WIFSS research on *E. coli* O157:H7 in central coastal California

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To all cooperators:

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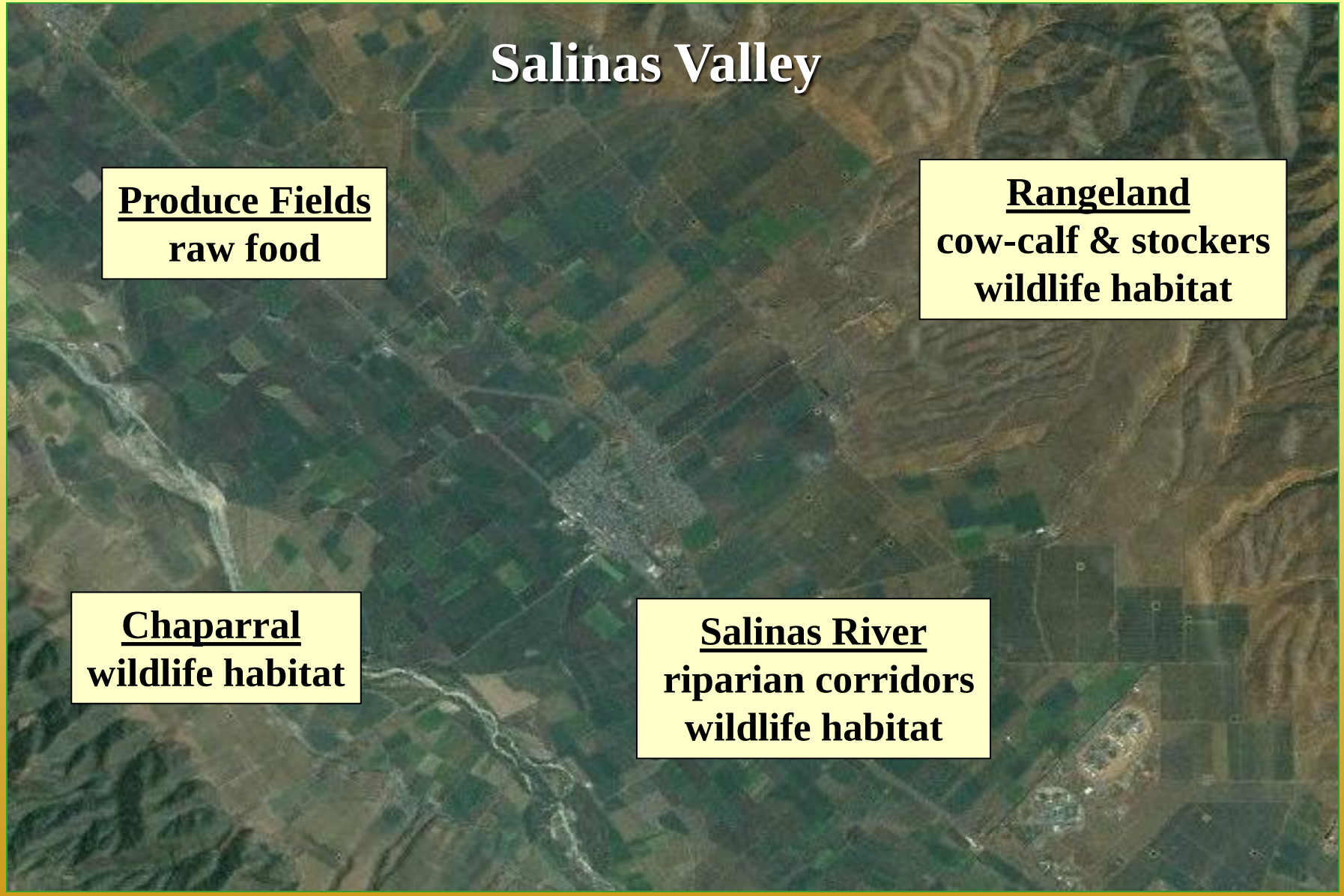
ranchers, growers, regulators,
environmentalists, resource managers, and the public

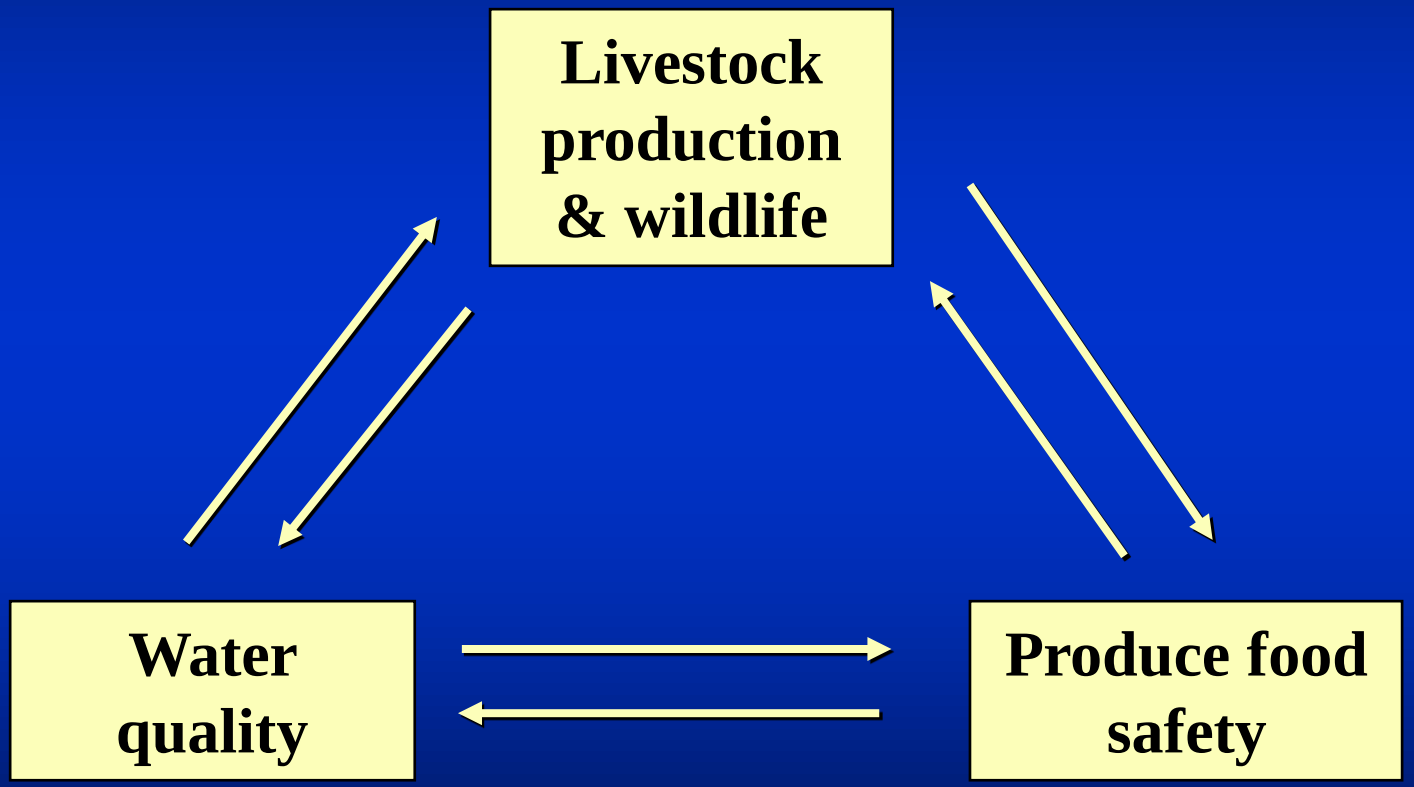
THANK YOU!

