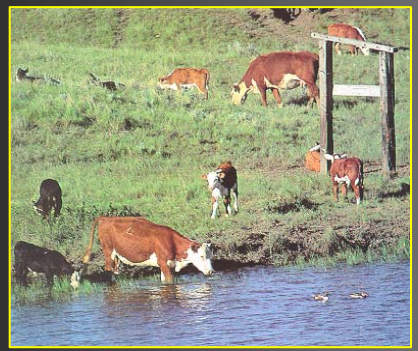
Characterizing the risk of *E. coli* contamination from animal agriculture and wildlife



Rob Atwill, D.V.M., M.P.V.M., Ph.D.
School of Veterinary Medicine
University of California, Davis

Livestock and wildlife

Under what conditions do these populations pose a risk to microbial water quality?

<u>Multiple processes need to occur</u>:

- **fecal (pathogen) loading**
- **transport: rainfall → runoff, direct deposition (wildlife)**
- **survival: solar and drying**

How much is in host populations?
How far does it move (how far back to place a fence)?
How long does it survive (when to rotate livestock out)?

Shiga-toxin producing *E. coli* in CA cattle

Hussein-UNR; Atwill-UCD; UCCE Livestock Advisors

	*Stx*1 or *Stx*2
Feedlot cattle	**2.5% n=640**
Cow-calf	
Irrigated	**3.5% n=638**
Range	**5.8% n=774**
Dairy cattle	**1.9% n=721**

Out of 2773 fecal samples, none were O157:H7

Rangeland cattle

	*Stx*1 or *Stx*2	
Summer	3.7%	n=219
Fall	4.7%	n=190
Winter	13.6%	n=198
Spring	1.0%	n=167
Cows	3.0%	n=403
Calves	8.1%	n=271

