Managing Rangeland Watersheds for Agricultural Production, Water Quality, and Food Safety

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WESTERN INSTITUTE for FOOD SAFETY & SECURITY

UNIVERSITY of CALIFORNIA Agriculture & Natural Resources

To all our cooperators from across California

be they ranchers, growers, or regulators, activists, resource managers, and the public

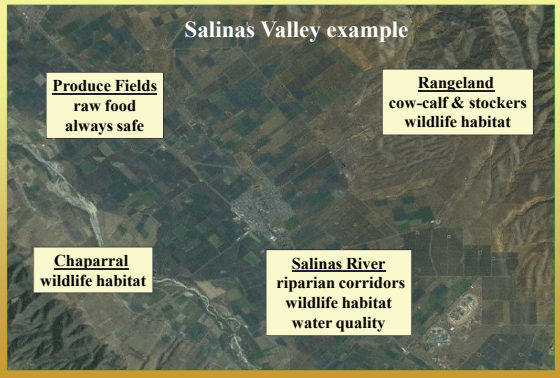
THANK YOU!

California feeds the nation, every day

California beef cattle

Juxtaposition of plant agriculture and grazed rangeland

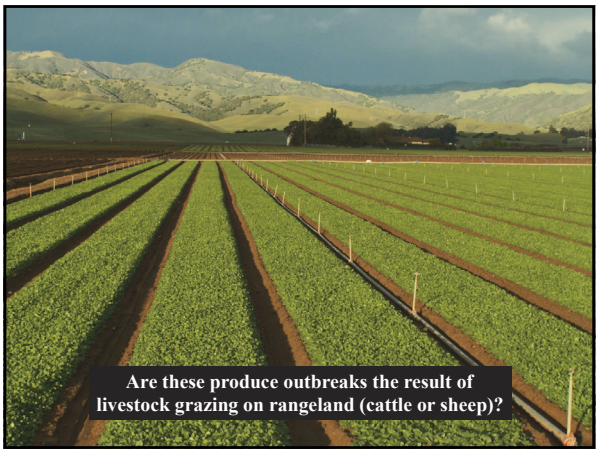
Salinas Valley example



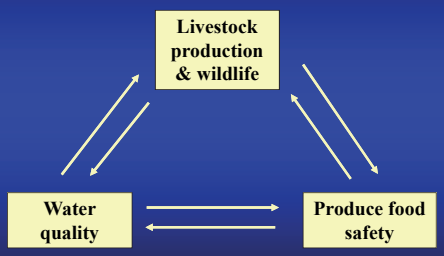
Produce outbreaks traced back to California
Many outbreaks occur in late summer to early fall

Year	Food Vehicle	Pathogen	Cases	Reference
1996	Mesclun lettuce	*E. coli* O157:H7	61	Hilborn et al., 1999
1996	Unpasteurized apple juice	*E. coli* O157:H7	70	CDC, 1996; Cody et al., 1999
1996-1998	Alfalfa or clover sprouts (6 outbreaks)	*E. coli* O157 *Salmonella*	600	Mohle-Boetani et al., 2001
2000-2001	Raw almonds	*Salmonella* Enteritidis PT30	168	Isaacs et al., 2005
2002	Romaine lettuce	*E. coli* O157:H7	29	CDHS, 2002
2002-2004	Raw almonds	*Salmonella* Enteritidis PT9c	47	CDHS, 2004
2003	Baby spinach	*E. coli* O157:H7	16	Reiss et al., 2007
2006	Baby spinach	*E. coli* O157:H7	205	CDC, 2006
2006	Iceberg lettuce	*E. coli* O157:H7	77	CDPH, 2007
2006	Iceberg lettuce	*E. coli* O157:H7	80	CDPH, 2008

Recalls and outbreaks continue to present day



Minimizing pathogen movement from livestock & wildlife to food and water



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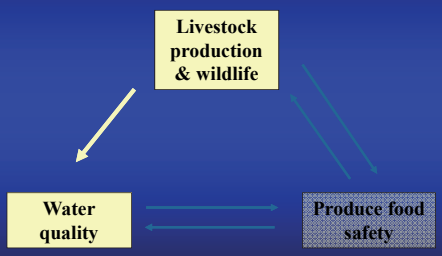

Waterborne pathogen BMPs for grazing

Key processes driving waterborne contamination

1. animal loading (who done it)
2. microbial transport (how did it get there)
3. microbial inactivation (is it still alive)

