LTRM 101: Connections among monitoring, research, and habitat rehabilitation

Habitat Rehabilitation and Enhancement Projects Workshop
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Why Long Term Resource Monitoring as part of the UMRR?

Complex system

Complex challenges

Multiple uses

Many agencies and organizations responsible for management or restoration of the river

Photo credit: John Sullivan

"lack of information has made it difficult for federal and state agencies to manage the river system for the competing uses."

--1982. Upper Mississippi River Basin Commission

Science in support of river restoration and management

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

Habitat rehabilitation
- Which habitats?
- Where?
- How?
- How'd we do?

Science and Monitoring (LTRM)
- Current condition of the river?
- How is it changing?
- How does the river function?
- How do management/rehabilitation actions affect the river?

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UMRR Long Term Resource Monitoring and Science

- **20+ years of data**
  - Study reaches (water quality, vegetation, fish, *inverts*)
    - 6 study reaches spanning the broad range of conditions within the UMRS
    - Standardized study design and methods
  - Systemic data:
    - Land cover data (every 10 years)
    - Lidar + bathymetry = "topobathy"
  - Centrally stored, and made publicly accessible in raw, summarized, and graphical formats

- **Extensive network of infrastructure, expertise, and collaboration**

- **Improved understanding of the UMRS**
  - Results of extensive analysis of the long-term data, and associated research projects have improved our understanding of the UMRS, and can inform rehabilitation projects and river management.

≡ **USGS**

http://www.umesc.usgs.gov/ltrmp.html

Systemic data: Topobathy

Lidar/bathymetry seamless data layers combined into a seamless elevation dataset that can be used for a variety of modeling efforts and habitat rehabilitation project planning
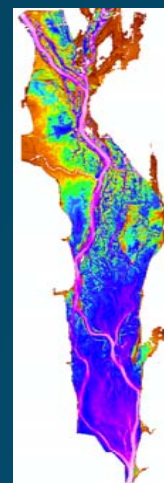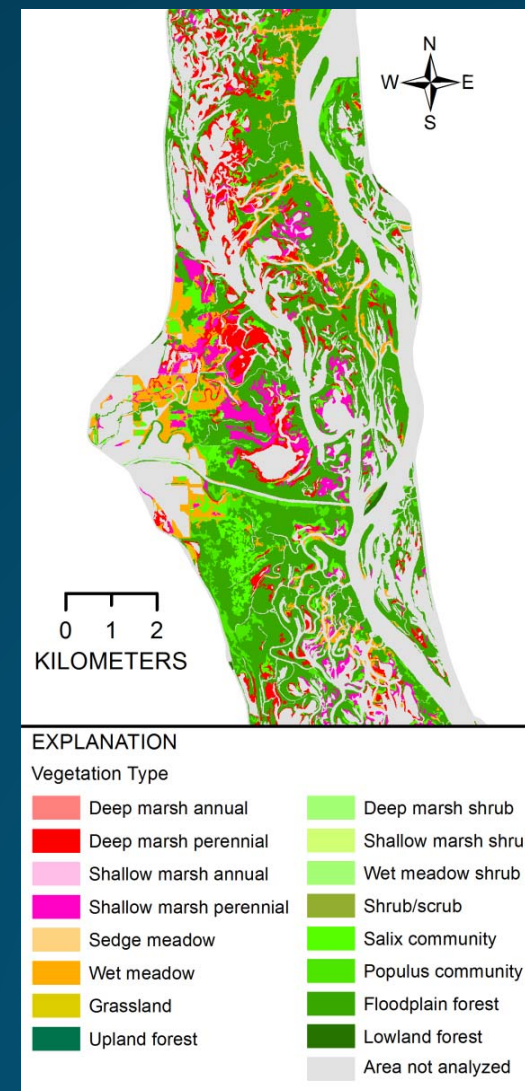

GPS satellites
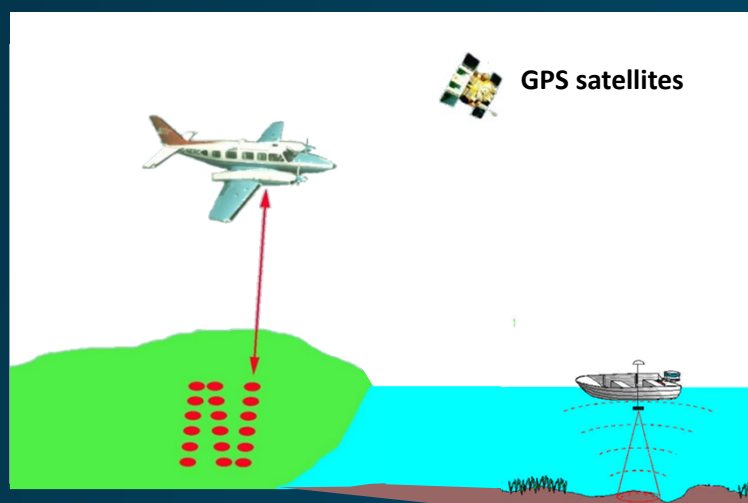
Topography (lidar)   +   Bathymetry   =   Topobathy

