Channel Stability and Ecosystem Restoration and Assessments

Laura L. Keefer[1]
William White[1]
Bruce Rhoads[2]

University of Illinois at Urbana-Champaign
[1] *Illinois State Water Survey, Institute for Natural Resource Sustainability*
[2] *Department of Geography*

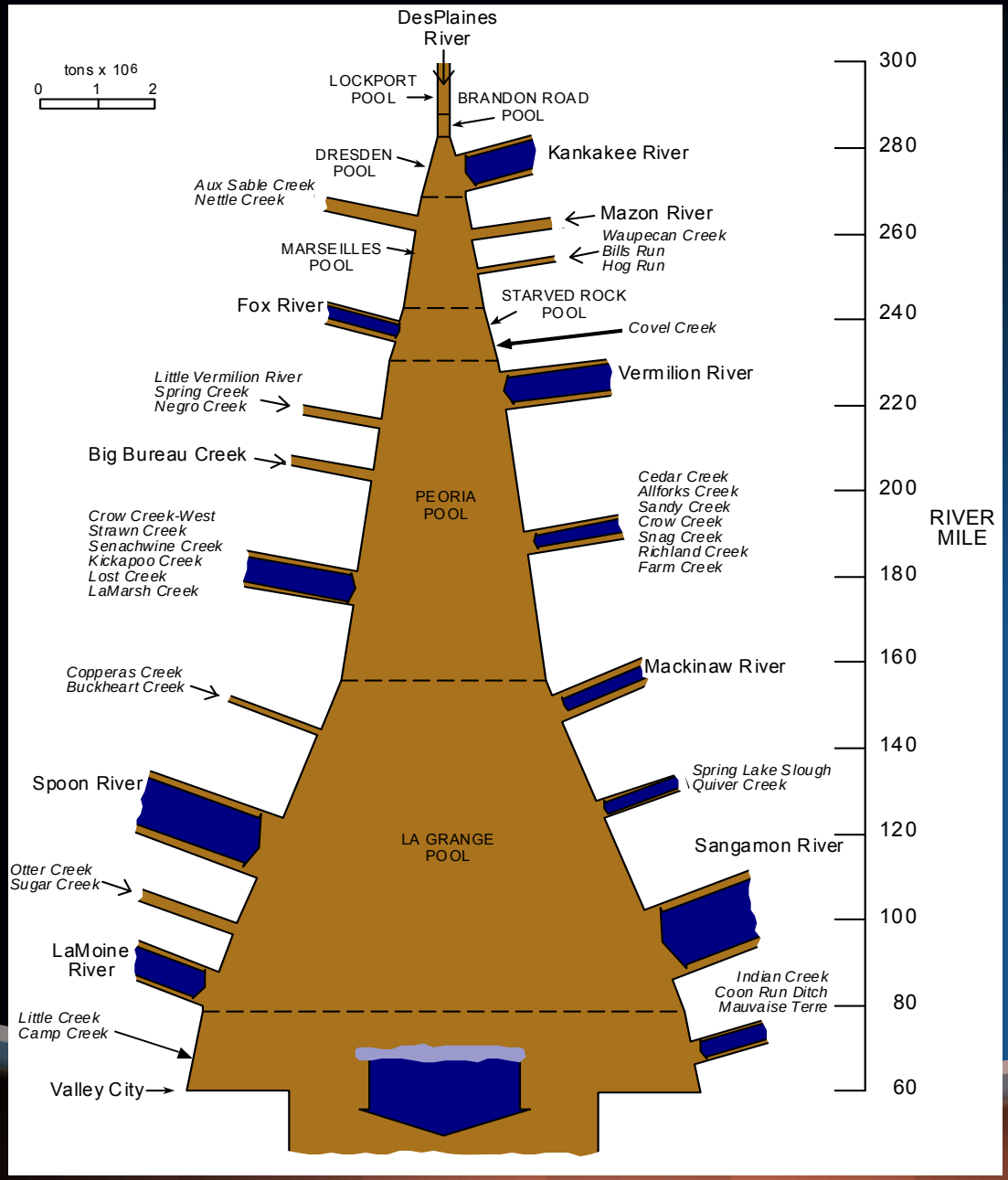
ILLINOIS

Overview

- Integrated Management Plan for the IRB
- Recommendation #10: Stabilize unstable stream channels
  - WHERE WERE WE
  - WHERE ARE WE NOW
  - WHERE DO WE GO FROM HERE