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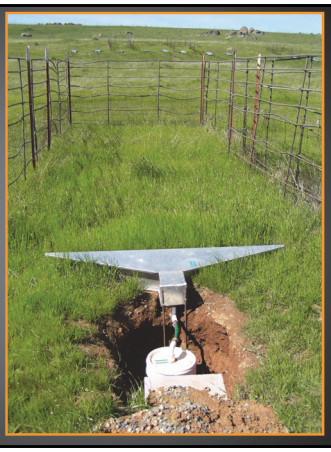
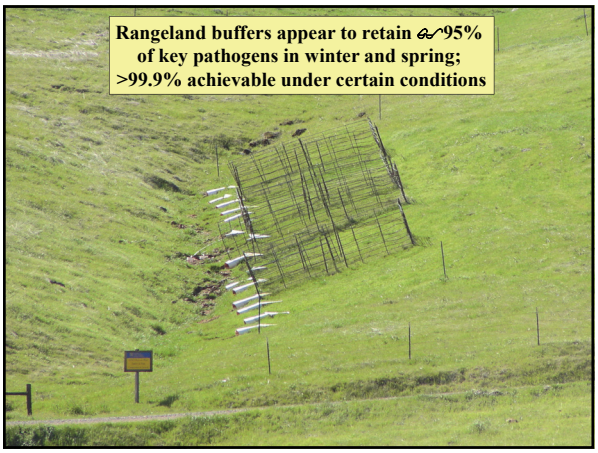
Sierra Foothill Research & Extension Center, University of California



Buffer width (m)
0.1, 1.1, 2.1

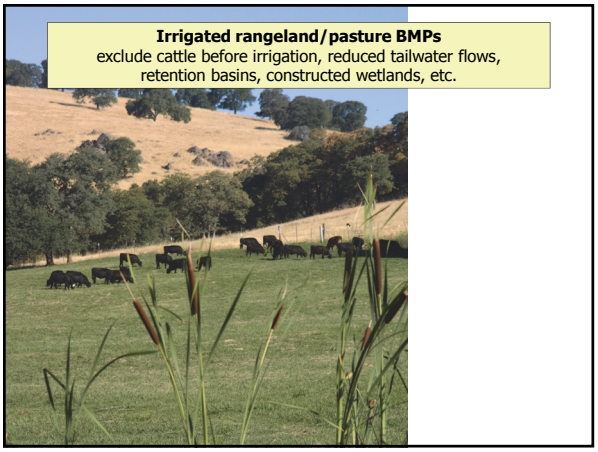
Land slope (%)
5, 20, 35

RDM (kg/ha)
225, 560, 900, 4500



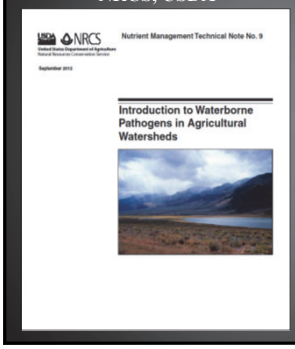
Rangelands and timing of grazing

- Match onset of rainy season to exclusion dates
- Summer riparian grazing
- Rotational grazing timelines

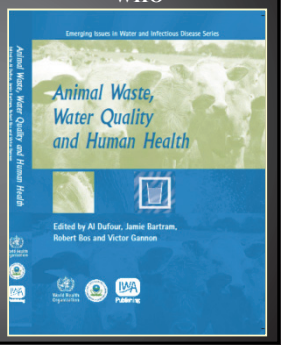


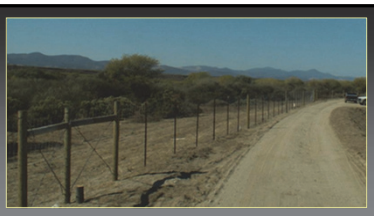
2012 technical reports on waterborne pathogens and BMPs
Ken Tate's website (California Rangeland Watershed Laboratory)
all are FREE!

NRCS, USDA

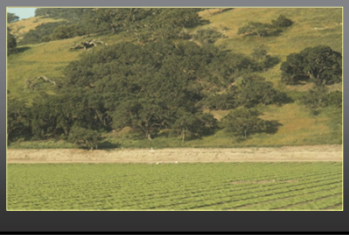


WHO



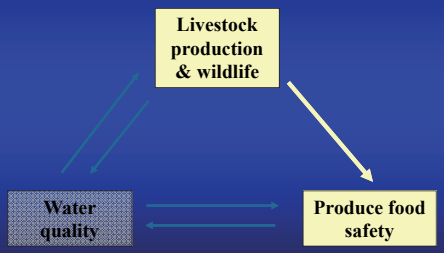


Riparian habitat removal



Bare ground buffers

Minimizing pathogen movement from livestock & wildlife to food and water



Are livestock and wildlife infected with key food safety pathogens?

