Future Monitoring Needs of the UMR: Linking Policy with Science

Joint Session of the EMP-CC and NECC

Meeting Summary

November 16, 2005
St. Paul Radisson Riverfront Hotel

ATTENDEES

The 58 attendees included members of the EMP-CC, NECC, and A-Team. A list of those who attended the joint meeting is included on the final pages of this summary.

PRESENTATIONS

A. John Barko provided an overview of the work of the 2003 Science Panel and 2005 Science Panel convened by the Corps. He discussed the role of objectives in the adaptive management process, applications of ecological modeling and monitoring, considerations in the selection of ecological endpoints and measures, and the work that the Science Panel will be doing in FY 06. The draft report of the Science Panel will be distributed at the end of December. [Barko's PowerPoint slides are attached.]

B. Barry Johnson's presentation addressed the role of monitoring in NESP, including the relationship between goals and objectives and monitoring, scales of monitoring (individual projects, multiple projects, navigation pool/reach, and floodplain reach/ systemic), and data management. [Johnson's PowerPoint slides are attached.]

C. Bob Gaugush provided an overview of the LTRMP 2005 Status and Trends Report and described the development of indicators in the absence of ecosystem goals. He described the selected indicators in each of 7 groups: hydrology, water quality, sedimentation, land cover/land use, aquatic vegetation, macroinvertebrates, and fish. In addition, he presented examples of the data and conclusions for one indicator in each group. [Gaugush's PowerPoint slides are attached.]

QUESTIONS AND KEY POINTS OF DISCUSSION

The Science Panel report includes refined ecological goals and objectives for the UMRS. How should these goals and objectives be used to help identify key indicators and monitoring needs?

Observations about the "process" of establishing goals and objectives:

- The goals and objectives will require additional review and comment before they are considered final. It is anticipated that the objectives will be refined over time as our understanding of the ecosystem changes and our institutional processes evolve.

- A process for reviewing and adopting the goals and objectives should be established, including an understanding of which group(s) will be involved and the roles they will play.
- Finalizing the goals and objectives should be done soon. Other major ecosystem restoration efforts, such as South Florida and Chesapeake Bay, already have established objectives.
- Some objectives, such as those for water quality, may have implications for state programs. In particular, it is not clear how the goals and objectives may impact state responsibilities for water quality assessment and impairment determinations under the Clean Water Act. It will be important to involve other agencies with different management responsibilities in the development of goals and objectives.
- Making the linkage between NESP goals and objectives and other agency programs should be the responsibility of the River Council or UMRBA.
- It was originally anticipated that NECC would review and discuss the goals and objectives at its February 2006 meeting.
- Goals reflect the desires of society at large. It is the responsibility of scientists and resource managers to articulate those goals, refine the objectives, and make them operational.
- Ken Barr proposed the following next steps in the process of developing goals and objectives:
  - December 2005: Distribute Science Panel report (including refined goals and objectives) for review.
  - January 2006: NECC and EMP-CC members identify key questions and issues related to the goals and objectives and submit them to the Corps by January 30.
  - February 2006: Convene a joint NECC/EMP-CC workshop on goals and objectives. The key issues submitted in January will provide the basis for discussion at the workshop.

Observations about the nature and purpose of goals and objectives:

- The goals and objectives are intended to serve as the basis for both NESP and the EMP.
- NESP monitoring should be tied to established goals and objectives and indicators. In the EMP, the indicators and measures were selected in the absence of goals and objectives, based on available data and a common understanding of what is important.
- Multiple indicators will be needed.
- A landscape analysis is needed, as was done for the CCP.
- Science needs to be put back in the process of goals, objectives, indicators, and project selection. Science and policy considerations must go hand-in hand.
- Objectives for individual reaches or pools and their associated indicators are not completely additive. Systemic goals and objectives are more than a compilation of individual project, pool, or reach objectives.
- We will need to decide if the water quality goals and objectives are for the ecosystem, for human health, or for both.

Will the identification of key indicators facilitate development of monitoring needs and lead to an Ecological Report Card?

- Consensus answer — YES
- Not all 45 indicators are appropriate for a report card. The report card will only include systemic indicators.

How does an Ecological Report Card relate to a Status and Trends Report? How can each help facilitate the development of future monitoring needs?

