Virtual

Upper Mississippi River Restoration Program Coordinating Committee

Quarterly Meeting

March 1, 2023

Agenda

with

Background

and

Supporting Materials

Virtual

Upper Mississippi River Restoration Program
Coordinating Committee

March 1, 2023

Agenda

[Note: The states, U.S. Army Corps of Engineers, and the Department of the Interior will arrange their respective pre-meetings via conference call prior to the March 1, 2023 quarterly meeting.]

Wednesday, March 1 UMRR Coordinating Committee Quarterly Meeting

Time	Attachment	Topic	Presenter
8:00 a.m.		Welcome and Introductions	*Brian Chewning*, USACE
8:05	A1-A17	Approval of Minutes of November 16, 2022 Meeting	
8:10		Regional Management and Partnership Collaboration	*Marshall Plumley*, USACE
	B1-B4	▪ FY 2023 Fiscal Update and FY 2024 Outlook	
		▪ Environmental Justice	
	B5-B23	▪ Strategic and Operational Plan Review	
		▪ Implementation Issues	
		▪ Report to Congress Update	
9:20		Break	
9:30		Ecological Status and Trends	
	C1-C4	▪ Long Rollout	*Andrew Stephenson*, UMRBA
9:40		Communications	
		▪ UMRR Communications Team	*Rachel Perrine*, USACE
		▪ External Communications and Outreach Events	*All*
10:15		UMRR Showcase Presentations	
		▪ Lower Pool 13 HREP	*Dillan Laaker/Julie Millhollin*, USACE
		▪ UMRS Topobathy Acquisition	*Jayme Strange*, USGS
11:15		Program Reports	
		▪ Habitat Restoration District Reports	*District HREP Managers*
12:00 p.m.		Lunch	
1:00		Program Reports (Continued)	
	D1-D16	▪ Long Term Resource Monitoring and Science	*Jeff Houser*, USGS
		– LTRM FY 2023 1st Quarter Highlights	
		– USACE LTRM Update	*Karen Hagerty*, USACE
		– A-Team Report	*Scott Gritters*, IA DNR
1:30	D17-D42	LTRM Implementation Planning Update	*Jeff Houser*, USGS *Max Post van der Burg*, USGS
2:30	E1-E13	Other Business Future Meeting Schedule	
2:40 p.m.		Adjourn	

ATTACHMENT A

Minutes of the November 16, 2022 UMRR Coordinating Committee Quarterly Meeting

(A-1 to A-17)

DRAFT
Minutes of the
Upper Mississippi River Restoration Program
Coordinating Committee

November 16, 2022
Quarterly Meeting

Davenport, IA

Sabrina Chandler of the U.S. Fish and Wildlife Service called the meeting to order at 8:02 a.m. on November 16, 2022. UMRR Coordinating Committee representatives in attendance were Brian Chewning (USACE), Mark Gaikowski (USGS), Chad Craycraft (IL DNR), Randy Schultz (IA DNR), Megan Moore (MN DNR), Matt Vitello (MO DoC), and Jim Fischer (WI DNR). A complete list of attendees follows these minutes.

Minutes of the August 10, 2022 Meeting

Matt Vitello moved and Jim Fischer seconded a motion to approve the draft minutes of the August 10, 2022 UMRR Coordinating Committee meeting as written. The motion carried unanimously.

Regional Management and Partnership Collaboration

FY 2022 Fiscal Update

Marshall Plumley reported that UMRR's FY 2022 plan of work included $33,583,764, including carryover from FY 2021. UMRR achieved an execution rate of 98.4 percent in FY 2022. UMRR averaged a 97.7 percent execution rate from 2017 to 2022. Regional science and monitoring obligations reflect pre-funding of the FY 2023 scope of work to ensure continuity of funding across fiscal years. Adjustments will be made back to other sources in FY 2023. Plumley said the program execution reflects the partnerships' effort and sends an important signal to Congress regarding program success.

FY 2023 Budget Outlook

Plumley said that, on September 30, 2022, Congress passed a continuing resolution authority (CRA) extending current funding levels of the federal government until December 16, 2022. The President's FY 2023 budget as well as the House and Senate FY 2023 energy and water appropriations bills include $55 million for UMRR. UMRR is proceeding with executing the Program at the $55 million level. The final FY 2023 appropriation is not yet known.

The draft plan of work for UMRR in FY 2023 at a $55 million funding scenario is anticipated to be as follows:

- Regional Administration and Program Efforts – $1,550,000
    - Regional management – $1,280,000
    - Program database – $100,000
    - Program Support Contract – $120,000
    - Public Outreach – $50,000

- Regional Science and Monitoring – $15,450,000
  - Long term resource monitoring – $5,500,000
  - Regional science in support of restoration – $8,350,000
  - Regional science staff support – $200,000
  - Habitat evaluation (split across three districts) – $1,275,000
  - Report to Congress – $125,000
- Habitat Restoration – $38,000,000
  - Rock Island District – $11,148,000
  - St. Louis District – $13,502,000
  - St. Paul District – $13,250,000
  - Model certification – $100,000

Plumley said that, at a $55 million funding level, regional science in support of restoration would increase from approximately $3.8 million to $8.3 million and habitat restoration funding in each district would increase from between $6 million and $7 million to between $11 million and $13 million. In response to a question from Mark Gaikowski regarding model certification funds, Plumley said model certification funds were obligated from FY 2018 to FY 2021 but that only one-quarter of the funds were used in FY 2022. Jim Fischer asked if $50,000 is adequate to support UMRR's communications needs, especially as the program expands under increased appropriation authority. Fischer named near term communications needs around the ecological status and trends flyers, the 2022 Report to Congress, and environmental justice. Plumley said there is separate funding designated for the LTRM status and trends and 2022 UMRR Report to Congress rollouts. The HREP allocation would cover restoration-related environmental justice opportunities at the project scale. Regional programmatic environmental justice activities would be paid from the public outreach allocation. Plumley said adjustments can be made across items if there are immediate needs.

WRDA 2022

Plumley reported that the Senate WRDA 2022 draft language includes an annual appropriation authorization increase for the HREP element of UMRR from $40 million to $75 million. With LTRM's authorized appropriation level of $15 million annually, the total UMRR annual authorized funding level would be $90 million. Plumley anticipates more information will be available after the conclusion of various election recounts. In response to a question from Jennie Sauer, Plumley said WRDA 2020 increased annual authorized funding for LTRM to $15 million, but WRDA 2022 did not address LTRM.

UMRR Ten-Year Plan

Plumley reported that updates to the UMRR 10-year implementation plan include adding Robinson Lake HREP in MVP and extending schedules for cost estimates on Green Island HREP in MVR, and design work at Harlow and Oakwood Bottoms HREPs in MVS. Plumley said twelve projects are anticipated to be in feasibility in FY 2023, requiring considerable staff time from implementing partners, and thanked partners for investing energy in planning to ensure a healthy pipeline of projects. In response to a question from Kirsten Wallace, Plumley said the program identified a need for a project selection process every five years to occur again in FY 2025, but that increased appropriations would result in accelerated project schedules and expedited need for a project selection process sooner. The program has available fact sheets now, but Plumley anticipates the next HREP selection process to begin in calendar year 2024. Kirk Hansen suggested revisiting existing fact sheets in conjunction with identifying new projects. Plumley said that a UMRR and NESP program-neutral selection process was completed in 2009 and may be considered again to make efforts most efficient and complimentary.

2022 Report to Congress

Plumley reported that the second in-progress review of the 2022 UMRR Report to Congress with USACE Headquarters was held on August 29, 2022. MVD and USACE HQ then completed an initial review of the draft 2022 UMRR Report to Congress that Plumley said resulted in mostly editorial comments to improve clarity. The revised report was routed to MVD and USACE HQ on November 9, 2022 for final approval. Plumley expressed appreciation to partners for their collective efforts in writing and reviewing the report, but especially to Jeff Houser, Andrew Stephenson, Jill Bathke for their contributions. The report is an excellent tool for communicating within the partnership and to others about the program. Plumley said he will distribute the finalized report to UMRR Coordinating Committee members in the coming weeks. The delivery of the report to Congress is anticipated in December 2022. Plumley said that, similar to the 2016 Report to Congress, a four-page handout will be developed to summarize this report.

Plumley provided an overview of the report highlights tied to the UMRR 2015-2025 strategic plan as follows:

<u>Leading</u>

— Implemented the UMRR program as outlined in the adopted Joint Charter and the goals and objectives of the 2015-2025 Strategic Plan.

— Provided critical insight and understanding of the UMRS through monitoring, research, and modeling to inform management of the UMRS.

— Promoted a common vision, sense of purpose, transparency, and accountability among the program partners.

<u>Innovating</u>

— Assessed and detected changes in the fundamental health and resilience of the UMRS.

— Defined ecological resilience and appropriate indicators to measure status and trends in the UMRS.

— Renewed UMRR's Habitat Needs Assessment and identified the suite of habitat projects to improve UMRS ecosystem health and resilience.

— Addressed key ecological needs at various spatial scales.

— Formulated and constructed 7 habitat restoration projects benefiting approximately 15,400 acres of nationally significant aquatic, wetland, forest, island, side channel and backwater habitats.

<u>Partnering</u>

— Actively exchanged information with UMRS watershed, national, and international partners.

— Evaluated and learned from constructed habitat restoration projects.

— Applied adaptive management principles to address risk and uncertainty.

— Collaborated with partners to further inform issues related to project partnership agreements.

Plumley said the report also includes recommendations that will help as UMRR kicks off development of the next strategic plan in 2024. Recommendations included:

— Apply defined ecological resilience concepts, the UMRR Habitat Needs Assessment-II, and adaptive management principles to address risk and uncertainty.

— Continue to identify and construct habitat projects that improve the UMRS ecosystem health and resilience and evaluate and learn from constructed habitat projects to inform future restoration and management.

— Assess, and detect changes in, the fundamental health and resilience of the UMRS ecosystem by continuing to monitor and evaluate its key ecological components.
— Provide critical insights and understanding regarding a range of key ecological questions in order to inform and improve management and restoration of the UMRS ecosystem.
— Work with key organizations and individuals in the UMRS watershed and provide information to organizations and individuals whose actions and decisions affect the UMRS ecosystem
— Promote a common vision and sense of purpose, transparency, and accountability among UMRR's implementing partner agencies
— Implement UMRR as outlined in Joint Charter and engage the partnership in 2024 in preparing the next UMRR Strategic Plan.
— The Corps and non-federal sponsors should continue to work together to further inform issues related to execution of PPA's.

Plumley expressed appreciation for the letters of support he received from various state and federal agencies and NGOs, noting they demonstrate ongoing commitment to the program and were included in a report appendix. In response to a statement from Wallace, Plumley agreed that a small group should be convened to help develop key messages and talking points for the report to help partners communicate about the report release in spring 2023.

Environmental Justice

Plumley reflected on the environmental justice discussion during the UMRR Coordinating Committee's August 10, 2022 quarterly meeting. Plumley said USACE will continue to fully integrate environmental justice into all aspects of its programs, including planning, design, construction, and operations and management. He reported that additional USACE guidance on environmental justice is anticipated in late November 2022. Plumley said that, following UMRR CC discussion at the August meeting and at his request, Stephenson sent an email to the UMRR Coordinating Committee on October 6, 2022, to designate staff from their respective agencies to participate in an *ad hoc* group to consider UMRR's roles in environmental justice. The *ad hoc* group's first steps will include sharing their respective agencies' perspectives on approaches and best practices, methods, and tools related to environmental justice in their work and discussing how UMRR currently approaches environmental justice through habitat rehabilitation and enhancement projects. Plumley said a request for availability for the first discussion is anticipated to be sent in the coming weeks after all agencies have identified participants. Stephenson added that because some agencies have identified staff who are not currently engaged with UMRR, there will be an information webinar held in advance of the first *ad hoc* group discussion on environmental justice. Bryan Hopkins asked for opportunities for NGOs to engage in the conversation on environmental justice and said The Nature Conservancy has expertise and perspective that could be valuable. Lindsay Brice indicated in the meeting chat Audubon's interest as well. Plumley said the initial discussion will be with Coordinating Committee members and other agency staff but welcomed broadening discussions to the wider partnership in subsequent discussions. Megan Moore expressed appreciation for Hopkins' comments and said that NGOs can have a productive role in achieving the program's environmental justice goals.

Implementation Issues

Plumley reported that, on August 31, 2022, the UMRR Coordinating Committee met to discuss revisions to the draft implementation issue papers. On September 21, 2022, UMRBA staff sent an email asking Coordinating Committee members to identify supported and preferred actions to address each issue. On November 10, 2022, UMRBA staff distributed finalized implementation issue papers to the UMRR Coordinating Committee with draft recommendations removed. Issues included:

- Project Partnership Agreements (PPAs)
- Engaging non-traditional sponsors
- Land acquisition
- Floodplain regulations
- External communications
- Federal easement lands
- Watershed inputs and climate change
- Water level management

Plumley noted that PPAs require action by Congress to address. Plumley said that in the coming months, the Coordinating Committee will convene a meeting to establish broad consensus on the recommended suite of alternatives to address implementation issues and consider lead agency and personnel for each action to be pursued. Plumley said this process will also help prepare the partnership for discussions on UMRR's next strategic plan as well.

2015-2025 Strategic and Operational Plan Review

Plumley said that a draft of the UMRR 2015-2025 Strategic Plan review report is nearly complete. The report summarizes the results of a survey distributed to the partnership at-large on September 20, 2021 and identifies what the program has done well and priority actions to fulfill the strategic plan. Plumley overviewed areas of program success and priority actions under each of the four goals in the strategic plan.

<u>Success Criteria</u>

Goal 1 Enhance Habitat

- Restoration projects provide opportunities for scientific research and inquiry
- HREPs enhance the health and resilience of the UMR
- UMRR serves as a source of guidance on restoration for similar programs nationally
- UMRR is recognized as a premier program in large river restoration

Goal 2 Advance Knowledge

- Research and monitoring inform restoration and management efforts
- UMRR is recognized as a premier program in large river monitoring and science
- UMRR serves as a source of guidance on monitoring and science for similar programs nationally
- UMRR effectively detects the status and trends of the UMR as related to indicators of ecosystem health and resilience

Goal 3 Communications

[no success criteria were available for Goal 3]

<u>Priority Actions</u>

Goal 1 Enhance Habitat

- Centralize HREP data and collect and digitize historic data currently stored in computers and file cabinets
- Establish consistent and standardized HREP monitoring
- Complete HREP project evaluation reports (PERs) across districts
- Define appropriate temporal and spatial scales for determining physical and biotic response of habitat project objectives

Goal 2 Advance Knowledge

- Connect resilience concepts with ongoing and future restoration work

Goal 3 Communications

- Link together habitat restoration projects with existing watershed projects and upstream contributors

Goal 4 Partnership

- The partnership is supportive of the program and its output
- UMRR has a highly engaged regional partnership

Goal 4 Partnership

- Create a narrative around missed-restoration opportunities because of existing policies

Plumley said a finalized report is anticipated to be submitted to UMRR Coordinating Committee members in the coming weeks. A meeting will be convened to review and discuss the results. This meeting will likely be held on conjunction with the meeting to discuss the implementation issues papers.

Status and Trends Report Long Rollout

Stephenson said that UMRBA staff are coordinating the development of a series of five two-page flyers related to findings presented in the 2022 UMRR LTRM status and trends report and are creating a plan for disseminating flyers to the UMRR partnership and media outlets. Topics include fisheries, water quality and nutrients, floodplain forest loss, aquatic vegetation, and sedimentation. Key findings from the joint press release are the basis for the flyers on fisheries, forest loss, and water quality. Stephenson said a finalized version of the fisheries flyer is included as attachment C1-C2 in the meeting agenda packet and drafts of the sedimentation and floodplain forest loss flyers are in development. Stephenson said there were not key takeaways developed for the press release regarding sedimentation or aquatic vegetation. Stephenson presented draft versions as follows:

- Sedimentation: Sediment accumulation has changed the river structure by creating new floodplain land areas and reducing depths in backwater areas. These changes affect the quality and availability of habitat for fish and wildlife.

  The loss of deep backwater areas can reduce suitable habitat for some fish species, especially for overwintering.

  New landforms with sandy substrates can be important habitats for shorebirds and waterbirds and offer ideal conditions for the establishment of important tree species such as willows and cottonwoods.

- Aquatic vegetation: Aquatic vegetation diversity has improved in the Upper Impounded Reach of the Upper Mississippi River. However, aquatic vegetation diversity remains low or unknown in other reaches of the river.

  Long-term monitoring reveals that improvements in aquatic vegetation are tied to lower nutrient loads in the water, better water clarity, and a decline in common carp.

  The increase in submersed aquatic vegetation and water clarity in much of the Upper Impounded Reach represents a significant improvement in the ecological condition of the Upper Mississippi River System.

  Aquatic vegetation helps sustain clearer water, provides important habitat for many aquatic animals, and is an important food source for migrating waterfowl.

Stephenson said that during various stages of development, flyers are reviewed by the report authors, UMRR Communications and Outreach Team, and A-Team members. Final draft versions are presented to the UMRR Coordinating Committee. Stephenson said that in lieu of a central photo repository, there is an ongoing request for photos with photo credit information to be submitted for use in the flyers. In response to a question from Vitello, Stephenson said distribution of the flyers has not yet been determined, but that the fisheries flyer will be available in three formats for digitally sharing, printing at home, and professional prints. Plumley said that print run could be arranged following a request to partners to assess needed numbers of copies. Stephenson said that many agencies are looking to participate in or hold in-person events and that a request will be sent to UMRR Communications and Outreach Team members regarding calendars of events for each agency. Hopkins said that since the Status and Trends report was published, he has received more inquiries about altered hydrology in the system. Hopkins noted that hydrologic changes impact many other important characteristics of the river. Hopkins suggested that linking this change to climate change would align well with the Administrations priorities. Megan Moorea agreed that water discharge is the master variable. Stephenson said that more water more of the time was a key takeaway from the press release and is being woven into each flyer. Lauren Salvato suggested linking water availability in terms of water quality and water supply into the flyer on water quality. Jennie Sauer said USGS is developing an FAQ based in interviews of inquiries that followed release of the report. The summary fact sheet is anticipated to be six to eight pages in length and will go through a similar partnership review process. Sauer said they will discuss the fact sheet with the publishing network on November 28, 2022 and solicit involvement of creative writers to help translate technical language. The fact sheet is anticipated for use with Congressional visits in 2023.

Fischer suggested adding a fact sheet specifically to address the issue of altered hydrology. Stephenson concurred and noted that although these handouts are meant to be individual topics, a general topic fact sheet could also be useful to unify them all. Houser questioned the development of a standalone fact sheet on hydrology and said the hydrologic information is based on USGS gage data, not LTRM data, and was included in the report to establish context, but is now drawing the most attention. Kirsten Wallace said the use and inclusion of the data aligns with goal three of the strategic plan in how we can learn from others to achieve our mission and vision. She agreed that he information is key to our knowledge about climate change. Sabrina Chandler suggested including information on altered hydrology as an intro paragraph to the flyers to set the tone for topics, but not as a separate flyer because it is not LTRM data. Stephenson reiterated that altered hydrology is a thread across all flyers. Fischer recalled that during UMRBA's open space meetings in 2019, it was evident that there was a need for greater understanding regarding how the river functions, how locks and dams are managed, and that Corps operations are not responsible for increased flood frequency or duration. A fact sheet focused on altered hydrology may help address that need. Stephenson said he has received requests for additional review time on flyers and that review periods will be lengthened, but will still be shorter than other materials as the products are short, there are multiple review opportunities, and language is derived mainly from information already presented in the status and trends report. Olivia Dorothy echoed Hopkin's request for a separate flyer on hydrologic changes in the river. Dorothy asked if USACE would look at the Status and Trends report as part of their consideration if the NESP programmatic environmental impact statement (PEIS) needs to be supplemented. Brian Johnson said the appropriate Corps staff to answer that question were not in attendance.

Communications

Bathke reported that, using insights gained from the 2022 UMRR LTRM status and trends report release, the UMRR Communications and Outreach Team (COT) developed a set of best practices and drafted a six-month schedule template for similar future efforts. Recommendations include identifying key partners involved and their respective needs early in the process as well as intended communication methods and modes of dissemination to various stakeholder groups. When possible, messages should be tailored to specific geographic areas and anticipated FAQs should be developed prior to a press release. Bathke emphasized that accessibility and accuracy during key message development is time well spent. The COT will continue to build relationships with the Mississippi River Basin Ag & Water Desk.

Bathke said future COT activities include developing communications materials to support publication of the 2022 UMRR Report to Congress, updating the UMRR communications and outreach plan, completing the UMRR video series, creating a communications inventory, and cooperating with advanced communications planning efforts around the 100th Anniversary of the Upper Mississippi River National Wildlife and Fish Refuge in 2024.

External Communications and Outreach

Communication and outreach activities in the fourth quarter of FY 2022 include the following:

- Lauren Salvato said she will present to the Iowa Learning Farm on UMRBA's How Clean is the River report, but also plans to discuss existing water quality monitoring under LTRM and the need for additional monitoring.
- Matt Vitello said that on September 24, Missouri Department of Conservation held a World River Day event in Cape Girardeau with tanks of fish and turtles, ask the professionals booth, and boat rides. The event had approximately 750 participants over 4 hours. Jennie Sauer commended Vitello for organizing boat rides for so many participants.
- Fischer said that on August 24, 2022, Jeff Janvrin presented on UMRR at the American Fisheries Society National Conference in Spokane, WA and on November 5, 2022 at Bucknell University's 17th annual river symposium in Lewisburg, PA. Fischer said that on September 6, 2022 he, Houser, and Marc Schultz with the La Crosse County Conservation Alliance participated in a panel discussion regarding the status and trends report with Ezra Wall on Wisconsin Public Radio.
- Gaikowski said that on November 10, 2022, UMESC staff were joined by Fischer and provided a briefing on LTRM to Senator Baldwin's staff. On September 13-15, 2022, Gaikowski and KathiJo Jankowski attended the Mississippi River Cities and Towns Initiative's annual meeting and Jankowski presented on the Status and Trends Report.
- Kirsten Wallace said she met with USACE Headquarters in early-October as part of Federal Water subcabinet meeting and underscored UMRR and PPA issues in response to questions of where there have been successful efforts of state and federal partnerships. She also met with congressional staff and USFWS leadership to underscore the importance of the Service in the program and the states.
- Plumley said that on October 26, 2022, he, Kirk Hansen, and Kara Mitvalsky presented on UMRR to the Interstate Council on Water Policy (ICWP) and shared information about habitat restoration. Wallace expressed appreciation for their participation and said that UMRBA was the outgoing chair of ICWP and selected the Quad Cities for the meeting to highlight UMRR. Wallace said The USEPA Region 7 Water Director was impressed with UMRR's work and the agency is trying to determine how best to reengage.
- Jeff Houser said that he also presented to ICWP on the Status and Trends Report at this event.

UMRR Showcase Presentations

FY 2022 LTRM Accomplishments

Jennie Sauer presented LTRM accomplishments in FY 2022, as follows:

<u>Partnership</u>

- Collaboration with agencies on newly planned ecological assessment programs on the Columbia and Hudson River systems
- Collaboration with UMRR HREPs, including the Big Lake, Pool 4, and Lower Pool 13
- Successful completion of the UMRR 2022 virtual science meeting with over 100 participants representing 17 different agencies and organizations
- Contributions to future generations of scientists, including the water quality lab hosting 60 interns over the last 30 years and multiple graduate student research projects utilizing LTRM fish data.

— Completion of monitoring of the Illinois Waterway consolidated closure

— LTRM implementation planning efforts

Publications

— Multiple publications based on 29 years of LTRM monitoring of fisheries and water quality and 24 years of aquatic vegetation monitoring, including the 2022 UMRR LTRM status and trends report and subsequent media coverage

— Advancing the UMRS resilience assessment including a new publication using the resist-accept-direct framework

— Development of a manuscript regarding side channel classification based on fish associations with physical metrics currently in review

New Methods, Tools, and Procedures

— Successful upgrade of ScanLog/data transfer to sFTP

— Ongoing renovation of the LTRM water quality lab and temporary move to University of Wisconsin-La Crosse

— Creation of methods for high-accuracy mapping of emergent vegetation (wild rice) using UAS assets

— Land cover/use (LCU) 2020 mapping

— Mapping potential sensitivity to hydrogeomorphic change in the UMRS riverscape and development of supporting GIS database and query tool

— Refining the framework of Upper Mississippi River's ecosystem states based on predictions of plant distribution (and why) on the landscape and areas with high restoration potential

— Systematic analysis of hydrogeomorphic influences on native freshwater mussels including establishing population estimates in Pools 8 and 13

— Modeling projected patterns of forest recruitment and succession with and without inhibition of forest regeneration in areas currently occupied by invasive reed canary grass under different hydrologic scenarios

Continuation of Important Work

— Ongoing work related to vital rates, genetics, and microchemistry of UMRS fishes

— Ongoing efforts to improve understanding of historic, contemporary, and future UMRS hydrology including development of a database template for historic and contemporary daily water service elevations at UMRS USACE gages.

