USGS
science for a changing world

A Resilience Assessment of the Upper Mississippi River System

Kristen Bouska, Jeff Houser, Nate De Jager

U.S. Geological Survey,

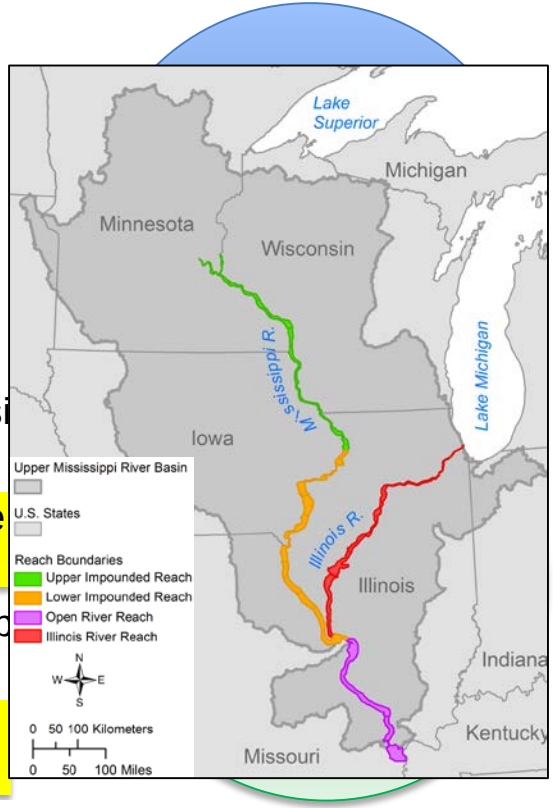
Upper Midwest Environmental Sciences Center

Upper Mississippi River Restoration
Leading Innovating Partnering

U.S. Department of Interior
U.S. Geological Survey

Upper Mississippi River Restoration Program

Vision: A healthier and more resilient Upper Mississippi River Ecosystem that sustains the river's multiple uses



Goals

- Enhance habitat for restoring and maintaining a healthier and more resi UMRS
- Advance knowledge for restoring and maintaining a healthier and more resilient UMRS
- Engage and collaborate with other organizations and individuals to help accomplish the UMRR Vision
- Utilize a strong, integrated partnership to accomplish the UMRR Vision

US Army Corps of Engineers · USGS science for a changing world · U.S. Fish & Wildlife Service · United States Environmental Protection Agency · NRCS · Minnesota Department of Natural Resources · Wisconsin Department of Natural Resources · DNR · Illinois Natural History Survey

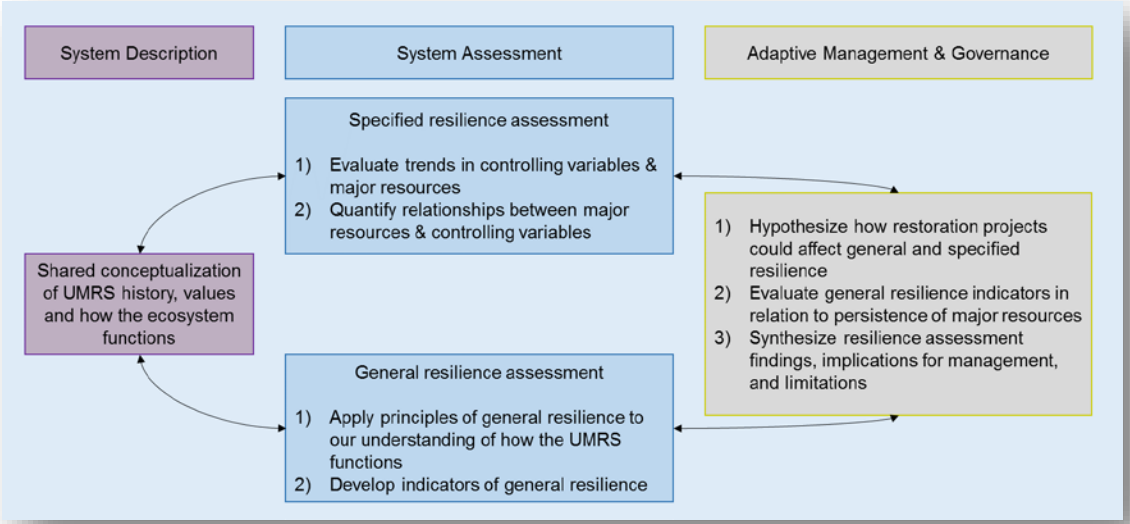
Ecological Resilience Assessment of the Upper Mississippi River System

