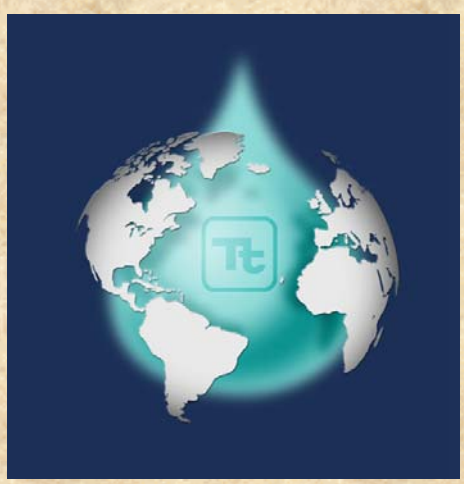
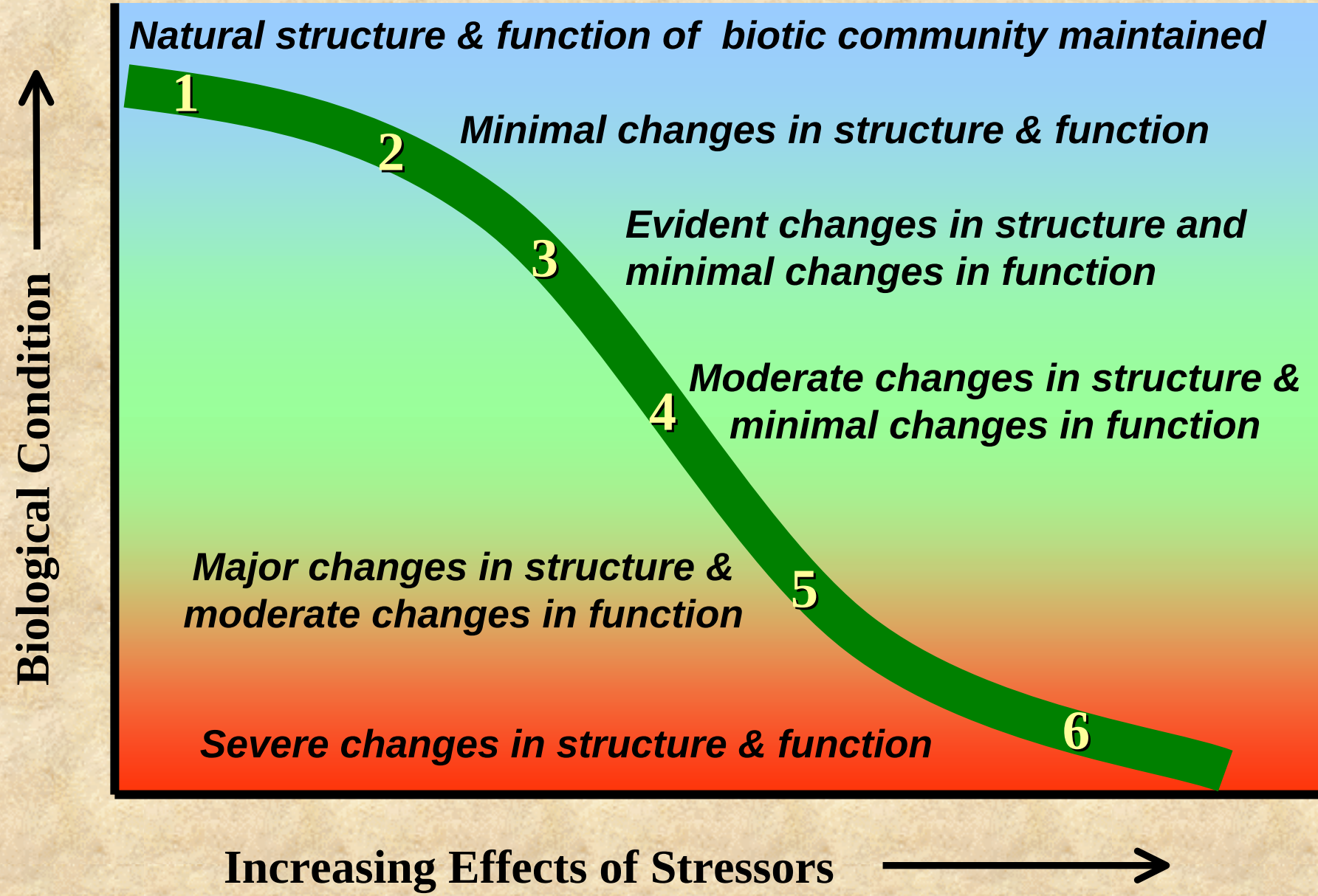
Tiered Aquatic Life Use for the Nation and in SoCal: Challenges and Implementation Strategies

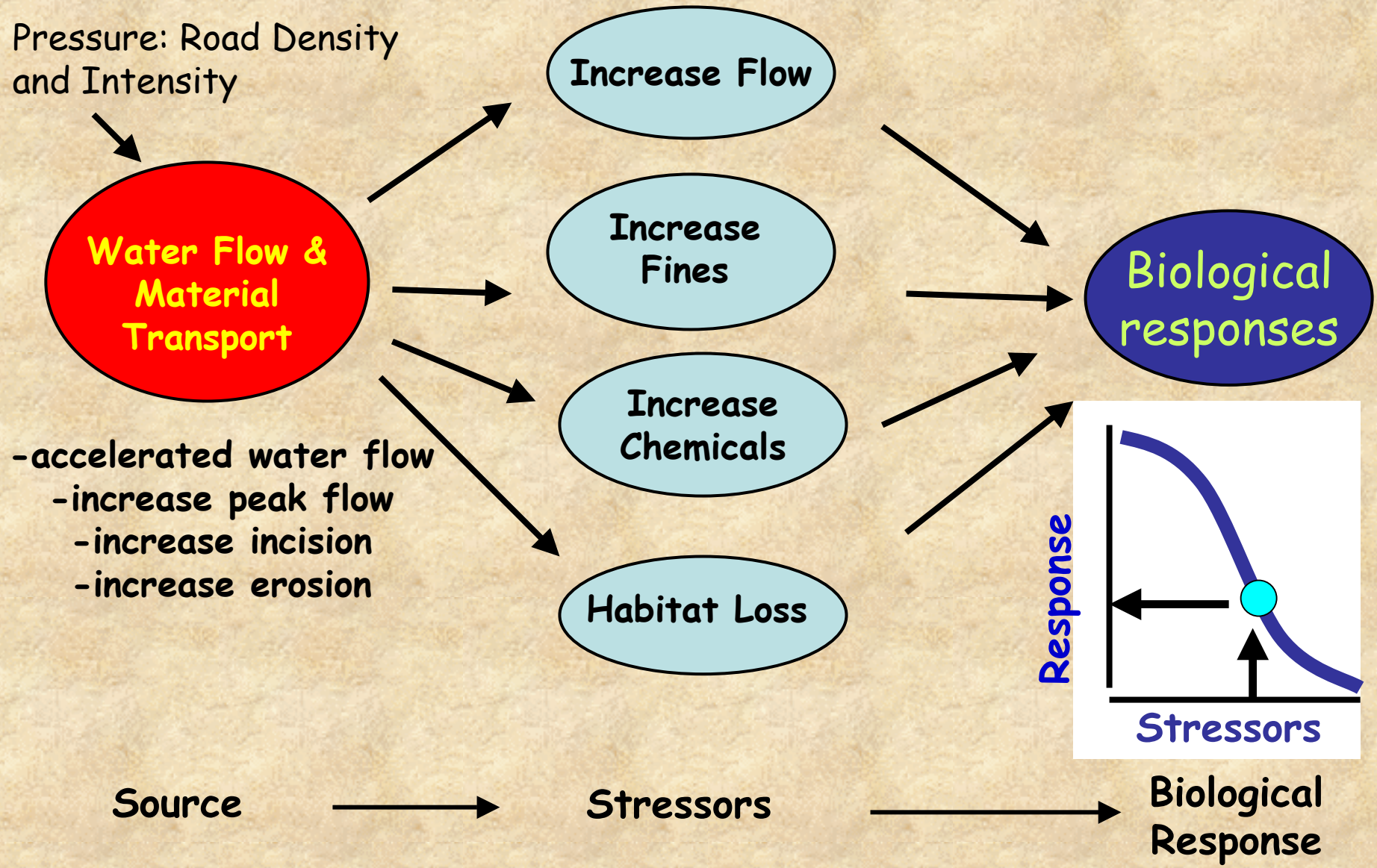


Michael T. Barbour, PhD
Director
Center for Ecological Sciences

The Biological Condition Gradient – Model



Characterizing the Stressor Axis - Example



Characterizing the Stressor Axis – BMP Effect

Pressure: Road Density and Intensity

Water Flow & Material Transport

- **-accelerated water flow**
- **-increase peak flow**
- **-increase incision**
- **-increase erosion**