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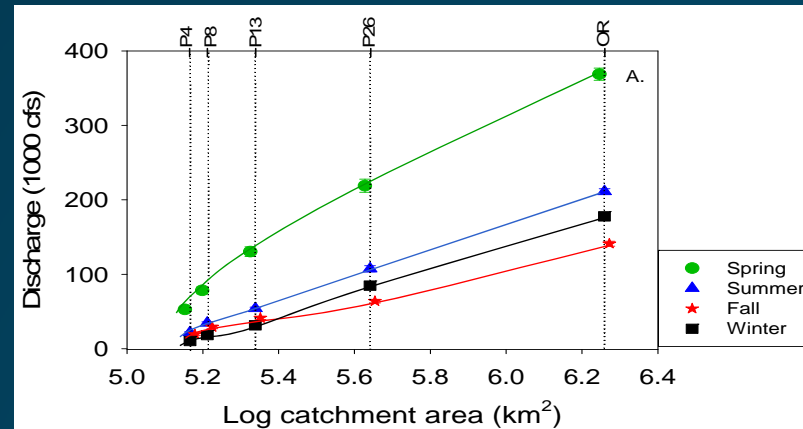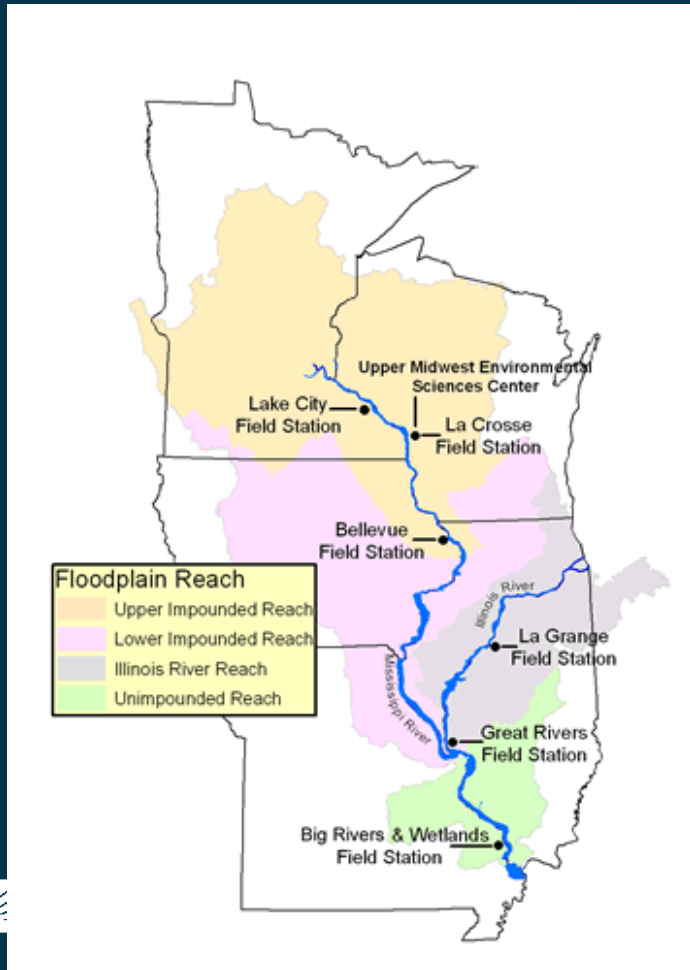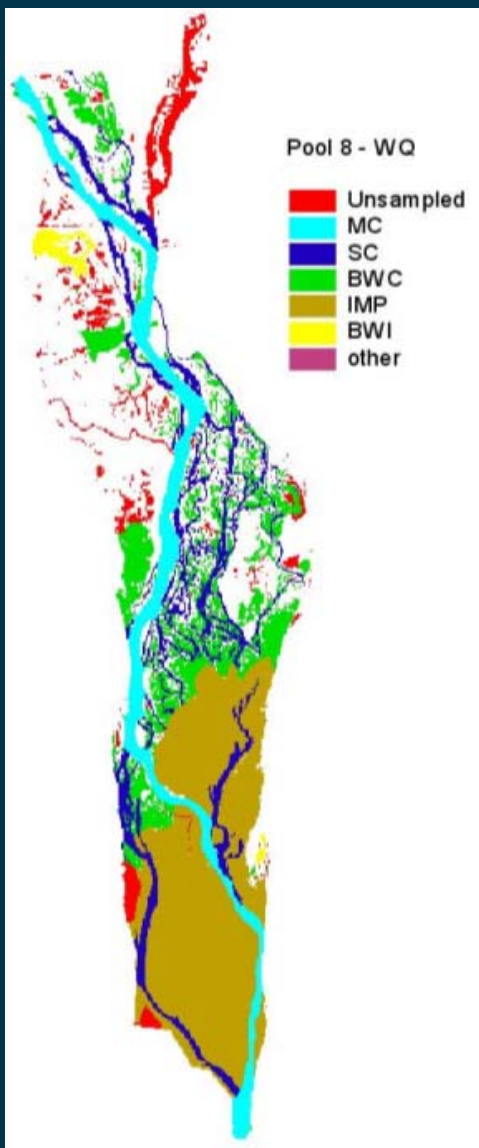Upper Mississippi
River Restoration

