

USING A HUMAN DISTURBANCE GRADIENT TO IMPROVE STATE WATER QUALITY PROGRAMS

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And

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**National Biological Assessment
and Criteria Workshop**

Advancing State and Tribal Programs



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TALU 201

USING BIOLOGICAL ASSESSMENTS TO REFINE DESIGNATED AQUATIC LIFE USES: THE HUMAN DISTURBANCE GRADIENT

Presenters and Contributors

Bob Hughes, Jim Harrison, Lester Yuan, Randy Apfelbeck, Susan Jackson, Tina Laidlaw

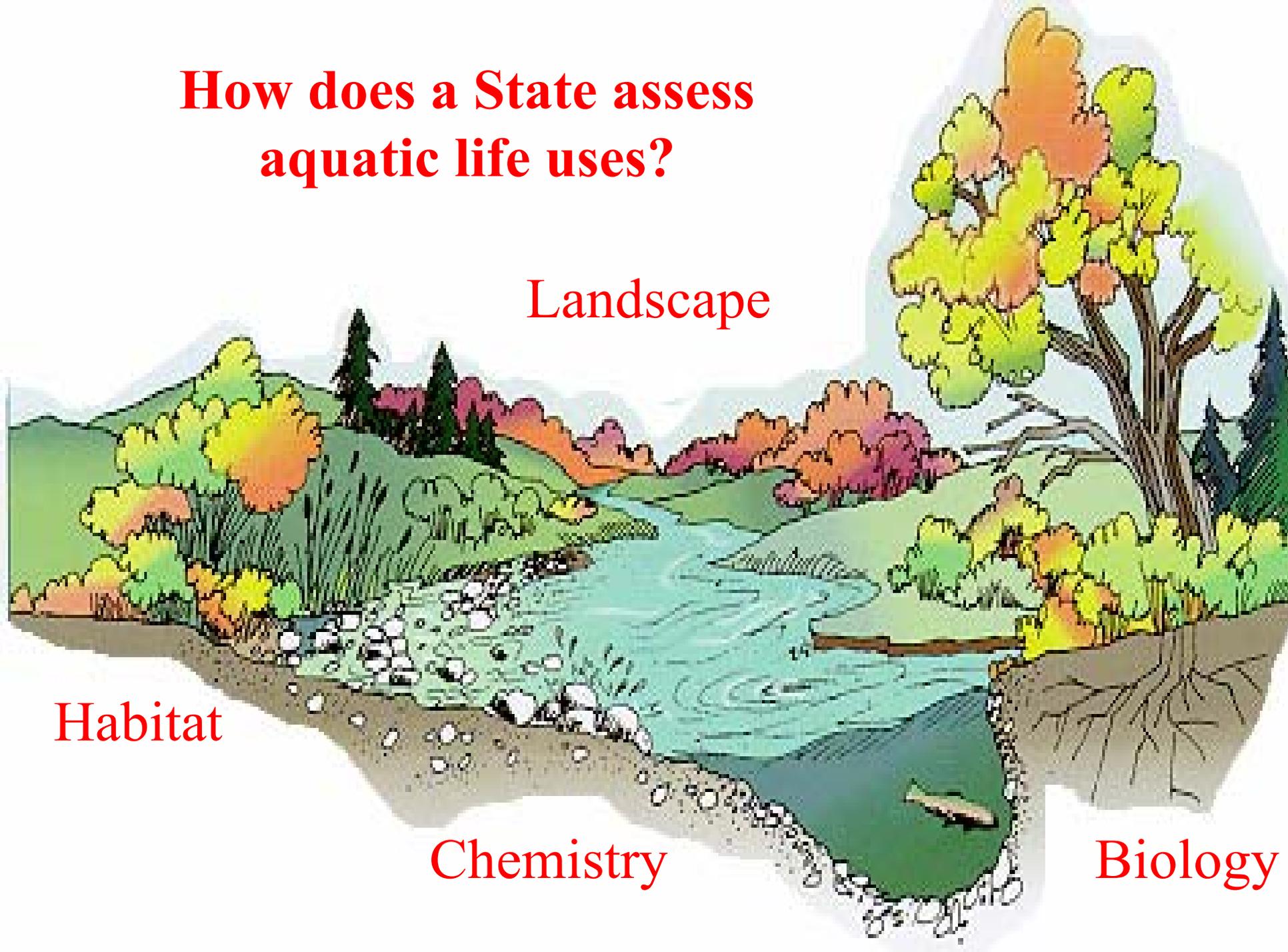
How does a State assess aquatic life uses?

