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The Great River "Reference Problem": Surmounting The Obstacles

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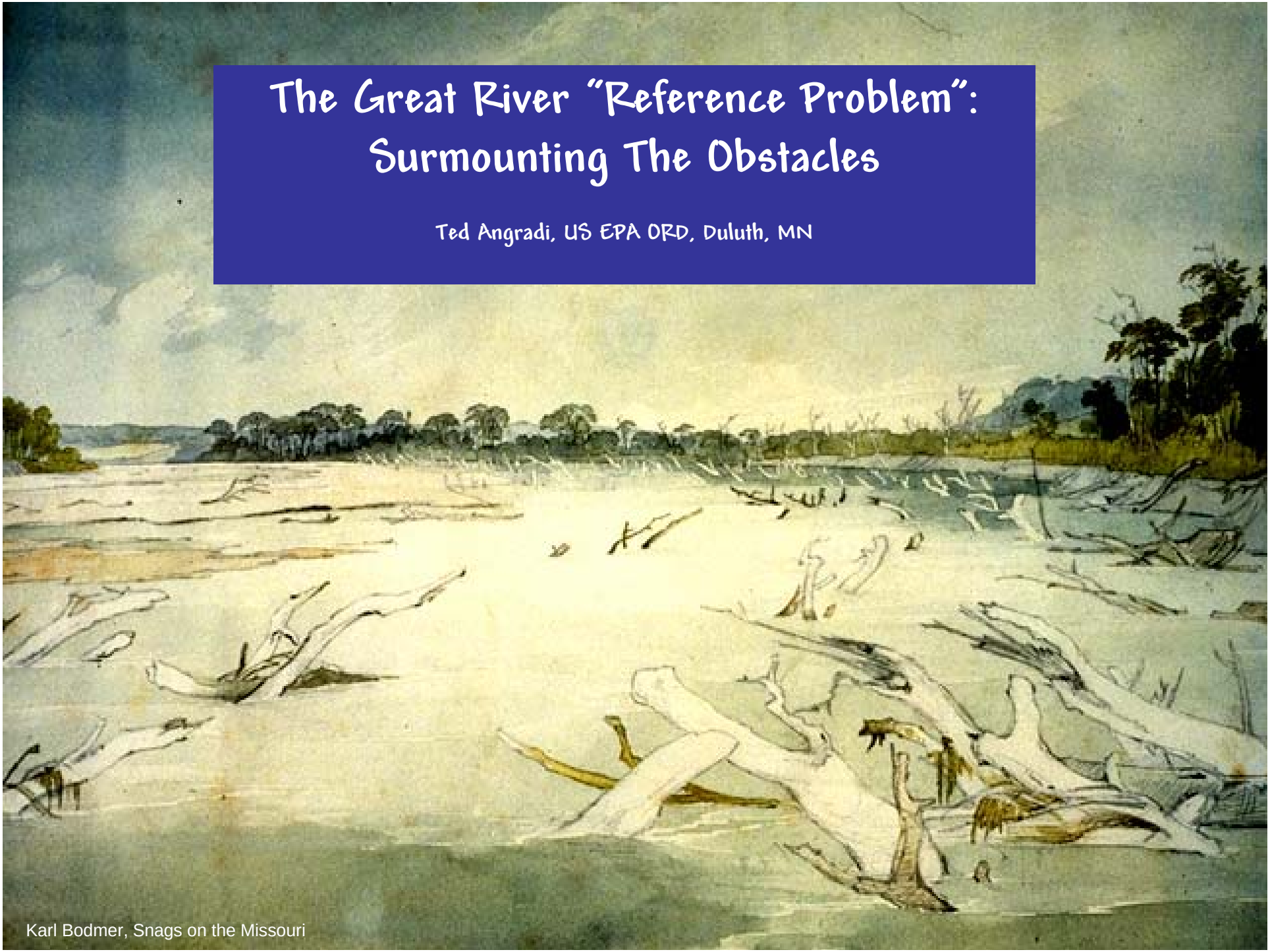

Karl Bodmer, Snags on the Missouri

The Great River “Reference Problem”

- Great Rivers are rare (ca.10-14 in North America).
- No temperate Great Rivers are pristine.
- Traditional regional reference-condition approach which is based on the best streams in a regional population of streams is not generally applicable.
- Large and Great River bioassessment can’t move forward without defensible approaches to reference.

Solutions?

- There are multiple potential solutions to the problem. None is unproblematic.
- The most satisfactory solutions will require integration of multiple approaches to setting reference expectations.

Framework for the workshop

- The purposes of reference
- A simple classification of approaches to reference

Main purposes of reference:

- For setting thresholds values (biocriteria) for bioassessment – Clean Water Act reporting
  - What is the current condition of the resource relative to "biological integrity"?
  - Usually based on a least disturbed condition
- For setting restoration or adaptive management goals
  - What should the resource look like (desired future condition)?
  - Can include multiple definitions of reference.
- Assessing progress toward restoration or management goals
  - Are we making progress? Is management working?
  - Can include multiple definitions of reference.

A classification of approaches to reference conditions for large and Great Rivers based on where the data come from.

- Empirical
- Reconstructive
- Modeling
- Holistic/hybrid

Empirical approach

- Comparison of “test sites” to current least disturbed conditions elsewhere
  - Regional reference conditions are based on a population of sites at some scale
    - State, ecoregional, physiographic-region scale
    - Continental-hemispheric scale
      - Parana River and the Upper Miss?
      - Paraguay River and the Missouri?

Empirical approach, continued

- Internal reference based on least disturbed conditions within the same river system
  - Mainstem reference reaches
  - Large tributaries
    - Lower Chippewa on Upper MS
    - Lower Yellowstone on Upper MO

Empirical approach, continued

- Ambient distribution
  - Expectation based on the range of conditions in a population
  - Like a regional reference approach except all sampled sites are used not just sites considered to be in LDC.

Reconstructive approaches

- Historical records can reveal minimally disturbed conditons
  - Fisheries records and collections
  - River geomorphology from old maps
  - Riparian trees species lists and narratives from GLO surveys
- Paleoecology goes further back
  - Diatoms in sediment cores can give insights into pristine river nutrient status

Models and Reference Condition

- Models can be used to describe aspects of a river in a minimally disturbed condition
  - Conceptual ecosystem models
  - Simulation models (e.g., dynamic landscape models)
  - Stress response models
- Models can be used as tools to find potential reference sites
  - EMAP-GRE linear “proximity model”
- Models can be used to score test sites
  - Predictive models
  - RIVPACS, O/E models

Holistic/hybrid approaches

- Approaches that integrate the other approaches: internal reference, regional reference, tributaries, historic records, various models,… and BPJ to arrive at expectations for the ecosystem.

- This has been called “virtual reference”.

- This is the most “evolved” approach, but…

Workshop Goals

- Promote understanding of what we mean by reference condition for Great and large rivers for bioassessment, restoration, adaptive management….
- Share experiences of what is working or not.
- Get new ideas to help us move forward.