

Assessment of Water Quality from Natural Landscapes

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Symposium

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Natural Landscapes Can Be a Constituent Source

- Bacteria occur naturally in the environment from a variety of sources
 - *Animals*
 - *Soil*
- Trace metals, which are a source of impairment in many watersheds, occur naturally in the environment
 - *Geology/Earth's crust*
 - *Soil*
- Nutrients are a natural constituent in surface waters
 - *Atmospheric deposition of nitrogen*
 - *Nitrogen leaching from soil*

What are natural levels?

Regulations Recognize Natural Sources

TMDLs and Basin Plans in all three S. Ca. Regional Boards allow for natural sources:

- **Not required to control contaminants or bacteria from natural sources.**
- **Need to assess “natural water quality” to establish reference condition**
- **How you define reference can make a big difference in terms of regulatory compliance**

Main Question

What is the range of natural “background levels” for a suite of constituents?

- *Not all watersheds are the same*
- *Need to be able to extrapolate data regionally*
- *Need to explore relationships/correlations between water quality and natural watershed characteristics*
- *Need data to calibrate models for natural areas*
- *Target levels for pollutant control activities*
- *How clean is clean enough?*

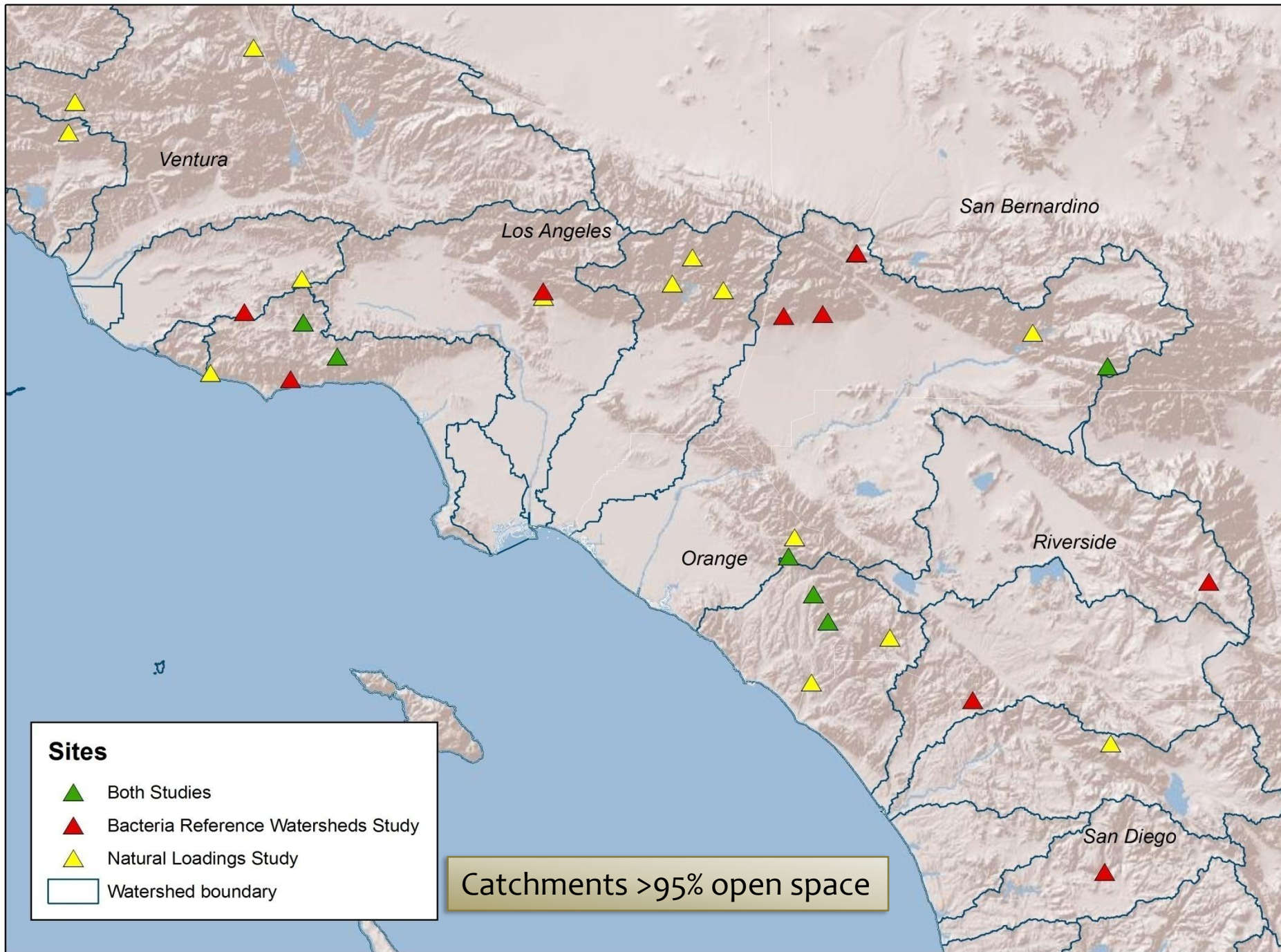
Two Studies

**Reference Criteria: Streams, > 95% Open Space,
No Ag Inputs, Both Wet & Dry**

- **Natural Loadings Study (2004-2006)**
 - 21 sites across southern California
 - Storm and non-storm sampling (quarterly)
 - Metals, nutrients, solids, bacteria

