

Public Lands Grazing and WQ Project

Presented to US Forest Service Region 5
Vallejo, CA
November 4, 2010
Ken Tate, UCD Plant Sciences

Herring Lake, Herring Creek Allotment, Stanislaus NF

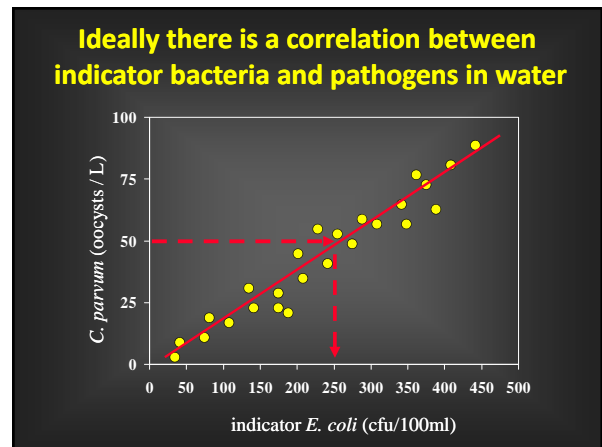
The Concern

Current grazing practices are increasing fecal indicator bacteria (FIB) and nutrient levels in waterbodies, thus human and ecological risk.

Fecal Indicator Bacteria (FIB)
total coliforms, fecal coliforms, indicator *E. coli*, *Enterococcus*

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

C. parvum *E. Coli* O157:H7 *Salmonella*



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Review
Fecal source tracking, the indicator paradigm, and managing water quality
Katharine G. Field^{a,*}, Mansour Samadpour^b

“E. coli and enterococci are not well correlated with pathogenic Salmonella spp. (Lemarchand and Lebaron, 2003), Campylobacter spp. (Bonadonna et al., 2002; Horman et al., 2004; Lemarchand and Lebaron, 2003; Lund, 1996), Cryptosporidium and Giardia spp. (Bonadonna et al., 2002; Harwood et al., 2005; Horman et al., 2004; Lemarchand and Lebaron, 2003; Lund, 1996), ...”

Irrigated Mountain Meadows

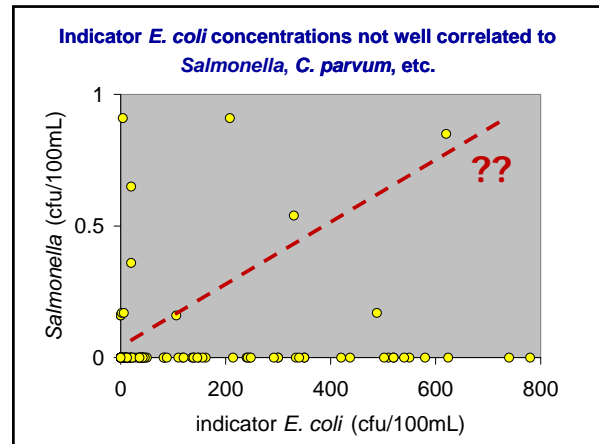
Sampled 16 sites above and below 4 irrigated, intensively grazed meadows. Sampled monthly for indicator *E. coli* and FC, *C. parvum*, *Salmonella*, *E. Coli* O157:H7, *Campylobacter*.

Irrigation, beef cattle grazing

1,000 to 20,000 AU 1,500 to 32,000 ac irrigated

Above v. Below EPA Guideline

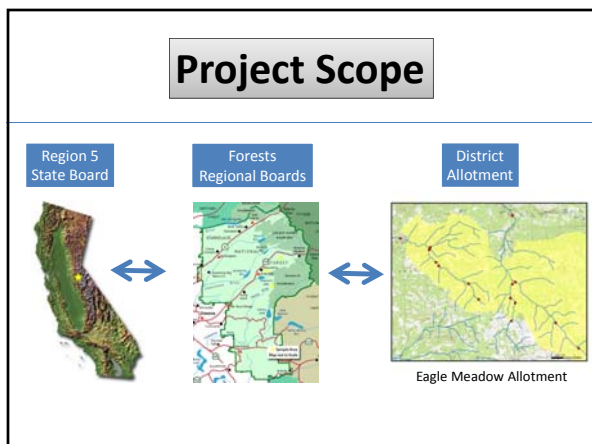
Indicator <i>E. coli</i>	<235 cfu/100ml	VS.	>235 cfu/100ml
<i>C. parvum</i> 8 positives	5/75		3/27
<i>Salmonella</i> 12 positives	9/75		3/27
<i>Campy</i> 0 positives	0/75		0/27
<i>E. coli</i> O157:H7 6 positives	4/95		2/21