***E. coli* O157:H7 in central California wildlife and cow-calf operations**

***E. coli* O157:H7, 2008-10**		
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%)

Cow-calf herds 68/2715 (2.5%)

Cow-calf herds, 2008-2010

***E. coli* O157 infection ranged from 0% to 10%**

***Salmonella* was <1%**

Herd	pos	n	prev (%)
A	0	489	0.0
B	7	480	1.5
C	0	200	0.0
D	44	434	10.1
E	0	61	0.0
F	6	386	1.6
G	2	271	0.7
H	9	256	3.5
I	0	138	0.0
Total	68	2715	2.5

Would vaccination for *E. coli* O157:H7 make sense?

Prevalence of pathogens in wild rodents in produce production fields, central California

<1% infected with *E. coli* O157:H7
3-4 % infected with *Salmonella*

Rodent species	*Cryptosporidium*	*Giardia*
CA parasitic mouse	11%	13%
Deer mouse	33%	27%
Dusky-footed wood rat	17%	17%
Total	**28%**	**25%**

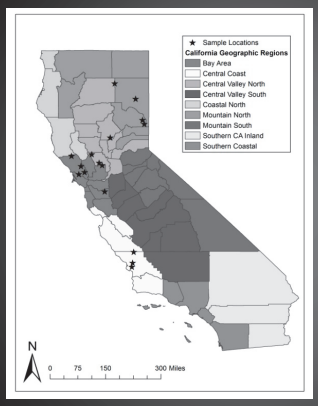
Preliminary data: *Crypto* appears human infectious, *Giardia* mostly not

2011 & 2012 field trials of romaine lettuce, Salinas Valley

Add in 2 hours of irrigation

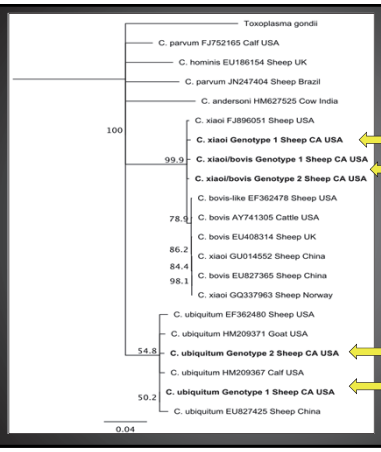
20 to 30% heads of lettuce contaminated with *E. coli* O157:H7

Statewide livestock survey
E. coli* O157:H7, *Salmonella*, *Cryptosporidium*, *Giardia
- sheep and cow-calf -



Sheep infection with *Cryptosporidium* spp.