Juxtaposition of plant agriculture and grazed rangeland

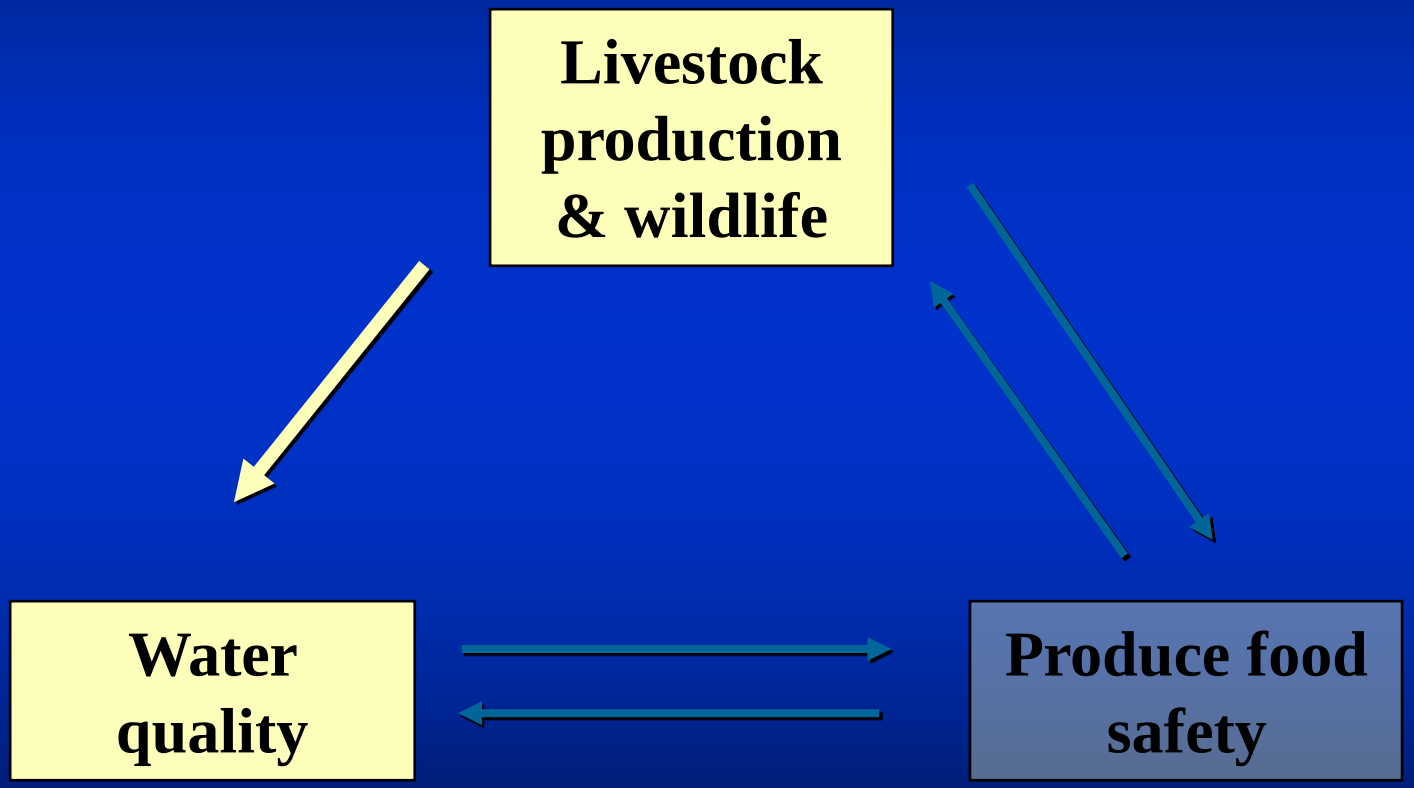



Are these produce outbreaks the result of livestock grazing on rangeland and/or wildlife?

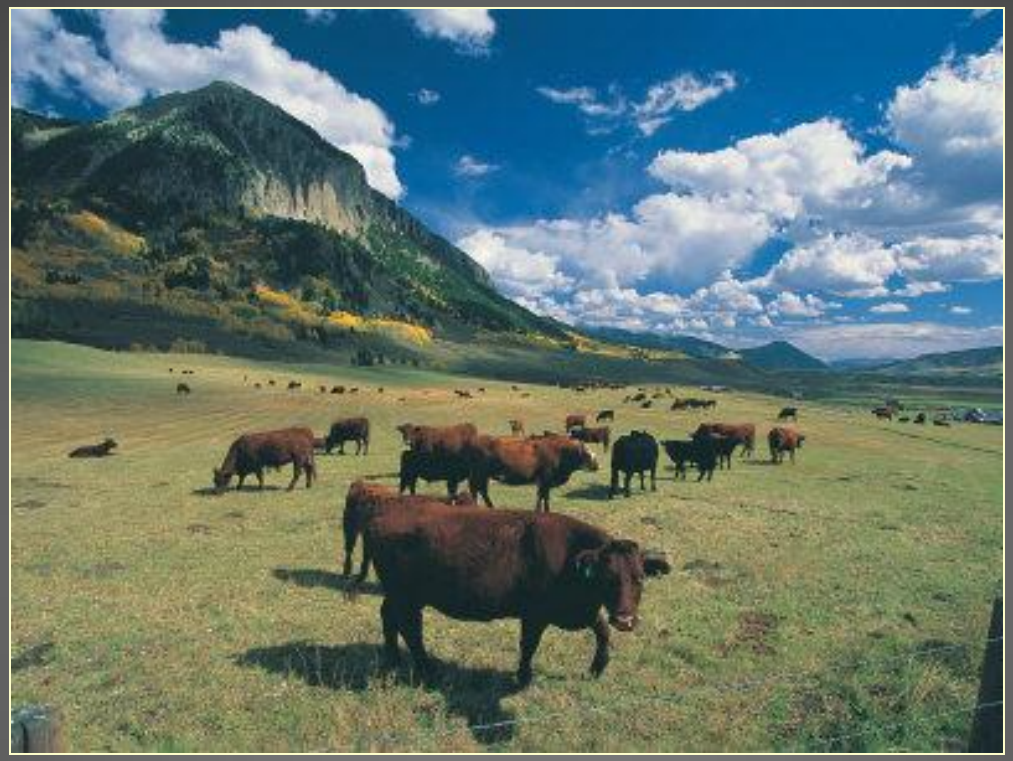
Minimizing pathogen movement from livestock & wildlife to food and water