Above v. Below Meadows

Location	Above	VS.	Below
<i>C. parvum</i> 8 positives	5		3
<i>Salmonella</i> 12 positives	10		2
<i>Campy</i> 0 positives	0		0
<i>E. coli</i> O157:H7 6 positives	0		6

- ### Project Objectives
1. FIB, pathogen, and nutrient source search monitoring program on representative allotments across Region 5.
 2. Link water quality (Obj. 1) with range condition and trend, annual use, allotment management, USFS BMPs.
 3. Outreach – make information available to USFS, WQCBs, stakeholders



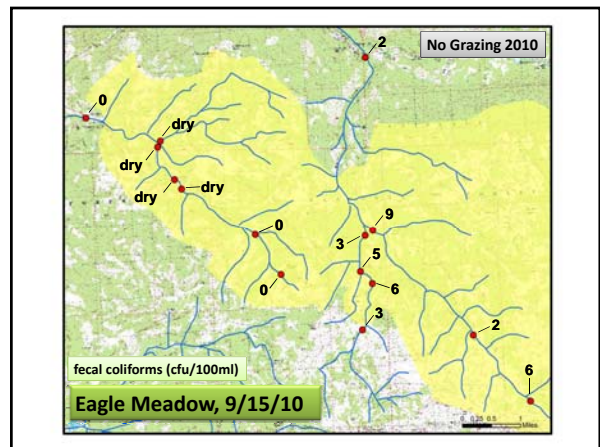
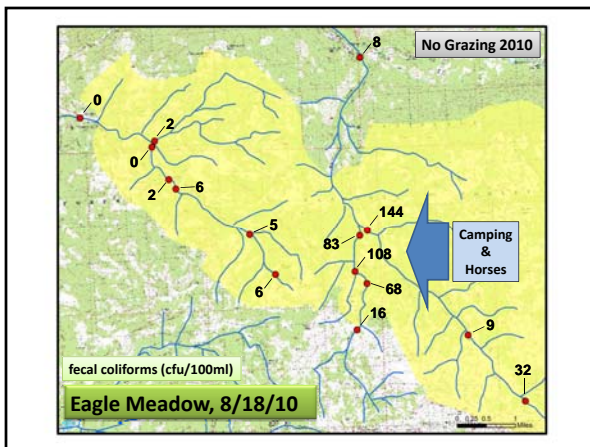
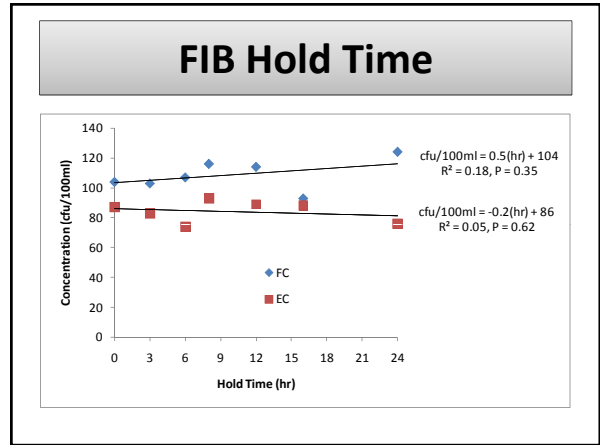
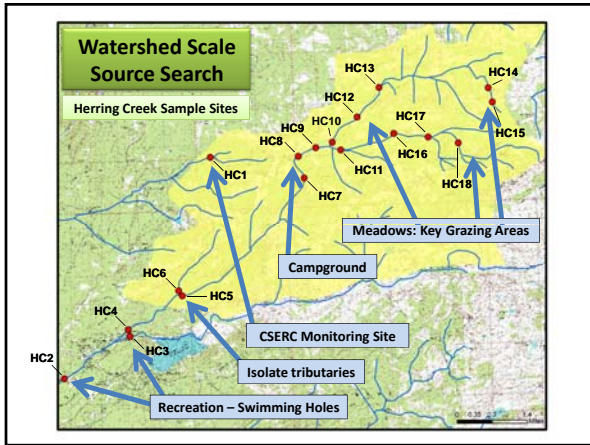
- ### Monitoring Plan
1. Stanislaus, Tahoe, Plumas, Klamath, Shasta-Trinity NF interested.
 2. Integrate with Dave Weixelman.
 3. Meet with staff on each interested forest.
 4. Need forest logistical support.
 5. Plan in place for Mar 2011 Range Workshop.
 6. Review (WQCBs, CSERC, CFBF/CCA, etc.)
 7. Start sampling before turn-out 2011.