Landscape

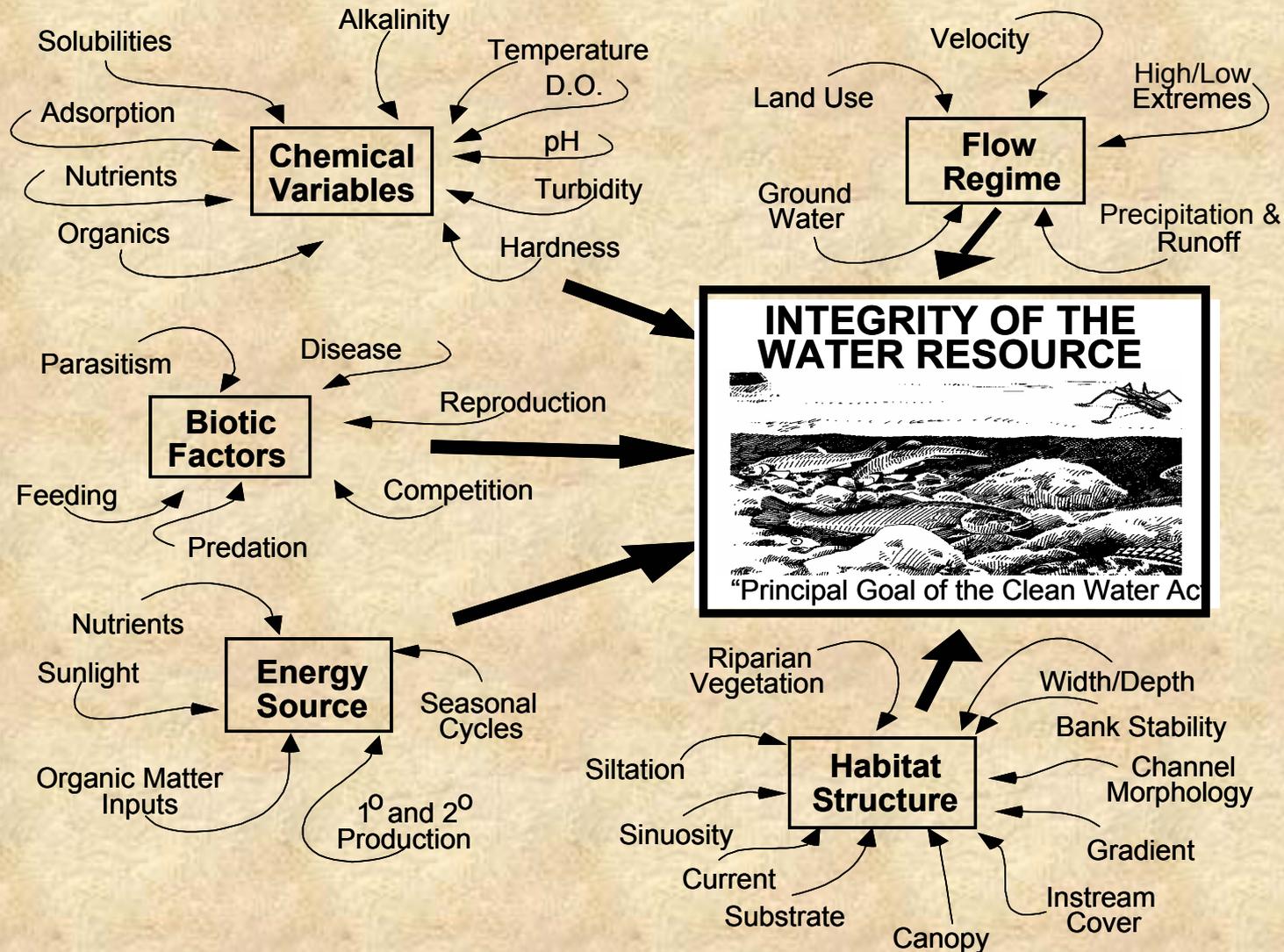
Habitat

Chemistry

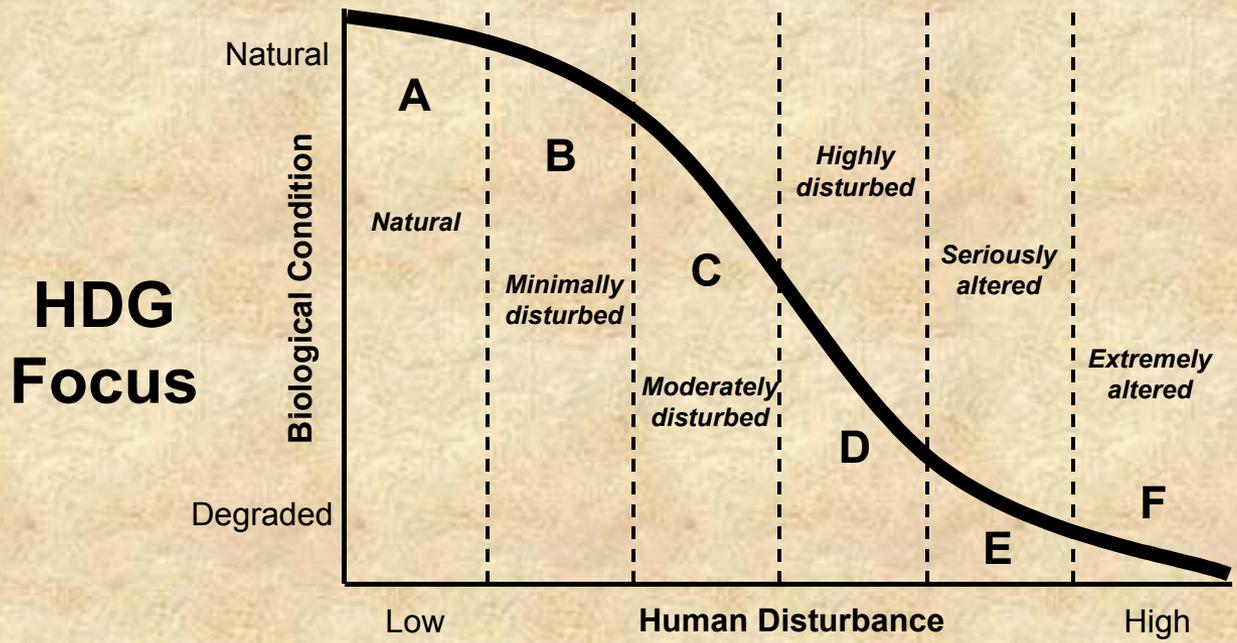
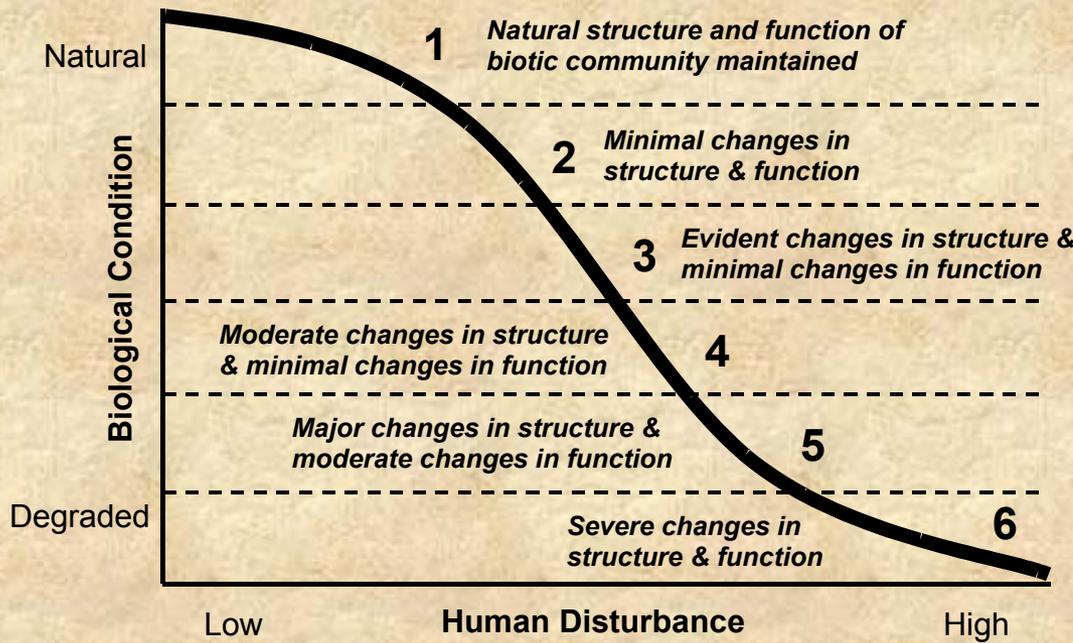
Biology

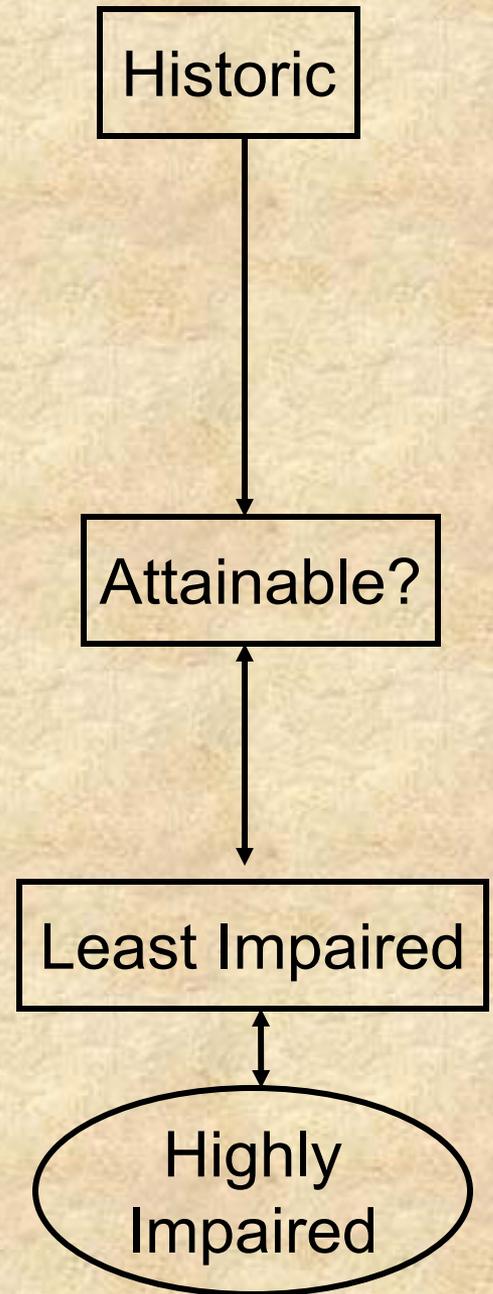
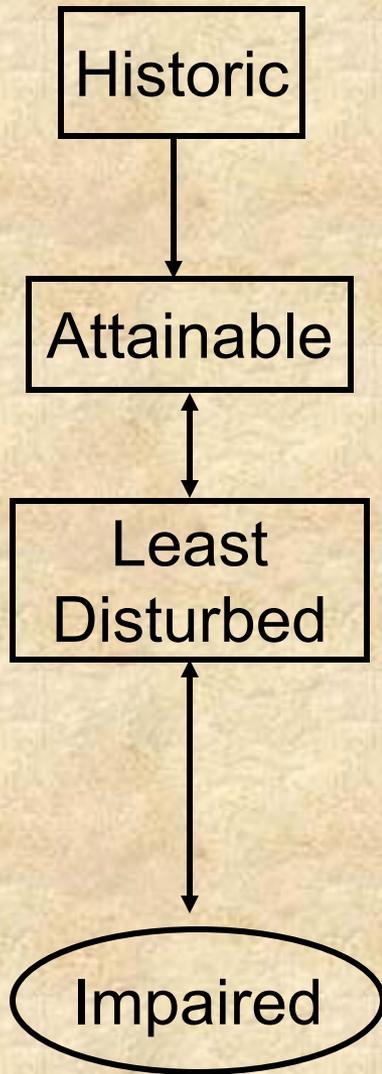
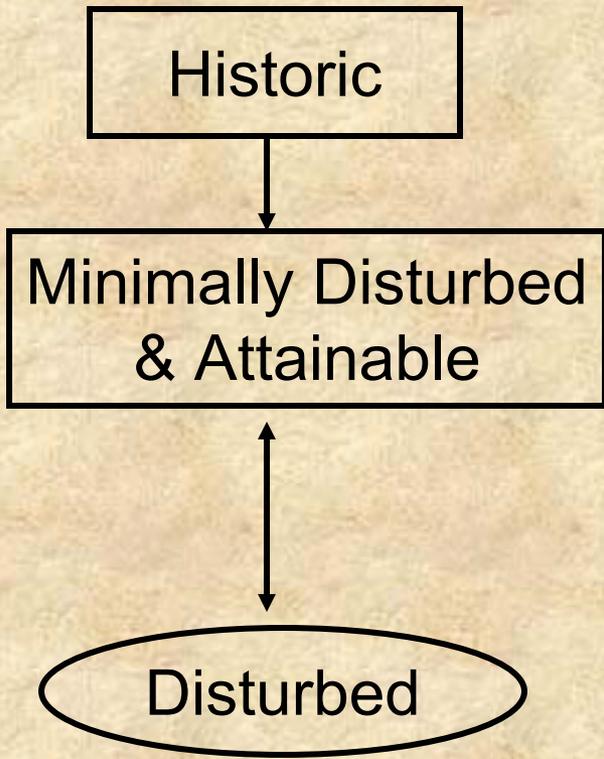