Sauer expressed appreciation to the technicians, field station leaders, and others who contributed to these accomplishments. Stephenson applauded Sauer for including the contributions to future generations recognizing those who passed through the program and Plumley agreed. In response to a question from Stephenson, Gaikowski said completed and ongoing renovations to the water quality lab include leveling the floor and installing HVAC and fire suppression. Fume hoods and cabinetry are scheduled to be installed in February 2023. The water quality lab is scheduled to move back to UMESC between September and December 2023.

Marshall Plumley presented Jennie Sauer with the Commanders Award for Public Service to recognize her exceptional service to UMRR and LTRM over 30 years. The award reads:

> "For exceptional service to the UMRR program's LTRM element over past 3 decades. Ms. Sauer made critical contributions to its success and recognition as a national and global leader in applied science and monitoring. As a field technician, principal investigator, and LTRM Branch Chief, she mentored her staff, coordinated research investigators, and ensured efficient LTRM operation, earning the enduring respect of UMRR partners. Her outstanding performance is in keeping with the highest traditions of civil service and reflects distinct credit upon herself, the UMRR program, the U.S. Geological Survey, and the U.S. Army. Signed Lt. Col. John M. Fernas, Deputy District Commander for the Rock Island District, U.S. Army Corps of Engineers."

Plumley expressed gratitude on behalf of himself and UMRR for Sauer's contributions to the program. Sauer expressed appreciation for the opportunity to work on LTRM and said she will retire in December 2022. Sauer was congratulated and applauded by the UMRR Coordinating Committee and meeting attendees.

FY 2022 HREP Accomplishments

District HREP managers presented on HREP accomplishments in FY 2022, as follows:

— Angela Deen said MVP's FY 2022 accomplishments include three ribbon cuttings to celebrate completion of Bass Ponds, Harpers Slough, and Conway Lake HREPs. The district awarded Stage II of McGregor Lake. Deen said MVP had multiple opportunities to host site visits to the Bass Ponds HREP, including for the UMRR Coordinating Committee and the River Resources Forum as well as a public ribbon cutting. Deen said the Shakopee Mdewakanton Sioux Community was able to harvest Wild Rice from at least one lake at the project for the first time in a long time. Deen said completing repairs at Harpers Slough required considerable work and overcoming many challenges. MVP public affairs created five videos and multiple social media posts featuring HREPs and participated in the UMRR Earth Day campaign. Videos were viewed nearly 8,000 times, reached 16,700 people, and elicited 637 reactions, comments, and shares. Deen said the district applied lessons learned from UMRR to other programs as well. Two accomplishments outside of UMRR include beneficially using dredged material at Pigs Eye Lake, a CAP 204 project, to create six islands and selection of Upper Pool 4 Islands as a CAP 1122 pilot project. The project will add islands to upper Lake Pepin. In response to a question from Jennie Sauer, Plumley said Harpers Slough was the first project that was complete and then impacted by flooding. The program had stopped budgeting for the project, which is why it required so much additional coordination. Plumley added that the CAP 1122 project on Lake Pepin is one of only a few pilot projects around the country and may have been selected in part because of MVP's 30 years of experience restoring ecosystems under UMRR. Stephenson said Bass Ponds HREP presents a great opportunity for public engagement and applauded the Corps and the USFWS Refuges for facilitating site visits.

— Julie Millhollin said MVR's FY 2022 accomplishments include advancing feasibility studies on four HREPs, awarding a construction contract for Steamboat Island, and completing construction of Keithsburg Stage I and Stage IIA as well as various components of the Beaver Island HREP. The district developed a ribbon cutting video to celebrate completion of the Pool 12 Overwintering HREP. Aquatic vegetation plantings at Huron Island have been successful and blanket purchase agreements have advanced tree planting and clearing as well as timber inventory efforts in the District. Millhollin said that MVR public affairs created three videos that garnered over 28.8 hours of viewership and featured multiple social media posts on UMRR and LTRM activities that reached over 25,000 users. The district plans to identify a new HREP to start in the fourth quarter of FY 2023.

— Brian Markert said MVS's FY 2022 accomplishments include advancing construction on three HREPs, design on two HREPs, and feasibility on two HREPs. The sediment deflection berm was completed at Crains Island, UMRR's first open river project, and pump stations are nearly complete at Clarence Cannon HREP. The District has drafted three new fact sheets and toured Cypress Creek Refuge to discuss restoration opportunities with the USFWS Refuge Manager. Site visits to Swan Lake, Cuivre Island, Calhoun Point, and Dresser Island helped identify construction and operation lessons learned. The Swan Lake Flood Damage Assessment letter report was advanced. In response to a question from Stephenson, Markert introduced MVS staff new to UMRR including Abby Hoyt, Ryan Swearingin, and Jack Hendrickson.

Long Term Resource Monitoring and Science

FY 2022 4th Quarter Report

Jeff Houser reported that accomplishments of the fourth quarter of FY 22 include publication of the following manuscripts and reports:

— *Annual Summer Submersed Macrophyte Standing Stocks Estimated From Long-Term Monitoring Data in the Upper Mississippi River*

— *Trophic reorganization of native planktivorous fishes at different density extremes of bigheaded carps in the Illinois and Mississippi Rivers, USA.*

— *Recommendations report regarding water level management to achieve ecological goals in the Upper Mississippi River System*

Houser said that renovation of the LTRM water quality laboratory, which has temporarily moved to the University of Wisconsin-La Crosse, is ongoing. The laboratory renovation is expected to be completed in July 2023.

USACE LTRM Report

Karen Hagerty said UMRR is operating under a $55 million funding scenario for FY 2023, in which LTRM is allocated $13.85 million. Allocations compared to the FY 2022 funding level are as follows:

— Base monitoring increases to $5.5 million from $5 million

— Science in support restoration (analysis under base) increases to $1.5 million from $1.3 million

— Science in support of restoration and management increases to $6.85 million from $2.5 million

Hagerty said the LTRM FY 2023 $7.4 million base monitoring and analysis-under-base program covers field stations, UMESC, and Corps technical and science representatives. Under the continuing resolution funding restrictions, LTRM is funded to continue base monitoring until more appropriations are received. High priority funding items for science in support of restoration total $1.975 million and include:

— LTRM balance: $464,671

— Ecohydrology: $459,797

— LC processing (last year): $335,238

— Proposal adjustments: $28,884

— Macroinvertebrate contaminants: $77,483

— Herbarium: $21,000

— Future landscape modeling: $588,674

Hagerty said remaining funds of approximately $4.9 million may be used to purchase equipment for field stations and the water quality lab, advance additional FY 2022 science proposals, and/or update topobathy. Hagerty noted that the topobathy data underlies many UMRR science and habitat restoration activities, but updating it would include financial support from NESP at this time. Sauer said that vegetation samples have been collected, pressed, and stored since the early 90's and that establishing a central herbarium would results in a collection of large river plants unlike any other. Fischer expressed support for improved cataloguing of vegetation samples and suggested archiving fish samples similarly.

[Note: following conclusion of the meeting, Brian Ickes provided additional information regarding fish sample specimens. He said that from the beginning of sampling, the fish component has preserved specimens for vouchering and maintaining a training set of samples. Early in the program, each field station maintained a specimen voucher collection locally. These were preserved specimens with two primary purposes: (1) maintaining specimens, particularly for difficult taxa, for verifying species IDs in the lab once the preserved voucher specimen had been identified by a trained ichthyologist/systematist (Bob Hrabik was one of these experts, along with a few others); (2) training seasonal and new field personnel in taxa identification and methods. About the time we switched from paper archives to digital archives for the data, a "house cleaning" initiative at most field stations occurred. As part of that, each field station sought out museums with ichthyological expertise to house their burgeoning voucher specimen collections. Some went the way of the Bell Museum in Minneapolis under Konrad Schmidt while others went to Southern Illinois University Carbondale under Brooks Burr and colleagues.]

LTRM Implementation Planning

Houser said the *ad hoc* LTRM implementation planning team has been tasked with determining research opportunities to expand the understanding of UMRS restoration and management. In part, an objective for this effort is to identify and prioritize research needs under increased potential for additional funding following the authorized increase in WRDA 2022.

Houser reported that, over the past several months, the implementation planning team has drafted objective statements and identified and prioritized information needs in four broad categories: floodplain ecology, hydrogeomorphic change, aquatic ecology, and restoration applications. Possible actions to address information needs include employing short-term research studies, adding capacity for analyzing existing LTRM data, spatially expanding baseline monitoring, and adding new long term monitoring components. Houser said, the team held an in-person workshop on September 13-15, 2022 to finalize scoring criteria and information needs. Agencies submitted final scores of information needs on November 10, 2022. The implementation planning team is scheduled to meet on November 17, 2022 to review scoring results. A small subgroup will develop approximate cost estimates associated with necessary actions to address each information need. The implementation planning team will then discuss how to optimize actions based on scores and estimated costs. Houser said he anticipates providing a set of recommended actions to the Coordinating Committee at the March 1, 2023 quarterly meeting.

A-Team Report

Scott Gritters said the A-Team met via webinar on October 25, 2022. Topics discussed included updating the A-Team Corner and the Corps webpages regarding LTRM Field Station descriptions, management implications of a resilience assessment of the UMRS, including application of the resist-accept-direct framework, the status of aquatic vegetation in Pool 13, potential A-Team roles in HREP/LTRM integration, development of the two-page flyers communicating the major findings from the 2022 UMRR LTRM status and trends report, and an introduction to the staff at the Wisconsin field station by Jim Fischer. Gritters said Kristen Bouska presented on how assessing resilience can aid in navigating the resist-accept-direct (RAD) framework by understanding general resilience, distance to thresholds, and desirability of conditions. Furthermore, understanding trajectories of change and implications on ecological resources can aid in evaluating management actions under future scenarios. Gritters said Seth Fopma presented on how Wild Celery in the impounded portion of Pool 13 increase in frequency of occurrence from 1998 to 2016, but has shown signs of decline over the last 6 years.

Gritters said the A-Team identified a few ways to support HREP/LTRM integration including informing all PDT members of available information, ensuring LTRM trend information is presented early in PDT discussions, and notifying PDT members that the A-Team chair and reps will respond to any information needs. Gritters said the A-Team has reviewed the fisheries flyer and was requested to review the forest loss flyer. Gritters commended UMRBA staff for effectively summarizing a great deal of information in the flyers. Gritters expressed appreciation to Fischer for the overview on the Wisconsin Field Station staff and sympathies and support for Craig Hoff's medical conditions. Fischer acknowledged the need to update the field station information and thanked Gritters for the opportunity to highlight staff and the great work they do and acknowledge Hoff's situation. Gritters said as next steps, the A-Team will request that field station staff review information on the A-Team Corner and Corps webpages and submit updated information.

Habitat Restoration

Angela Deen said MVP's planning priorities include Robinson Lake, Big Lake - Pool 4, and Reno Bottoms. A kick-off meeting for Robinson Lake is being planned and will use the same PDT as the Big Lake Pool 4 project. The Reno Bottoms draft report was completed and released for public review and a public meeting was held on November 3, 2022. A design contract award for Lower Pool 10 is expected at the end of this month. Construction was completed at Harpers Slough, Bass Ponds, and Conway Lake HREPs. O&M manuals are nearly complete. A contract to complete McGregor Lake HREP construction was awarded at the end of the last fiscal year. The project will use approximately 500,000 cubic yards of dredge material form the main channel. Deen said other efforts in the District include development of a Trempealeau HREP letter report outlining repair needs and the development of 12 storymaps for recent HREPs. Sabrina Chandler said the work Mandy Michaelson from ERDC presented on HABs at the UMRBA Board's quarterly meeting on August 9, 2022 would be relevant to Trempealeau. Chuck Theiling said Nicole Manasco would be another good resources. In response to a question from Stephenson, Deen said the selection of presentation-style or open-house style public meetings can be driven by venues and the availability of technology or input from community members ahead of the meeting.

Julie Millhollin said MVR's planning priorities include Lower Pool 13, Green Island, Pool 12 Forestry, and Quincy Bay. The Pool 12 Forestry PDT conducted a site visit on October 26, 2022 and is finalizing alternatives. Cost estimates for Green Island are being finalized and the Lower Pool 13 has a virtual public Q&A scheduled for November 17, 2022. The Quincy Bay PDT held an alternatives workshop on November 2, 2022 and established concurrence on the final array of alternatives. The District's design priority is Steamboat Island Stage II, with a 65 percent review anticipated to begin in January 2023. Millhollin said MVR has five projects in construction including Pool 12 Overwintering, Beaver Island Stage IB, Steamboat Island Stage I, Keithsburg Division Stages I and II, and Huron Island Stage III. The District is working to turn over the Pool 12 Overwintering Stage II project to the sponsor. A construction contract for Steamboat Island Stage I was awarded on August 31, 2022. The Beaver Island HREP included a large tree planting that required five semi-truck loads of trees. A ribbon cutting for Huron Island Stage II was held on September 7, 2022. MVR is working to address sponsor comments on the Upper Pool 13 fact sheet. Chandler said she is aware of a group of stakeholders opposed to pelicans and aquatic vegetation who have engaged USFWS and Iowa DNR in the past and may join the Pool 13 virtual meeting, but expressed displeasure over the 4:00 p.m. meeting time. Millhollin said the PDT walked through issues related to pelicans and received input online regarding the meeting time and can look for alternative times in the future. Fischer said Pool 13 is a trend pool and suggested highlighting the data to educate stakeholders on the importance of submersed aquatic vegetation. In response to a question from Chad Craycraft, Millhollin said that when they have difficulty sourcing tree species, they may substitute different species, but that the blanket purchase agreement they have allows two years for work to be completed and has allowed nurseries to prepare for a given need. Chandler said volunteer groups have also been collecting acorns to provide local seed to growers.

Brian Markert said MVS's planning priorities include West Alton Islands and Yorkinut Slough. Hydraulic and hydrologic modeling for West Alton Islands and cost estimates for incremental cost analysis and the draft tentatively on Yorkinut Slough are nearly complete. Markert said MVS's design priorities include Piasa & Eagles Nest, Harlow Island, Oakwood Bottoms, and Crains Island. MVS has three projects in construction: Crains Island, Piasa and Eagles Nest, and Clarence Cannon Refuge HREPs. Pre-solicitation for Stage II of Piasa & Eagles Nest was issued on October 26, 2022 and a construction contract award is anticipated for the second quarter of FY 23. Exterior berm setback work continues at Clarence Cannon Refuge HREP. The District is developing new fact sheets with the Forest Service, Illinois DNR, and USFWS and anticipates a draft letter report for a flood damage assessment at the Swan Lake HREP.

LTRM and HREP Special Reports

Mike Spear, INHS, presented on fish community response to decreased vessel traffic on the Illinois Waterway. Consolidated extended closure of eight locks and dams in 2020 spurred a multi-agency monitoring effort from 2019 to 2021 to assess changes in river conditions from decreased navigation traffic. This was a unique ecosystem-scale opportunity to assess anthropogenic impacts of vessel traffic to a large river using a before/after/control impact study design. Three variables were evaluated including vessel traffic intensity, water quality, and fish communities in the main channel for direct impacts, side channels without direct traffic, and backwaters separated from noise and turbidity. Navigation pools showed a 50 percent to 100 percent decrease in vessel traffic during the closure. Turbidity was lower in the main channel and side channel habitats during the closure year of 2020. In addition, catch of sound-sensitive and rheophilic fish taxa as well as Gizzard shad increased in main and side channel habitats as compared to the backwater "quasi-control" condition. In response to a question from Stephenson, Spear said decreases in turbidity may have increased visibility by a couple inches.

Collin Moratz, USACE, presented an update on aquatic vegetation plantings at the Huron Island HREP. ERDC provided support from FY 18 to FY 20 to establish native aquatic vegetation at the project site. ERDC used flood tolerant native plant species of regional provenance and monitored plantings for adaptive management purposes. Herbivory exclosures were installed and initial specimens planted in August 2019. Assessments in 2020 indicated some mortality due to 2019 flooding, but also that some species had established outside exclosures. An assessment June 2021 showed unprotected arrowhead recruitment, additional spread of longleaf pondweed from exclosures, and good to high survival of ten species in exclosures. An additional planting was conducted in July 2021. An assessment in September 2021 showed high survival of 13 species in exclosures and rushes and arrowheads observed in unprotected areas. From July 26-28, 2022 a three day field campaign was conducted with ERDC, MVR, and Iowa DNR to establish larger exclosures with additional plantings. During an assessment on September 21, 2022, pens showed 70 percent to 99 percent coverage with some plants spreading from exclosures showing signs of herbivore damage. Overall, there was limited spread observed for both emergent and SAV beyond protected exclosures, likely due to herbivory pressure both aquatic and from terrestrial herbivores. One remaining question is whether a critical mass can be reached, whereby unprotected plant communities are robust to herbivory. In response to a question from Houser, Moratz said grass carp, common carp, some smaller herbivorous fishes, and turtles are likely the primary herbivores, but that researchers had considered developing a statement of need to specifically address that question and make information for applicable to other areas of the river. Hansen said grass carp are likely. In response to a question from Matt Vitello, Moratz said that, absent ice issues or complaints from boaters, the plan is to keep cages in place for a number of years for additional monitoring. Moratz said they are in regular contact with the area biologist to be able to address any concerns quickly. In response to a question from Hansen, Moratz said arrowhead is likely from the seedbank following freshly receded water, but that the top one foot of sediment was removed by dredging prior to the plantings.

Other Business

Upcoming quarterly meetings are as follows:

- **February/March 2023 – Virtual**
  - UMRBA quarterly meeting – February 28
  - **UMRR Coordinating Committee quarterly meeting – March 1**

- **May 2023 – St. Paul, MN**
  - UMRBA quarterly meeting – May 23
  - **UMRR Coordinating Committee quarterly meeting – May 24**

- **August 2023 – La Crosse, WI**
  - UMRBA quarterly meeting – August 8
  - **UMRR Coordinating Committee quarterly meeting – August 9**

With no further business, Chad Craycraft moved, and Jim Fischer seconded a motion to adjourn the meeting. The motion carried unanimously, and the meeting adjourned at 2:30 p.m.

UMRR Coordinating Committee Attendance List
November 16, 2022
[Note: this includes in-person and virtual attendees]

UMRR Coordinating Committee Members

Brian Chewning	U.S. Army Corps of Engineers, MVD
Sabrina Chandler	U.S. Fish and Wildlife Service, UMR Refuges
Mark Gaikowski	U.S. Geological Survey, UMESC
Chad Craycraft	Illinois Department of Natural Resources
Randy Schultz	Iowa Department of Natural Resources
Megan Moore	Minnesota Department of Natural Resources
Matt Vitello	Missouri Department of Conservation
Jim Fischer	Wisconsin Department of Natural Resources

Others In Attendance

Jim Cole	U.S. Army Corps of Engineers, MVD
Thatch Shepard	U.S. Army Corps of Engineers, MVD
Leann Riggs	U.S. Army Corps of Engineers, MVD
Samantha Thompson	U.S. Army Corps of Engineers, MVD
Angela Deen	U.S. Army Corps of Engineers, MVP
Jill Bathke	U.S. Army Corps of Engineers, MVP
Marshall Plumley	U.S. Army Corps of Engineers, MVR
Karen Hagerty	U.S. Army Corps of Engineers, MVR
Leo Keller	U.S. Army Corps of Engineers, MVR
Julie Millhollin	U.S. Army Corps of Engineers, MVR
Jodi Creswell	U.S. Army Corps of Engineers, MVR
Davi Michl	U.S. Army Corps of Engineers, MVR
Greg Kohler	U.S. Army Corps of Engineers, MVS
Brian Markert	U.S. Army Corps of Engineers, MVS
Jasen Brown	U.S. Army Corps of Engineers, MVS
Jack Hendrickson	U.S. Army Corps of Engineers, MVS
Abby Hoyt	U.S. Army Corps of Engineers, MVS
Ryan Swearingin	U.S. Army Corps of Engineers, MVS
Collin Moratz	U.S. Army Corps of Engineers, RPEDN
Chuck Theiling	U.S. Army Corps of Engineers, ERDC
Kraig McPeek	U.S. Fish and Wildlife Service, IIFO
Sara Schmuecker	U.S. Fish and Wildlife Service, IIFO
Lauren Larson	U.S. Fish and Wildlife Service, IIFO
Laura Muzal	U.S. Fish and Wildlife Service
JC Nelson	U.S. Geological Survey
Jeff Houser	U.S. Geological Survey, UMESC
Jennie Sauer	U.S. Geological Survey, UMESC
Jennifer Dieck	U.S. Geological Survey, UMESC
Kristen Bouska	U.S. Geological Survey, UMESC
Scott Gritters	Iowa Department of Natural Resources
Kirk Hansen	Iowa Department of Natural Resources
Kevin Stauffer	Minnesota Department of Natural Resources
Nick Schlesser	Minnesota Department of Natural Resources
Lindsay Brice	Audubon
Anshu Singh	Corn Belt Ports
Rick Stoff	Stoff Communications
Bryan Hopkins	The Nature Conservancy
Mike Spear	Illinois Natural History Survey

Kirsten Wallace	Upper Mississippi River Basin Association
Andrew Stephenson	Upper Mississippi River Basin Association
Mark Ellis	Upper Mississippi River Basin Association
Lauren Salvato	Upper Mississippi River Basin Association
Natalie Lenzen	Upper Mississippi River Basin Association
Erin Spry	Upper Mississippi River Basin Association

ATTACHMENT B

Regional Management and Partnership Collaboration

- **UMRR Quarterly Budget Reports (1/9/2023)** *(B-1 to B-3)*
- **UMRR 10-Year Outlook FY22 - FY32 UMRR CC (02/2023)** *(B-4)*
- **2015-2025 Strategic and Operational Plan Review Report Draft (2/13/2023)** *(B-5 to B-23)*

UMRR Quarterly Budget Report: St. Paul District

FY2023 Q1; Report Date: Mon Jan 09 2023

Habitat Projects

Project Name	Cost Estimates			FY2023 Financials			
	Non-Federal	Federal	Total	Carry In	Allocation	Funds Available	Actual Obligations
Bass Ponds, Marsh, and Wetland	-	$6,300,000	$6,300,000	-	-	-	$30,931
Conway Lake	-	$7,413,000	$7,413,000	-	-	-	$2,271
Harpers Slough	-	$13,675,000	$13,675,000	-	-	-	-$262,462
Lower Pool 10 Island and Backwater Complex	-	$17,000,000	$17,000,000	-	$3,248,000	$3,248,000	$195,837
Lower Pool 4, Big Lake	-	-	-	-	$550,000	$550,000	$96,389
McGregor Lake	-	$23,550,000	$23,550,000	$183,743	$6,600,000	$6,783,743	$6,929,582
Reno Bottoms	-	$10,000,000	$10,000,000	$34,983	$200,000	$234,983	$118,767
Robinson Lake, MN	-	-	-	$32,325	$550,000	$582,325	-
Total	-	$77,938,000	$77,938,000	$251,051	$11,148,000	$11,399,051	$7,111,315

Habitat Rehabilitation

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
District Program Management	-	-	-	$72,666
Total	-	-	-	$72,666

Regional Program Administration

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
Habitat Eval/Monitoring	-	-	-	$22,288
Total	-	-	-	$22,288

	Carry In	Allocation	Funds Available	Actual Obligations
St. Paul Total	$251,051	$11,148,000	$11,399,051	$7,206,269