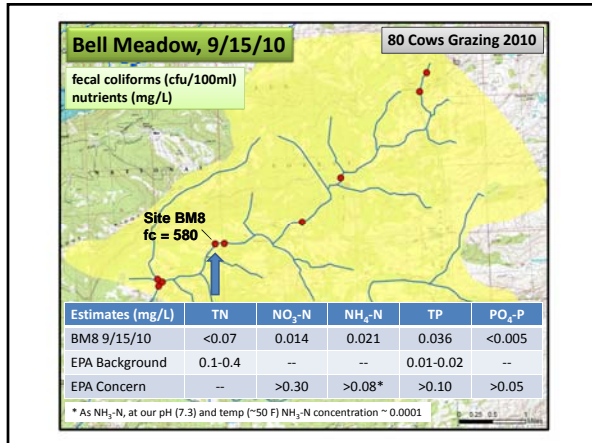
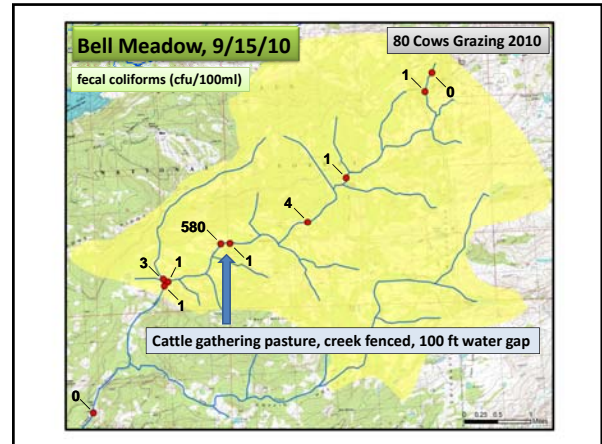
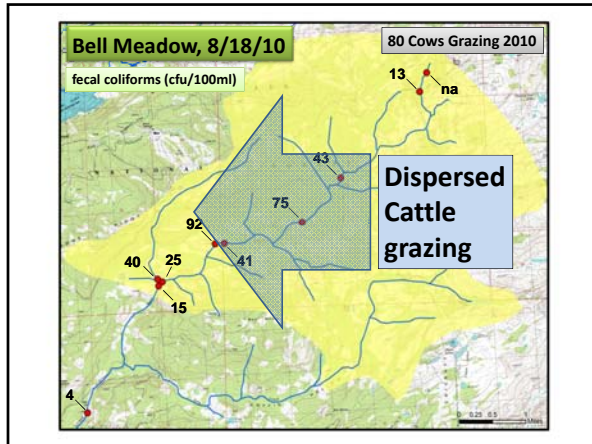
Monitoring Data

1. FIB, pathogen, nutrients (N, P), temperature, discharge, conductivity.
2. Stream reach assessments, canopy - SCI
3. Annual livestock use – standards and guides, fecal loading.
4. Long-term meadow/riparian/stream condition trends – Weixelman.
5. Open to ideas and collaboration.

