Presented at

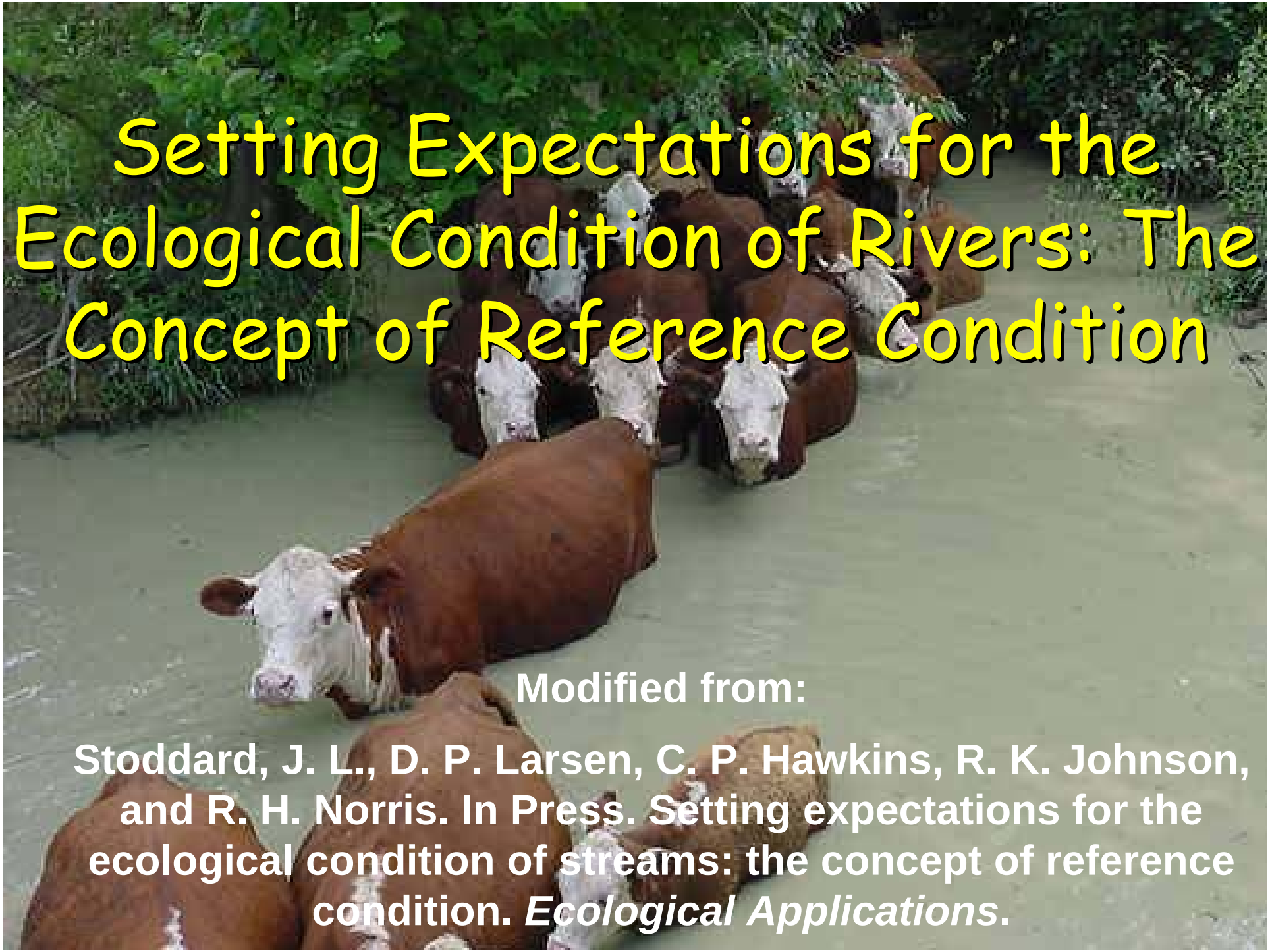
Great Rivers Reference Condition Workshop

January 10-11, Cincinnati, OH

Sponsored by

The U.S. Environmental Protection Agency and The Council of State Governments

Setting Expectations for the Ecological Condition of Rivers: The Concept of Reference Condition



Modified from:

Stoddard, J. L., D. P. Larsen, C. P. Hawkins, R. K. Johnson, and R. H. Norris. In Press. Setting expectations for the ecological condition of streams: the concept of reference condition. *Ecological Applications*.