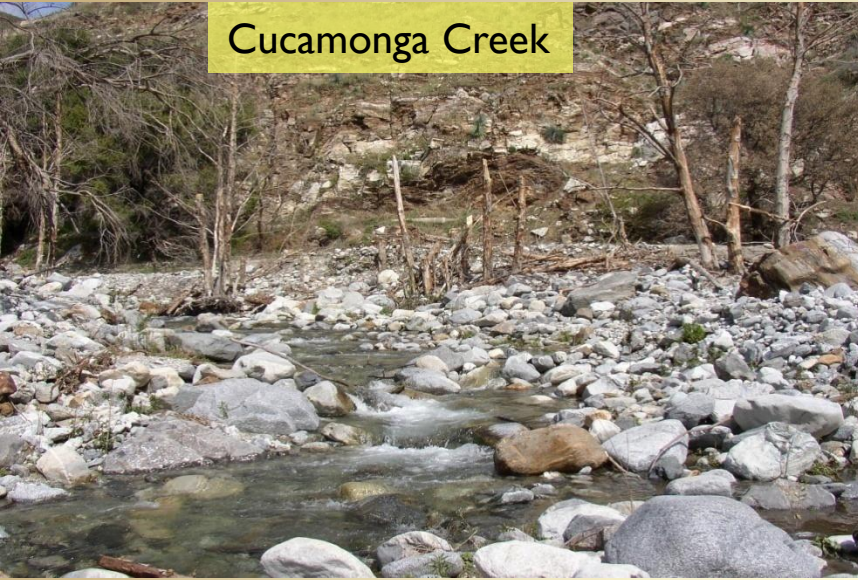
SCCWRP Technical Report #500
- **Bacteria Reference Watershed Study (2006-2007)**
 - 15 sites across southern California
 - Weekly sampling, non-storm only
 - Total coliforms, enterococci, E. Coli., Bacteroides