Stanislaus NF 2010 – 3 Allotments

Eagle Meadow no turnout 0 cows 20,727 ac
Herring Creek 7/15 to 9/30 50 cows 17,246 ac
Bell Meadow 7/15 to 9/30 80 cows 13,211 ac





Nutrients Low

Allotment	Date	Mean Concentration (mg/L)				
		TN	NO ₃ -N	NH ₄ -N	TP	PO ₄ -P
Eagle Meadow N=15 (11)	Aug 18	0.04	0.01	0.03	0.033	0.017
	Sep 15	0.07	0.04	0.05	0.056	0.015
Herring Creek N=16 (17)	Aug 18	0.19	0.03	0.04	0.082	0.026
	Sep 15	0.10	0.02	0.03	0.071	0.010
Bell Meadow N=9 (10)	Aug 18	0.07	0.07	0.03	0.023	0.014
	Sep 15	0.04	0.03	0.03	0.055	0.008
		>0.30		>0.100		>0.050

Allotment	Date	Percent (%) of Samples Below Detection				
		TN	NO ₃ -N	NH ₄ -N	TP	PO ₄ -P
Eagle Meadow N=15 (11)	Aug 18	100	40	0	0	0
	Sep 15	82	18	0	0	18
Herring Creek N=16 (17)	Aug 18	56	19	6	0	13
	Sep 15	67	0	0	0	40
Bell Meadow N=9 (10)	Aug 18	56	0	0	33	22
	Sep 15	90	40	0	0	80

Stream Temperatures Low

Allotment	Daily Stream Temperature (F)		
	Min	Mean	Max
Eagle Meadow	48	52	59
Herring Creek	47	51	56
Bell Meadow	49	53	59

- ### Outreach
1. Workshops, field tours, training.
 2. Guidance for incorporating WQ into allotment planning (e.g., NEPA, WQMP, waivers, BMPs)
 3. Information to local and regional forest communities.

Make Knowledge Available

Environ. Sci. Technol. 2005, 39, 4434-4438

Seasonal Temperature Fluctuations Induces Rapid Inactivation of *Cryptosporidium parvum*

Article.pdf

Translation

Management Implication

Once temperature in a cow fecal pat exceeds 104 °F all of the *C. parvum* in that pat die within a matter of hours. Fecal pats in direct sun achieve 104 °F once air temperature reaches 78 °F.

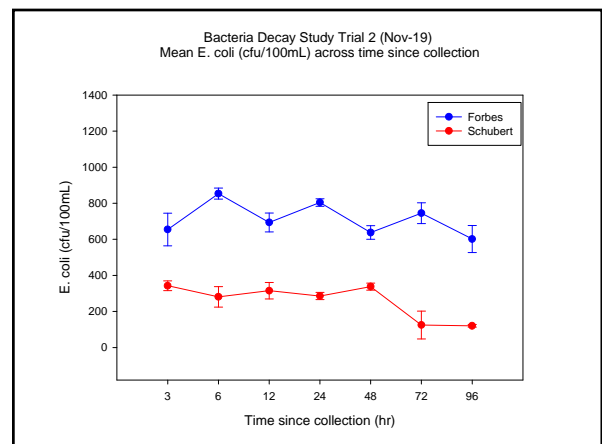
We can use this fact to time grazing in critical runoff areas so that there are enough days above 78 °F to neutralize any *C. parvum* in cattle fecal pats prior to rainfall and runoff.