Underlying Questions

- Science Question: How does human activity affect aquatic ecosystems and, in particular, aquatic biota?
  - What is our Benchmark for assessing current condition?
- Management Question: What should we do about the fact that human activities have degraded aquatic ecosystems?
  - What should we use as a target for management actions?

Where does the concept come from?

- Clean Water Act objective:
  "to restore and maintain the physical, chemical, and biological integrity of the nation's waters"
- Biological Integrity definition:
  "community of organisms having a species composition, diversity and functional organization comparable to those of natural habitats within a region"

A confusion of terms

- Reference condition
- Pristine condition
- Undisturbed condition
- Natural Condition
- Minimally disturbed condition
- Least disturbed condition
- Historical condition
- Attainable condition
- Expected condition

Reference Condition – RC(BI)

- The condition unaffected by anthropogenic disturbance; pristine; unpolluted; natural
- Reserve the term as a descriptor for biological integrity
- General international agreement on use of the term

Minimally Disturbed Condition (MDC)

- Condition nearly unaffected by anthropogenic disturbance
  - And related stressors/exposures
- Approximately equivalent to:
  - Pristine
  - Natural
  - Undisturbed

Least Disturbed Condition (LDC)

- Present-day condition found in conjunction with the best available physical, chemical, and biological habitat conditions.
- Condition found in presence of lowest amount of human disturbance and stressors
- “Best of What’s Left”

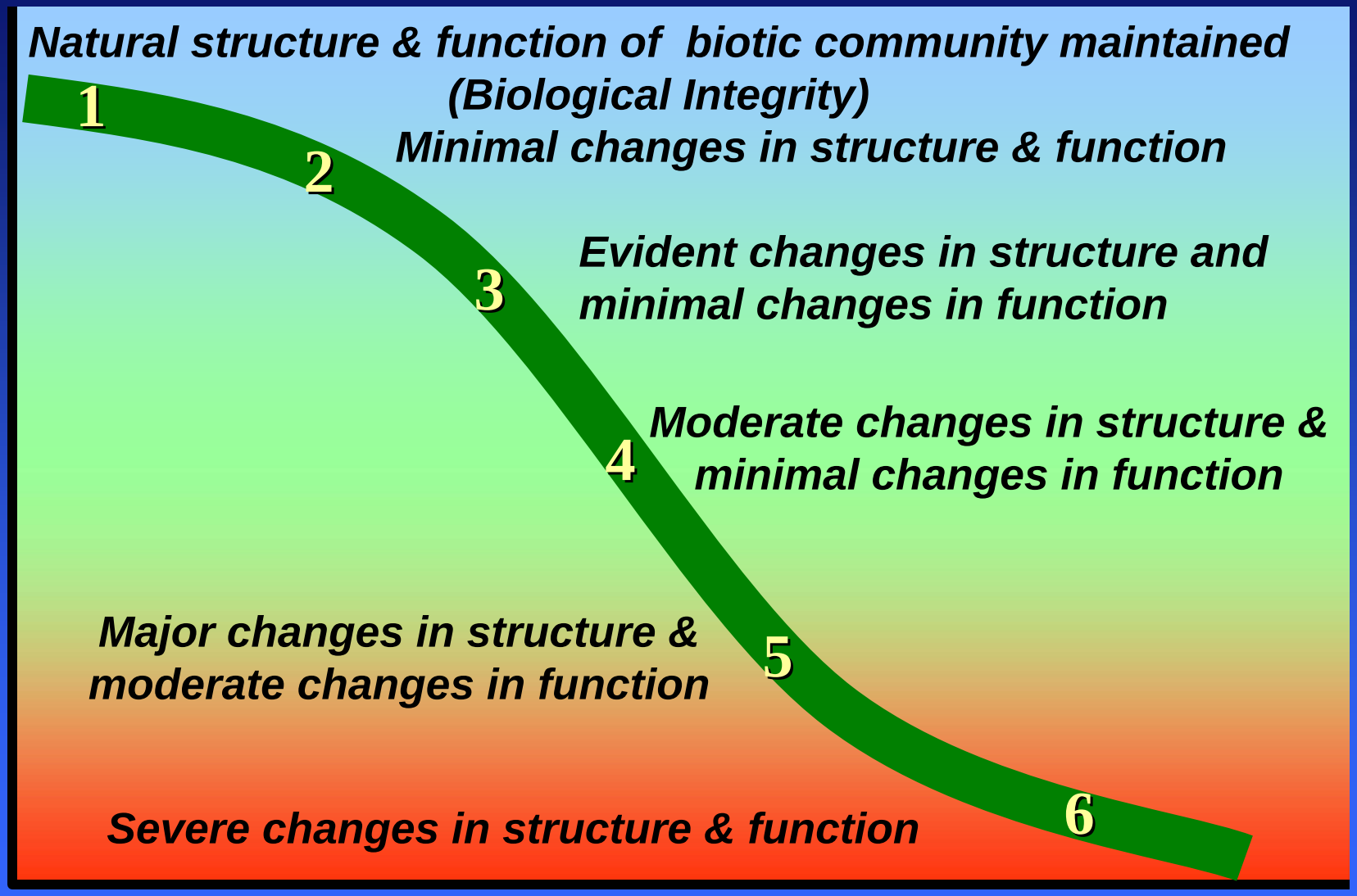
Distinguishing minimally and least disturbed