Illinois State Water Survey
Bhowmik et al. (2001)

Sediment Budget WY1981-2000



- 12.1 millions tons/year delivered
- 55% trapped (5.4 million/tons/yr)

Illinois State Water Survey
Demissie et al. (2004)

Where were we?

- Perception that streambank erosion was inherently bad and must be controlled
- Streambank erosion was local scale – treat symptom
- Meandering streams naturally erode banks
- Definition: unstable … depends!
  - Engineering: magnitude of erosion generates public concern
  - Geomorphological: abrupt, episodic, progressive changes
- Balance of sediment inputs/outputs

Stabilize stream channels

- 1997 Integrated Management Plan for the IRB
- 6 Recommendation Groups
  - Total of 34 Recommendations
- Soil & Water Movement (Rec. #7-13)
  - Hydrology & Hydraulics Action Team
- Recommendation #10: Stabilize unstable stream channels (urban and rural)

Recommendation #10

- Stabilize unstable streams in rural and urban areas as identified by rate or magnitude of erosion yields
  - Establish assessment criteria for identifying unstable streams based primarily on scientific info on geomorphology of stream system (network/watershed)
  - Conduct site investigations to generate info on instability causes
  - Formulate ‘holistic’ management strategies (combine natural and engineered stabilization techniques)
  - Initiate low-cost, long-term monitoring at selected sites to evaluate effectiveness of stabilization techniques

Where are we now?

- Expand to system-wide investigations
  - Stream Channels and associated watershed
- Observed changes in erosion and sedimentation are a result of various management practices designed to meet societal needs
  - Altering flow and habitat availability through impoundment, channelization, leveeing, and water diversion
  - Land management practices alter transport capacity
  - Temporal and spatial impacts on the physical and biological processes that define a given ecosystem

Where are we now?

- Multi-scale, multi-disciplinary, & collaborative
  - Hydrology/hydraulics; channel geomorphology; geology, climate; aquatic habitat & biology; land management activities/practices
- Long-term monitoring
- River restoration is emerging field with likely knowledge gaps that may
  - Need investigations to better understand ecosystem responses to restoration practices
  - Studies to identify the underlying processes that will aid in understanding the ecosystem

IRB Restoration Comprehensive Plan

- Provide vis … red future, and recomm … ecological i …
- Restore an … structure and functio …
- Framework … ection, study and i … on projects, m … nagement activities, a … ations
- Integrated … d context for system- … n goals