Minimizing pathogen movement from livestock & wildlife to food and water



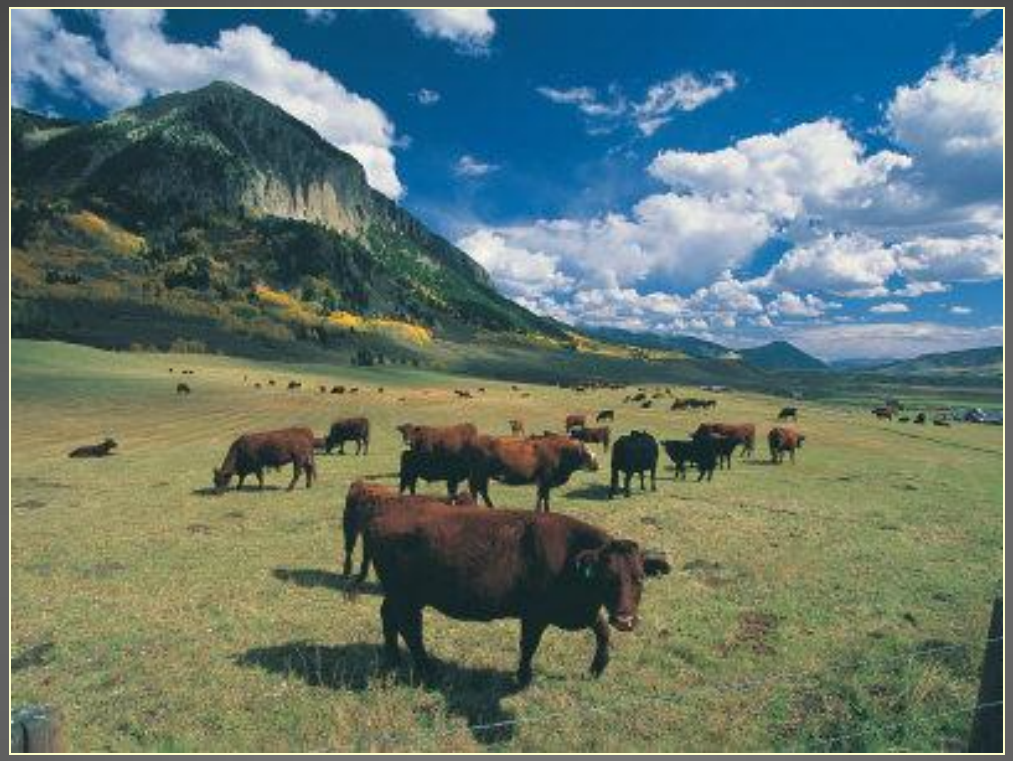
Waterborne pathogen BMPs for grazing



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)**

Waterborne pathogen BMPs for grazing



Key processes driving waterborne contamination

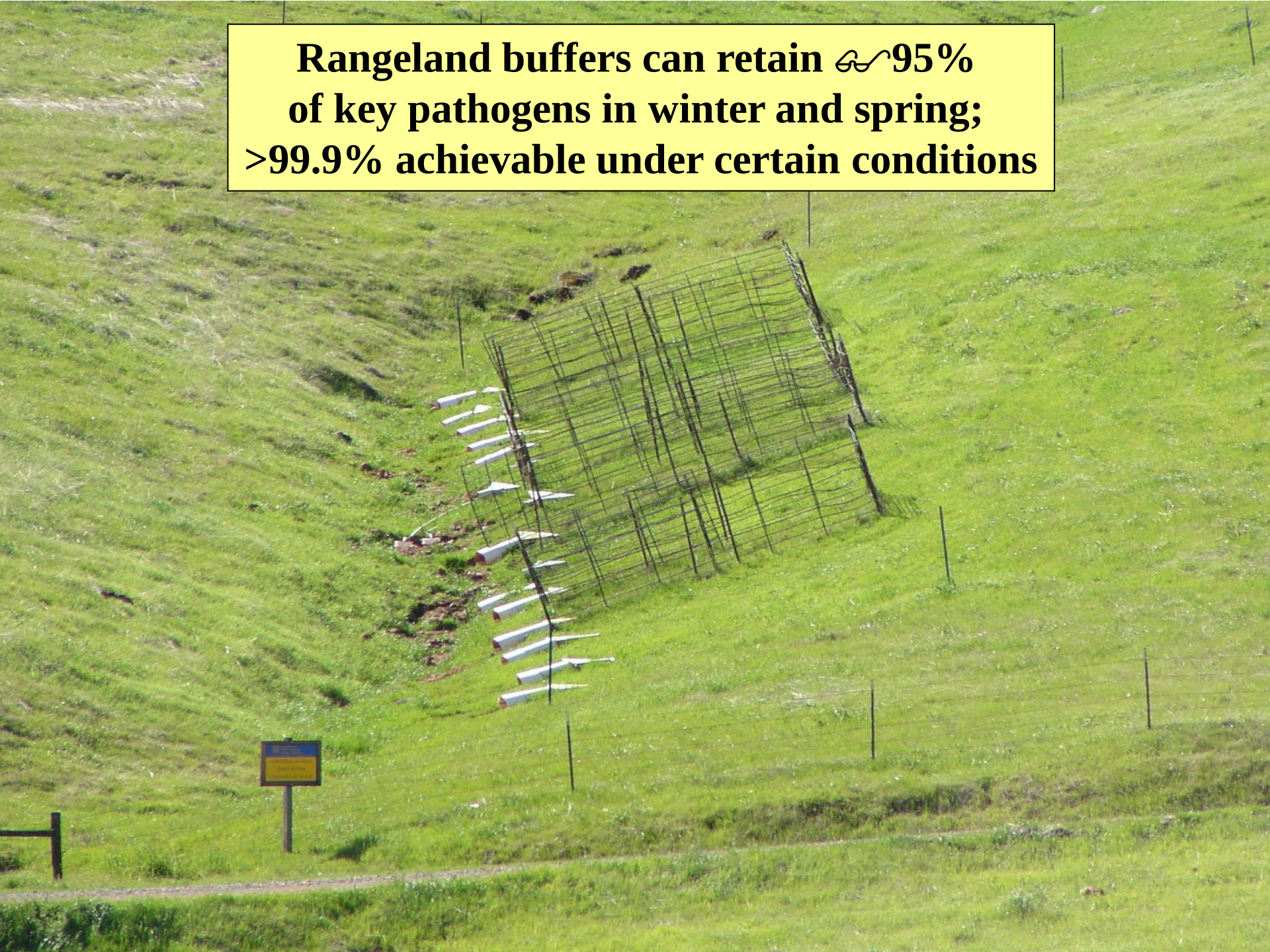
1. animal loading (who done it)
2. microbial transport (how did it get there)
3. microbial inactivation (is it still alive)