- Minimally Disturbed: Absolute
  - Some regions might have no sites that meet minimal disturbance criteria.
- Least Disturbed: Relative
  - No matter how disturbed the region, some sites are likely less disturbed than others.

(Best) Attainable Condition

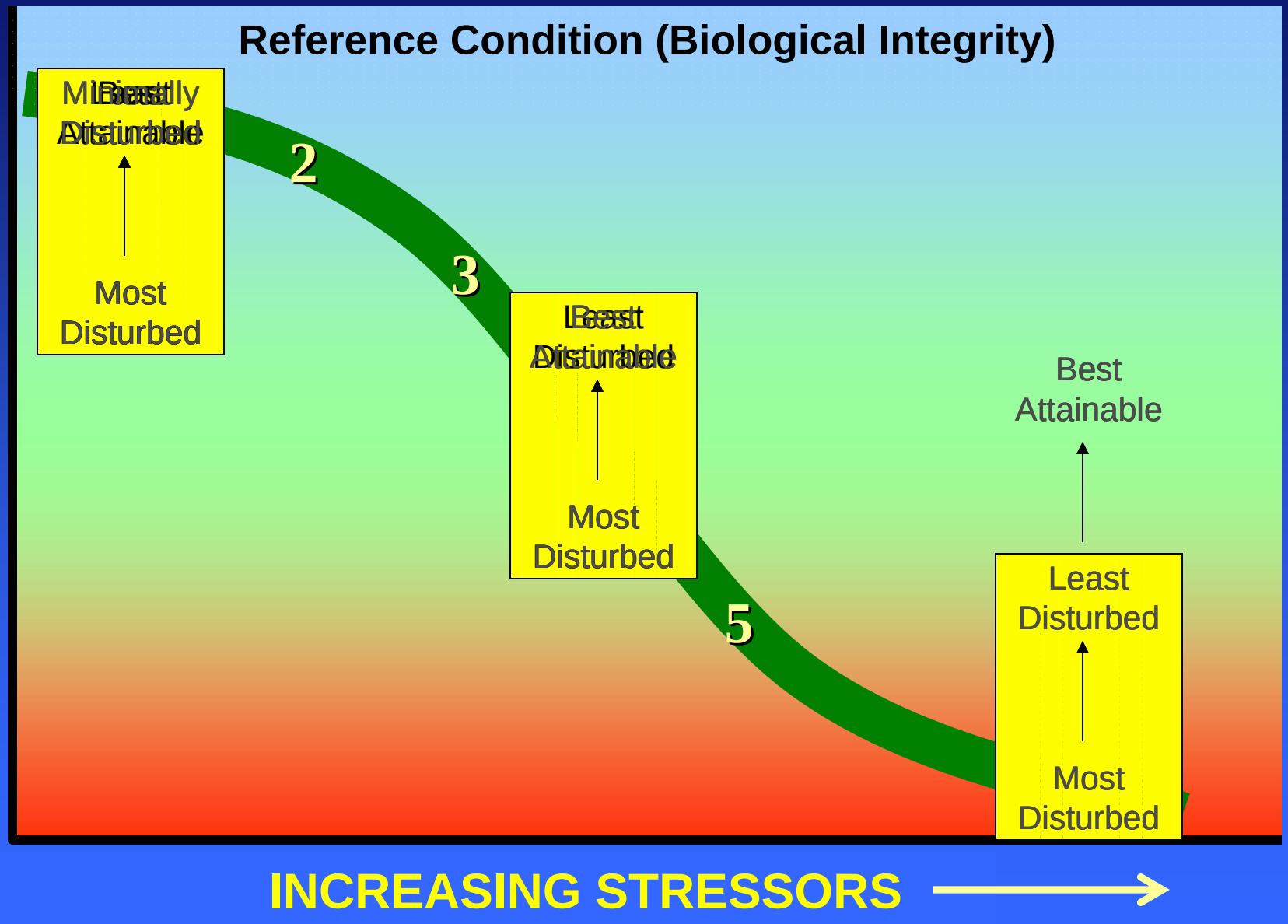
- An expected condition taking into account best management practices, societal will to improve condition, economic resources
- Reduced effect of human activities on aquatic biota (i.e., manage for best condition in face of human disturbance)
- Can be better than current day conditions (i.e., better than LDC)