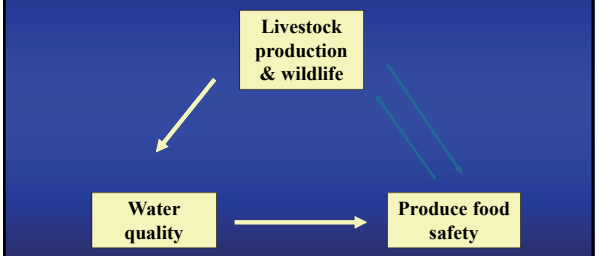
lambs 31%
ewes 3%

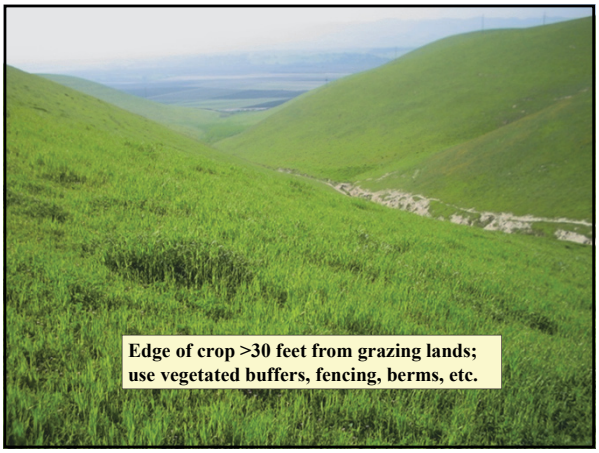


90% not human infectious

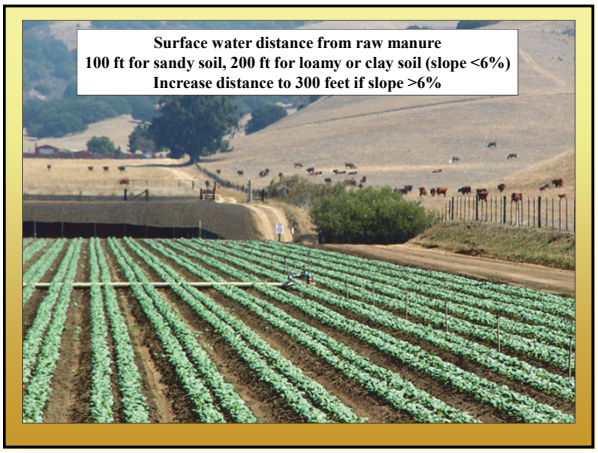
10% human infectious

Minimizing pathogen movement from livestock & wildlife to food and water



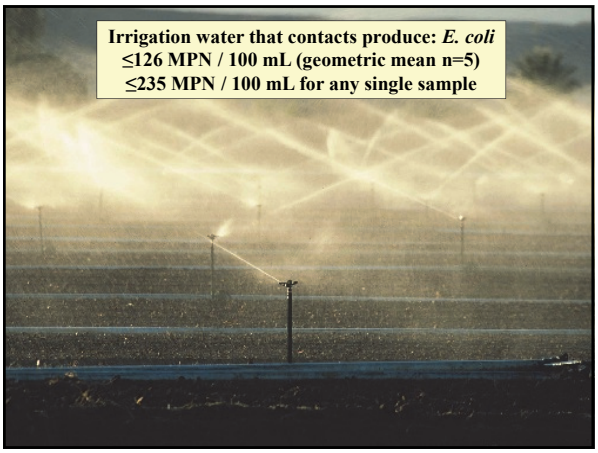


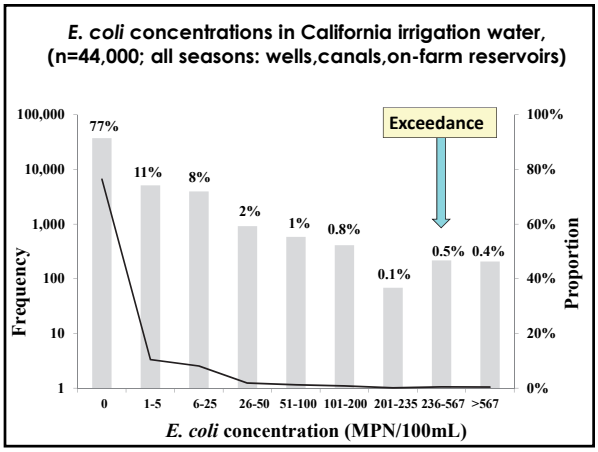
Edge of crop >30 feet from grazing lands; use vegetated buffers, fencing, berms, etc.

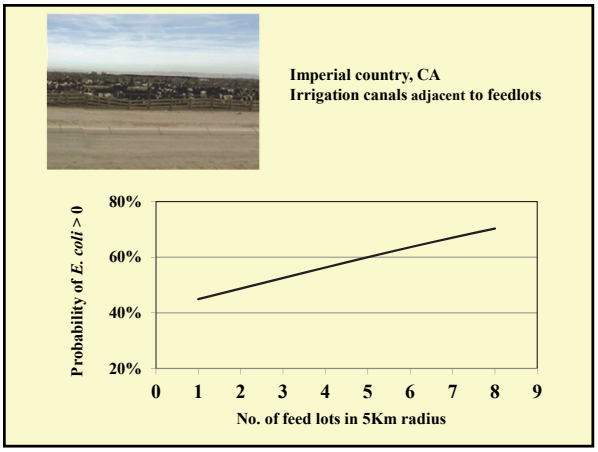


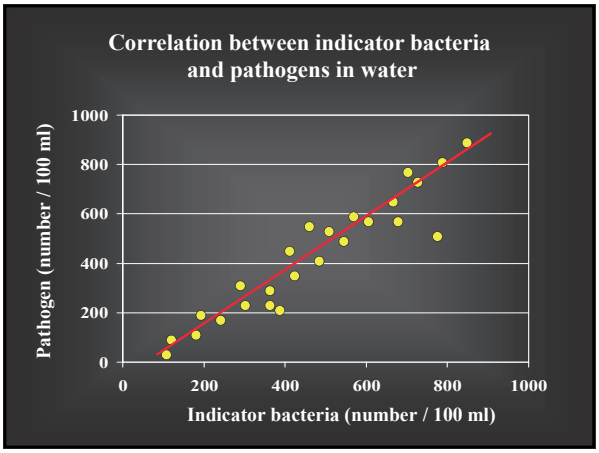
Surface water distance from raw manure
100 ft for sandy soil, 200 ft for loamy or clay soil (slope <6%)
Increase distance to 300 feet if slope >6%