Systemic data: Land cover / land use

- Land cover/land use (LCLU) data for the UMRS help understand the system, determine resource trends and impacts, and develop management alternatives.
- Systemic high-resolution LCLU data sets for the UMRS have been created for 1890s, 1975, 1989, 2000, 2010/11.
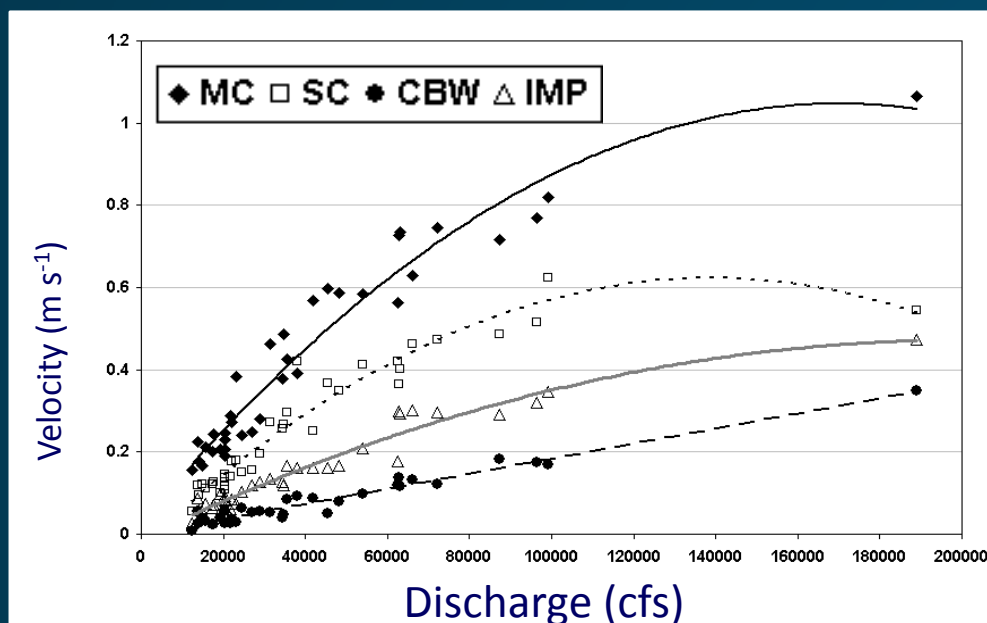

EXPLANATION
Vegetation Type

Deep marsh annual	Deep marsh shrub
Deep marsh perennial	Shallow marsh shrub
Shallow marsh annual	Wet meadow shrub
Shallow marsh perennial	Shrub/scrub
Sedge meadow	Salix community
Wet meadow	Populus community
Grassland	Floodplain forest
Upland forest	Lowland forest
	Area not analyzed

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Upper Mississippi
River Restoration

Detailed fish, vegetation, and WQ data collected annually from six study reaches that span informative gradient of environmental conditions
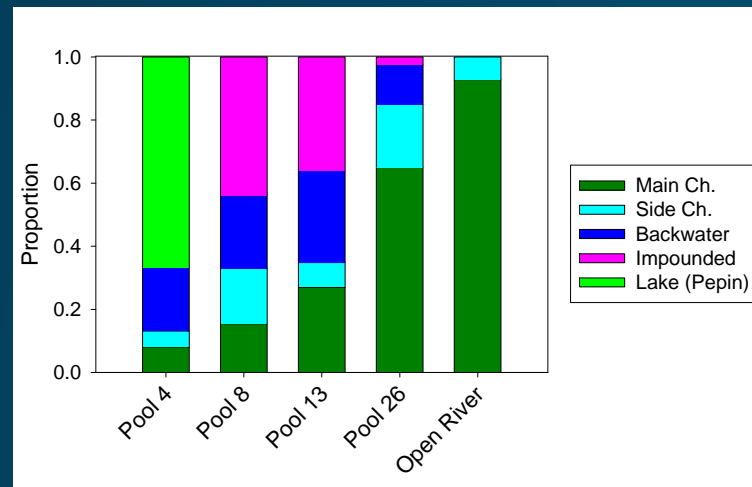
Within study reaches LTRMP Sampling Strata include a diversity of conditions