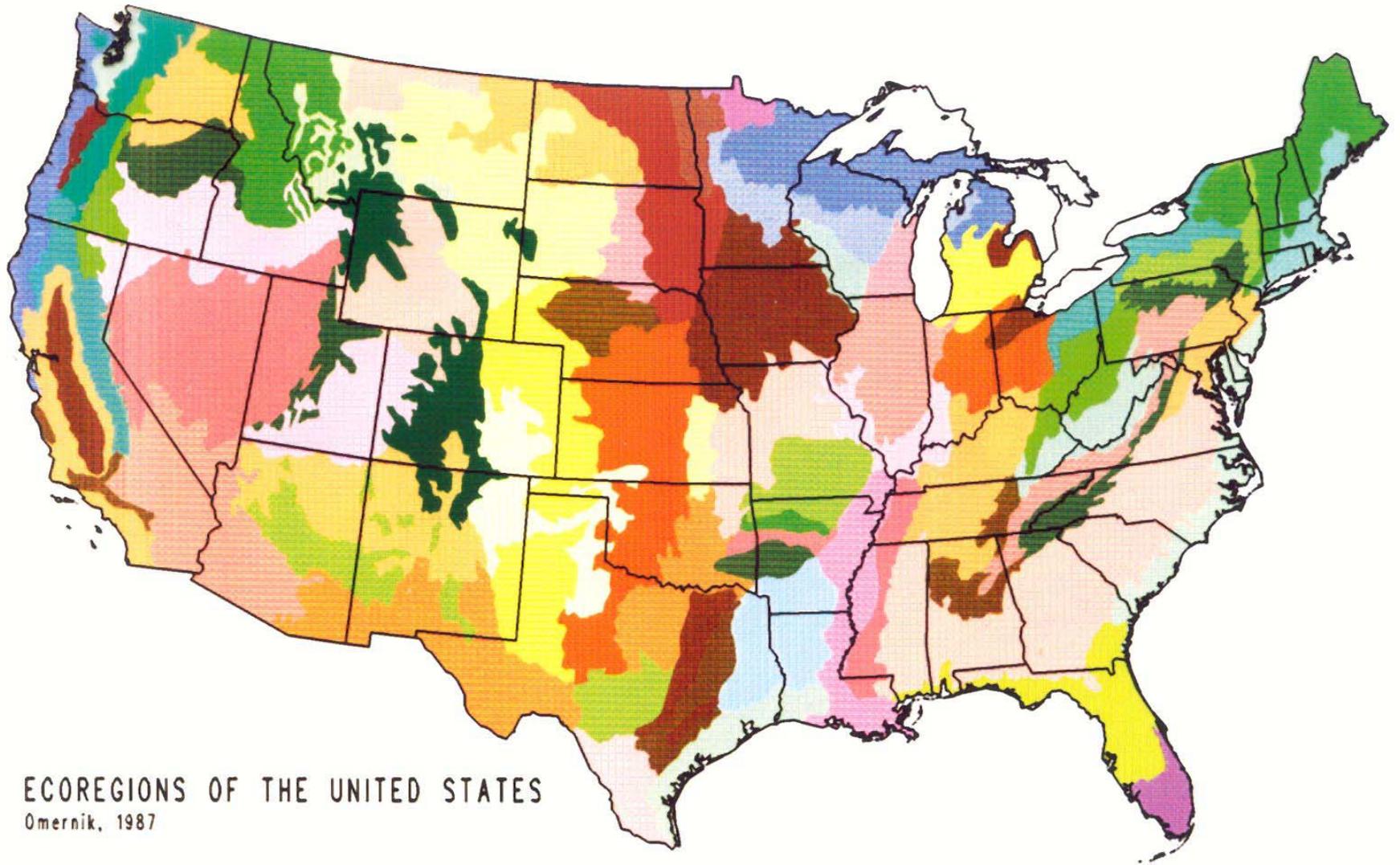
Five major factors that determine the integrity of aquatic resources



(modified from Karr et al. 1986).







ECOREGIONS OF THE UNITED STATES
Omernik, 1987

Human Activities
(e.g., land Use or water use)
(Disturbance or source)