IRB Restoration Comprehensive Plan

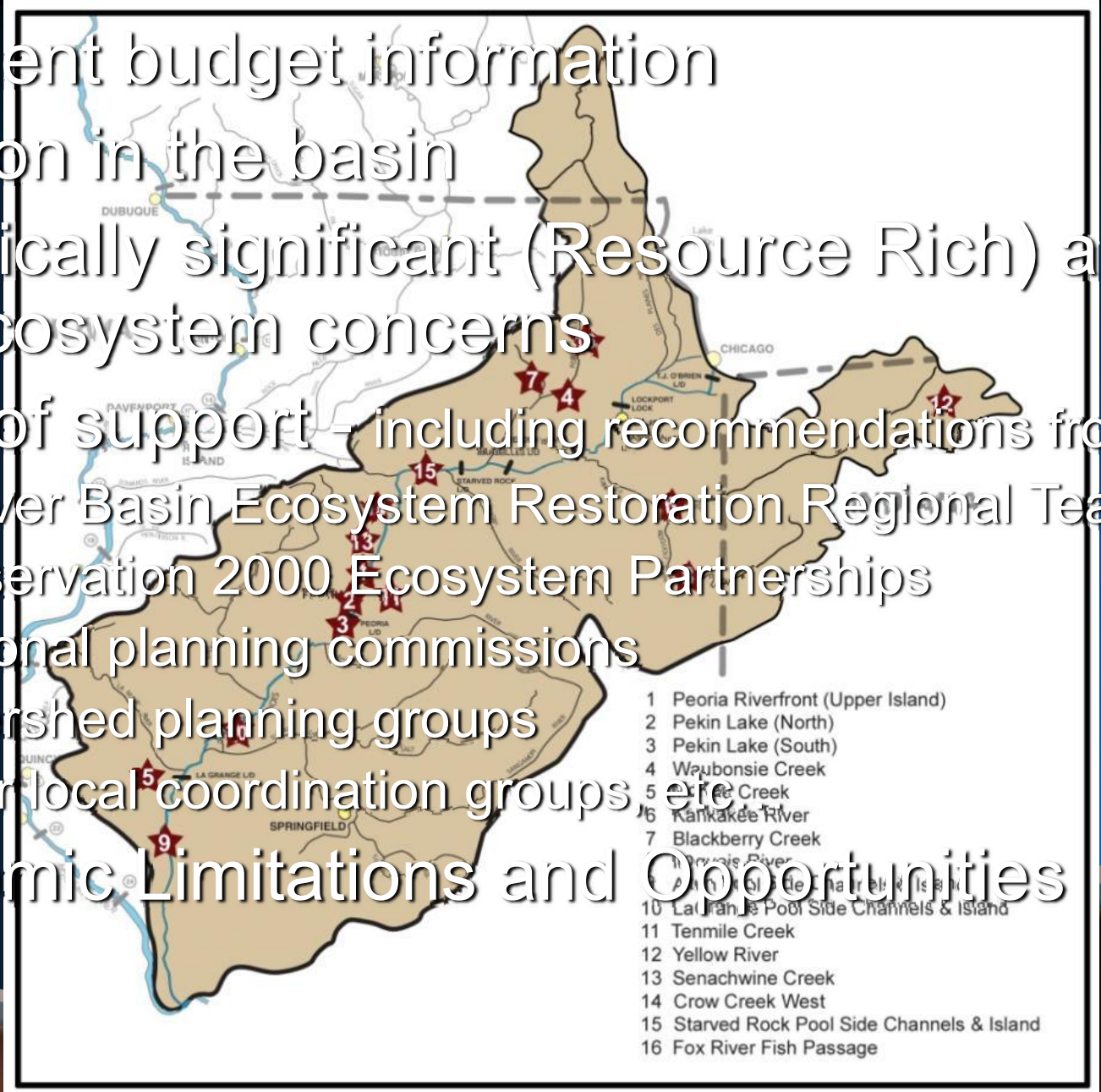
- **Long-term Monitoring Plan (Geomorphic, Ecological, Hydrologic and Sediment)**
  - **Main Stem Level**
  - **Sub-basin Level**
  - **Project Level**

IRB Restoration Comprehensive Plan

- **Watershed Assessment Framework**
  - Describe and document patterns, processes, and functions within a watershed system to assist in understanding past and present conditions
    - *Compare and prioritize watersheds*
    - *Establish a reference watershed*
    - *Rapid watershed assessment*
    - *Watershed characterization*
    - *Integrated assessment and evaluation*
    - *Project recommendations*