UMRR Quarterly Budget Report: Rock Island District

FY2023 Q1; Report Date: Mon Jan 09 2023

Habitat Projects

Project Name	Cost Estimates			FY2023 Financials			
	Non-Federal	Federal	Total	Carry In	Allocation	Funds Available	Actual Obligations
Beaver Island	-	$25,288,000	$25,288,000	-	$300,000	$300,000	$48,887
Green Island, IA	-	$16,600,000	$16,600,000	$23,581	$400,000	$423,581	$143,901
Huron Island	-	$15,773,000	$15,773,000	$65,698	-	$65,698	$3,766
Keithsburg Division	-	$29,643,000	$29,643,000	-	$6,600,000	$6,600,000	$105,232
Lower Pool 13	-	$25,288,000	$25,288,000	$48,000	$400,000	$448,000	$197,695
Lower Pool 13 Phase II	-	-	-	$21,336	$600,000	$621,336	$32,140
Pool 12 (Forestry)	-	-	-	$53,705	$600,000	$653,705	$125,073
Pool 12 Overwintering	-	$20,870,822	$20,870,822	$1,598	-	$1,598	-
Quincy Bay, IL	-	-	-	$12,312	$600,000	$612,312	$122,380
Steamboat Island	-	$41,977,000	$41,977,000	-	$3,952,000	$3,952,000	$5,778,131
TBD	-	-	-	-	$50,000	$50,000	-
Total	$7,280,000	$188,899,585	$196,179,585	$341,755	$13,502,000	$13,843,755	$6,557,205

Habitat Rehabilitation

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
District Program Management	-	-	-	$47,135
Total	-	-	-	$47,135

Regional Program Administration

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
Adaptive Management	-	$200,000	$200,000	-
Habitat Eval/Monitoring	-	-	-	$42,519
Model Certification/Regional HREP	-	$100,000	$100,000	-
Public Outreach	-	$50,000	$50,000	$1,893
Regional Program Management	$2,993	$1,500,000	$1,502,993	$180,039
Regional Project Sequencing	-	$125,000	$125,000	-
Total	$2,993	$1,975,000	$1,977,993	$224,451

Regional Science and Monitoring

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
Long Term Resource Monitoring	-	$5,500,000	$5,500,000	$3,930
Science in Support of Restoration/Management	-	$8,350,000	$8,350,000	$15,973
Total	-	$13,850,000	$13,850,000	$19,903

	Carry In	Allocation	Funds Available	Actual Obligations
Rock Island Total	$344,748	$29,327,000	$29,671,748	$6,848,694

UMRR Quarterly Budget Report: St. Louis District

FY2023 Q1; Report Date: Mon Jan 09 2023

Habitat Projects

Project Name	Cost Estimates			FY2023 Financials			
	Non-Federal	Federal	Total	Carry In	Allocation	Funds Available	Actual Obligations
Clarence Cannon	-	$29,800,000	$29,800,000	-	$950,000	$950,000	$40,472
Crains Island	-	$36,562,000	$36,562,000	-	$1,900,000	$1,900,000	$15,389
Gilead Slough	-	-	-	-	$350,000	$350,000	-
Harlow Island	-	$37,971,000	$37,971,000	-	$325,000	$325,000	$8,059
Oakwood Bottoms	-	$29,000,000	$29,000,000	-	$575,000	$575,000	$235,767
Piasa - Eagle's Nest Islands	-	$26,746,000	$26,746,000	$31,151	$8,300,000	$8,331,151	$40,796
West Alton Missouri Islands	-	-	-	$16,510	$425,000	$441,510	$94,780
Yorkinut Slough, IL	-	$8,500,000	$8,500,000	$13,681	$375,000	$388,681	$117,330
Total	-	$168,579,000	$168,579,000	$61,342	$13,250,000	$13,311,342	$552,593

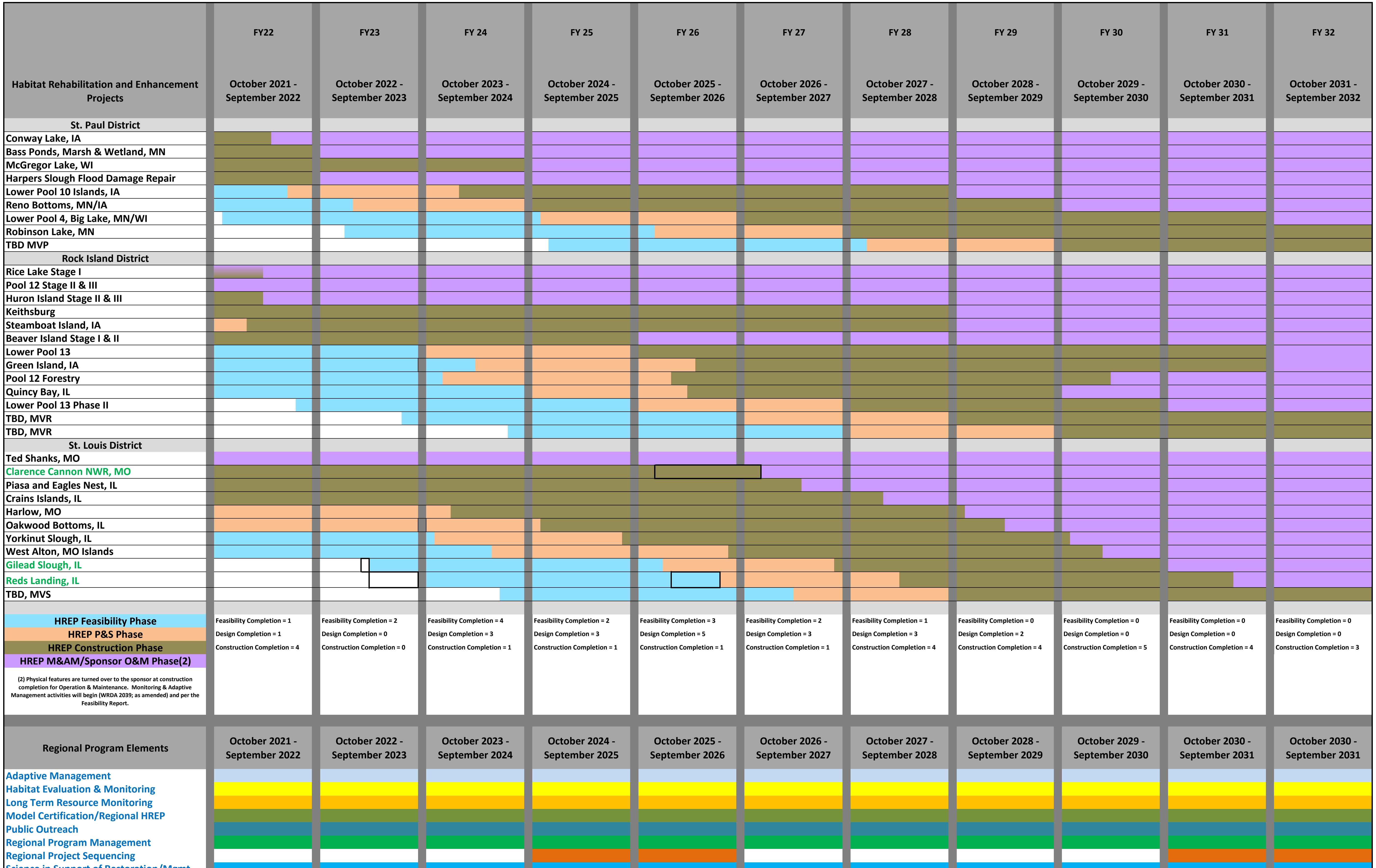
Habitat Rehabilitation

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
District Program Management	-	-	-	$138,927
Total	-	-	-	$138,927

Regional Program Administration

Subcategory	FY2023 Financials			
	Carry In	Allocation	Funds Available	Obligations
Habitat Eval/Monitoring	$450	$1,275,000	$1,275,450	$86,112
Total	$450	$1,275,000	$1,275,450	$86,112

	Carry In	Allocation	Funds Available	Actual Obligations
St. Louis Total	$61,792	$14,525,000	$14,586,792	$777,632


Habitat Rehabilitation and Enhancement Projects
FY22
October 2021 - September 2022
FY23
October 2022 - September 2023
FY 24
October 2023 - September 2024
FY 25
October 2024 - September 2025
FY 26
October 2025 - September 2026
FY 27
October 2026 - September 2027
FY 28
October 2027 - September 2028
FY 29
October 2028 - September 2029
FY 30
October 2029 - September 2030
FY 31
October 2030 - September 2031
FY 32
October 2031 - September 2032
St. Paul District
Conway Lake, IA
Bass Ponds, Marsh & Wetland, MN
McGregor Lake, WI
Harpers Slough Flood Damage Repair
Lower Pool 10 Islands, IA
Reno Bottoms, MN/IA
Lower Pool 4, Big Lake, MN/WI
Robinson Lake, MN
TBD MVP
Rock Island District
Rice Lake Stage I
Pool 12 Stage II & III
Huron Island Stage II & III
Keithsburg
Steamboat Island, IA
Beaver Island Stage I & II
Lower Pool 13
Green Island, IA
Pool 12 Forestry
Quincy Bay, IL
Lower Pool 13 Phase II
TBD, MVR
TBD, MVR
St. Louis District
Ted Shanks, MO
Clarence Cannon NWR, MO
Piasa and Eagles Nest, IL
Crains Islands, IL
Harlow, MO
Oakwood Bottoms, IL
Yorkinut Slough, IL
West Alton, MO Islands
Gilead Slough, IL
Reds Landing, IL
TBD, MVS
HREP Feasibility Phase
HREP P&S Phase
HREP Construction Phase
HREP M&AM/Sponsor O&M Phase(2)
(2) Physical features are turned over to the sponsor at construction completion for Operation & Maintenance. Monitoring & Adaptive Management activities will begin (WRDA 2039; as amended) and per the Feasibility Report.
Feasibility Completion = 1
Design Completion = 1
Construction Completion = 4
Feasibility Completion = 2
Design Completion = 0
Construction Completion = 0
Feasibility Completion = 4
Design Completion = 3
Construction Completion = 1
Feasibility Completion = 2
Design Completion = 3
Construction Completion = 1
Feasibility Completion = 3
Design Completion = 5
Construction Completion = 1
Feasibility Completion = 2
Design Completion = 3
Construction Completion = 1
Feasibility Completion = 1
Design Completion = 3
Construction Completion = 4
Feasibility Completion = 0
Design Completion = 2
Construction Completion = 4
Feasibility Completion = 0
Design Completion = 0
Construction Completion = 5
Feasibility Completion = 0
Design Completion = 0
Construction Completion = 4
Feasibility Completion = 0
Design Completion = 0
Construction Completion = 3
Regional Program Elements
October 2021 - September 2022
October 2022 - September 2023
October 2023 - September 2024
October 2024 - September 2025
October 2025 - September 2026
October 2026 - September 2027
October 2027 - September 2028
October 2028 - September 2029
October 2029 - September 2030
October 2030 - September 2031
October 2030 - September 2031
Adaptive Management
Habitat Evaluation & Monitoring
Long Term Resource Monitoring
Model Certification/Regional HREP
Public Outreach
Regional Program Management
Regional Project Sequencing
Science in Support of Restoration/Mgmt.

Upper Mississippi River Restoration

2015-2025 Strategic and Operational Plan

Broad Partnership Review Survey Report

Draft as of February 13, 2023

Contents

Executive Summary ii
Program Success ii
Priority Actions iii
Additional Considerations iii
Introduction 1
Materials, Methods, and Participants 1
Results 2
Program Success 3
Goal 1: Enhance habitat for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem. 3
Goal 2: Advance knowledge for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem 4
Goal 4: Utilize a strong, integrated partnership to accomplish the Upper Mississippi River Restoration vision. 5
Priority Actions 6
Goal 1: Enhance habitat for restoring and maintaining a healthier and more resilient UMR ecosystem 6
Goal 2: Advance knowledge for restoring and maintaining a healthier and more resilient UMR ecosystem 9
Goal 3: Engage and collaborate with other organizations and individuals to help accomplish the UMRR vision 11
Goal 4: Utilize a strong, integrated partnership to accomplish the UMRR vision 13
Comments and Suggestions Beyond the Scope of the Survey 15

Executive Summary

In summer 2021, the Upper Mississippi River Restoration (UMRR) Coordinating Committee requested an interim review of the UMRR 2015-2025 Strategic Plan by the broad program partnership. The purposes for this review were to seek input regarding progress achieved since 2015, priorities for the remainder of the planning period, and issue areas to include in the 2022 Report to Congress.

On September 20, 2021, a survey was distributed to the UMRR partnership at-large regarding the 2015-2025 Strategic and Operational Plan. The distribution list included 200 individuals from state and federal agencies and non-governmental organizations involved in implementation of UMRR. Fifty-eight responses were received for a 29 percent response rate.

The survey included questions about respondents' relation to, and involvement in, UMRR and their assessment of UMRR. Participants evaluated success criteria for three of the four goals outlined in the strategic plan using a five-point Likert-scale from *strongly disagree* to *strongly agree*; no success criteria were available for Goal 3 – i.e., communications. Additionally, participants prioritized actions meant to support each goal also using a five-point scale from *not a priority* to *highest priority*. Results are presented with *agree* and *strongly agree* response options for success criteria and *not a priority* and *low priority* response options for priority actions combined.

Program Success

The survey results conclude that UMRR partners believe that the program has been largely successful in meeting the success criteria outlined in the 2015-2025 UMRR Strategic and Operational Plan. A majority of respondents agreed or strongly agreed with each of the following success criteria:

Goal 1 Enhance Habitat

- ✓ *Restoration projects provide opportunities for scientific research and inquiry*
- ✓ *HREPs enhance the health and resilience of the UMR*
- ✓ *UMRR serves as a source of guidance on restoration for similar programs nationally*
- ✓ *UMRR is recognized as a premier program in large river restoration*

Goal 2 Advance Knowledge

- ✓ *Research and monitoring inform restoration and management efforts*
- ✓ *UMRR is recognized as a premier program in large river monitoring and science*
- ✓ *UMRR serves as a source of guidance on monitoring and science for similar programs nationally*
- ✓ *UMRR effectively detects the status and trends of the UMR as related to indicators of ecosystem health and resilience*

Goal 3 Communications

[No success criteria were available for Goal 3.]

Goal 4 Partnership

- ✓ *The partnership is supportive of the program and its output*
- ✓ *UMRR has a highly engaged regional partnership*

Participants pointed to the following areas needing additional programmatic attention including:

- Identifying how UMRR can serve as a resource or model internationally
- Understanding UMRR's progress in improving the ecological condition of the river
- Better communicating about the ecological status and trends of the UMRS

[Note: This survey was conducted prior to the publication of the Ecological Status and Trends of the Upper Mississippi and Illinois Rivers.]

Priority Actions

A majority of respondents indicated the following actions to be of high or highest priority to support each goal:

Goal 1 Enhance Habitat

- *Centralize HREP data and collect and digitize historic data currently stored in computers and file cabinets*
- *Establish consistent and standardized HREP monitoring*
- *Complete HREP project evaluation reports (PERs) across districts*
- *Define appropriate temporal and spatial scales for determining physical and biotic response of habitat project objectives*

Goal 2 Advance Knowledge

- *Connect resilience concepts with ongoing and future restoration work*

Goal 3 Communications

- *Link together habitat restoration projects with existing watershed projects and upstream contributors*

Goal 4 Partnership

- *Create a narrative around missed restoration opportunities because of existing policies*

Additional Considerations

Respondents suggested additional items for the UMRR Coordinating Committee to discuss in conjunction with setting priorities following the review of the 2015-2025 UMRR Strategic and Operational Plan. Programmatic items included:

- Resolving disparities amongst agency priorities and missions.
- Adequately resourcing programmatic communication efforts.
- Better conveying the importance of science to the program.
- Efficiently completing after action reviews to inform future project planning.

Other items focused more externally such as:

- Addressing tributary and watershed issues to improve river ecosystem conditions by expanding the scope of support and funding to those areas and developing relationships with additional potential partners in the watershed.
- Strategizing how to maintain current high levels of support from states and federal agencies.
- Addressing how UMRR will adapt to climate influences.

Introduction

The Upper Mississippi River System (UMRS) region has a rich tradition of interagency and interdisciplinary partnership dating back to the 1982 Upper Mississippi River Basin Commission's Master Plan. The Upper Mississippi River Restoration (UMRR) Coordinating Committee is a system-level forum for partners to discuss and consider program and budget priorities and issues regarding habitat restoration, scientific research, and monitoring. UMRR also has coordinating groups for partners to discuss technical implementation issues related to HREPs and long term resource monitoring. In addition, UMRR partners, including non-governmental entities, connect and integrate habitat restoration and knowledge-building with related programs and projects throughout the basin.

In summer 2021, the UMRR Coordinating Committee requested an interim review of the 2015-2025 UMRR Strategic and Operational Plan by the broad program partnership. This serves as a valuable check-in on the progress UMRR has made in achieving the goals and objectives of the Strategic and Operational Plan as well as affords the partnership an opportunity to prioritize activities through 2025.

In fall 2021, the UMRR Coordinating Committee employed a survey seeking input from a broad group of UMRR partners. Respondents were asked to evaluate UMRR's implementation in 2015-2020 based on the goals and objectives outlined in the 2015-2025 UMRR Strategic Plan. The survey had five sections with one section for each goal listed below and one section related to respondents' involvement with UMRR.

Goal 1 — Enhance habitat for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem.

Goal 2 — Advance knowledge for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem.

Goal 3 — Engage and collaborate with other organizations and individuals to help accomplish the Upper Mississippi River Restoration vision.

Goal 4 —Utilize a strong, integrated partnership to accomplish the Upper Mississippi River Restoration vision.

Materials, Methods, and Participants

Questionnaire Development

In May 2020, the UMRR Coordinating Committee agreed to employ a midpoint review of the 2015-2025 UMRR Strategic and Operational Plan. A survey was selected as means to inform how UMRR has progressed on the various goals and objectives contained within the Strategic and Operational Plan. The UMRR Coordinating Committee named the priority actions included in this broad partnership survey. While many of the Coordinating Committee's suggestions directly align with actions identified in the Strategic and Operational Plan, some may relate to multiple goals and objectives.

Success criteria identified in the Strategic Plan were modified into a series of statements for which levels of disagreement or agreement could be assessed by the broad UMRR partnership. Participants assessed each statement on a five-point scale: *Strongly disagree, Disagree, Neither disagree nor agree, Agree, Strongly agree*. All questions included a *Prefer not to respond* response option. Likert-type questions included *Unsure* and *Prefer Not to Respond* response options.

The complete survey and responses can be found in Appendix A. Open-ended responses are included in Appendix B.

Respondents

The survey was distributed to 200 individuals representing all implementing partner agencies and organizations and both elements of the UMRR program (i.e., habitat rehabilitation and enhancement projects and long term resource monitoring), including:

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- The five Upper Mississippi River states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin
- U.S. Department of Agriculture – Natural Resource Conservation Service
- U.S. Environmental Protection Agency
- Conservation nonprofit organizations that actively engage in UMRR's implementation

Email invitation and reminders

Initial email invitations were sent on September 14, 2021 to 200 potential respondents to complete the questionnaire via an online polling service or Word document. On September 20, 2021 and October 12, 2021, reminder emails were sent to all potential respondents who had not yet responded. [Note: Difficulties with some email services flagging messages as spam or invitees being unable to access the online survey may have reduced the number of responses.]

Analysis

Respondents were not required to answer every question. Therefore, total number of responses differ between questions. The data presented in this report represent percentages of responses. For questions related to success criteria, participants assessed statements on a five-point scale: '*Strongly Disagree*,' '*Disagree*,' '*Neither Disagree nor Agree*,' '*Agree*,' '*Strongly Agree*.' Participants could also select '*Unsure*' or '*Prefer Not to Respond*.' Null responses (e.g., *Prefer not to respond*) were removed from the analysis presented in the figures and text, but are included in the results in Appendix A. There were no success criteria directly related to Goal 3 of the Strategic and Operational Plan. For questions related to priority actions, responses of "*Not a priority at all*" and "*Low priority*" are combined in this analysis as well as results of "*high priority*" and "*highest priority*." Null responses (e.g., *Unsure*, *Prefer not to respond*) were removed from the analysis presented in the figures and text, but are included in the results in Appendix A.

Results

Demographics

Responses were received from at least eight organizations in the UMRR partnership with the most responses from state agencies (39.7%), USACE (27.6%), and USGS (12.1%). Participants primarily working within Pools 1-13 had the greatest representation (74.1%), but each floodplain reach had at least one-quarter of respondents indicate it was in their predominant area of work. Over 80 percent of respondents have been involved with UMRR for over five years, with many respondents (41.4%) having been involved with the program for more than 10 years. The most common UMRR activities in which respondents have participated included: science meetings (63.8%), district-based river team meetings (58.6%), HREP project development teams (51.7%), and the 2019 UMRR HREP Planning and Design Workshop (50.0%). Over one-half of respondents indicated that they work on the HREP element and fully (31.0%) or marginally (24.1%) understand the LTRM element. Just under one-third of respondents work in the LTRM element and fully (8.6%) or marginally (20.7%) understand the HREP element. Over one-half of respondents indicated that they were moderately (41.4%) or very (13.8%) familiar with the 2015-2025 UMRR Strategic Plan and Operational Plan.

Program Success

Criteria for evaluating success in achieving the 2015-2025 UMRR Strategic and Operational Plan are as follows:

1. Restoration projects that enhance the health and resilience of the Upper Mississippi River and demonstrate progress in achieving this Strategic Plan's goals and objectives.
2. A highly integrated program in which research and monitoring informs restoration and management efforts and in which restoration efforts are readily available for scientific use.
3. The ability to detect and communicate the status and trends of the Upper Mississippi River as related to indicators of ecosystem health and resilience as well as management objectives.
4. A highly engaged regional partnership that is supportive of the program and its outputs.
5. The Upper Mississippi River Restoration is recognized as a premier program in large river restoration and science and is a source of guidance for similar programs nationally and internationally.

In the survey, these success criteria were modified into a series of statements for which levels of disagreement or agreement could be assessed by the broad UMRR partnership. Participants assessed each statement on a five-point scale: '*Strongly Disagree*,' '*Disagree*,' '*Neither Disagree nor Agree*,' '*Agree*,' '*Strongly Agree*.' Participants could also select '*Unsure*' or '*Prefer Not to Respond*.' Null responses (e.g., *Prefer not to respond*) were removed from the analysis presented in the figures and text of this section, but are included in the percentages shown in Appendix A. There were no success criteria directly related to Goal 3 of the Strategic and Operational Plan.

Goal 1: Enhance habitat for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem.

Most respondents (85%) agreed that HREPs enhance the health and resilience of the Upper Mississippi River and provide opportunities for scientific research (89%) (Figure 1). However, respondents also noted that HREPs are a piece of a larger, more complicated system and may not necessarily be able to address certain drivers of change, such as watershed influences to the system.

> *"UMRR provides great opportunities for expanding and rehabilitating habitat for preferred fishes and wildlife, but does not address the actual causes of habitat degradation, like impacted watershed hydrology."*

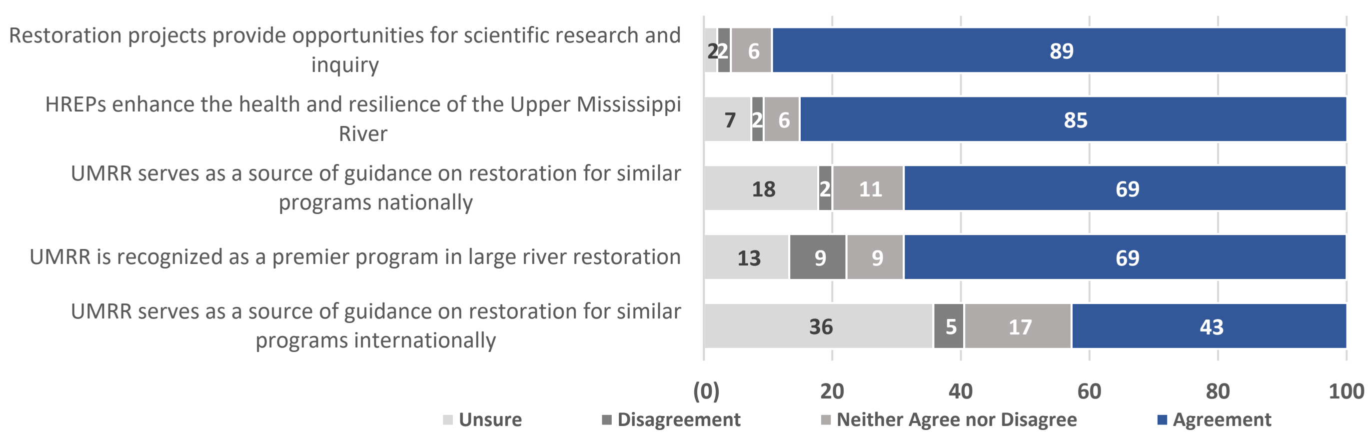


Figure 1. Evaluation of UMRR program health and resilience. Numbers indicate percentage of responses.