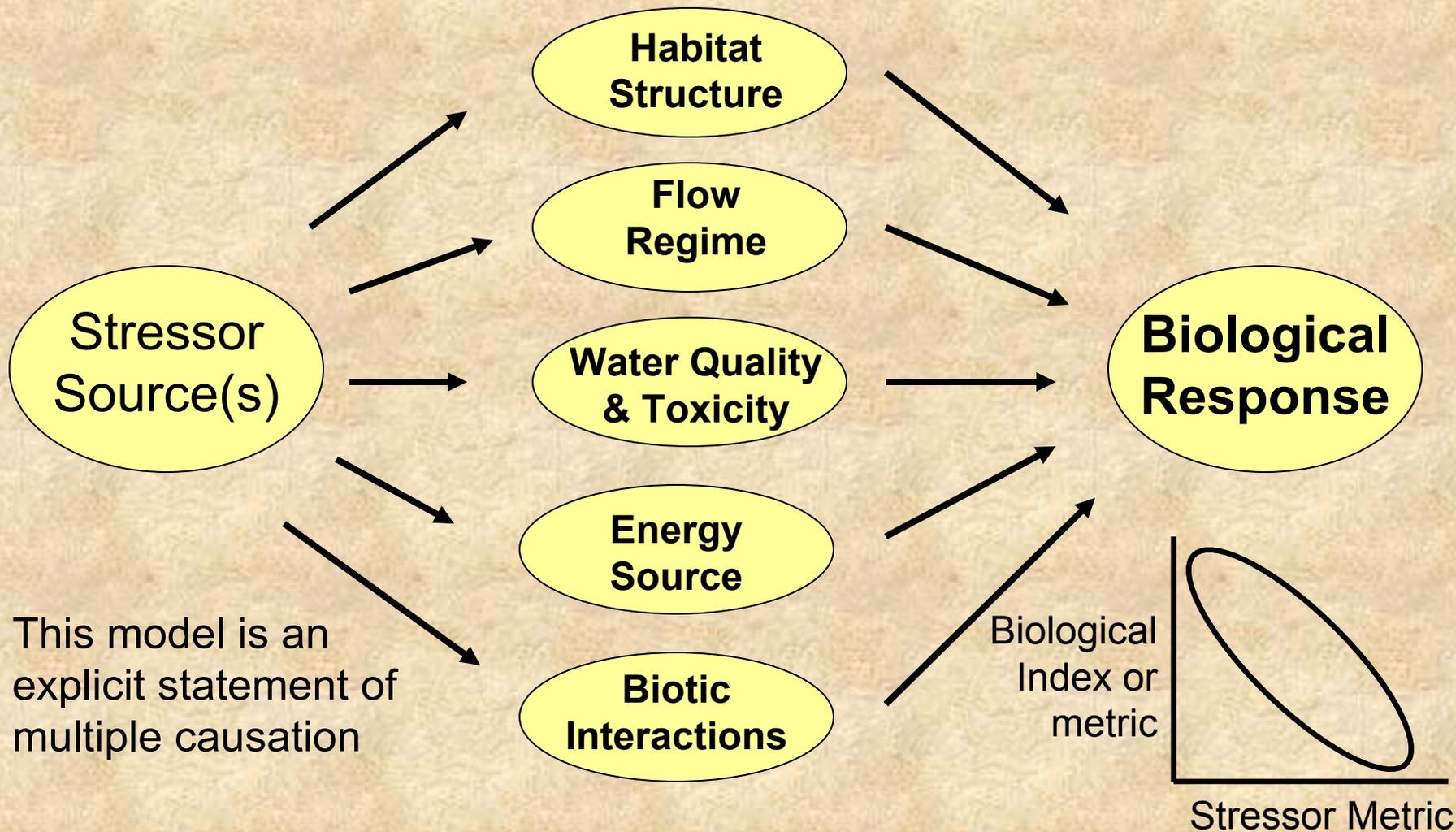


Stressors
(Habitat Responses)