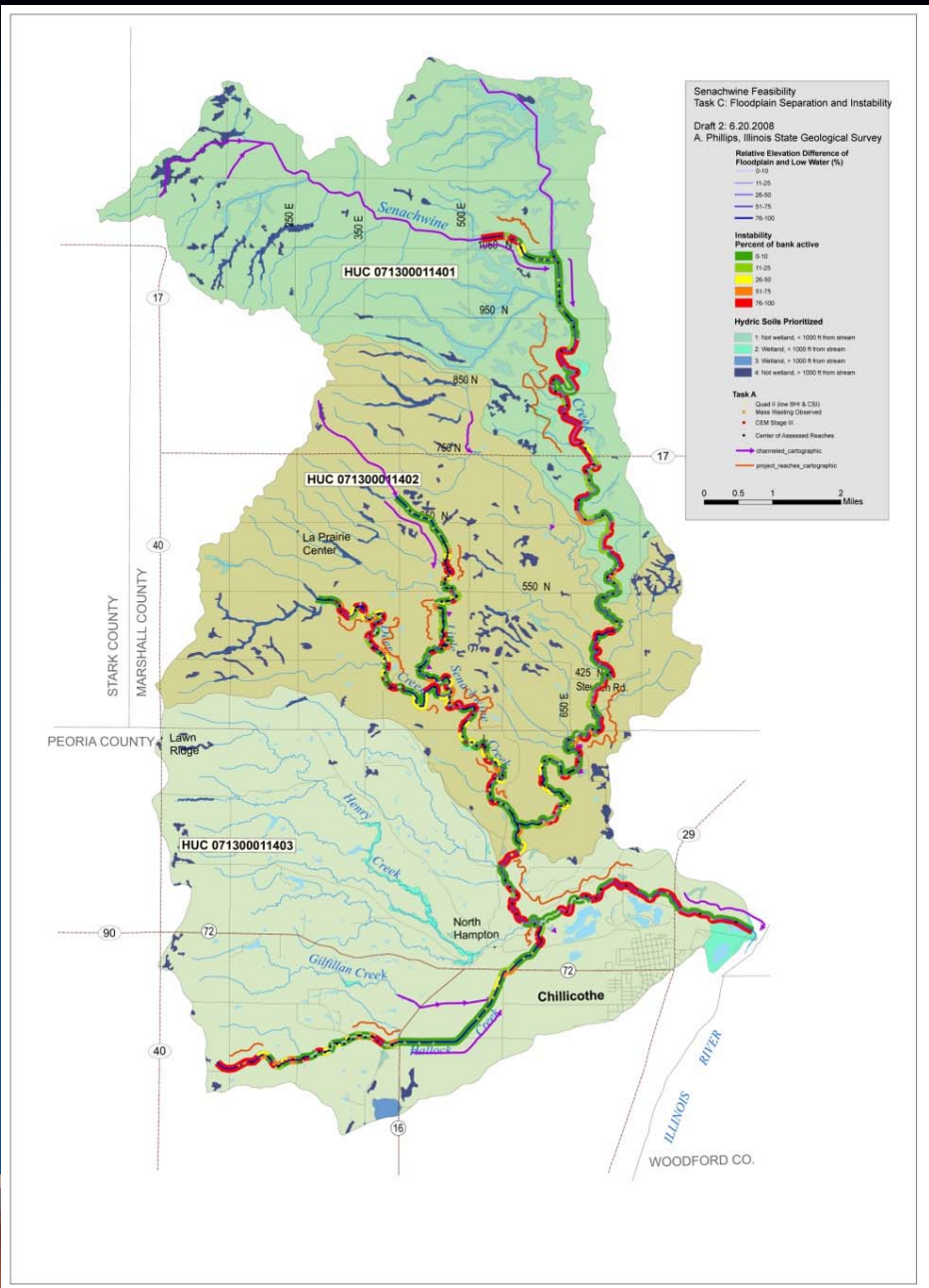
Assessment Watershed Priority

- Sediment budget information
- Location in the basin
- Biologically significant (Resource Rich) areas and ecosystem concerns
- Level of support – including recommendations from:
  - IL River Basin Ecosystem Restoration Regional Teams
  - Conservation 2000 Ecosystem Partnerships
  - Regional planning commissions
  - Watershed planning groups
  - Other local coordination groups, etc.
- Economic Limitations and Opportunities