Sierra Foothill Research & Extension Center, University of California

Buffer width (m)
0.1, 1.1, 2.1

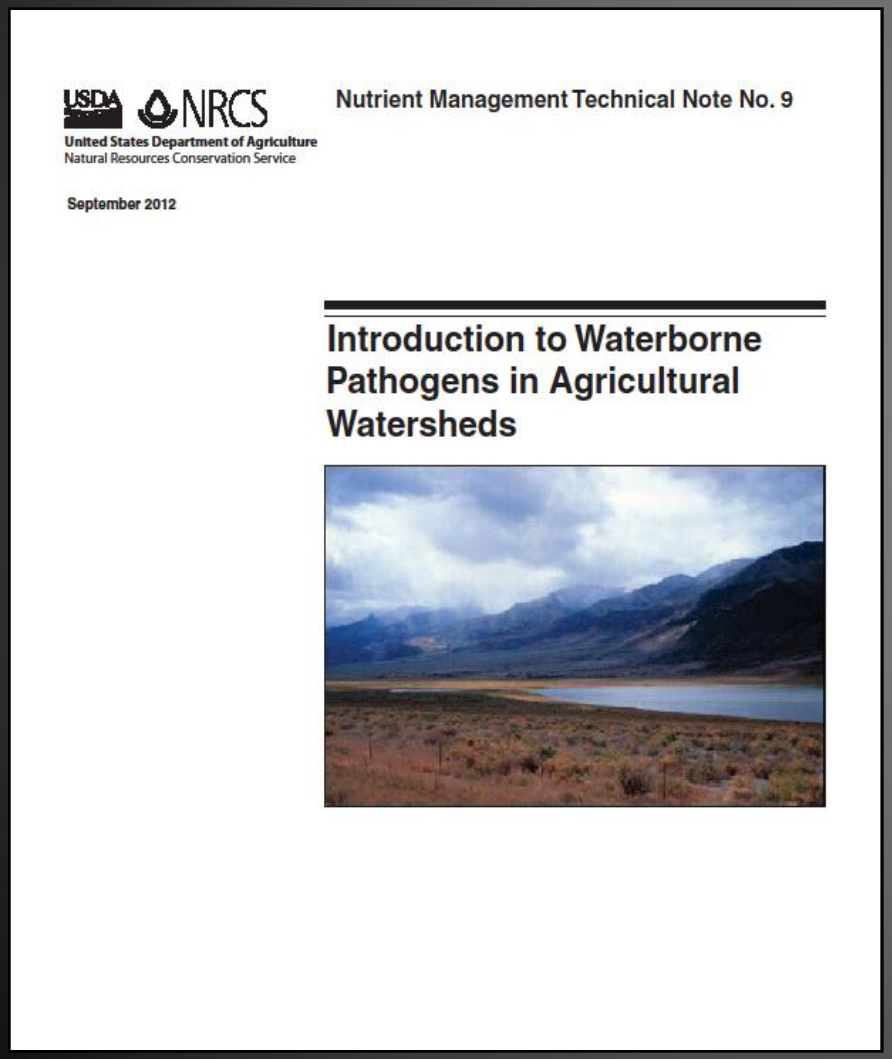
Land slope (%)
5, 20, 35

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

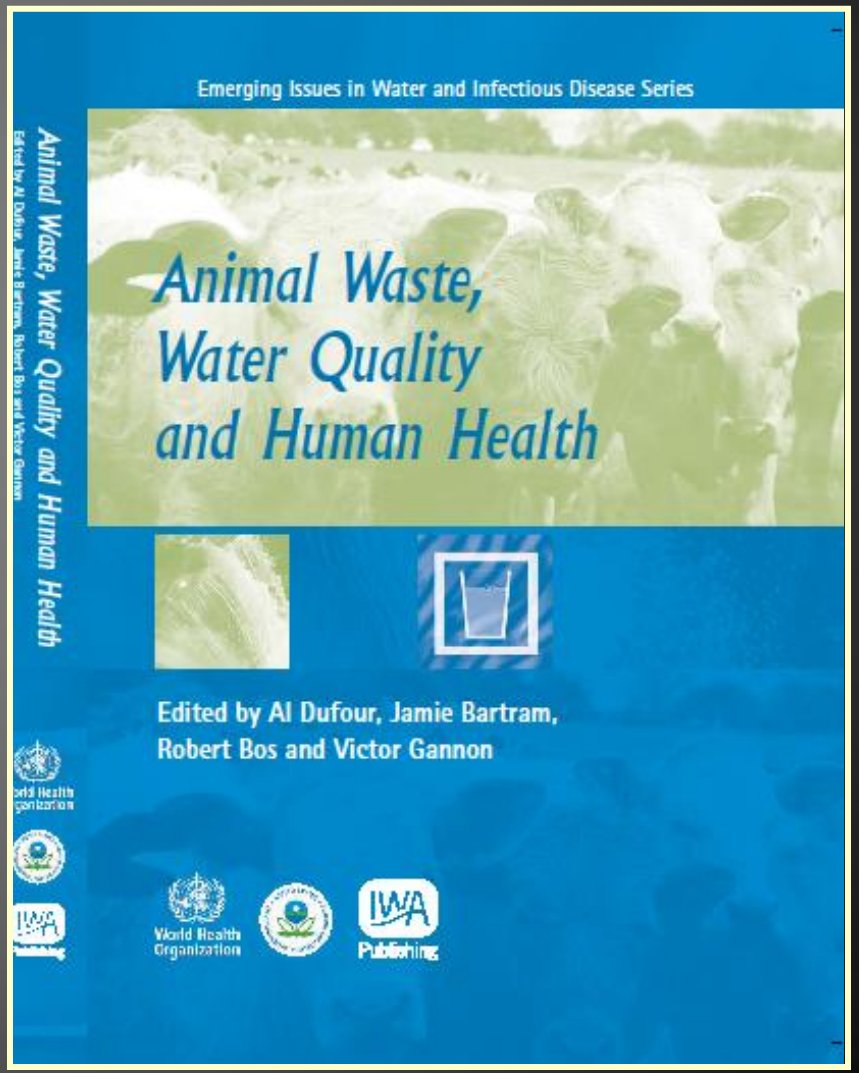

Rangeland buffers can retain ~95%
of key pathogens in winter and spring;
>99.9% achievable under certain conditions

2012 technical reports on waterborne pathogens and BMPs, both are FREE!

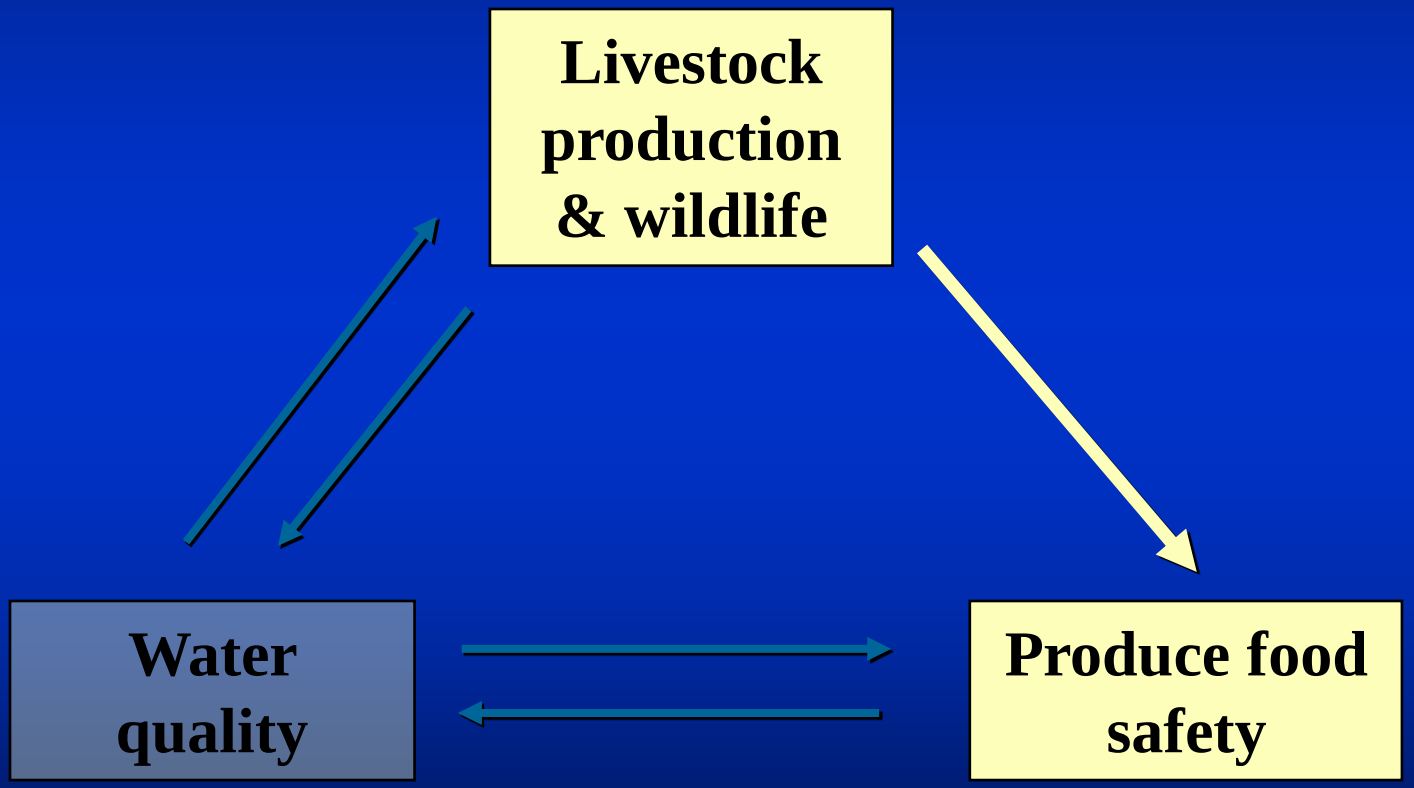
NRCS, USDA



World Health Organization



Minimizing pathogen movement from livestock & wildlife to food and water



Testing raw product (lettuce) throughout Salinas Valley

April 2008 through Nov 2011

0/2462 *E. coli* O157:H7

Samples taken all over Salinas Valley

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

0.2% infected with *E. coli* O157:H7
no difference b/t produce or livestock sites

3% infected with *Salmonella*
areas with high trap success (>20%)