- The LTRMP Status and Trends Reports represent the first effort on the UMR to develop a reporting mechanism. However, it must be recognized that the approach used in those reports was developed by working backwards from the data.
- The Status and Trends Report and Report Card are both important, complimentary tools. The Report Card is a snapshot, indicating whether goals have been met. The Status and Trends Report is what supports the assigned "grade" in the Report Card.
- The Report Card is a simplified or short version of the Status and Trends Report.
- It will be necessary to select only a few indicators for the Report Card. Some may not be obvious and will require explanation.

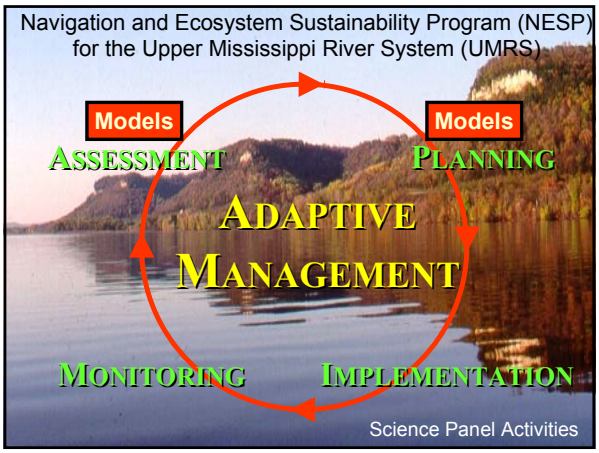
Where do we go from here?

- In February 2006, the NECC and EMP-CC will again meet jointly. The focus of that second joint meeting will be ecological goals and objectives.
- In FY 06 the Science Panel will be working on criteria for project selection. But that effort will not be a substitute for the difficult task of prioritizing activities and investments.
- The "philosophy" of NESP should be written down to describe the overall purpose and goals of the program to decision-makers. The Program Management Plan (PMP) may satisfy this need.
- Given that there are a variety needs and options for monitoring at different scales, how will decisions about monitoring be made and who will decide? Recommendations will be made in February to the River Council (or EMP-CC and NECC, if the Council does not yet exist). At that point a policy decision will need to be made.

EMP-CC and NECC Joint Meeting Attendance List
November 16, 2005
(* = on conferencing phone)

Charles Barton	U.S. Army Corps of Engineers, MVD
Susan Smith	U.S. Army Corps of Engineers, MVD
John Barko	U.S. Army Corps of Engineers, R&D, Vicksburg
Mike Thompson	U.S. Army Corps of Engineers, MVS
Brian Johnson	U.S. Army Corps of Engineers, MVS
Brian Markert	U.S. Army Corps of Engineers, MVS
Marvin Hubbell	U.S. Army Corps of Engineers, MVR
Scott Whitney	U.S. Army Corps of Engineers, MVR
Ken Barr	U.S. Army Corps of Engineers, MVR
Roger Perk	U.S. Army Corps of Engineers, MVR
Chuck Spitzack	U.S. Army Corps of Engineers, MVR
Jack Carr	U.S. Army Corps of Engineers, MVR
Chuck Theiling	U.S. Army Corps of Engineers, MVR
Don Powell	U.S. Army Corps of Engineers, MVP
Jeff DeZellar	U.S. Army Corps of Engineers, MVP
Rebecca Soileau	U.S. Army Corps of Engineers, MVP
Al Fenedick	U.S. Environmental Protection Agency, Region 5
Bill Franz	U.S. Environmental Protection Agency, Region 5
Larry Shepard	U.S. Environmental Protection Agency, Region 7 (in Duluth)
Dave Bolgrien	U.S. Environmental Protection Agency, ORD (Duluth)
Don Hultman	U.S. Fish and Wildlife Service, UMR Refuge
Sharonne Baylor	U.S. Fish and Wildlife Service, UMR Refuge
Gary Wege	U.S. Fish and Wildlife Service, Bloomington, MN
Tim Yager	U.S. Fish and Wildlife Service, Region 3
Bob Clevenstine	U.S. Fish and Wildlife Service, Rock Island Field Office
Jon Duyvejonck	U.S. Fish and Wildlife Service, Rock Island Field Office
Rick Nelson	U.S. Fish and Wildlife Service, Rock Island Field Office
Linda Leake	U.S. Geological Survey, UMESC
Barry Johnson	U.S. Geological Survey, UMESC
Patricia Heglund	U.S. Geological Survey, UMESC
Michael Jawson	U. S. Geological Survey, UMESC
Jennie Sauer	U.S. Geological Survey, UMESC
Robert Gaugush	U.S. Geological Survey, UMESC
Jeff Houser	U.S. Geological Survey, UMESC
Ken Lubinski	U.S. Geological Survey/TNC
Brian Ickes	U.S. Geological Survey
Jim Rogala	U.S. Geological Survey
Jennifer Dieck	U.S. Geological Survey
Butch Atwood*	Illinois Department of Natural Resources
Rob Maher*	Illinois Department of Natural Resources
John Chick*	Illinois Natural History Survey
Mike McGhee	Iowa Department of Natural Resources
Tim Schlagenhaft	Minnesota Department of Natural Resources
Walt Popp	Minnesota Department of Natural Resources

