

Reducing Agricultural Impacts on Water

***How Science Can Contribute to
Agricultural NPS Policy***

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First Organizing Principle

Agriculture is Inherently a Leaky System

1. Temporal discontinuities in nutrient cycling processes.
2. High levels of soil disturbance exacerbate temporal discontinuities.
3. High levels of nutrient enrichment.
4. Lack of resistance to the disturbance of extreme climatic events

Second Organizing Principle

Farmer Behavior is Spatially and Temporally Heterogeneous

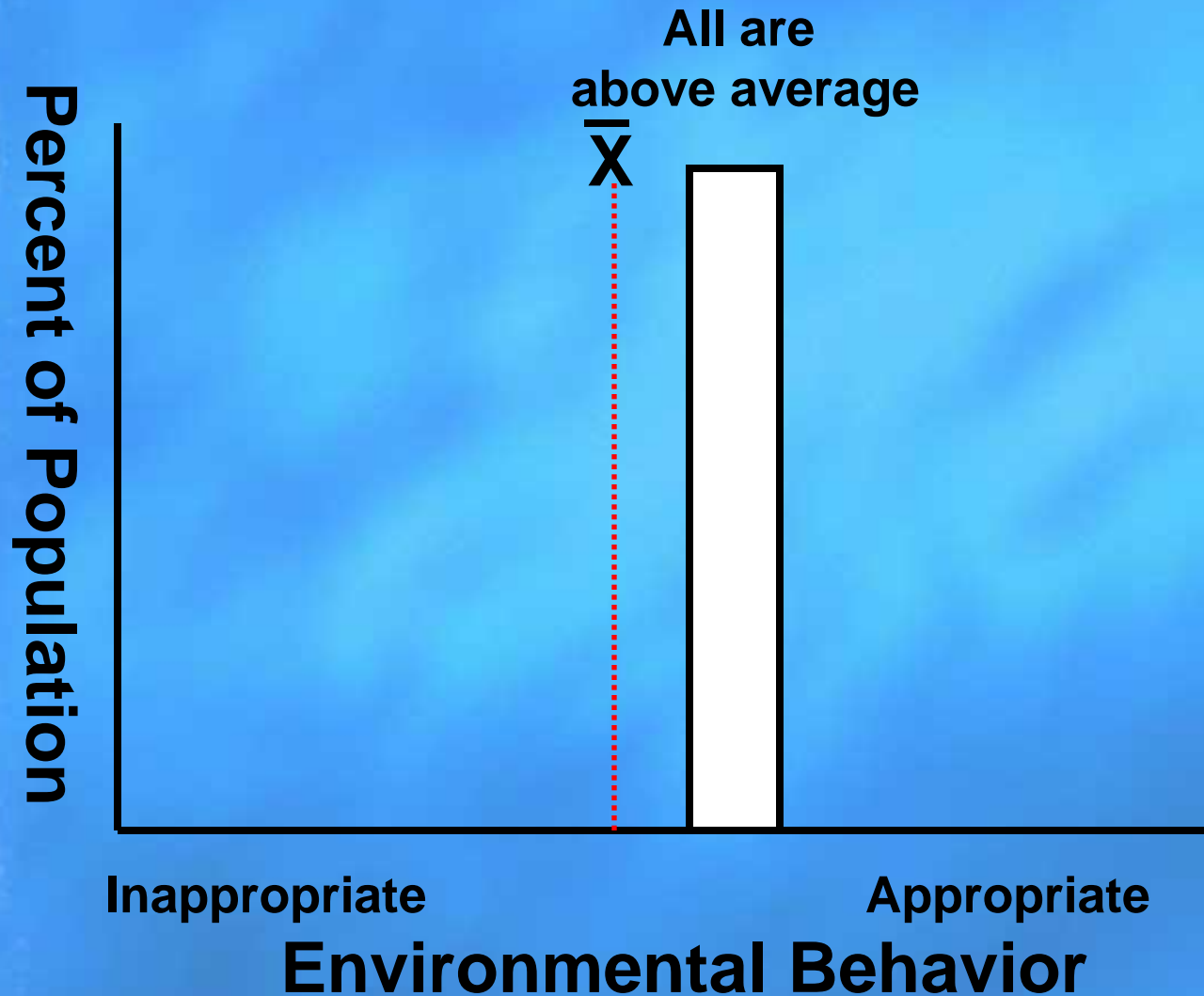
- Tradition, technology, markets, beliefs, and peer pressure all influence what is done when within a farm operation.
- Farmers are the “keystone species” in a complex, adaptive social system that manipulates biophysical systems.

