Upper Mississippi River Restoration Program Coordinating Committee Quarterly Meeting

August 9, 2017

Highlights and Action Items

Program Management

- **UMRR's total FY 17 allocation is $33.17 million**, including $20 million from the FY 17 Consolidated Appropriations Act and an additional $13.17 million from the Corps' work plan. Allocations within the program are as follows:
  - Regional Administration and Programmatic Efforts – $1,235,400
  - Regional Science and Monitoring – $9,385,000
    - Long term resource monitoring – $4,610,000
    - Regional science in support of restoration – $3,500,000
    - Regional science staff support – $100,000
    - Habitat project evaluations – $975,000
    - Habitat Needs Assessment II – $200,000
  - Habitat Restoration – $22,549,000
    - Regional project sequencing – $100,000
    - MVP – $7,683,100
    - MVR – $5,050,000
    - MVS – $9,716,500

- **The President's FY 18 budget includes $33.17 million for UMRR. The House and Senate Appropriations Committees matched that funding level in their respective FY 18 energy and water appropriations measures.** The final budget outcome remains unknown.

- **District staff are working with Corps Headquarters on UMRR's FY 19 budget proposal.** Due to continued funding levels at $33.17 million in FYs 17-18, the District is directed to plan for full federal funding in FY 19.

- **The 2016 UMRR Reports to Congress are printed and available upon request. The report is also available on UMRR's website (linked here).**

- **Angie Fryermuth will no longer be able to dedicate substantial time to UMRR external communications and outreach. UMRR Coordinating Committee members underscored the value of external communications, noting its priority as a goal in the 2015-2025 Strategic Plan. In response to a request for UMRBA to implement external communications strategies, Marv Hubbell said Col. Baumgartner does not want to contract out UMRR's communications. In response, members acknowledged the importance for partners to engage the public and other external audiences if the Corps is not able to do so. Committee members agreed to develop a more detailed recommendation for implementing a UMRR communications strategy.**

- The UMRR Communications Team met via conference call on June 14 and August 2, 2017. The Team is developing folders with communications materials for partners to readily distribute as external outreach and engagement opportunities arise.

- Recent and upcoming external communications and outreach activities are:
  - September 9 – UMESC Open House will include a UMRR booth.
  - September 19-21 – Mississippi River Parkway Commission will hold its annual meeting in Marquette, Iowa.
  - July 11 – Mississippi River Connections Collaborative included a presentation regarding opportunities to partner with UMRR.
  - July 6-7 – Wisconsin DNR provided a tour of the Mississippi River to Wisconsin Wetlands Association.
  - Discovery Channel is developing a six-part series on the Mississippi River and interviewed various partners, including Megan Moore and Illinois DNR representatives.
  - Washington Post is developing an interactive piece that will likely be published in fall 2017.

UMRR Showcase Presentations

- Tom Novak discussed the design of Harpers Slough and the knowledge gained from its construction, including adding features to provide access to islands for critters and seeding techniques to also encourage natural volunteers like cottonwood trees.

- Bill Richardson overviewed current research at the Maquoketa confluence into the Mississippi River to quantify the effect of floodplain-river connectivity for the removal of sediment, nutrients, and carbon. So far, findings suggest that:
  - Large quantities of sediment, carbon, nitrogen, and phosphorous are captured within a small reconnected section of tributary floodplain.
  - Large quantities of nitrogen are permanently removed from floodplains through denitrification.
  - Lack of river-floodplain connectivity hinders the process of sediment, carbon, and nutrient removal.
  - Floodplain soils are primed to secure or release stored phosphorous depending on concentrations of phosphorous in floodwaters.

Habitat Needs Assessment

- **Major milestones in the current HNA II development schedule is as follows**:
  - September 5: Steering Committee webinar to review a draft Information Development Summary Report and determine a process for review by partner agencies and the river teams
  - September 29: Draft systemic data layers are made available to partners for review
  - October: Partner webinar to showcase available HNA data layers
  - November 7: Final systemic data layers are published
  - November 8: UMRR Coordinating Committee meeting includes an update on the HNA II development process
  - February 7: UMRR Coordinating Committee meeting includes an update on the HNA II development process
  - March 1-31: Steering Committee and river teams review the draft HNA II Report

- May 2018: UMRR Coordinating Committee consider approval of HNA II Report as written for use in a public review
- May-June: Public review of HNA II Report
- August 2018: UMRR Coordinating Committee considers endorsement of final HNA II Report

- Nate De Jager discussed the HNA II's framework for relating the UMRS goals and objectives, Essential Ecosystem Characteristics (EECs) and quantitative measures (indicators) of ecosystem structure, function, and resilience. **Pending additional input, a draft document explaining this framework will be distributed to the HNA II Steering Committee soon.**

- **In response to questions from the UMRR Coordinating Committee, Hubbell said the HNA tri-chairs will consult with the UMRR Communications Team about the public review process.**

UMRR Database

- Kayleigh Thomas presented on the purposes, design, construction, and applications of the UMRR Database as well as ongoing work to develop capabilities to generate program- and project-level reports and analyses.

Habitat Restoration

- MVS is planning several habitat projects in the open river reach, including Crains Island, Harlow Island, and Oakwood Bottoms. Design work on Clarence Cannon is complete and will be the District's primary construction investment in FY 18. MVS is finalizing construction work on the Ted Shank's pump station and will turn that project over to Missouri DoC soon. In addition, the District recently completed the Pool 25 and 26 Islands O&M Manual and sent a close-out letter to Illinois.

- Conway Lake is preparing to award a construction contract this fiscal year. This project is critical to maintaining full FY 17 execution. Hubbell expressed sincere appreciation to the staff within the District and Division who worked extremely hard on the project.

- MVR is developing plans and specs for Beaver Island, anticipating construction starting in FY 18. The District's completed repairs from the Rice Lake flood damages and is planning a ribbon cutting ceremony this fall. MVR plans to turn the Rice Lake project over to Illinois by September 1.

- USACE is preparing to start a partnership process to select the next generation of habitat projects when the ecological resilience and HNA II work is complete. Efforts are underway to select a few projects within each District in the interim.

Long Term Resource Monitoring and Science

- Accomplishments of the third quarter of FY 17 include the publication of two technical reports regarding:
  - Mapping areas invaded by Reed canary grass in Pools 2-13
  - Detecting *Potamogeton crispus* in LTRM summer surveys, estimating its seasonal biomass and nutrient standing stocks, and linking it to water quality conditions in Pools 7 and 8

- Publication is pending final review on a manuscript describing the fundamental relationships affecting the UMRS's ecological resilience. **A draft manuscript of general resilience indicators will be provided to the UMRR resilience work group in early September.** The indicators were updated following input at the May 2017 UMRR Joint Workshop of Ecosystem Resilience and HNA II. **Next steps of the ecological resilience**

effort include 1) analyzing data for developing specified resilience indicators and 2) hosting a resilience work group web-based conference call in September.

- **In light of UMRR's increased FY 17 budget, an additional $2.5 million is available for science-related projects. Hubbell will submit a formal proposal in mid-August to the UMRR Coordinating Committee for funding specific research and equipment needs and will ask the Committee for its review in September.** The Committee's endorsement will be needed with sufficient time for the Corps to execute funding agreements before the end of FY 17. Jeff Houser provided more detailed information about each research proposal.

- The standard process for utilizing two SOWs for LTRM will occur again in FY 18, with a SOW developed for LTRM base monitoring and a second SOW developed for science in support of restoration and management.

- The A-Team will review the FY 18 proposals for science in support of restoration and management at its January 2018 meeting. The proposals will then be presented to the UMRR Coordinating Committee at its February 2018 quarterly meeting for consideration of endorsement.

- The A-Team met remotely on August 1, 2017 to discuss the UMRR ecological resilience effort, science research proposals, and the next Status and Trends Report. In addition, Sara Tripp presented on managing the UMRS as a migratory swimway for fish. The A-Team's next meeting will be held in conjunction with the UMRCC Fish Tech Group on October 3, 2017 in Lake Pepin.

Other Business

- **MVD recently employed a reorganization. Under the new structure, Brian Chewning will be the Division's new liaison to the UMRS and will be co-chairing UMRR Coordinating Committee meetings. Hubbell thanked Don Balch for all of his work on behalf of the UMRS and UMRR over the past few years.**

- **Hubbell also expressed appreciation to Dave Hokanson for his contributions to UMRR over his tenure with UMRBA. Hokanson accepted a new position at Minnesota Department of Health. Hubbell congratulated Kirsten Mickelsen on her promotion to Executive Director of UMRBA.**

- **Upcoming quarterly meetings are as follows:**
  - **November 2017 — St. Paul**
    - UMRBA quarterly meeting — November 7
    - **UMRR Coordinating Committee quarterly meeting — November 8**
  - **February 2018 — Quad Cities**
    - UMRBA quarterly meeting — February 6
    - **UMRR Coordinating Committee quarterly meeting — February 7**
  - **May 2018 — St. Louis**
    - UMRBA quarterly meeting — May 15
    - **UMRR Coordinating Committee quarterly meeting — May 16**

UPPER MISSISSIPPI RIVER RESTORATION (UMRR) PROGRAM COORDINATING COMMITTEE

AUGUST QUARTERLY MEETING

Marvin E. Hubbell – MVR

Regional UMRR Program Manager

Mississippi Valley – Rock Island District (MVR)
Mississippi Valley – St. Louis District (MVS)
Mississippi Valley – St. Paul District (MVP)

May 24, 2017

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USGS
science for a changing world

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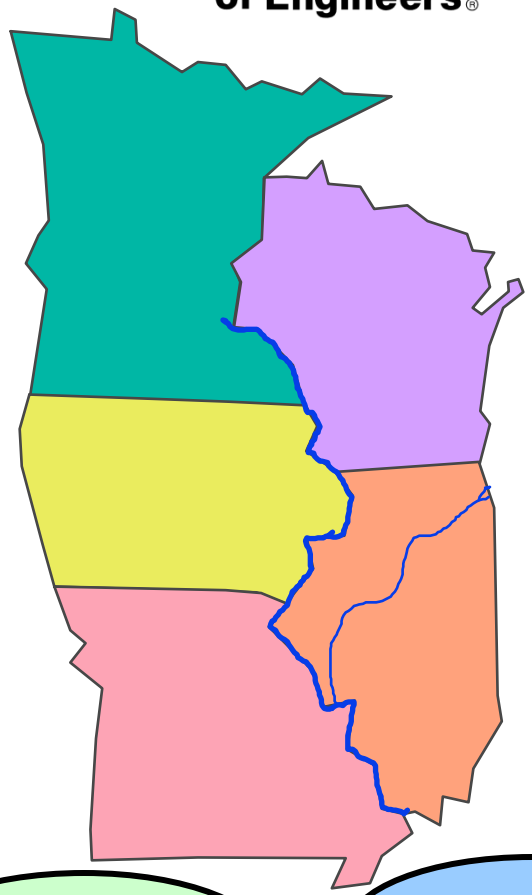
U.S. FISH & WILDLIFE SERVICE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

USDA



PUBLIC

NGO's

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FY 17

PBUD	$ 20,000,000
Omnibus Bill	$ 20,000,000
Appropriation	$ 20,000,000
FY17 Work plan	$ 13,170,000
FY17 Total	$ 33,170,000

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FY17 PLAN OF WORK

TOTAL FY17 Program	**$20,000,000**
Regional Administration and Program Efforts	**$ 761,000**
Regional Management	$ 543,000
Program Database	**$** 75,000
Program Support Contract (UMRBA)	$ 78,000
Public Outreach	$ 50,000
2016 Report to Congress	$ 15,000
Regional Science and Monitoring	**$ 6,764,000**
LTRM (Base Monitoring)	**$** 4,610,000
UMRR Regional Science In Support Rehabilitation/Mgmt. (MIPR's, Contracts, and Labor)	$ 1,000,000
UMRR Regional (Integration, Adapt. Mgmt.)	$ 129,000
Habitat Evaluation (**split equally between MVS,MVR,MVP**)	$ 975,000
HNA II	$ 150,000
District Habitat Rehabilitation Efforts (Planning and Construction)	**$12,475,000**
Rock Island District	$ 4,363,600
St. Louis District	$ 4,005,700
St. Paul District	$ 4,005,700
Model Cert. (AHAG)	$ 100,000

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FY17 PLAN OF WORK

TOTAL FY17 Program	**$33,170,000**
Regional Administration and Program Efforts	**$ 1,235,400**
Regional Management	$ 1,000,400
Program Database	**$** 90,000
Program Support Contract (UMRBA)	$ 80,000
Public Outreach	$ 50,000
2016 Report to Congress	$ 15,000
Regional Science and Monitoring	**$9,385,000**
LTRM (Base Monitoring)	**$** 4,610,000
UMRR Regional Science In Support Rehabilitation/Mgmt. (MIPR's, Contracts, and Labor)	$ 3,500,000
UMRR Regional (Integration, Adapt. Mgmt.)	$ 100,000
Habitat Evaluation (**split equally between MVS,MVR,MVP**)	$ 975,000
HNA II	$ 200,000
District Habitat Rehabilitation Efforts (Planning and Construction)	**$22,549,600**
Rock Island District	$ 5,050,000
St. Louis District	$ 9,716,500
St. Paul District	$ 7,683,100
Model Cert. (AHAG)	$ 100,000

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FY 18 PBUD

President's Budget	$ 33,170,000
House	$ 33,170,000
Senate	$??????
FINAL APPROPRIATION	$??????