SCCWRP Technical Report #542



Study Sites

Cucamonga Creek



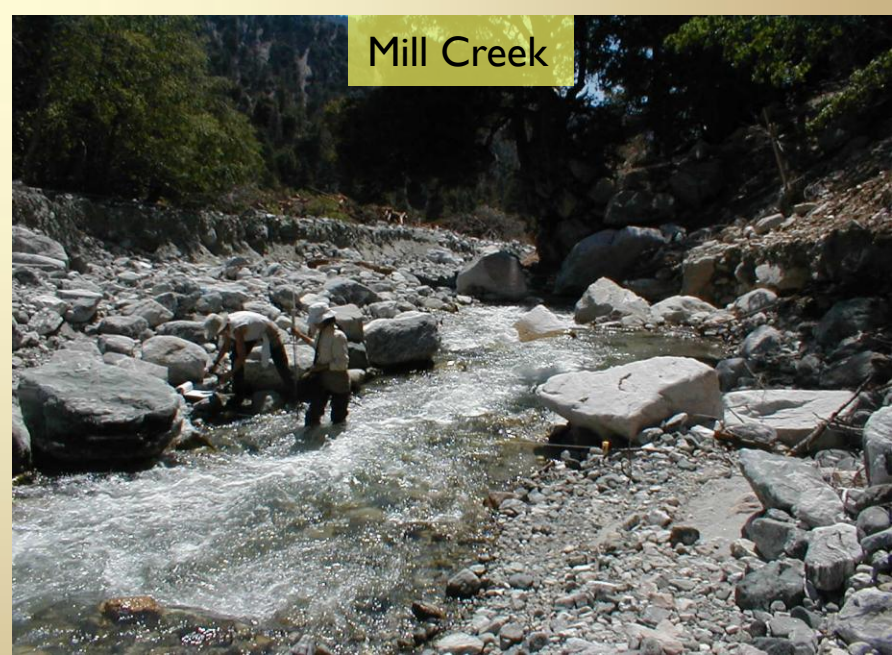
Piru Creek



Arroyo Seco

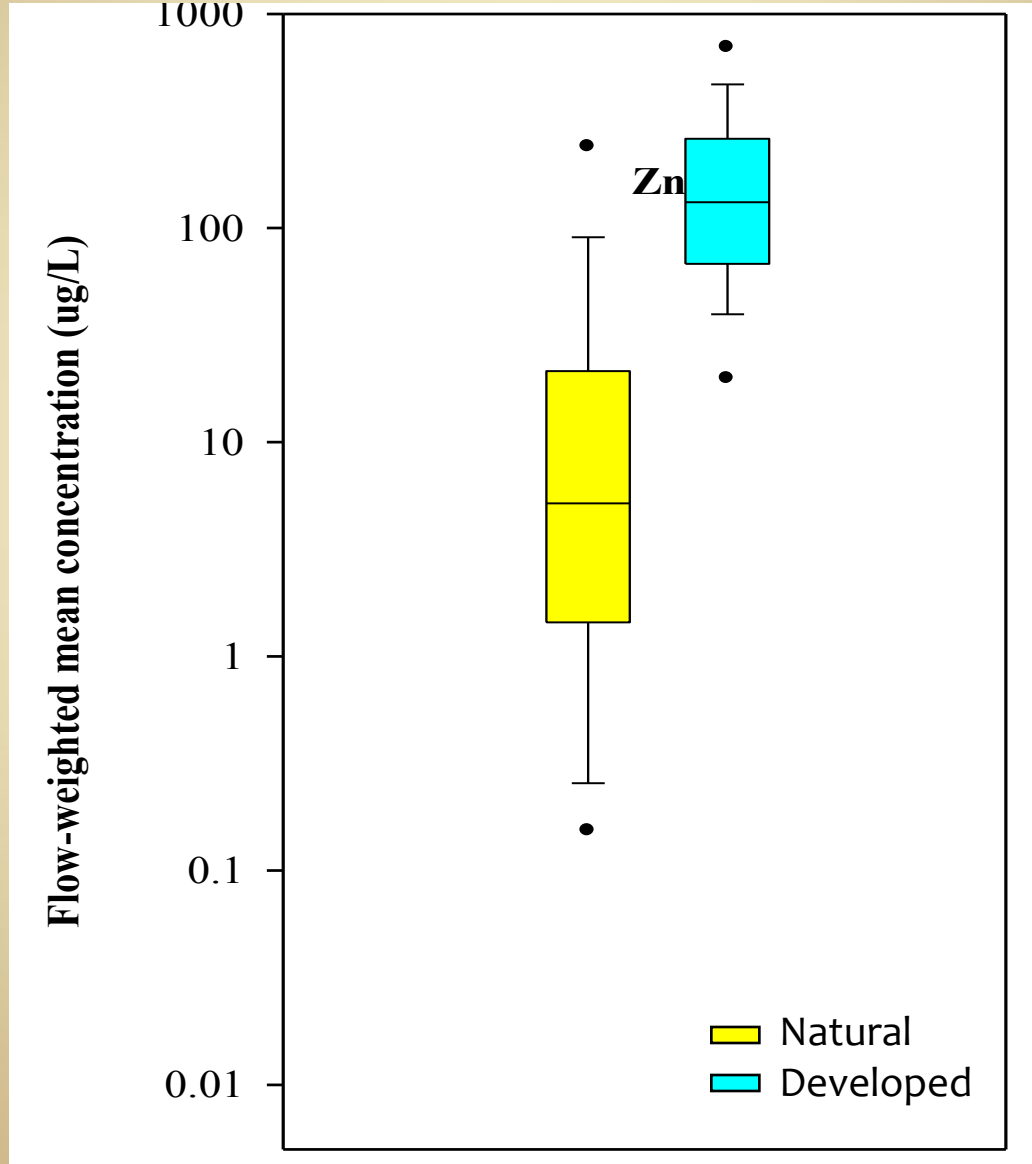


Mill Creek



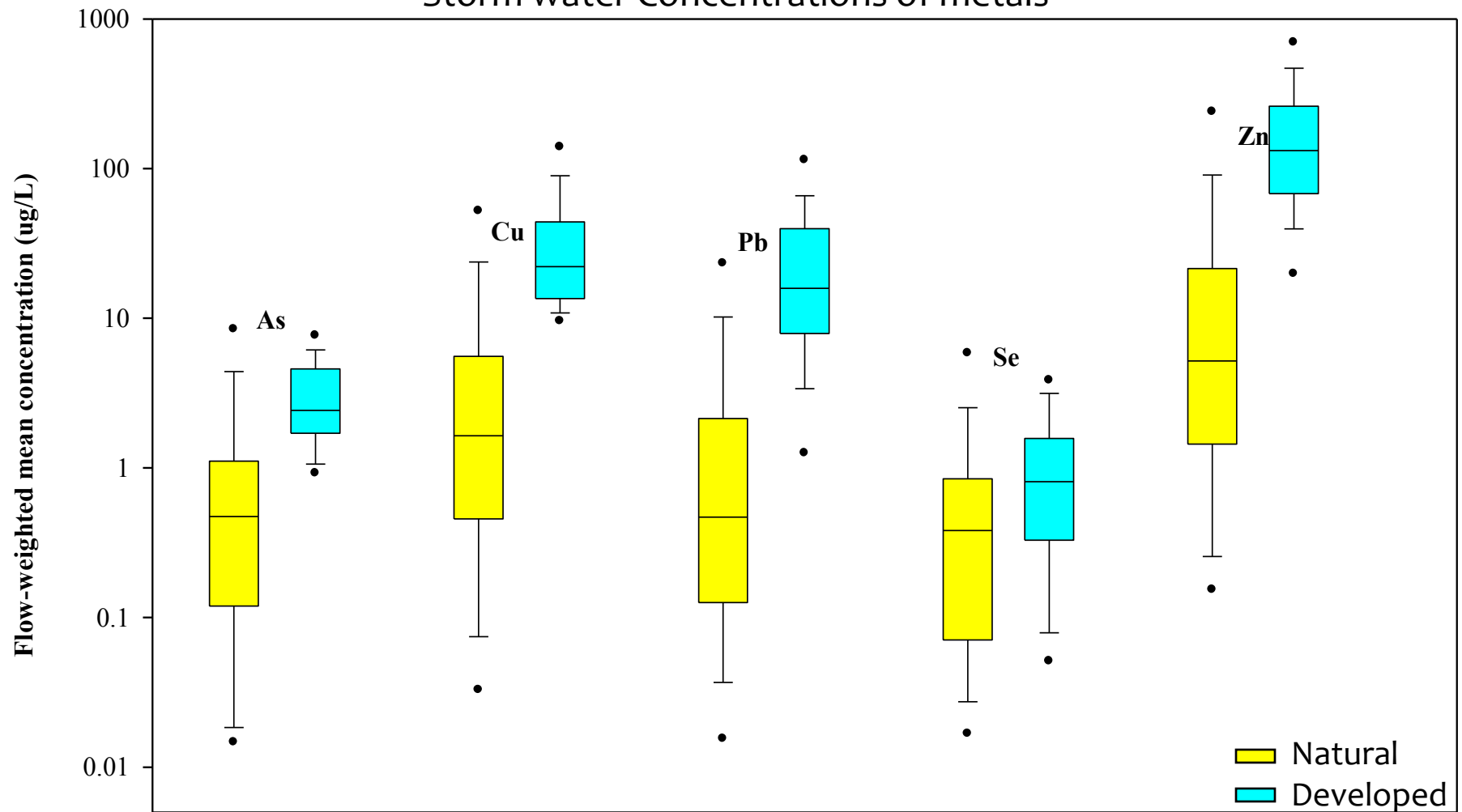
Natural << Anthropogenic

Storm water Concentrations of metals