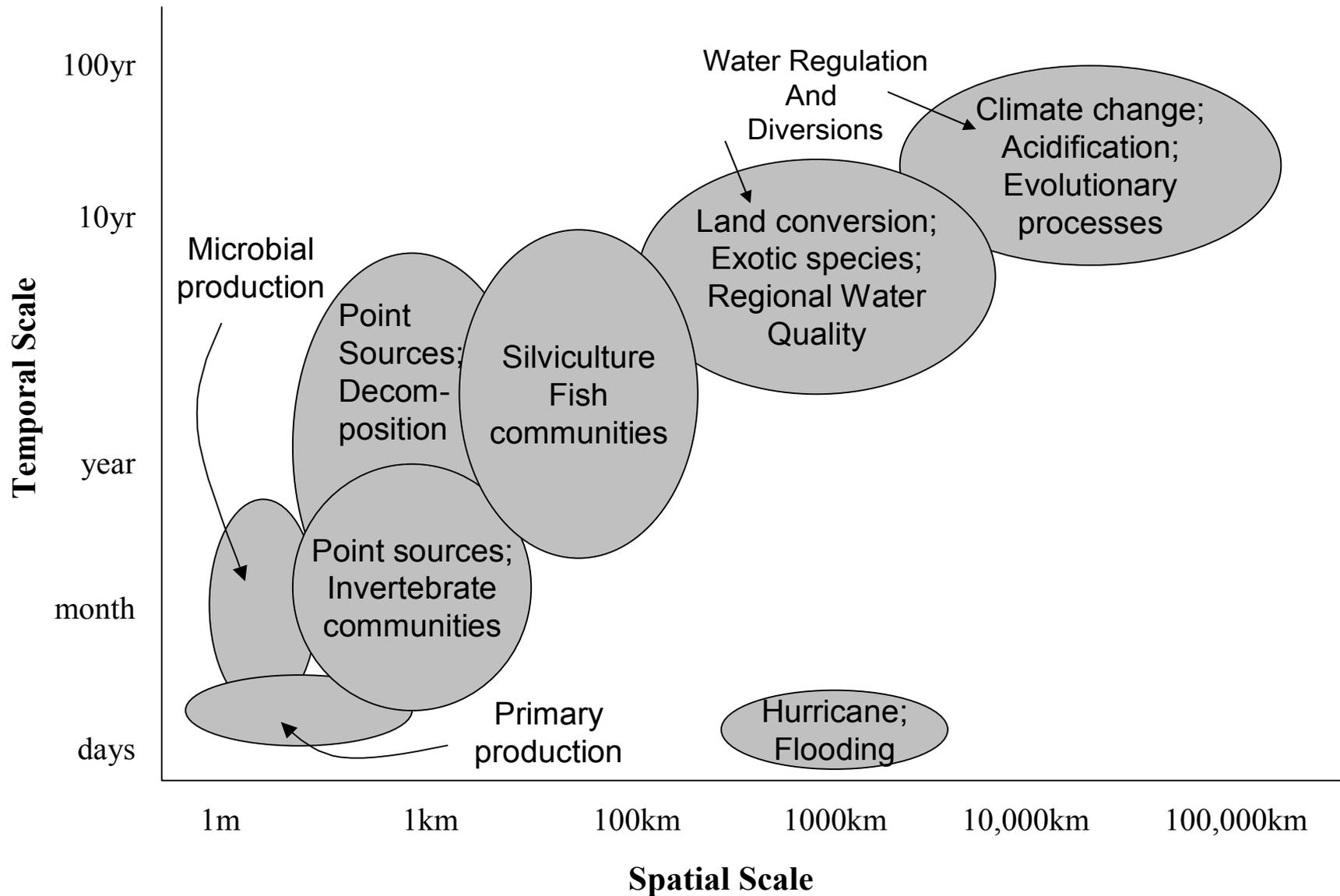


Biological Responses

The Linkage From Stressor Effects to Ecosystem Response

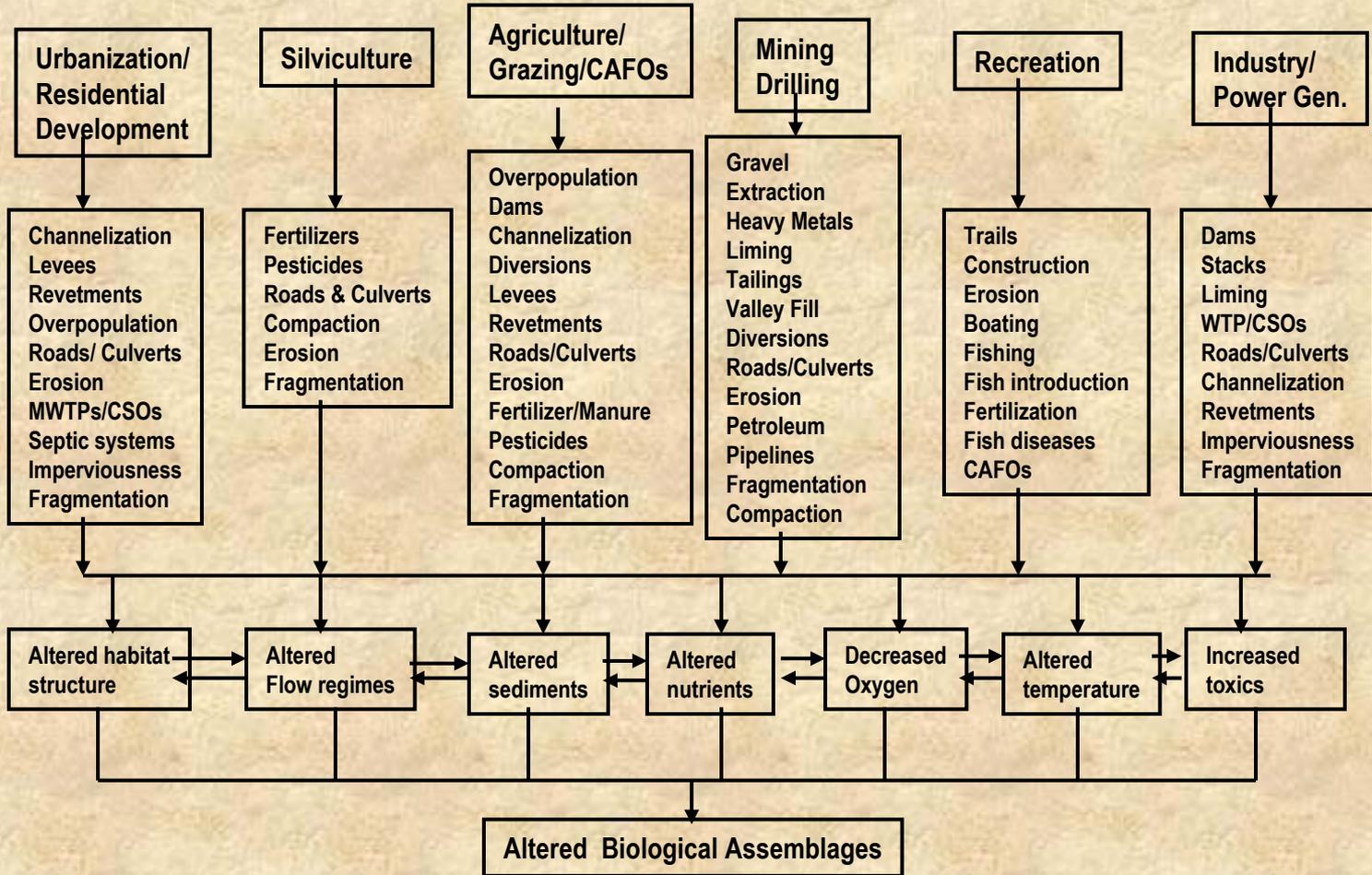


STRESSORS $\xrightarrow{+}$ **STRESS/EXPOSURE** $\xrightarrow{=}$ **RESPONSE**

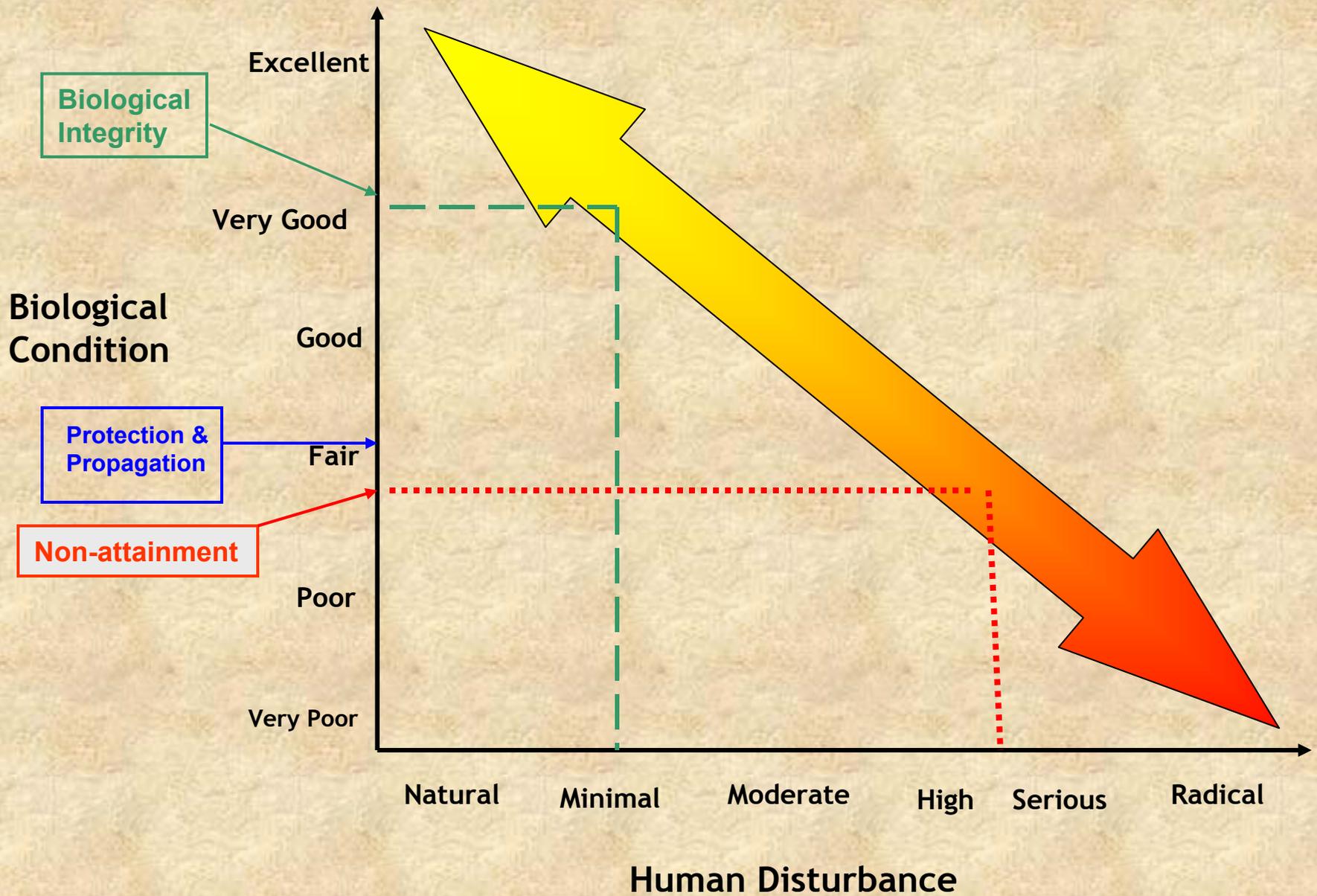


modified from Richards, C. and L.B. Johnson. 1998. Landscape perspectives on ecological risk assessment. In: M.C. Newman and C. Strojjan (eds). *Risk Assessment: Logic and Measurement*. Ann Arbor Press.

Human Activities
(Disturbance, Land Use,
Water Use etc.)