The Biological Condition Gradient

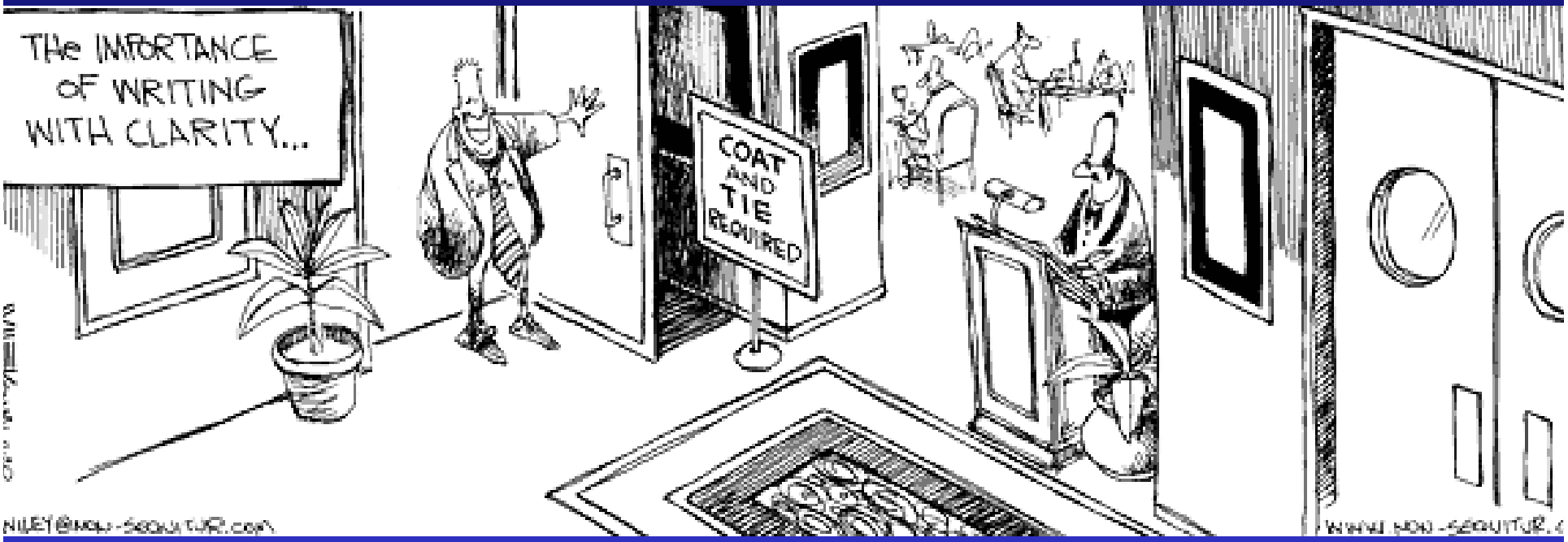


From Davies and Jackson (in press)