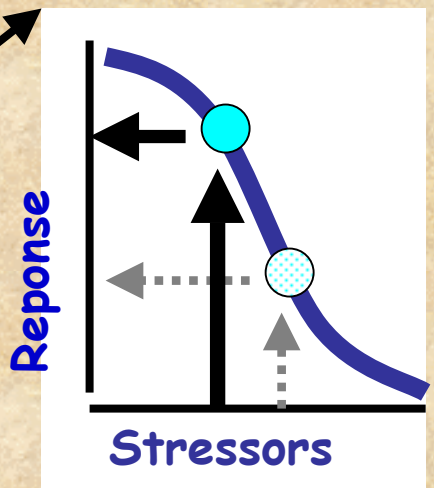
Increase Flow

Increase Fines

Increase Chemicals

Habitat Loss

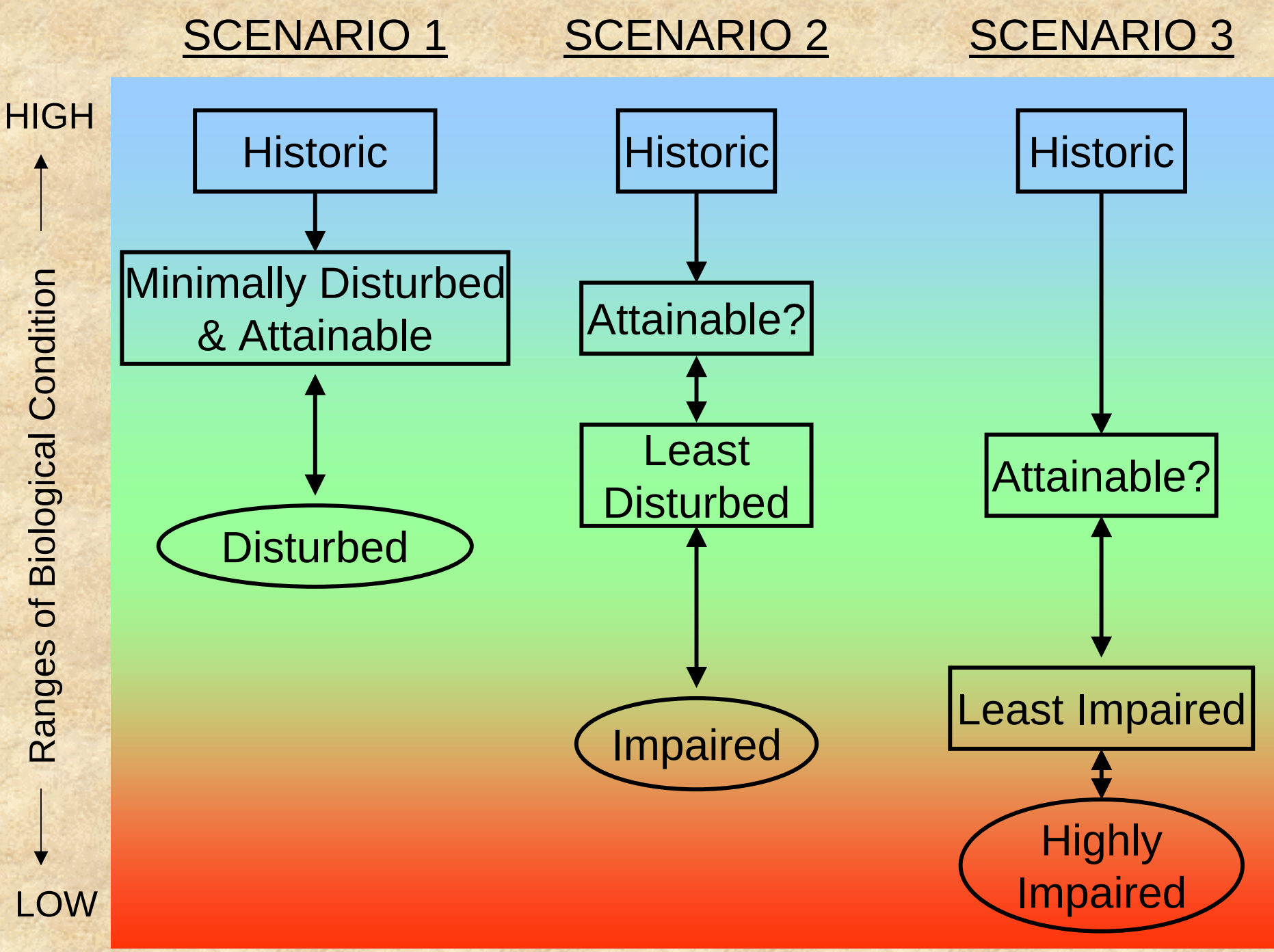
Biological responses



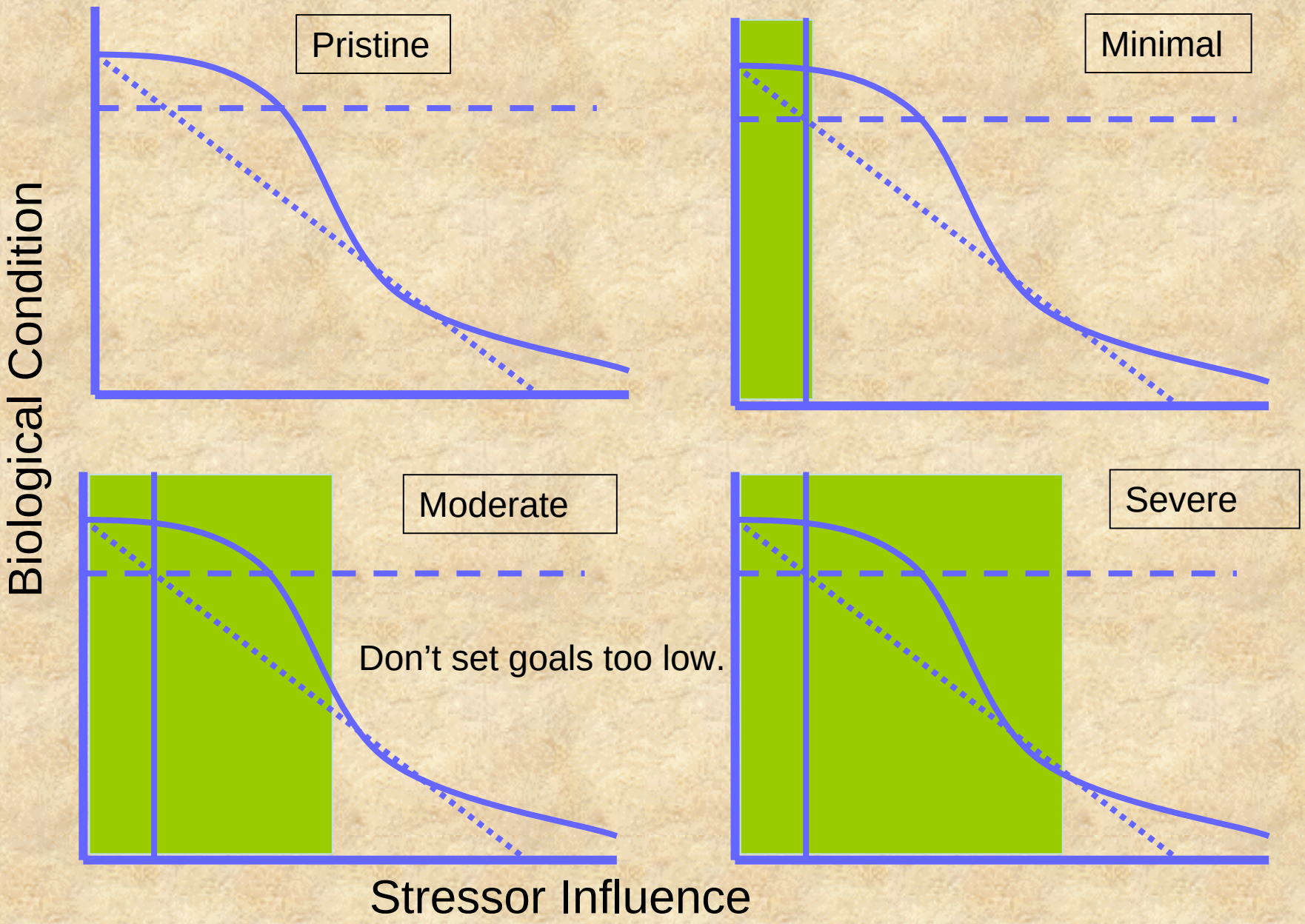
Management Actions

Source → Stressors → Biological Response

"Management influences Source-Stressor mechanisms or sometimes level of source"