An aerial photograph of a plowed agricultural field, showing distinct furrows and rows of soil. The image is overlaid with a blue gradient that transitions from a lighter blue on the left to a darker blue on the right. The text is centered in the middle of the image.

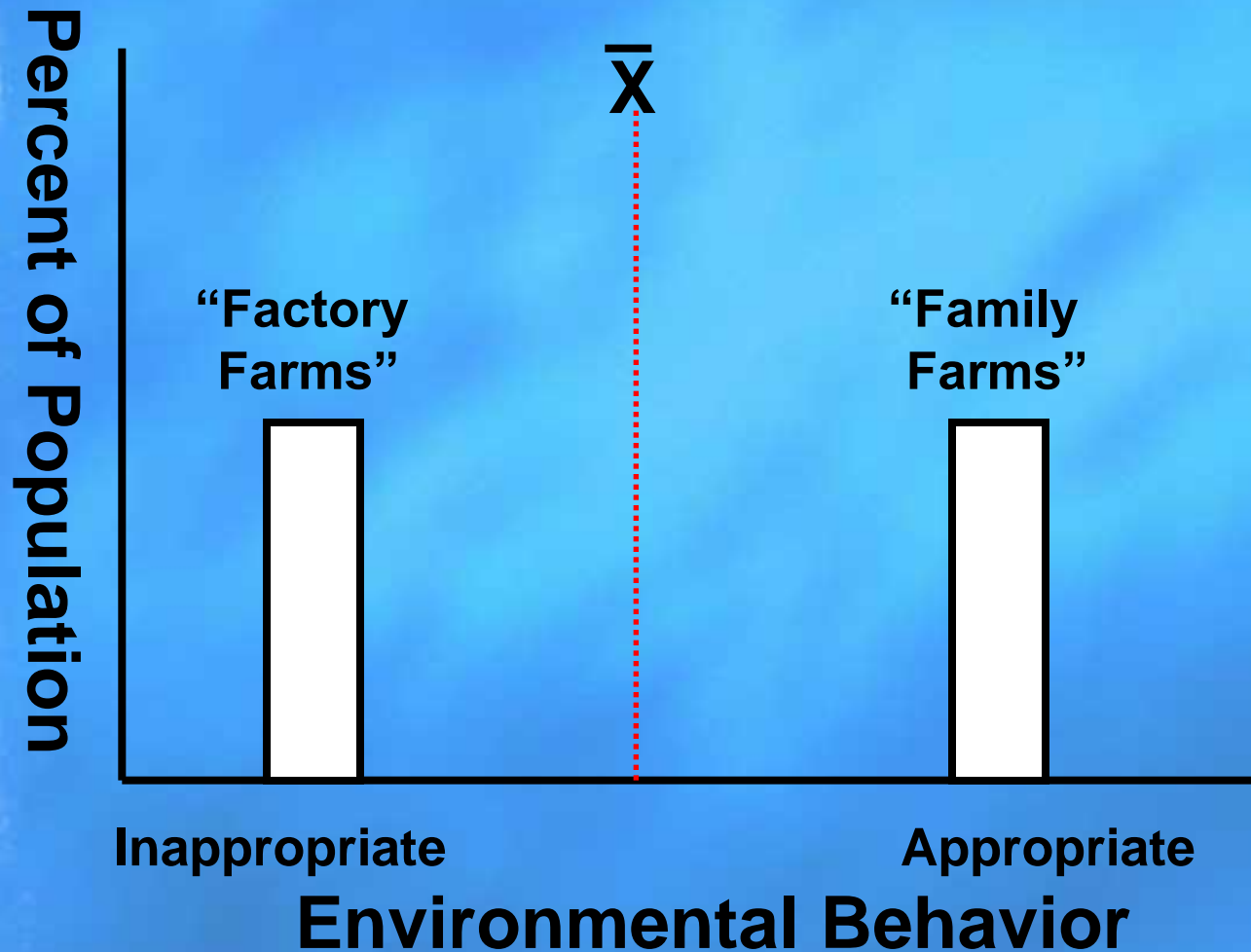
Farmers

An Introductory 101 Overview

The "Lake Wobegon" Farmer

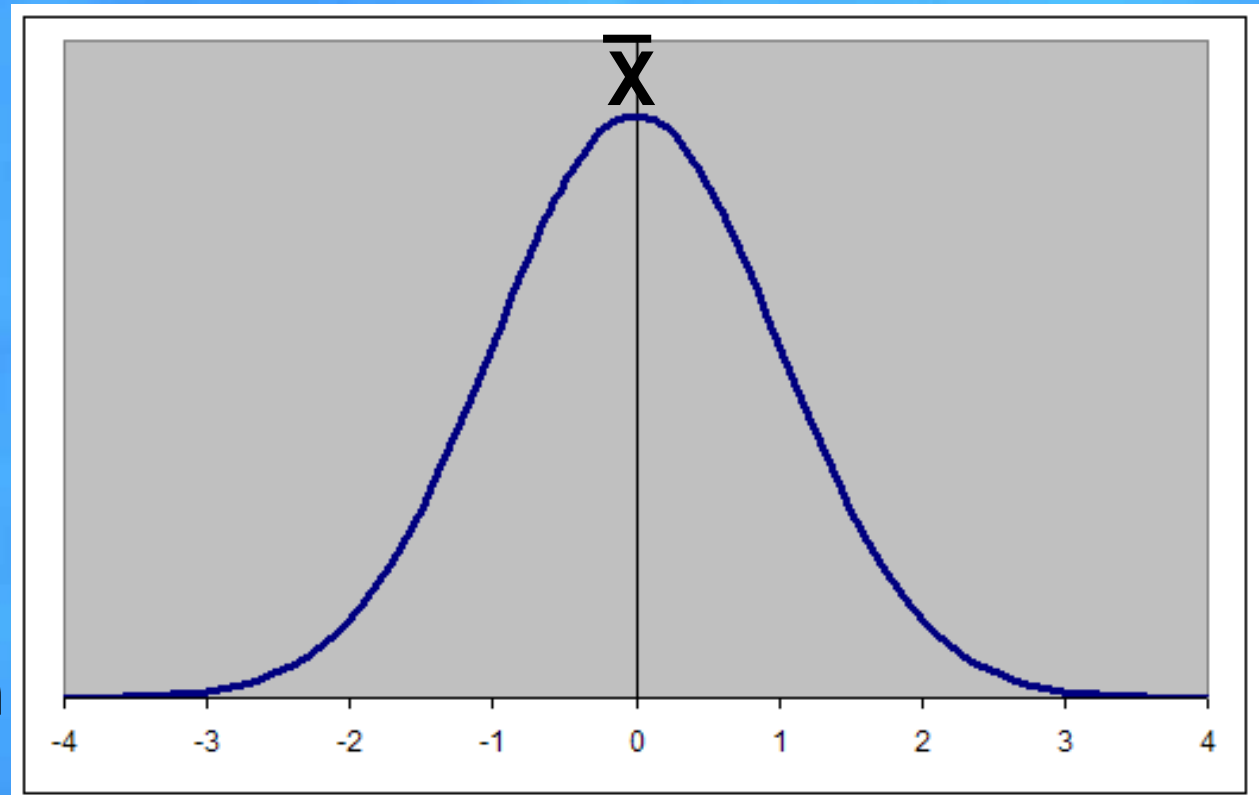


The “Us Versus Them” Farmers



The "Statistically Normal" Farmer

- Modeling of recommended behaviors