O antigen serotypes: O26,O86, O111,O125, O127, O146, O158, O166

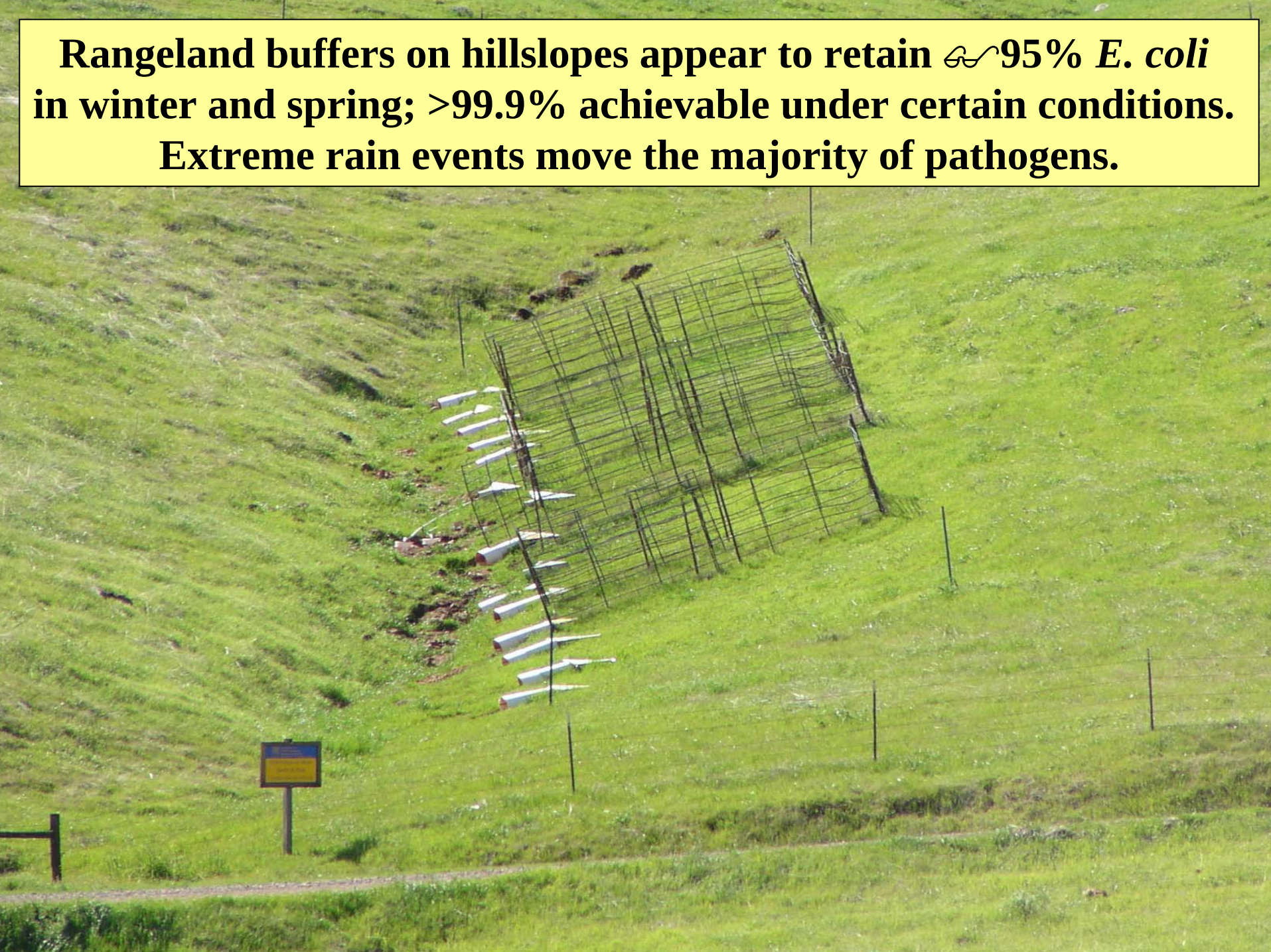
Characterizing vertebrate sources

$$\frac{\text{No. of pathogens}}{\text{Kg feces}} \times \frac{\text{Kg feces / day}}{\text{animal unit}} = \frac{\text{No. of pathogens / day}}{\text{animal unit}}$$

$$\frac{\text{Pathogens / day}}{\text{animal unit}} \times \text{animal density} = \text{No. of pathogens / day / geographical area}$$

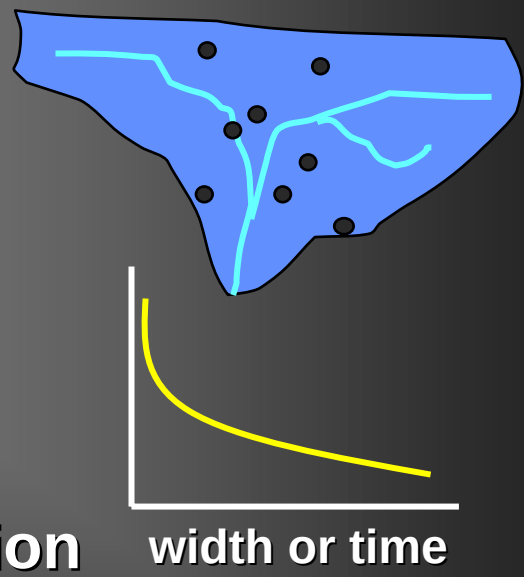
Spatial pattern of fecal deposition
~proportion of feces that are relevant to transport~

Rangeland buffers on hillslopes appear to retain ≈95% *E. coli* in winter and spring; >99.9% achievable under certain conditions. Extreme rain events move the majority of pathogens.



Key processes governing microbial risks: waterborne transport between locations

- Maximum pathogen load (pathogens / Kg feces)
- Distance between load and water
- Buffer retention as a function of buffer width and other covariates
- Rate of inactivation versus replication
- Removal processes during downstream transport (shallow stream versus a hardened irrigation ditch)



A microbe's journey between two locations is subject to numerous attenuating and inactivating processes

Despite the difficulty, connectivity occurs