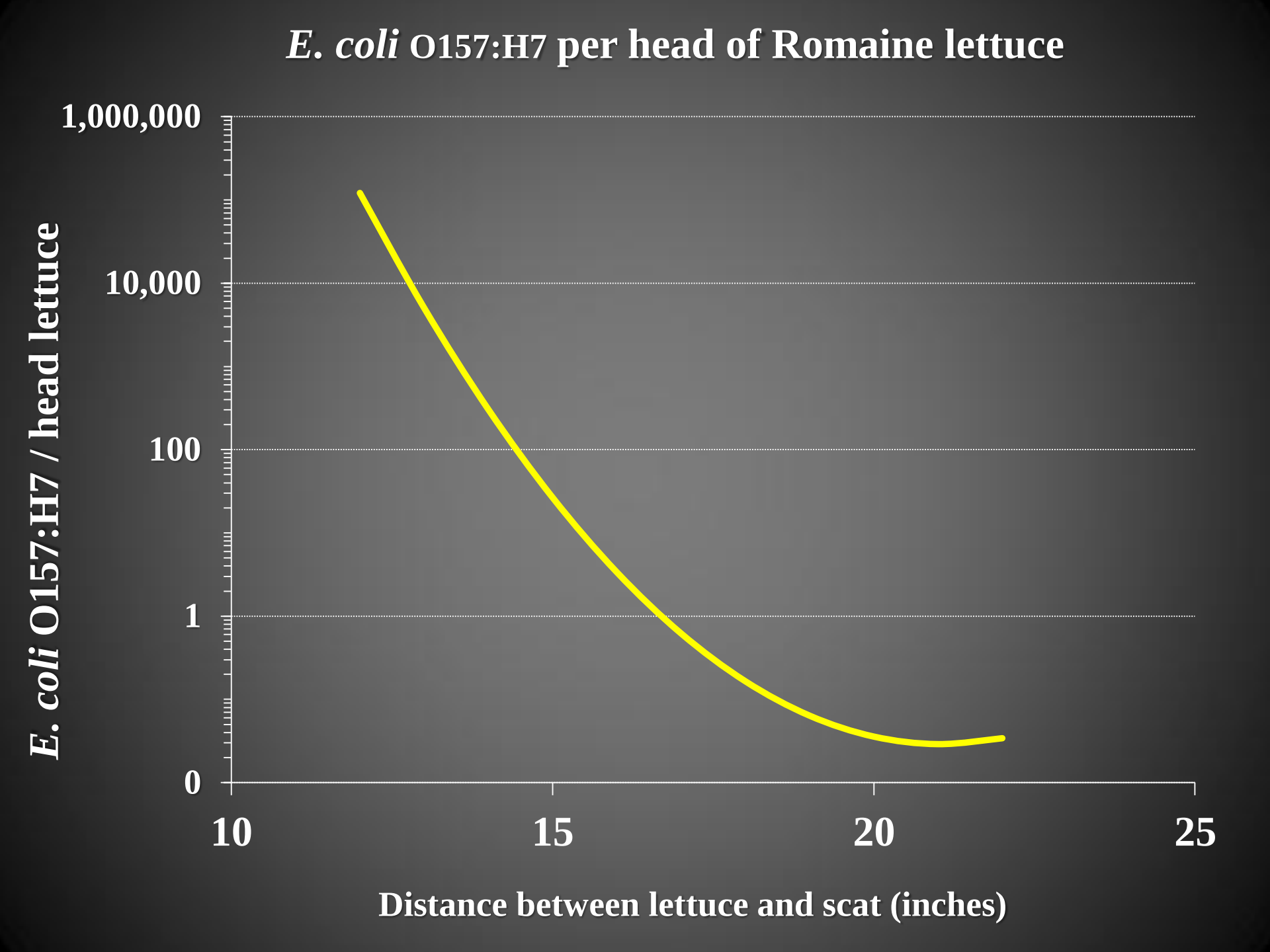
Rodent species	*Cryptosporidium*	*Giardia*
CA parasitic mouse	11%	13%
Deer mouse	33%	27%
Dusky-footed wood rat	17%	17%
Total	**28%**	**25%**

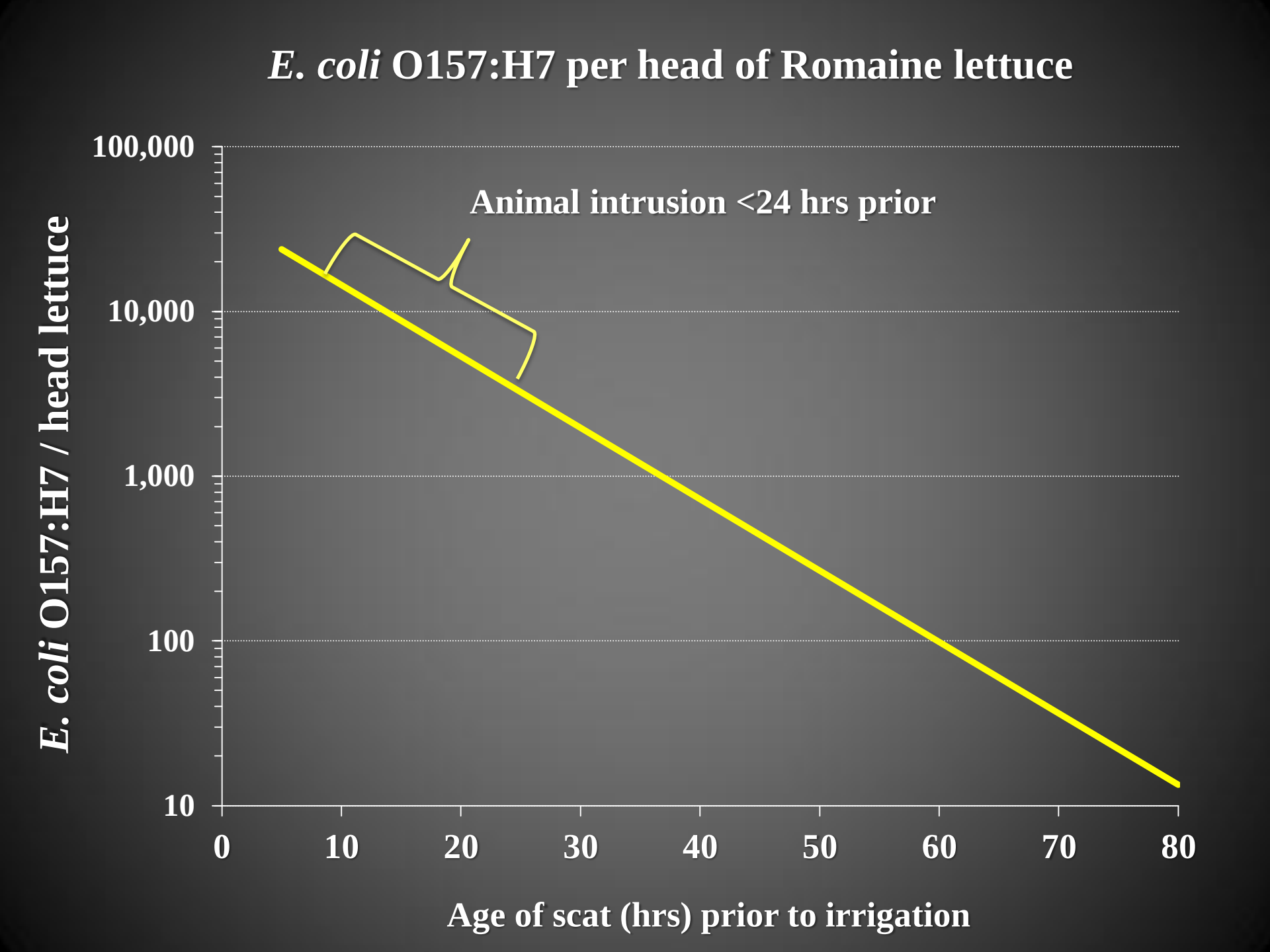
Preliminary data: *Crypto* appears human infectious, *Giardia* mostly not