Mike Davis	Minnesota Department of Natural Resources
Kevin Stauffer	Minnesota Department of Natural Resources
Janet Sternburg	Missouri Department of Conservation
Bob Hrabik*	Missouri Department of Conservation
Dru Buntin	Missouri Department of Natural Resources
Gretchen Benjamin	Wisconsin Department of Natural Resources
Jim Fischer	Wisconsin Department of Natural Resources
Dan McGuiness	Audubon
Mark Beorkrem	Mississippi River Basin Alliance
Robin Grawe	Mississippi River Citizen Commission
Barry Drazkowski	St. Mary's University
Catherine McCalvin	The Nature Conservancy
Dave Hokanson	Upper Mississippi River Basin Association
Holly Stoerker	Upper Mississippi River Basin Association



Environmental Science Panel Convened Initially in 2003 by the Corps of Engineers to –

- Develop and refine UMRS conceptual models
- Identify appropriate evaluation tools that address ecosystem needs at multiple scales
- Refine ecosystem restoration goals and objectives provided by stakeholders
- Identify and evaluate management actions focused on the attainment of goals and objectives
- Assist with the development of alternative plans for ecosystem restoration

Recommendations of the 2003 Science Panel

- Planning for a formal adaptive management approach to river restoration should be accelerated
- Ecosystem goals & objectives should be further clarified and integrated
- Simulation modeling should be undertaken as a first step in the adaptive management process
- Management actions should be implemented with system-wide considerations
- Report card and appropriate monitoring program should be developed to track outcomes
- Initial management actions should be considered as experiments

Environmental Science Panel Reconvened in 2005 by the Corps of Engineers to -

- Develop ecosystem restoration project evaluation and sequencing criteria
- Develop ecosystem restoration monitoring protocols over multiple spatial and temporal scales
- Develop a “report card” framework to track progress in restoring the UMRS
- Further evaluate and refine goals and objectives of ecosystem restoration
- Integrate numerical models for forecasting applications on the UMRS
- Define projected ecological outcomes (benefits) in terms of goods and services provided through ecosystem restoration

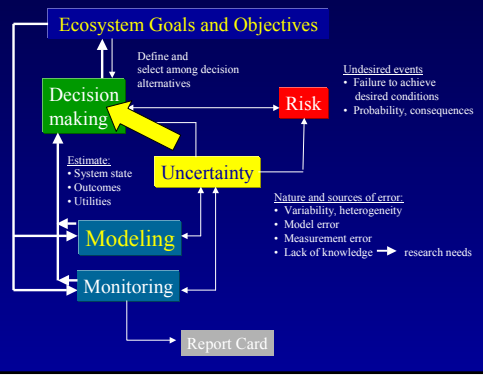
NESP Science Panel (SP) Team Members

John W. Barko
Steve Bartell
Charlie Berger
Robert Clevenstine
Mike Davis
David L. Galat
Barry L. Johnson
Kenneth Lubinski
John M. Nestler
Larry Weber

NESP Science Panel Regional Support Team (RST)

Robert Davinroy
Jon Hendrickson
Tom Keevin
Kevin Landwehr
Charles Theiling
Dan Wilcox