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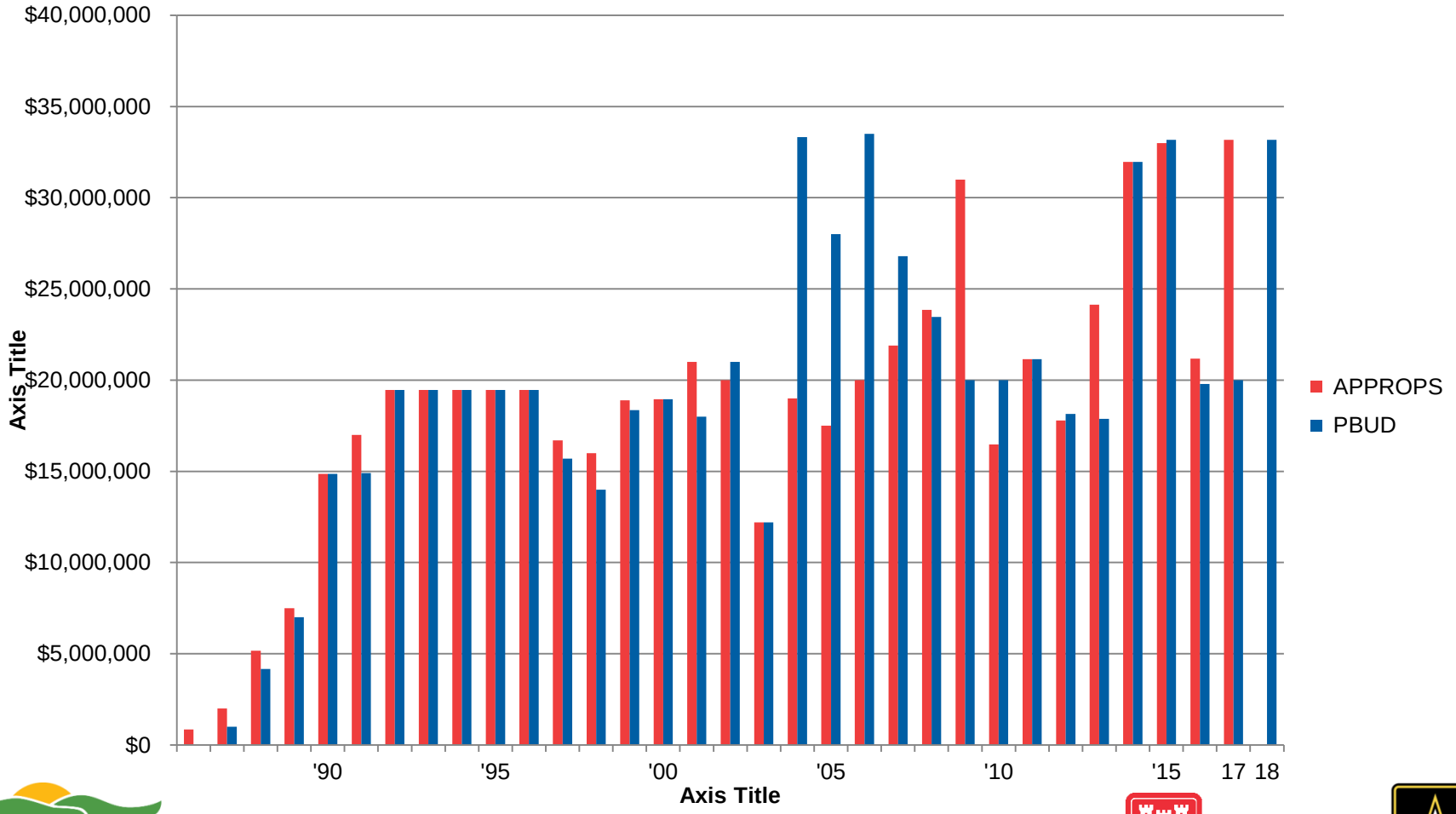
UMRR PROGRAM
APPROPRIATION/BUDGET HISTORY



FY1985 to FY2018

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UMRR SIX YEAR PLAN

HREP Feasibility Phase
HREP P&S Phase
HREP Construction Phase
HREP O&M Phase

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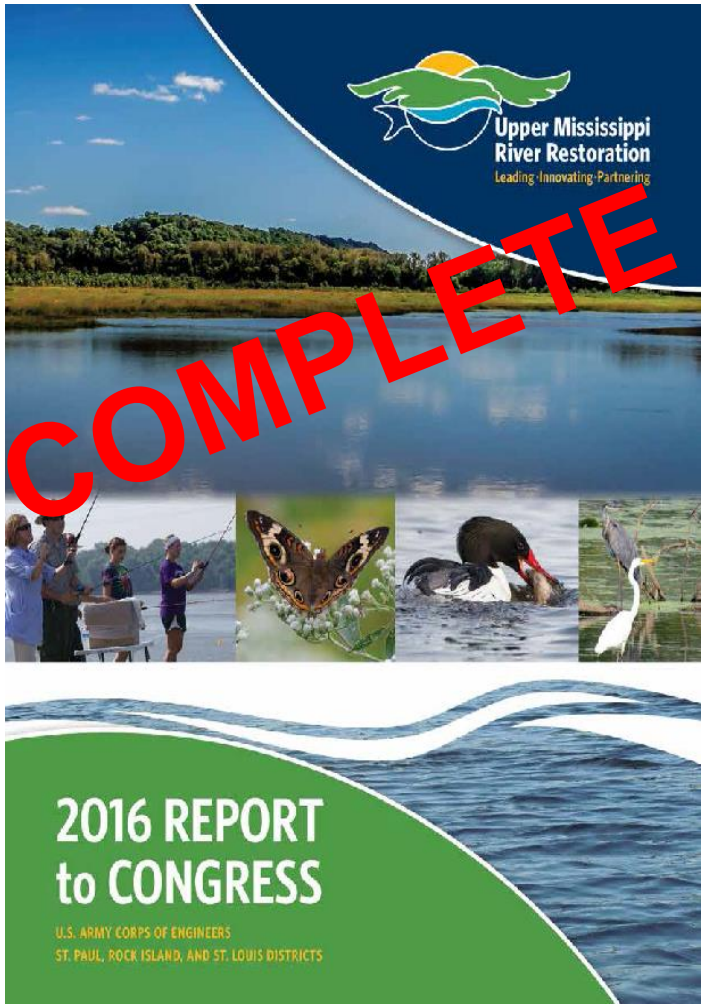
REPORTS TO CONGRESS



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PUBLIC COMMUNICATIONS AND OUTREACH

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PUBLIC COMMUNICATIONS AND OUTREACH

UMRR External Communications Strategy

- Team met on August 2, 2017
  - Angie Freyermuth – Lead
  - Karen Hagerty – Corps
  - Harland Hiemstra – MN
  - Randy Hines – UMESC
  - Kirsten Mickelsen – UMRBA
  - Marty Atkins - NRCS
  - Neal Jackson - FWS
  - Would like representatives from TNC, USEPA and another state

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PUBLIC COMMUNICATIONS AND OUTREACH

UMRR External Communications Strategy

Potential tasks to improve communications:

- UMRR folder with talking papers on select issues
- Investigating a UMRR.org address
- Investigating a UMRR Facebook page
- Developing signage for projects and field stations
- Developing UMRR Program handouts

Next meeting - April

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FARMERS FOR UMRR

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UMRR SHOWCASE

LTRM

McGregor HREP

Tom Novak

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HABITAT NEEDS ASSESSMENT II

Overview and Schedule

- Key efforts:
  - HNA II what is it and
  - Revised Schedule

Science Details

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HABITAT NEEDS ASSESSMENT II

Revised Schedule

Draft paper on scientific overview and rational	Aug. 15
Steering Committee webinar rational paper	Sept. 7
Functional Class working subgroup review	Aug. 15
Steering Co. webinar to review rational paper	
Complete review of FC existing conditions	Sept. 29
Agency review of rational paper	Sept. 29
Draft Systemic data layers complete	Sept. 29
Webinar on how to review systemic data	Oct. 7
Partnership review of systemic data layers	Oct. 31
Linking data layer with mgmt. needs	Oct - Dec

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HABITAT NEEDS ASSESSMENT II

Revised Schedule

Finalized data layers available to Partnership	Nov. 7
Forecasting future needs	??
Detailed update to UMRR CC	Nov. 8
Initiate writing HNA II Report	Dec.
Detailed update to UMRR CC	Feb. 7
UMRR CC endorse draft final report	May
Public review of draft final report	June
UMRR CC endorsement of final report	Aug.

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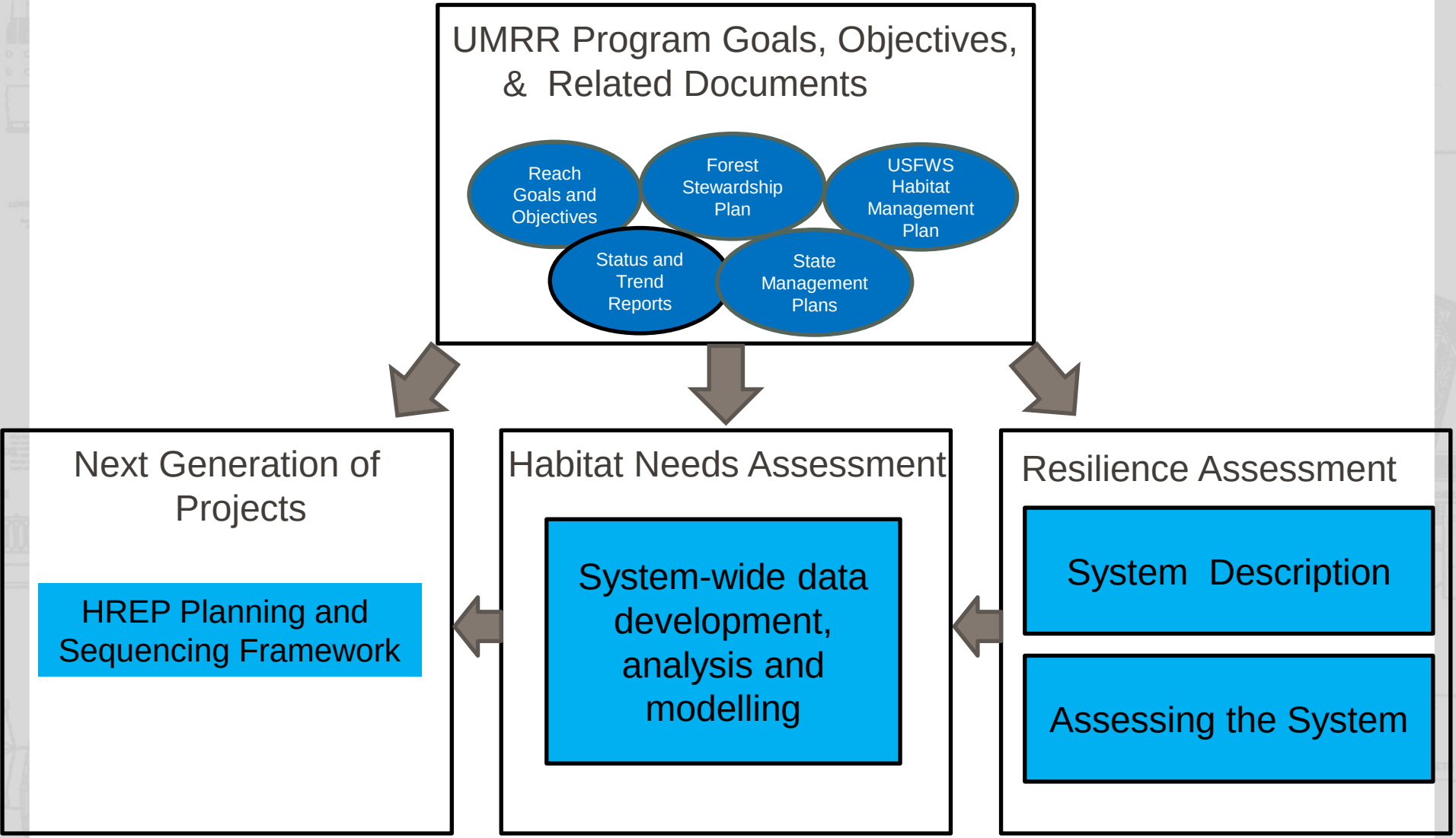