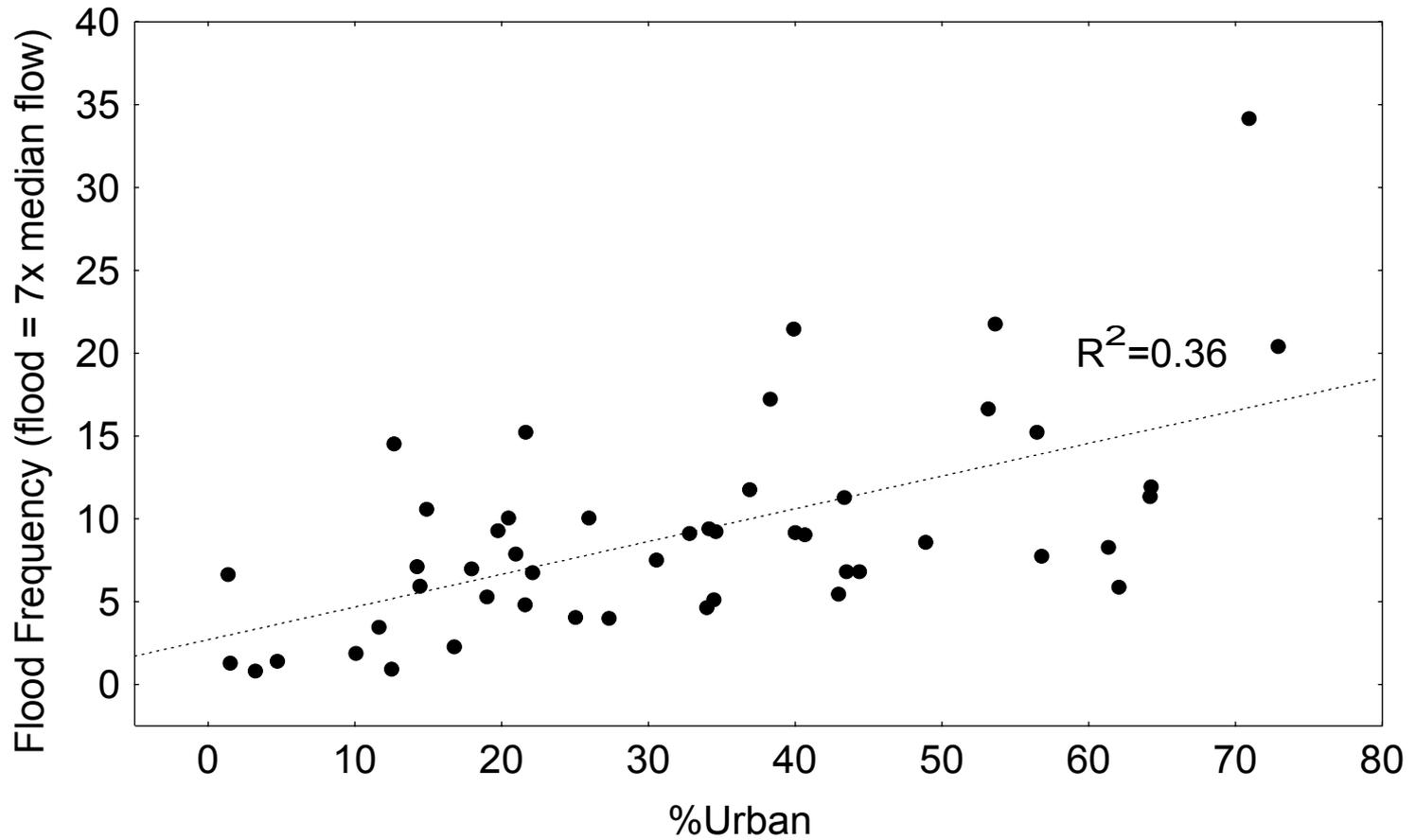
(from Bryce et al. 1999. J. Am. Wat. Resour. Assoc. 35:23-36)