Generic Framework for Ecosystem Restoration



Proposed NESP Adaptive Ecosystem Management Process Organized around Objectives

System-wide objectives
Pool and reach objectives
Project objectives
Management actions
Indicators & performance measures
Modeling & monitoring activities
Project evaluation (report card)
Refine objectives

Objectives attained
Ecosystem outputs
Value to society
Lessons learned

Purposes of reporting process

Ecological Modeling: Applications to Ecosystem Restoration and Management, UMRS

- Refine objectives for condition of the river ecosystem
- Pose hypotheses about system response to management activities
- Evaluate and compare combinations of management alternatives
- Formulate the sequence of restoration and management actions
- Aid in evaluating the effectiveness of management actions
- Estimate the benefits (output of ecosystem goods and services) of river management actions
- Forecast future conditions systemically

Resource Monitoring: Applications to Ecosystem Restoration and Management, UMRS

- Track trends in river resource conditions over space and time with attention to endpoints/indicators
- Detect changes in habitat availability and suitability
- Assess variations in interactions among river biota and processes
- Evaluate effects of exotics
- Evaluate effects of watershed activities
- Others (see Barry Johnson)

Generic Considerations in the Selection of Ecological Endpoints (Indicators)

- Species-level (keystone, endangered, nuisance, etc.)
- Community-level (diversity, structure, etc.)
- Ecosystem-level (processes, habitat, gaps, etc.)
- Landscape-level (disturbances, connectivity pattern, etc.)

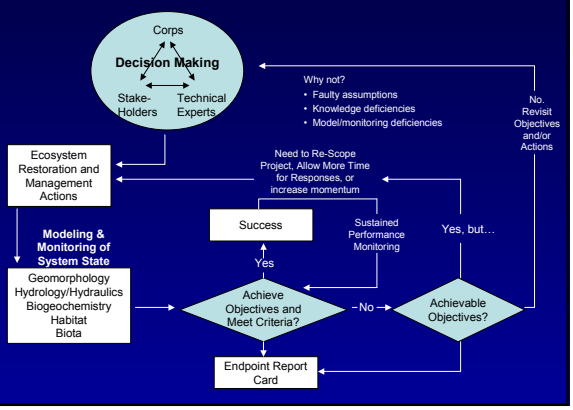
Modified from Harwell et al. (1990).

Generic Considerations in the Selection of Measures

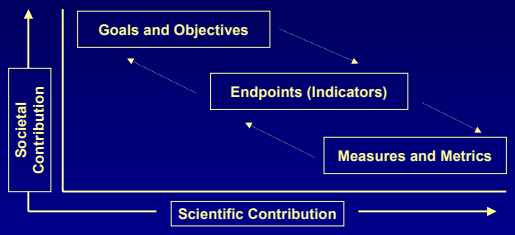
- Signal-to-noise ratio (sensitivity to stressor versus natural variability)
- Rapid response (early exposure; rapid dynamics [e.g., short life span])
- Reliability and specificity of response to stressor
- Ease and economy of monitoring
- Historical database availability – reference conditions
- Relevance to endpoint

Modified from Harwell et al. (1990).

Adaptive Management Loop in Decision Making



Relationships Among Societal Goals/Objectives and Endpoints/Measures in Ecological Assessments



Modified from Harwell et al. (1999).

NESP-Science Panel in FY06 – Where do we go from here?

- Develop a DSS that has information technology and knowledge and information management components.
- Develop a data management plan
- Formalize interactions with PDTs / begin formal review of project plans
- Develop system-wide project sequencing criteria
- Develop system-wide monitoring and management action plan
- Formally identify specific models and their interconnectivity in a system modeling framework for forecasting purposes
- Interface with Corps System-wide Water Resources Program (SWWRP)
- Seek input per requirements of River Council/NECC
- Advance state of understanding in quantifying river goods & services
- Complete report card framework with stakeholders
- Organize & conduct a multidisciplinary workshop to ensure appropriate attention to engineering approaches in River O&M
- Conduct an assessment of information needed for adaptive ecosystem management including restoration planning, modeling, monitoring, and report card development

Monitoring under NESP - points for discussion.

Barry Johnson & NESP Science Panel
USGS, Upper Midwest Environmental Sciences Center
EMPCC/NECC Joint meeting, 16 Nov. 2005

U.S. Geological Survey
Department of the Interior

Goals/Objectives

- NESP: "… long-term sustainability of economic uses and ecological integrity …"
  - Achieved through the cumulative effect of many individual projects
  - Gage success through monitoring
    - Determine effectiveness of different tools and techniques
    - G & O's at different scales will determine the data needed.