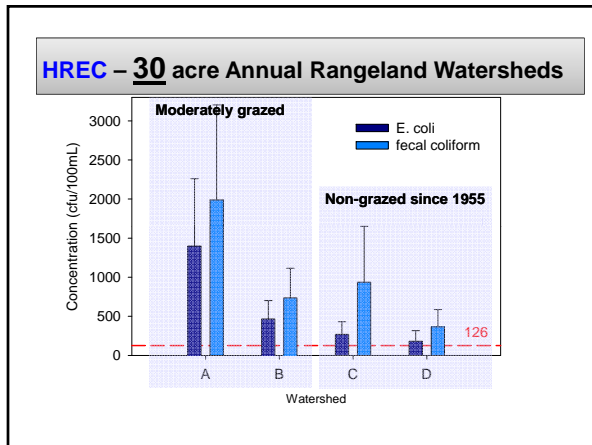
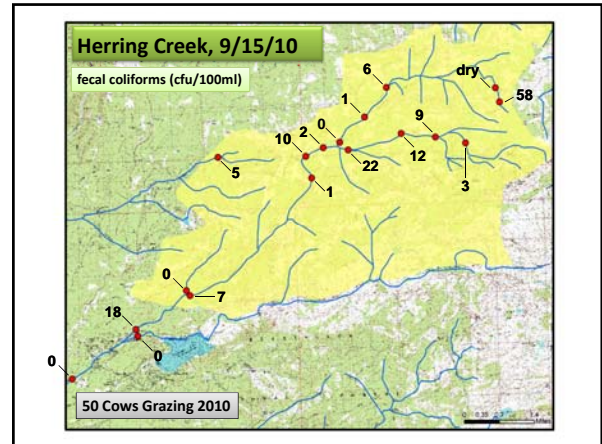
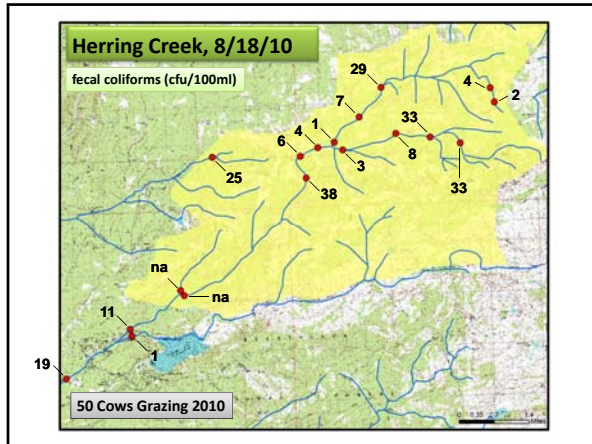


Extra Slides for Possible Questions or Documentation

- ### Developing Partnerships
- Forests and Districts, Grazing Managers
 - State, Regional WQ Control Boards
 - Resource Conservation Districts, NRCS
 - Sierra Business Council
 - National Forest Foundation
 - Anyone ready to solve this issue

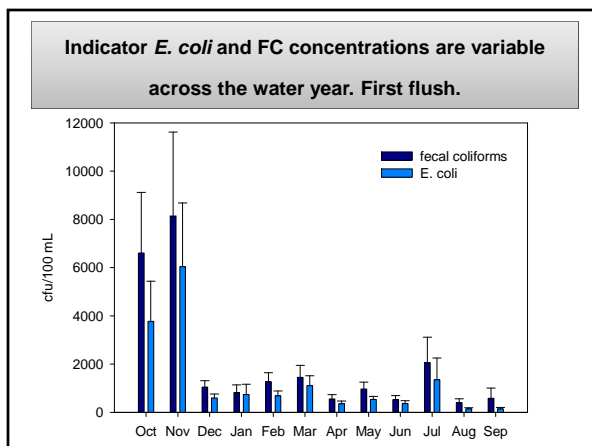
- ### Products
1. Direct monitoring support of adaptive management.
 2. Correlations between USFS standard & guides, grazing management, and WQ.
 3. Link meadow/riparian trends to WQ.
 4. Web-based guidance for incorporating WQ into allotment planning.





300 ac Annual Range Watersheds

Grazing Intensity	Sediment mg/L	Nitrate mg/L	E. Coli cfu/100ml
None 4000+ lb/ac RDM	2	0.1	310
Moderate 800 lb/ac RDM	7	0.4	425
Heavy 500 lb/ac RDM	24	0.8	1250



Livestock Pathogens of Waterborne & Public Health Concern:

Protozoa: "hard" to eliminate during water treatment, low infectious dose, mild to moderate illness

- ❖ *Cryptosporidium parvum*
- ❖ *Giardia duodenalis*

Bacteria: "easy" to eliminate during water treatment, higher infectious dose, mild to serious illness

- ❖ pathogenic *E. coli* (e.g., Stx 1&2, O157:H7)
- ❖ *Salmonella*
- ❖ *Campylobacter*

Beef Cattle FIB and pathogens not consistently correlated at the "end of the cow"

Fecal Indicator Bacteria:
 Fecal coliform, *E. coli* are shed every day, all animals, millions per gram of feces

Pathogens:
C. Parvum is shed seasonally by 10% of calves < 4 mo age at 100K per gram feces, and annually by 1% of adult cows at < 100 per gram feces.