Natural << Anthropogenic

Storm water Concentrations of metals



Sources of Variability

MORE IMPORTANT

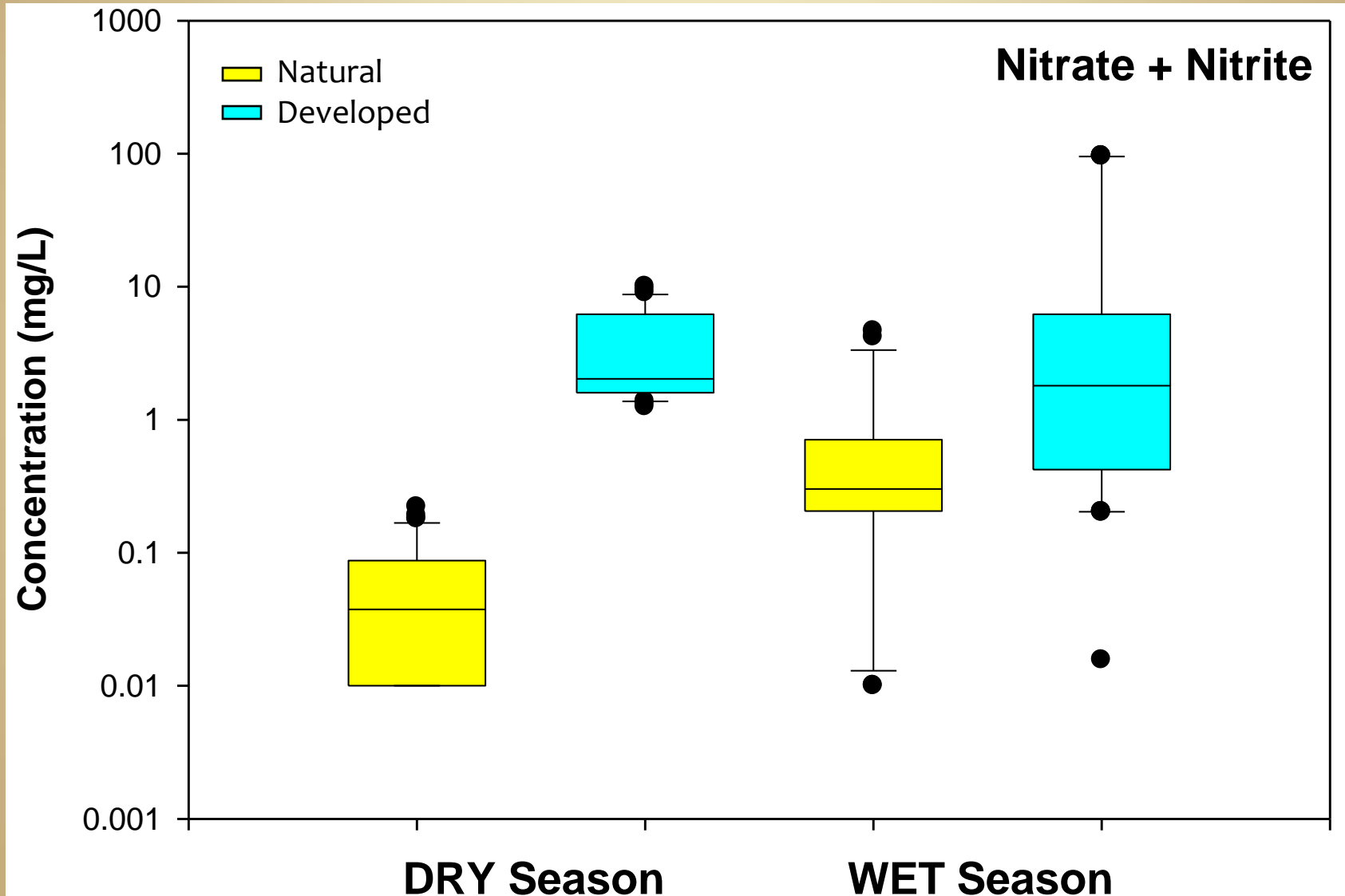
- Season
 - Temperature
 - Time since rain
 - Use by animals and humans
- Flow regime
- Geology
- Degree of disturbance