The Biological Condition Gradient



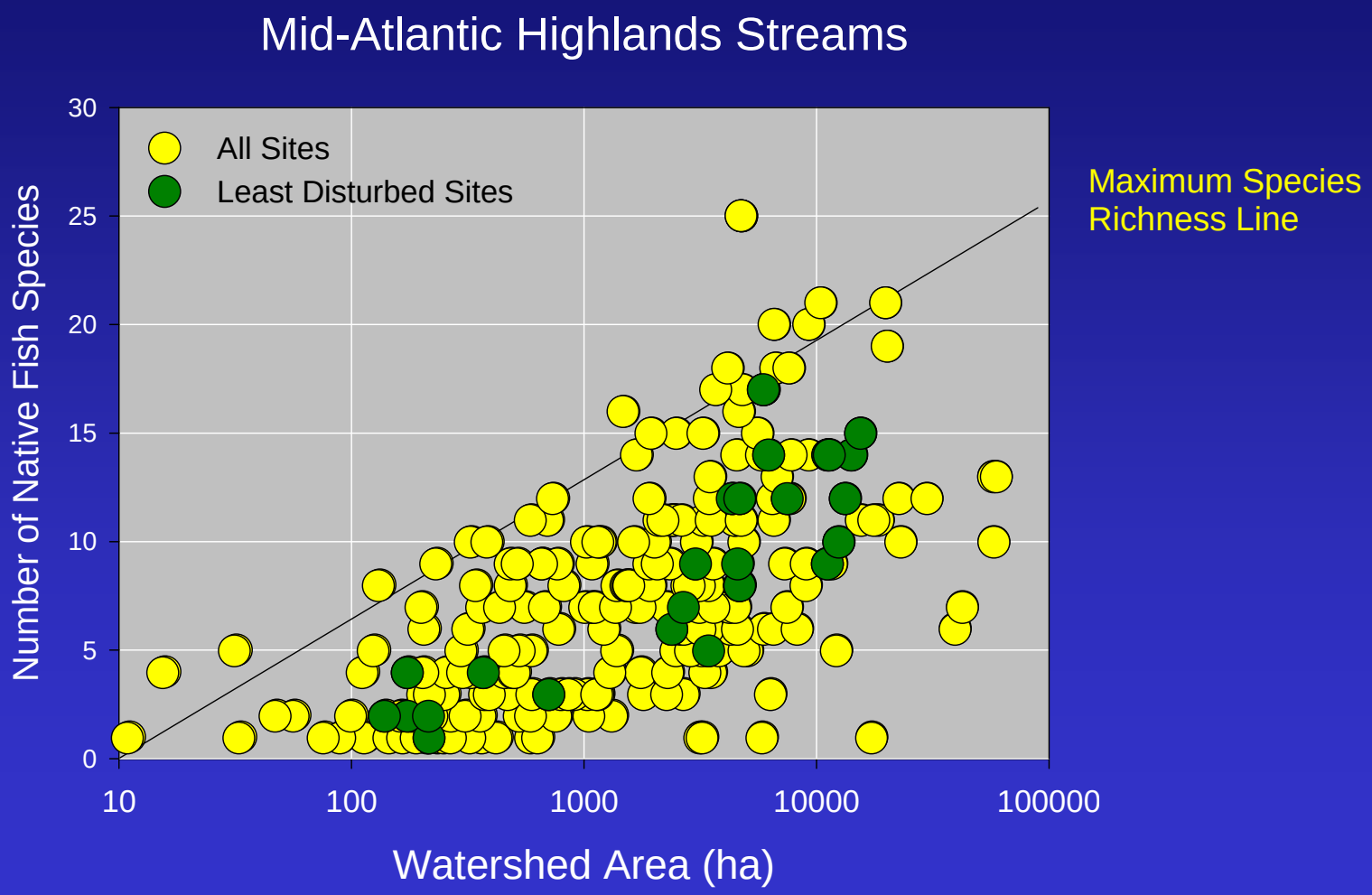
Let's Be Clear



Methods for Estimating Reference Condition

- The Reference Site Approach:
  - Minimally Disturbed Condition?
  - Least Disturbed Condition
- Application of ecological theory

Application of ecological theory



Methods for Estimating Reference Condition

- The Reference Site Approach:
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- Interpreting historical condition

Historical Condition

- Pre-Columbian
- Pre-European settlement
- Pre-intensive agriculture
- Other?