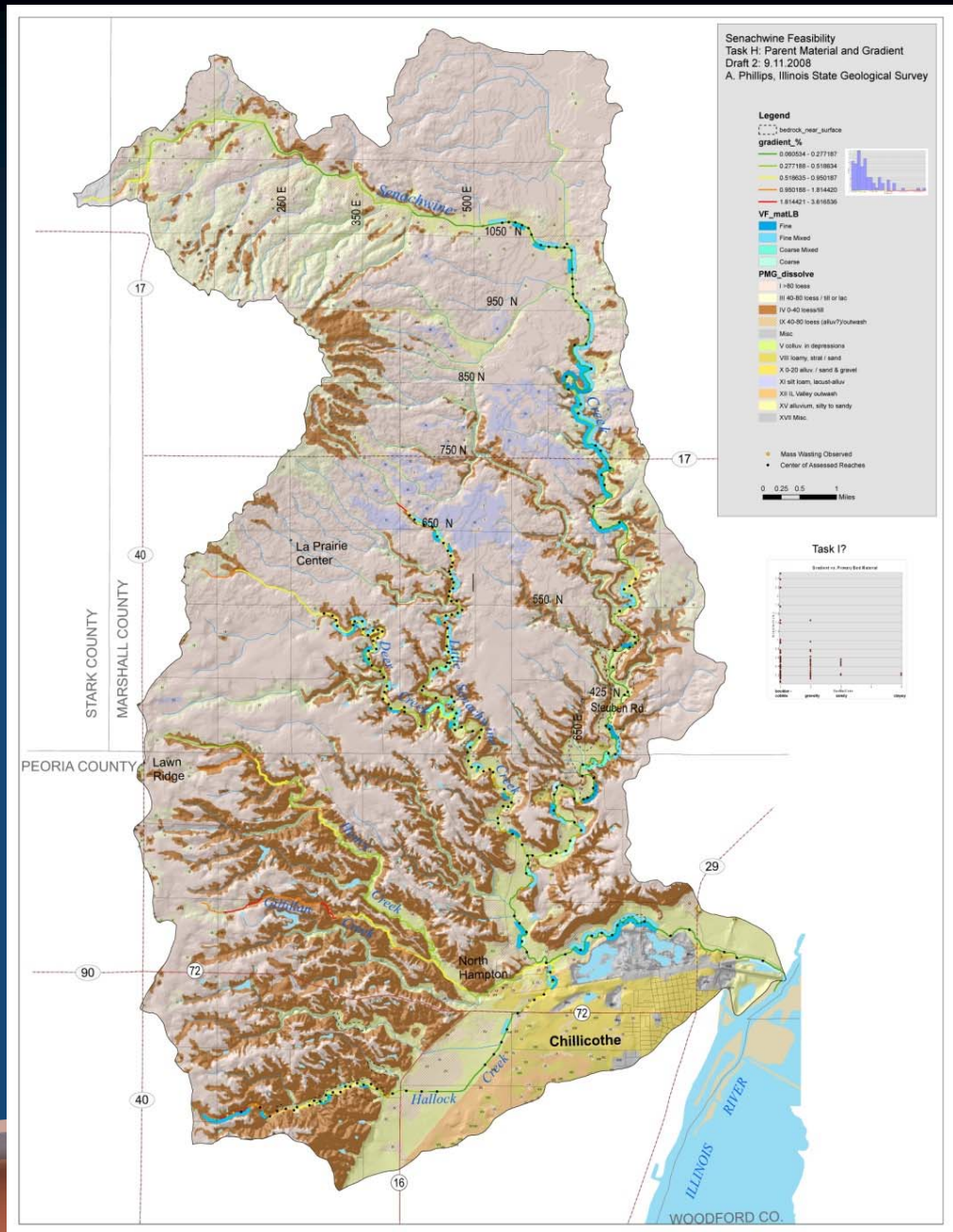


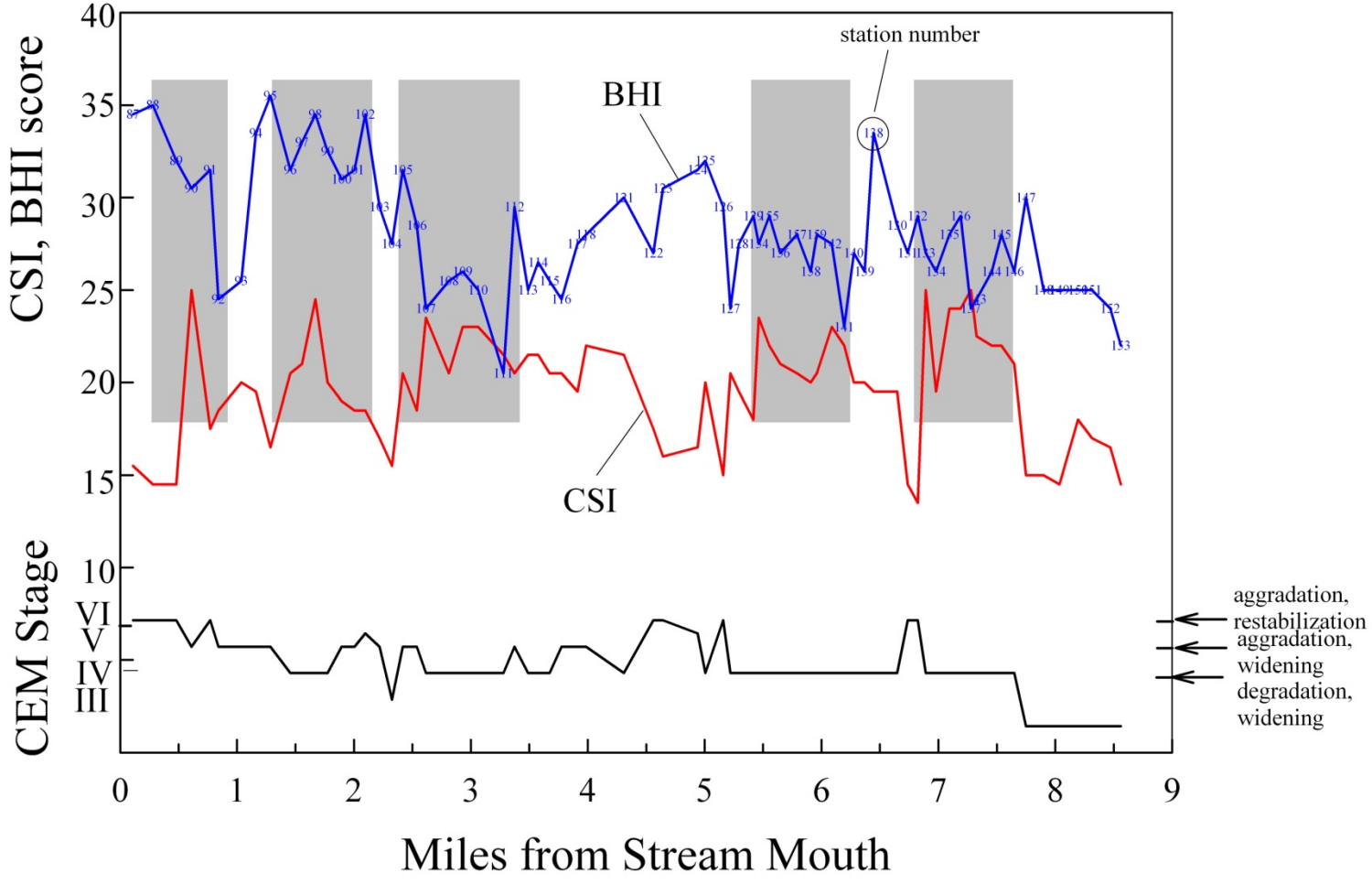
- Example of spatial density of rapid assessment sites

- Example of integrated data analysis using watershed characteristics, geology, biology, and rapid channel data