LESS IMPORTANT

- Catchment size
- Slope/gradient
- Latitude/County
- Natural land cover
 - Forested
 - Scrub/shrub

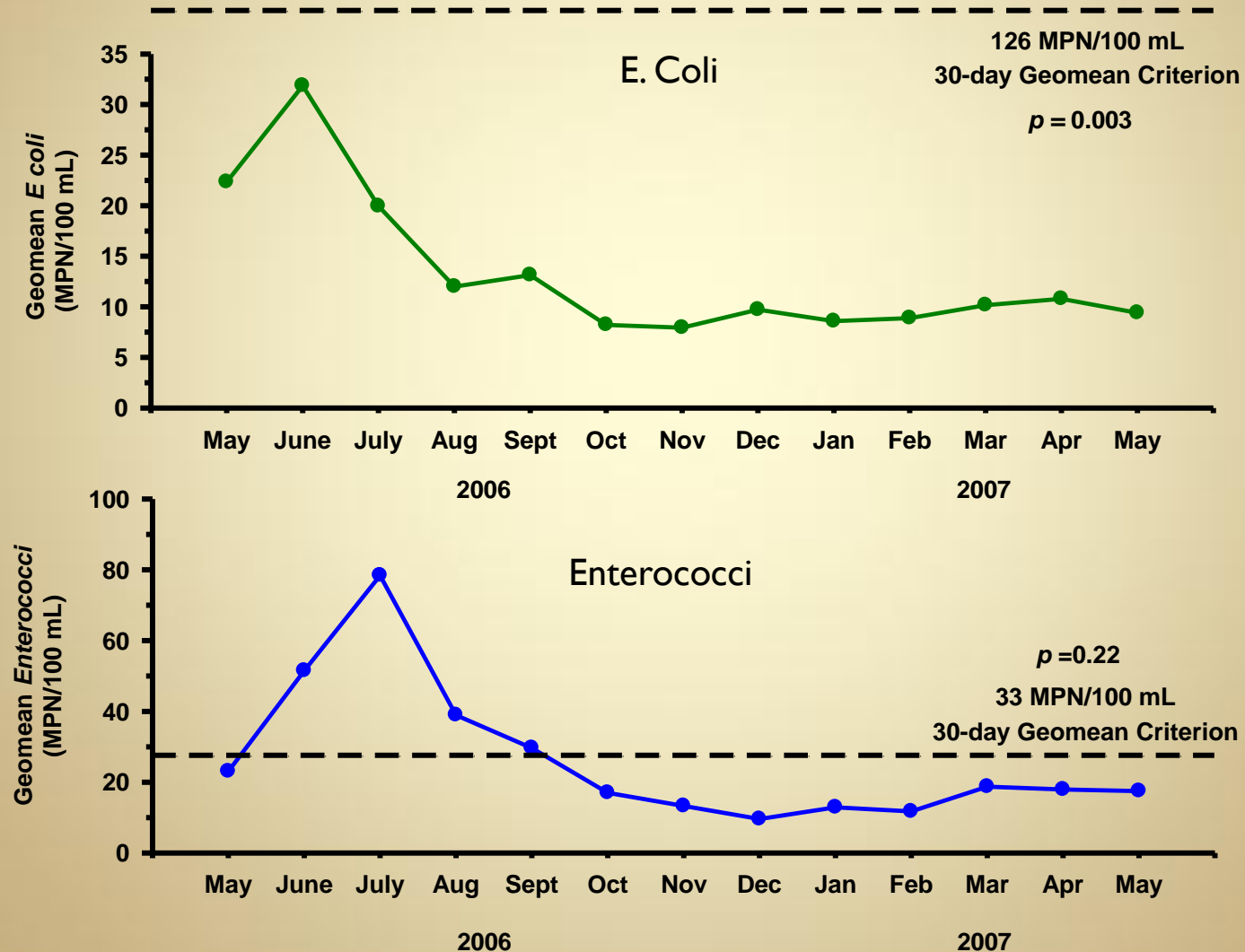
Wet vs Dry Weather Concentrations

Nutrients



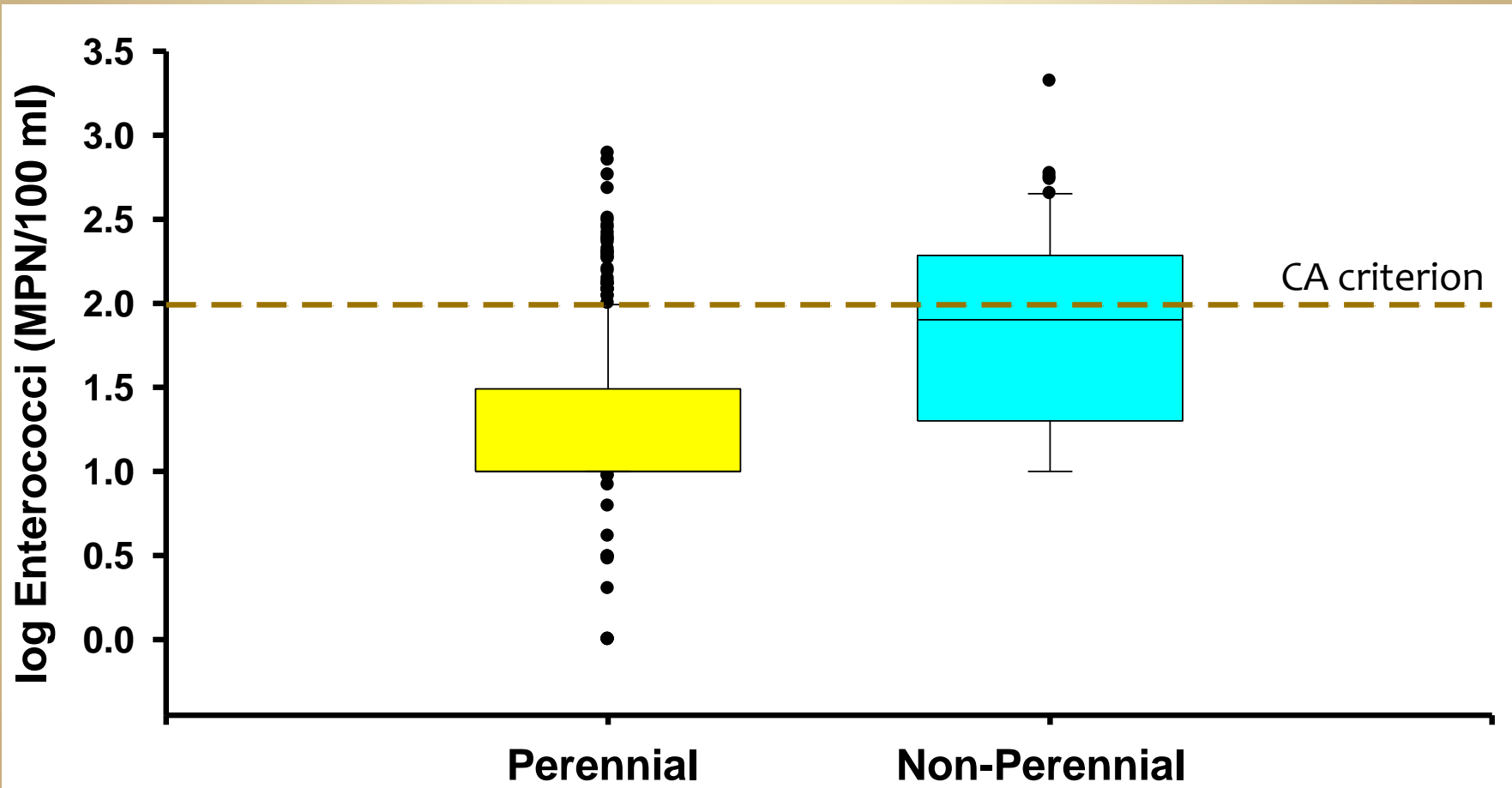