SCENARIO 1
SCENARIO 2
SCENARIO 3
HIGH
Ranges of Biological Condition
LOW
Historic
Minimally Disturbed & Attainable
Disturbed
Historic
Attainable?
Least Disturbed
Impaired
Historic
Attainable?
Least Impaired
Highly Impaired

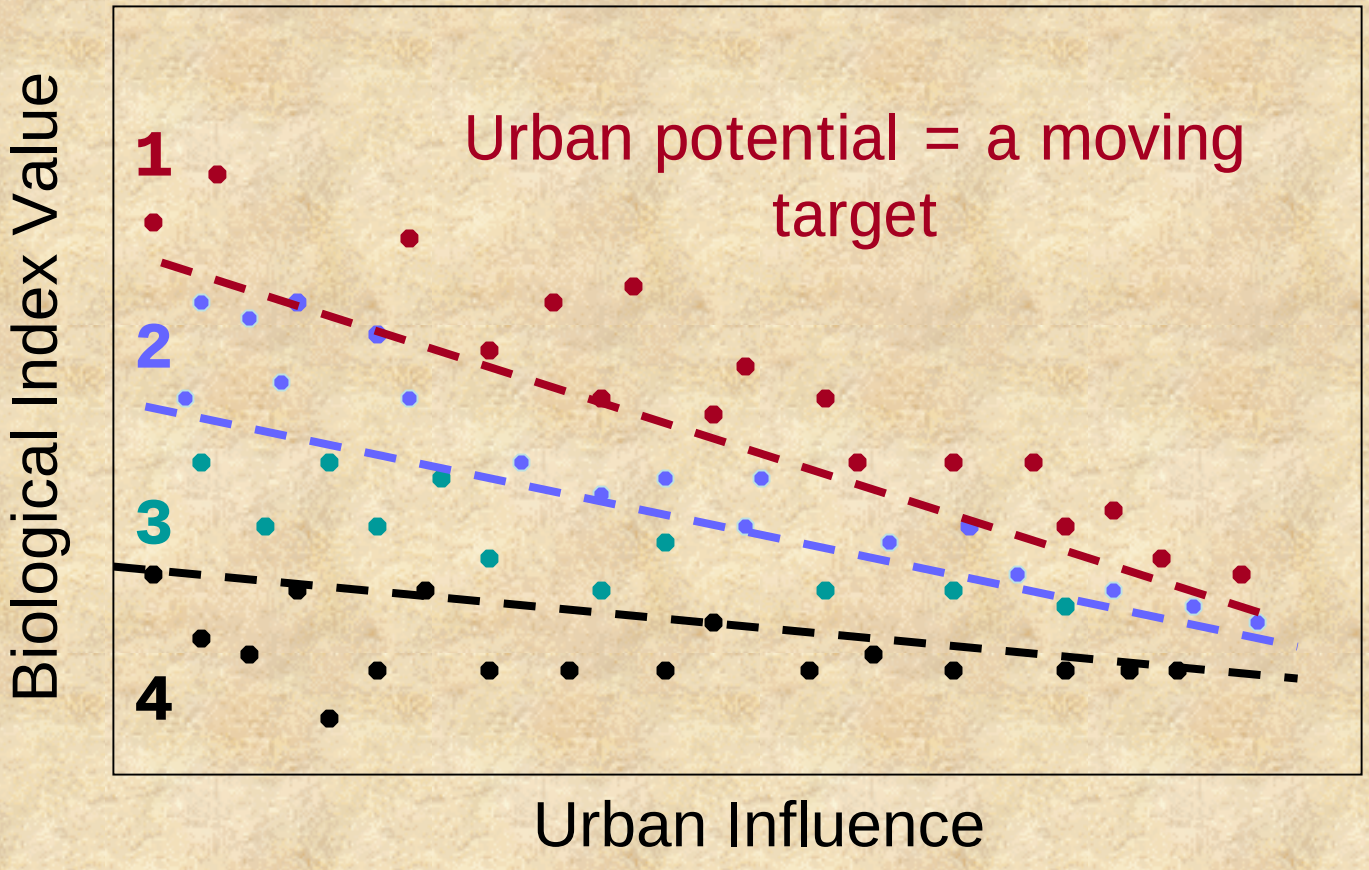
What we consider as “attainable” improves with an understanding of the condition gradient!



Don’t set goals too low.

Explaining Biological Potential

- Approach – **binning** and **logistic regression**
- May help explore differences across gradient



Explaining Biological Potential

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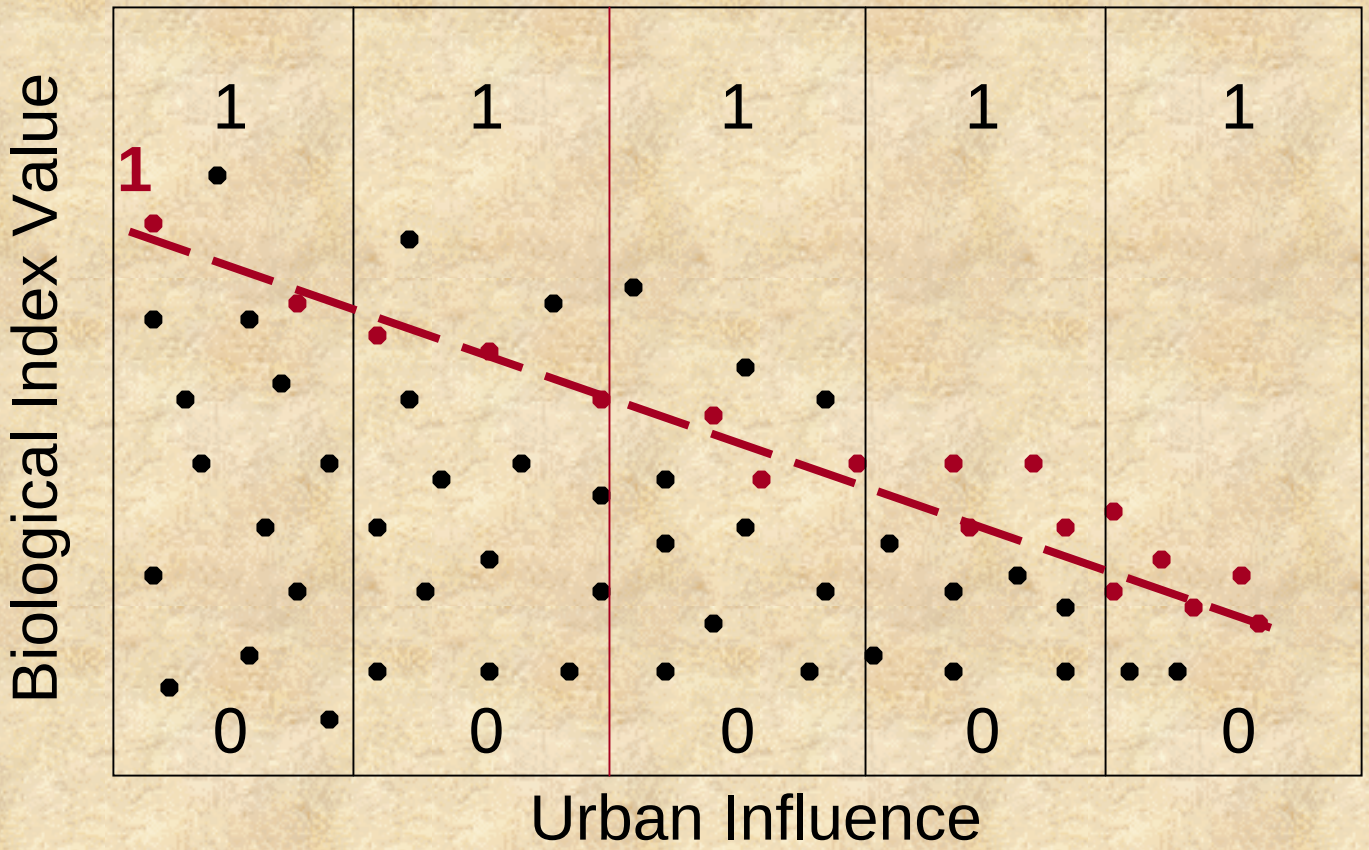