- Assumption of uniform implementation



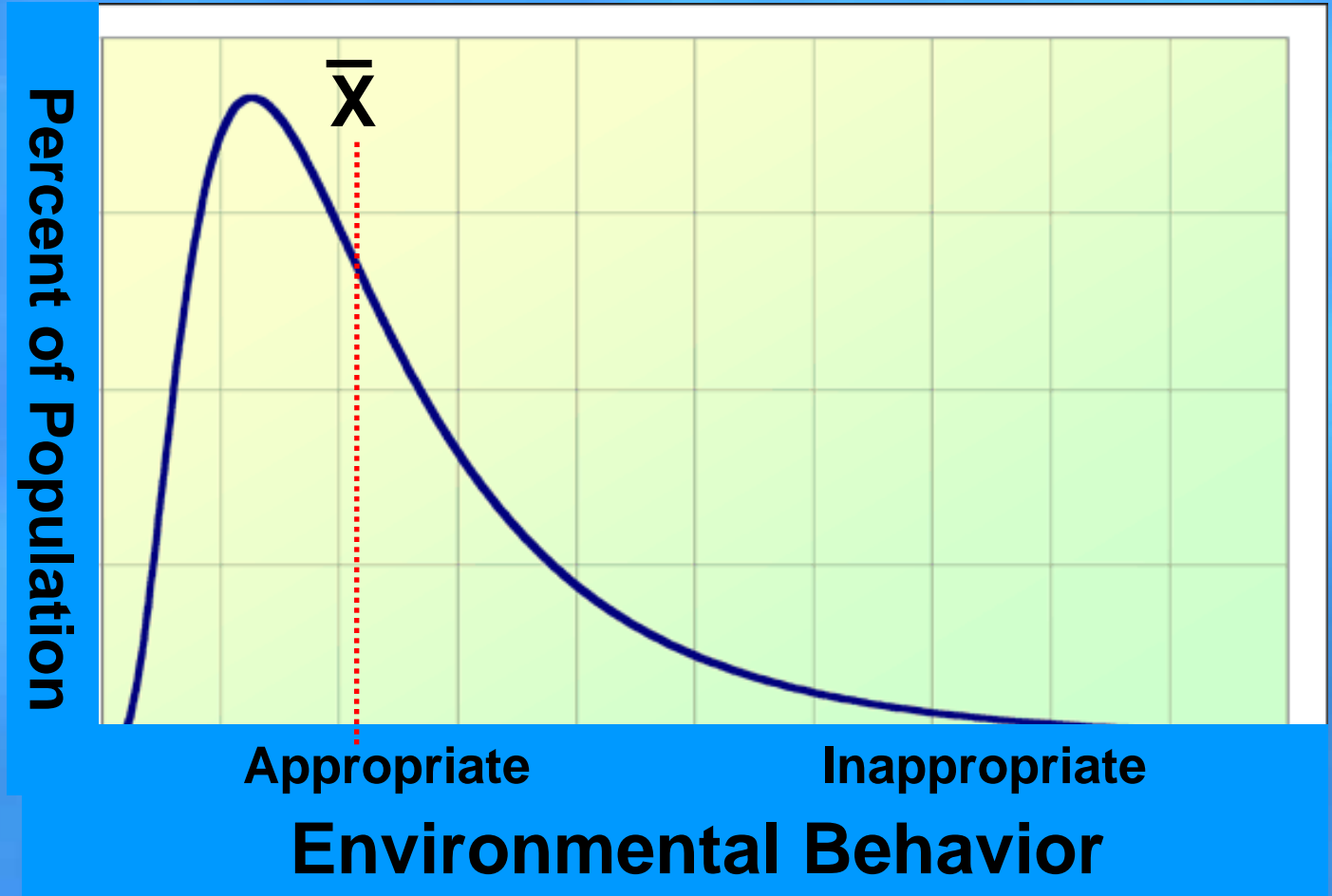
Inappropriate

Appropriate

Environmental Behavior

The "Orwellian" Farmer

- The "tail wags" the distribution



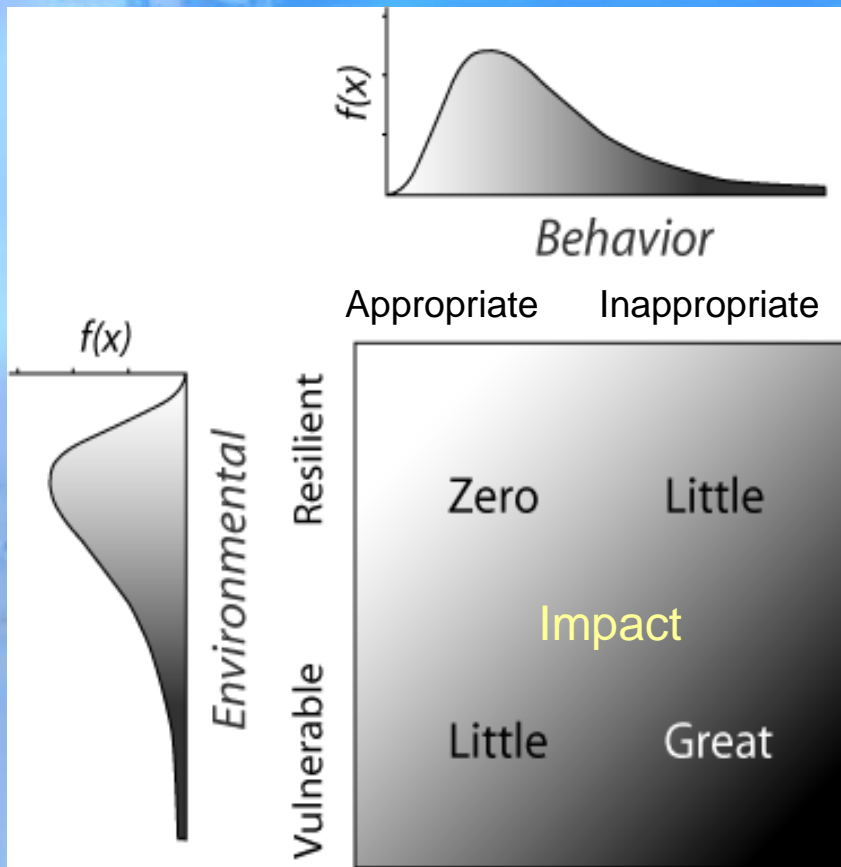
Scale Matters!