Seasonal Variability in Geomean

Non-storm Bacteria

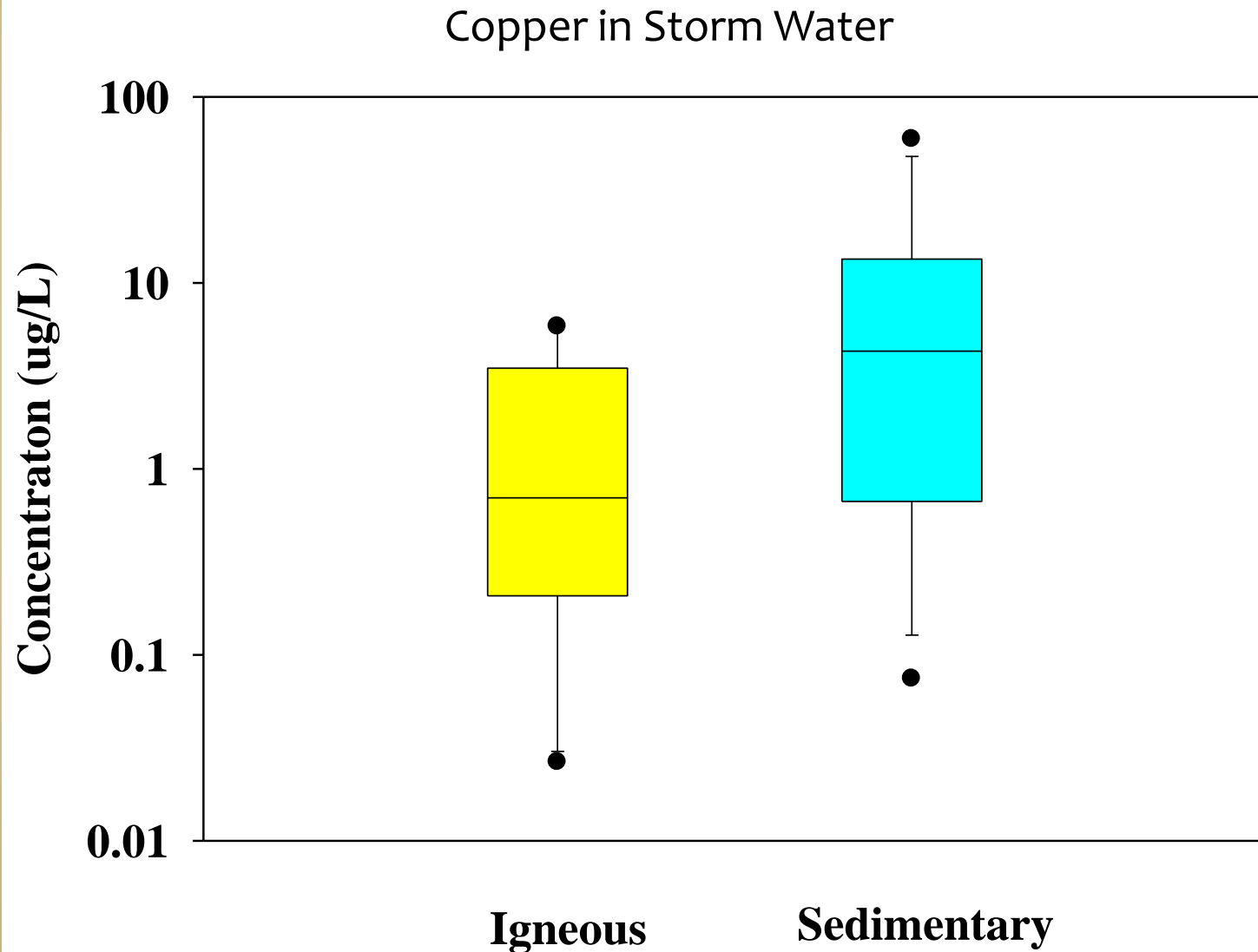


Effect of Flow Regime

Non-storm Bacteria



Effect of Geologic Setting



Minimally Disturbed Sites

▶ Stone Creek