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UMRR DATABASE

Kayleigh Thomas

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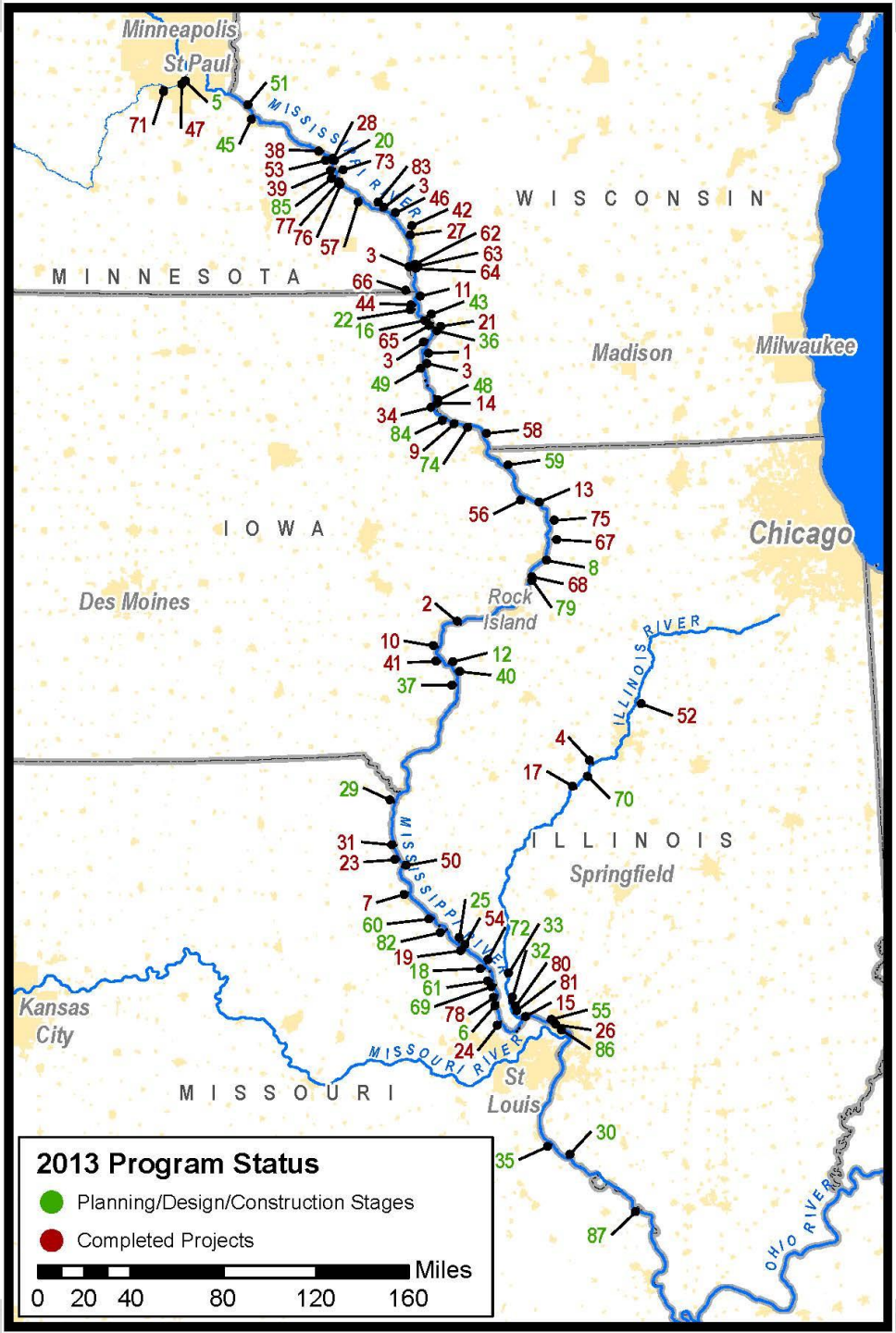

UMRR HABITAT REHABILITATION AND ENHANCEMENT PROJECTS

AS OF NOVEMBER 2016:
55 PROJECTS COMPLETED

5 PROJECTS IN CONSTRUCTION

30 PROJECTS IN DESIGN

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PROJECT PARTNERSHIP AGREEMENTS

UMRR Leadership Summit

- Indemnification
- OMRR&R in perpetuity
- Crediting nonprofit organizations for the value of donated goods

Statutory requirements for Indemnification and OMRR&R are long standing and reaffirmed in WRDA86)

Future Actions

- Changes to these requirements would require legislative action because they are statutory.
- Offer to “engage in detailed discussions” to find the best way to address concerns without negatively impacting the Civil Works program

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ST. PAUL DISTRICT (MVP)
FY17 HREP WORK PLAN (24 MAY 2017)

PLANNING – in priority order…..

Conway Lake Floodplain forest and overwintering**, Pool 9, IA – ($250k)**

- Feasibility Report 30-day public review release on 5/16.

McGregor Lake Islands, Pool 10, WI – ($200k)

- Continue Draft Feasibility Report

FWWG working on prioritizing new 2-3 projects with approved fact sheets… Pool 10 Islands, Bass Lake Ponds (Mn River), Lake Winneshiek (Pool 9), Weaver Bottoms and Finger lakes

CONSTRUCTION

Harpers Slough Islands, Pool 9, IA ($300k)

- Stage 1 - Complete construction and turnover to USFWS this FY. Begin tree plantings next spring

Conway Lake, Pool 9, IA (~$5-10m)

- Stage 1 – Award first contract in FY 17.

EVALUATION

- Baseline & Post Project Monitoring
- Performance Evaluations Ambrough Slough, Island 42, Polander, Trempealeau & Pool 8 Phase II

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Harpers Slough

Upper Mississippi River, Pool 9

Upper Mississippi River Restoration
Habitat and Rehabilitation
and Enhancement Project

Construction: *2015 - 2017*

Project Area Size: *3000+ acres*

Habitats Restored/Protected: *Main channel border, backwater, wetland, waterfowl nesting habitat, backwater lake, secondary channel*

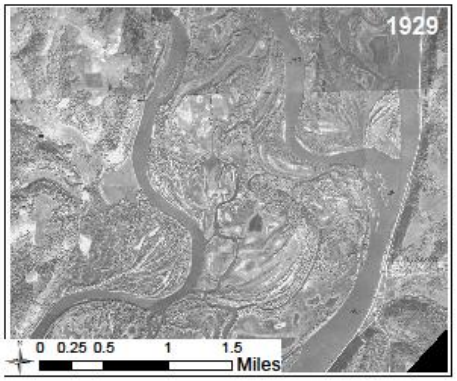
Target Species: *Waterbirds, aquatic vegetation, freshwater mussels, fish*

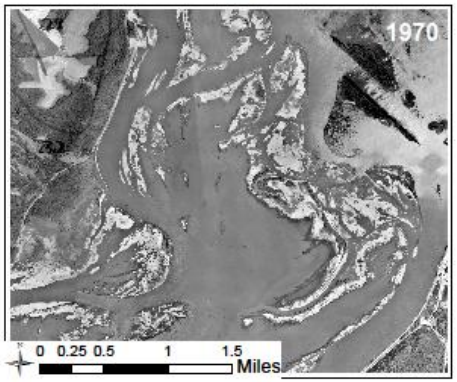
Tools and Unique Features: *Mudflats, varying island widths, 98 acres of islands, variable depths dredged in backwaters*

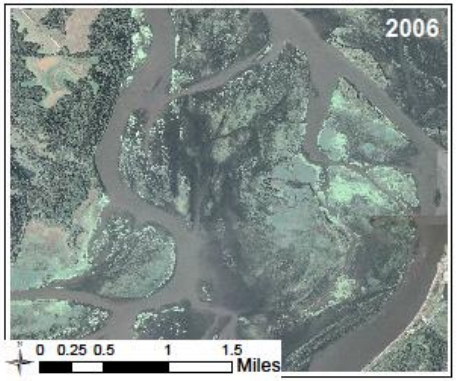
Quantities (Est.):
Sand > 545,000 cubic yards
Fines > 150,400 cubic yards
Rock > 62,400 Tons

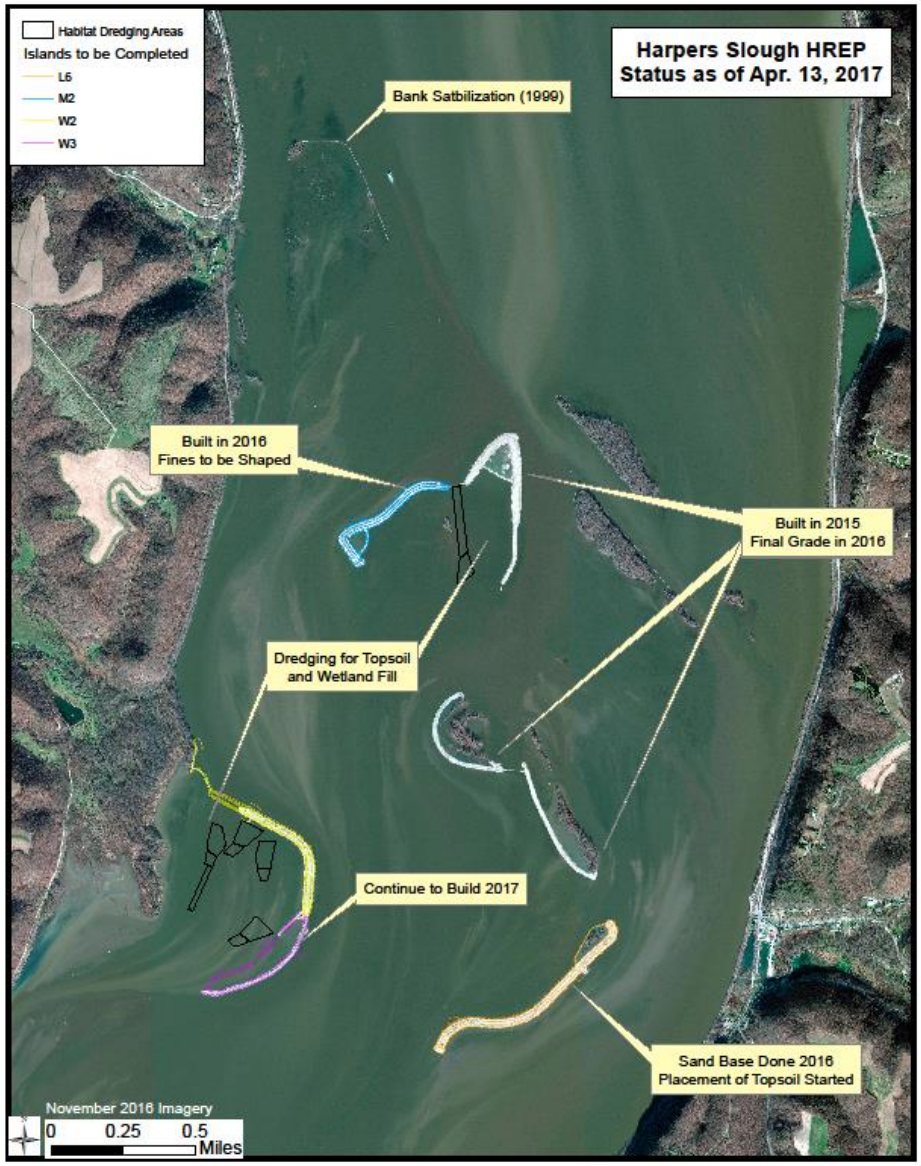
Construction Cost: *Est. $12 million*

Upper Mississippi River Restoration









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ST. LOUIS DISTRICT (MVS)
FY17 HREP WORK PLAN (AUG 2017)

PLANNING

Rip Rap Landing, IL *$15k*

Final Draft Feasibility complete

- *HQ level discussions between USACE and NRCS (led by NWD and MO River)*

Piasa & Eagles Nest Islands, IL *$250k*

Complete Draft Report of the TSP

- Complete ATR
- Initiate MVD Review

Crains Open River Island, IL *$400k*

Complete Draft Report of TSP

- Completed ATR
- Initiated MVD Review
- Initiate Public Review

Harlow Open River Islands, MO *$50k*

Complete Draft Report of TSP

Oakwood Bottoms, IL *$75k*

Initiate Feasibility Study

- Completed Site Visit
- Acquiring forestry data
- Coordinating Planning Workshop in early FY18

EVALUATION *$150k*

Baseline Monitoring & Post Project Monitoring

Performance Evaluation – Stag Island complete

DESIGN

Clarence Cannon Refuge, MO *$675k*

- Complete Pump Station Design
- Initiate Riverside Setback Design

CONSTRUCTION

Ted Shanks, MO *$775k*

- Pump Station – punch list items
- Award Reforestation Contract
- Complete Draft O&M Manual

Pools 25 & 26 Islands, MO

- Complete Closeout *$50k*
- *Complete O&M Manual*

Clarence Cannon Refuge , MO *$7m+*

- *Exterior Gravity Drain Water Control Structure - underway*

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TED SHANKS CONSTRUCTION

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CLARENCE CANNON HREP
CONSTRUCTION

ROCK ISLAND DISTRICT (MVR)
FY17 HREP WORK PLAN (AUGUST 2017)

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PLANNING

- Beaver Island, Pool 14, **IA ($255K)**
- Delair, IL **($143K)**
- Keithsburg Division, Pool 18, IL **($440K)**
- Steamboat Island, Pool 14, IA **($175K)**

DESIGN

- Beaver Island Stage I, Pool 14, IA **($200K)**

CONSTRUCTION

- Lake Odessa Flood Recovery, IA Pools 17 and 18, IA3 **($90K)**
- Pool 12 Overwintering Stage I, Pool 12 IL **($39K)**
- Pool 12 Overwintering Stage II, Pool 12 IL **($269K)**
- Pool 12 Overwintering Stage III, Pool 12 IL **($1.7M)**
- Huron Island Stage I, Pool 18, IA **($75K)**
- Huron Island Stage II, Pool 18, IA **($100K)**
- Rice Lake Stage I, IL LaGrange Pool **($80K)**

EVALUATION

- FWS **($256K)**
- Baseline Monitoring
- Post Project Monitoring
- Performance Evaluations **($200K)**: Bay Island, Andalusia, Brown's Lake, Banner Marsh, Pool 11, Cottonwood Island, Lake Chautauqua
- Adaptive Mgmt. Pool 12

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HREP IMPROVEMENT PROCESS

Foundation is communications

Identification of key planning steps and decision points

Decision log

Follow through

Focused discussion this afternoon

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NEXT GENERATION OF PROJECTS

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Mud Lake Pool 11 July 2006

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ST. PAUL DISTRICT (MVP)
FY17 HREP Work Plan (9 Aug 2017)

PLANNING –

McGregor Lake Islands, Pool 10, WI – ($200k)

- Continue Draft Feasibility Report

* FWWG working on prioritizing new 1-2 projects with approved fact sheets… Pool 10 Islands, Bass Lake Ponds (Mn River), Lake Winneshiek (Pool 9), Weaver Bottoms and Clear Lake (Pool 5)

DESIGN –

Conway Lake Floodplain forest and overwintering, Pool 9, IA – ($250M)

- Complete Plans & Specifications

CONSTRUCTION

Harpers Slough Islands, Pool 9, IA ($300k)

- Complete construction and turnover to USFWS. Project Dedication and tree plantings next spring

Conway Lake, Pool 9, IA (~$5-10m)

- Award contract in FY 17.