While most respondents believe UMRR is a premier large river restoration program (69%) and national example for habitat restoration (69%), many respondents were unsure (36%) how well the program is known internationally. One respondent noted that there may be greater awareness of the LTRM element of UMRR than the HREP element. Others suggested that presentations at international or national conferences, such as the American Fisheries Society, as well as increased interaction with the academic community could help raise awareness of UMRR. Another suggestion was to empower biologists and managers to talk about the program to their inland or regional counterparts with an emphasis on the value of resource managers and biologists to successful projects.

> *"My perception is there is greater awareness of the LTRM component than HREPs. Predominantly because of peer reviewed publication of the LTRM research and monitoring and presentations at professional conferences. However, it is much more challenging to get peer review publication of each individual HREPs performance and/or the science and data that goes into the project design."*

Goal 2: Advance knowledge for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem

Approximately, four out of five respondents agreed that research and monitoring inform restoration and management (84%) (Figure 2). One respondent specifically noted the essential nature of topobathy data for HREP planning and design.

> *"LTRM monitoring, and especially landcover/bathymetry data, are fundamental to the planning and design of HREPS, but importantly also provide an ongoing description of the basic condition of the river, the understanding of which is central to selecting/planning future HREPs"*

Those who disagreed with the statement noted that, while LTRM monitoring may inform restoration at a broad scale, its application to specific HREPs is limited to those in trend pools and that other considerations, such as administrative policies or agency priorities, may be more important when sequencing HREPs.

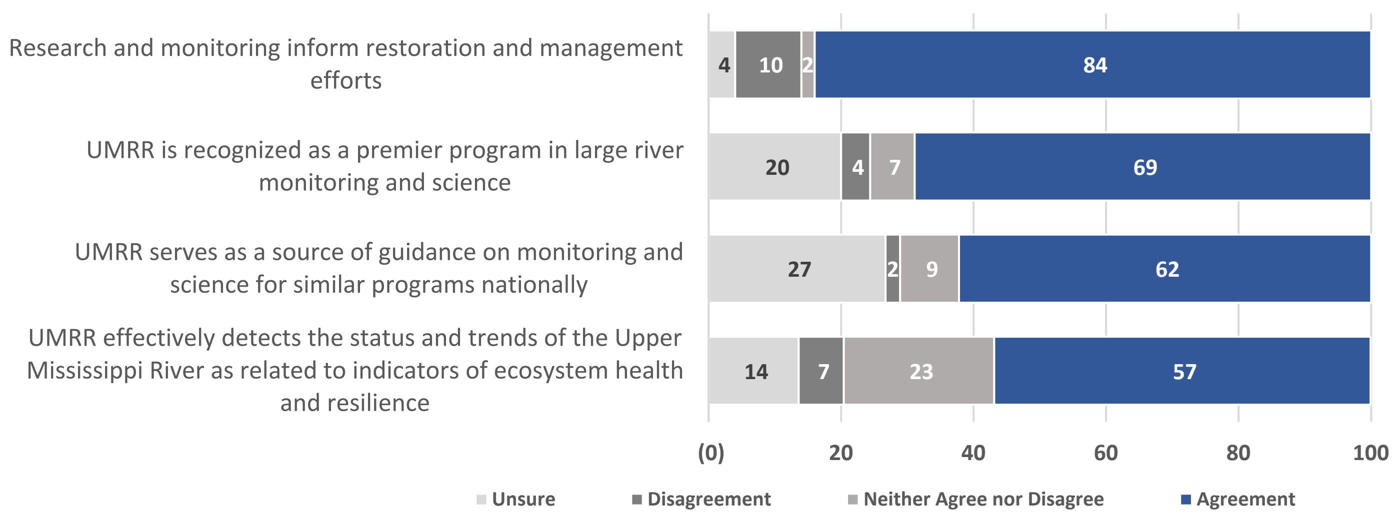


Figure 2. Evaluation of UMRR program monitoring and science. Numbers indicate percentage of responses.

Most UMRR partners (57%) think UMRR effectively detects trends of the UMRS as related to ecosystem health and resilience while only 43% (Figure 3) believe it does so related to restoration and management. Folks that disagreed noted that the scale of status and trends monitoring may not accurately capture restoration work.

> *"For example, it does not appear that physical features of many HREPs are included because the as-built elements (i.e., dredge cuts or emergent marsh) are not updated in the bathymetry and LIDAR."*

Respondents agreed that UMRR is recognized nationally as a premier program and leader in the science and monitoring of large rivers (62%) but were unsure of its international standing (32%) (Figure 3). As examples of this, one respondent indicated that LTRM personnel are frequently invited to present the results of the program's monitoring in regional, national, and international venues and are also consulted by others working to start or modify river monitoring programs. Multiple exchanges with scientists in China are the clearest example of past international efforts, but it is unclear how much of those activities are still occurring.

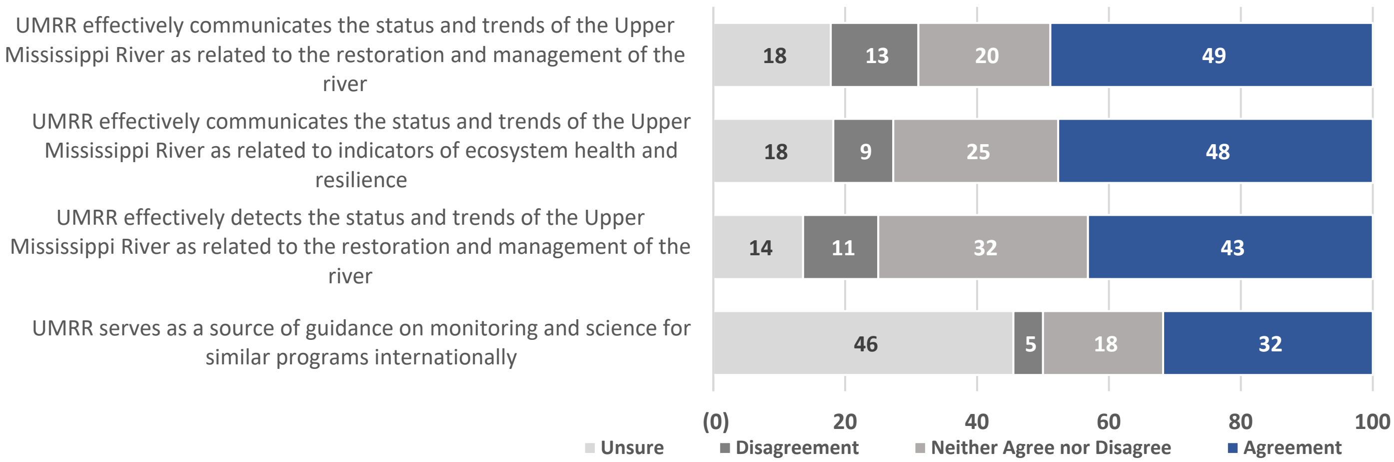


Figure 3. Evaluation of UMRR program detection and communication efficacy. Numbers indicate percentage of responses.

Approximately 48% to 49% of respondents believe that the partnership effectively communicates status and trends of the UMRS. This is accomplished by means of fact sheets, presentations at various partnership venues, publications, and conversations among UMRR partners. Respondents anticipated the forthcoming ecological status and trends report as an important component of future communication.

Goal 4: Utilize a strong, integrated partnership to accomplish the Upper Mississippi River Restoration vision.

Most partners feel that UMRR has a highly engaged regional partnership (79%) that is supportive of the program and its outputs (80%) (Figure 4). However, notable opportunities to strengthen the partnership and support of the program exist. These include updating project sponsorship agreements to increase partners ability to serve as project sponsors and ensuring the new project planning process leaves adequate time for collection and understanding of new data. One respondent noted increased workload demands affect partners ability to fully engage and that additional appropriations may further exacerbate capacity issues.

> *"…we need deeper engagement from partners in discussions. While there is desire to be engaged, too often people are forced to attend meetings not fully prepared due to workload demands. We need to message that to agency leadership to gain support for staffing, and we need to figure out how to transfer federal funds*

routinely to the states in support of the program. With increased appropriations, we will exceed our capabilities without additional capacity funding to the states."

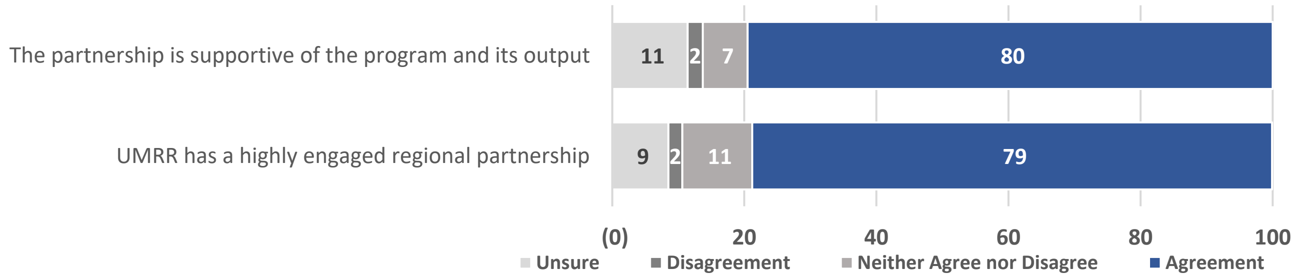


Figure 4. Evaluation to UMRR partnership. Numbers indicate percentage of responses.

Priority Actions

Goal 1: Enhance habitat for restoring and maintaining a healthier and more resilient UMRS ecosystem

Objective 1.1 **Address key ecological needs at various spatial scales through habitat projects that reflect best available knowledge and advance UMRR's vision**

Strategy 1 Identify and select habitat projects that will most effectively and efficiently advance UMRR's vision, utilizing an interagency, science-driven, systemic planning approach

Strategy 2 Plan, design, and construct habitat projects to best, and most efficiently, address their defined objectives and advance the UMRR's vision, using structural and non-structural measures and considering ecological benefits at various spatial scales

Strategy 3 Perform operation and maintenance on UMRR's habitat projects to ensure key features are working properly and effectively advancing the projects' goals and UMRR's vision

Objective 1.2 **Apply adaptive management principles to address risk and uncertainty and continually enhance restoration and knowledge of the Upper Mississippi River ecosystem**

Strategy 1 Refine and implement a framework to operationalize UMRR's adaptive management efforts, including when and how to apply certain adaptive management techniques and documenting, communicating, and integrating the results and conclusions

Strategy 2 Apply monitoring and adaptive management principles to set learning objectives (for select projects), adjust project designs based on ecological models, evaluate the ecological responses to project features, modify constructed project features if not performing as intended or to enhance effectiveness, assess operation and maintenance activities, and enhance future restoration efforts

Strategy 3 Employ deliberate and explicit adaptive management analyses (hypothesis testing) using selected habitat projects to explore priority science questions or learning objectives and evaluate the effects of UMRR's restoration efforts on the Upper Mississippi River ecosystem's health and resilience

Strategy 4 Communicate and integrate learned information into future restoration alternatives and scientific investigations to guide and optimize UMRR's investment in enhancing restoration and knowledge of the Upper Mississippi River ecosystem

Priority actions to support Goal 1 of the Strategic Plan

The highest priority actions identified by survey respondents to support Goal 1 were related to HREP monitoring and evaluation. Most respondents indicated four actions to be of high or highest priority (Figure 5):

- Centralize HREP data and collect and digitize historic data currently stored in computers and file cabinets (66%)
- Establish consistent and standardized HREP monitoring (66%)
- Complete HREP project evaluation reports (PERs) across districts (59%)
- Define appropriate temporal and spatial scales for determining physical and biotic response of habitat project objectives (56%)

Survey respondents stated that centralizing HREP data would benefit current project planning efforts. Those who indicated that this effort is not a priority explained that digitizing historic data would require a significant effort and that centralizing currently collected data is a higher priority. Participants who prioritized consistent and standardized HREP monitoring said it would substantially increase the value of pre- and post-construction monitoring data by easing the compilation and serving of data, thereby improving data availability for adaptive management implementation as well as application in future project planning and design. PERs serve as records of project performance, and as such are an important document for informing future projects. However, respondents expressed concern that completing PERs has been of low priority and is complicated by inconsistencies across Corps' Districts and agencies in monitoring, evaluating, and reporting. Timely completion of PERs could provide meaningful data for PDTs in the development of alternatives or calculation of habitat units for cost effectiveness and incremental cost analysis (CEICA) and improve estimates of operation and maintenance (O&M) costs of project features. Respondents identified that defining appropriate temporal and spatial scales of habitat project objectives would allow the program to better answer questions about project success, measure and communicate impacts of projects at the system scale, and inform adaptive management needs.

> *"Evaluating projects and providing summary reports in a timely fashion pre- and post-construction allows us to make any necessary informed design modifications and/or implement adaptive management strategies in a timely fashion. Further, it helps to inform the development of future projects based on what has been successful and lessons learned."*

Many respondents indicated that creating ecosystem models (e.g., floodplain forest succession) (45%) and additional Habitat Suitability Index (HSI) models (e.g., diving duck, gray squirrel) (45%) were of high or highest priority. Respondents stressed the need for additional model development to assess benefits of HREPs accurately, noting that current models can be ineffective and do not include species important to riverine faunal groups.

> *"Placing a priority on developing ecosystem models will not only inform future scenarios (alternatives with/without project), but the results can be applied to development or refinement of the HSI models. We need to better tie the HSI models to our desired outcomes."*

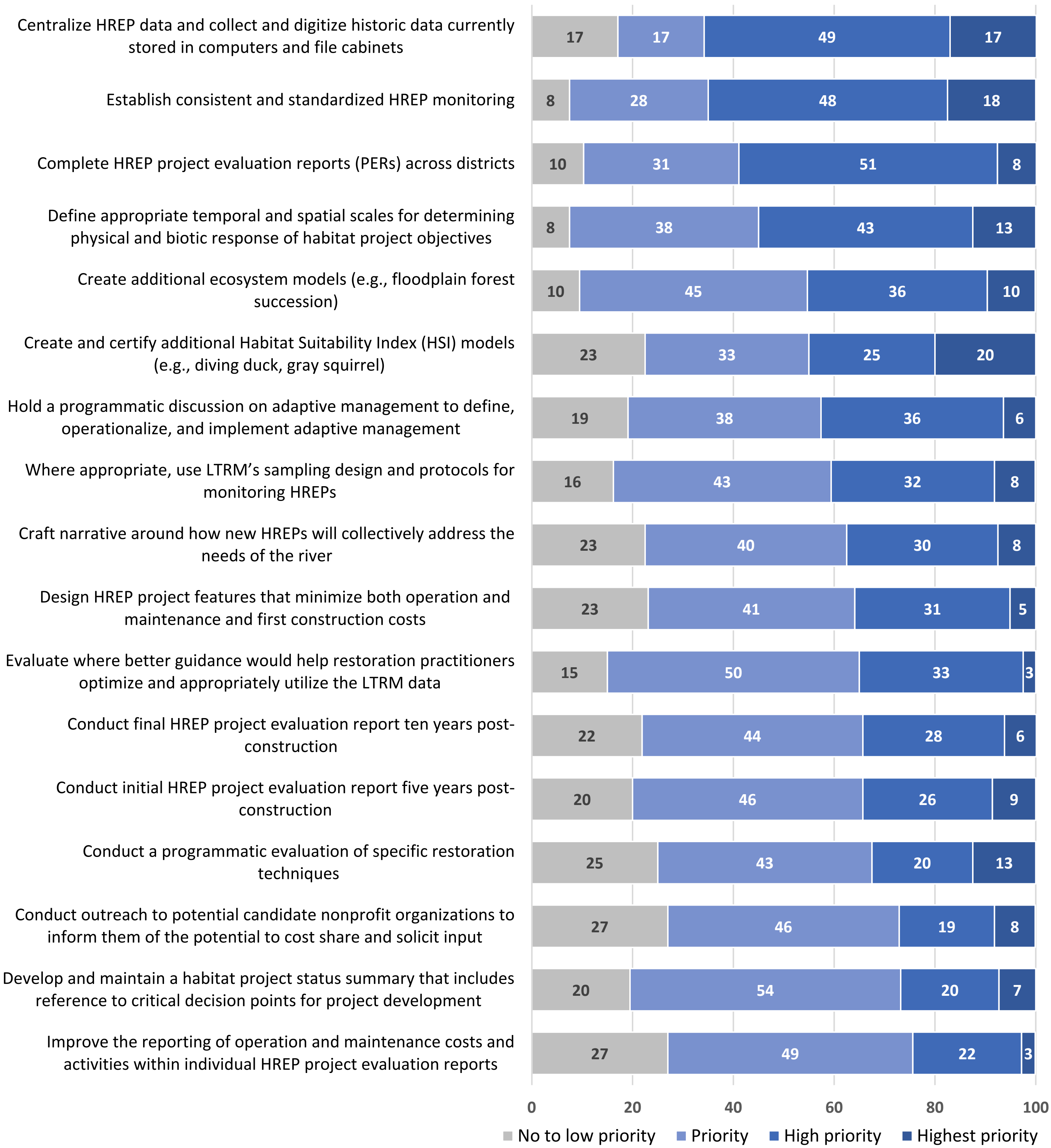


Figure 5. Evaluation of priorities among actions presented in the survey to support Goal 1 of the strategic plan. Numbers indicate percentage of total responses not including null responses.

Holding a programmatic discussion on adaptive management to define, operationalize, and implement adaptive management was also of high priority (44%) for many respondents. Reasons provided for prioritizing adaptive management discussions across the program were to create a common definition, goals, and implementation approach for adaptive management. The program's longevity allows for applying lessons learned from past HREPs to future projects, but it was also noted that some early HREPs are now degrading, and adaptive solutions are not being addressed because of a lack of adaptive management implementation.

The actions indicated as no or low priority by a quarter or more of respondents were programmatic evaluation of specific restoration techniques (25%), outreach to potential candidate nonprofit organizations to inform them of the potential to cost share and solicit input (27%), and improving the reporting of O&M costs and activities within individual HREP project evaluation reports (27%). One respondent suggested a programmatic evaluation focused instead on how various HREP objectives are met via implementation of different project features.

> *"Ecosystem restoration requires a diverse mix of tools appropriate for the desired objectives of a project at a given location on the river. A better approach would be to prepare a UMRR handbook similar to the HREP design handbook, but have its focus be on the various HREP objectives and describe how different projects implemented features to achieve the physical and chemical criteria of an objective."*

Goal 2: Advance knowledge for restoring and maintaining a healthier and more resilient UMRS ecosystem

Objective 2.1 **Assess, and detect changes in, the fundamental health and resilience of the Upper Mississippi River ecosystem by continuing to monitor and evaluate its key ecological components of aquatic vegetation, bathymetry, fish, land use/ land cover, and water quality**

Strategy 1 Evaluate the Upper Mississippi River's ecological status and trends through comprehensive, integrated analyses of key ecological indicators using UMRR's long term data

Strategy 2 Conduct scientific analysis, research, and modeling using UMRR's long term data, and any necessary supplemental data, to gain knowledge about the Upper Mississippi River ecosystem status and trends and process, function, structure, and composition

Strategy 3 Continue to improve the effectiveness of long term data collection, analysis, storage, and dissemination to maintain the data's integrity, long-term consistency, relevance, and usability

Strategy 4 Evaluate additional ecological components as priorities and resources allow to gain an even broader understanding of the Upper Mississippi River ecosystem and expand possibilities for important scientific analyses

Objective 2.2 **Provide critical insights and understanding regarding a range of key ecological questions through a combination of monitoring, additional research, and modeling in order to inform and improve management and restoration of the Upper Mississippi River ecosystem**

Strategy 1 Conduct focused research and analyses to gain critical, management-relevant information about the Upper Mississippi River ecosystem's process, function, structure, and composition as well as the dynamics and interactions among system components

Strategy 2 Conduct research projects that improve our understanding of critical ecological conditions and processes by examining the effects of select habitat restoration projects on those conditions and processes

Strategy 3	Utilize other information, as needed, to augment UMRR's long term data sets for comprehensive analyses of the river's health and resilience
Strategy 4	Develop and improve ecological models and other decision support tools to enhance science capabilities and understandings, and improve understanding of the potential effects of future management actions
Strategy 5	Effectively communicate to habitat project planners and managers regarding how research findings may be applied to habitat projects

Priority actions to support Goal 2 of the Strategic Plan

All actions under Goal 2 had broad support as priority actions (Figure 6). Most survey respondents identified connecting resilience concepts with ongoing and future restoration work as a high priority (54%) and many respondents supported efforts to connect outputs from the LTRM ecological status and trends report, HNA-II, and the resilience assessment (43%). Respondents noted that a focus on resilience is especially important in light of climate change and ongoing changes to the dynamic environment. A suggestion for further connecting resilience with restoration work was to develop a structured approach to incorporate resilience concepts into project selection. One proposed approach was to integrate resilience concepts and drivers with HREP design criteria.

> *"This also needs… a finer resolution step that includes what specific combination of resiliency concepts/drivers are needed to achieve habitat for species/ guilds/major resources so that the engineers can cross-walk HREP design criteria to the resilience controlling variables."*
>
> *"Resilience is key with regards to a changing system… Climate change is only exacerbating that issue and furthering the need to focus on resilience."*
>
> *"…there remains some lack of clarity around resilience and how to integrate resiliency concepts into on-the-ground restoration and resource management within the authority of the UMRR program."*

Many respondents identified support for reviewing the accessibility and usability of scientific data as well as learning sessions focused on accessing and utilizing LTRM data.

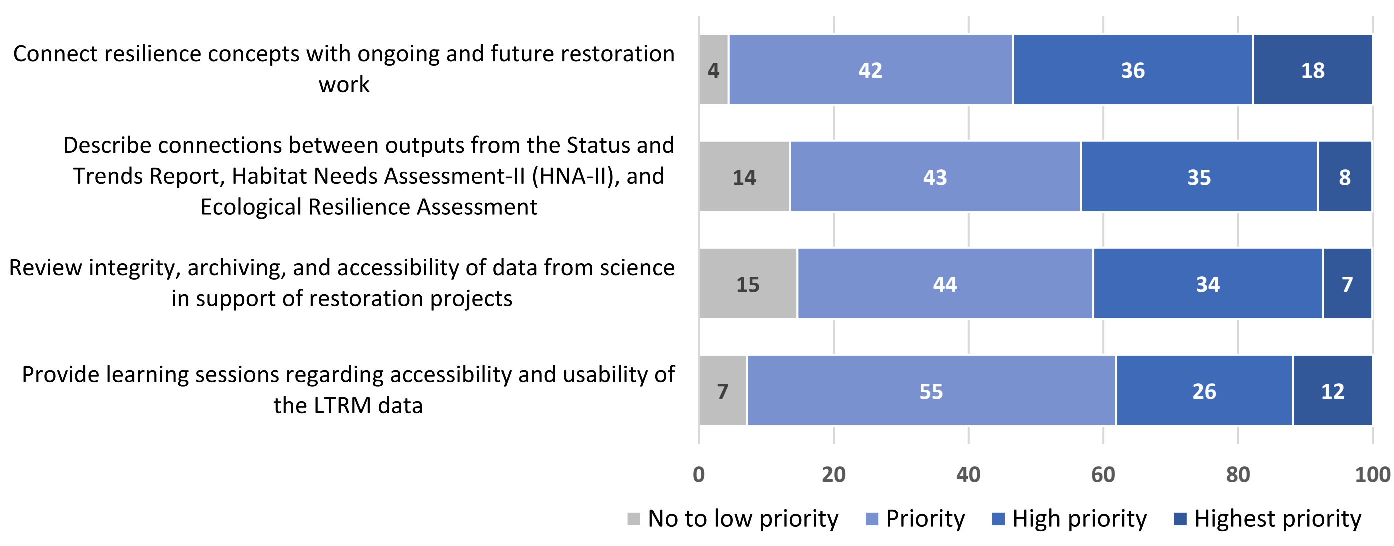


Figure 6. Evaluation of priorities among actions presented in the survey to support Goal 2 of the strategic plan. Numbers indicate percentage of total responses not including null responses.