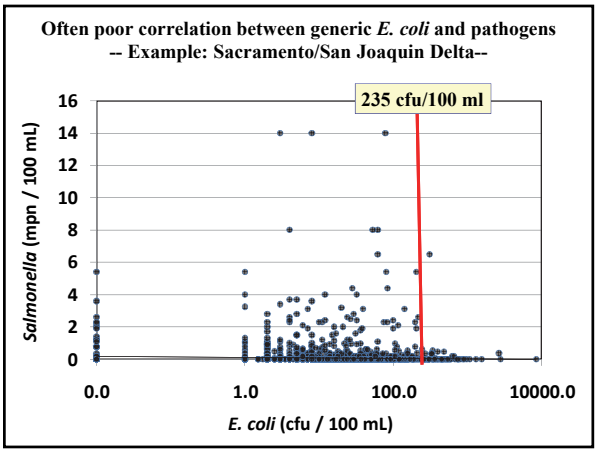
Microbiological safety of irrigation water

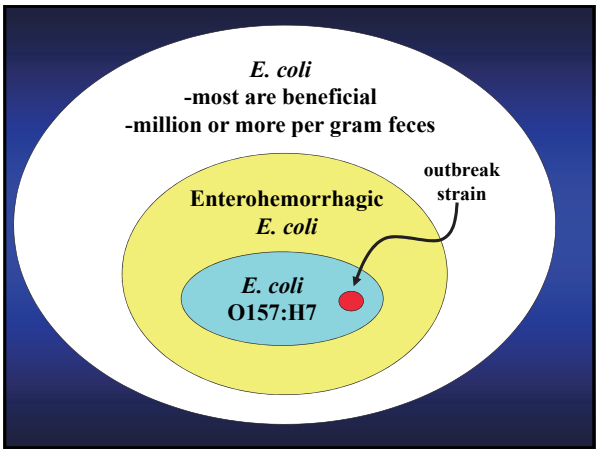










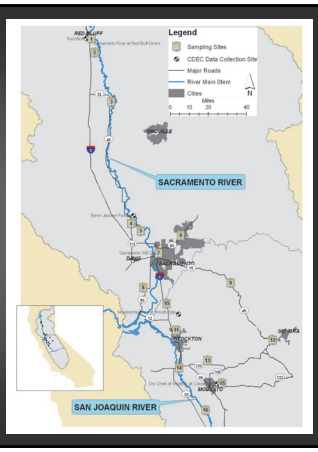


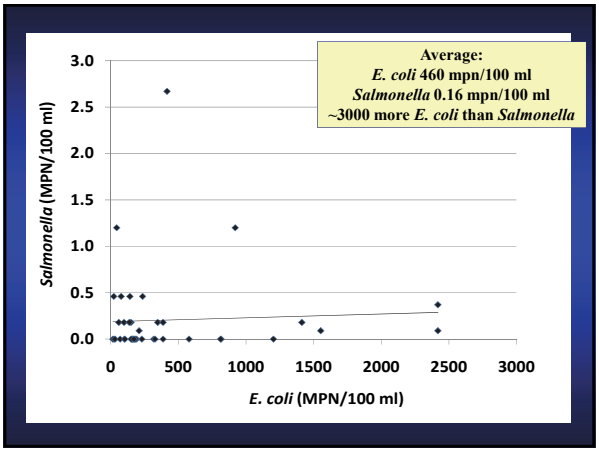
CVRWQCB

From Red Bluff to Sacramento, Sonora to Modesto

***E. coli* O157**
2/60 = 3%

Salmonella
21/60 = 35%





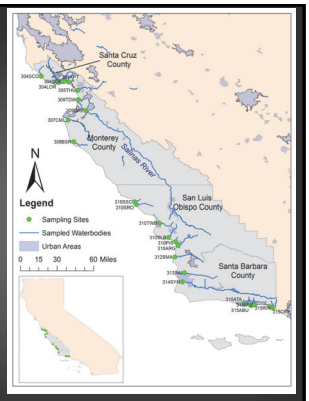
CCRWQCB

From Rincon Creek up to Aptos Creek 23 rivers, creeks or their estuaries

April 2009 to April 2010

***E. coli* O157**
6/251 = 2.4%

Salmonella
78/251 = 35%
1.3 MPN/100 ml



Recall <1% cow-calf shed *Salmonella*; 2-6% in wildlife