EVALUATION

- Baseline & Post Project Monitoring
- Performance Evaluations Ambrough Slough, Island 42, Polander, Trempealeau & Pool 8 Phase II

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Harpers Slough HREP

Sharonne Baylor - USFWS
Wendy Woyczik - USFWS
Steve Winter - USFWS

Scott Baker - COE
Kacie Opat - COE

Keith Weaver - WI DNR
Brenda Kelly - WI DNR
Jeff Janvrin - WI DNR

Mike Griffin - IA DNR
Kirk Hansen - IA DNR
Karen Osterkamp - IA DNR

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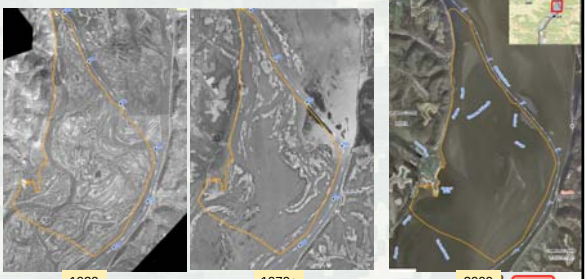
Harpers Slough Project Area

- RM 665.0 – 650.0
- Pool 9
- ~3,500 acres
- 100% Federal lands – McGregor District

3

BUILDING STRONG®

Historic vs. Current Conditions



1929 1970s 2009

4

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Harpers Features

Islands (new & protect existing)
Rock sills
Rock Mounds
Groins or vanes
Habitat dredging
Emergent wetlands

HARPERS SLOUGH

Base Contract Awarded: September 2014
Options Award: October 2014
Construction start: April 2015

Contract Amount: $11,923,095
Current Contract amount: 11,995,819

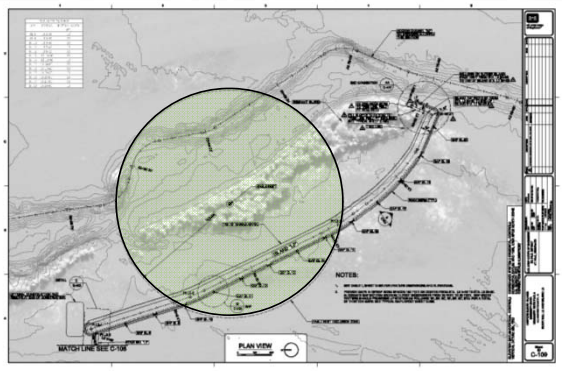
Status: Pre-final Inspection on 2 August 2017

O&M and As-Built: Fall 2018
Turn-over to USFWS: Fall 2018

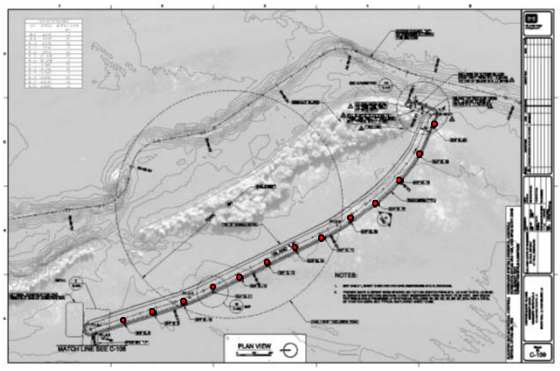
Tree Planting: April 2018 (Earth Day?)

Dedication ceremony: May 2018

Island L3 – Eagle restrictions



Island L3 – critter access



Critter access – 10, 20 and 30 foot gaps in rock berm

Erosion in gaps due to wind fetch and wave action during high water.

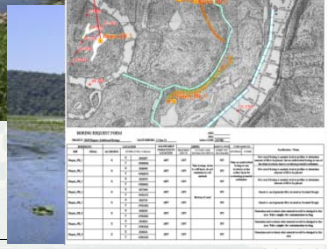
Had willow plantings and seeding been done prior to these events erosion may have been less

After islands were overtopped a second time, the gaps were smoothed out due to deposition and settling of material

10 foot gaps reached equilibrium in the erosion process whereas the 20 and 30 foot gaps did not

Agencies proposed other techniques such as rock protection layer in base.

Volunteer vegetation near gaps



Rock Sill L2

Soft material encountered – modification included excavating soft fines and placing granular material. Rock was then placed to complete sill.

Rock Sill M4

Rock Sill W1

Island L3 volunteer vegetation

Agencies have been discussing alternatives to tilling the islands with volunteer vegetation. Not tilling these islands would have the following advantages: immediate erosion protection and possible volunteer cottonwoods and willows survival. If the volunteer vegetation on these islands are tilled and then the island seeded, island maintenance will be needed for the permanent seeding (spraying, etc.). Agencies discussed the possibility of seeding these islands via broadcast method to avoid destroying volunteer vegetation or leaving the islands untouched completely.

Island M5 volunteer cottonwood 2 week difference

Quantifying the effect of floodplain-river connectivity: sediment, nitrogen, phosphorus and carbon removal by flooding on the Maquoketa River floodplain, Iowa.

William Richardson[1], Greg Nalley[2], Lynn Bartsch[1], Rebecca Kreiling[1], Jessica Garrett[2], Sean Bailey[1],

[1]U.S.Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

[2] U.S.Geological Survey, Iowa Water Science Center, Iowa City, IA

UMRBA 8_9_17

USGS science for a changing world

EASTERN TALLGRASS PRAIRIE & BIG RIVERS LANDSCAPE CONSERVATION COOPERATIVE

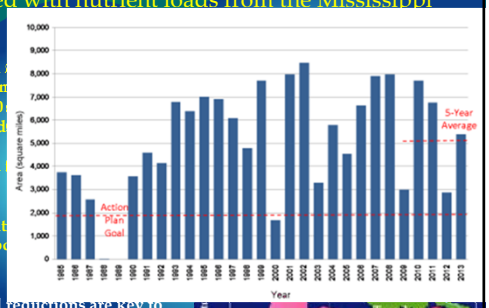
Hypoxia in the northern Gulf of Mexico is correlated with nutrient loads from the Mississippi River

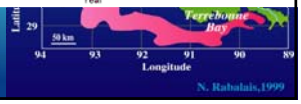
Size of "dead **discharge fron** **(approx. 8,000** **of storm wind**

Duration and **increasing.**

Strong indicat **is driving proc** **BOD.**

Nutrient load reductions are key to reducing coastal hypoxia



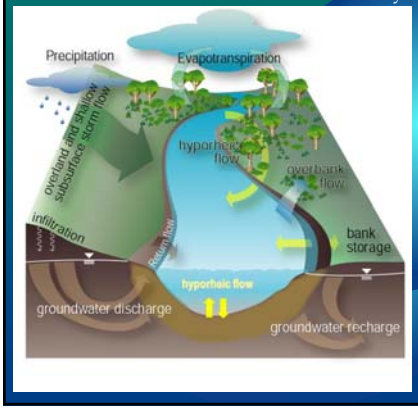


"Traditional" efforts to reduce loads of nitrogen and phosphorus to coastal areas have been relatively ineffective.

We need new approaches to solve this problem, including:

- Enhanced river-floodplain connectivity
- "instream Best Management Practices"

The multidimensional nature of Connectivity



Lateral – overbank flow – flooding – important transport of both dissolved and particulate materials into the floodplain

Longitudinal - downstream flux of material, especially during floods. Interupted by dam building.

Vertical – hyporheic flux – subsurface flows associated with flooding – important for transport of dissolved materials

Floodplains as sites of intense biophysical activity

- **High biodiversity**
- **Large range of sediment moisture conditions**
- **Wide range of redox states (sediment oxygen)**
  - ❖ *due to seasonal wetting and drying*
- **Carbon-rich environments**
- **Rapid rates of biogeochemical reactions**
- **Rapid turnover of N and C**
- **Accumulation of sediment and phosphorus**

- **Historically, highly connected to rivers –**
  - ❖ **high rates of material delivery**
  - ❖ **high of export of important biomolecules**

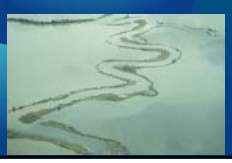
(Root River, MN)

Anthropocene conditions have interrupted these beneficial patterns and processes

-Destroyed connectivity for the sake of flood control and property protection

-Current floodplain capacity is overwhelmed by sediment and nutrient loading

- To study and document these potential benefits we must now look for situations of reconnection



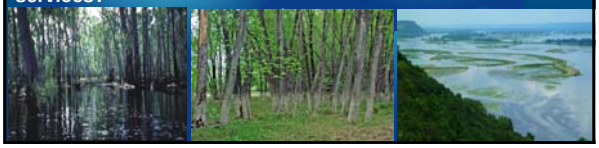
The Big Question Before Us:

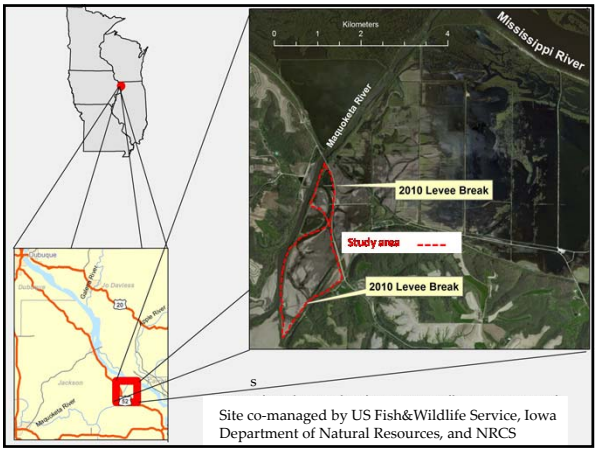
How do we as managers/practioners re-establish these functions?

What are the modern rates of deposition and nutrient cycling (N-cycling, P-retention, Carbon sequestration) ?

What is the effect of "reconnectivity" in reducing river loads of N and P?

How do we balance water quality services with production services?





Maquoketa levee and breach

Goals of Maquoketa River floodplain reconnection study

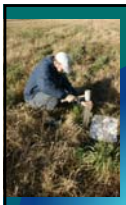
1. **Quantify linkages between flooding and floodplain retention of flood-deposited sediment, carbon, nitrogen, and phosphorus.**
2. **Determine floodplain nitrogen removal rates (sediment denitrification) and hyporheic loss of NO_3^- associated with flooding**
3. **Scale-up N, P, C, and sediment retention measurements to entire delta-floodplain system (via modeling) (2-d HEC–RAS) and regionally with floodplain inundation models.**

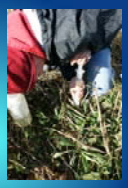
Loads and sediment deposition results

Sediment Collection and Measurement Sites: October 2014, March 2015, May 2015

LOCATION OF CLAY MARKER HORIZONS

Sediment Coring

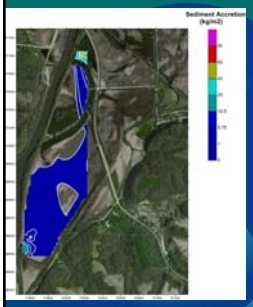


Deploying Clay Marker Horizons

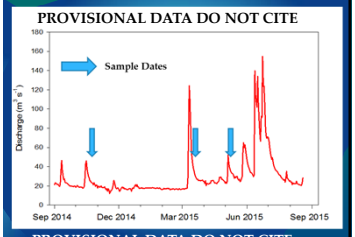


Sediment capture on floodplain during 2015



Spatial pattern of sediment deposition on the Maquoketa River floodplain.