- Resilience: "…capacity of a system to **absorb disturbance** and reorganize while undergoing change so as to **still retain essentially the same function, structure, identity and feedbacks** (Holling 1973, Walker et al. 2004)"

Ecological Resilience Assessment: Overview

Objectives

- Establish a resilience working group
- Develop conceptual understanding and definition of ecological resilience
- Develop indices of resilience for the UMRS
- Evaluate potential effects of restoration on resilience of the UMRS



USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment

Establish a resilience working group

- Diversity of partnership perspectives (~14 individuals)
- Review ongoing work and participate in planning
- Conduit of information to and from partner agencies
- Meets 2-4 times/year

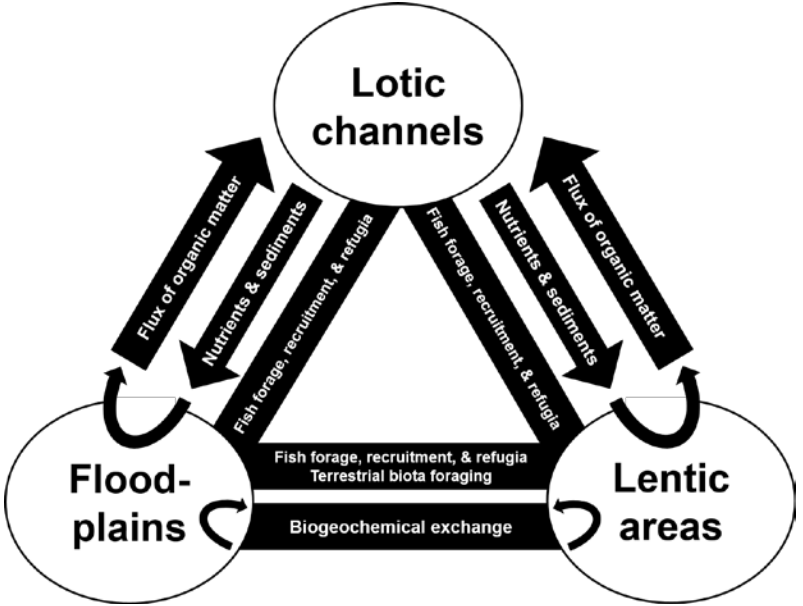
USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: System Description

Develop conceptual understanding and definition of ecological resilience

- Hosted 3-day workshop facilitated by experts in resilience science and assessment
  - Common understanding of resilience
  - Discussion regarding valued benefits of the UMRS, shifting ecological regimes, current state of the system, and a timeline of management history
- Partnership and peer-reviewed publication
  - Bouska, K. L., J. N. Houser, N. De Jager, and J. Hendrickson. 2018. Developing a shared understanding of the Upper Mississippi River: the foundation of an ecological resilience assessment. Ecology and Society 23(2)



Bouska et al. 2018.

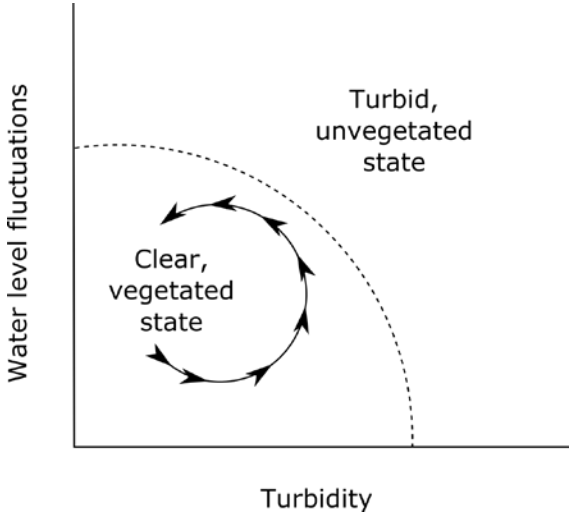
USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: Specified Resilience

Use conceptual models to advance understanding of regime shifts

- Diverse floodplain forest to reed canarygrass dominant
- Clear, vegetated backwaters to turbid, non-vegetated backwaters
- Diverse native fish community to invasive-dominant fish community