Scales of monitoring

Floodplain Reach & Systemic

↑

Navigation Pool/Reach

↑

Multiple projects

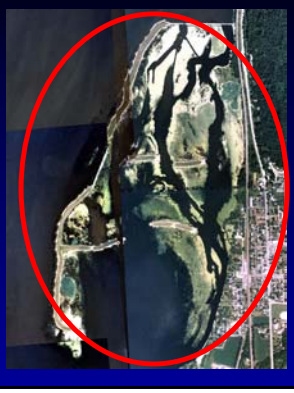
↑

Individual Projects

Individual project – e.g., Backwater rehabilitation

Local effects

- How successful are different techniques?
- What tools work where?
- How to improve design and implementation.



Individual project – e.g., Backwater rehabilitation

-What is the spatial extent of the project effect?

- A focus of NESP, but we expect more projects than we can monitor

Monitoring for learning

- What projects should we evaluate?
  - Not all projects will present learning opportunities.
  - Monitor when we can learn the most: address specific questions, test hypotheses, etc.
  - Sci. Panel can help decide what projects to monitor.
- PDT's develop monitoring plans to include:
  - Expected response(s) at specific spatial scale(s)
  - A timeframe for those responses.
  - Science Panel provides review & guidance

Multiple projects

- If one was good, more is probably better.
- Effects are not always additive.
- applies to “Sandbox” locations

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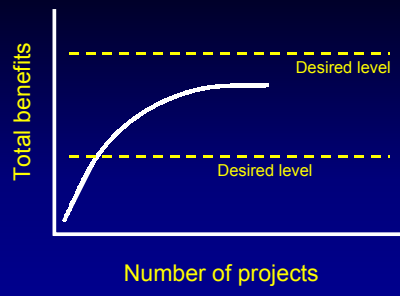
Multiple projects



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Multiple Projects

- Sequencing & interactions among projects
- Project response under different environmental conditions
- Effects of different design features on project performance (e.g., time between drawdowns, amount of flow in side channels, width of fish passage devices, etc.)
- Requires substantial pre-planning and design to be most effective. Will need input from Sci Panel or special PDT’s.
- Critical that this approach be question based.
- Working on this in NESP Sandbox projects

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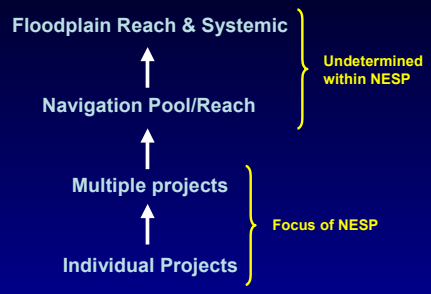
Scales of monitoring



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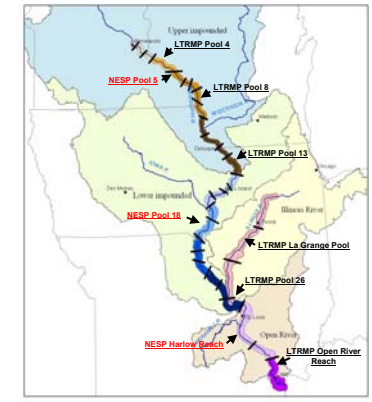
Navigation Pool/Reach scale

- Monitor for cumulative effects of multiple projects
- Project monitoring will require pre- and post-project data
- Need an efficient process for getting pre-data in pools where we have none
- Might be best to concentrate projects in areas where we have existing data and will be collecting future data.
- Concept of Focal pools - as laboratories for projects

USGS

Pool/Reach Scale

- Focus of LTRMP
- Provides baseline for projects within focal pools
- Integrate pool scale effort with local monitoring
- Have at least one pool in each of the 4 floodplain reaches
- Could maintain the long term data sets from LTRMP reaches



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Floodplain Reach, System Scale

- Evaluates the ultimate goal of NESP
- Should relate directly to Systemic Goals (need to develop)
- Report Card and indicators derive from Goals
- Monitoring individual projects won't result in systemic evaluation.
- We don't do systemic monitoring under LTRMP
- Example of one method using random sampling within floodplain reaches