Stratum	Depth	Current	Sediment
Main Channel	Deep	Fast	Sandy, inorganic
Side Channel			
Impounded			
Backwater	Shallow	Slow	Fine, organic

http://www.umesc.usgs.gov/ltrmp.html

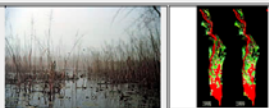WQ graphical browser
Pool 13 Turbidity in main channel and backwater
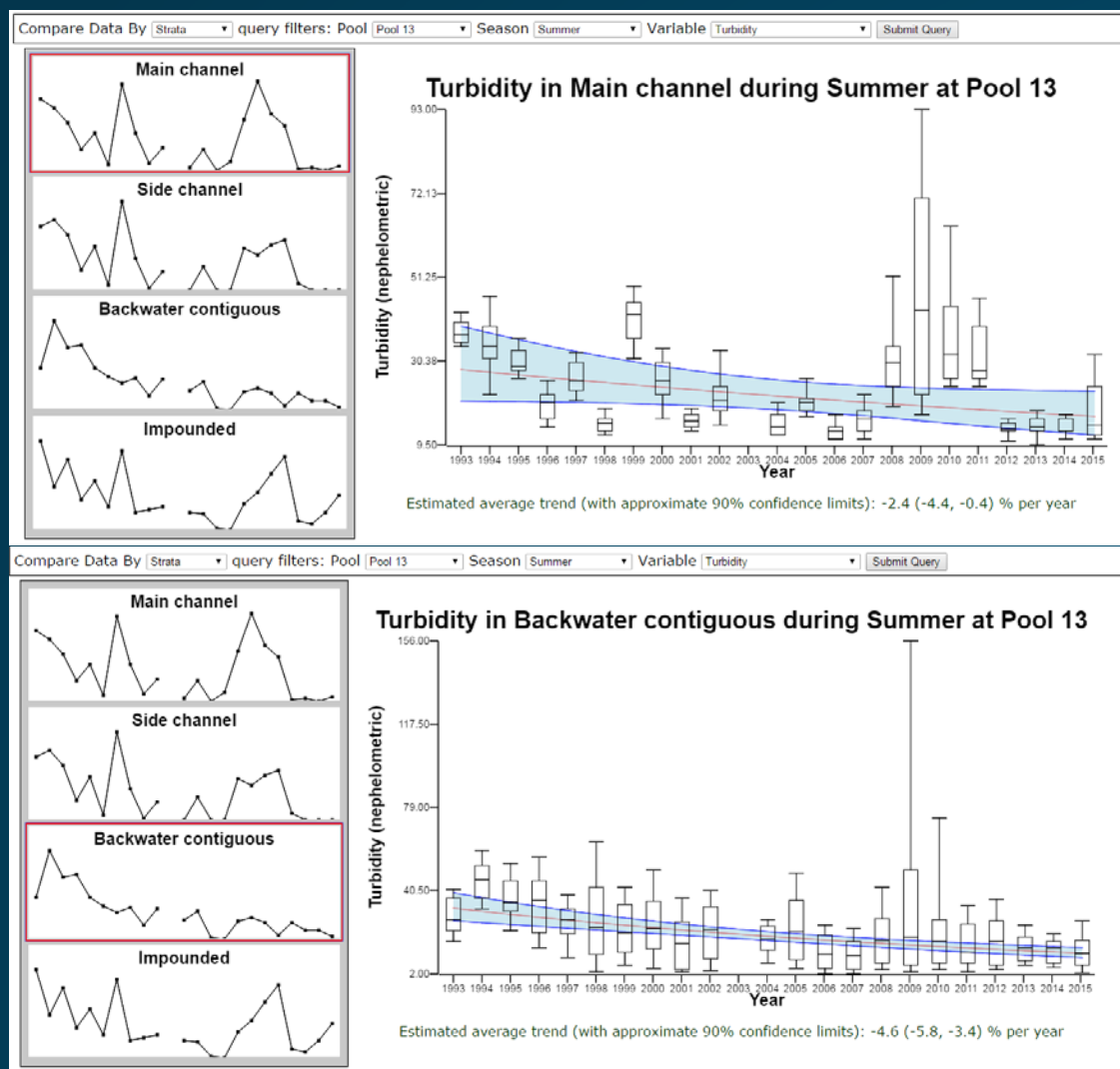
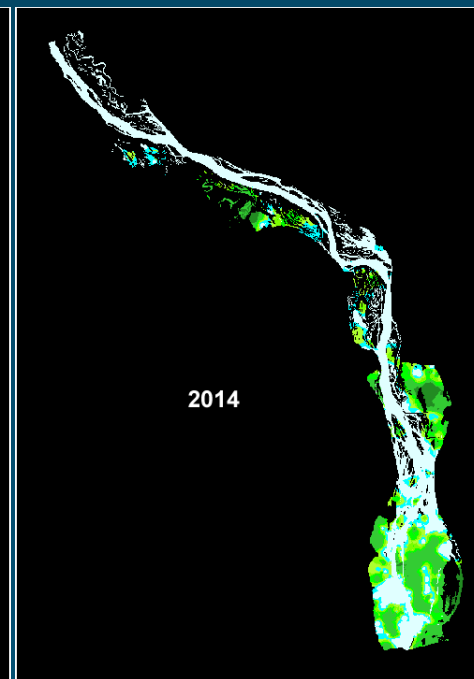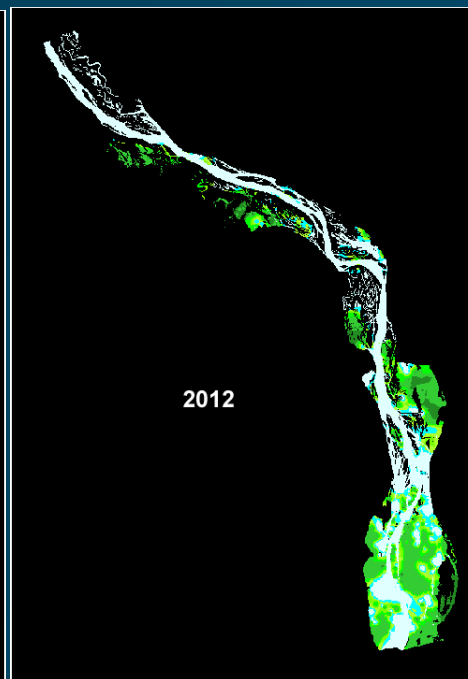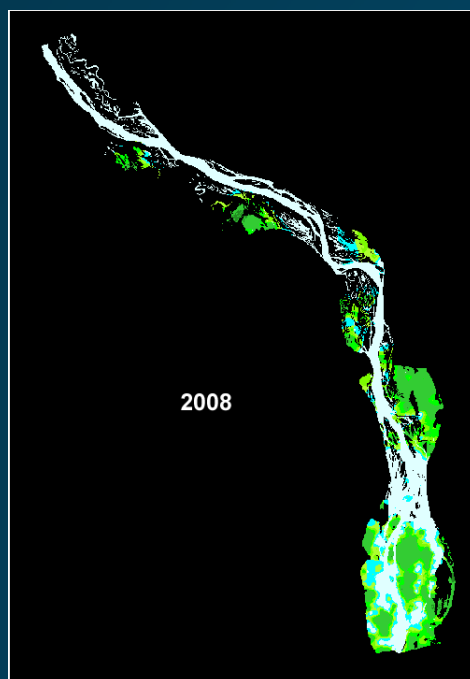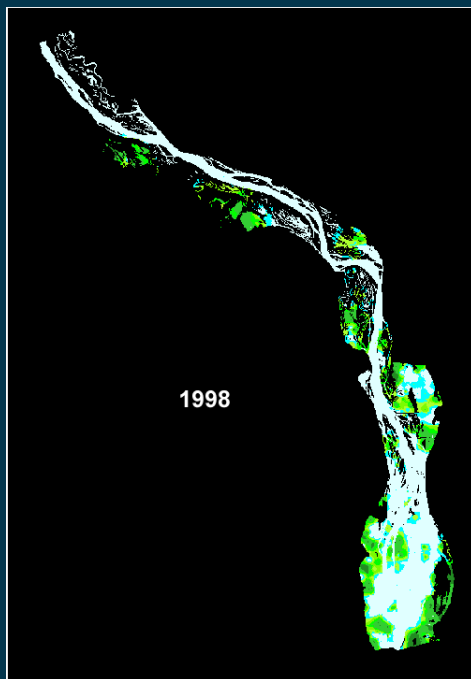http://www.umesc.usgs.gov/data_library/water_quality/graphical/wq_browser.html

