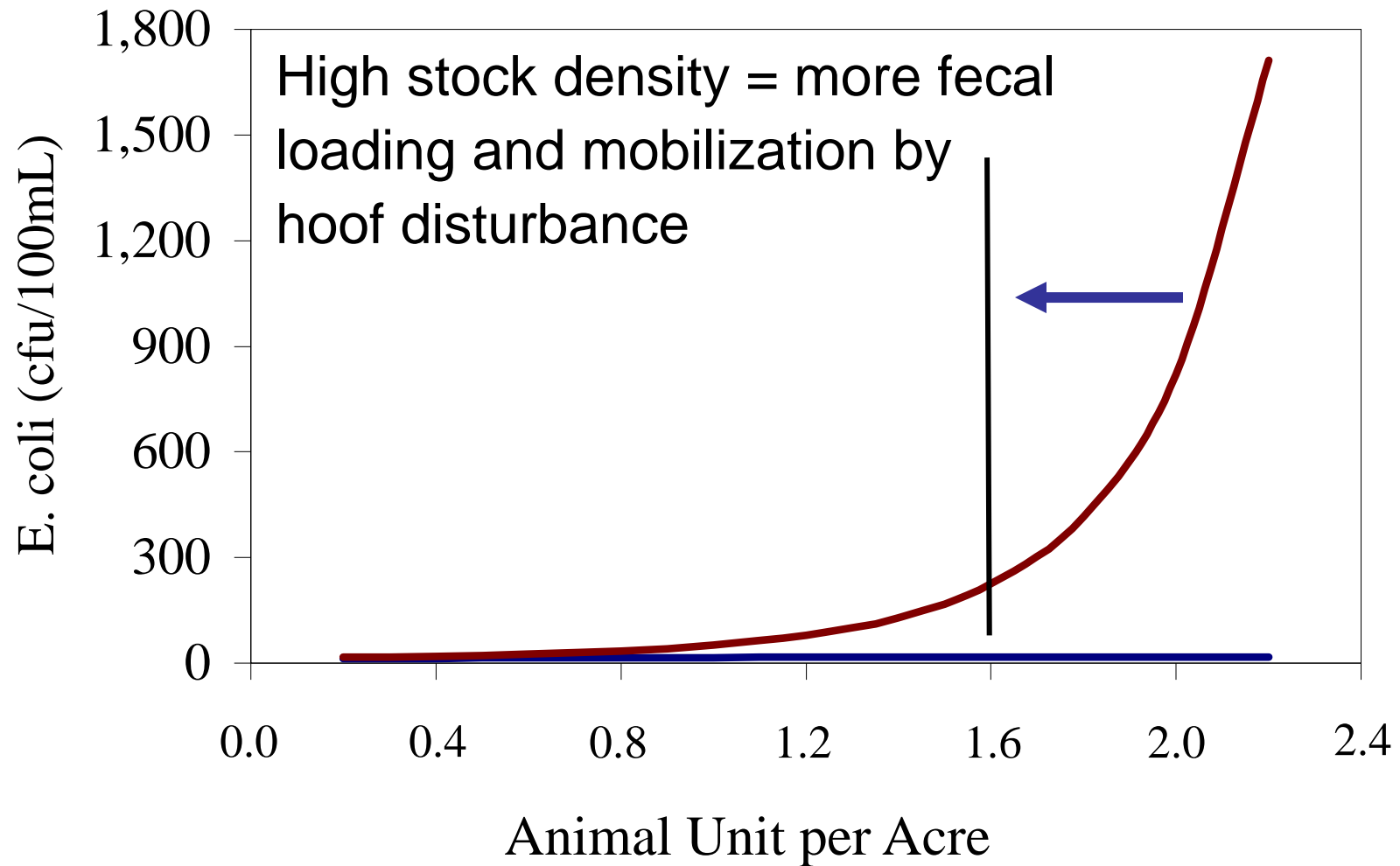


3. Analyze to determine associations between management and water quality.

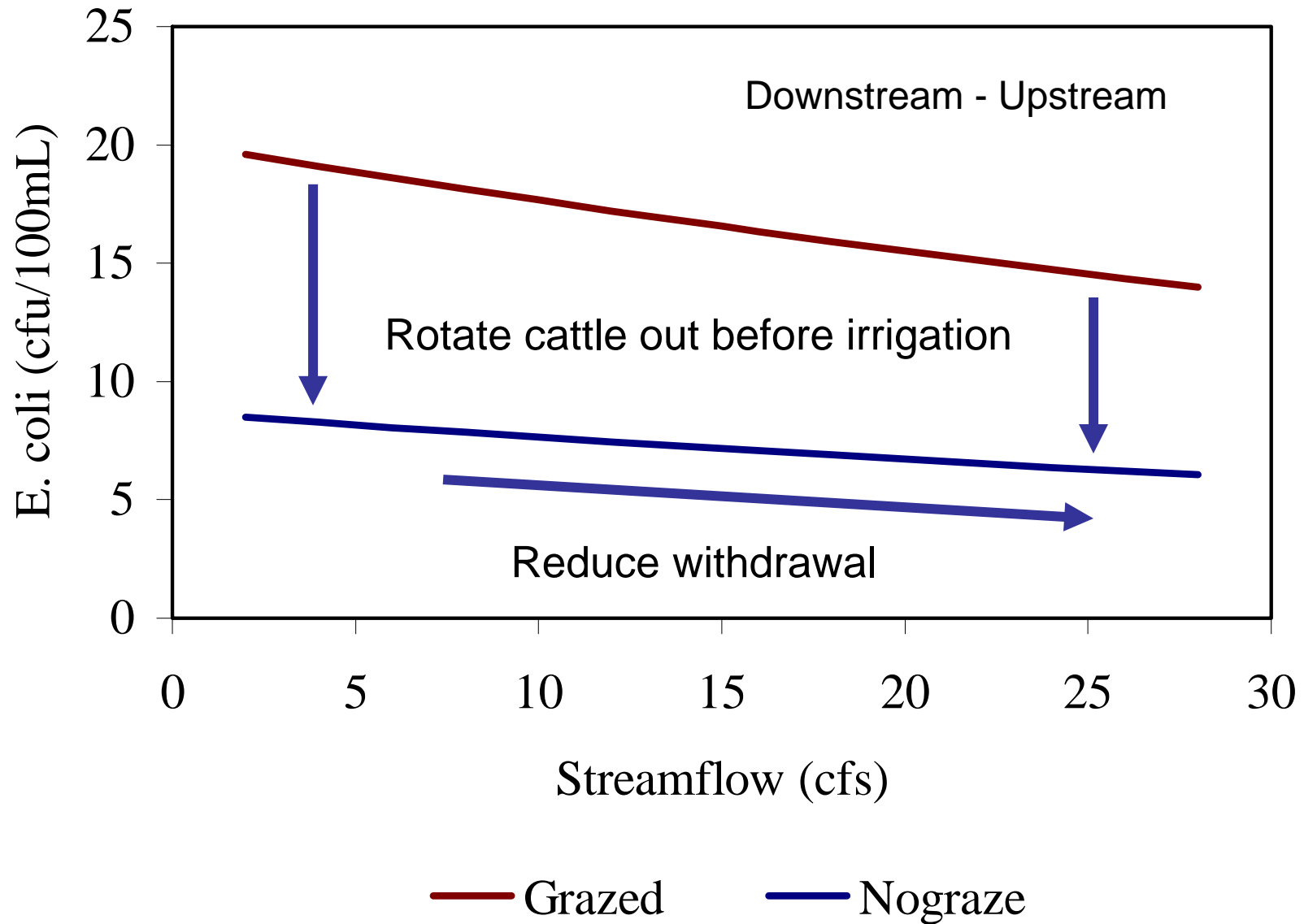
Irrigation Application Rate – Runoff Rate



Cattle Stocking Density (AU = 1 cow)



Rotational Grazing and Diversion Rate



Filtering Tail-Water

- Do wetlands filter runoff from pastures?
- Opportunity to filter water from multiple pastures, or at the end of a series of ranches?