Goal 3: Engage and collaborate with other organizations and individuals to help accomplish the UMRR vision

Objective 3.1 Work with key organizations and individuals in the Upper Mississippi River watershed

Strategy 1 Ensure rich collaboration with key organizations and individuals in the Upper Mississippi River watershed in advancing complementary visions, missions, and goals

Strategy 2 With key watershed programs and projects, jointly develop and communicate common messages about the restoration and knowledge needs of the Upper Mississippi River

Strategy 3 Seek knowledge from other organizations and individuals for the purposes of being aware of activities that may influence UMRR's work and enhancing programmatic efforts

Strategy 4 Directly engage relevant organizations or individuals in implementing UMRR's efforts, as appropriate

Objective 3.2 Provide information to organizations and individuals whose actions and decisions affect the Upper Mississippi River ecosystem

Strategy 1 Enhance the delivery and utility of UMRR's knowledge in order to increase understanding of the Upper Mississippi River's ecosystem drivers and means to achieve the UMRR vision

Strategy 2 Provide decision makers with timely, relevant, understandable, and usable knowledge about the needs and tools available to advance the UMRR's vision

Objective 3.3 Exchange knowledge with other organizations and individuals nationally and internationally

Strategy 1 Serve as a resource for similar programs nationally and internationally

Strategy 2 Seek knowledge from other organizations and individuals nationally and internationally to enhance UMRR's efforts in advancing its vision

Priority actions to support Goal 3 of the Strategic Plan

The highest priorities identified by survey respondents to support collaboration with others included connecting with people in the watershed through targeted communication at the pool and Congressional district scale (Figure 7). The highest priorities identified were to "link together habitat restoration projects with existing watershed projects and upstream contributors (50%) and "finalize the UMRR communications and outreach plan (43%)."

> *"Connecting, enhancing, and working mutually with watershed efforts in any way should be a priority. Strengthening or influencing restoration efforts in the watershed will improve what is flowing to us (the mainstem UMR)."*

One respondent noted that securing participation from watershed groups early in the outreach process would improve outcomes.

> *"If you desire outside participation and support, may need to secure upfront participation in development of scope and plan."*

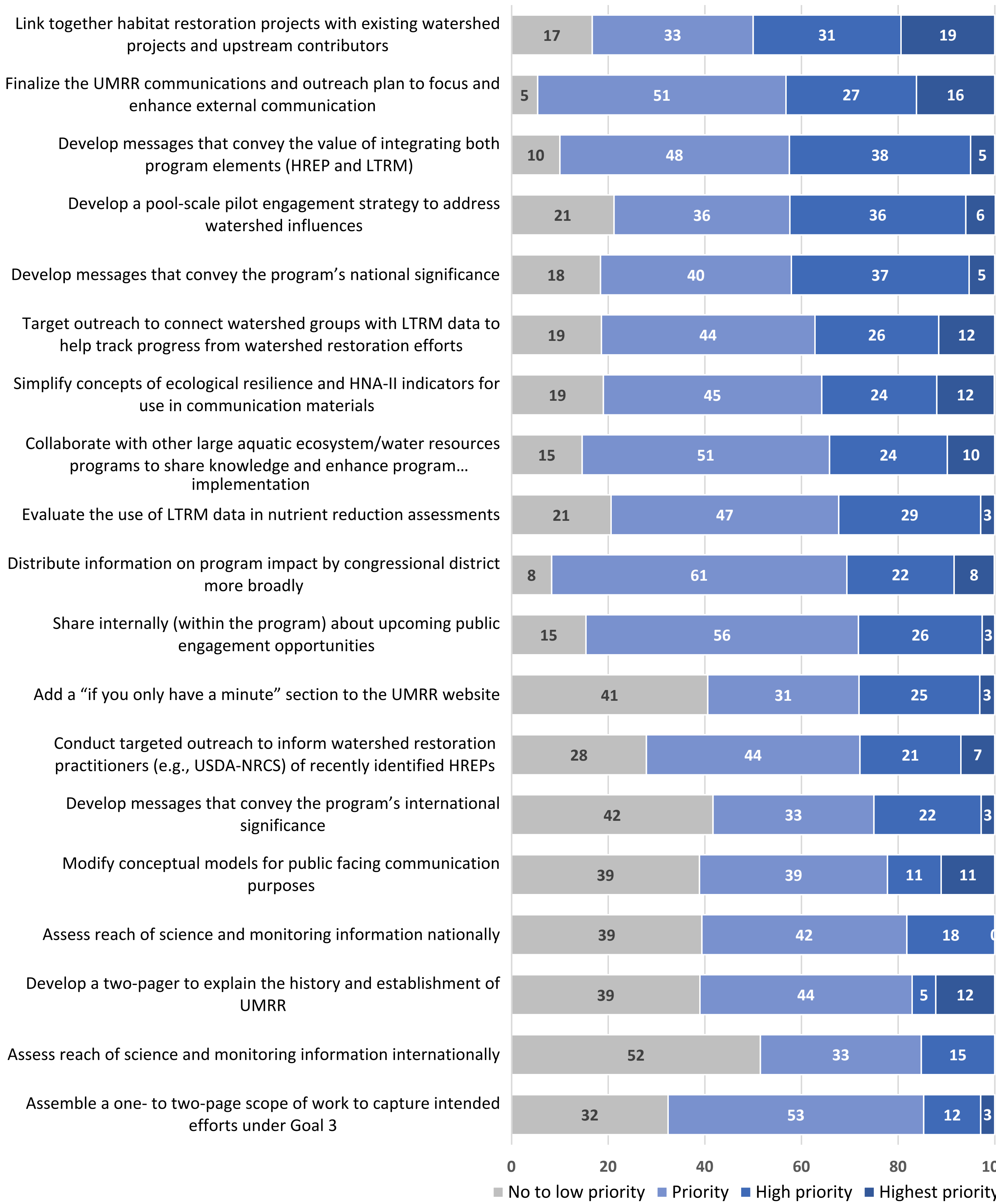


Figure 7. Evaluation of priorities among actions presented in the survey to support Goal 3 of the strategic plan. Numbers indicate percentage of total responses not including null responses.

The lowest priority actions identified as low to no priority were assessing UMRR's international reach of science and monitoring information (52%) and developing messages to convey UMRR's international significance (42%). Adding an "if you only have a minute" section to the UMRR website (41%) was also indicated as low to no priority by many respondents. Respondents noted that messages to the public must include information that resonates with them:

> *"Messaging needs to continue to include metrics that average folks can comprehend and appreciate, not just scientific measures or habitat unit increase, like increased angler/hunter usage and harvest, O&M (or any other public-born cost) cost savings resulting from the project, jobs supported/local revenue during construction and from increased usage."*

Goal 4: Utilize a strong, integrated partnership to accomplish the UMRR vision

Objective 4.1	**Promote a common vision and sense of purpose, transparency, and accountability among UMRR partners**
Strategy 1	Partners carry a strong, unified message regarding UMRR's value, accomplishments, and importance to the region and nation
Strategy 2	Partners work in collaboration to enhance restoration and knowledge of the Upper Mississippi River to advance UMRR's vision
Strategy 3	Continually learn and improve as a program and in implementing restoration and science techniques
Strategy 4	Improve transparency and accountability within the partnership regarding program priorities and budgets
Strategy 5	Organize and maintain institutional knowledge of UMRR's policy and programmatic efforts
Objective 4.2	**Implement the UMRR as outlined in the program's adopted Joint Charter for the UMRR Coordinating Committee, Analysis Team, and Habitat Planning and Sequencing Framework Teams, as well as the FY 2015-2025 UMRR Strategic Plan**
Strategy 1	Partner agencies implement program activities in accordance to the adopted Joint Charter
Strategy 2	Partner agencies collaboratively develop and implement the strategic plan

Priority actions to support Goal 4 of the Strategic Plan

The highest priority identified by survey respondents to support Goal 4 was to develop a narrative around existing policies resulting in missed restoration opportunities (57%) (Figure 8). Multiple participants noted barriers to restoration opportunities, and one proposed annual reporting of the lost economic and environmental benefits of those missed opportunities.

> *"Existing policies and requirements that prevent us from following through with HREPs that fit the restoration needs should be addressed as soon as possible. PPA requirements create major barriers but also Corps real estate requirements create barriers as well."*

> *"Any opportunities missed because of a policy should be reported in a specific section annually, along with projected economic and environmental lost benefits."*

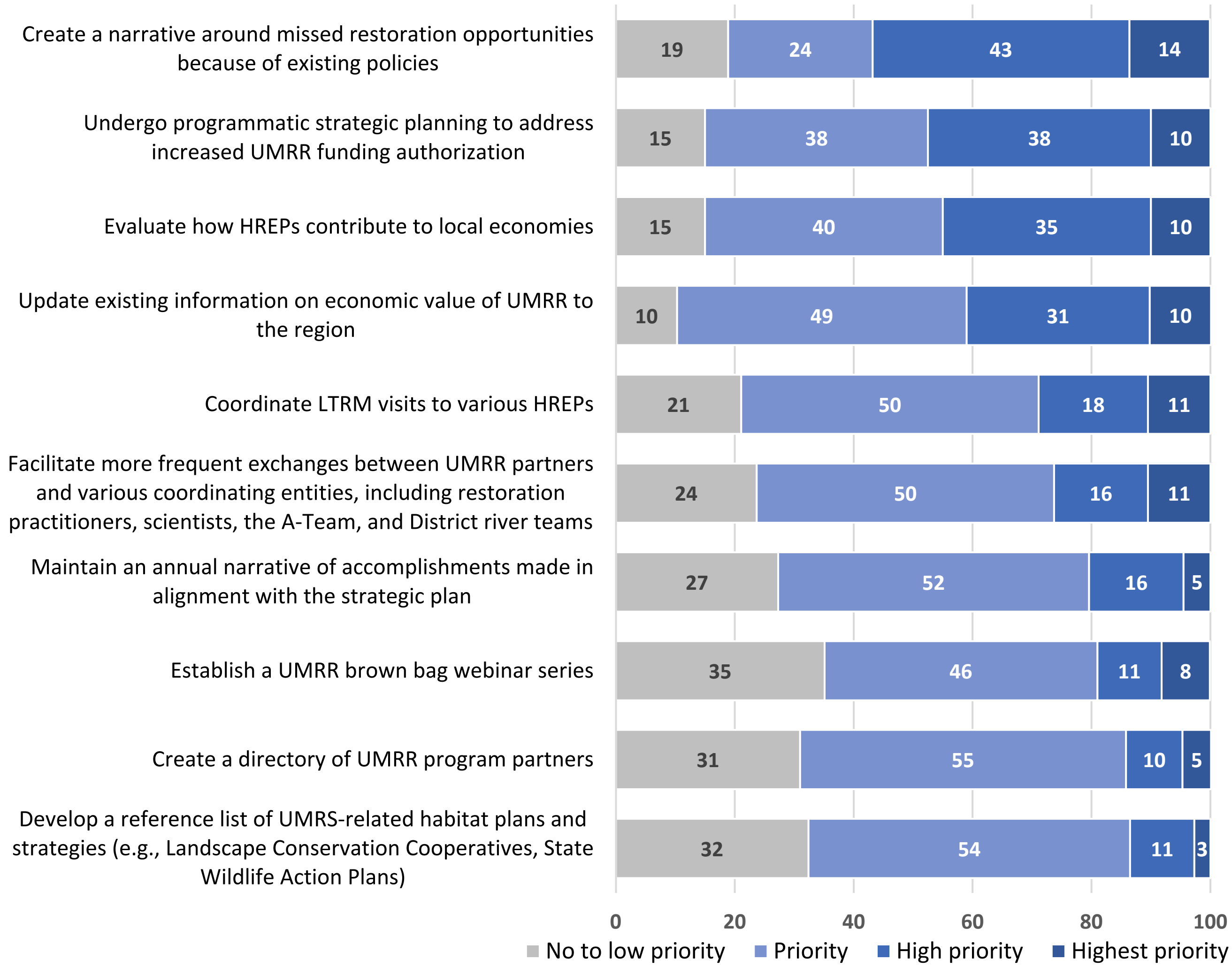


Figure 8. Evaluation of priorities among actions presented in the survey to support Goal 4 of the strategic plan. Numbers indicate percentage of total responses not including null responses.

Many respondents also prioritized efforts to address the increased UMRR funding authorization through strategic planning (48%) and evaluate HREP contributions to local economies (45%). Those in favor of assessing HREP contributions to local economies suggested it could increase public support for the program and provide a conduit for more public involvement in the program. However, others raised concerns over an economic impact analysis of HREPs as it could take away from the focus on habitat restoration needs as the priority.

> *"Annual reporting and strategic planning are important to ensure continued or strengthened funding, but shouldn't get in the way of actual program delivery."*

> *"Economy and economics should not play into our decision making. We should restore habitats unrelated to the economic or recreational value."*

> *"Evaluating the economics of HREPs and how much they really contribute the local economy is needed. Popular HREPs (e.g. Stoddard, Lake Onalaska) have likely paid for themselves many times over. The program needs to poll the public regarding the types of projects they would like to see more often."*

The lowest priority actions were the development of a UMRR brown bag series (35%) and reference list of UMRS-related habitat plans and strategies (32%). Respondents favored focus on developing habitat plans specific to the river as a partnership and in-person connections across UMRR elements over webinars.

> *"We need to develop partnership goals and objectives for the subsystems and major resources that focus on the Rivers. These other plans provide some overview for river management, but what is missing is a partnership plan for the river that includes habitats and biotic communities."*
>
> *"Brown bag seminars would be valuable, but I feel that they may not pay the dividends sought. Investing in face-to-face interactions between HREP and LTRM practitioners will provide more valuable benefit in the form of expanded networks and hands-on learning at HREP visits or science discussion."*

Comments and Suggestions Beyond the Scope of the Survey

Respondents suggested additional items for the UMRR Coordinating Committee to discuss in conjunction with setting priorities following the review of the strategic and operational plan. Programmatic items included:

- Resolving disparities amongst agency priorities and missions,
- Adequately resourcing programmatic communication efforts,
- Better conveying the importance of science to the program, and
- Efficiently completing after action reviews to inform future project planning.

Other items focused more externally such as:

- Addressing tributary and watershed issues to improve river ecosystem conditions by expanding the scope of support and funding to those areas and developing relationships with additional potential partners in the watershed,
- Strategizing how to maintain current high levels of support from states and federal agencies, and
- Addressing how UMRR will adapt to climate influences

ATTACHMENT C

UMRR Forest Loss and Sedimentation Flyers

- **UMRR Forest Loss Flyer (2023)** *(C-1 to C-2)*
- **UMRR Sediment Flyer (2023)** *(C-3 to C-4)*

Upper Mississippi and Illinois Rivers Floodplains Experience Widespread Loss of Forested Areas

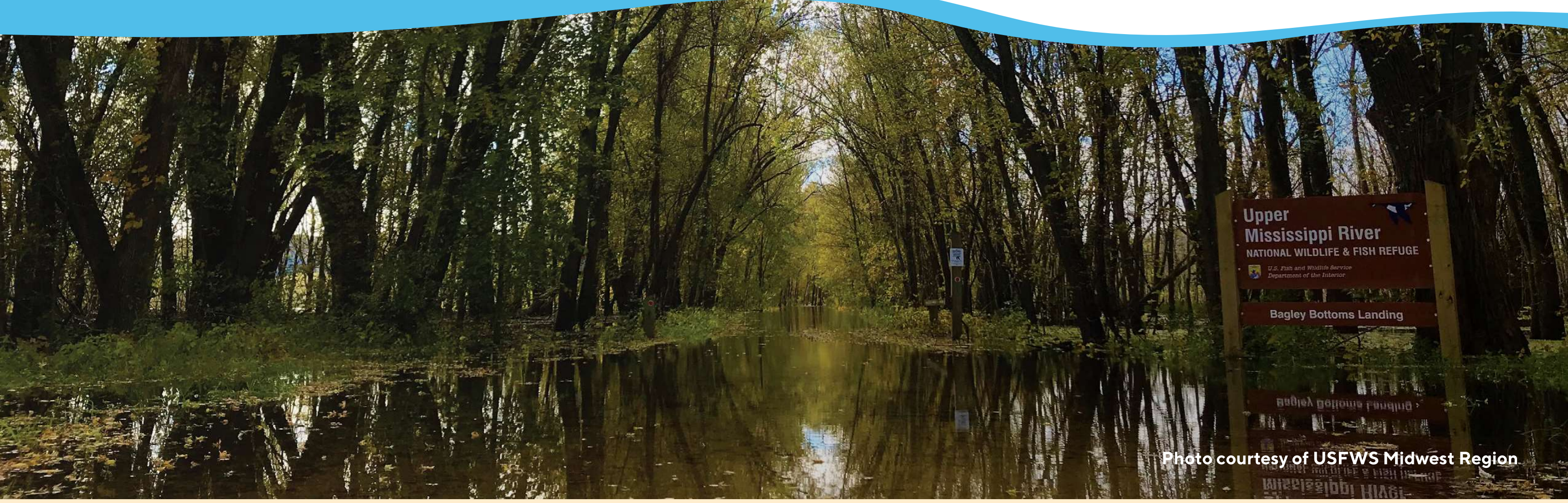


Photo courtesy of USFWS Midwest Region

Longer periods of flooding, human modifications to the river, and other environmental changes contribute to the decline of floodplain forests.

What are floodplain forests?

Floodplain forests along the banks and islands of the Upper Mississippi and Illinois Rivers are subject to periodic flooding. Tree species native to the floodplains are adapted to being temporarily underwater, such as silver maple, swamp white oak, willow, northern pecan, boxelder, cottonwood, sycamore, river birch, and ash. These forests make up most of the vegetation in the rivers' floodplains.

Why are forests important?

In addition to providing rich habitat for wildlife and migrating birds, floodplain forests provide scenic recreational landscapes, valuable wood products, critical carbon storage, and improve water quality by filtering excess pollutants, sediment, and nutrients from water.



Photos courtesy of Larry Reis

Historic Forest Loss

The Upper Mississippi and Illinois Rivers have lost nearly one-half of all forest area from 1891 to 1989 due to the expansion of agriculture and urban communities, poor forest management, and lock and dam construction in the 1930s and 1940s.

This forest loss reduced habitat quality and quantity and increased the amount of edge habitat. More edge habitat can increase pressure from invasive species, alter movement of plant and animal populations, make it difficult to manage forests on a landscape scale, and reduce available habitat for species that depend on large connected areas of forests.

US Army Corps of Engineers · U.S. Fish & Wildlife Service · Wisconsin Dept. of Natural Resources · Missouri Department of Conservation · Illinois Department of Natural Resources · DNR · Minnesota Department of Natural Resources · UMRBA Upper Mississippi River Basin Association · USGS science for a changing world · Illinois Natural History Survey Prairie Research Institute

mvr.usace.army.mil/UMRR

Upper Mississippi River Restoration
Leading·Innovating·Partnering

Upper Mississippi and Illinois River Floodplains Experience Widespread Loss of Forested Areas

This is a summary of the long-term trends in floodplain forests observed via monitoring from 1989 to 2010 as reported in the Ecological Status and Trends of the Upper Mississippi and Illinois Rivers.

Floodplain Forests are Still Declining

Floodplain forests have continued to decline since 1989. This decline may be in response to several factors:

- Longer periods of flooding, extending beyond the tolerances of native tree species, have increased tree mortality.
- Dutch Elm Disease and attacks from insects such as the emerald ash borer have led to declines in elm and ash populations.
- Invasive herbaceous species, such as Japanese hops and reed canary grass, outcompete native tree seedlings for light, space, and resources, preventing regeneration in canopy gaps.


Photo courtesy of Stephen Winter, USFWS

Changing Hydrology Threatens Forests

There is more water in the river more often with high flows lasting longer and occurring more frequently throughout the system. Floodplain forests are experiencing greater stress due to this change in hydrology, which is predicted to occur even more often as the climate shifts. This stress, combined with competition from invasive species, is expected to result in additional floodplain forest decline in coming years.

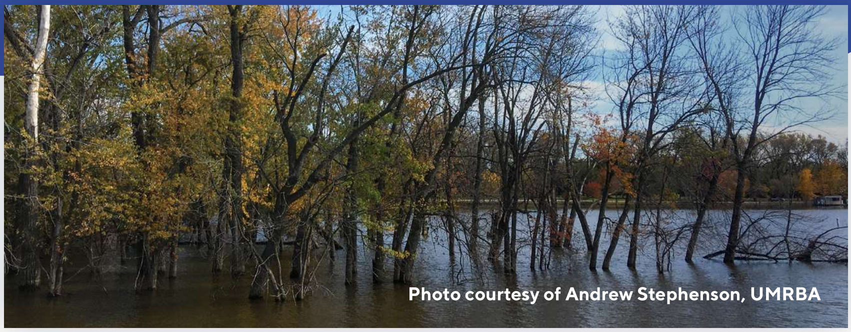


Photo courtesy of Andrew Stephenson, UMRBA

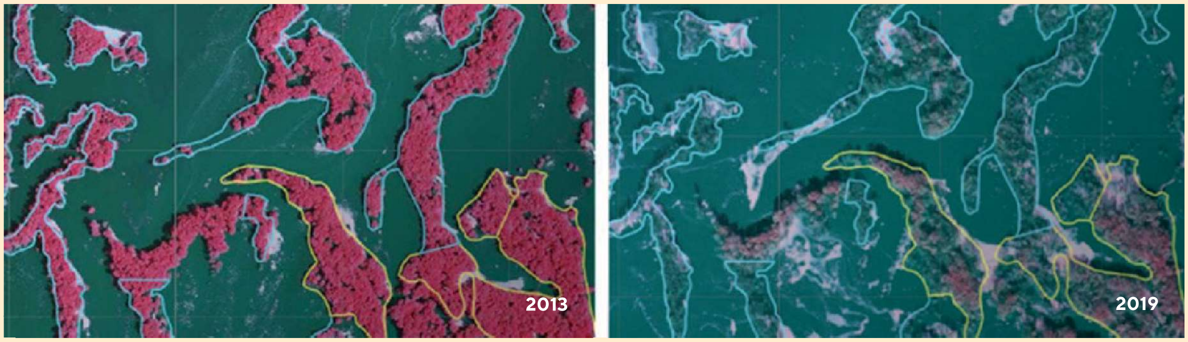
Restoring Our Forests

The Upper Mississippi River Restoration program (UMRR) and others monitor floodplain forests to assess the health of these areas and target habitat restoration projects. The restoration of forest areas will ensure the river system continues to provide habitat for wildlife, including rare and endangered species, and connect human communities to the river.

Management practices include forest improvement work to promote natural regeneration, tree planting, chemical and mechanical treatments, and increasing land elevations to protect forested areas from high water.

Mapping the Future of Floodplain Forests

Partners who manage forest areas map floodplain forests to assess the quality and quantity of habitat for wildlife that use floodplains as their homes or as migratory corridors. The maps below show impacts from the record 2019 flood and reveal additional floodplain forest loss in parts of the river. This recent flood event was not captured in the report.



To the Left:** Aerial imagery of historic 2019 flooding reveals further impacts on the floodplain forest community. Infrared imagery shows the health of trees in the floodplain: live trees are red and dead trees are green. Outlines show a reduction in live trees of 50% in blue and 90% in yellow.* ***Photos courtesy of Andy Meier, USACE

Sediment Changes the Depth and Shape of the Upper Mississippi River

Photo courtesy of Andrew Stephenson

The recently published **Ecological Status and Trends of the Upper Mississippi and Illinois Rivers Report** investigated changes in the distribution of sediment in select backwaters of the Upper Mississippi River. Sediment accumulation has changed the river structure by creating new floodplain land areas and reducing depths in backwater areas. These changes affect the quality and availability of habitat for fish and wildlife.

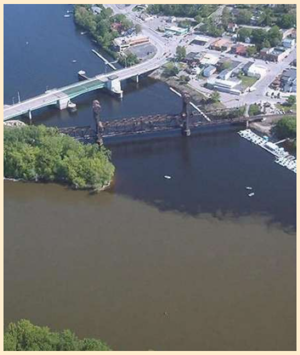
There is more water in the river more of the time.

Flood events are occurring in the river system more often and are more severe than in the past. This can move large amounts of sediment through the river system quickly. Increased discharge may also contribute to greater probability of river bank erosion.

Predicting future changes to river structure and its ecological effects is challenging. Years with high flows are more likely to remove fine-grained sediment from backwater areas while also depositing sediment on the floodplain, creating new land areas.

