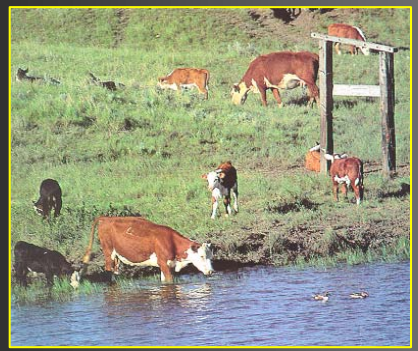
# Characterizing the risk of *E. coli* contamination from animal agriculture and wildlife



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# *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

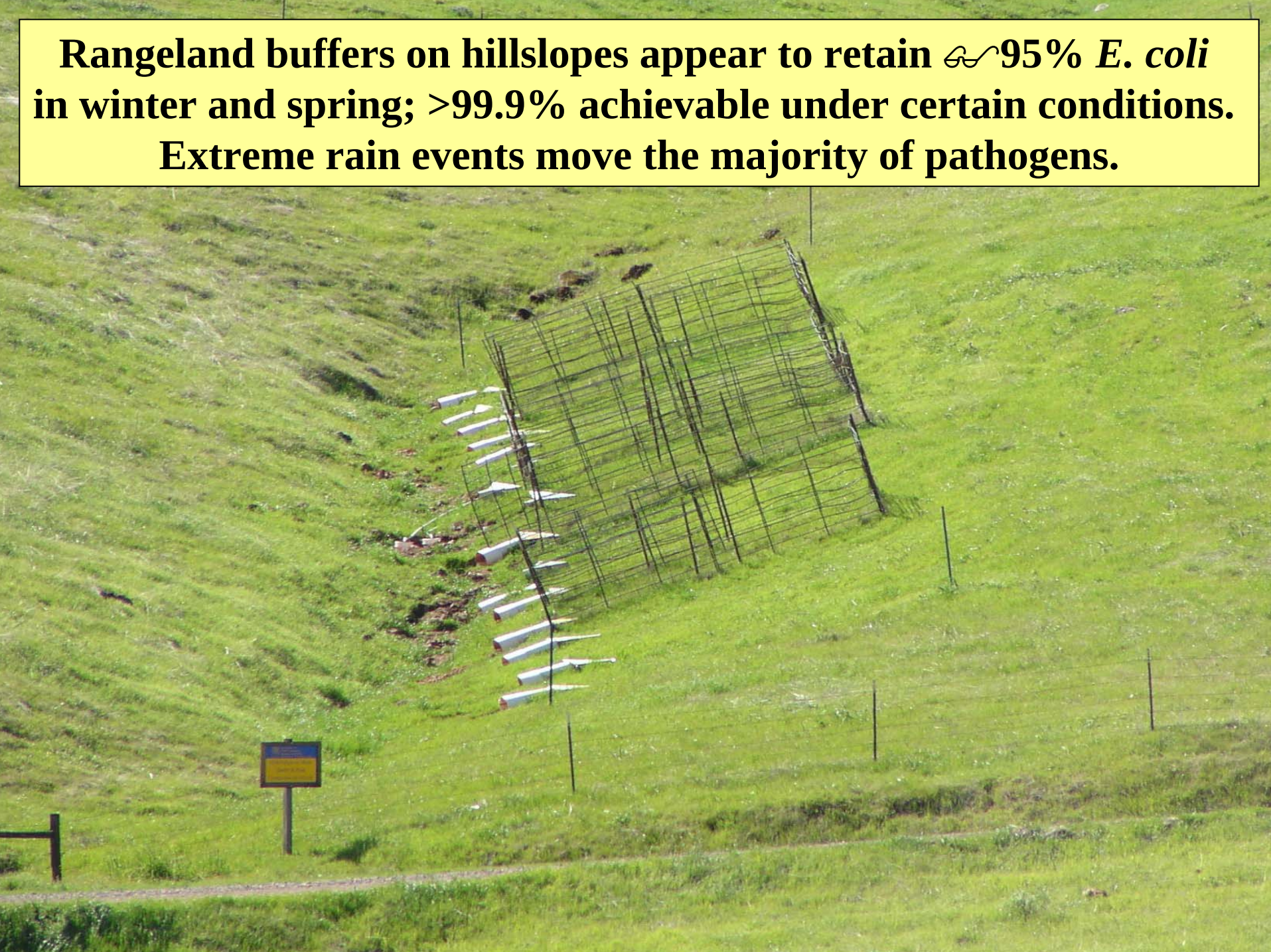
# Characterizing vertebrate sources

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

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

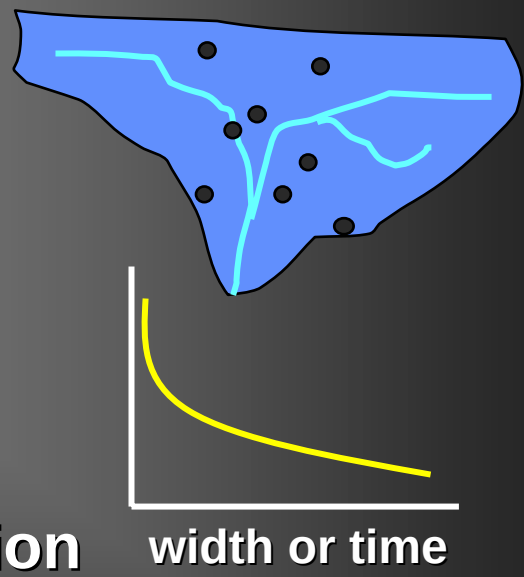
# Spatial pattern of fecal deposition
# ~proportion of feces that are relevant to transport~

**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**