- The same type of differences that occur between farms also occurs within a farm.
 - An appropriate behavior in one biophysical setting may be inappropriate in another.
 - An appropriate behavior at one time may be inappropriate at another time.
- Scale is the missing element in our policy debates and discussions.

Putting it Together

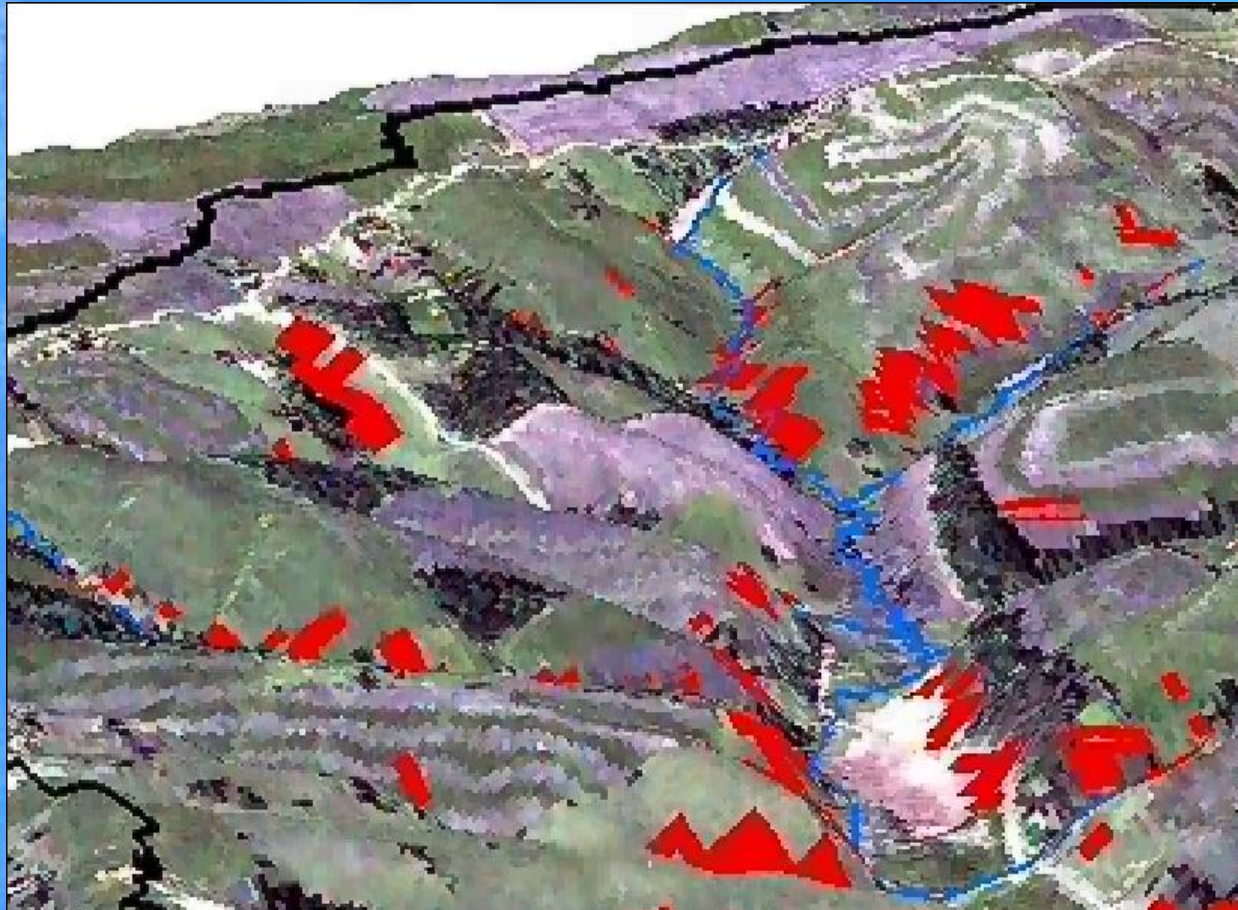
- Biophysical scientists recognize that the vulnerability, buffering capacity, landscape sensitivity, or resiliency of a specific setting within a landscape can be characterized as a log-normal distribution.
- What we have failed to acknowledge is that farmer behavior can be arrayed in a similar distribution across spatial and temporal scales.