Why are sediment accumulation and erosion important?

Large rivers change their size and shape over time. Changes in the Upper Mississippi and Illinois Rivers reflect both natural processes and human modifications to the river system. As a result of these structural alterations, the river's hydrological, hydraulic, and sediment dynamics have also changed. These shifts have long been a concern of agencies charged with maintaining and restoring river habitat due to their effects on the quality and availability of habitat for fish and wildlife.



Above: *Aerial photo of confluence of Minnesota and Mississippi Rivers with sediment suspension visible.*

Photo courtesy of MPCA

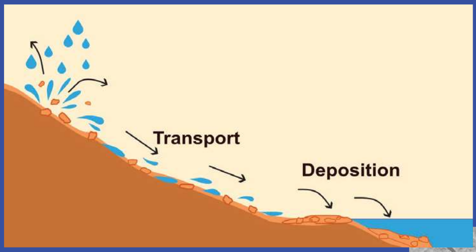
What is sediment?

In rivers, sediment consists of fine particles of sand, silt, and clay that are moved there by wind, water, and ice. Sediment and water interact within a river system in complex ways to affect the amount, quality, and configuration of aquatic and floodplain habitats. For example, sediment distribution across a riverbed changes river depth and sediment particles suspended in the water can affect water clarity, impacting aquatic vegetation communities.

Sediment Changes the Depth and Shape of the Upper Mississippi River

How does sediment move in the river system?

Sediment enters the system when soil is carried over land surfaces into the river by water, wind, ice, and other erosional processes and further moves through the river system suspended in the water and along the river bed.



To the Left: *Erosion processes transport sediment into and throughout the river system. Deposition occurs when sediment stops moving.*

Photo courtesy of Erin Spry

Deposition occurs when suspended sediments sink onto the riverbed or floodplain, filling in channels and lakes and forming deltas, islands, and other landforms.

To the Right: *Map shows new landmasses in green formed as a crevasse delta in Pool 4.*

Photo courtesy of Molly Van Appledorn and Jim Rogala

Historic erosion and sedimentation

Erosion and sedimentation in the Upper Mississippi River were significantly changed in the middle to late 20th century because of lock and dam construction. Rates of erosion and sedimentation may also be impacted by increased annual rainfall, increased variability in flood severity from year to year, and increases in upland sources of sediment from many tributaries.

Above: *Riverbank erosion exposes roots of a cottonwood tree. Photo courtesy of U.S. Fish and Wildlife Service*

How has sediment impacted our rivers?

The report highlights two main findings:

- Sediment accumulation in backwater lakes can reduce depth of and water flow to these areas, impacting suitable habitat for some fish species, especially during winter months. The loss of uncommon, deep backwater areas (reported for Pools 4 and 8 near Wabasha, Minnesota and La Crosse, Wisconsin) concerns resource managers because of their importance as habitat for fish.
- Sediment is being deposited on banks in the Upper Impounded Reach, creating critical habitat for shorebirds and waterbirds and providing ideal growing conditions for trees such as Willow and Cottonwood.

To the Right: *Greater yellowlegs at Pool Slough IA.*

Photo courtesy of Larry Reis

Looking Ahead

Multiple agencies continue to monitor changes to the size and shape of the river, which can help predict future habitat availability for aquatic and floodplain plants and animals. Additional research on sediment, erosion, and deposition in the Upper Mississippi River System will be important for managing and improving the health and function of this complex ecosystem.

ATTACHMENT D

Program Reports

- **FY23 Milestones (2/13/2023)** *(D-1 to D-6)*
- **UMRR Science Support FY14 & FY15 (November 2022)** *(D-7)*
- **Herbarium SOW** *(D-8 to D-11)*
- **Landscape Adaptation SOW** *(D-12 to D-16)*
- **UMRR LTRM Implementation Planning (February 2023)** *(D-17 to D-42)*

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Aquatic Vegetation Component						
2023A1	Complete data entry and QA/QC of 2022 data; 1250 observations.					
	a. Data entry completed and submission of data to USGS	30-Nov-2022		15-Dec-2022		Lund, Carhart, Fopma
	b. Data loaded on level 2 browsers	15-Dec-2022		28-Dec-2022		Schlifer
	c. QA/QC scripts run and data corrections sent to Field Stations	28-Dec-2022		15-Jan-2022		Sauer, Schlifer
	d. Field Station QA/QC with corrections to USGS	15-Jan-2023		30-Jan-2022		Lund, Carhart, Fopma
	e. Corrections made and data moved to public Web Browser	30-Jan-2023		30-Jan-2022		Larson, Schlifer, Caucutt
2023A2	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2022 data	31-Jul-2023				Larson, Schlifer
2023A3	Wisconsin DNR annual summary report 2022 that combines current year observations from LTRM with previous years' data, for the fish, aquatic vegetation, and water quality components.	30-Sep-2023				Bartels, Hoff, Kalas, Carhart
2023A4	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	31-Aug-2023				Lund, Carhart, Fopma
2023A5	Pool 4: Graphical summary and maps of aquatic vegetation current status and long-term trends.	30-Dec-2023				Lund
2023A6	Pool 8: Graphical summary and maps of aquatic vegetation current status and long-term trends.	30-Dec-2023				Carhart
2023A7	Pool 13: Graphical summary and maps of aquatic vegetation current status and long-term trends.	30-Dec-2023				Fopma
Intended for distribution						
Manuscript and data release: "Integrating machine learning and ecosystem state concepts: Modeling submersed plant resilience and vulnerability to ecosystem state transitions" (Delaney and Larson, in revision; IP-141445 and IP-149270)						
Manuscript and data release: "Reconstructing missing data by comparing common interpolation techniques: applications for long-term water quality data and beyond" (Larson and others, In USGS review; IP-146440)						

2/13/2023

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Fisheries Component						
2023B1	Complete data entry, QA/QC of 2022 fish data; ~1,590 observations					
	a. Data entry completed and submission of data to USGS	31-Jan-2023	28-Feb-2023		Field stations still working on finishing counting containers of fish in the lab.	DeLain, Dawald, Bartels, Hine, Kueter, Gittinger, West, Solomon, Maxson
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	15-Feb-2023	28-Feb-2023		Will be completed immediately after 2023B1a is completed.	Ickes, Schlifer
	c. Field Station QA/QC with corrections to USGS	15-Mar-2023				DeLain, Dawald, Bartels, Kueter, Hine, Gittinger, West, Solomon, Maxson
	d. Corrections made and data moved to public Web Browser	30-Mar-2023				Ickes and Schlifer
2023B2	Update Graphical Browser with 2022 data on Public Web Server.	31-May-2023				Ickes and Schlifer
2023B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	31-Oct-2023				DeLain, Dawald, Bartels, Kueter, Hine, Gittinger, West, Solomon, Maxson
2023B4	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2021-2022. Includes Pool 12 Overwintering HREP Adaptive Management Fisheries Response Monitoring	30-Jun-2023				Kueter
2023B5	Sample collection, database increment on Invasive carp age and growth: collection of cleithral bones	31-Jan-2023				Solomon, Maxson
2023B8(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9–11	30-Sep-2023				Kueter
2023B9(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	30-Sep-2023				Kueter
Intended for distribution						
Manuscript: A synthesis on river floodplain connectivity and lateral fish passage in the Upper Mississippi River (B. Ickes, 2021B11; Submitted to USGS review; IP-123678)						

2/13/2023

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Water Quality Component						
2023D1	Complete calendar year 2022 fixed-site and SRS water quality sampling	31-Dec-2022		31-Dec-2022		Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
2023D2	Complete laboratory sample analysis of 2022 fixed site and SRS data; Laboratory data loaded to Oracle data base.	15-Mar-2023		9-Feb-2023		Yuan, Schlifer
2023D3	1st Quarter of laboratory sample analysis (~12,600)	30-Dec-2022		30-Dec-2022		Yuan, Manier, Burdis, Kalas, Johnson, L. Gittinger, Cook, Sobotka
2023D4	2nd Quarter of laboratory sample analysis (~12,600)	30-Mar-2023				Yuan, Manier, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
2023D5	3rd Quarter of laboratory sample analysis (~12,600)	29-Jun-2023				Yuan, Manier, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
2023D6	4th Quarter of laboratory sample analysis (~12,600)	28-Sep-2023				Yuan, Manier, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
2023D7	Complete QA/QC of calendar year 2022 fixed-site and SRS data.					
	a. Data loaded on level 2 browsers; QA/QC scripts run; SAS QA/QC programs updated and sent to Field Stations with data.	30-Mar-2023				Schlifer, Jankowski
	b. Field Station QA/QC; USGS QA/QC.	15-Apr-2023				Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
	c. Corrections made and data moved to public Web Browser	30-Apr-2023				Schlifer, Jankowski
2023D8	Complete FY2023 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool	30-Sep-2023				Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka
2023D9	WEB-based annual Water Quality Component Update w/2022 data on Server.	30-May-2023				Schlifer, Jankowski
2023D10	Operational Support to the UMRR LTRM Element. Serve as in-house Field Station for USGS for consultation and support on various LTRM-wide topics	30-Sep-2023				Kalas, Hoff, Bartel, Carhart
2023D11	Phytoplankton dataset updated	30-Dec-2022				Jankowski

2/13/2023

Upper Mississippi River Restoration
Long Term Resource Monitoring Element
FY2023 Base Scope of Work

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
On-Going						
2019D12	Draft LTRM Completion Report: Assessment of Phytoplankton Samples collected by the Upper Mississippi River Restoration Program-Long Term Resource Monitoring Water Quality Component	30-Dec-2019	30-Jul-2023		Lead (Fulgoni) took new position	TBD and Jankowski
2020D12	Final LTRM Completion Report: Assessment of Phytoplankton Samples collected by the Upper Mississippi River Restoration Program-Long Term Resource Monitoring Water Quality Component	30-Mar-2021	30-Dec-2023			TBD and Jankowski
Intended for distribution						
Memo, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis) (Complete, Posted https://umesc.usgs.gov/reports_publications/ltrmp/water/srs/srs_methods.html)						

2/13/2023

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Spatial Data Component						
2023SD1	Orthorectification of scanned photos (St. Louis District Mississippi River pools and Open River Reach, and the Illinois River pools)	30-Sep-2023				Strange
2023SD2	Draft LTRM Completion Report 3D Digital Environment from Aerial Imagery using Structure from Motion Workflow Documentation	31-Dec-2023				Finley
2023SD3	Presentation: Implement and Expand Application of UAS Based Emergent Vegetation Mapping Method in LTRM Data Efforts	30-Jun-2023				Finley
2023SD4	Dataset development: Utilizing Existing Technology to produce 3D Geospatial Surfaces of a key Research	30-Sep-2023				Finley
2023SD5	Draft LTRM Completion Report on Implementation of potential Ground Penetrating Radar unit to Increase and Augment Data Collection Ability	30-Sep-2023				Finley
2023SD8	Maintenance ArcGIS server	30-Sep-2023				Rohweder
2023SD7	Data Analysis: Land Cover Change in the UMRS (all available pools, 1989-2020)	30-Sep-2023				De Jager
2023SD8	Draft LTRM Completion Report: Land Cover Change in the UMRS Key Pools	30-Sep-2023				De Jager
2023SD9	Draft LTRM Completion Report: Spatial Data Component Review and Future Objectives	30-Sep-2023				De Jager
2023SD10	Draft LTRM Completion Report: Pattern of Wild Rice Colonization (2022SD7)	30-Sep-2023				Finley
On-Going						
2022SD4	Aerial Thermal Application Completion Report-Posting in 2023	30-Mar-2023			Completed as an informational report, to be loaded to LTRM website.	Finley
2022SD5	Spatial Point Repository Tool of UMRS-Posting in 2023	30-Mar-2023			Completed as informational report, to be loaded to LTRM website.	Finley
2021SD10	Draft Report: Evaluating effects of alternative flooding scenarios on forest succession and landcover in the UMRS.	30-Sep-2021	30-Mar-2023		Changing to a manuscript	De Jager
Intended for distribution						
2021SD7 Topobathy 2023 For the Upper Mississippi River System. SOW/Strategic Planning Document available upon request.						
Manuscript: De Jager, N.R., Rohweder, J.J., Van Appledorn, M., Hlavececk, E., Meier, A. In Prep. Mapping where Reed Canarygrass (*Phalaris arundinacea*) is a driver of forest loss in the Upper Mississippi River Floodplain under different future hydrological regimes to identify locations for resisting, accepting, or directing ecosystem change. (2021SD10)						

2/13/2023

Upper Mississippi River Restoration
Long Term Resource Monitoring Element
FY2023 Base Scope of Work

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Data Management						
2023M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	30-May-2023				Schlifer
2023M2	Load 2022 component sampling data into Database tables and make data available on Level 2 browsers for field stations to QA/QC.	30-Jun-2023				Schlifer
2023M3	Assist LTRM Staff with development and review of metadata and databases in conjunction with publishing of reports and manuscripts	On-going				Schlifer
UMRR LTRM Team Meeting						
2023TM1	Draft agenda developed	30-Jan-2023	17-Feb-23			Houser, Ickes, Larson, Jankowski, De Jager, and others
2023TM2	Meeting held, Muscatine, IA	April 11-13, 2023				All LTRM
Status and Trends 3rd edition						
2023ST1	Draft S&T3 Fact Sheet	31-Dec-22	28-Feb-2023		USGS publishing center consulted Nov. 28, 2022	Authors
Equipment Inventory						
2023ER1	Property inventory and tracking	15-Nov-2023				LTRM staff as needed

2/13/2023

UMRR Science in Support of Restoration and Management
FY2014 and FY2015 Scopes of Work
November 2022 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Plankton community dynamics in Lake Pepin						
2015LPP1	Phytoplankton processing; species composition, biovolume	30-Dec-15		22-Oct-15		Burdis
2015LPP2	draft manuscript: Plankton community dynamics in Lake Pepin	30-Sep-16	31-Dec-22		first draft completed, anticipate submission to journal by Dec	Burdis, Manier
Predictive Aquative Cover Type Model - Phase 2						
2015AQ1	Develop 2-D hydraulic model of upper Pool 4	30-Sep-15		30-Sep-15		Libbey (MVP H&H)
2015AQ2	Apply model to Pool 4 and resolve discrepancies	31-Dec-15	31-Mar-16	31-Mar-16		Yin, Rogala
2015AQ3	Detailed summary of work for Phases I & II	31-Dec-15		NA	Work terminated with resignation of Dr. Yin. Danelle Larson will re-evaluate vegetation modeling in a future time frame	Sauer (for Yin), Rogala, Ingvalson

10/31/2022

SCOPE OF WORK

Development and propagation of a centralized herbarium for the Upper Mississippi River System

INTRODUCTION

The Upper Mississippi River System (UMRS) is home to at least 90 aquatic plant species, and many more wetland-obligate and floodplain forest species. Aquatic plant diversity remains a top restoration priority (McCain et al. 2018), but the UMRR program currently does not have a comprehensive species list or herbarium with representative collections to showcase and document diversity. The Long Term Resource Monitoring element (LTRM) currently has 2500 valuable aquatic vegetation specimens in various conditions but does not have a long-term preservation plan. Our current protocol (Yin et al. 2000) requires collecting vouchers, but we need to develop procedures and an herbarium to properly preserve and store those specimens. Understanding and documenting the diversity of natural assemblages has been synonymous with the field of ecology for hundreds of years. Collection efforts for species encountered along the UMRS began at the inception of the LTRM.

Three of the state LTRM field stations (Lake City MN (Pool 4); La Crosse, WI (Pool 8); Bellevue, IA (Pool 13)) annually conduct comprehensive aquatic vegetation surveys to monitor the diversity, distribution, and prevalence of aquatic vegetation found within these study areas. These same field stations currently house collections of a few hundred to a thousand plant specimens. The majority of these collections are composed of specimens collected during the 1990s from key monitoring pool, and include both fully aquatic and terrestrial species; some samples from non-key pools have also been collected. Since the implementation of the stratified random sampling for aquatic vegetation in 1998 (Yin et al. 2000), relatively few specimens have been collected as vouchers and even fewer preserved within field station herbariums. There is a need to continue collecting vouchers to document the incursion of multiple invasive species and recovery of macrophyte diversity within the UMRS (Larson et al. 2022). Additionally, the dispersal of species into neighboring pools and HREPs has been documented but not formally vouchered since the 1990s. Existing collections include a range of terrestrial and aquatic species (approximately 2500 total specimens in total), with the quality of specimens varying greatly within collections. Variation in the quality of specimens is due to a variety of factors including storage and handling procedures that do not support the long-term longevity and utility of collections that are professionally curated and maintained.

OBJECTIVES

1. Merge, repair, and permanently curate approximately 2500 existing specimens into a centralized, physical, and digital herbarium including a publicly accessible database. Most of the specimens were collected in the 1990s and are currently stored at the aforementioned state field stations

2. Continue collection of specimens for addition to the centralized herbarium. These additional specimens would be collected annually and would be independently verified prior to inclusion in the collection.
   a. The LTRM aquatic vegetation component will create a rigorous, standardized protocol for annual collections as part of routine sampling in the key study pools.

b. Specimen collection would primarily be organized and conducted by LTRM aquatic vegetation specialists at the field stations.
c. Novel collections could come from anywhere on the UMR and Illinois River.

BENEFITS

1. The capacity to use verified species records to update the list of expected species used by the LTRM aquatic vegetation component (2022 LTRM Science Needs, Focal Area 2.3.15). We will collaboratively use expertise within and outside LTRM for identifying and validating novel plant collections.

2. An established protocol to collect, verify and preserve specimens collected across the UMRS.

3. A digital reference of curated voucher specimens for education (training LTRM field interns, environmental education beyond LTRM) and identification reference.

RELEVANCE TO THE UMRS

A purpose of the LTRM is to **provide scientifically sound information on the UMRS.** This is achieved by offering the data and information generated by the LTRM in a variety of ways. The LTRM information is used extensively to improve understanding, aid in problem-solving, and inform decision-making as it pertains to the UMRR Program. A current and maintained species list and voucher protocol would ensure the scientific soundness of data collected by LTRM and regional partners. The following list includes areas of future work that would benefit from this work and is by no means exhaustive:

1. Document the emergence and composition of novel vegetative stands (as the result of HREPs or other causes).
2. Monitor and record successional patterns in vegetative community composition.
3. Identify potential spatio-temporal differences in species composition across the UMRS.
4. Independent verification (i.e. species identification) of current and future specimens.
5. Generate a long-term reference collection to observe possible phenotypic shifts and phenotypic variation within species.

METHODS

We will first secure a long-term, collaborative museum/herbarium partner with expertise and staffing to curate the existing herbarium collections into one centralized location and collection. This effort will also include the digitization of current vouchers and any novel collections, including digital images of all specimens. This digital record would be made available to partners and the public for reference and an online project page would increase exposure of the UMRR LTRM.

Spurred by a renewed interest in appropriately caring for historic specimens and vouchering novel species, the LTRM vegetation staff has already initiated the process of evaluating current collections (from years 1998–2022). While most specimens are perceived to be in good condition and ready for deposit, an unknown number will require additional effort (repair, labeling, indexing) prior to deposition. Many specimens at the Lake City Field Station need sorting, identification, mounting, and labeling, which would be done by Eric Lund and a paid intern (Ms. Emily Plessel).

The LTRM aquatic vegetation component will develop a written, formalized protocol for the ongoing collection and curation of aquatic plant specimens. The protocol development will require collaboration with the herbarium vendor to learn the most appropriate field collection and sample preparation techniques to ensure the highest possible quality of future contributions. The vendor would be responsible for the curation of future specimens. Future collections would be deposited annually and would consist of ~ 50 individual specimens per year. Specimen collection would not be limited to key pools, rather specimens collected throughout the UMRS could be included (areas above Pool 4, areas below Pool 13, HREP areas, etc.). The deposition of these specimens to the centralized herbarium would be organized by LTRM field station staff as part of their annual, base monitoring. The museum/depository vendor will include independent species verification of uncertain current and future vouchers by curator(s) and taxonomic expert(s).

TIMELINE

Lund and Larson will continue to explore potential vendors in winter 2022/23. All existing specimens will be shared with the museum/depository for curating by spring 2023. A voucher protocol will be peer-reviewed by USGS by spring 2024 (after a field season trial in summer 2023). Annual specimen deposits will be made following the primary vegetation sampling seasons.

EXPECTED DELIVERABLES

A long-term, collaborative partnership to properly curate specimens, restore existing specimens in poor condition, and permanently house the herbarium.

A professionally maintained, digitized reference collection of plants found in and around the UMRS. Data would be publicly available and easily searchable from the vendor's website.

An updated species list to guide UMRS aquatic vegetation sampling efforts.

Principal Investigators:

Mr. Eric Lund, Minnesota Department of Natural Resources, Aquatic Vegetation Specialist, Phone: 503-318-4275; Email: eric.lund@state.mn.us

Dr. Seth Fopma, Iowa Department of Natural Resources, Aquatic Vegetation Specialist, Phone: 563-590-1347; Email: seth.fopma@dnr.iowa.gov

Mrs. Alicia Carhart, Wisconsin Department of Natural Resources, Aquatic Vegetation Specialist, Phone: 608-781-6378; Email: Alicia.carhart@wisconsin.gov

Dr. Danelle Larson, U.S. Geological Survey, LTRM Aquatic Vegetation Lead, Phone: 608-781-6350; Email: dmlarson@usgs.gov

Collaborators:

Unidentified museum/depository

References Cited

Larson, D.M., Lund, E.M., Carhart, A.M., Drake, C.D., Houser, J.N., De Jager, N.R., Bouska, K.L., Bales, K.R., and S.M. Giblin. 2022. Aquatic Vegetation Indicators, chap. F *of* Houser, J.N., ed. Ecological Status and Trends of the Upper Mississippi and Illinois Rivers. (ver. 1.1, July 2022): U.S. Geological Survey Open-File Report 2022–1039, 24 p.

McCain, K.N.S., S. Schmuecker, and N.R. De Jager.2018. Habitat Needs Assessment-II for the Upper Mississippi River Restoration Program: Linking Science to Management Perspectives. U.S. Army Corps of Engineers, Rock Island District, Rock Island, IL.

Yin, Y., J.S. Winkelman, and H.A. Langrehr. 2000. Long Term Resource Monitoring Program procedures: Aquatic vegetation monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. April 2000. LTRMP 95-P002-7. 8 pp. + Appendixes A-C.

References of Interest

Hedrick, B. P., J.M. Heberling, E.K. Meineke, K.G. Turner, C.J. Grassa, D.S. Park, J. Kennedy, J.A. Clarke, J.A. Cook, D.C. Blackburn, S.V. Edwards, and C.C. Davis. 2020. Digitization and the Future of Natural History Collections, *BioScience*, Volume 70, Issue 3: 243–251.

Hilton, E. J., Watkins-Colwell, G. J., and S. K. Huber. 2021. The Expanding Role of Natural History Collections. Ichthyology and Herpetology 109, No 2: 379-391.

Miller, S.E., L. N. Barrow, S.M. Ehlman, J.A. Goodheart, S.E. Greiman, H.L. Lutz, T.M. Misiewicz, S.M. Smith, M. Tan, C.J. Thawley, J.A. Cook, and J.E. Light. 2020. Building Natural History Collections for the Twenty-First Century and Beyond, *BioScience*, Volume 70, Issue 8: 674–687

Schindel D.E., J.A. Cook. 2018. The next generation of natural history collections. PLoS Biol 16(7): e2006125.

SCOPE OF WORK

Future landscape adaptation informed by historical landscape patterns and climate scenarios

INTRODUCTION

Over the past few decades, changes in streamflow resulting from changes in precipitation and land-use in the region have been observed (Slater and Villarini 2017, Neri et al. 2019), and annual discharges on the Upper Mississippi River System (UMRS) have increased since 1940 (Van Appledorn 2022). Regional climate change analyses indicate these trends in increasing precipitation and discharge may continue into the future (Byun et al. 2019, Neri et al. 2020).

In 2019, a significant portion of the floodplain forests was lost in the upper impounded reach of the UMRS due to prolonged inundation that year. That event has amplified longstanding questions and concerns about what happens to floodplain vegetation following gap formation or forest loss, particularly in the context of *Phalaris arundinacea* (reed canarygrass) invasion. Further, documented hydrologic trends raise questions about what the future holds and how to best prepare. While extreme events, such as the flooding in 2019, can be frustrating to deal with and respond to, they also present opportunities to inform how systems may transform in the future as conditions continue to change.