PROVISIONAL DATA DO NOT CITE

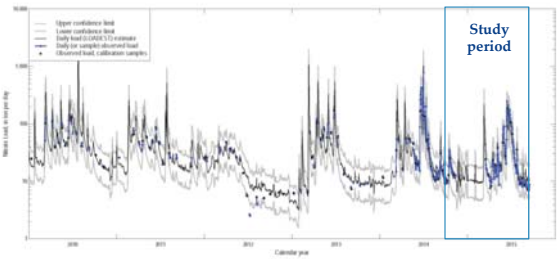


PROVISIONAL DATA DO NOT CITE

Total deposition (over 93.45 ha floodplain) from 2015 flood:

Sediment -	700,718 kg
Carbon-	12,010 kg
Nitrogen-	1,262 kg
Phosphorus-	510 kg

Nitrate-N load in the Maquoketa River IA (tons N per day) from real time NO3 probe

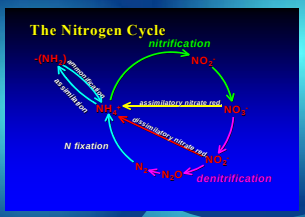


PROVISIONAL DATA DO NOT CITE

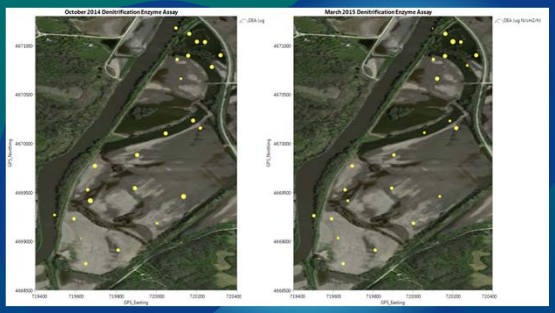
Summed N-load over study period: 8,282 Mg (metric tons);
Deposited on floodplain: 1.16 Mg

River derived N deposited on the floodplain represented ~0.015 percent of the annual N load, or ~0.39% of the event transport (3 days).

Denitrification results



Spatial Patterns of denitrification



Denitrification removed NO_3^--N ranging from 250 kg d^{-1} (March 2015) to 668 kg d^{-1} (October 2014).

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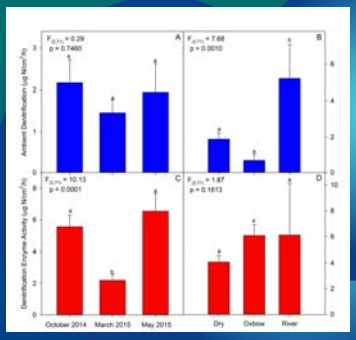
PROVISIONAL DATA DO NOT CITE



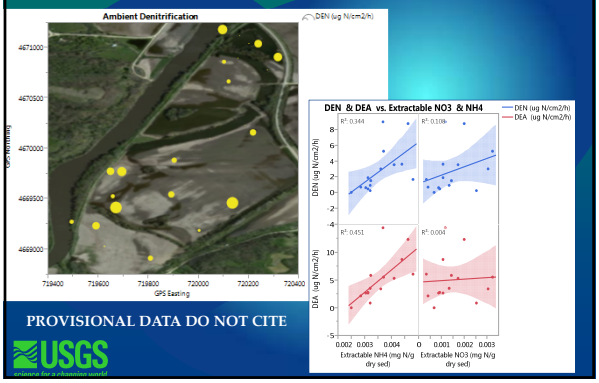
Ambient Denitrification

- higher than typical rate in the UMR backwater lakes (0.02 – 0.4 µg N /cm^2/hr)

Maximum Denitrification Potential

- lower than typical UMR backwater rates (2.5 – 22 µg N /cm^2/hr)

Nitrogen biogeochemistry related to sediment NH_4^+, NO_3^-, and sediment moisture



PROVISIONAL DATA DO NOT CITE

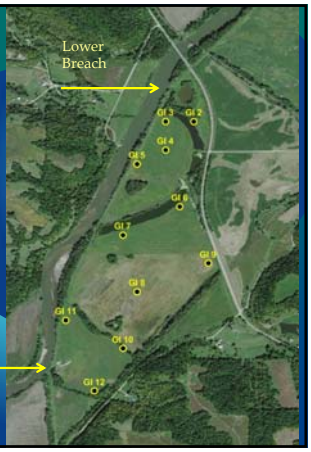
USGS

Flood Plain Groundwater studies

Shallow wells

Monitor:
GW surface, conductivity, water temperature, and dissolved inorganic nitrogen

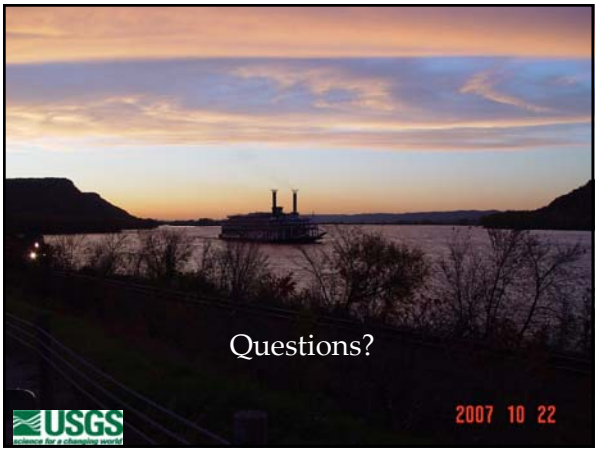
Data forthcoming



Take home:

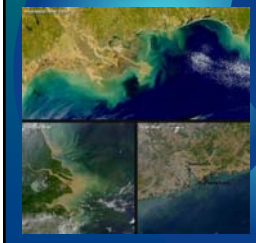
1. Large quantities of sediment, carbon, nitrogen and phosphorus are captured on a small reconnected section of tributary floodplain
2. Large quantities of nitrogen are *permanently* removed from floodplains through denitrification – rates are high, with large potential for even greater N-removal – likely limited by NO_3^- delivery.
3. Lack of river-floodplain connectivity hinders this ecosystem service.
4. Sediment Phosphorus Equilibrium data suggests floodplain soils are primed to take up or release stored P depending on floodwater P concentrations

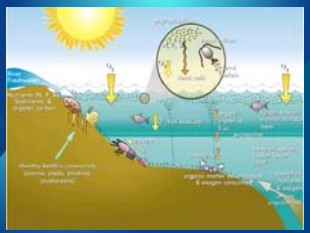
USGS



Productivity of Oceans controlled primarily by Nitrogen

Gulf of Mexico Hypoxic Dead Zone as example of effects of excess nitrogen delivered by the Mississippi River

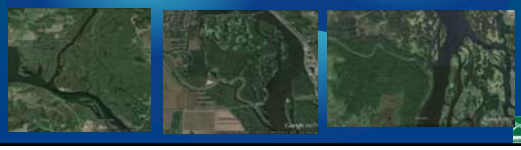




USGS

2017 goals:

1. With funds from USGS, US FWS, and ACOE - continue flood-nutrient deposition study at Maquoketa-Green Island flood plain
3. Characterize hyporheic nitrate concentration on Maquoketa floodplain in relation to river stage.
4. Complete HEC- RAS 2-d nutrient model on Maquoketa site
5. Build floodplain inundation process model (ECOFHM)
6. Initiate extrapolation to other tributary confluence sites (e.g.Wapsapinicon, Root, Zumbro , Chippewa)

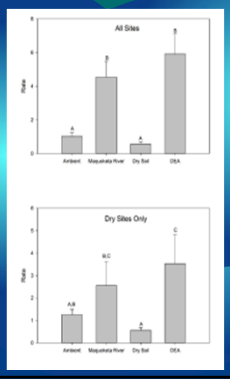


What do you do without a flood?

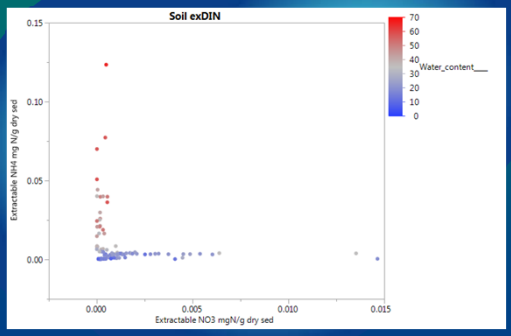
Punt and look at "dry dynamics"!

Floodplain sediment nitrogen and phosphorus information

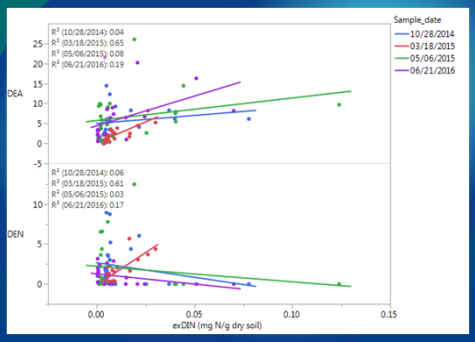
Floodplain Denitrification SU 2016
Dry and wet sites



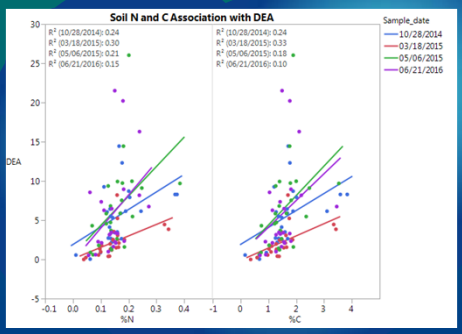
Soil Nitrogen 2016 related to moisture content

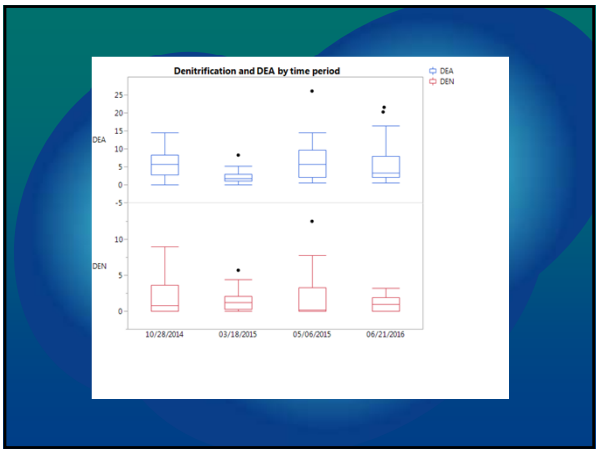


Soil DIN v denitrification and potential denitrification on different dates 2014 - 2016

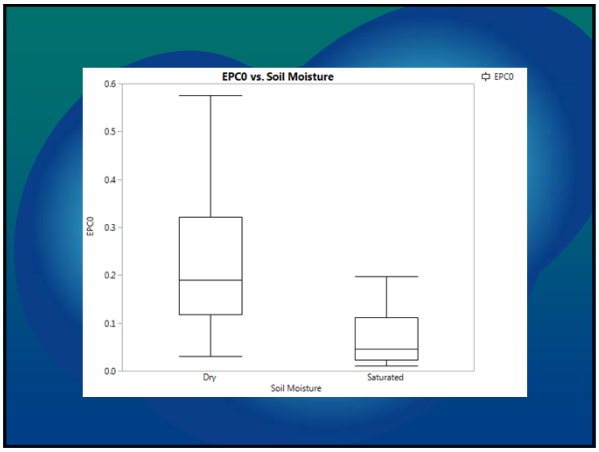


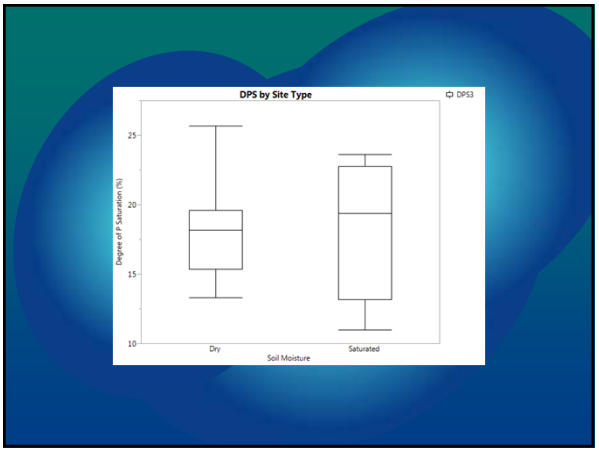
Soil C and N v denitrification and potential denitrification on different dates 2014 - 2016