Explaining Biological Potential

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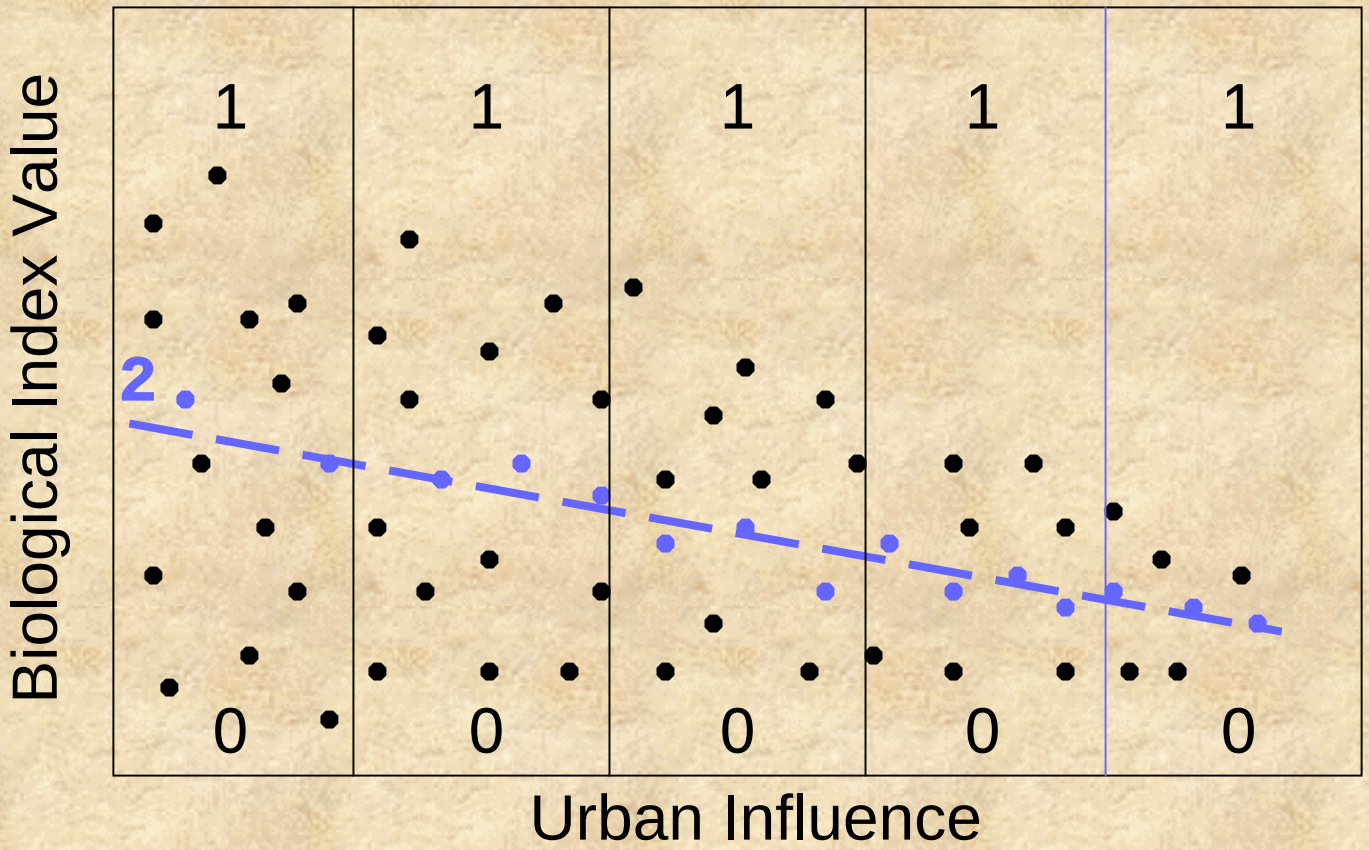
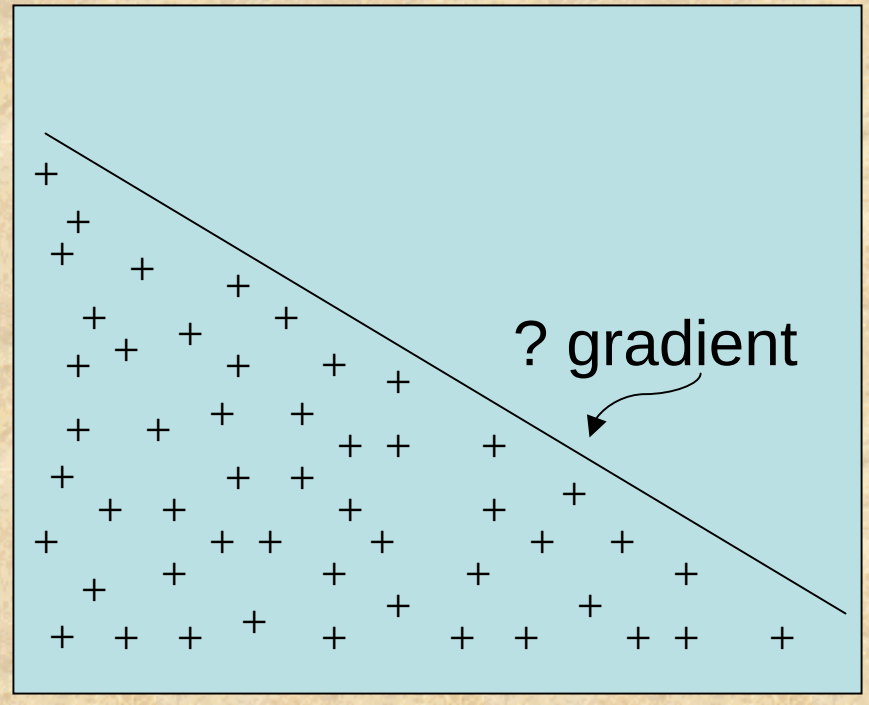


Data Explorations

?

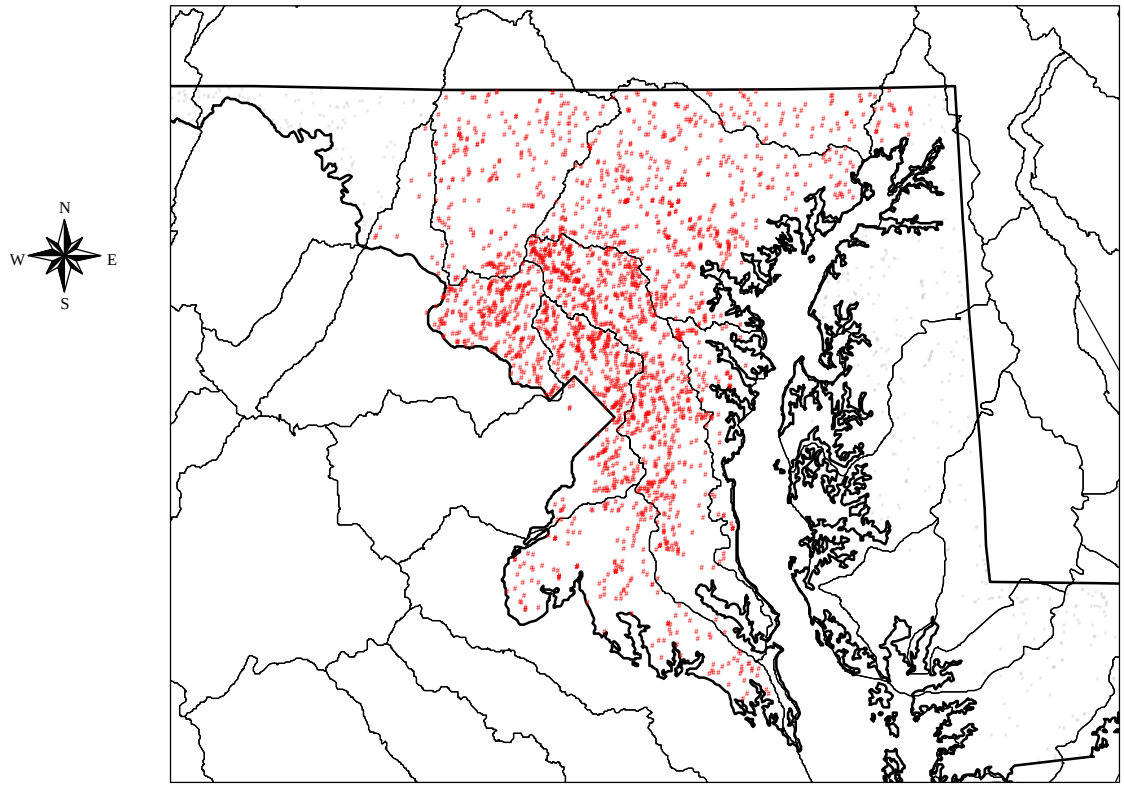
Biological Indicator



Urban Intensity

?