While managers have observed and responded to increasingly more frequent extreme events, developing strategic approaches to prepare for future conditions remains challenging. Assessments of vulnerability to climate change impacts can provide useful tools for prioritizing resource management (e.g., Delaney et al. 2021b), but proactive or anticipatory efforts that seek to adjust management actions in the present to be more resilient in the future can be difficult to identify due to the vast uncertainty in climate change projections. A variety of resources and tools have been developed to aid in climate adaptation efforts (e.g., Runyon et al. 2020, Delaney et al. 2021a, Thompson et al. 2021), that have great potential for application to the UMRS (Bouska et al. 2022).

The floodplain vegetation of the UMRS has been described as existing in two alternate regimes, a dynamic floodplain vegetation mosaic vs. a wet meadow monoculture of invasive plants (Bouska et al. 2020). Vegetation communities in the floodplain are structured largely by inundation regimes with herbaceous communities found in areas with the highest level of inundation duration, followed by floodplain forest at intermediate levels, and more diverse forest communities in areas with the lowest levels of flooding (De Jager et al. 2016). The floodplain forests of the UMRS are less diverse than they were prior to Euroamerican settlement and have become dominated by flood and shade tolerant tree species, which are reaching their longevity and are susceptible to mortality due to increased inundation and other factors (Romano 2010). While modeling floodplain forest succession has increased our understanding of factors influential to forest succession and loss (De Jager et al. 2019), herbaceous community responses remain unknown. Once a forest is lost, regeneration of the forest can be inhibited by invasion of *P. arundinacea* or by changes in the long-term inundation regime (i.e., climate change). Given the influence of *P. arundinacea* on natural forest regeneration, the factors affecting invasion and potential transition are particularly important to understand. Answering questions related to potential for, and drivers of, invasion and transition among a variety of landcover types including the herbaceous communities will further our understanding of the mechanisms influencing landcover change in the UMRS, how landcover may continue to change in the future, and how to plan for and respond to future change.

This scope of work builds off ongoing landscape patterns, ecohydrology, and resilience research frameworks in the UMRS to better understand landcover transitions and the environmental factors that drive them to provide context for climate change adaptation. Specifically, this project will apply a state and transition model for floodplain vegetation developed by Bouska et al. (2020) in a spatial framework by integrating landcover change classes in relation to inundation regime (Van Appledorn et al. 2021) and other environmental factors related to *P. arundinacea* invasion (De Jager et al. 2013, 2017, Delaney et al. *in prep*). Classification modeling will be employed to determine the influential factors and thresholds attributed to various changes in landcover classification (e.g., forest, shrub, wet meadow, and *P. arundinacea* dominant) over three decades (1989 to 2000, 2000 to 2010, and 2010 to 2020). Probabilities of landcover change will be used to construct a predictive state and transition model for three test pools where estimate of *P. arundinacea* dominance in wet meadows exist (pools 7, 8, and 9). We will form a working group of regional managers and climate adaptation experts to develop plausible future climate change scenarios and evaluate potential opportunities for climate change adaptation based upon results of the predictions from the spatial state and transition model. Climate change scenarios could be derived from a future hydrology dataset currently in development (Van Appledorn and Sawyer *in prep*). If a future hydrology dataset has not been completed at the time of scenario development, the scenarios would rely upon expert knowledge of past influential events and precipitation projections from climate models for the region and could be updated later with a future hydrology product.

Finally, understanding landcover change and the mechanisms that drive those changes could be enhanced by utilizing satellite imagery products (e.g., Landsat or Sentinal-2). While satellite imagery is at a coarser spatial resolution (10m to 30m) than the aerial imagery (0.2m to 0.4m) collected each decade, the temporal resolutions of satellite imagery are much finer (annual, seasonal, or weekly). We will explore the feasibility of compiling and applying such datasets to answer questions related to *P. arundinacea* invasion, successional trajectories of herbaceous communities following forest loss, and detection of forest stress due to prolonged inundation.

OBJECTIVES

1) Form a working group consisting of regional managers and climate change adaptation planners.
2) Identify environmental factors that influence changes in key landcover types over three decades.
3) Construct a spatial state and transition model for floodplain vegetation that runs on a decadal timestep.
4) Meet with working group to develop future hydrologic scenarios relevant to floodplain vegetation dynamics.
5) Apply spatial state and transition model to future hydrologic scenarios.
6) Meet with working group to present model scenario results and identify climate adaptation approaches.
7) Explore and develop approaches for investigation of landcover patterns at finer temporal scales using satellite imagery products.
    a. Potential research questions:
        i. Can we distinguish between *P. arundinacea* dominated wet meadows and native wet meadows using satellite imagery?

ii. What are the successional trajectories of herbaceous communities following forest loss?
iii. Can we quantify forest health using satellite imagery to use for early stress detection?

EXPECTED DELIVERABLES

The proposed work will result in manuscripts and other products which will be outlined in the UMRR annual scope of work process. In addition to manuscripts and other reports, results will be presented at conferences and other UMRS meetings. Status reports will be provided annually.

Expected Timeline:

Activity	Fiscal year
Form working group consisting of resource managers and climate change adaptation experts	FY24
Identify influential environmental factors and collect datasets	FY24
Build interpretable machine learning models for landcover changes to assess influence and identify potential thresholds	FY24
Use probabilities and thresholds of landcover change to construct a spatial state and transition model.	FY24/FY25
Take trainings on satellite imagery acquisition, processing, and analysis	FY24/25
Meet with working group to develop future hydrologic scenarios	FY25
Apply spatial state and transition model to scenarios	FY25
Meet with working group to present results and apply adaptation framework	FY26
Develop approaches for integrating satellite imagery for increased temporal resolution	FY26
Final report and manuscripts	FY26
Annual status reports	FY24, FY25, FY26

LITERATURE CITED

Bouska, K. L., N. R. De Jager, and J. N. Houser. 2022. Resisting-accepting-directing: Ecosystem management guided by an ecological resilience assessment. Environmental Management.
Bouska, K. L., J. N. Houser, N. R. De Jager, D. C. Drake, S. F. Collins, D. K. Gibson-Reinemer, and M. A. Thomsen. 2020. Conceptualizing alternate regimes in a large floodplain-river ecosystem: Water clarity, invasive fish, and floodplain vegetation. Journal of Environmental Management 264:110516.

Byun, K., C.-M. Chiu, and A. F. Hamlet. 2019. Effects of 21st century climate change on seasonal flow regimes and hydrologic extremes over the Midwest and Great Lakes region of the US. Science of The Total Environment 650:1261–1277.

De Jager, N. R., B. J. Cogger, and M. A. Thomsen. 2013. Interactive effects of flooding and deer (Odocoileus virginianus) browsing on floodplain forest recruitment. Forest Ecology and Management 303:11–19.

De Jager, N. R., J. J. Rohweder, and E. E. Hoy. 2017. Mapping areas invaded by *Phalaris arundinacea* in Navigation Pools 2-13 of the Upper Mississippi River. Page 20.

De Jager, N. R., J. J. Rohweder, Y. Yin, and E. Hoy. 2016. The Upper Mississippi River floodscape: spatial patterns of flood inundation and associated plant community distributions. Applied Vegetation Science 19:164–172.

De Jager, N. R., M. Van Appledorn, T. J. Fox, J. J. Rohweder, L. J. Guyon, A. R. Meier, R. J. Cosgriff, and B. J. Vandermyde. 2019. Spatially explicit modelling of floodplain forest succession: interactions among flood inundation, forest successional processes, and other disturbances in the Upper Mississippi River floodplain, USA. Ecological Modelling 405:15–32.

Delaney, J. T., K. L. Bouska, and J. D. Eash. 2021a. Climate change adaptation thinking for managed wetlands: U.S. Geological Survey Open-File Report 2021–1103, 25 p.

Delaney, J. T., K. L. Bouska, J. D. Eash, P. J. Heglund, and A. J. Allstadt. 2021b. Mapping climate change vulnerability of aquatic-riparian ecosystems using decision-relevant indicators. Ecological Indicators 125:107581.

Delaney, J. T., M. Van Appledorn, K. L. Bouska, and N. R. De Jager. *in prep*. Predicting reed canarygrass invasion in floodplain forest understories of the Upper Mississippi River.

Neri, A., G. Villarini, and F. Napolitano. 2020. Statistically-based projected changes in the frequency of flood events across the U.S. Midwest. Journal of Hydrology 584:124314.

Neri, A., G. Villarini, L. J. Slater, and F. Napolitano. 2019. On the statistical attribution of the frequency of flood events across the U.S. Midwest. Advances in Water Resources 127:225–236.

Romano, S. P. 2010. Our current understanding of the Upper Mississippi River System floodplain forest. Hydrobiologia 640:115–124.

Runyon, A. N., A. R. Carlson, J. Gross, D. J. Lawrence, and G. W. Schuurman. 2020. Repeatable approaches to work with scientific uncertainty and advance climate change adaptation in US national parks. Parks Stewardship Forum 36.

Slater, L., and G. Villarini. 2017. Evaluating the Drivers of Seasonal Streamflow in the U.S. Midwest. Water 9:695.

Thompson, L. M., A. J. Lynch, E. A. Beever, A. C. Engman, J. A. Falke, S. T. Jackson, T. J. Krabbenhoft, D. J. Lawrence, D. Limpinsel, R. T. Magill, T. A. Melvin, J. M. Morton, R. A. Newman, J. O. Peterson, M. T. Porath, F. J. Rahel, S. A. Sethi, and J. L. Wilkening. 2021. Responding to Ecosystem Transformation: Resist, Accept, or Direct? Fisheries 46:8–21.

Van Appledorn, M. 2022. Chap B Hydrologic Indicators of Houser, J.N., ed., Ecological status and trends of the Upper Mississippi and Illinois Rivers: U.S. Geological Survey Open-File Report 2022-1039. Pages 38–54.

Van Appledorn, M., N. R. De Jager, and J. J. Rohweder. 2021. Quantifying and mapping inundation regimes within a large river-floodplain ecosystem for ecological and management applications. River Research and Applications 37:241–255.

Van Appledorn, M., and L. Sawyer. *in prep*. UMRR future hydrology meeting series. Page 178. LTRM Report.

UMRR LTRM Implementation Planning
Information Needs and Criteria
1 November 2022

Beginning in March 2022, a core team representing the UMRR LTRM Partnership has been meeting to plan for LTRM implementation planning with the potential of an increase in funds under the Water Resources Development Act of 2020. If additional funds are appropriated, this would present an opportunity to expand our understanding of the UMRS and better inform restoration and management.

The LTRM Implementation Planning Team (IPT) is developing a framework to annually choose project recommendations for funding to the UMRR Coordinating Committee that best supports partner management goals, while also taking advantage of the new opportunities such funding provides, from a decision analysis perspective. The following pages contain the information needs identified by the IPT following input from the various LTRM partner agencies and the criteria the IPT will be using to score these information needs.

Next steps:

- 10 Nov. 2022: Scoring the information needs by the IPT (with input from others within your agency/organization as you think through scoring)
- 17 Nov. 2022: Facilitators will present the results of the scoring to the IPT and discuss
- On-going: Develop cost estimates of information needs
- TBD: Run through an optimization exercise
- TBD: Review final products

1.0 Information needs related to Floodplain Ecology

The information needs under floodplain ecology address primary concerns of management agencies related to the resilience and restoration of native plant communities, related ecosystem functions, as well as habitat use and distributions for associated faunal communities. Two decades of observed forest loss (De Jager and Rohweder 2022) and recent observations of additional punctuated forest losses in 2019 across major parts of the system underscore the importance of this theme. There are also ongoing concerns about invasive species, nutrient enrichment, and the development of alternative stable vegetation-soil states (wet meadows), as well as continued changes in land/use and hydroclimatic conditions that should serve to continue to change the floodplain ecosystem over the next century. The questions in this section address how floodplain vegetation, soil processes, and faunal communities vary spatially and change temporally within the UMRS. There will also be newly collected forestry data, updated system-wide topobathy data, and new 2-D hydrodynamic models for the system that might make an existing flood inundation – forest succession model broadly applicable at both the system and HREP scales to evaluate potential alternative future floodplain vegetation dynamics.

1.1 Floodplain Ecology: Vegetation Change Across the System

Information need: System-level vegetation change assessments. What is the spatial distribution of different plant species and communities? How have plant species distributions changed over time? What are the main drivers of plant species distribution and change over time? What are the drivers of forest loss across the system? What are the consequences of vegetation change for spatial patterns of forest fragmentation or other general landscape habitat features?

> Geographic extent: Reach/UMRS scale. This may need to include some data from south of the UMRS floodplain as we could be seeing range expansion of southern species into the UMRS.
>
> How the information will be used: Better assess and understand past and current plant species distributions and major drivers of vegetation change. Improve management and restoration by understanding mechanisms of vegetation change and preparing for emerging issues. Extend to specific HREPs by identifying hydrogeomorphic conditions for plant establishment and growth (e.g., elevation, soils, inundation).
>
> Measurement or endpoint: 1) Collect (continue collecting) floodplain vegetation data, including forestry data, invasive species, (e.g., reed canary grass, Japanese hops), native herbaceous communities (sedge meadows), possibly explore the use of UAS for specific monitoring of areas. 2) Analyze vegetation data for change over space and time and associated drivers of change, 3) write reports/summaries and deliver maps of forest loss/vegetation change.

1.2 Floodplain ecology: Simulate alternative future conditions

Information need: What are possible simulated future trajectories of plant species compositions following different management actions and/or hydroclimatic conditions? Reduce uncertainty in current flooding-forest succession model by incorporating newly collected forestry data, more recent topobathy data, updated hydrodynamic models, improved model parameters, and climate change scenarios for the system and apply them at HREPs. Improved input data and model parameters may make the model broadly useful for HREPs.

Geographic extent: UMRS (system) and local (project) scales

How the information will be used: Inform management agencies on possible future trajectories of flooding and vegetation change across the system and at HREP locations. Make better decisions about where to manage forests, and what project features are most likely to improve forests locally.

Measurement or endpoint: Improved model performance and improved management decisions.

1.3 Floodplain ecology: distribution of birds and bats

Information need: Better understand the spatial and temporal distribution of avian fauna (e.g., birds, bats) that depend on the floodplain during different life cycle phases. Determine habitat use by avian and bat communities through long-term monitoring. Develop habitat suitability models and map spatial prioritization of habitat throughout the UMRS.

Geographic extent: Reach/UMRS scale, and/or Reach between Pool 13 and Pool 26 is currently being sampled (Audubon), need for more data farther north.

How the information will be used: Assessing ecosystem health by documenting bird and bat abundance/use of the floodplain, improving management and restoration by identifying project futures that could improve habitat, and preparing for emerging issues by identifying drivers of bird and bat use and potential changes in them. Develop a management guide discussing results and management suggestions for birds and bats. Couple bird data with current forest inventory datasets and forest-flood interaction findings.

Measurement or endpoint: Data on bird and bat distribution and use of the floodplain. Before-after-control-impact study design to determine community shifts across management strategies and habitats. Fine-scale bird-habitat suitability models. Comprehensive model of faunal spatial prioritization as it pertains to the UMRS.

1.4 Floodplain ecology: terrestrial and aquatic herpetofauna

Information need: What is the abundance, distribution, and status of reptile and amphibian species within the Upper Mississippi River and Illinois Rivers? Better understand the spatial and temporal distribution of terrestrial and aquatic herpetofauna (i.e., reptiles and amphibians) that depend on the floodplain during different life cycle phases. What drives reptile and amphibian abundances and distribution throughout the UMRS and individual reaches? What, where, and how many non-native herpetofauna are present in the UMRS? Determine habitat use by focal communities through long-term monitoring. Develop habitat suitability models and map spatial prioritization of habitat throughout the UMRS.

Geographic extent: Reach/UMRS scale.

How the information will be used: Assessing ecosystem health by documenting herpetofauna abundance/use of the floodplain, improving management and restoration by identifying project futures that could improve habitat use, and preparing for emerging issues by identifying drivers of herpetofauna use and potential changes in them. Develop a management guide discussing results and management suggestions for reptiles and amphibians. Coupled with current forest inventory datasets and forest-flood interaction findings

Measurement or endpoint: Quantify the status of reptile and amphibian populations (abundance at LTRM study reach scale) and communities and identify relations with various other ecological attributes (e.g., habitat). Identify non-native species and potential/existing invasive status. Data on herpetofauna distribution and use of the floodplain and aquatic areas. A long-term component would establish a robust infrastructure for assessing trends and changes in reptile and amphibian abundances, distributions, and resilience (including species of concern) as well as infrastructure for targeted studies. Before-after-control-impact study design to determine community shifts across management strategies and habitats. Fine-scale reptile/amphibian suitability models. A comprehensive model of herpetofauna spatial prioritization as it pertains to the UMRS. Allow managers to relate habitat decisions to impacts on herpetofauna.

2.0 Information needs related to hydrogeomorphic change.

Hydrogeomorphology is the study of the interactions of water and channel-floodplain topography (geomorphology). One of the most important facets of hydrogeomorphology is its strong control over the spatial and temporal distributions of riverine habitats. Hydrogeomorphology changes over time on two overlapping time scales. The hydrodynamics timescale refers to variation in hydraulics and habitat metrics that results from changes in water discharge in the absence of significant change in channel-floodplain geomorphology. Hydrodynamic variation is dominated by seasonal hydrology, punctuated by rare events. With climate change, however, hydrodynamic variation may also become non-stationary and involve multi-decadal trends.

The morphodynamics timescale refers to variation attributed to changes in geomorphology as sediment is redistributed in a river corridor or watershed as a result of adjustments to factors like dams, channel engineering, land-use patterns, and climate change. Morphodynamic timescales tend to be longer than hydrodynamics timescales (typically multi-decadal to millennial) although geomorphic change can be rapid in areas where erosional energy is concentrated or where sediment accumulates. Geomorphic adjustments in the river corridor or propagated through drainage basins can create long-term and lagged responses as sediment and energy are redistributed. Hence, geomorphic trajectories can be complex and challenging to predict. In the Upper Mississippi River System, geomorphic changes fundamentally alter the mosaic of riverine habitats, for example in infilling backwaters or in areas of channel incision and bank erosion downstream from dams.

Prediction of the changes in hydrogeomorphology – that is, the integrated effects of changes in hydrology and changes in geomorphology – is fundamental to understanding long-term resilience of the Upper Mississippi River System and for planning sustainable restoration projects. The following sections describe information needs related to gaining predictive understanding of hydrogeomorphic change. We assume that the hydrology component of hydrogeomorphic change will be evaluated by the proposed LOCA-VIC-mizuRoute project, or something similar, and so emphasis is on geomorphic change and how change is integrated with future hydrology.

2.1 Hydrogeomorphic change: Geomorphic trends

Information need: These information needs relate to predictive understanding of geomorphic trends within the rivers and their floodplains and include: 1. Where, how, and to what degree is the geomorphology of the river and floodplain changing and expected to change over planning horizons of decades to centuries? 2. How do these geomorphic changes relate to long-term changes in discharge and episodic weather events? 3. How are geomorphic changes affected by ongoing navigation channel operations, e.g., dredging and placement site operations, wing dikes, closing structures, revetments, etc.? 4. What are the implications for the future spatial and temporal distributions of habitat metrics such as water depth, inundation frequency/depth/duration, water residence time, and physical, biological, and chemical properties of the system? It will be addressed as empirical evaluations based on observed changes in bathymetric (elevation) data (as opposed to -processed-based evaluations in 2.2)

Geographic extent: Reach/UMRS scale. There is a system-wide need, but it may be approached operationally by nesting acquisition at a reach/pool level and scaling up to the system scale. Systemic assessment may be more easily justified for some kinds of data, for example, lidar data for which economies of scale can be achieved in a regular schedule of flights. Because of the time and cost investments required for bathymetric data collection at scales applicable to a range of project needs, bathymetric data may be amenable to targeted, sequential collections. An example might be the prioritization of backwater sedimentation rate monitoring in select areas.

How the information will be used: Understanding geomorphic change, and how it is integrated with future hydrology, is fundamental to assessing ecosystem health and resilience. Understanding the spatial and temporal distributions of geomorphic change will provide essential context for restoration planning and management decisions. Because the geomorphic template of the UMRS will provide fundamental insight into system trajectory, it is likely to be applicable when identifying emerging issues.

Measurement or endpoints: 1. Topo-bathymetric data collected to evaluate geomorphic change are also the foundation for hydrodynamic modeling; hence, a basic endpoint is multiple updates of gridded topo-bathymetric digital elevation models (DEMs) at appropriate resolutions; 2. Raster-based datasets of differences of topo-bathymetric DEMs collected over multiple periods to calculate rates, magnitudes, and locations of recent change; 3. Evaluations of expected rates, magnitudes, and locations of future change based on trends evident in repeated topo-bathymetric DEMs; 4. Statistical models relating geomorphic change and rates of change to covariates including emergent and submergent vegetation communities, factors in contributing watershed areas, channel geometry variables, channel-training structures, restoration projects, and distance to dams.

2.1a Hydrogeomorphic change: implications for improving restoration projects

Information need: This need addresses the implications of the changes identified in 2.1 for selection, design, implementation, and sustainability of aquatic and floodplain restoration projects over multi-decade planning horizons. These evaluations will support assessments in section 4.

Geographic extent: This need is addressed at the HREP or local scale, and will consist of project-level analyses of physical, chemical, and biological responses to changes in hydrogeomorphology variables including erosion, deposition, hydroperiod, temporal and spatial habitat metrics including inundation timing, duration, and depth for floodplain areas. Local-scale learning may be best addressed by using HREPs as field-scale, hypothesis-driven, adaptive-management experiments.

How the information will be used: These assessments will be focused on improving project selection, design, and implementation within the context of hydrogeomorphic change. The analyses will address sustainability of projects over planning horizons of multiple decades. It will provide guidance for geomorphological settings for HREP selection and design. Understanding how, where, and how much the geomorphology of the rivers and their floodplains are changing and is likely to change – and how those changes affect project performance -- will allow identification of HREP sites and designs that are most likely to meet and sustain objectives.

Measurement or endpoint: The endpoint of this information need will be reports that synthesize how changes in channel-floodplain topography and hydrology will change over time and affect restoration results and strategies. We anticipate that the synthesis will be based on statistical models that evaluate project effects in the context of hydrogeomorphic change and other covariates. This approach is well suited to before/after control/impact (BACI) experimental designs.

2.2 Hydrogeomorphic change: process-based predictions of sediment dynamics (erosion, transport, and deposition)

Information need: Whereas section 2.1 addresses hydrogeomorphic change by assessing trends in measured topography and bathymetry, the need addressed here is prediction of geomorphic change based on process-based predictive models and empirical sediment budgets. The performance of the predictive models will be calibrated and evaluated by comparison to the topobathymetric measurements in section 2.1. These models will add value to the assessments in section 2.1, by extending the predictive time horizon for geomorphic changes by indicating likely future trends in where, when, and what types of sediment will be redistributed at pool and system scales.

Geographic extent: Reach/UMRS scale. Because of the (mostly) closed nature of UMRS pools with respect to sediment transport, most of the emphasis will be on routing sediment redistribution at the reach scale, including understanding sources from tributaries. Understanding may be approached at a reach level and rolled up to the system.

How the information will be used: This information need will inform assessments of ecosystem health and resilience and improve restoration planning by incorporating multi-decadal predictions of geomorphic change into planning.

Measurement or endpoint: The endpoint of this information need will be predictive models of sediment redistribution within selected reaches and projected sediment budgets that will indicate prospects for long-term management and resilience. Sediment budgets will need to be developed that evaluate major sources, sinks, and transport vectors.

2.2a Hydrogeomorphic change: implications of process-based predictions of sediment dynamics (erosion, transport, and deposition)

Information need: This information need addresses the implications of the results from process-based sediment dynamics models. What does our understanding of the distribution of areas of erosion and deposition mean for the selection, design, implementation, and long-term success of HREPs? Analyses developed under this information need will be based on hypotheses and attendant uncertainties identified from section 2.2.

Geographic extent: The scale of this effort will be generally local (HREP) to reach because of the resolution needed to understand local erosional and depositional phenomena. We anticipate that information collected, and models developed at the HREP scale (individual backwaters, for example), will provide a basis for extension to reach and system scales. Local-scale learning may be best addressed through working with HREPs as field-scale adaptive-management experiments.

