

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



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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

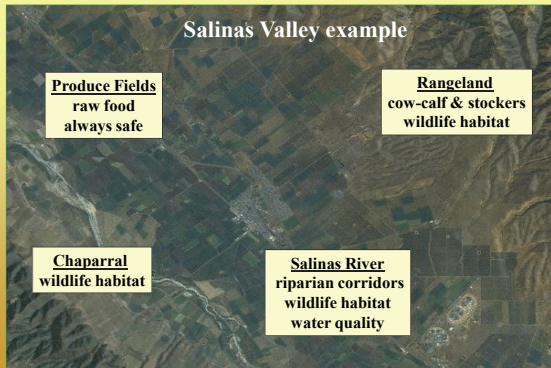
Salinas Valley example

Produce Fields
raw food
always safe

Rangeland
cow-calf & stockers
wildlife habitat

Chaparral
wildlife habitat

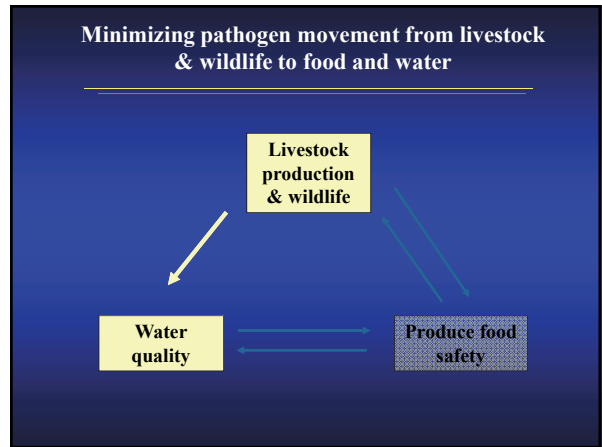
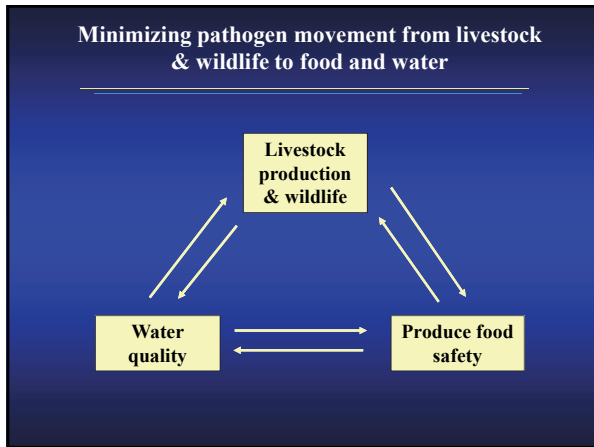
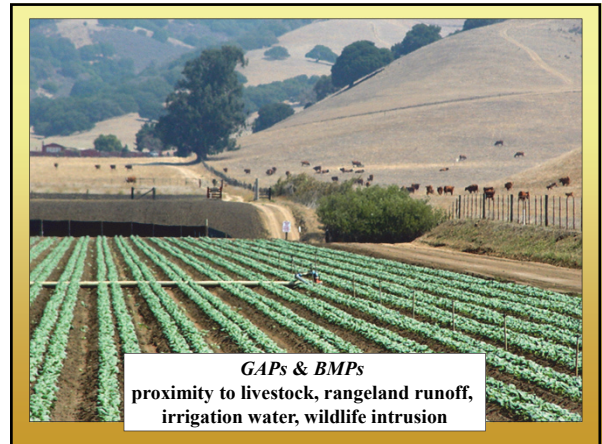
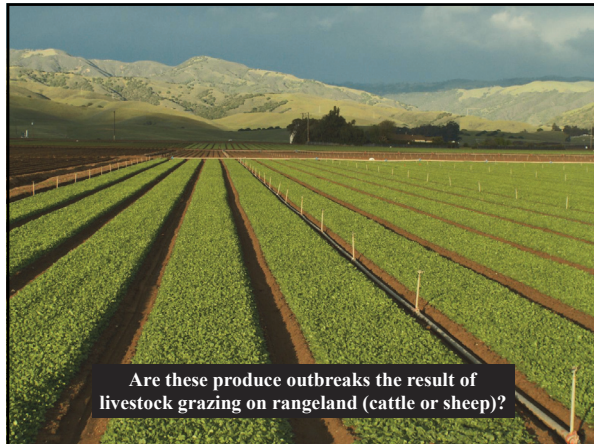
Salinas River
riparian corridors
wildlife habitat
water quality