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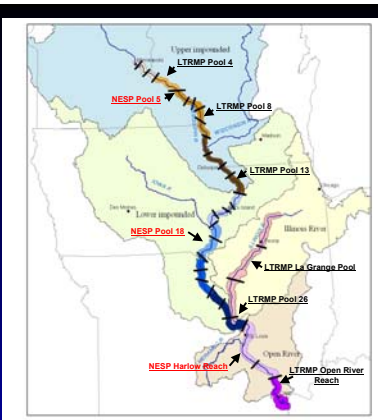
System Scale

- Stratify by floodplain reach (habitat basis)
- Use a random or rotating design to sample pools (or segments) within each reach
- Sample at lower intensity than LTRMP, mainly for trends
- Allows estimating indicators within each reach and system-wide
- Provides data for all pools & reaches over time



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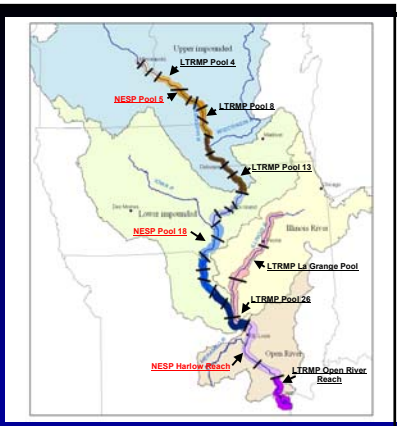
System Scale

- Some indicators are truly systemic, e.g., nutrients, sediments, fish passage.
- A design based on river corridor and tributaries may be better.



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Data management

- Use existing data for designing projects and monitoring plans
- Build on existing data sets
- Allow easy access to both old and new data
- Take advantage of the LTRMP database and data infrastructure when possible.

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Take home messages

- Need data at both small and large scales for effective adaptive management.
- Need goals/objectives to determine what data to collect.
- Need to plan for learning in:
  - Project design and implementation
  - Evaluations and monitoring
- Build on existing data and provide easy access to old & new data.

USGS

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LTRMP

Status and Trends of the Upper Mississippi River System

An Indicator Based Approach

R. Gaugush
USGS/UMESC, La Crosse

A bit of history…

LTRMP Goals and the Prevalent View

LTRMP Goals*

1. Develop a better understanding of the ecology of the UMRS and its resource problems
2. Monitor resource change
3. Develop alternatives to better manage the UMRS
4. Provide for the proper management of LTRMP information

* Operating Plan for the UMRS LTRMP (1992)

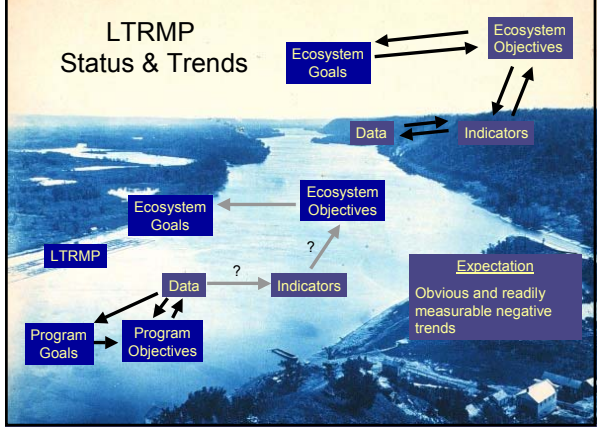
LTRMP Goals

- NOT ecosystem goals, rather they are program goals
- As a result, no ecosystem objectives or indicators are explicitly stated
- Very different from what is being proposed by the Science Panel

Goal 2: Monitor resource change

- "change" is the operative word
- Expectation was, in some sense, built into the goal
- Common perception at the time was that the Mississippi River was either in or poised to enter a serious decline
- Illinois River was the model for the Mississippi River and the Mississippi River would follow the vegetation collapse seen on the Illinois River in the 1950's

LTRMP Status & Trends



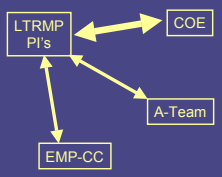
Format for indicators*

1. An assessment
2. Purpose
3. State of the ecosystem
4. Future pressures

* Adopted from State of the Great Lakes (2001)