Putting it Together: Disproportionality



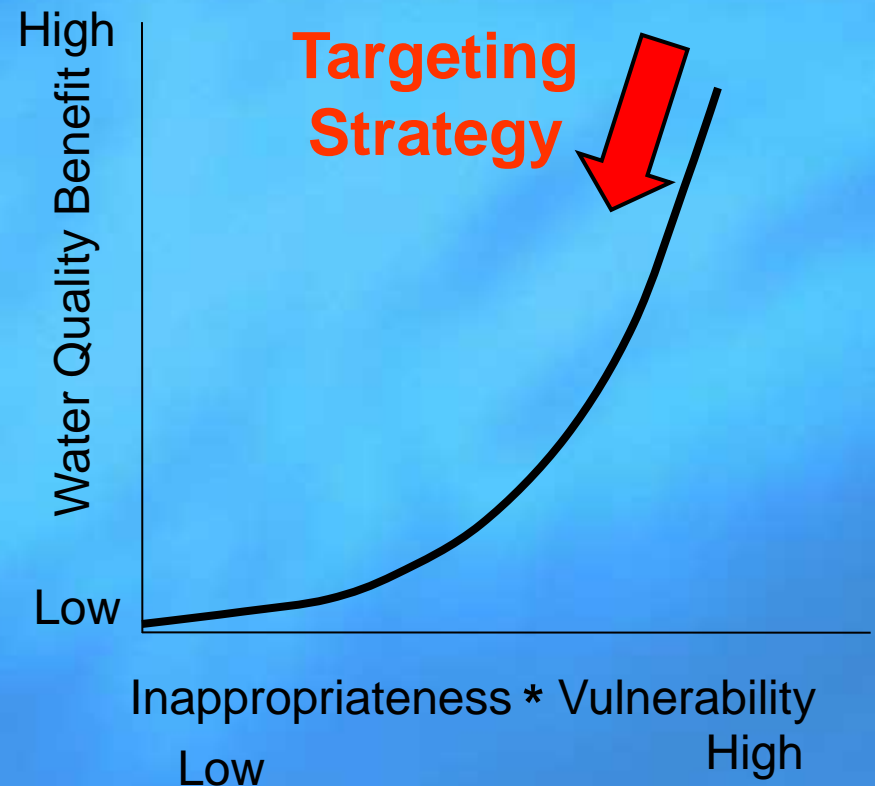
Disproportionality occurs when there is a significant degree of asymmetry between the appropriateness of social behaviors and the buffering capacity, landscape sensitivity, or resiliency of the specific biophysical setting where or when these behaviors occur.

Disproportionality



How Does Disproportionality Relate to the Targeting for Water Quality?

The more inappropriate the behavior, and the more vulnerable the setting, the greater the potential water quality benefit.



Exciting Questions

- At what spatial and temporal scales does one target disproportionality?
 - Research needs to establish the relative contributions of different scales before establishing what is practical or feasible from an implementation perspective.

Exciting Questions

- Do we have the remedial practices and recommendations to address disproportionality at different spatial and temporal scales?
 - Many of our technologies were designed to over-ride or nullify agro-ecological variation, and many recommendations are implemented at the farm or field scale.

Thank you