2011 & 2012 field trials of romaine lettuce, Salinas Valley

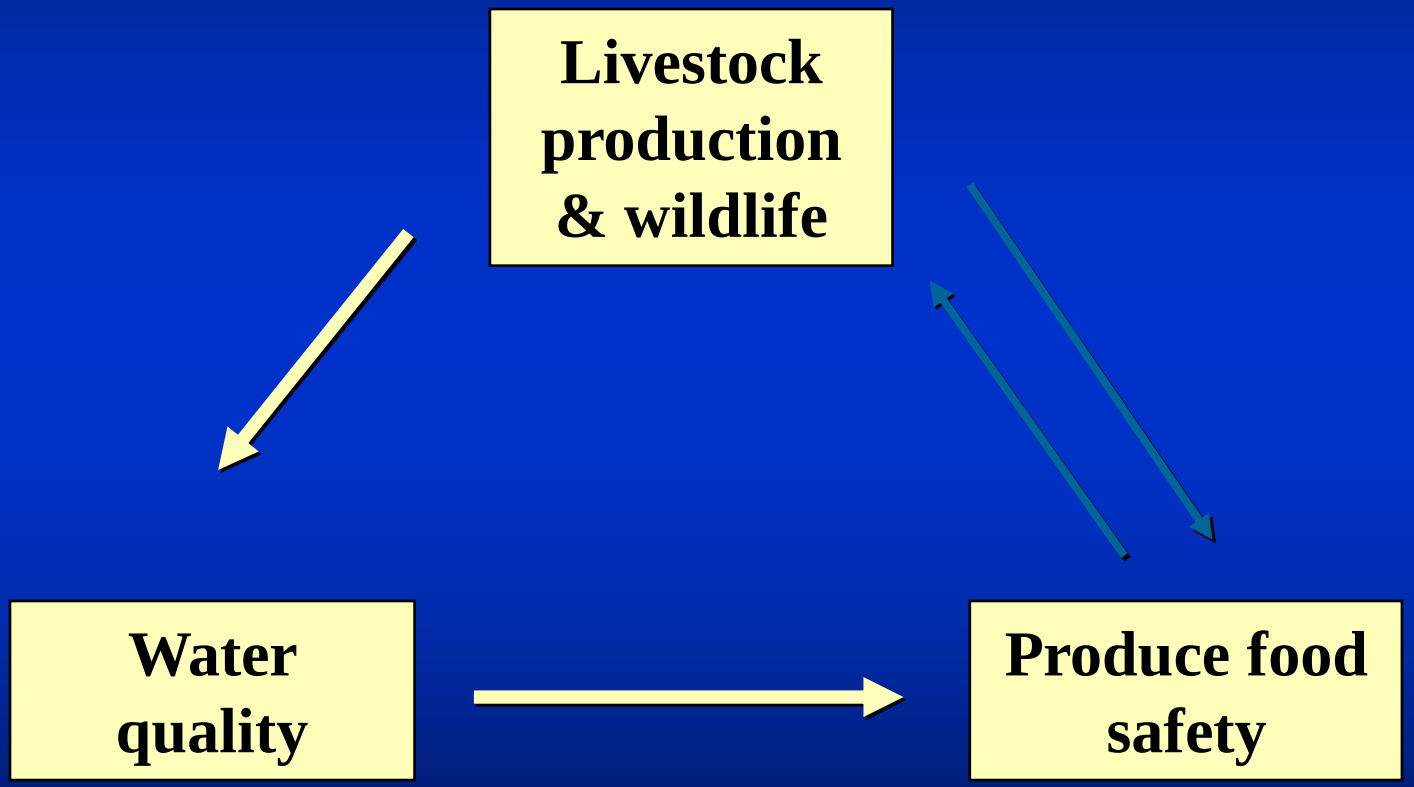
Add in 2 hours of irrigation

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

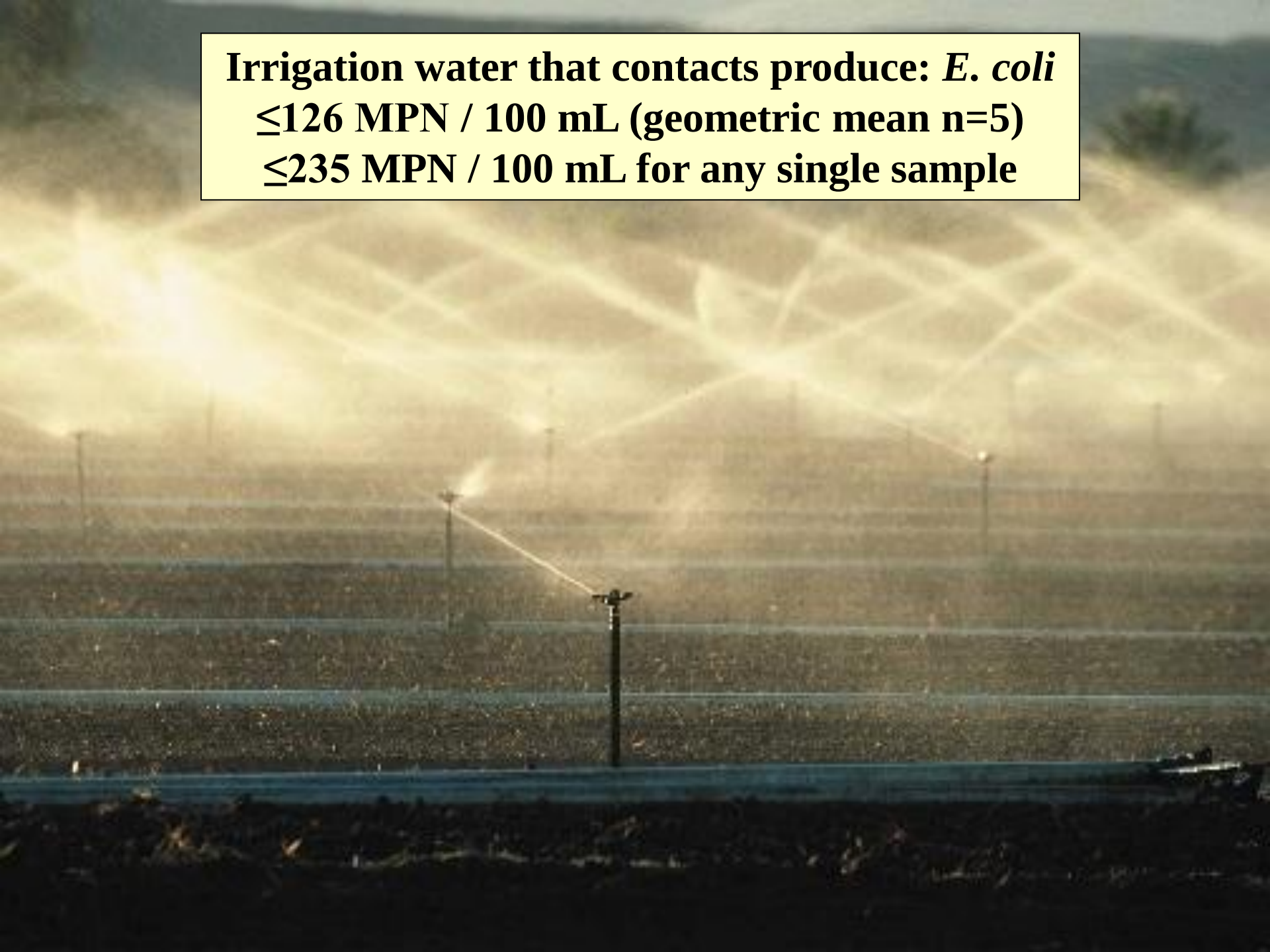

E. coli O157:H7 per head of Romaine lettuce
1,000,000
10,000
100
1
0
E. coli O157:H7 / head lettuce
10
15
20
25
Distance between lettuce and scat (inches)


E. coli O157:H7 per head of Romaine lettuce
100,000
10,000
1,000
100
10
E. coli O157:H7 / head lettuce
Animal intrusion <24 hrs prior
0
10
20
30
40
50
60
70
80
Age of scat (hrs) prior to irrigation