Indicator Groups

- Hydrology
- Water Quality
- Sedimentation
- Land Cover/Land Use
- Aquatic Vegetation
- Macroinvertebrates
- Fish



Essentially LTRMP + hydrology

Indicator Groups

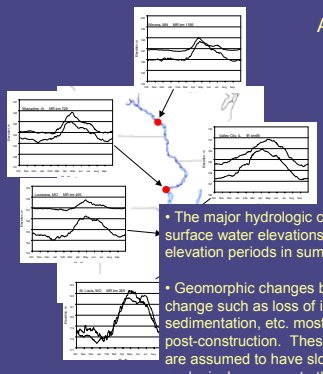
- Hydrology
  - Indicators of hydrologic alteration
- Water Quality
  - Major nutrients (TN and TP)
  - Chlorophyll a
  - Total suspended solids
  - Dissolved oxygen
  - Winter habitat for centrarchids
- Sedimentation
  - Depth diversity in impounded areas
  - Net sedimentation rates in backwaters

Indicator Groups

- Land Cover/Land Use
  - Floodplain forest
  - Emergent vegetation
  - Aquatic area
  - Frequently flooded terrestrial area
  - Infrequently flooded terrestrial area
- Aquatic Vegetation
  - Submersed aquatic vegetation
- Macroinvertebrates
  - Burrowing mayflies
  - Fingernail clams

Indicator Groups

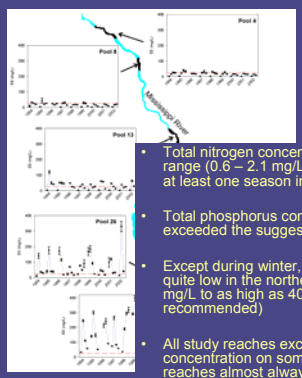
- Fish
  - Bluegill
  - Channel catfish
  - Sauger
  - Stock-sized Smallmouth buffalo
  - Fish forage index
  - Species richness
  - Non-native fishes
  - Recreationally-harvested fishes
  - Commercially-harvested fishes
  - Nongame fishes



Annual hydrographs
Status: Mixed
Trend: Stable

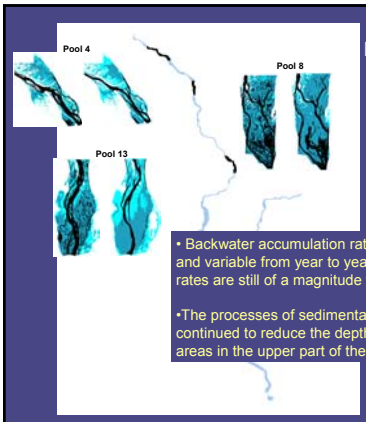
• The major hydrologic change has been an increased surface water elevations resulting in a loss of low water elevation periods in summer and fall

• Geomorphic changes brought about by the hydrologic change such as loss of islands, filling of deeper areas by sedimentation, etc. most likely were most rapid immediately post-construction. These processes are still occurring but are assumed to have slower rates of change. The ecological response to the hydrologic change is also still occurring.



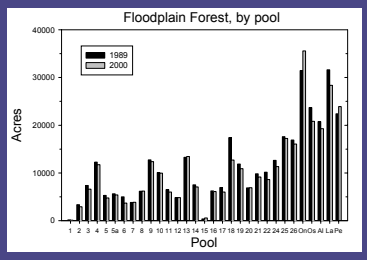
Total suspended solids
Status: Mixed to poor
Trend: Stable/improving (upper reaches), Stable (lower reaches)

- Total nitrogen concentrations exceeded the suggested range (0.6 – 2.1 mg/L) about 50% of the time, including at least one season in every year from 1994-2002.
- Total phosphorus concentration almost always exceeded the suggested range of 0.01 – 0.08 mg/L.
- Except during winter, when TSS concentrations are quite low in the northern reaches, TSS ranges from 5 mg/L to as high as 400 mg/L(TSS < 25 mg/L recommended)
- All study reaches exceeded the recommended concentration on some occasions, the southern study reaches almost always exceeded the recommended maximum concentration.