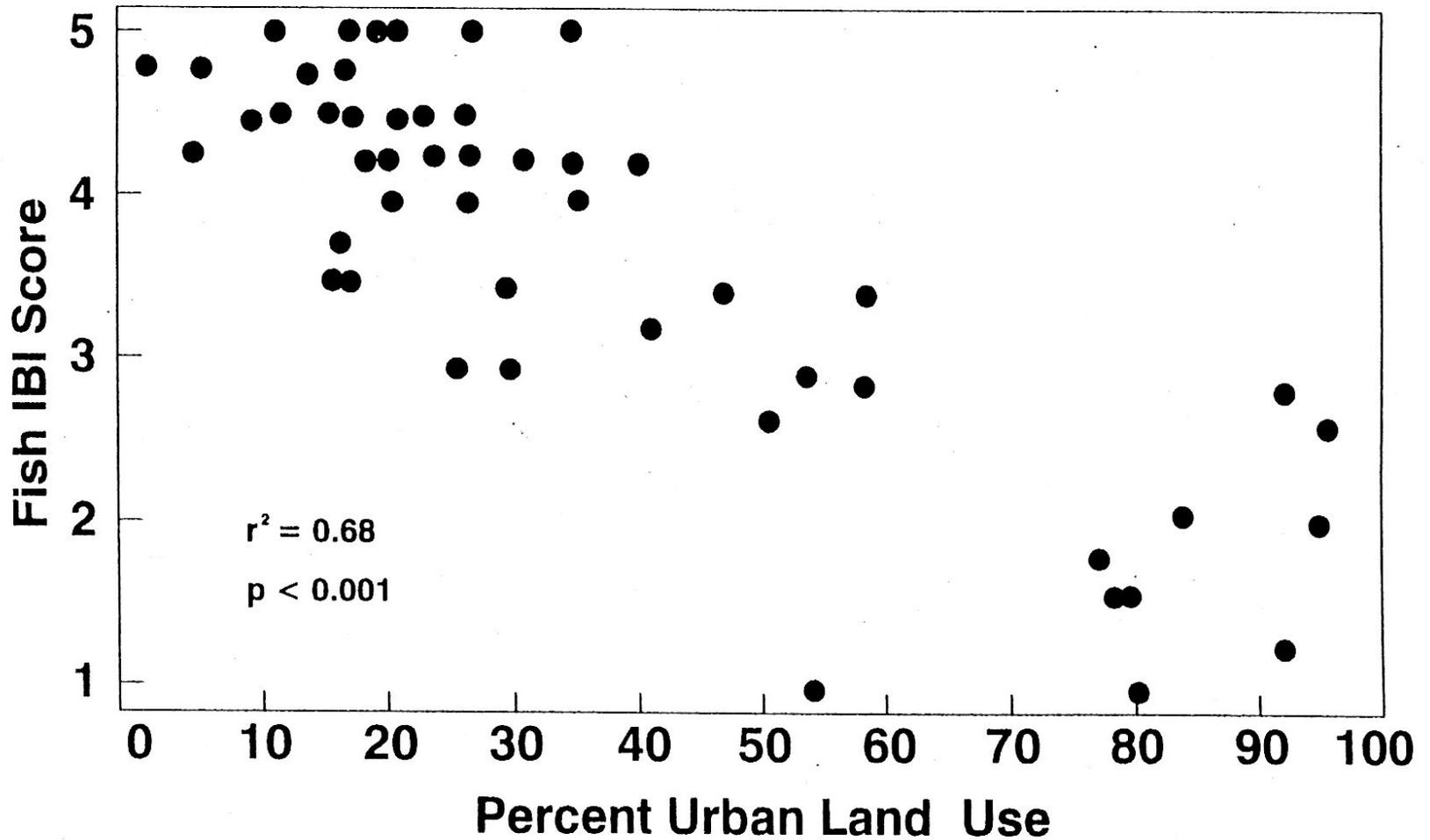


Rationale for HDG

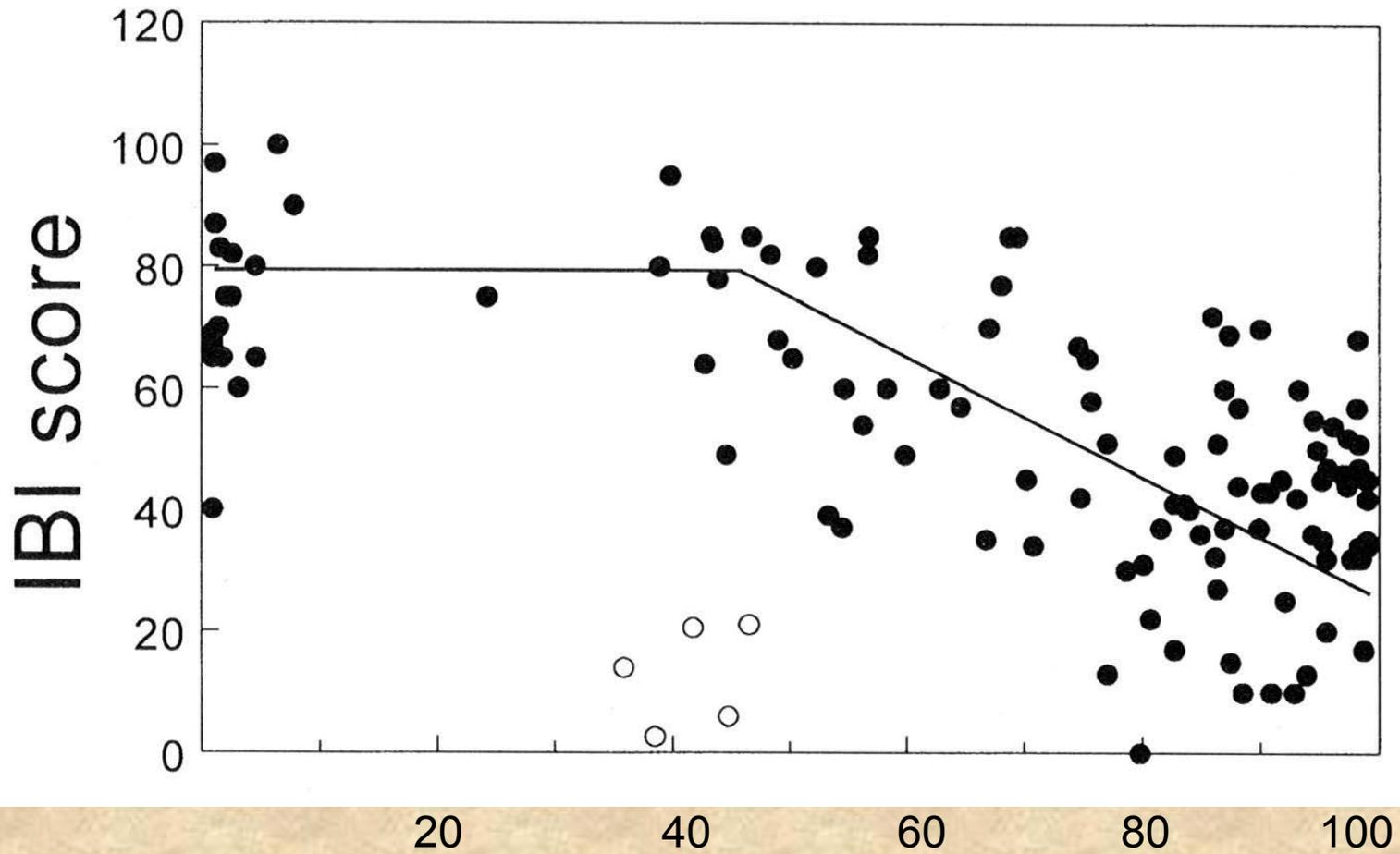
- Essential for determining reference sites & minimal disturbance
- Necessary for metric & index development & evaluation
- Often represents half the variability in biological response scores
- Easier to assess than large suite of stressors
- Assists in diagnosing stressors
- Source of most-manageable stressors
- Critical for stream protection, BMPs & restoration

Single Source-Stressor Example from Maryland





(from Klauda et al. 1998. Environ. Monitor. Assess. 51:299-316)

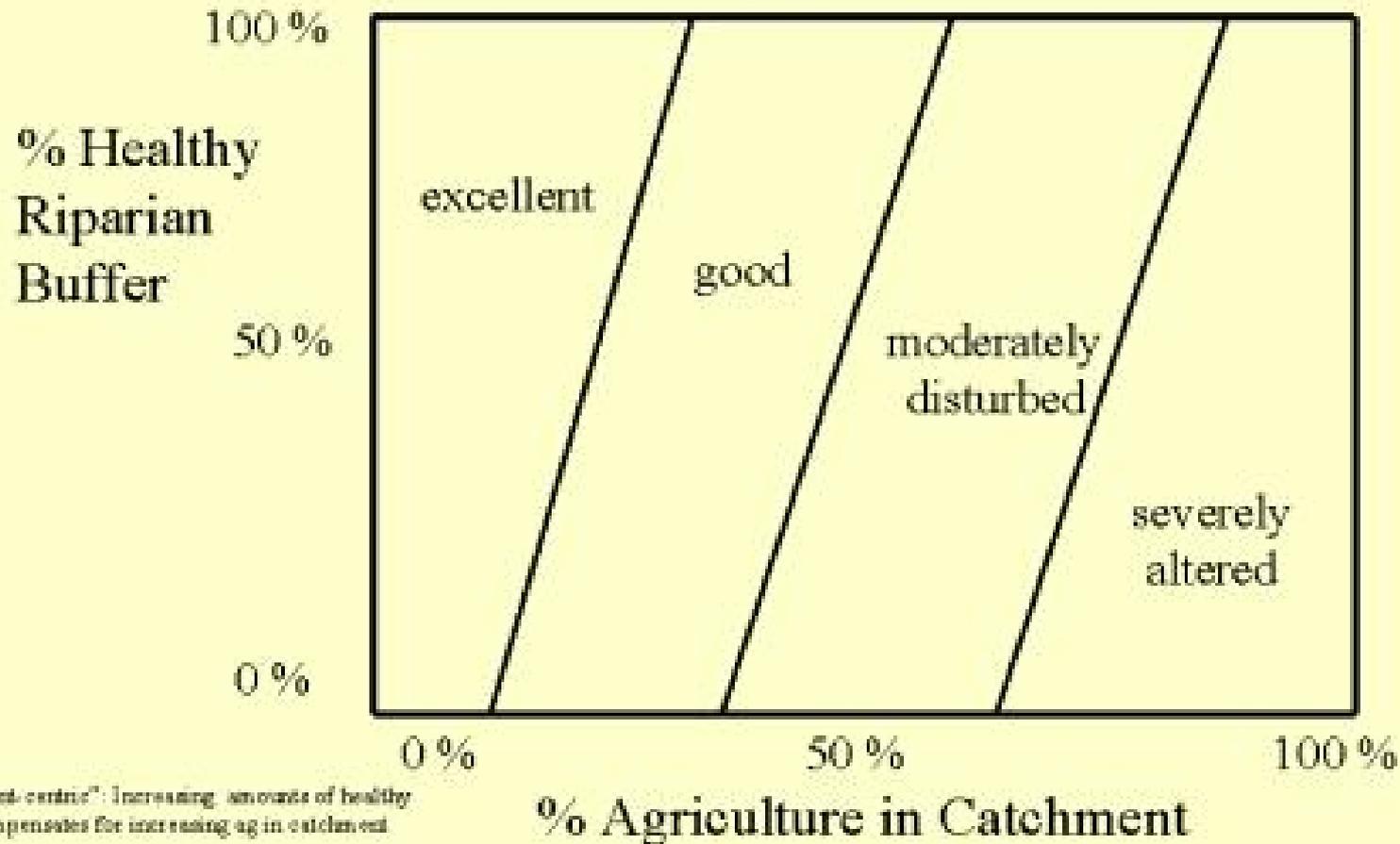


% Catchment Agricultural Land Cover
(from Wang et al. 1997. Fisheries 22(6):6-12)