Minimizing pathogen movement from livestock & wildlife to food and water

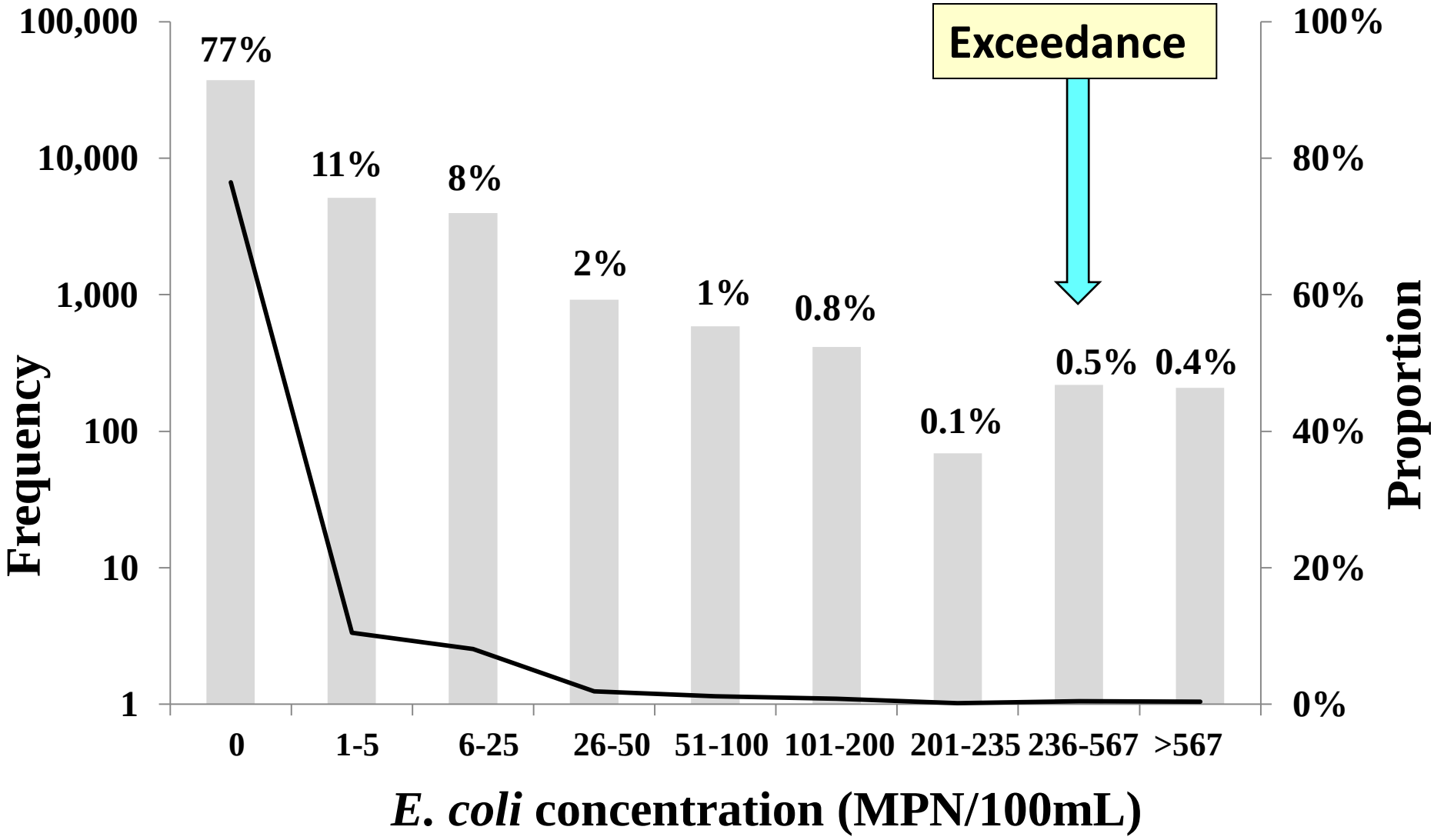


Microbiological safety of irrigation water



Irrigation water that contacts produce: *E. coli*
≤126 MPN / 100 mL (geometric mean n=5)
≤235 MPN / 100 mL for any single sample

E. coli concentrations in California irrigation water, (n=44,000; all seasons: wells, canals, on-farm reservoirs)



Changes in water quality: well compared to reservoir storage

E. coli concentrations (MPN/100mL)				
Seasons	**Well**	**Reservoir**	**Average Difference**	**% Increase**
Winter	**1.0**	**18.5**	**17.5**	**>1800**
Spring	**9.8**	**21.5**	**11.7**	**>200**
Summer	**19.4**	**77.6**	**58.2**	**400**
Fall	**20.8**	**65.4**	**44.6**	**>300**
Overall	**13.9**	**50.6**	**36.7**	**>300**

E. coli O157:H7 in irrigation & surface water, 2008-2010

	E. coli O157:H7	% positive
WATER		
produce farm	**1/242**	**0.4%**
public source	**9/316**	**2.8%**
SEDIMENT		
produce farm	**1/192**	**0.5%**
public source	**5/159**	**3.1%**