Methods for Estimating Reference Condition

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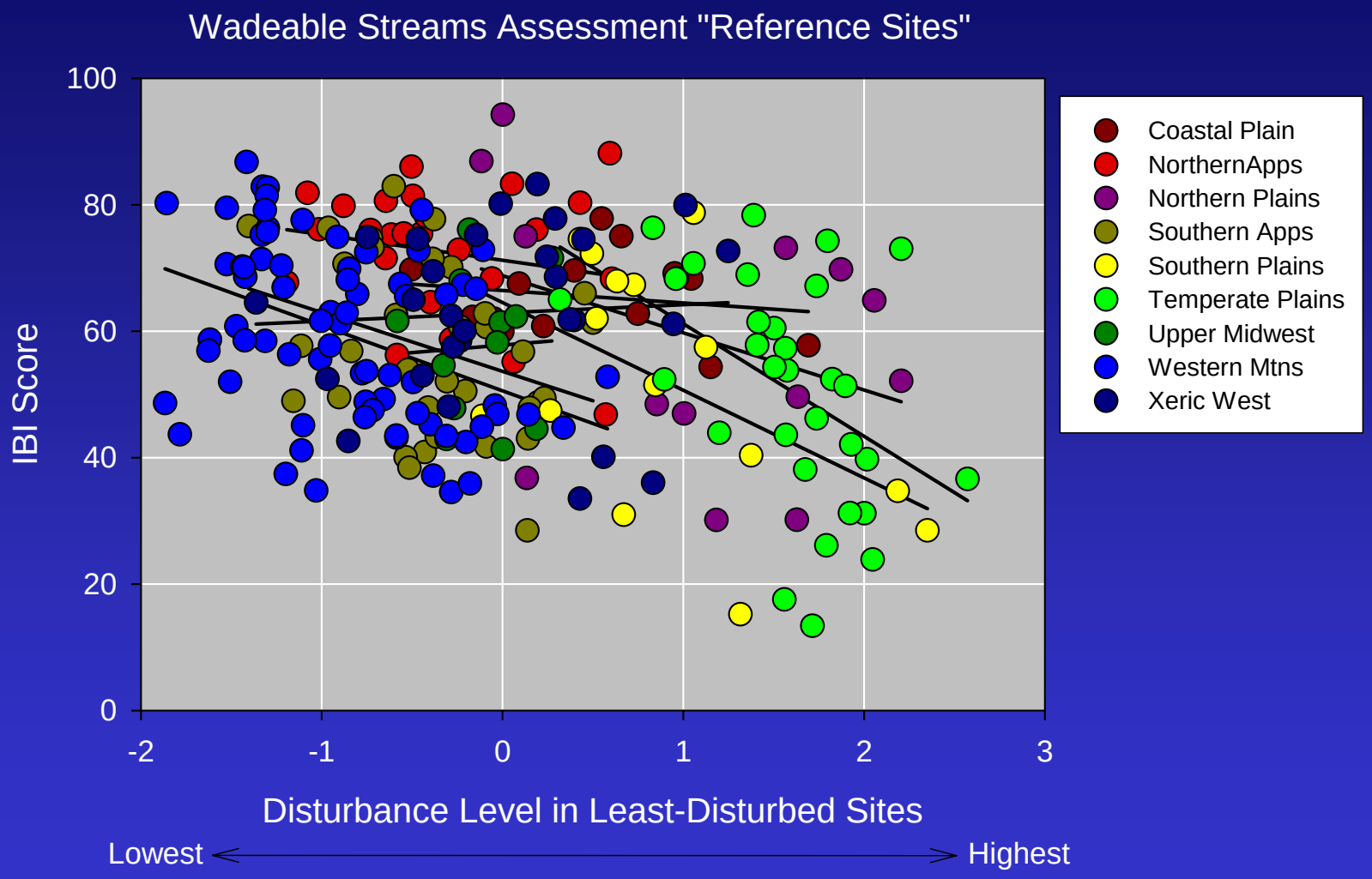