Baltimore, MD/Washington, DC

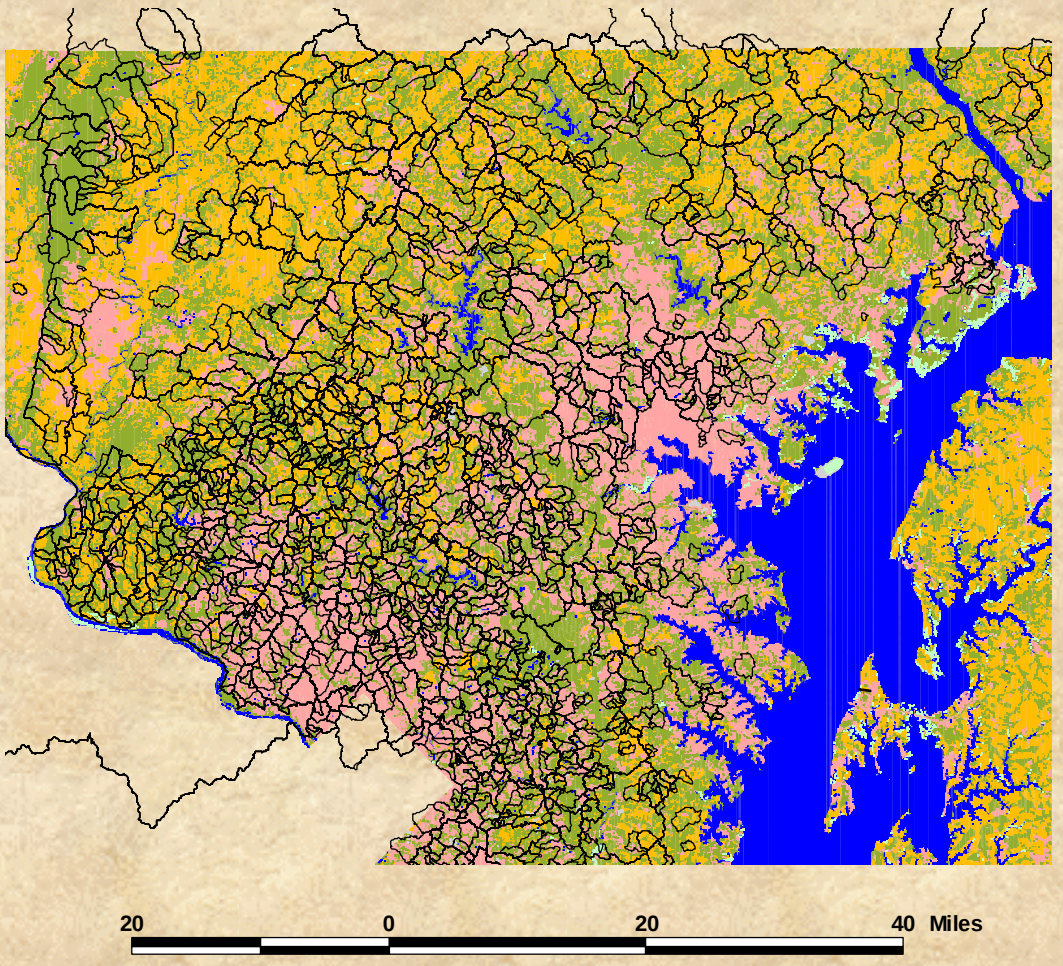


Baltimore/Washington, D.C. Study Area Sites
Major Watershed Boundaries
State Boundaries
Sites outside of study area