Vegetation surface maps: Pool 13

Fish Graphical Data Browser: Silver Carp
(Day electrofishing)

Pool 26

Max ≈ 12

Max ≈ 5

Max ≈ 220

http://www.umesc.usgs.gov/data_library/fisheries/graphical/fish_front.html

Fish Graphical Data Browser: Silver Carp
(Day electrofishing)

CrossMark

ORIGINAL PAPER

Max

Max

Long-term changes in fish community structure in relation to the establishment of Asian carps in a large floodplain river

Levi E. Solomon · Richard M. Pendleton ·
John H. Chick · Andrew F. Casper

Max

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http://www.umesc.usgs.gov/data_library/fisheries/graphical/fish_front.html

Long-term monitoring and research can support and inform habitat rehabilitation and river management

- Describe current condition of the UMRS
  - What problems need solved?
  - Provides better understanding of basic structure and function of the river to inform river management and restoration.
- Provide useful information for river restoration and management
  - Existing data and expertise
  - Models using this data may improve predictions of HREP effects and project design
  - Provide context required for effective shorter-term, smaller-scale studies of HREP effectiveness.
- Directly study effects of some HREPs

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Upper Mississippi
River Restoration

River condition: Vegetation recovery in Upper Impounded reach

Pool 8

Pool 8

Pool 26
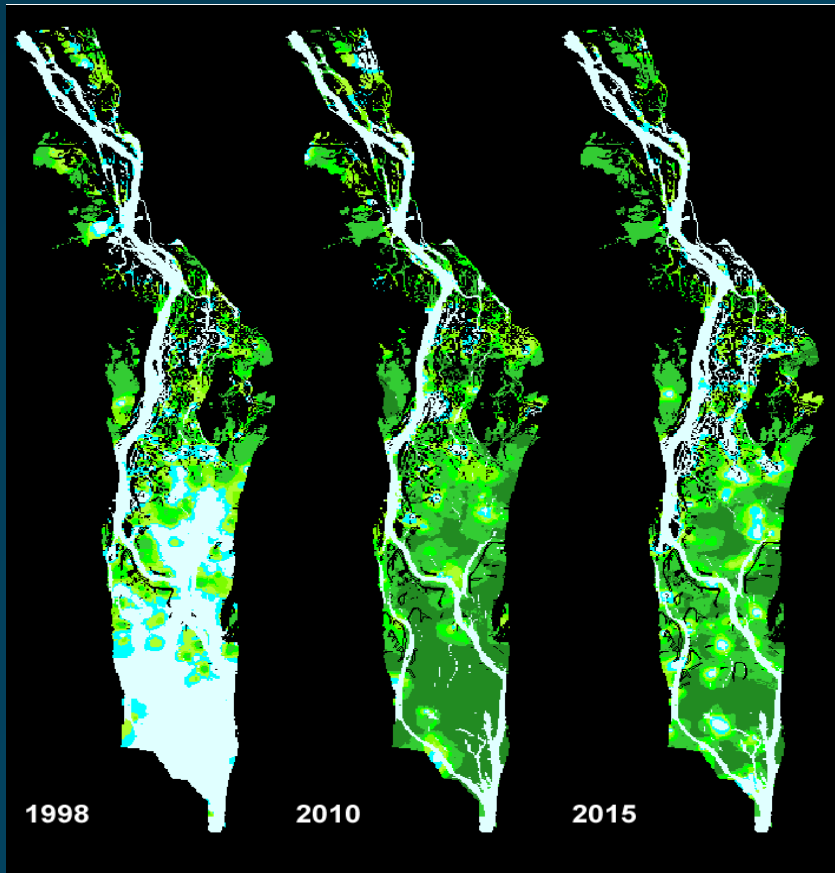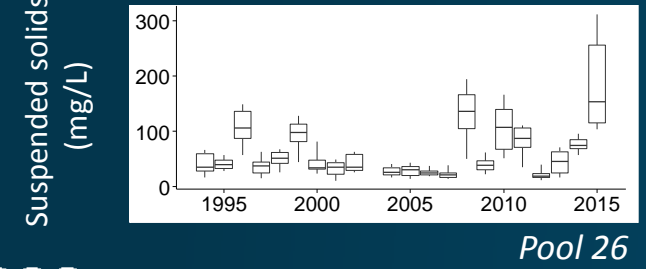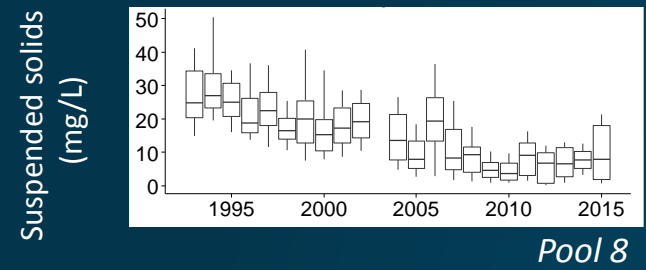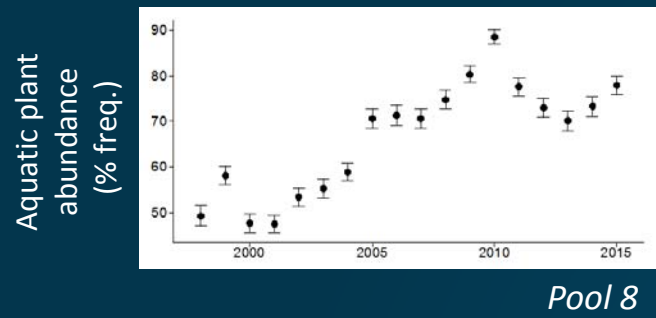
Models that estimate effects of island configuration applied to Harper's Slough scenarios