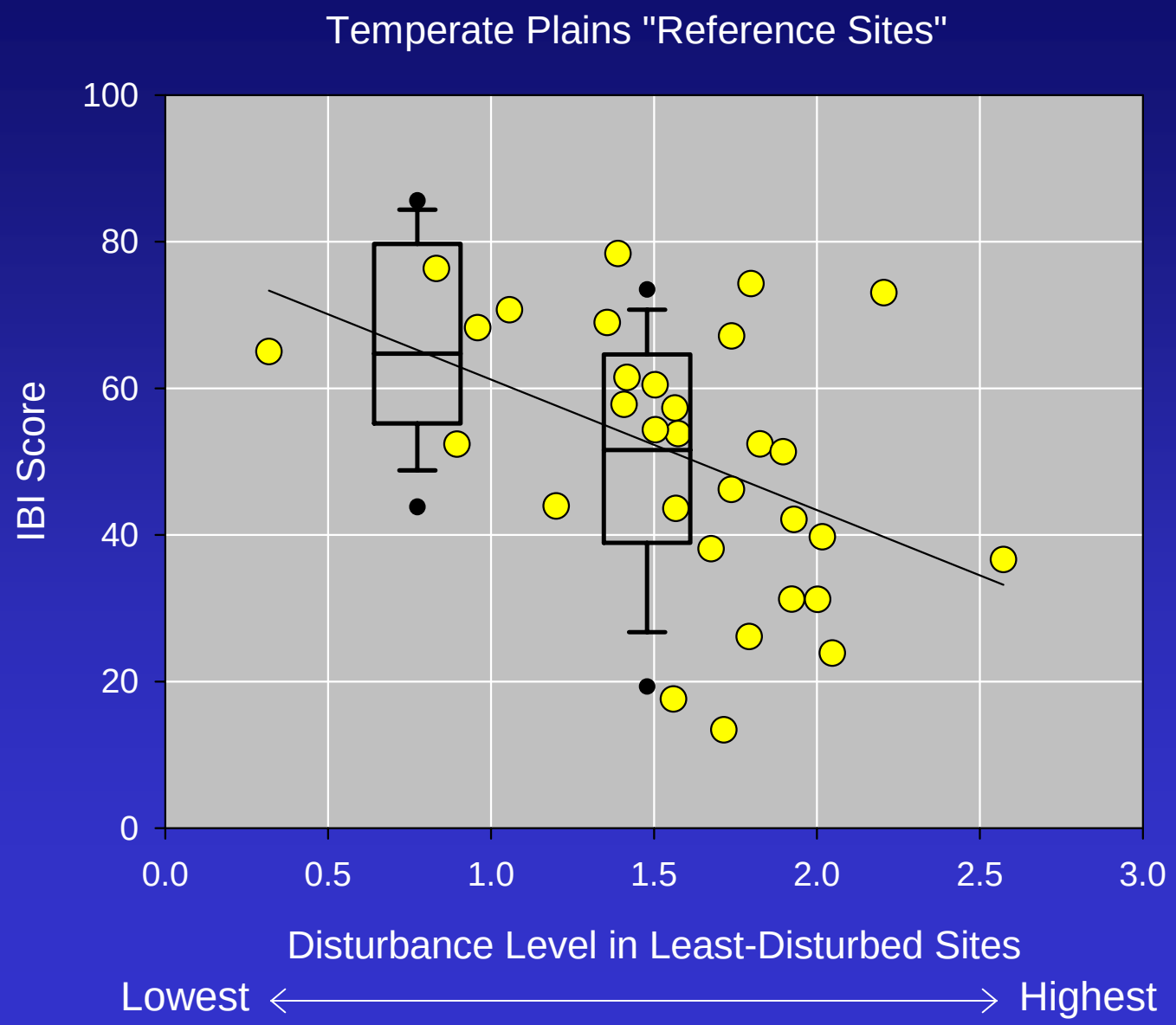
- Interpreting historical condition
- Extrapolating from empirical models