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

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

Recalls and outbreaks continue to present day



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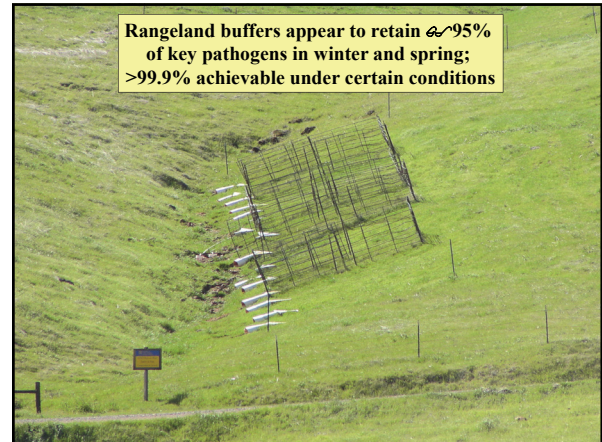
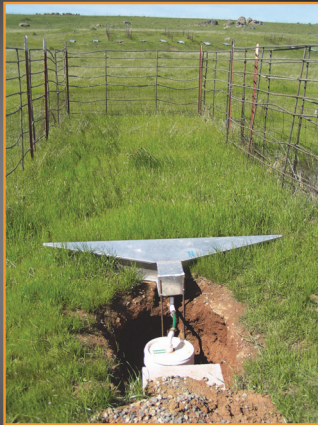
1. animal loading (who done it)
2. microbial transport (how did it get there)
3. microbial inactivation (is it still alive)

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



Rangeland buffers appear to retain ~95%
of key pathogens in winter and spring;
>99.9% achievable under certain conditions

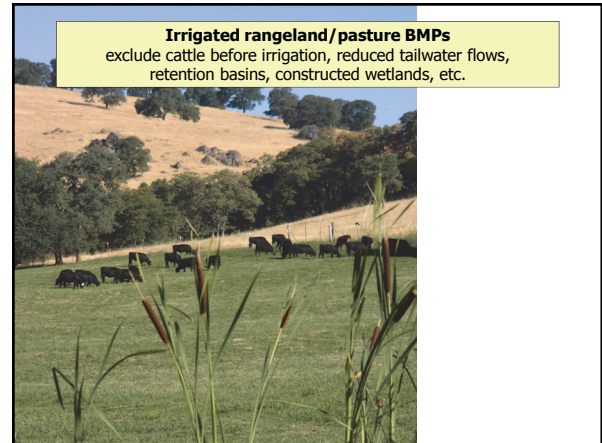
Rangelands and timing of grazing

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



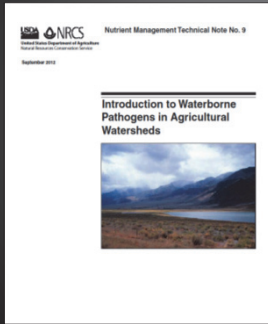
Irrigated rangeland/pasture BMPs

exclude cattle before irrigation, reduced tailwater flows,
retention basins, constructed wetlands, etc.

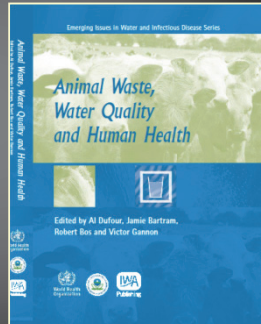


2012 technical reports on waterborne pathogens and BMPs
Ken Tate's website (California Rangeland Watershed Laboratory)
all are FREE!