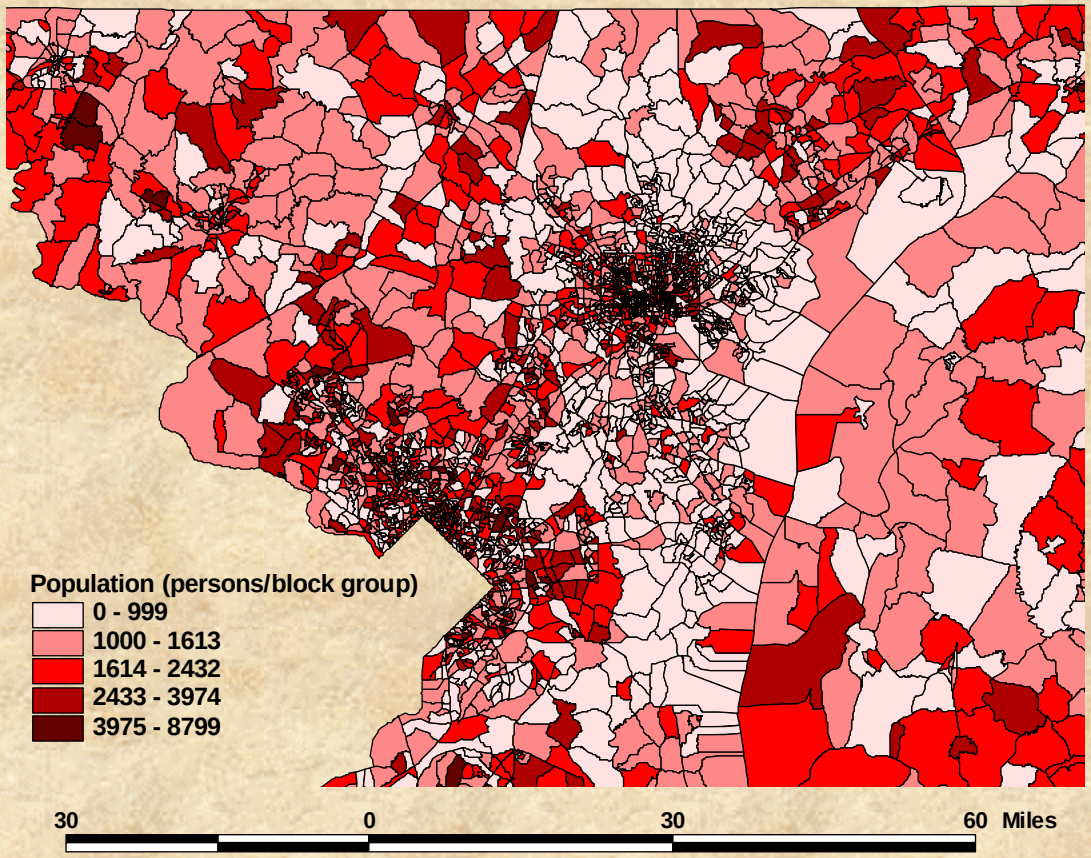
0 30 60 90 Miles

1,955 Sites

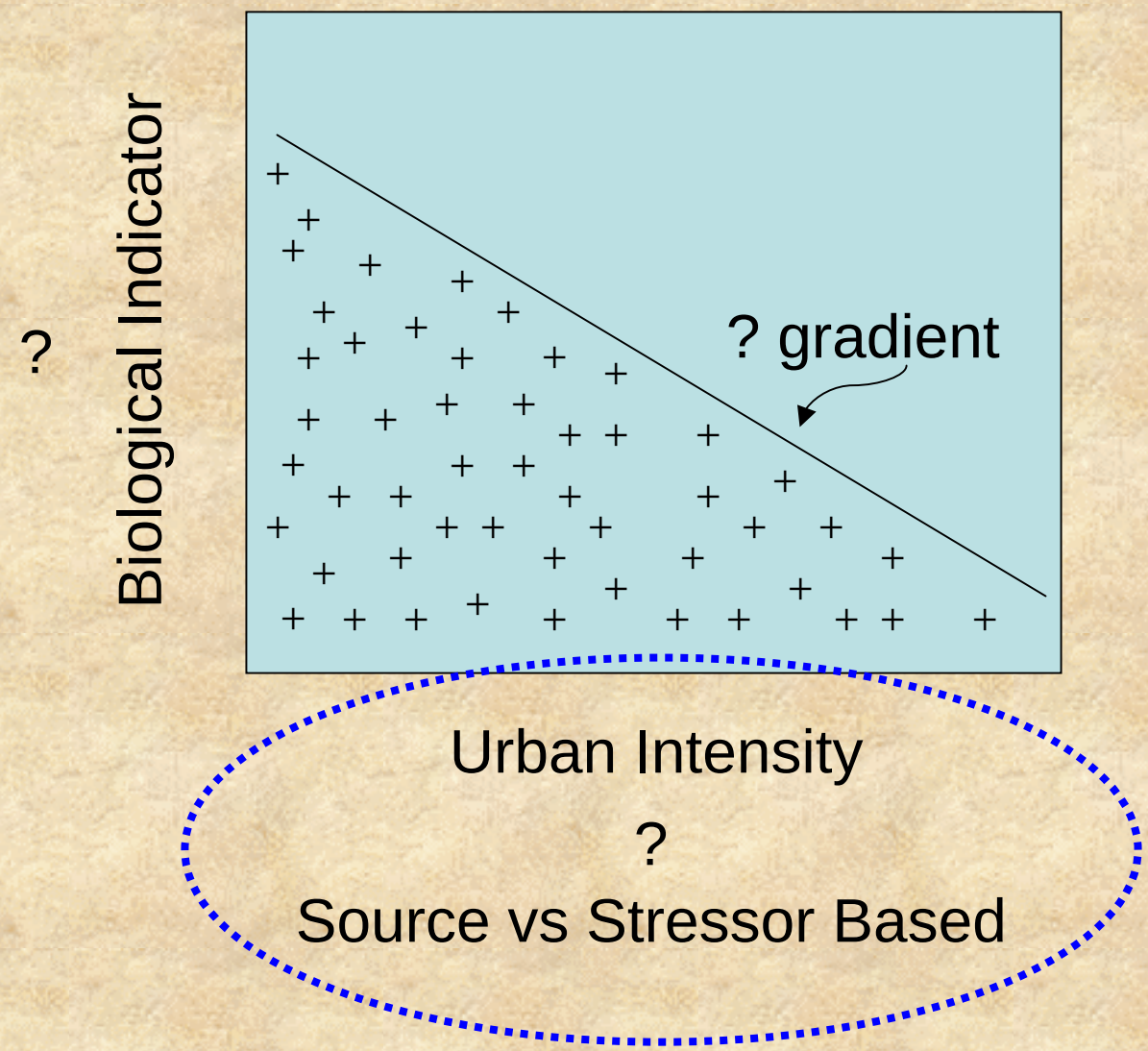
GIS Analysis



GIS Analysis



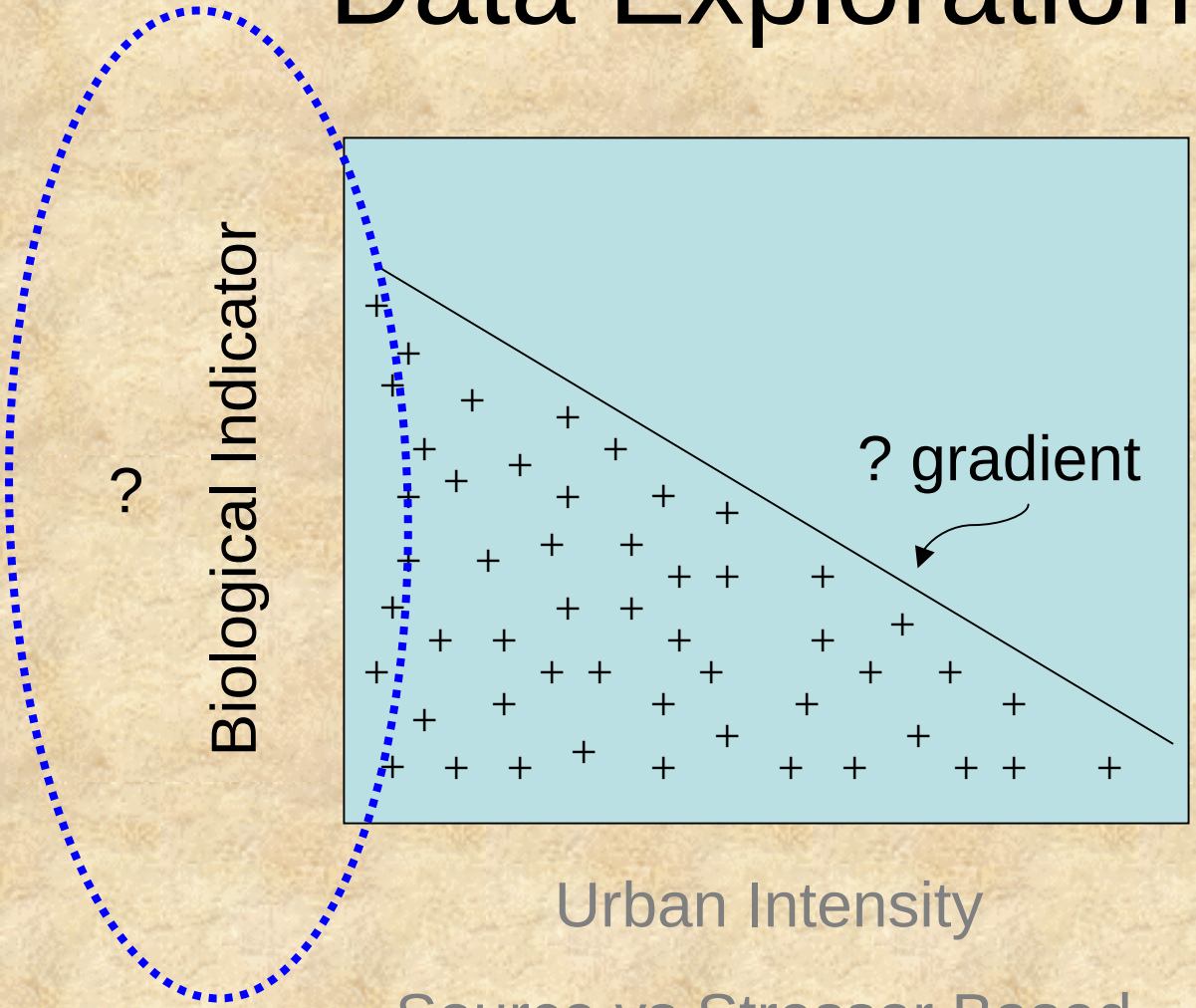
Data Explorations



Potential urban gradients

- Example urban gradient – source based:
  - Low-high residential
  - Commercial
  - Industrial
  - Population density
  - Road density

Data Explorations



Source vs Stressor Based

Selecting biological indicators

- Investigated relationships of biological metrics with urban gradient
- Assembled metrics into potential urban indexes
  - Metrics related to structure and function
    - TALU
  - Three metrics in each index

Selecting biological indicators

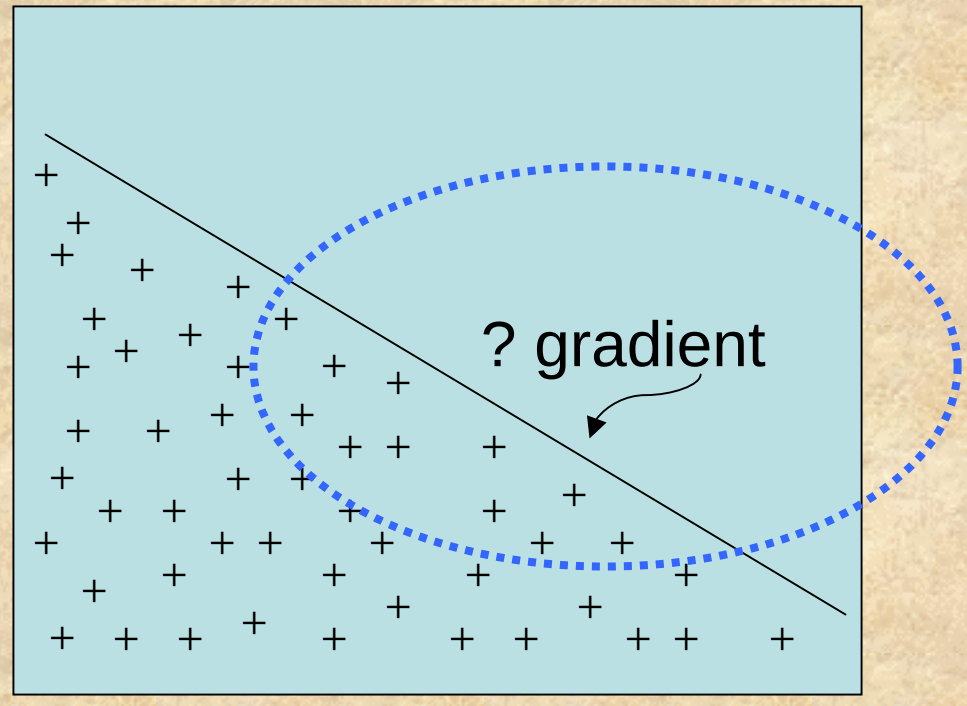
- Assembled metrics into 10 potential indexes