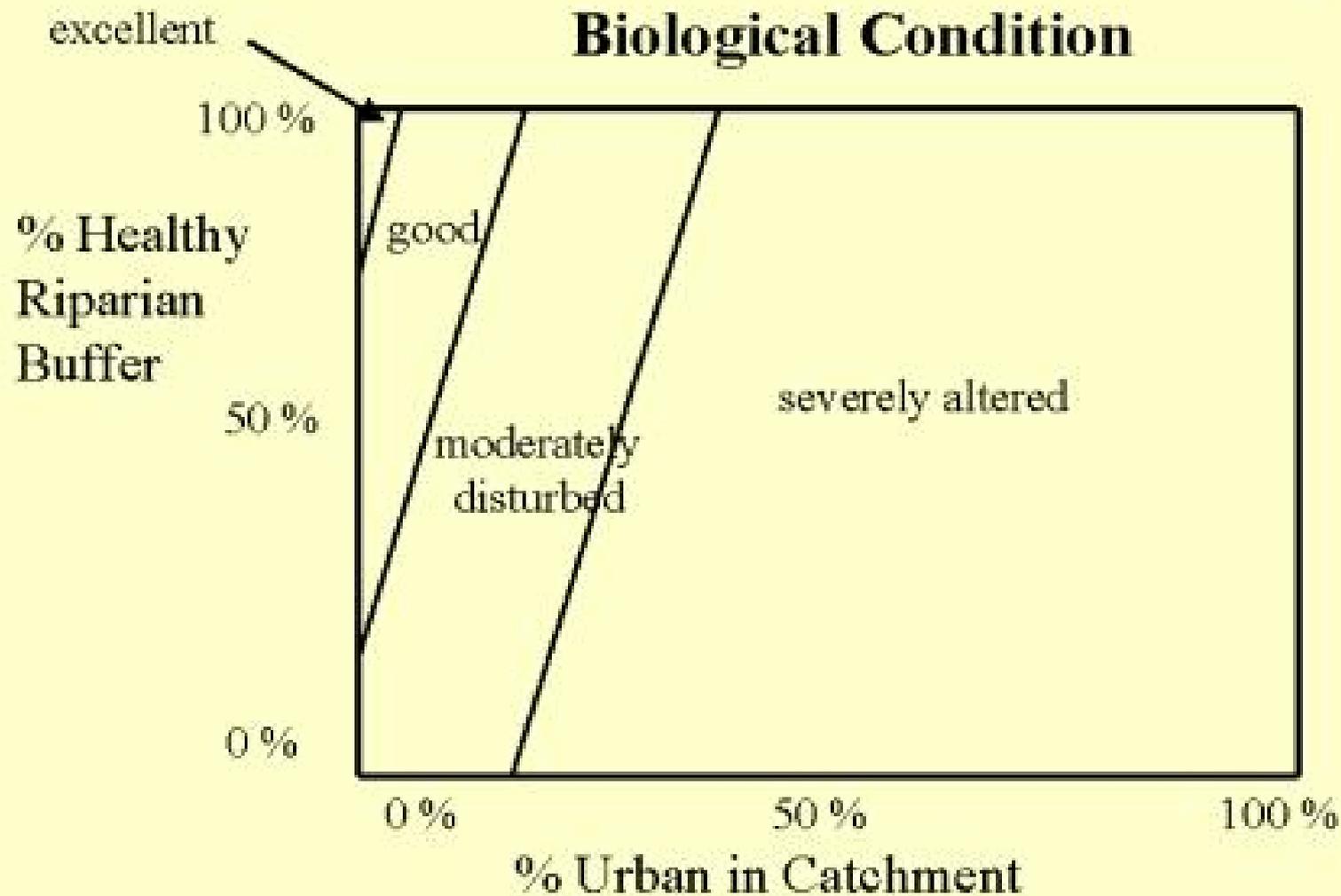
Catchment vs Riparian Land Cover - Agriculture

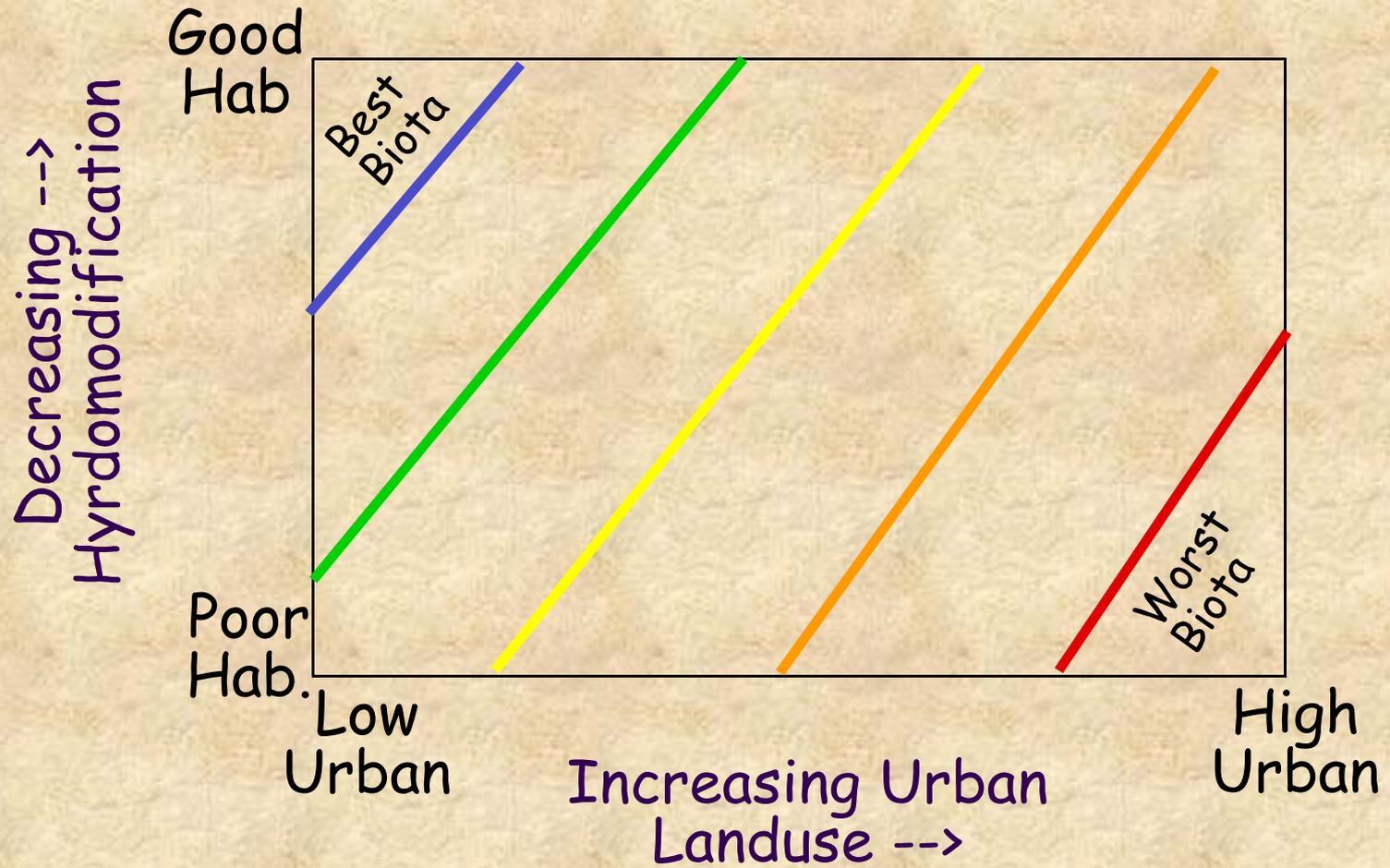
Biological Condition



"Catchment-centric": Increasing amounts of healthy buffer compensates for increasing ag in catchment

Catchment vs Riparian Land Cover - Urban





HDG Layout

- **Six tiers (A-F)**
- **Six major stressor classes**
 - **Habitat structure**
 - **Flow regime**
 - **Water quality**
 - **Toxics & bioengineered chemicals**
 - **Energy sources**
 - **Biotic interactions**

HDG Layout (continued)

- **Six major disturbance classes**
 - **Landscape Character**
 - **Riparian Condition**
 - **Barriers**
 - **Channel Morphology (map scale)**
 - **Atmospheric Deposition**
 - **Biotic Interactions**

TALU Workshop Summary & Future Needs

- State participants classified site & basin data into HDG tiers
- 80 % agreement on tiers for Northern Forest, Midwest & Southeast work groups
- HDG must be modified for plains, deserts & large rivers
- Linkages between catchment/riparian HDG & instream stressors must be refined
- Influence of BMPs on stressors must be better understood
- Methods for incorporating multiple sources and stressors must be developed (e.g., LDI and GLEI approaches)

EPA Region 4

TALU 3-Day Workshop

April 18-21 2005

Chattanooga, TN