NRCS, USDA

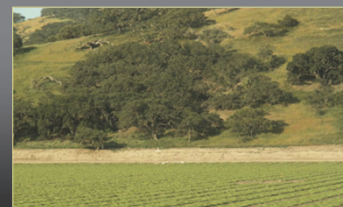


WHO

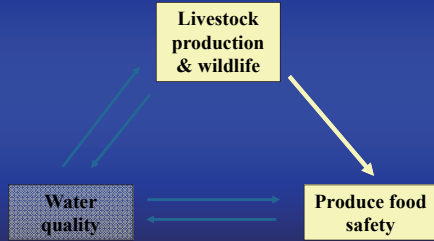


**Riparian
habitat
removal**

**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	<i>Cryptosporidium</i>	<i>Giardia</i>
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

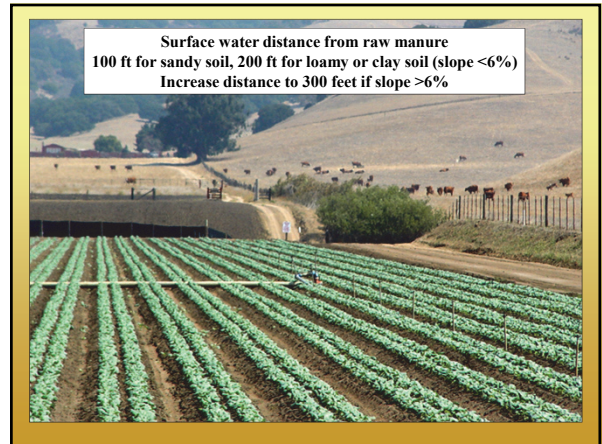
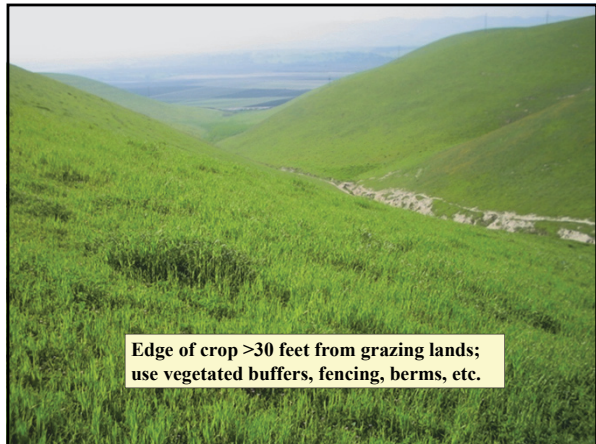
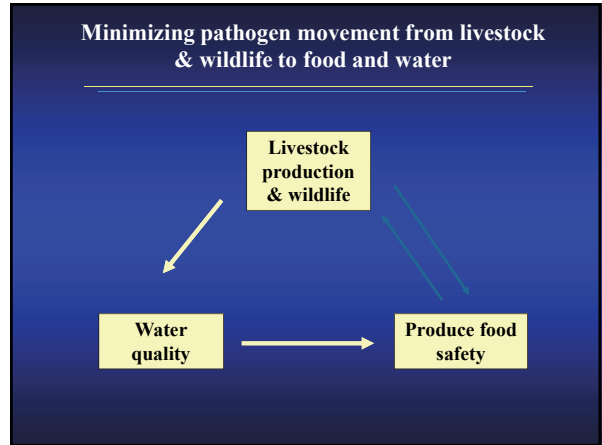
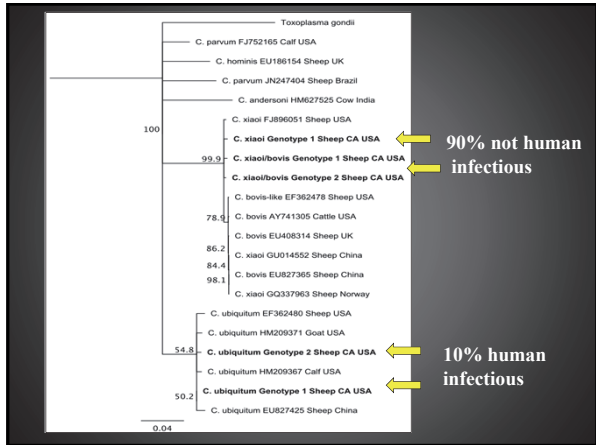
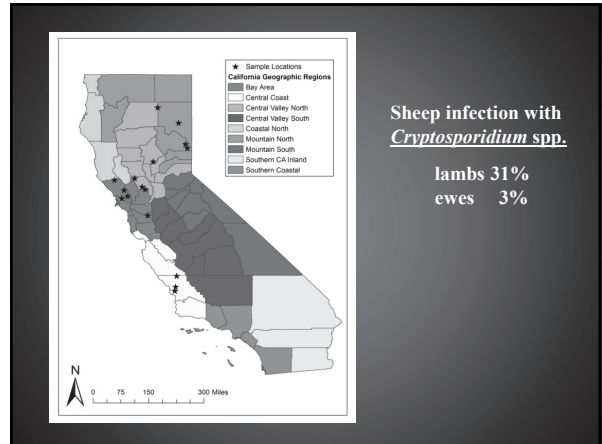
2011 & 2012 field trials of romaine lettuce, Salinas Valley