Index1	Index2	Index3	Index4	Index5
FiltrPct	FiltrPct	CllctTaxR100	CllctTaxR100	FiltrTaxR100
ClngrTaxR100	SwmmrTaxR100	ClngrTaxR100	SwmmrTaxR100	ClngrTaxR100
EPTTaxR100	EPTTaxR100	EPTTaxR100	EPTTaxR100	EPTTaxR100

Index6	Index7	Index8	Index9	Index10
FiltrTaxR100	ScrapTaxR100	ScrapTaxR100	ShredTaxR100	ShredTaxR100
SwmmrTaxR100	ClngrTaxR100	SwmmrTaxR100	ClngrTaxR100	SwmmrTaxR100
EPTTaxR100	EPTTaxR100	EPTTaxR100	EPTTaxR100	EPTTaxR100

Example biological index

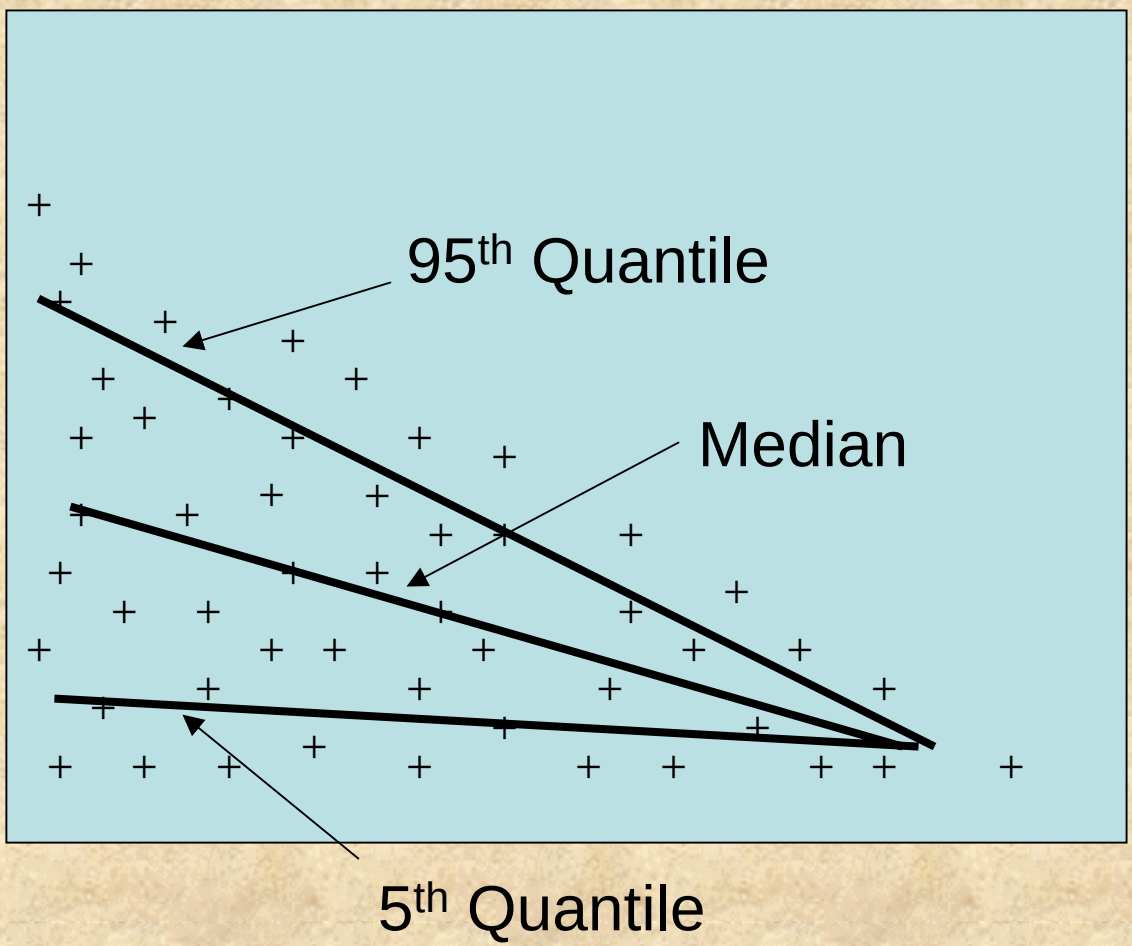
Defining Biological Potential



Source vs Stressor Based

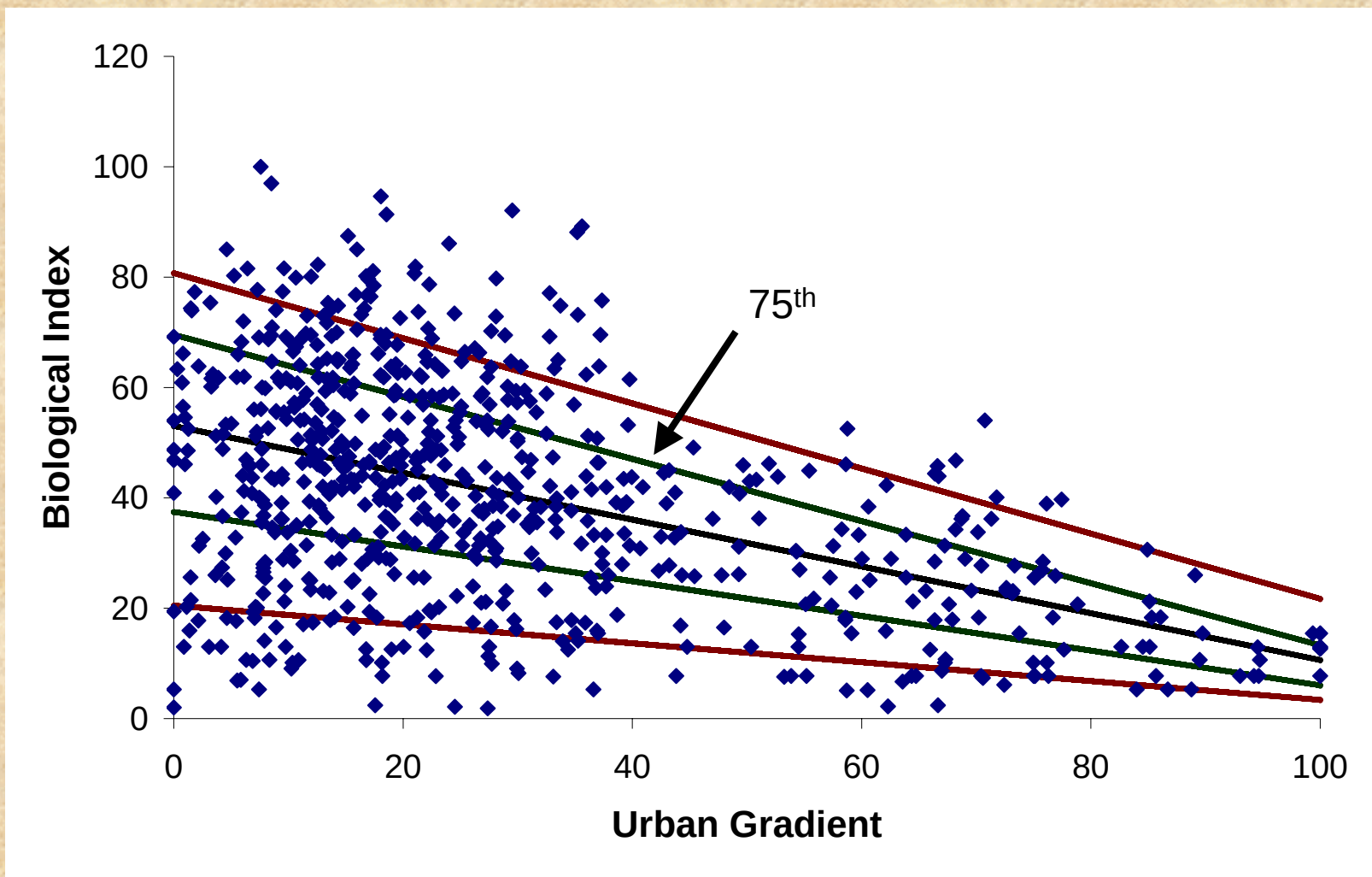
Defining Biological Potential

- Quantile regression



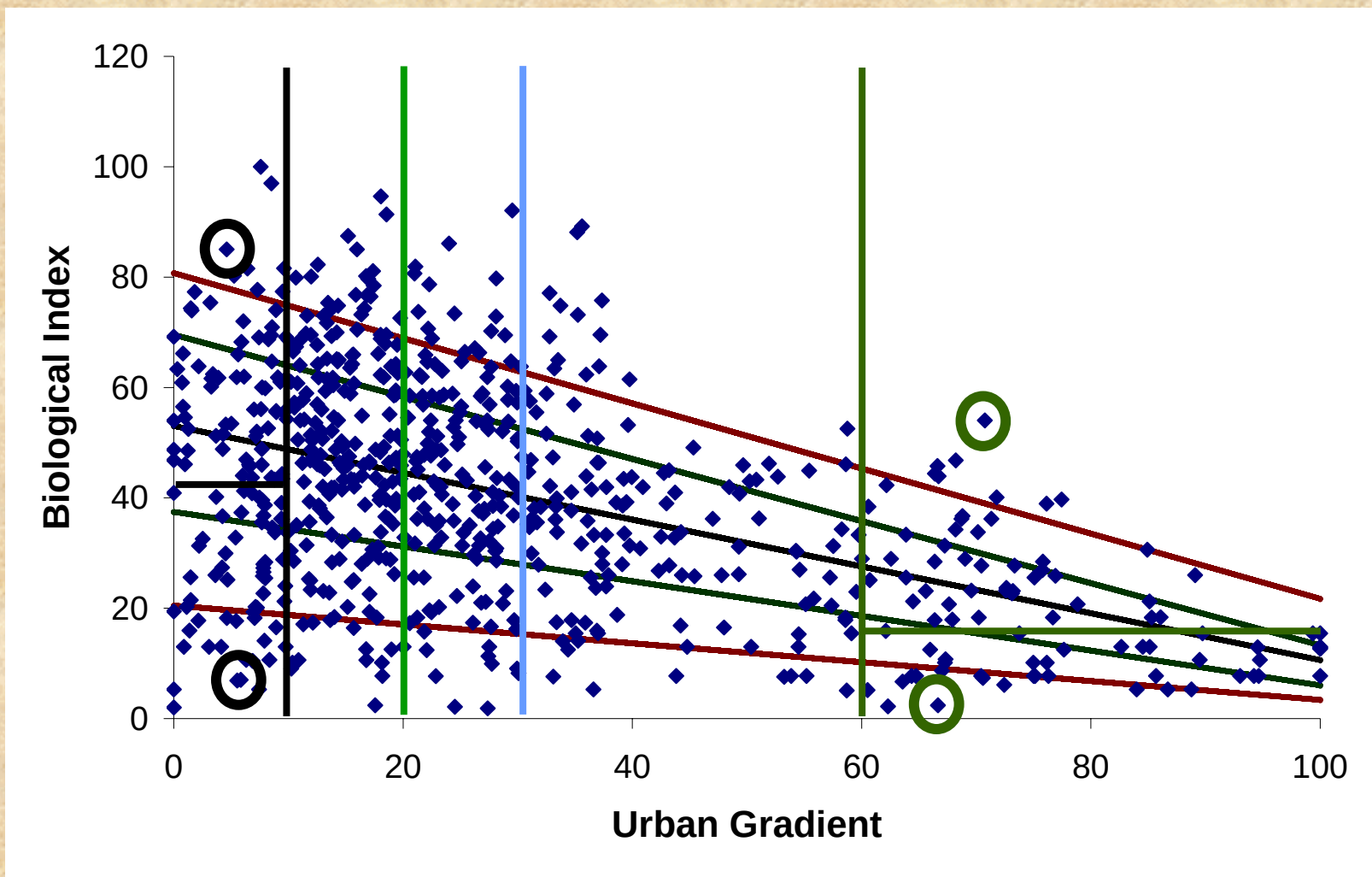
Defining Biological Potential

- Quantile regression

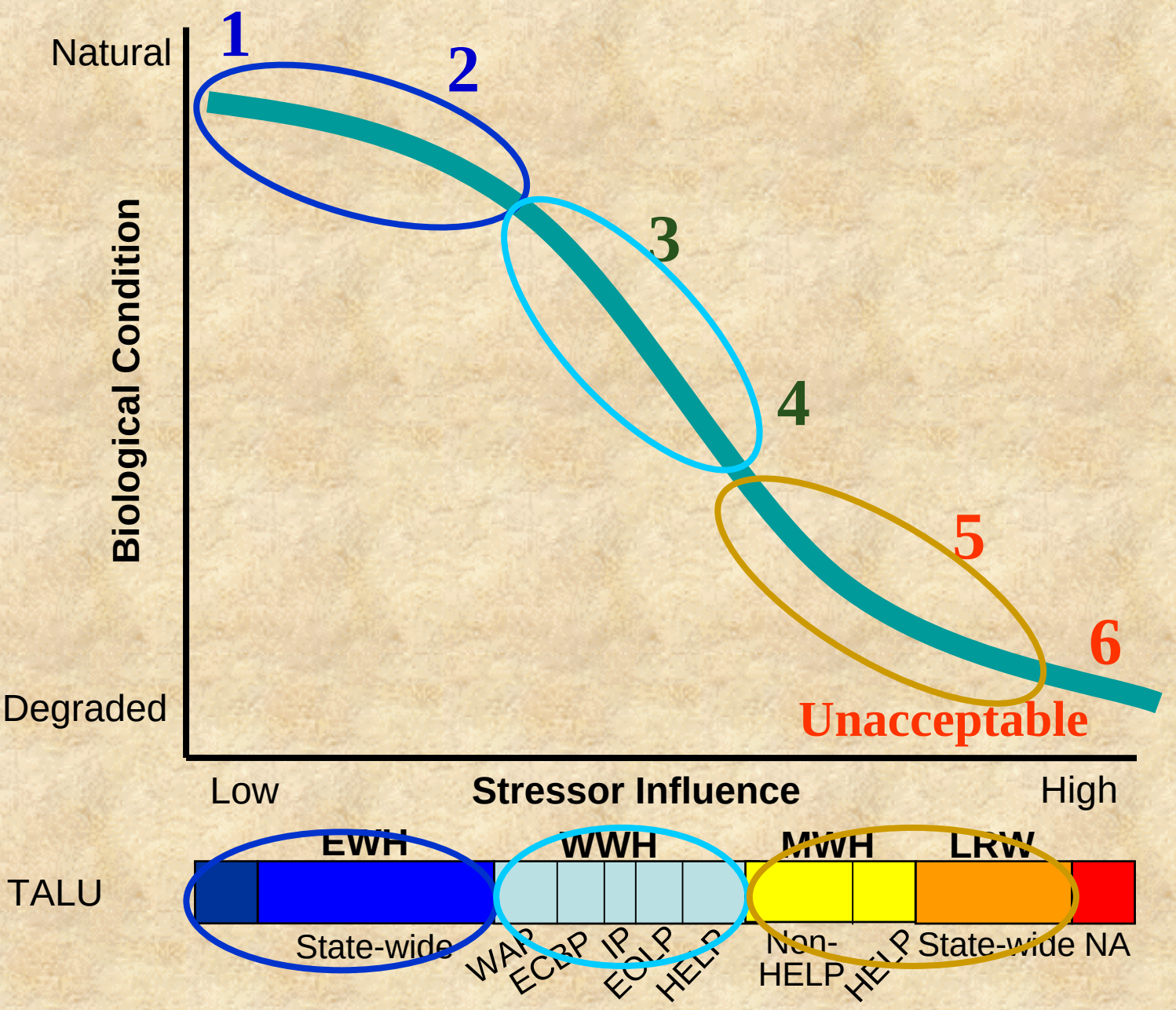


Defining Biological Potential

- Expanded analysis –evaluating position



Relation to OH Designated Uses



Translating Results of this Study to Aquatic Life Use Expectations in Urban Streams

- Need to know relationship between sources/stressors and biota
- Knowledge of link from condition → stressors → sources will allow analysis of "feasibility" of restoration and consideration of "irretrievable" conditions as required by CWA
- Essential steps in creating use not meeting CWA fishable/swimmable goal of act
- EPA and individual states/tribes need to flesh out definitions of feasible restoration and "irretrievable" conditions; this analysis provides scientific link between biological expectations and limiting factors

Determining Uses for Urban Streams

- Determination of an appropriate use for an urban stream needs to be built on data intensive, sound scientific foundation → key is linking biological response to stressors/sources
- Do not want to institutionalize degraded streams that are feasibly restorable over a reasonable time frame
- Subsequent UAAs also need to be based on sound science: (1) protect against institutionalizing degraded streams and (2) produce a realistic framework for modification of aquatic life uses
- This process should not be onerous for any entity with adequate monitoring program