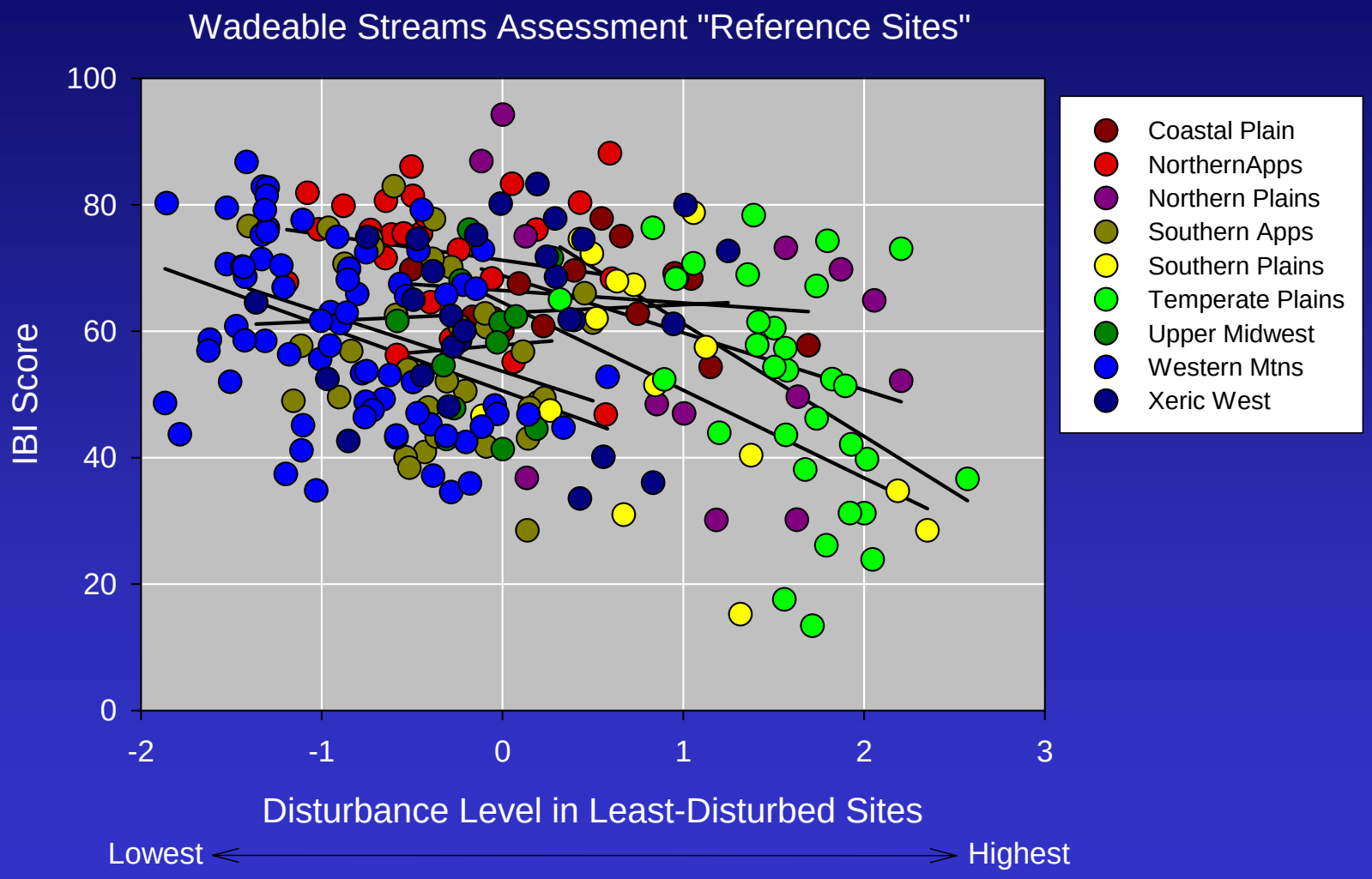
Extrapolating from Empirical Models



Extrapolating from Empirical Models



Extrapolating from Empirical Models



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- Best professional judgment

Best Professional Judgment

Summary

- Reserve use of Reference Condition, or RC(BI), to describe biotic integrity
- Use other terms (MDC, LDC, Attainable Condition) to describe other benchmarks
- Recognize that choice of method may force a choice of definition
- We may never all agree on the “right” definition – in the meantime, be clear about what we mean by the terms we use