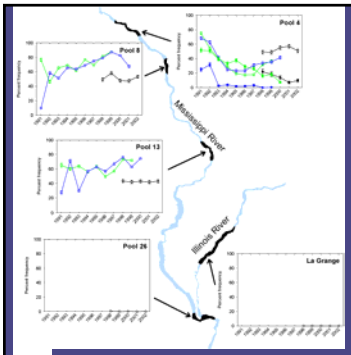
Depth Diversity
Status: Poor
Trend: Slightly declining

- Backwater accumulation rates are highly variable in space, and variable from year to year, but overall accumulation rates are still of a magnitude for concern.
- The processes of sedimentation and erosion have continued to reduce the depth diversity of the impounded areas in the upper part of the UMR since impoundment.



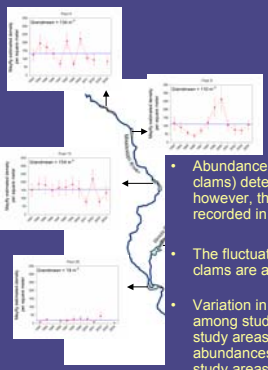
Floodplain Forest
Status: Mixed to poor
Trend: Declining

- Floodplain forest area has declined slightly in most pools of the UMRS (5.0% overall) between 1989 and 2000.
- Coverage by emergent vegetation generally decreased in the upper pools (1-13) of the Mississippi but increased in the middle pools (14-26), as well as in the open river and in the Illinois River pools between 1989 and 2000.



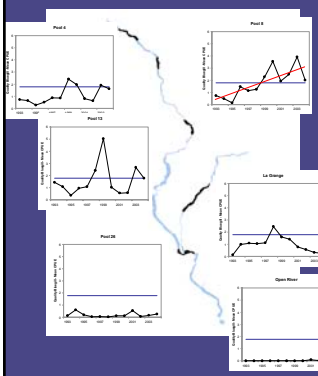
- SAV is abundant in the upper impounded pools and generally absent/scarce in the lower impounded pool
- The longitudinal pattern appears to be very stable
- SAV fluctuated annually, but so far, has been quite resilient to disturbances of high flow and high turbidity.

Submersed aquatic vegetation
Status: Good (upper reaches), Poor (lower reaches)
Trend: Stable



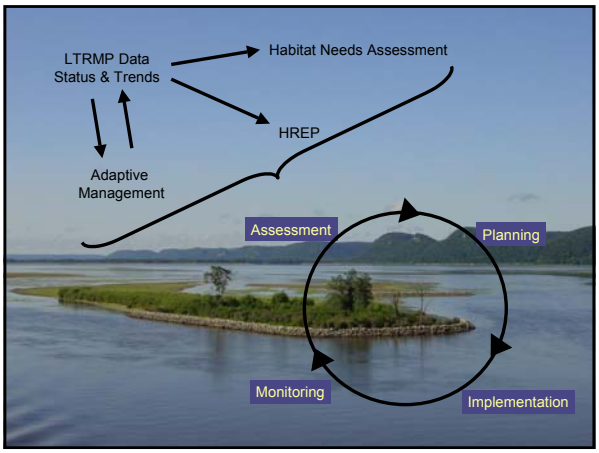
Burrowing Mayflies
Status: Mixed
Trend: Stable

- Abundances of macroinvertebrates (mayflies, fingernail clams) determined by LTRMP were highly variable; however, they do fall within the range of abundances recorded in past studies, from 1952-1990.
- The fluctuations indicate that mayflies and fingernail clams are able to rebound if conditions are right.
- Variation in abundance of macroinvertebrates is greater among study areas than among years. The northern study areas (Pools 4, 8, and 13) have greater abundances of the target organisms than the southern study areas (Pool 26, Open River Reach, and La Grange Pool).



Bluegills (CPUE)
Status: Mixed
Trend: Mixed

- Nearly all species historically observed in the UMRS remain today, though at altered levels of abundance.
- Non-native species account for 23-68% of total fish biomass. Non-native biomass is proportionally greatest in the southern reaches, but appears to be declining throughout the UMRS.
- The status of backwater and channel species reflect gradients in floodplain and channel disturbance along the UMRS.
- Few trends are evident in any indicators.


LTRMP Data
Status & Trends
Habitat Needs Assessment
HREP
Adaptive
Management
Assessment
Planning
Monitoring
Implementation