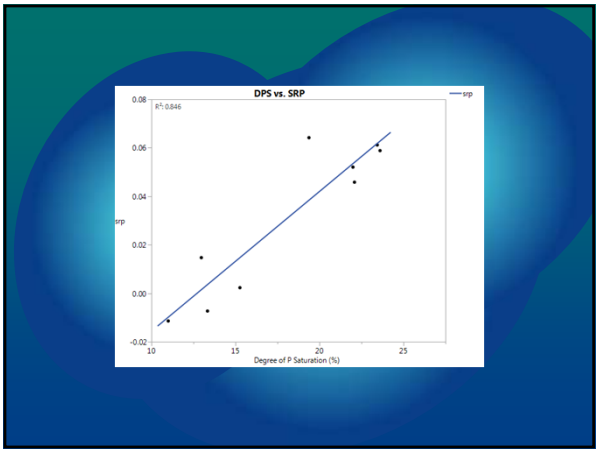


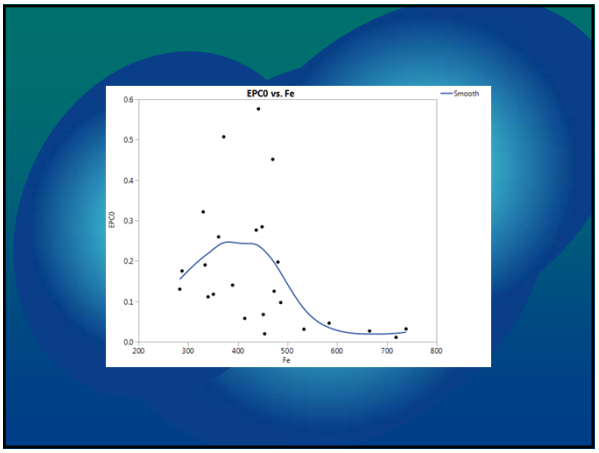


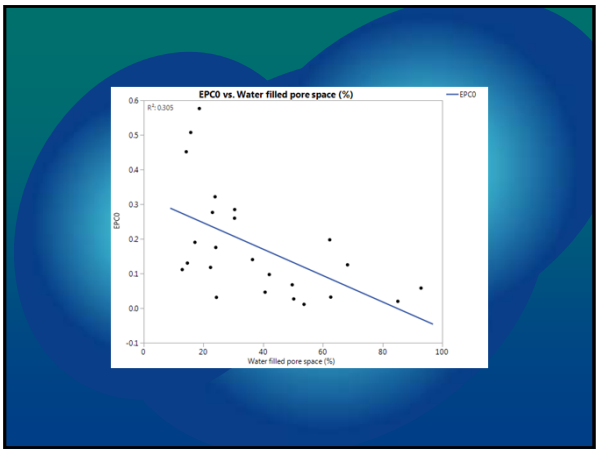
Soil Phosphorus stuff

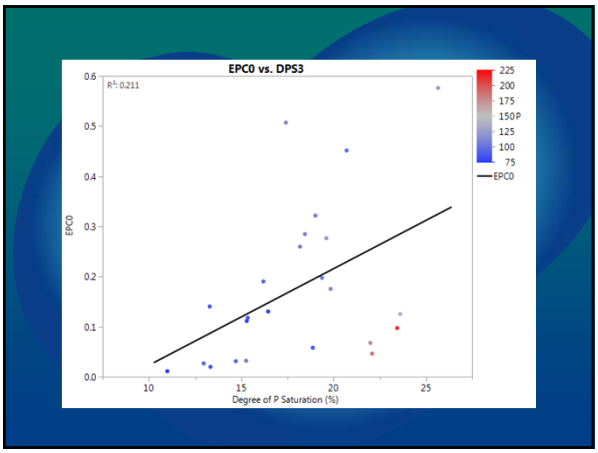


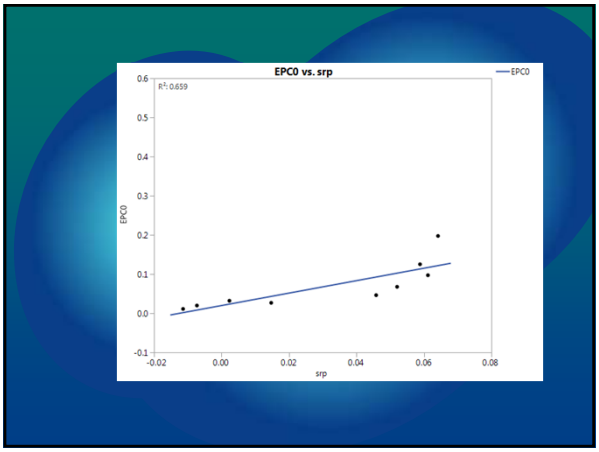







EPC0 vs. Water filled pore space (%)
EPC0
R²: 0.305
EPC0
Water filled pore space (%)


EPC0 vs. DPS3
R²: 0.211
225
200
175
150 P
125
100
75
EPC0
EPC0
Degree of P Saturation (%)


EPC0 vs. srp
EPC0
R²: 0.659
EPC0
srp

HNA-II Progress Report: Moving from data development to a formal HNA-II document

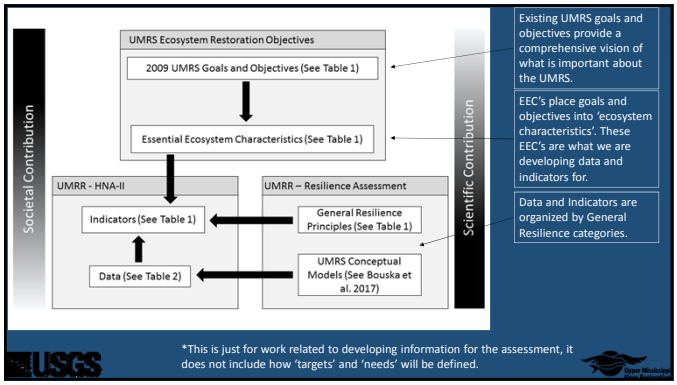
(UMRR-CC - 8/9/2017)

Nathan De Jager (USGS) on behalf of Kathryn McCain (USACE), Sara Schmuecker (USFWS) and the HNA-II Steering Committee

Jim Rogala, Janis Ruhser, Molly Van Appledorn, Jason Rohweder, Tim Fox, Jeff Houser, Kristen Bouska (UMESC)

Key Takeaways for Today

- We have developed a framework that links existing UMRS goals and objectives and Essential Ecosystem Characteristics (EEC's) with quantitative measures (i.e., indicators) of ecosystem structure, function, and resilience.
- We are in the process of developing a draft document that recommends the framework and a series of indicators.
- We will be looking for feedback on the recommended framework and indicators.
- Additional efforts will be needed to identify management/restoration 'targets'.

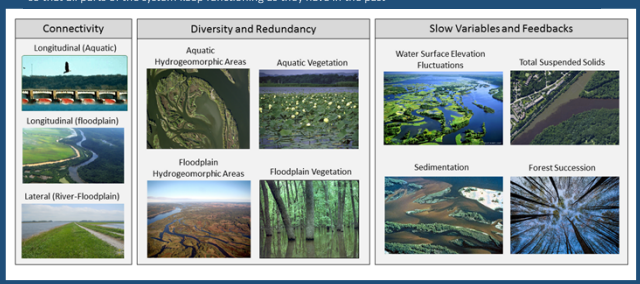


*This is just for work related to developing information for the assessment, it does not include how 'targets' and 'needs' will be defined.

Essential Ecosystem Characteristic	Objective	UMR System	UIR	LIR	ORR	IRR	HNA-II Indicator	General Resilience Theme
Hydraulics and hydrology	A more natural stage hydrograph	X	X	X		X	Water Surface Elevation Fluctuations	Slow Variables and Feedbacks
	Restored hydraulic connectivity	X	X	X	X	X	Lateral (River-Floodplain) Connectivity	Connectivity
	Naturalize the hydrologic regime of tributaries	X		X		X	A	
	Increase storage and conveyance of flood water on the floodplain	X		X	X	X	Lateral (River-Floodplain) Connectivity	Connectivity
Biogeochemistry	Improved Water Clarity	X	X	X			Total Suspended Solids	Slow Variables and Feedbacks
	Reduce Nutrient Loading		X	X			B	
	Reduce Sediment Loading		X	X		X	Total Suspended Solids	Slow Variables and Feedbacks
	Reduce Contaminants loading		X				C	
	Water Quality conditions sufficient to support native species			X	X	X	Total Suspended Solids	Slow Variables and Feedbacks
Geomorphology	Restore Rapids		X				A	
	Restore Sediment Transport Regime	X	X			X	Sedimentation in off-channel areas	Slow Variables and Feedbacks
	Restore Backwater Areas	X	X	X	X	X	Aquatic Hydrogeomorphic Diversity	Diversity and Redundancy
							Sedimentation in off-channel areas	Slow Variables and Feedbacks
	Restore Lower Tributary Valleys	X		X		X	D	
	Restore Bathymetric Diversity			X	X	X	Sedimentation in off-channel areas	Slow Variables and Feedbacks
	Restored floodplain topographic diversity	X		X	X	X	Floodplain Hydrogeomorphic Diversity	Diversity and Redundancy
	Restore Secondary channels	X			X	X	Aquatic Hydrogeomorphic Diversity	Diversity and Redundancy
	Restore lateral hydraulic connectivity	X		X	X	X	Lateral (River-Floodplain) Connectivity	Connectivity

Habitat	Restore Habitat Connectivity		X	X	X	X	Longitudinal Floodplain Connectivity	Connectivity
	Restore Riparian/Floodplain Habitat	X	X	X	X	X	Floodplain Hydrogeomorphic Diversity	Diversity and Redundancy
							Floodplain Vegetation Diversity	Diversity and Redundancy
							Floodplain Forest Succession	Slow Variables and Feedbacks
	Restore Aquatic off-channel areas	X	X	X	X	X	Aquatic Hydrogeomorphic Diversity	Diversity and Redundancy
							Sedimentation in off-channel areas	Slow Variables and Feedbacks
	Restore channel areas	X	X	X	X	X	Aquatic Hydrogeomorphic Diversity	Diversity and Redundancy
	Restore native aquatic vegetation				X		Aquatic Vegetation Diversity	Diversity and Redundancy
	Restore a floodplain corridor	X	X	X	X	X	Longitudinal Floodplain Connectivity	Connectivity
	Restore Floodplain wetlands		X	X	X	X	Floodplain Vegetation Diversity	Diversity and Redundancy
	Restore rare and native habitats		X	X	X	X	E	
	Restore moist soil habitat and communities [ii]		X	X			Floodplain Vegetation Diversity	Diversity
	Restore vulnerable mud and sand habitats that reflect a dynamic river system [iii]		X	X			Floodplain Vegetation Diversity	Diversity
	Restore isolated wetlands [iv]		X				Floodplain Hydrogeomorphic Diversity	Diversity and Redundancy
	Restore habitat and biota needed due to highly modified navigation channel [vi]					X	E	
Biota	Aquatic Vegetation		X	X		X	Aquatic Vegetation Diversity	Diversity and Redundancy
	Floodplain Forest and Prairies	X	X	X	X	X	Floodplain Vegetation Diversity	Diversity
							Floodplain Forest Succession	Slow Variables and Feedbacks
	Native Fish		X	X	X	X	F	
	Native Mussels		X	X		X	F	
	Native Birds		X	X	X	X	F	
	Reduce Effects of Invasive Species			X	X	X	G	
	Viable populations of native species		X	X	X	X	E	

Indicators organized according to components/themes of general resilience: "the capacity of a system to absorb disturbances of all kinds, including novel, unforeseen ones, so that all parts of the system keep functioning as they have in the past"



Connectivity

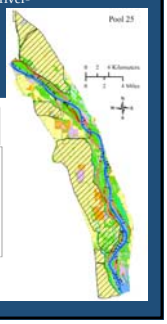
Longitudinal (Aquatic)

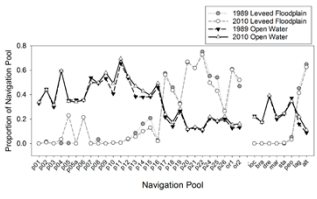
Longitudinal (floodplain)

Lateral (River-Floodplain)

Connectivity provides access to a wide range of conditions and habitats for organisms moving through the UMRS and for water-mediated transport of materials and energy across the river-floodplain transition zone.

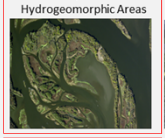
Jason Rohweder (UMESC)



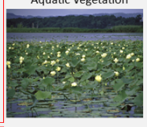


Diversity and Redundancy

Aquatic Hydrogeomorphic Areas



Aquatic Vegetation



Floodplain Hydrogeomorphic Areas

Floodplain Vegetation

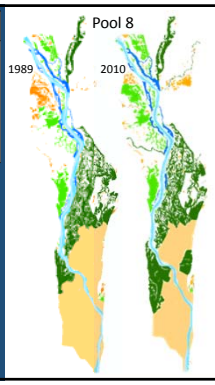
Diversity and redundancy provides options and insurance for responding and adapting to change and disturbances. In river-floodplain systems, the diversity of hydrogeomorphic structures provides asynchronous conditions and promotes diversity and redundancy in associated biological populations and functional attributes that support stable delivery of ecosystem services.