- *27.5% disturbed type land use*
- *Agricultural and rural residential*

▶ Cajon Creek

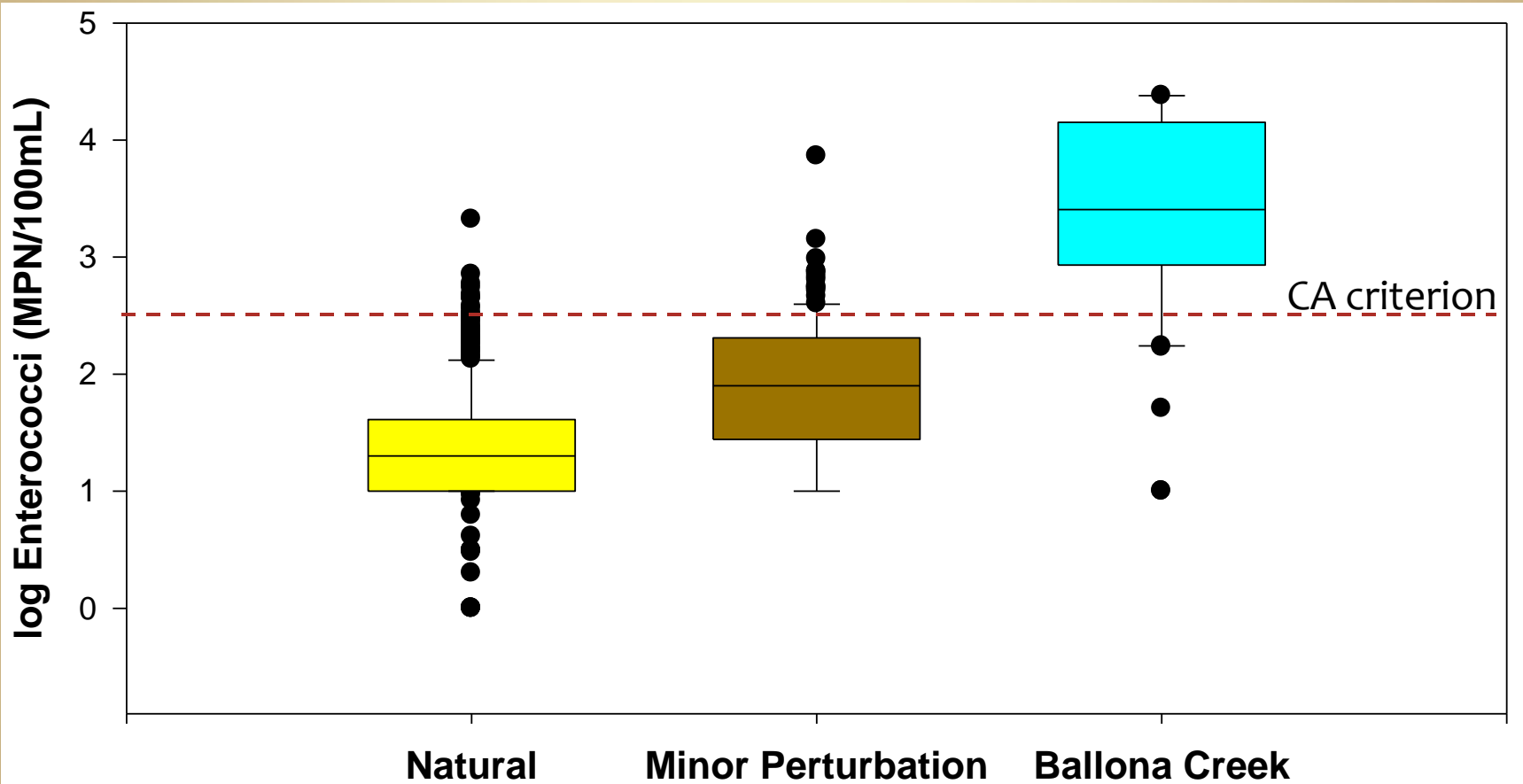
- *Site nearby major highway (Cajon Pass)*
- *Heavily used railroad located nearby*
- *Aerial Deposition*