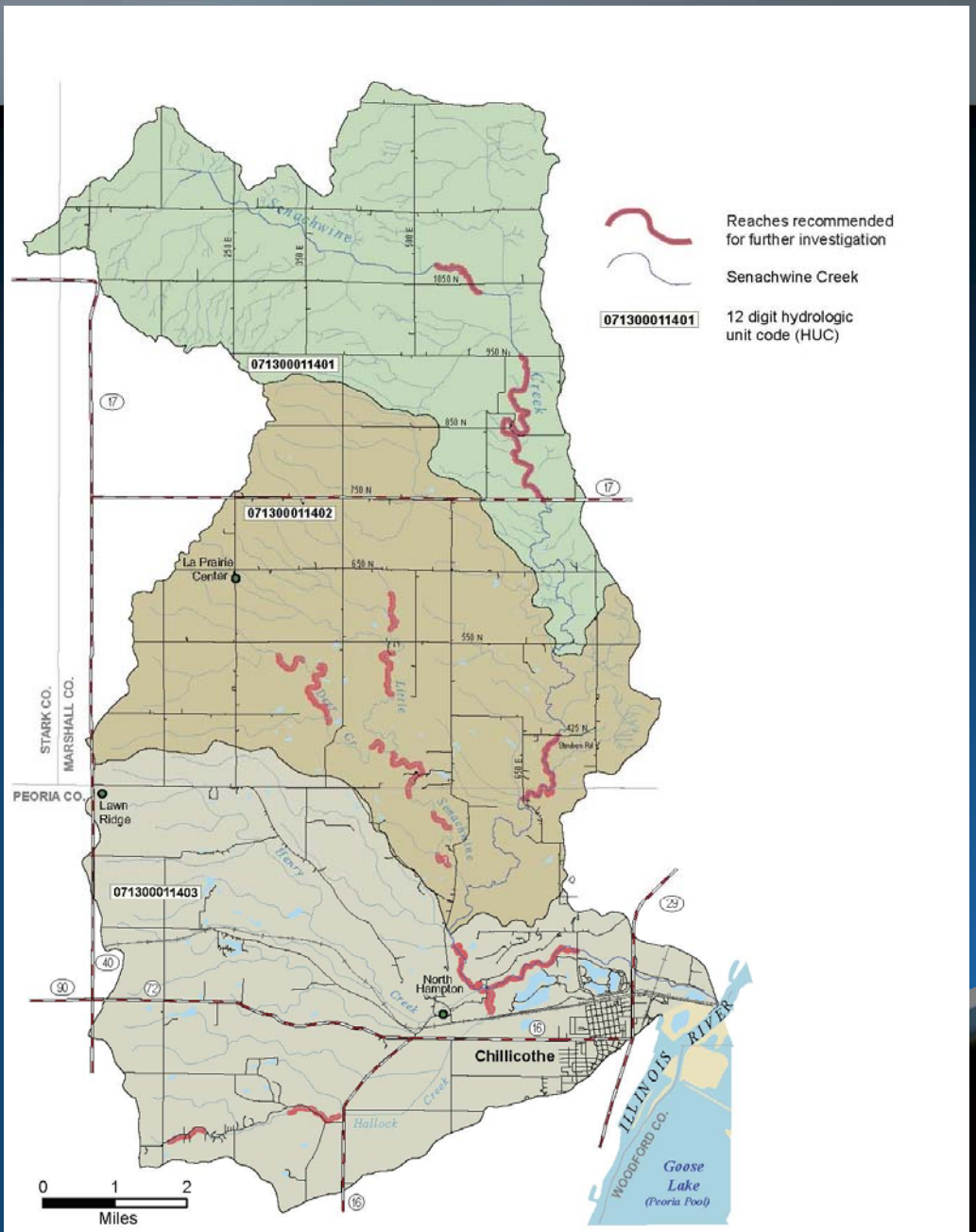


- Example of integrated data analysis




CSI, BHI score
40
35
30
25
20
15
10
station number
BHI
CSI
CEM Stage
VI
V
IV
III
aggradation, restabilization
aggradation, widening
degradation, widening
0
1
2
3
4
5
6
7
8
9
Miles from Stream Mouth

- Example of multi-disciplinary collaboration using integration of existing and rapid geologic, biologic, geomorphic datasets to identify reaches for more investigation and possible projects



Where do we go from here?

- Comprehensive approach to stream management that includes geomorphological processes linked to ecological and water quality concerns
- Understand the need for balance of sediment transport (input/output)
- Some banks need to erode at reasonable rates to contribute balance of sediment
- Strategic implementation of restoration projects based on assessments of systemic erosion processes

Where do we go from here?

- Need investigations to better understand ecosystem responses to restoration practices
- Studies to identify the underlying processes that will aid in understanding the ecosystem

Thank you