Weighted wind fetch

Suspended sediment probability

Rohweder and others. 2012. Application of Wind Fetch and Wave Models for Habitat Rehabilitation and Enhancement Projects – 2012 Update.
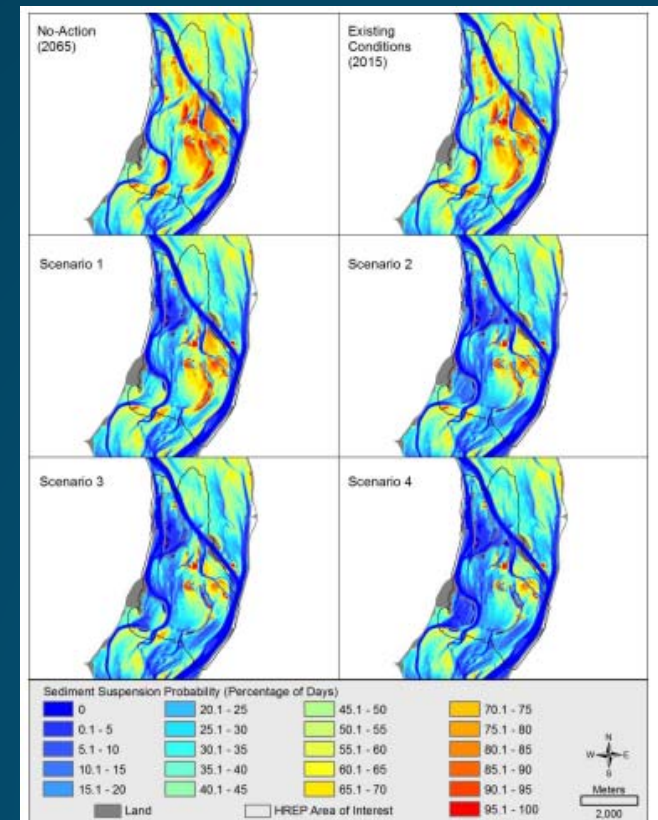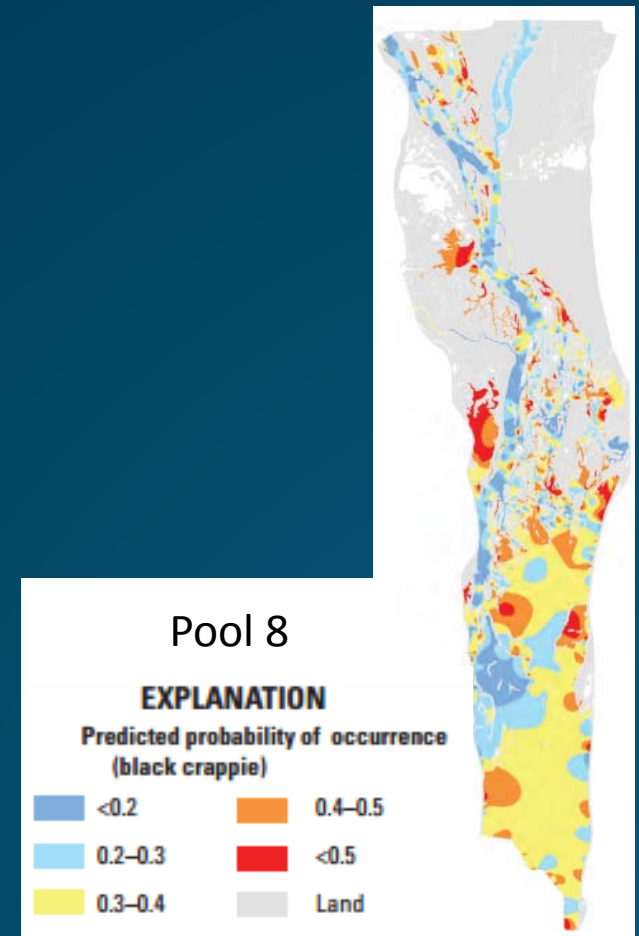
Understanding the river: models that estimate effects of changing basic environmental drivers to inform river restoration

Example: Use analysis of long term monitoring data to build a model that predicts vegetation abundance from basic environmental drivers.

Yin & others. Submersed aquatic vegetation model
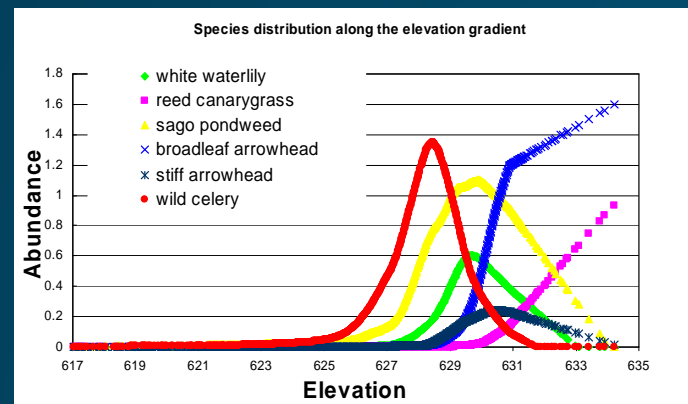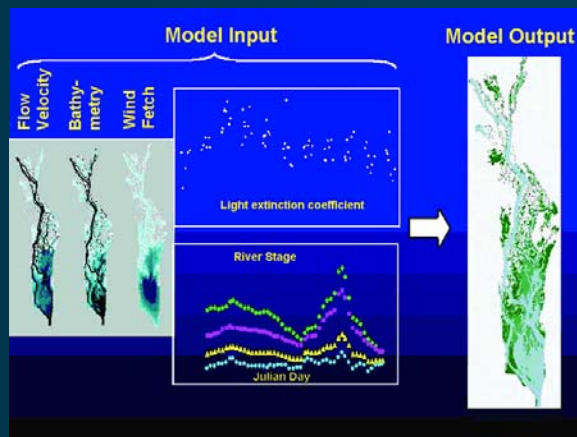
Understanding the river: models that predict fish distribution