Effectiveness is dependent on flow dispersion, infiltration, and residence time

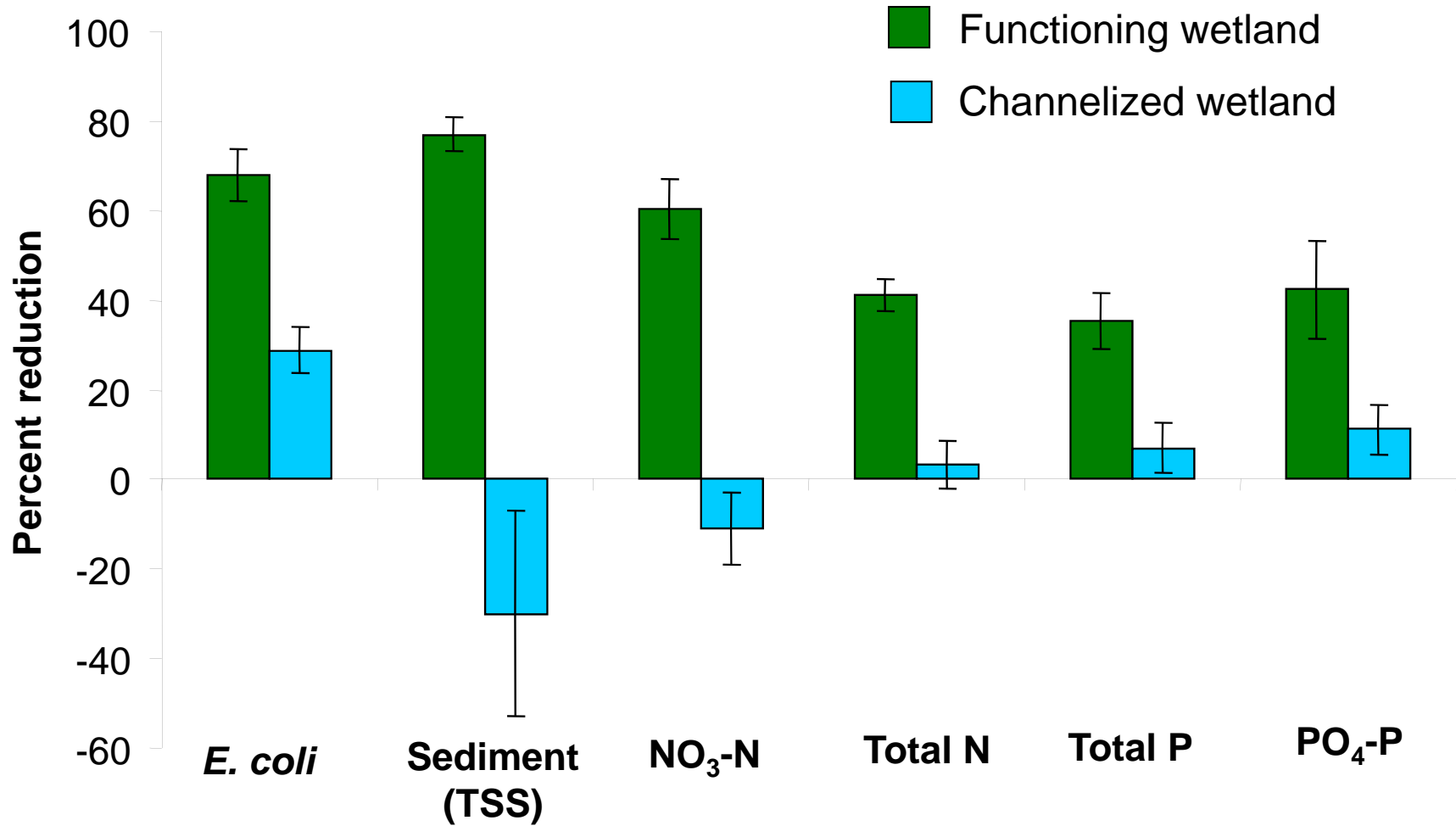


Functioning Wetland



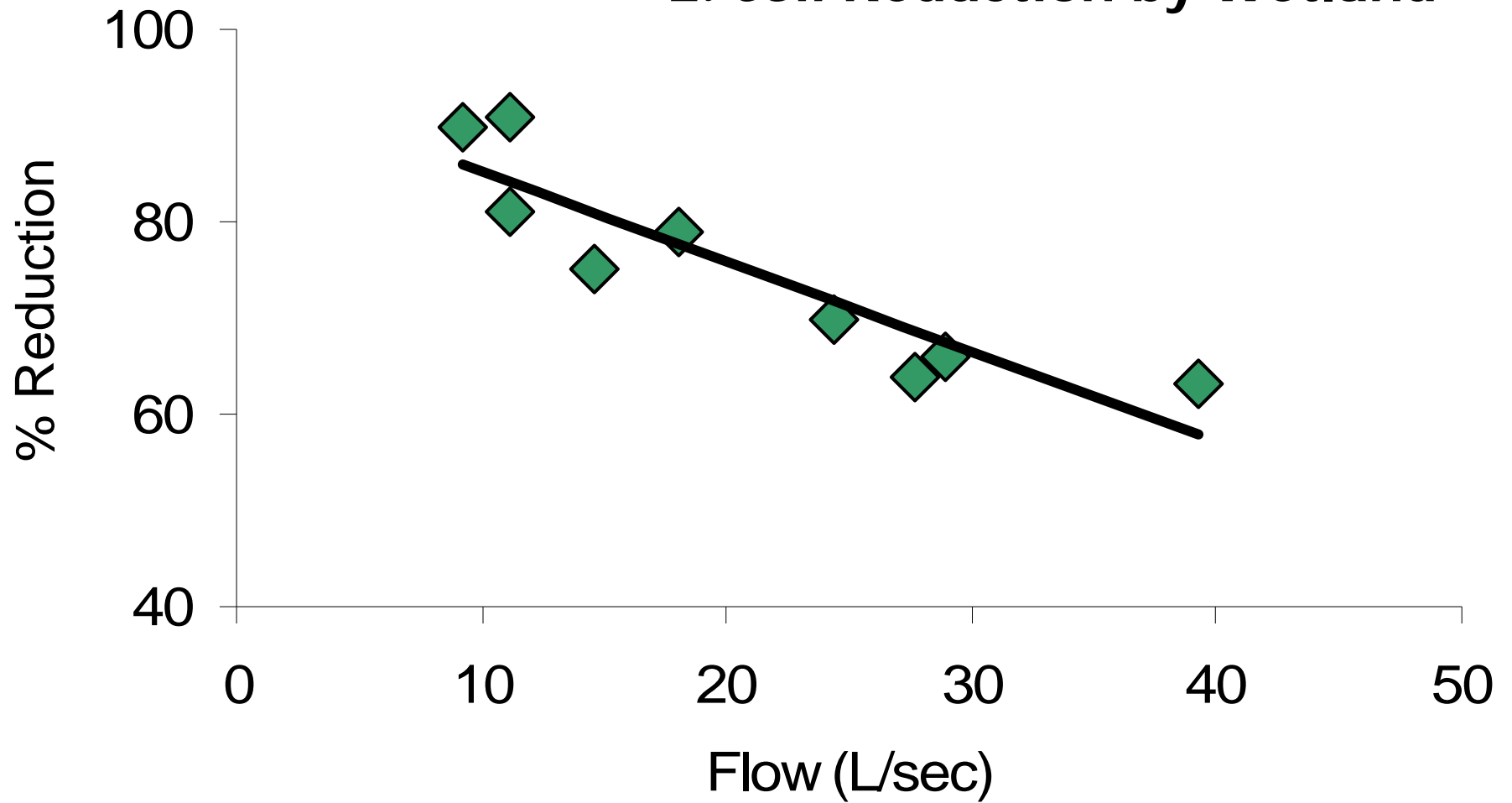
Channelized Wetland

Reduction of Pollutants due to Wetland



Less Filtration Under High Flow Conditions

E. coli Reduction by Wetland



Summary

- “Source” pasture characteristics:
 - high runoff rates
 - high stocking rates
 - grazing during irrigation
 - discharge to low flow streams

Summary

- Management solutions:
 - moderate stocking rates
 - rotate grazing relative to irrigation
 - reduce runoff rates
 - improve delivery to reduce diversion
 - wetland, buffer, tail-water pasture

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Irrigated Pasture Management

Enhancing adoption of sustainable irrigated pasture management strategies is critical to farming and ranching economic viability, environmental quality, and supply of ecosystem goods and services.