CCRWQCB

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

April 2009 to April 2010

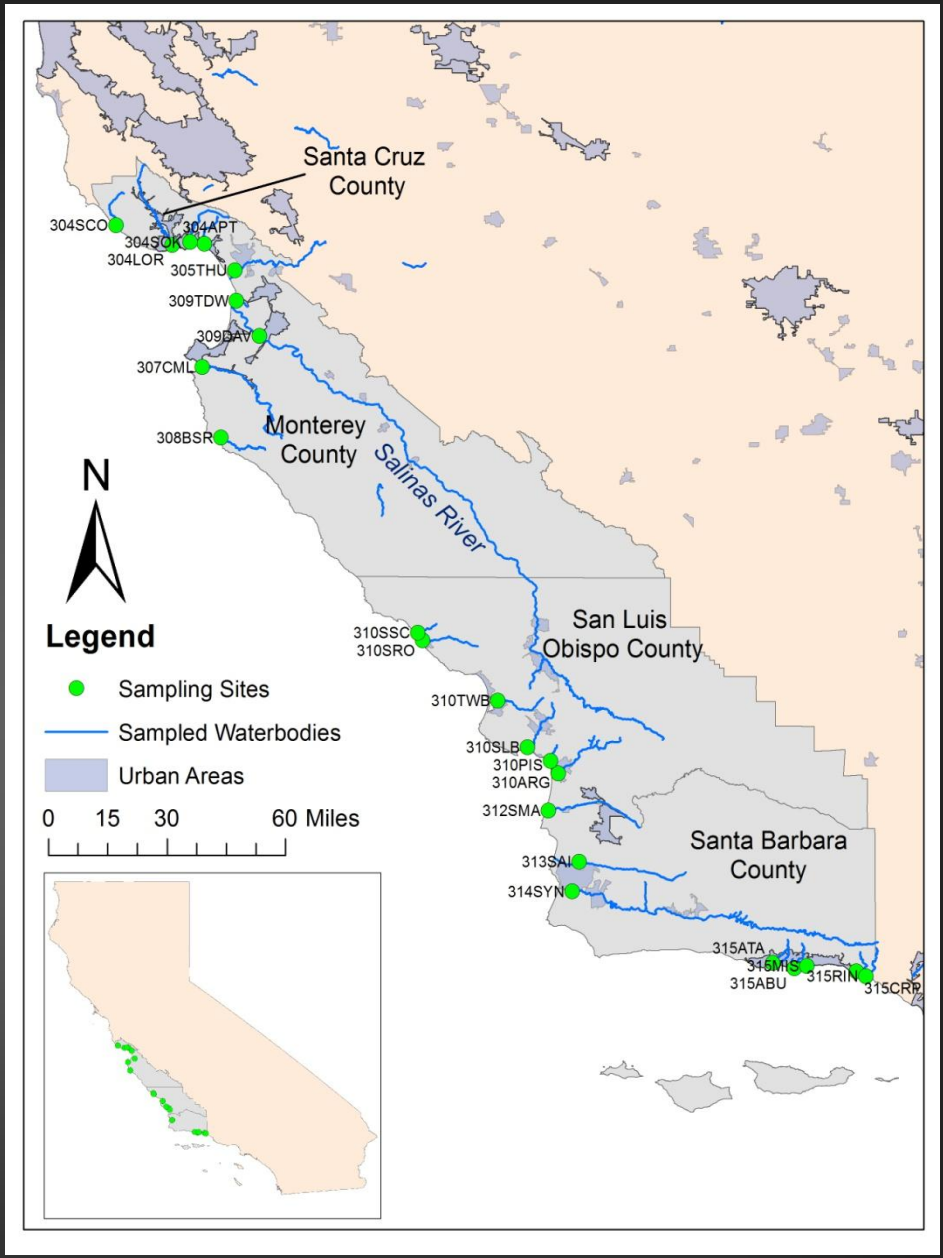
***E. coli* O157**

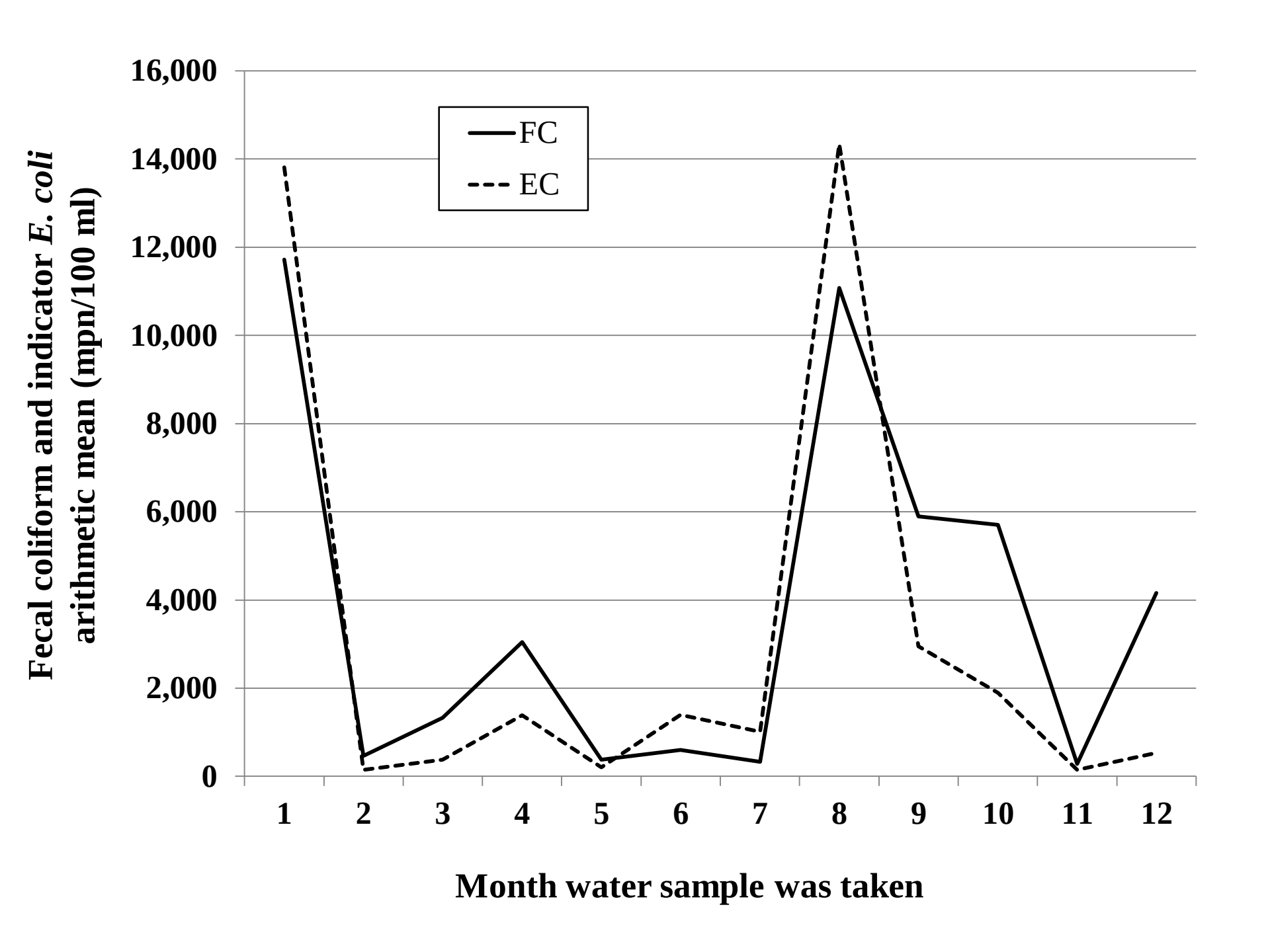
6/251 = 2.4%

Salmonella

78/251 = 35%

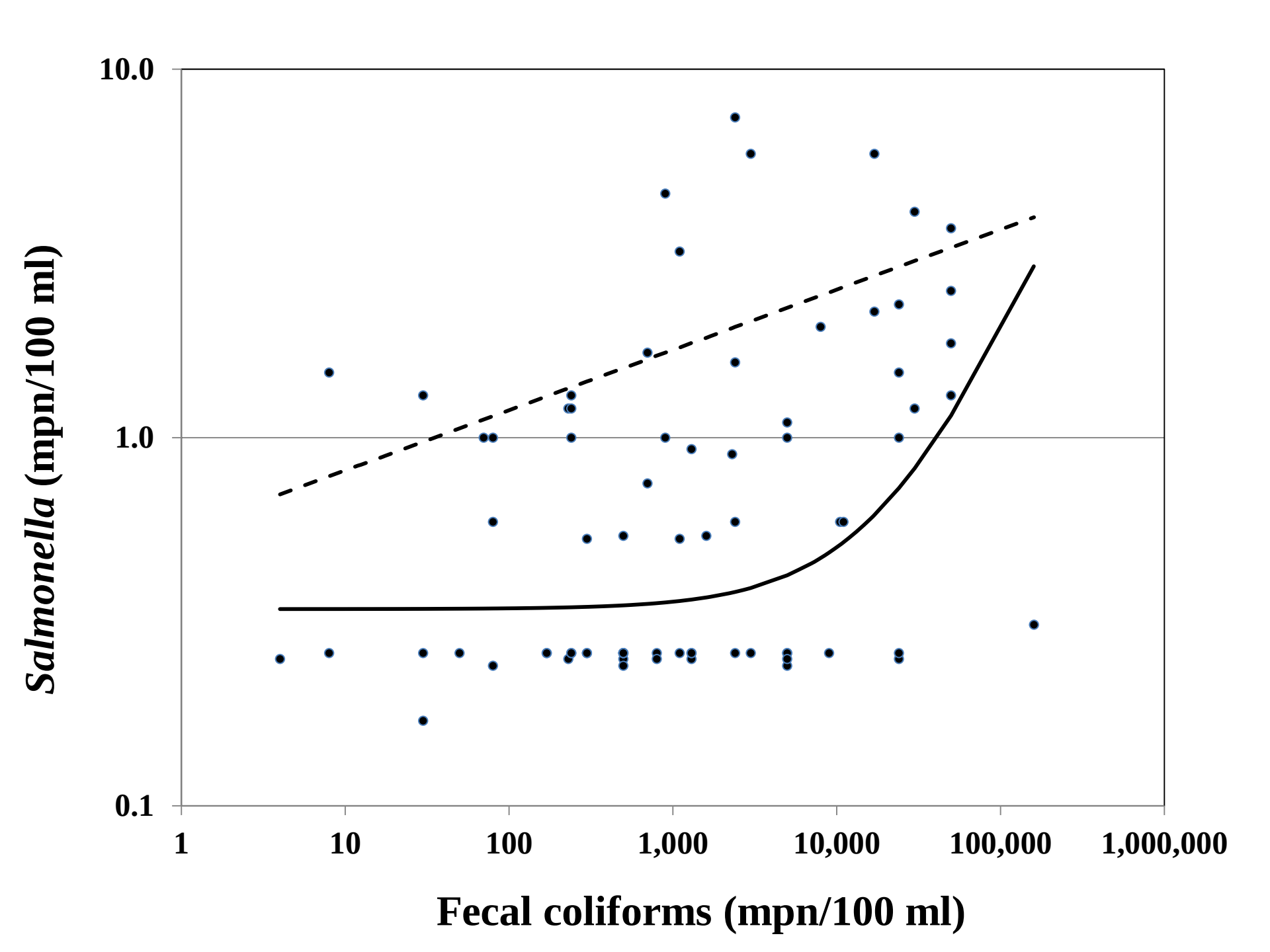
1.3 MPN/100 ml




16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
FC
EC
Fecal coliform and indicator E. coli arithmetic mean (mpn/100 ml)
1
2
3
4
5
6
7
8
9
10
11
12
Month water sample was taken

Bacterial indicators and pathogens for water samples from 23 sites, some of which are listed for a Total Maximum Daily Load in the Central Coast Basin Plan (2008), California 303(d) list of water quality limited segments

Bacteria	N	Average or %
Fecal Coliform (MPN/100 mL)		
TMDL not listed	61	1818
TMDL listed	185	4278
E. coli (MPN/100 mL)		
TMDL not listed	62	1665
TMDL listed	185	3547
Salmonella (MPN/100 mL)		
TMDL not listed	63	0.32
TMDL listed	188	0.42
E. coli O157:H7 (present/absent)		
TMDL not listed	63	1.6 %
TMDL listed	188	2.7 %


10.0
1.0
0.1
Salmonella (mpn/100 ml)
1
10
100
1,000
10,000
100,000
1,000,000
Fecal coliforms (mpn/100 ml)

Any questions