- Spatially Explicit Habitat Models for 28 Fishes from the Upper Mississippi River System (AHAG 2.0)
  - Brian S. Ickes, J.S. Sauer, N. Richards, M. Bowler, and B. Schlifer
- Based on LTRM fisheries and environmental data
- Current: Use the maps to evaluate distribution of suitable habitat for selected fish species
- Future: use models for pre- and post- project comparisons

Pool 8

EXPLANATION
Predicted probability of occurrence
(black crappie)

<0.2	0.4–0.5
0.2–0.3	<0.5
0.3–0.4	Land

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Upper Mississippi River Restoration

Analysis of LTRMP monitoring data to detect effects of HREPs in study reaches
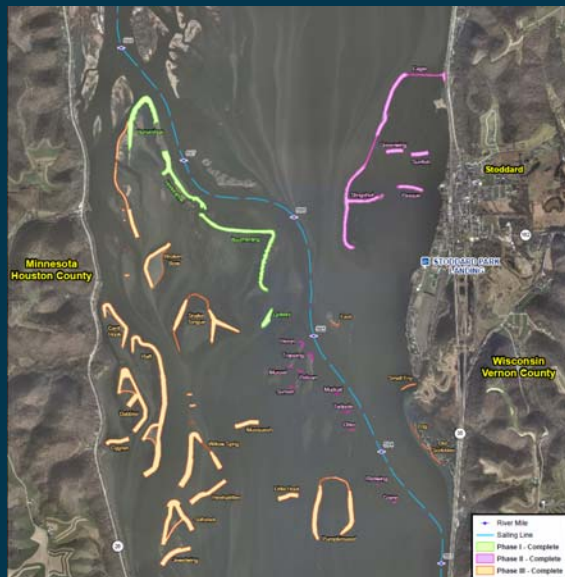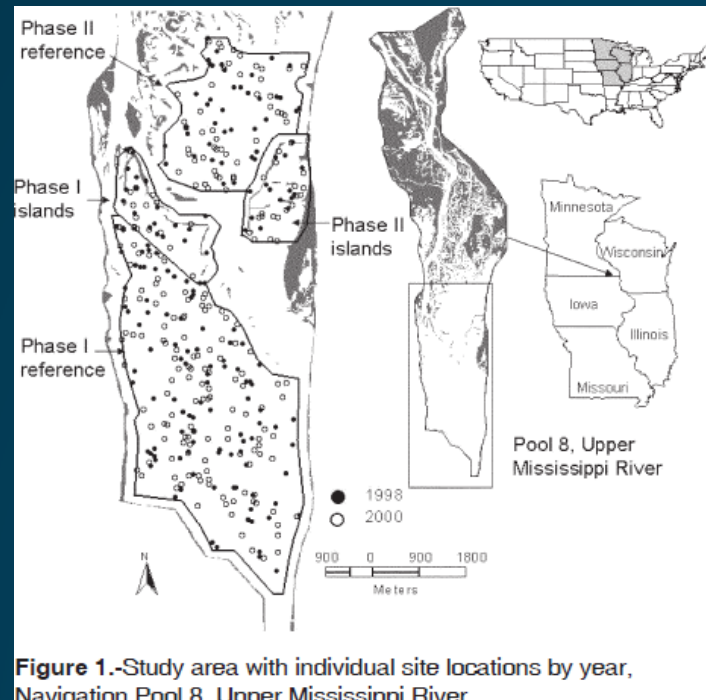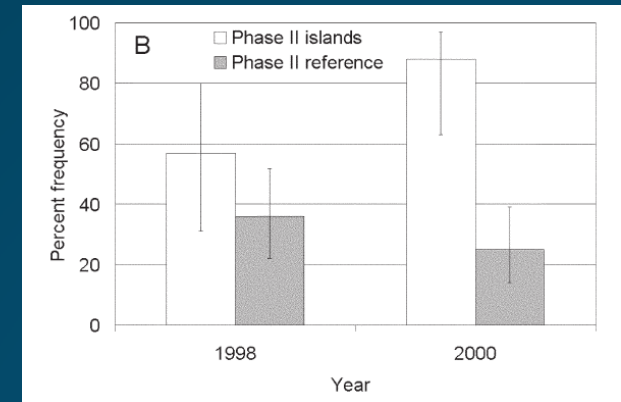

Pool 8 Islands

Figure 1.-Study area with individual site locations by year, Navigation Pool 8, Upper Mississippi River.

Langrehr, Gray & Janvrin. 2007

Moving forward

- Continue use LTRM data to learn about how the river functions and better anticipate how it will respond to management and rehabilitation actions
- What are the largest sources of uncertainty for the biological/ecological responses to HREPs?
- Look for opportunities to learn from the effects of restoration and management actions. Examples:
  - Pool 12 overwintering studies
  - Possible modifications to Peterson Lake HREP to further reduce connectivity with channel
    - Effects on distribution of water velocity, temp and DO?
    - Effects on vegetation distribution and abundance?

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Who to contact with your questions / ideas:
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