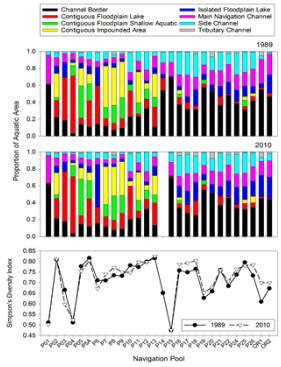
Diversity and Redundancy

Aquatic Hydrogeomorphic Areas

Janis Ruhser (UMESC)

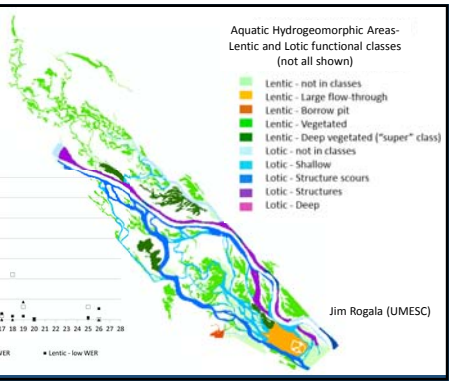
Pool 8





Diversity and Redundancy

Aquatic Hydrogeomorphic Areas

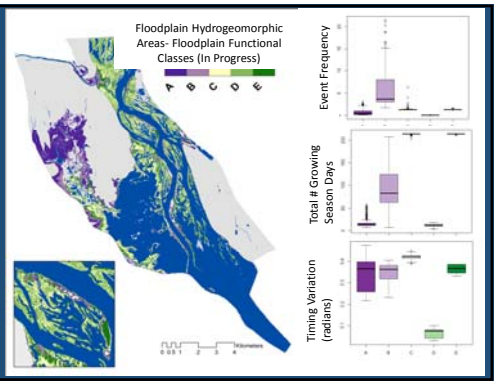


Jim Rogala (UMESC)

Diversity and Redundancy

Floodplain Hydrogeomorphic Areas

Molly Van Appledorn (UMESC)



Slow Variables and Feedbacks

Water Surface Elevation Fluctuations

Total Suspended Solids

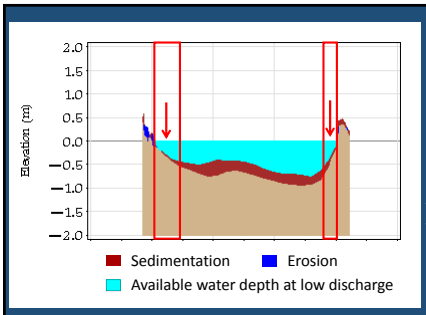
Sedimentation

Forest Succession

Slowly changing variables that are coupled with stabilizing feedbacks can help maintain persistent ecological conditions. However, when slowly changing variables cross over critical thresholds, ecosystems may change rapidly.

In other words: Just because something is changing slowly, based on past observations (e.g., sedimentation and forest change) does not mean that they will continue to change slowly in the future.

USGS



Jim Rogala (UMESC)

Slow Variables and Feedbacks

Sedimentation

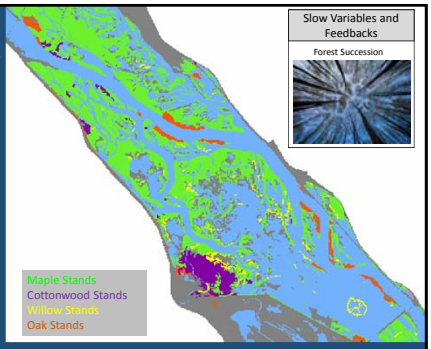
How will the abundance of lentic functional classes change over time as sediment accumulates in off-channel areas?

Are there critical thresholds, that when crossed over, produce rapid changes in lentic functional classes?

How will the abundance of different forest types change over time in response to flooding and (potentially) other disturbances?

Are there critical thresholds, that when crossed over, produce rapid changes in forest types?

Nathan De Jager and Molly Van Appledorn (UMESC)
Ben Vandermyde, Andy Meier, Robert Cosgriff (USACE)
Lyle Guyon (NGRREC)



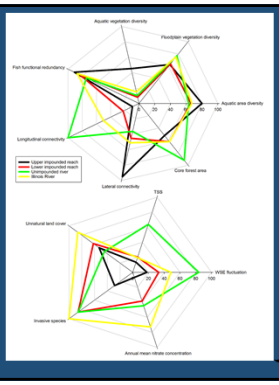
Slow Variables and Feedbacks

Forest Succession

Synthesis

- Developing ways to visualize multiple aspects of ecosystem structure, function, and resilience across the system.
- Work in Progress

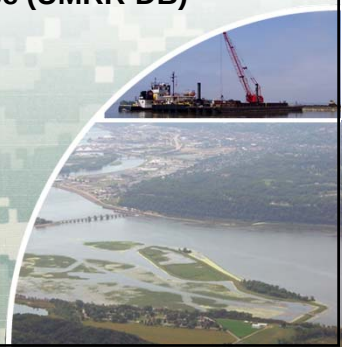
Jeff Houser, Kristen Bouska, Nathan De Jager (UMESC)



Key Takeaways for Today

- We have developed a framework that links existing UMRS goals and objectives and Essential Ecosystem Characteristics (EEC's) with quantitative measures (i.e., indicators) of ecosystem structure, function, and resilience.
- We are in the process of developing a draft document that recommends the framework and a series of indicators.
- We will be looking for feedback on the recommended framework and indicators.
- Additional efforts will be needed to identify management/restoration 'targets'.

Upper Mississippi River Restoration Database (UMRR-DB)



Kayleigh Thomas
Geographer
August 2017

US Army Corps of Engineers
BUILDING STRONG®

Presentation Overview

1. Purpose and objectives
2. Problem statement
3. Solution
4. Accomplishments
5. In progress
6. Feature roadmap
7. Examples

UMRR-DB Purpose

The purpose of the UMRR-DB is to combine key UMRR information into a single database application to produce *priority program and project level reports and analyses*.

UMRR-DB Goals

1. **Standardize Reporting** – Standardize program and project level reporting to increase awareness of UMRR accomplishment of program strategic goals and objectives.
2. **Support Analysis** – Support HREP design, analysis, and performance monitoring to increase effectiveness of applied ecosystem restoration science.

Problem Statement

Databases of HREP projects have been maintained since 1997, however they have all suffered from several of the same problems:

- Built on single user platform (i.e., MS Access) and therefore impossible for efficient multiuser editing
- Spatial data (e.g., boundaries, features) managed in a different format than the project summary data
- Difficult to coordinate/standardize updates across three USACE districts (partners, impossible)
- Never matured to the point of being useful for analyzing program/project effectiveness

Solution

Built a new system using:

- Web-database application technology allowing multiple simultaneous editors
- Enterprise level, industry standard technologies (Oracle)
- Project summary data integrated with geometry (Oracle Spatial, ESRI ArcSDE), readily available to analysts
- Rapid database application development environment to help reduce maintenance cost (Oracle APEX)

Oracle Application Express (APEX)

- Oracle Application Express (Oracle APEX) is a declarative, rapid web application development tool for the Oracle database.
- It is a fully supported, no cost option available with all editions of the Oracle database.
- Using only a web browser, you can develop and deploy professional applications that are both fast and secure.
- Fully embraced by USACE. Won't change in the foreseeable future.

Advantages

- Links all program data together
- Not a replacement for enterprise data systems; fills gaps
- Records history of program on key issues
- Standardized, tailored reporting
- Access is provided based on roles (within USACE)
- Standardized workflow maintains data quality/consistency

Accomplishments

1. Developed Oracle APEX web-based application supporting multiuser editing on the USACE network
2. Migrated data from previous MS Access 2003 and 2007 databases
3. Compiled HREP data for all three UMRR USACE Districts (i.e., St. Louis, Rock Island, and St. Paul Districts)
4. Added HREP total project cost estimates
5. Combined HREP status, spatial locations, financial costs, organizations, HREP documents, etc. into a single framework to support comprehensive report generation

Accomplishments (continued)

6. Developed several standardized reports (e.g., congressional fact sheets, state fact sheets, PB3 report)
7. Updated user authentication model to support definition of fine-grained user roles
8. Performed several QA checks of specific data elements to ensure accuracy and consistency
9. Established of a standing product development team (PDT) to guide development and maintenance of UMRR-DB

Accomplishments (continued)

10. EMP-CC Quarterly reports have been digitized and all historic cost data has been migrated to the database
11. Developed a standard data model for storing HREP restoration features with 3D geometry
12. Project Boundary Review complete establishing a consistent acreage for upward reporting

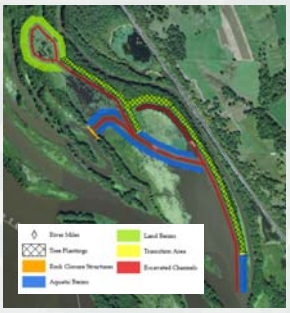
In Progress

1. Developing a workflow that assigns clear roles and responsibilities for quarterly data update and QA
2. Digitizing all key HREP documents (i.e., fact sheets, feasibility reports, plans & specs, as-builts, O&M manuals, performance evaluation reports (PER)) and loading into the database
3. Developing a workflow for regular updates of cost data and cross walk from historical information to current P2 reporting methods to allow for additional cost reporting capabilities

In Progress (continued)

4. Updating points of contact (POC) for all specialty areas for all HREPs
5. Adding HREP goals, project objectives, and performance criteria
6. Automate production of the UMRR-CC quarterly meeting cost reports and plan of work reports
7. QA review of HREP restoration features with relevant POCs

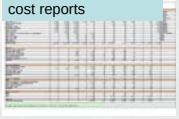
Restoration Features Example – Pool 12 Overwintering, Sunfish Lake



- Utilized CAD files, authoritative documents, and coordination with project engineers to produce restoration features
- Consistent classification of features based on the Environmental Design Handbook allows for future feature based reporting

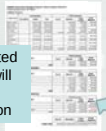
Cost Report Example

Compile and digitize 30+ years of historic cost reports



Manual data entry of historic data from EMPCC Reports and exports from budgeting systems for current costs

Create automated reports which will allow for rapid report generation



Feature Roadmap

1. Migrate report outputs and data products to the public facing website for partnership access and review
2. Add images to HREPs
3. Add contracts to HREPs
4. Automate production of the J-Sheet report

Feature Roadmap (continued)

5. Develop reports to support the next Report to Congress (e.g., HREP status, HREP restoration features, HREP habitat types)
6. Add HREP PER tracking and scheduling
7. Provide exported reports on the public-facing website
8. Automate HREP web fact sheet report

Questions

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Michael Dougherty, Geographer
Michael.P.Dougherty@usace.army.mil
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Kayleigh Thomas, Geographer
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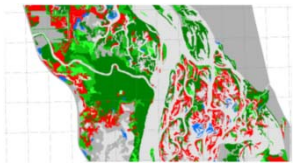
LTRM Highlights

9 August 2017

Reports & Publications



De Jager, Hoy, & Rohweder, J.J. 2017. Mapping areas invaded by *Phalaris arundinacea* [Reed canarygrass] in Navigation Pools 2-13 of the Upper Mississippi River. Completion Report.

- Used existing GIS data to identify:
  - 1) open wet meadow areas that are currently dominated (>80% cover) by RCG,
  - 2) forested areas with RCG present in the understory,
  - 3) forests with more open canopies that are potentially susceptible to RCG encroachment in the future.
- Navigation Pools 4, 7, 8 and 9 appear to support large areas showing signs of invasion (>62% of wet meadow area and > 30% of sampled forest area).
- Maps of the area of open forest canopy can be used to identify forest areas that may be at risk of future invasion.
- Maps can be used to target areas for RCG eradication, to protect existing native plant communities, or to promote forest regeneration in areas near RCG wet meadows.

Drake, Kalas, & Giblin. 2017. Potamogeton crispus: Detection in LTRM summer surveys, seasonal biomass and nutrient standing stocks, and links to water quality in Pools 7 and 8 of the Upper Mississippi River System. Completion Report.

- Invasive *Potamogeton crispus* undergoes a conspicuous mid-summer senescence, fall germination, and grows and photosynthesizes through the late fall, winter, and early spring. It reaches maximum biomass and flowers in early-to mid- May.
- "Sampleable" biomass of *P. crispus* was approximately 100x higher in May than it was in mid-July (the mid-point of the LTRM sampling season).
- 2016 LTRM aquatic vegetation surveys underestimated the maximum (May) prevalence of *P. crispus* in three study areas by 0%, 40% and 100%.
- This study produced a rough, pool-wide estimate of 60-80% underestimation of *P. crispus* percent frequency occurrence in Pool 8, excluding the few areas where it is very abundant.

Resilience assessment update

- System Description manuscript
  - Accepted pending final revision / review
- General Resilience indicators manuscript
  - Indicators have been updated based on comments from the HNA 2 / Resilience workshop and the text is being revised accordingly.
  - Initial draft to RWG for review before September conference call.
  - Subset of these indicators are part of HNA II.
- Next:
  - Data analysis derived from conceptual models and LTRM data to investigate select aspects of specified resilience
  - RWG webinar / call in mid – late September

UMRR Science FY17 Workplan Proposals

- Improve our understanding of the processes that support biological production in the river and how they are affected by fundamental drivers of the river's health and resilience;
- Investigate the extent to which water clarity is driven by external drivers (total inputs of suspended material) versus internal biological processes (submersed vegetation and phytoplankton production).
  - Such work informs our understanding of the extent to which internal modifications (e.g., HREPs) can reasonably expected to affect the system as compared to external drivers that affect inputs to the system;
- Pursue strategic, short-term additions to LTRM data including:
  - 1) Growth, age, recruitment and mortality rates of select UMRS fish species,
  - 2) more direct measurements of submersed vegetation biomass at select LTRM sampling sites; and,
- Develop additional information for the development of indicators of ecological health and resilience in support of river restoration and management.

Plankton community dynamics of Lake Pepin – the role of crustacean zooplankton

Rob Burdis, MDNR

- Expands ongoing work on phytoplankton and small-bodied zooplankton (rotifers) to larger zooplankton (crustaceans)
- Completes the overall picture of the plankton community at a set of LTRM sampling sites in Lake Pepin.
- Allows a comprehensive assessment of the plankton community and how it is affected by fundamental drivers of ecosystem health and resilience such as water velocity and residence time.
- Lays the groundwork for assessing the response of the system to future biological invasions and other stressors, and informative comparisons with other study reaches.