▶ Cheseboro Canyon

- *A fire recently burned in the watershed*
- *Heavily used trails near stream*

Effect of Minor Disturbances

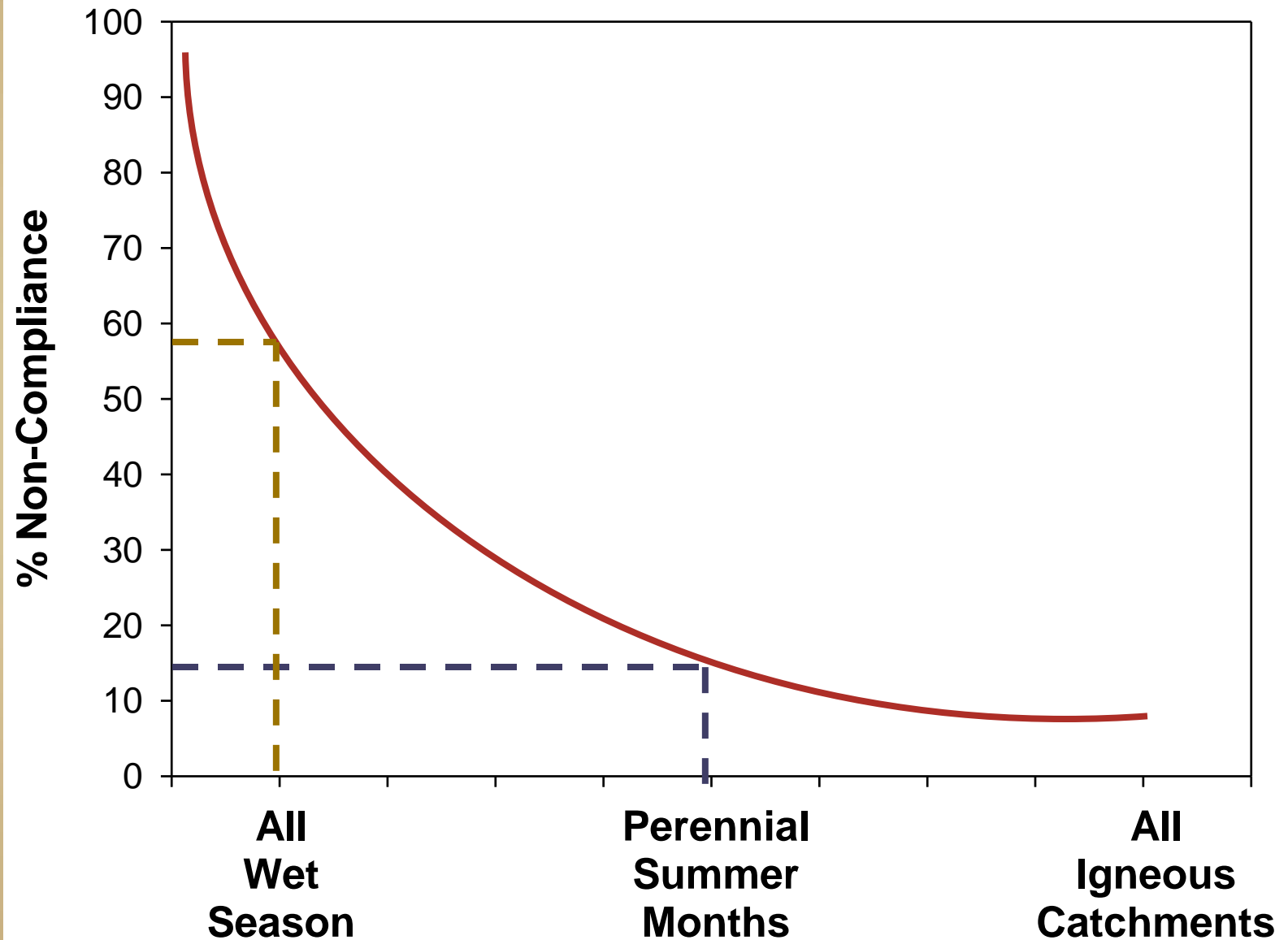
Non-storm Bacteria



Conclusions

- **Natural “background” levels can be quantified**
 - *Substantially lower than levels seen in “impacted areas”*
 - *Natural concentration may exceed standards at some times*
 - *Differences between natural and anthropogenic are greater in non-storm than storm conditions*
- **“Natural” is not the same in all areas/conditions**
 - *Natural levels vary seasonally based on temp., flow, etc.*
 - *Flow regimes affect expectations of background levels*
 - *Geologic setting can affect background levels*

Take Home Message



Questions??