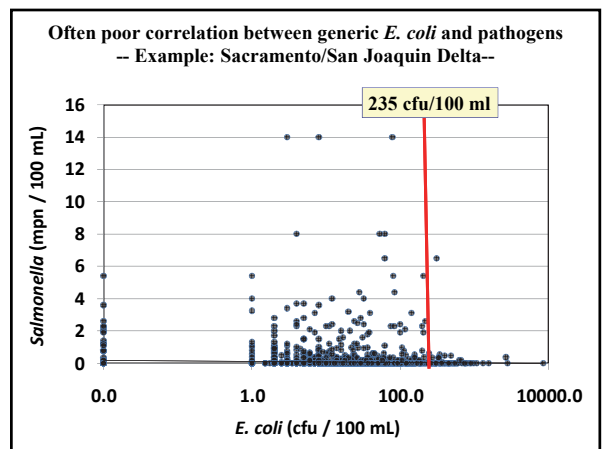
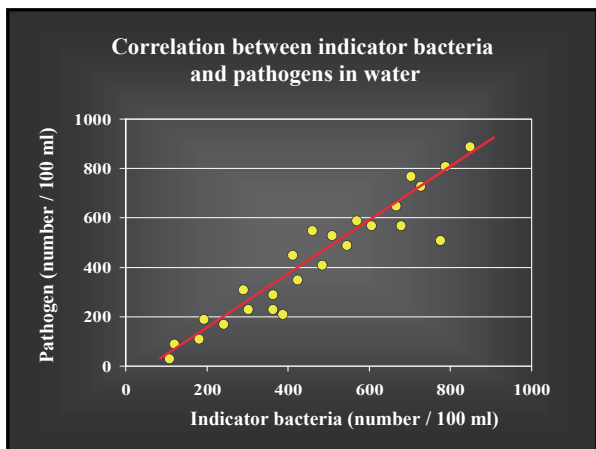
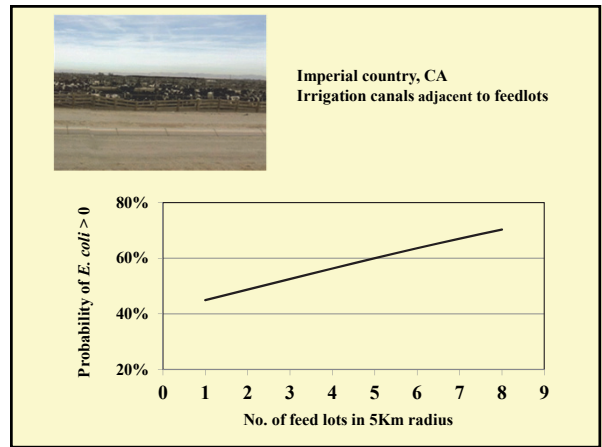
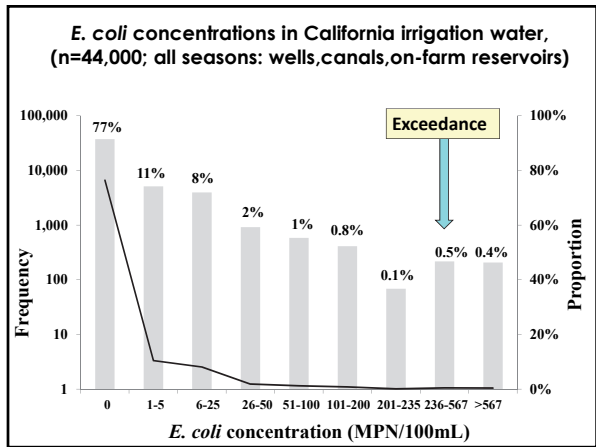
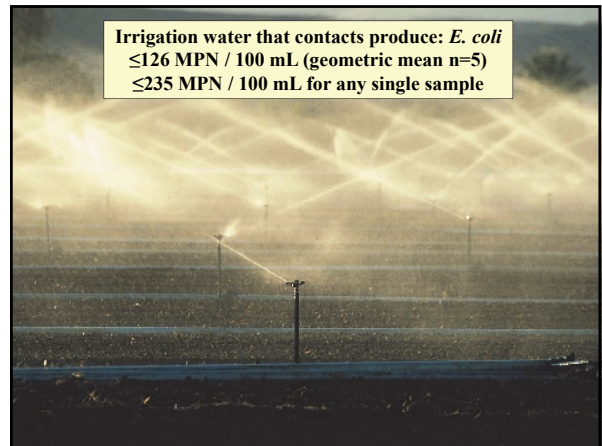
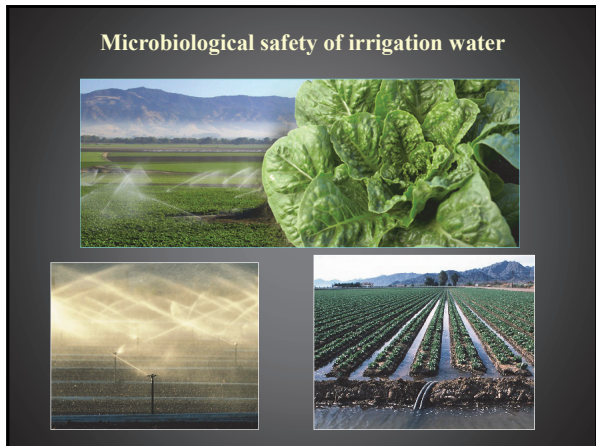