Water Clarity in Pool 8 of the Upper Mississippi River: the contributions of changes in external inputs and changes in internal conditions to long term trends

Deanne Drake, WDNR

- Role of changes in tributary and upstream inputs and aquatic vegetation in changing water clarity
- Provide insight into possible feedbacks between vegetation and TSS
- Future work could expand analyses to Pools 4 and 13.
- contribute to our broader understanding of the resilience of the UMRS

Developing methods of estimating of submersed aquatic vegetation biomass in the Upper Mississippi River.

Deanne Drake, WDNR; Eric Lund MDNR

- Base monitoring data provides an index of abundance but is not intended, or designed, to predict vegetation biomass
- Test a relatively simple method to estimate vegetation biomass
- Estimates of vegetation biomass may improve our ability to describe and quantify vegetation derived processes such as fish habitat provision, oxygen production, nutrient sequestration and changes in water clarity.
- Data generated by this project will also be assessed to see the extent to which it may be able to enhance rake scores generated as part of the standard LTRM methods.

Using measurements of age, recruitment, growth rates, and mortality to understand population demographics of Smallmouth Buffalo in the Upper Mississippi River Basin

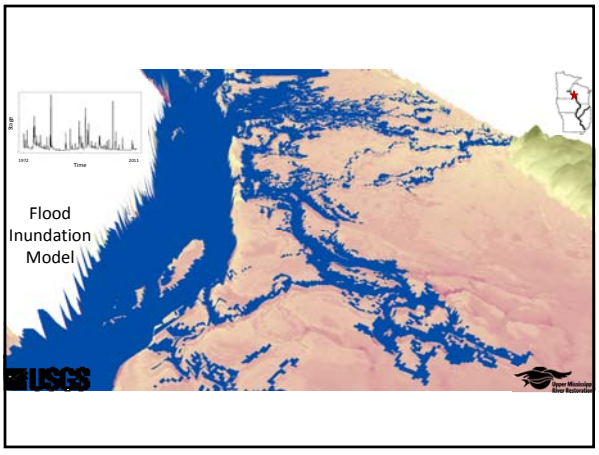
Levi Solomon & Kris Maxson, INHS

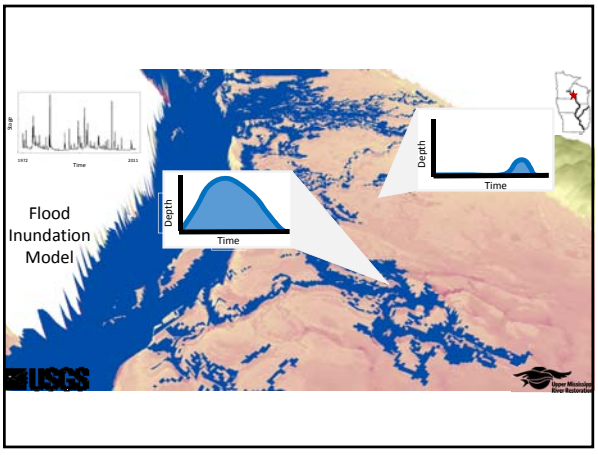
- Use a standard fisheries method (otolith analysis) to estimate rates of recruitment, growth, and mortality as well as population age structure for Smallmouth Buffalo in LTRM study reaches of the UMRS (except Pool 8).
- The extent to which these rates differ through time and along the gradients spanned by LTRM study reaches may provide insights into the effects of environmental conditions, extreme events (flood/droughts), and winter conditions.
- Improved information for the Commercial Fish Indicator intended for inclusion in the next Status and Trends Report

Landscape Pattern Research and Application on the UMRS (FY18-21).

De Jager, Van Appledorn, Rohweder

- Guiding Documents:
  - Landscape Patterns Research Framework
    - Need for Flood Inundation Modeling Work
    - Need for Floodplain Vegetation and Soils Work
    - Need for Simulation Models that allow for Future Projections
  - Habitat Needs Assessment II
    - Reduce Uncertainty in Flood Inundation Model (developed for HNA-II)
    - Better Characterization of Flood-Vegetation-Soil Relationships
    - Reduce Uncertainty and add functionality to simulation model (developed for HNA-II)
  - Resilience Assessment
    - Quantify the spatial and temporal resilience of floodplain forests



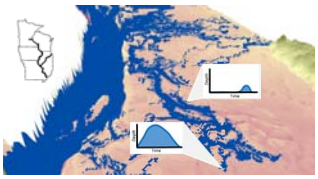


Specific Tasks/Work Items

FY 2018-21:

1) **Facilitate long-term curation** of the inundation modelling framework
2) **Continue empirical examination** of model outputs in collaboration with LTRM field stations
3) Integrate model outputs with vegetation data to **identify opportunities to apply a better understanding of flood-vegetation interactions at the HREP scale**
4) **Examine model outputs for spatial and temporal trends** in flood regime
5) **Evaluate alternative scenarios** of floodplain management on forest succession and nutrient/Carbon cycling

UMRS Floodplain Inundation Model



New datasets characterize landscape-scale hydro-geomorphic patterns across the UMRS

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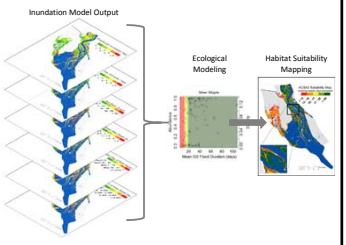

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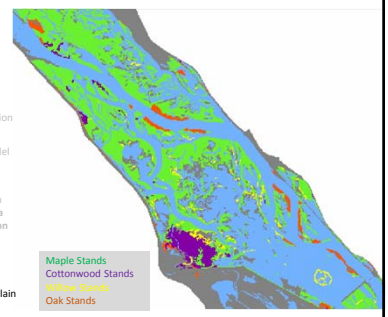
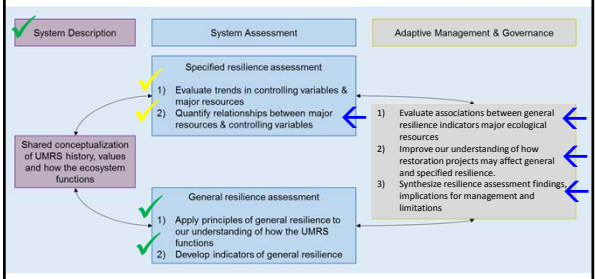


Operationalizing Ecosystem Resilience Concepts in the UMRS (2018-2021)



Operationalizing Ecosystem Resilience Concepts in the UMRS

1) Evaluate general resilience indicators in relation to persistence of major resources

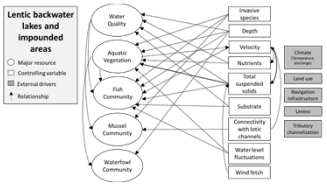
General Resilience Principle	UMRS Resilience Metric
Maintain diversity and redundancy	Aquatic area diversity
	Floodplain inundation diversity
	Fish functional diversity and redundancy
	Aquatic vegetation diversity
	Floodplain vegetation diversity
Manage connectivity	Longitudinal aquatic connectivity
	Lateral connectivity
Manage slow variables and feedbacks	Water surface elevation fluctuations
	Nutrient loads
	Sediment loads
	Invasive species

How do general resilience indicators relate to the persistence of major resources and measures of ecosystem health?

How does the understanding of these associations inform the use of resilience indicators in restoration planning?

Operationalizing Ecosystem Resilience Concepts in the UMRS

2) How may restoration projects affect general and specified resilience?

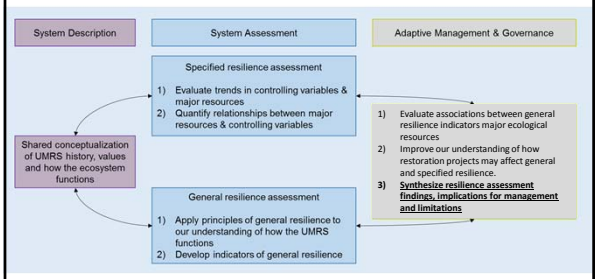


1. How do different types of Restoration actions (HREPs) influence controlling variables?

2. What are the implications for specified resilience of the UMRS?

3. How may HREPs influence general resilience as measured by indicators?

Operationalizing Ecosystem Resilience Concepts in the UMRS (2018-2021)



2020 Land Cover camera testing

Larry Robinson, UMESC

- Purchase of a specially-designed complementary achromatic camera would allow for the collection of 4-band imagery, the preferred format for mapping vegetation.
- 4-band imagery can be georeferenced and displayed as:
  - Color infrared
    - Primary format used for vegetation mapping
  - True color
    - Ideal for use in interpretive displays
- System assembly / integration – Summer 2018
- Sample land use / land cover imagery collected in 2019

UMRR Science in Support of Restoration and Management Potential Projects for FY 17

- Plankton community dynamics of Lake Pepin – the role of crustacean zooplankton. *Rob Burdis, MDNR.*
- Water Clarity in Pool 8 of the Upper Mississippi River: the contributions of changes in external inputs and changes in internal conditions to long term trends. *Deanne Drake, WDNR.*
- Developing methods of estimating of submersed aquatic vegetation biomass in the Upper Mississippi River to expand capabilities within the UMRR program and improve the utility of the long term vegetation data. *Deanne Drake, WDNR & Eric Lund, MDNR.*
- Using measurements of age, recruitment, growth rates, and mortality to understand population demographics of Smallmouth Buffalo in the Upper Mississippi River Basin. *Levi Solomon, INHS.*
- Developing and applying an approach to better understanding Long-Term Performance of Habitat Rehabilitation and Enhancement Projects for the backwaters of the Illinois River. *John Chick & Andy Casper, INHS.*
- Development of young of the year fish indicator for use in the UMRR. *Andy Casper, INHS*.
- Using a snapshot of Age, Growth, Recruitment, and Mortality to improve our understanding of the processes behind the patterns observed in the LTRM fisheries data. *Andy Bartels. WDNR*.
- Landscape Pattern Research and Application on the UMRS (FY18-21). *Nathan De Jager, Molly Van Appledorn, Jason Rohweder. USGS – UMESC.*
- Operationalizing Ecosystem Resilience Concepts in the UMRS. *Kristen Bouska, USGS -- UMESC.*

Proposals under development

- Using a snapshot of Age, Growth, Recruitment, and Mortality to improve our understanding of the processes behind the patterns observed in the LTRM fisheries data. *Andy Bartels, WDNR, Quinton Phelps*
- Developing and applying an approach to better understanding Long-Term Performance of Habitat Rehabilitation and Enhancement Projects for the backwaters of the Illinois River. *John Chick & Andy Casper, INHS*
- Development of Young of the Year Fish Indicator for Use in the UMRR. *Andy Casper, INHS*

UMRR Monitoring & Science FY17

- 2 SOWs in FY17
  - ▸SOW for LTRM base monitoring
    $4.61M
  - ▸SOW for science in support (analysis under base)
    $1.0M
- Both SOWs <u>together</u> are equivalent to a fully funded UMRR LTRM element **$5.61M**

UMRR Monitoring & Science FY17

- 2 SOWs in FY17
  - ▸SOW for LTRM base monitoring
    $4.61M
  - ▸SOW for science in support (analysis under base)
    $1.0M
- Both SOWs <u>together</u> are equivalent to a fully funded UMRR LTRM element **$5.61M**

+$2.50M FY17 workplan science funds

UMRR Science FY17 Workplan

- Proposals:
  - ▸4 Field Station proposals
  - ▸Equipment refresh
  - ▸Landscape pattern research
  - ▸Operationalizing ecosystem resilience
  - ▸2020 Land Cover Land Use camera testing
  - ▸Water quality lab modernization

Detailed proposals will be coordinated with UMRR CC next week

UMRR Monitoring & Science FY18

- 2 SOWs in FY18
  - ▸SOW for LTRM base monitoring
  - ▸SOW for science in support (analysis under base)
- Both SOWs <u>together</u> are equivalent to a fully funded UMRR LTRM element
- Additional funding for Science

UMRR Science FY18 Timeline

- Request for Proposals
  - ▸Late August
  - ▸Themes:
    - Strategic plan, research frameworks
    - Ecosystem health and resilience
    - Systemic effort/analyses
    - UMRR impacts to the UMRS
- Review & Coordination
  - ▸A-Team in January 2018
  - ▸UMRR CC in February

UMRR Monitoring & Science FY18

- 2 SOWs in FY18
  - ▸SOW for LTRM base monitoring
    $4.725M ($4.61 M in FY17)
  - ▸SOW for science in support (analysis under base)
    $1.025M ($1.0 M in FY17)
- Both SOWs <u>together</u> are equivalent to a fully funded UMRR LTRM element **$5.75M**
- Additional funding for Science
  $2.15M

UMRR Monitoring & Science FY2018

	Budget (gross)
MN	$560,555
WI	$536,939
IA	$464,996
Great Rivers (IL)	$414,703
Big Rivers & Wetlands (MO)	$385,605
IRBS (IL)	$472,791
Science meeting travel	$ 7,363
STATES TOTAL	**$2,842,952**
UMESC TOTAL	**$2,840,624**
Corps tech reps	**$ 80,000**
TOTAL FY18 LTRM BUDGET	**$5,763,576**

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