Bouska et al. *In prep.*

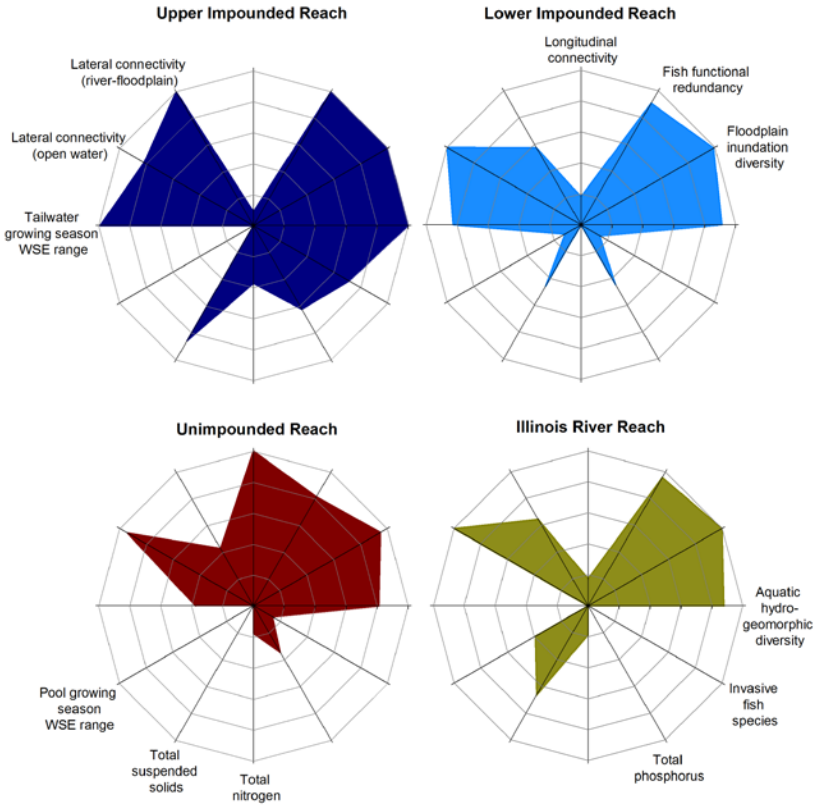
USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: General Resilience

Develop indices of resilience for the UMRS

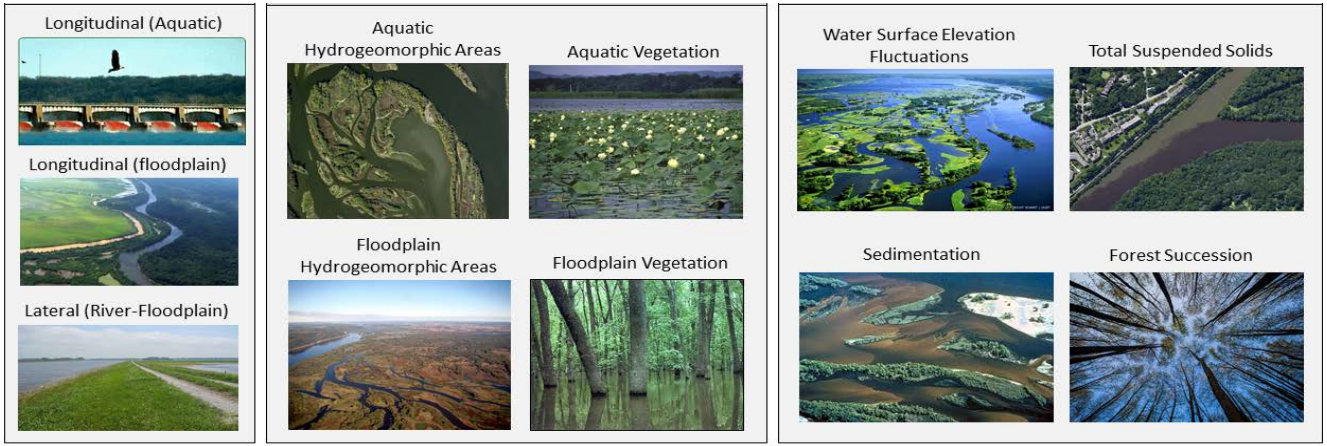
- Applied concepts of general resilience (Biggs et al. 2015)
  - Maintain diversity and redundancy
  - Maintain connectivity
  - Manage controlling variables & feedbacks
- Indicators were developed and reviewed by partnership at a 3-day workshop
- Provide insight into current coping capacity of the UMRS reaches



Bouska et al. *In Review.*

Ecological Resilience Assessment: Habitat Needs Assessment

- System-wide indicators of ecosystem structure and function
  - Used to assess the desirability of current conditions and identify restoration and management needs



De Jager et al. *In Press*.

USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: General Resilience

Upper Impounded	Middle Impounded	Pool 15	Lower Impounded	Open River	Upper Illinois	Lower Illinois
Total Suspended Solids (TSS)	Tailwater Flux	Leveed Area	FP Functional Class		Leveed Area	% Time Gates Open
Tailwater Flux	Leveed Area	Pool Flux	FP Veg	% Time Gates Open	AFC1	Tailwater Flux
Aquatic Vegetation (Aq Veg)	Pool Flux	Tailwater Flux	AFC2	TSS	Open Water	AFC1
Leveed Area	FP Functional Class	FP Functional Class	AFC1	FP Functional Class	% Time Gates Open	Leveed Area
Floodplain Vegetation (FP Veg)	Natural Area	FP Veg	% Time Gates Open	FP Veg	Pool Flux	Natural Area
Open Water	% Time Gates Open	Aq Veg	TSS	AFC2	Tailwater Flux	Pool Flux
Natural Area	TSS	AFC2	Pool Flux	AFC1	FP Veg	FP Functional Class
Pool Flux	FP Veg	% Time Gates Open	Tailwater Flux	Natural Area	AFC2	FP Veg
Floodplain Functional Class (FP Functional Class)	Aq Veg	TSS	Open Water	Tailwater Flux	Natural Area	Open Water
Aquatic Functional Class 2 (AFC2)	AFC2	AFC1	Natural Area	Open water	TSS	TSS
Aquatic Functional Class (AFC1)	AFC1	Open Water	Leveed Area	Leveed Area	FP Functional Class	AFC2
% Time Gates Open	Open Water	Natural Area	Aq Veg	Aq Veg	Aq Veg	Aq Veg

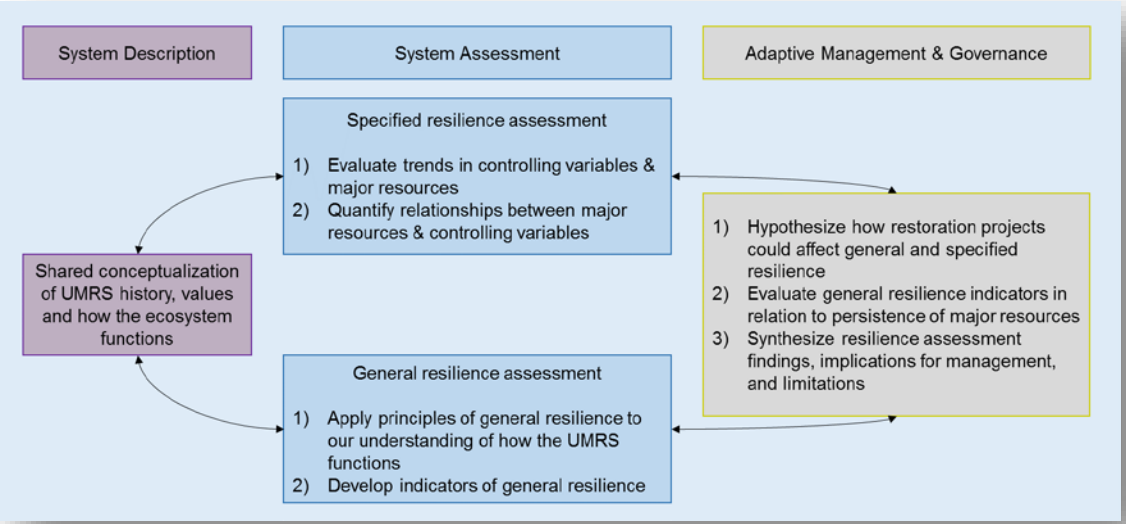
USGS

McCain, Schmuecker, and De Jager. *In Review*.

Upper Mississippi River Restoration

Ecological Resilience Assessment: Next steps

Evaluate potential effects of restoration projects on resilience of the UMRS



USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: Lessons Learned

- Building relationships between scientists, managers, and planners is key to integration of science into restoration practices
  - Constraints on all ends are difficult to be aware of without conversation
  - Anticipate clashes between big-picture and site-specific thinkers
  - Requesting feedback to a written document was more effective than a presentation

USGS

Upper Mississippi River Restoration

Ecological Resilience Assessment: Anticipated Outcomes

Improved understanding of

- desirability of current state and adaptive capacity of UMRS
- regime shifts as they relate to the UMRS and identification of controlling variables
- potential impacts of management and restoration activities on resilience

USGS

Upper Mississippi River Restoration

Acknowledgements

Resilience Working Group

Dave Bierman (IDNR)
Kristen Bouska (USGS)
Andy Casper (INHS)
Bob Clevenstine (FWS)
Sarah Schmuecker (FWS)
Nate De Jager (USGS)
Shawn Giblin (WDNR)
Kenn Barr (USACE)
Jon Hendrickson (USACE)
Dave Herzog (MDC)
Jeff Houser (USGS)
Marvin Hubbell (USACE)
Kirsten Mickelsen (UMRBA)
Nate Richards (USACE)
Levi Solomon (INHS)
Steve Winter (FWS)