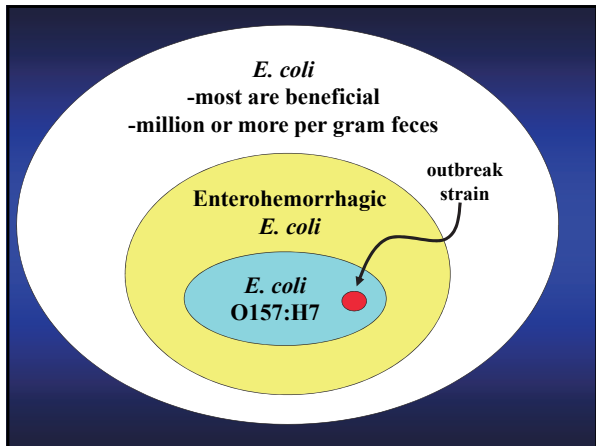
Add in 2 hours of irrigation



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





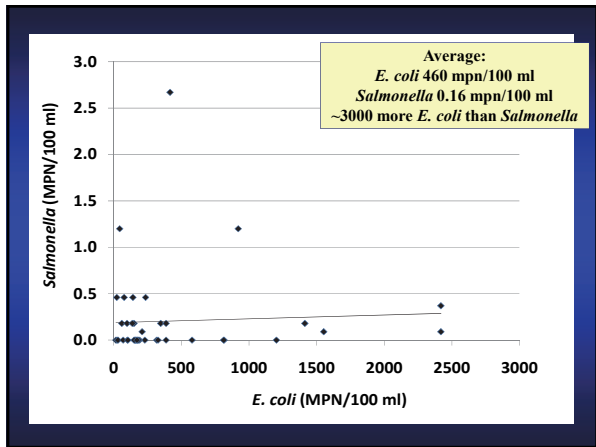


CVRWQCB

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