Irrigated Pastureland Enhancement Program



Producing Clean Tailwater



Vegetative Buffers and Wetland Filters



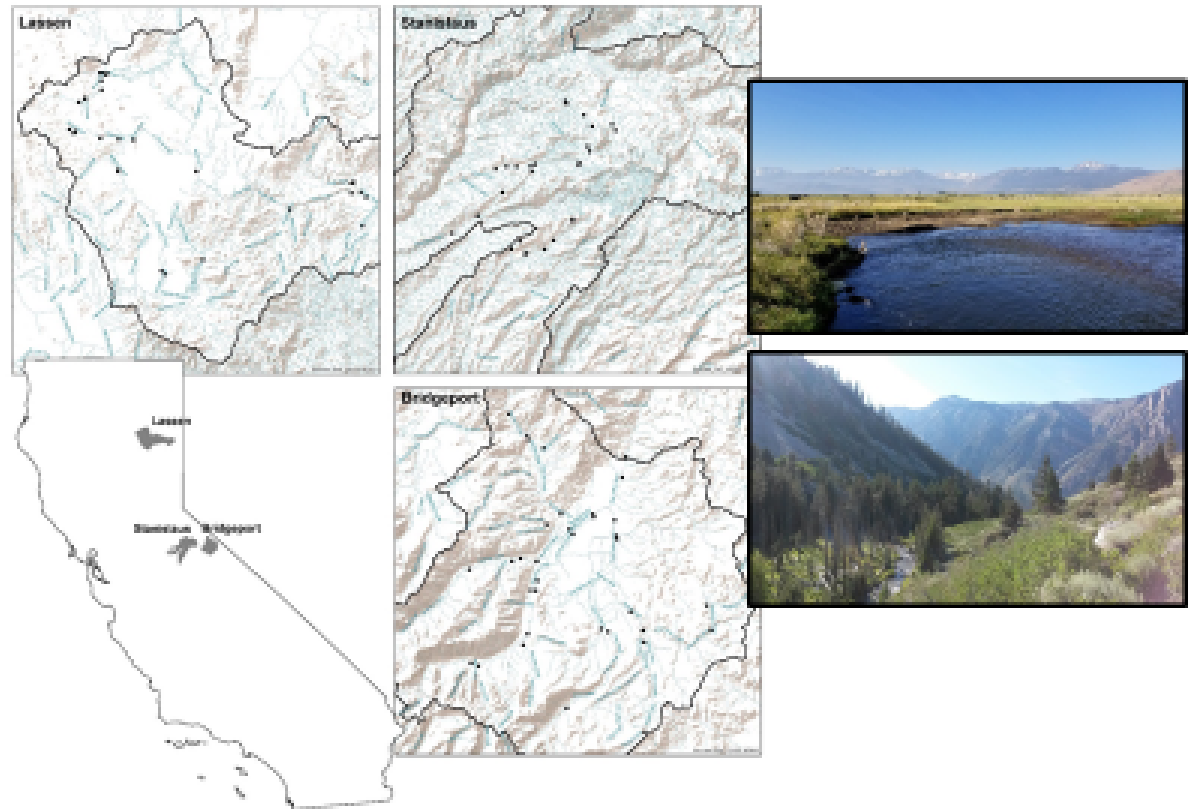
Irrigation Impacts on Forage Quality



Water Quality Conditions Associated with Livestock, Recreation, and Residences on Multiple-Use Landscapes - 2016

DeRose *et al.* (in prep)

- Three watersheds
 - Public grazing land
 - Public recreation
 - Residential areas
 - Private irrigated pasture
- 87 stream sites
- Sampled ~ every 10 days
- July 1 – Sept 30
- 680 samples total
- *E. coli* and fecal coliform concentrations



Results - *E. coli* concentrations