How the information will be used: This information will be most directly applicable to planning, siting, design, and implementation of HREPs. The information could be used to determine applicability of passive or active restoration approaches and to evaluate resiliency and sustainability of projects within the context of ongoing geomorphic change. The information will also provide insights into general ecosystem health and resilience.

Measurement or endpoint: The endpoint of this information need will consist of process-based analyses and models for deposition and erosion at project scales and synthesis of those results to predict the trajectory of site elevations, habitat suitability, hydroperiod, and soil characteristics.

2.3 Hydrogeomorphic change: evaluation of large woody debris source, transport, and fate

Information need: This information need addresses improving understanding of woody debris dynamics (source, transport, fate) including the role of woody debris in providing habitats for various species and its effects on river geomorphology. Where is it coming from, where is it going, and where is it accumulating? This need includes a methods development component to evaluate the most efficient means to evaluate inventories and dynamics of large woody debris in the Upper Mississippi River System.

Geographic extent: Reach/UMRS scale. There is a system-wide need for this information, but it may be approached at a reach level and rolled up to the system.

How the information will be used: Large, woody debris in river systems can be instrumental in creating habitat for invertebrates, interacting with hydraulics to influence aquatic habitat diversity and floodplain sedimentation, and, when the wood eventually decays, contributing to the carbon base of the riverine ecosystem. Understanding large woody debris dynamics will contribute to general assessments of ecosystem health and resilience by indicating sources, sinks, and spatial distributions and trends in accumulation of wood. The information also can be applied to restoration management and planning by indicating how large woody debris can be incorporated into HREPs and/or anticipated to interact with HREP designs (section 2.3a).

Measurement or endpoint: The endpoint of this information need will be an assessment of large woody debris dynamics. The specifics of the assessment will depend on developing appropriate methods to evaluate and quantify dynamics. The method may include repeat remote-sensing of debris to map accumulations over time, radiotelemetry to evaluate transport and fate of individual pieces, or plot studies to inventory large woody debris. The assessment may also include comparison with geomorphic change data (section 2.1) to indicate the strength of interaction between large woody debris and erosional/deposition processes.

[Additional information:

2.3a Hydrogeomorphic change: implications of input, transport, and fate of large woody debris for restoration.

Information need: This information need will build on section 2.3 to expand understanding into implications for restoration designs and biological endpoints. Specifically, it addresses how large woody debris may be incorporated in HREP designs and seeks to predict resulting HREP evolution. In addition, this information need addresses how HREP designs may effectively trap and retain large woody debris and the biological consequences of incorporating large woody debris into HREPs, including results for invertebrate communities and aquatic and terrestrial habitats. Because wood eventually rots, this need also includes evaluation of how its geomorphic and biological functions vary over time.

Geographic extent: This information need is best addressed at a local or project scale, potentially in field-scale adaptive management experiments. Information gleaned at the local scale will be amenable to scaling up to reach and system scales. Reach and system scale information gathered in section 2.3 will provide context for local-scale efforts

How the information will be used: Understanding large woody debris dynamics will contribute to improving HREP aquatic and floodplain project design by improving understanding of the costs and benefits of incorporating woody materials into the designs.

Measurement or endpoint: The endpoints for this information need will be multiple assessments of project performance in field-scale adaptive management experiments. Experiments will include a variety of aquatic and floodplain habitats and will evaluate physical and biological performance over diverse applications of large woody debris in designs.

3. Aquatic Ecology

The information needs in the Aquatic Ecology category deal with fully aquatic organisms living in the UMRS (as opposed to semi-aquatic or floodplain organisms such as waterfowl). Needs fall into three broad groups: status and trends in populations, contribution to resiliency, and how these groups respond to outside drivers. Status and trends in populations are assessed in terms of changes in abundance of organisms at either the entire system level, the level of the LTRM study reaches, or at the local scale. Reach scale information needs also address questions of movement and connectivity between populations. Status and trends of groups considers changes in community (e.g., changes in species diversity or richness and changing patterns in species distribution) across space and time. Needs addressing contribution to resiliency consider how populations will (and have) respond to changes in habitat, especially response to climate change and established and emerging contaminants and invasive species. Information needs addressing outside drivers examine other local scale questions. Local-scale questions would address issues of how a group might respond to an HREP project or other local management action such as reconnecting a side channel or dredging a backwater. For the most part, information collected in addressing the information need could be used to better plan HREPS and other management actions in the future, but more specific issues are addressed in category 4. Restoration Ecology.

LTRM has historically collected data on two major groups mentioned here: aquatic turtles (incidental catch) through the LTRM fish component, and phytoplankton, through the LTRM water quality component. These data have been minimally analyzed. For turtles see Johnson and Briggler 2012 and in the case of phytoplankton, organism ID has been accomplished in smaller studies [Decker, J.K. 2012; Manier et al. 2021] with other subsets of samples recently being identified) however, there is opportunity to examine past conditions and trends. Other sources of data already existing include numerous mussel surveys completed by state and federal agencies, LTEF data collection in non-LTRM study reaches, and shorter-term studies by universities on a variety of topics. These data could provide some context as planning to address specific needs is implemented.

Decker, J. K. 2012. Nutrient controls on phytoplankton composition and ecological function among hydrologically distinct habitats in the Upper Mississippi River. Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Biology Department at Fordham University.

Johnson, T.R. and Briggler, J.T., 2012. Turtles of the upper Mississippi River system. Jefferson City: Missouri Department of Conservation Report.

Manier, J.T., R. J. Haro, J. N. Houser, E. A. Strauss. 2021. Spatial and temporal dynamics of phytoplankton assemblages in the upper Mississippi River. River Res Applic., 1-12. DOI: 10.1002/rra.3852

3.1 Aquatic ecology: Aquatic plant distribution

Information need: What are the factors which limit aquatic plant distribution and (re)establishment throughout the system, especially the unsampled portions of the lower impounded reach (P14-25). Is it individual factors e.g., lack of backwater or shallow areas or a combination of several physical/chemical (natural and/or anthropogenic) factors? What, if any, inputs from the tributaries in this reach contribute to the lack of aquatic plants? How does the hydrologic regime affect aquatic plant community dynamics? What are the implications of shifting seasonality and magnitude of hydrologic extremes? How do invasive species (of aquatic plants or other groups) impact native plant distribution?

Geographic extent: Reach/UMRS scale.

How the information will be used: Assessing status and trends, assessing ecosystem health and resilience. Improving management and restoration.

Measurement or endpoint: same endpoints as in LTRM aquatic vegetation sampling protocol (Yin et al. 2000; plant abundance, plant density, species composition, diversity metrics) and LTRM's water quality protocol (Soballe and Fischer 2004; at least 10 water quality parameters), aquatic plant presence/absence through time, and associated [bathymetry, water level fluctuation] herbivory, turbidity, flocculent sediment, flow, (flow refuge), water level fluctuations, other drivers (association with invasive species), herbicide concentrations, turbidity, flow, sediment composition) above and below tributary confluences.

3.2 Aquatic ecology: fish community connectivity

Information need: What is affecting broad-scale fish movement? Is this impacted by locks and dams? What physical, ecological, and anthropogenic changes impact fish movement?

Geographic extent: Reach/UMRS scale; Species like skipjack may be more system-level, while other species like Lake Sturgeon, Paddlefish, and White Bass may operate as a population in a pool or set of pools and their tributaries. Many river species (particularly members of the sucker family) may have populations currently utilizing or potentially utilizing multiple pools that have not been documented due to the non-game classification typically applied to this group. Results from the genetics and microchemistry portions of the vital rates project may provide a starting point or template for further study if it strongly indicates movement or lack thereof that might imply barriers in the system

How the information will be used: Assessing ecosystem health and resilience by improving understanding of where fishes are when. Improving management and restoration by allowing managers to tie together state-level projects to address populations across boundaries. Project goals could be to support native species of concern or impede invasive species.

Measurement or endpoint: movement patterns, transition probabilities, and home ranges of native and nonnative fishes and their controlling variables.

3.3 Aquatic ecology: mussel distribution

Information need: What are the status and trends of mussel species within the Upper Mississippi River and Illinois Rivers? What, where, and how many non-native mussel species are present within the UMRS?

Geographic extent: Reach/UMRS scale

How the information will be used: Assessing ecosystem health and resilience. Improving management and restoration.

Measurement or endpoint: quantify the status and trends of mussel populations and communities and identify relations with various other ecological attributes (e.g., habitat, water level). Additional metrics (recruitment, survival, growth, diversity) may be needed.

3.5 Aquatic ecology: fish populations

Information need: What are the current age and spatial structure of fish populations across the system?

Geographic extent: Reach/UMRS scale

How the information will be used: Improve management and restoration; north-south gradient can affect how quickly a species may exhibit a detectable response to restoration actions. Provide context and interpretive value to existing LTRM fish CPUE data. When used in conjunction with information need 3.2 this can be used to target critical life stages/sizes of fish with habitat projects. Preparing for emerging issues. Changes in growth or age characteristics in a population can also be indicative of factors such as invasive species, climate change, or other anthropogenic disruptions sooner than changes in abundance might. Examining and quantifying presence and impact of invasive species on native communities, and drivers of growth and recruitment on a local and system-wide scale can model expected species-level responses. This data also captures invasive species information and helps managers track the spread of species like bighead and silver carp.

Measurement or endpoint: age, growth, recruitment, mortality, population structure, metabolic rate; transition probabilities for inter-pool movement, metapopulation, and stock structure dynamics, tie to variable drivers along gradient of the river, bottleneck to recruitment and incorporate into larger spatially explicit models to measure the resilience of these communities and provide more tenable management targets for game and non-game species)

3.6 Aquatic ecology: Implications of changing hydrologic regime on biota.

Information need: How does the hydrologic regime and water temperature affect fish population dynamics? For example, Why do the biggest year classes of common carp in Pool 4 occur during drought years? How do winter floods affect fish survival or community composition? What are the implications of shifting seasonality and magnitude of hydrologic extremes? How do water level fluctuations affect aquatic plants and their restoration? How might invasive species populations move or change in response to forecasted changes in climate?

Geographic extent: Reach/UMRS scale

How the information will be used: Assessing ecosystem health and resilience. Improving management and restoration. Preparing for emerging issues (e.g., climate change or invasive species resistance or adaptation built into HREP design and placement)

Measurement or endpoint: model climate factor associations with long-term catch data, growth recorded in otolith or mussel shell increment width, mortality and recruitment.

3.7 Aquatic ecology: macroinvertebrate contribution.

Information need: What is the status (composition, abundance, and distribution) of native and non-native macroinvertebrates in the UMRS? What is the contribution and response of macroinvertebrates to ecosystem health and resilience? How will aquatic macroinvertebrates, and the ecosystem services they provide (biofiltration, nutrient cycling, fish forage) be affected by climate-induced changes and future river modifications?

Geographic extent: Reach/UMRS scale. Note: Species composition, structure, and tolerance levels will change across reaches

How the information will be used: Assessing ecosystem health and resilience.

Measurement or endpoint: community-level macroinvertebrate data on large (LTRM-inclusive and outpool reaches of UMRS) spatial and temporal scales capturing soft-substrate communities using benthic ponar and EPT communities using rock bag/plate samplers); trends and changes in macroinvertebrate abundances, distributions, and resilience. Shifts in community composition, abundance, and MBI tolerance values can reflect habitat and reach-wide resilience. Long-term component establishes robust infrastructure for targeted studies (e.g., contaminants, adult emergence, genetics, and microplastics).

3.7a Aquatic ecology: macroinvertebrate contribution

Information need: How do macroinvertebrate communities and associated habitat and environmental needs/characteristics change at the individual project or HREP scale and how can these changes better inform HREP design and implementation throughout the UMRS

> Geographic extent: Local Scale. Could be measured at project or individual HREP scale. [Note: Species composition will change across reaches] Sets infrastructure for targeted studies within reaches or aquatic areas (contaminants, emergence, genetics, microplastics)
>
> How the information will be used: Assessing ecosystem health and resilience. Improving mgmt & restoration
>
> Measurement or endpoint: Trends and changes in macroinvertebrate abundances, distributions, and resilience. Long-term component and individual project-scale evaluation, establishes robust infrastructure for targeted studies on the influence of rock used in HREP construction, contaminants, timing and magnitude of adult insect emergence, genetic structure, and microplastics, and local level associations between macroinvertebrates and habitat characteristics

3.9 Aquatic ecology: lower trophic contribution

Information need: What are the abundance, distribution, and status of lower trophic organisms (zooplankton and phytoplankton)? What is the lower trophic base contribution and response to ecosystem health and resilience? What, where, and how many non-native plankton are present in the UMRS?

> Geographic extent: Reach/UMRS scale. Use existing phytoplankton samples from field stations. And consider specific outpool samples in the future that may have connections to other LT monitoring efforts (e.g., LTEF) or expansion of LTRM. Zooplankton and other lower trophic (e.g., microbes) investigations would require additional sample collection.
>
> How the information will be used: Assessing ecosystem health and resilience.
>
> Measurement or endpoint: Establish baseline abundance, community composition, and spatiotemporal change for lower trophic base and investigate relationships with environmental conditions. Identify non-native species and potential for or existing invasive status.

3.9a Aquatic ecology: Implications for lower trophic contribution

Information need: How do phytoplankton and zooplankton respond to local water quality conditions and HREPs, including attention to responses of toxin producing cyanobacteria. How do plankton respond to the presence of invasive species (including invasive plankton and invasives from other groups)? What factors influence invasive plankton spread throughout the UMRS?

Geographic extent: Local scale. Within outpools and LTRM study reaches at project scale (e.g., at strata specific aquatic areas, backwaters and HREPs).

How the information will be used: Assessing ecosystem health and resilience relative to plankton communities at project scale.

Measurement or endpoint: Assessment of community composition and abundance of lower trophic base (zooplankton and phytoplankton) at smaller spatiotemporal scales relative to habitat and environmental conditions.

3.11 Aquatic ecology: tributary inputs

Information need: How do tributary inputs* of water discharge, sediment, and nutrients change over time? What are the impacts of these changes on the UMRS and what areas within-pool are most impacted? (*broader set of tributaries than currently monitored). Where are tributary influences greater than upstream mainstem influences? Which tributaries act as important habitat refugia for aquatic organisms?

Geographic extent: Reach/UMRS scale

How the information will be used: Assessing ecosystem health and resilience. Improved management and restoration decisions. Identify additional tributaries of interest for targeting with short-term studies. Better evaluation of the effectiveness of conservation actions and projects: If a tributary has a large influence or is contributing a pollutant (sediment, nutrient, etc.) action within the tributary may be more effective than action within the mainstem UMRS.

Measurement or endpoint: 1. Water quality monitoring at additional tributary confluences or upstream at important locations. 2. Loading estimates of water quality variables. 3. Assessment of the spatial impact of tributaries within pools.

3.12 Aquatic ecology: river gradients

Information need: Understand status of fish, veg, (including invasive species present in monitoring) and water quality in the stretch of river between Pools 13 and 26.

Geographic extent: Reach/UMR scale

How the information will be used: Assessing ecosystem health and resilience.

Improving management and restoration by expanding understanding.

Measurement or endpoint: LTRM base monitoring data structure and/or other monitoring sources (e.g., FLAMe sensor or satellite data) across similar spatial scales and strata designations. The goal would be to expand LTRM data collection to the understudied reach though with likely less temporal intensity.

3.13 Aquatic ecology: Pollutants and habitat

Information need: **What impacts do excess nutrients (i.e., harmful algal blooms) and contaminants (i.e., road salt, pharmaceuticals, microplastics, legacy contaminants [lead]) have on native species and habitats?** Is the frequency or magnitude of harmful algal blooms changing? If so, what factors are contributing? How do the impacts of pollutants alter the effects of invasive species on native populations?

> Geographic extent: Reach/UMRS scale. Species composition will change across reaches as will pollutants of interest and greatest impact.
>
> How the information will be used: assessing ecosystem health and resilience by allowing stakeholders to predict future conditions and attempt to mitigate. Improving management and restoration by allowing managers to target vulnerable areas or species for protection or remediation.
>
> Measurement or endpoint: Understand existing conditions and how this can be used to evaluate the impact of contaminants on native communities. Establishing effects of contaminants including HAB toxins on biota. This monitoring could occur in conjunction with already occurring LTRM sample collection.

4.0 Information needs related to restoration applications

The information needs contained in the Restoration Applications theme relate to needs identified that would directly improve the selection, design, performance, and capacity to learn from Habitat Rehabilitation and Enhancement Projects. Several information needs listed may resolve uncertainties regarding the ecological role of HREP features and thus improve UMRR's use of HREPs to meet specific objectives. Given the diversity of taxonomic groups found in the UMRS, an emphasis was placed on priority species, guilds, communities, and habitat types in several of the information needs. Several information needs are strategic in the sense that they represent broad knowledge gaps that require attention. Moving forward on strategic needs may necessitate the development of working groups to specify the initial direction for how the need could best be addressed. Lastly, several needs that emphasized the programmatic need for integration between Long Term Resource Monitoring staff, resources, and expertise and HREP planning staff and processes were ultimately removed from this list to allow the UMRR CC to determine how to best meet that need.

4.1 Restoration Applications: habitat conditions

Information need: What are the conditions needed to support species, guilds, and communities that are prioritized for conservation?

For example: What are the critical variables (e.g., substrate stability, velocity, host fish presence/absence, dissolved oxygen, temperature, food availability) driving the distribution and abundance of mussel species? What are the seasonal movement patterns, home ranges, and population bottlenecks of native and non-native fishes? Do fish in the river stay in the river consistently, or do they use tributary habitat during different seasons or life stages?

Geographic extent: Reach/UMRS scale (but products should be useable at project scale)

How the information will be used: Improving management and restoration

Measurement or endpoint: The endpoint of this information need is an improved understanding of the habitat conditions that support the life history needs of priority species (state and federal T&E; state species in greatest need of conservation; USFWS Trust species; national wildlife refuge priority resources of concern). This is a broad need and a working group would ideally be formed to determine which guild(s) and/or community(ies) to be the initial focus of targeted sampling and habitat assessments. Examples include lotic mussels, migratory fish such as blue sucker, paddlefish, and sturgeon, herps, etc. Methods will be taxa-dependent; for example, pit tags and pit tag readers could provide locational information on fish at different times of the year and different life stages.

4.2 Restoration Applications: biotic response to HREPs

Information need: How do species, guilds, and communities that are prioritized for conservation and habitat conditions respond to conventional or commonly implemented HREP measures/features?

For example: How can HREPs influence critical variables to benefit mussels and how do mussels respond? What is the response to placement of woody debris? What ages/life stages of fish are using project features? What spatial distribution of habitats/features/projects is optimal? How do bird communities shift in response to HREP features/measures?

Geographic extent: Local scale because the information need is concerned with the HREP-scale issues and applications. Data will be collected from multiple projects to support broad-scale analyses.

How the information will be used: Improving management and restoration

Measurement or endpoint: Improved understanding of how prioritized species, guilds, and communities (state and federal T&E; state species in greatest need of conservation; USFWS Trust species; national wildlife refuge priority resources of concern) are expected to use HREP features. Pre- and post-HREP monitoring could include presence/absence, abundance, reproductive output, survivorship, etc., of the target species or guilds as well as the associated environmental/habitat conditions.

4.3 Restoration Applications: floodplain vegetation change at HREP scales

Information need: Project-level monitoring to adaptively manage sites and improve forest simulation model parameters (see 1.2). What are the rates of mortality by age of different plant species in relation to built project features (e.g., soil types, elevations, inundation periods)? What are the establishment rates of unplanted species? How do invasives respond to built features?

Geographic extent: Local scale

How the information will be used: Adaptively manage HREP site conditions and plant assemblages as needed. Improve model parameters for future model applications.

Measurement or endpoint: Targeted floodplain vegetation measurements at HREP and other small-scale management sites pre- and post-project across a range of site conditions, HREP feature designs, and floodplain vegetation species and ages. Improved model parameters (reduce uncertainty), improved site conditions for HREPs and better project alternatives selected by improved modelling. Information, lessons learned transferred to other HREPs.

4.4 Restoration Applications: soil dynamics and ecosystem processes at HREPs

Information need: Project-level understanding of soil nutrient content, composition, and depth in existing and created floodplain soils as well as; ‘natural’ deposition or erosion of project features or project areas. How does soil composition (OM and texture), nutrient availability and turnover rates relate to patterns of connectivity/inundation and above ground plant communities? Where are the opportunities to amend floodplain soils for restoration?

> Geographic extent: Local Scale. HREP scale because the information need is concerned, in part, with vegetation/soil relationships that would be needed for HREP planning. the other part is understanding the capacity of HREPs to sequester nutrient and sediments. And it is not feasible to measure nutrient processing rates at broader scales.
>
> How the information will be used: Improving management and restoration
>
> Measurement or endpoint: Data on nutrient content, soil composition (OM and texture), depth of existing soils and created soils, and nutrient processing rates across a range of built and natural hydrogeomorphic conditions.

4.5 Restoration Applications: hypothesis testing

Information need: Capacity to use HREPs as opportunities to reduce uncertainties through research designed to test specific hypotheses. One approach is to ask which questions identified in the Research Frameworks can be addressed through intentional study of HREPs. Specific examples include understanding mussel velocity/substrate/shear stress requirements and validating wind fetch/wave models in Pool 13

> Geographic extent: Reach/UMRS scale (project-level learning with systemic applications)
>
> How the information will be used: Improving management and restoration
>
> Measurement or endpoint: Improved understanding of assumptions regarding how HREP features/design influence physical and ecological processes. Ideally, a working group would be formed to identify the hypothesis to be tested and design research.

4.6 Restoration Applications: Floodplain Connectivity

Information need: What effect does re-establishing different extents of floodplain connectivity have on the flora, fauna, and water quality of large river ecosystems. Can berms/levees and control structures be constructed/degraded in a manner that allows for a level of connectivity or residence time that maximizes the benefit to flora and fauna of large river ecosystems? Where might land acquisition opportunities by partners capable of doing so have the greatest impact and benefit for current or future project locations?

> Geographic extent: Local scale. Impact would be more localized to reach or river pool. There could potentially be a cumulative impact.
>
> How the information will be used: Assessing ecosystem health, improving management and restoration, and preparing for emerging issues
>
> Measurement or endpoint: Determining the relationships between flora/fauna and the extent of floodplain connectivity can provide a better understanding of the quantity of connected floodplain needed to benefit flora and fauna. Assessments of residence time, water quality, and inundation patterns at floodplain reconnection sites can inform how connections can be designed to improve water quality.

4.7 Restoration Applications: reduce invasive species impacts at habitat project sites

Information need: What are the life history needs of invasive species? How can habitat projects be designed to promote native populations while also discouraging non-native species (For example: bigheaded carp, reed canary grass, flowering rush)? Have habitat project characteristics resulted in increased invasive species establishment within pools compared to background establishment rates?

Geographic extent: UMRS and local scale

How the information will be used: Improved Management and restoration.

Measurement or endpoint: Life history needs, habitat associations (e.g., depth, velocity, residence time, DO, substrate) and propagule dispersal mechanisms of targeted invasive species. One-time analysis of established HREPs and data to look at pre- and post-implementation invasive species populations. Information will be used in design of future HREPs to incorporate invasive-species prevention strategies into project design. Long-term monitoring of HREP sites and corresponding pools to determine the effects of new HREPs on establishment of invasive species. Outpool sampling could expand the early detection and monitoring of invasive species.

4.8 Restoration Applications: water level management

Information need: What is the optimal frequency and timing of water level management for meeting different ecological objectives (Heglund et al. 2022)? Are there specific water level thresholds to consider for different biotic groups (i.e., emergent vegetation, mussels)?

Geographic extent: Reach /Systemic

How the information will be used: Improved management and restoration

Measurement or endpoint: Various potential metrics are detailed in a recent report (Heglund et al. 2022) including, but not limited to, total suspended solids, distribution of native plants, native mussel mortality, tuber biomass, young-of-year native fish catch rates, and invertebrate diversity and abundance.

Relevance Criteria

Relevance or Importance	Ecosystem Understanding and Assessment	Management and Restoration (UMRR Outcome)
Irrelevant (0)	Ecosystem understanding is insensitive to the information need	Outcomes are insensitive to the information need
Somewhat (1)	Ecosystem understanding is indirectly linked to the information need and is thus predicted to improve marginally by addressing the information need.	Outcomes are somewhat determined by the information need and are thus predicted to improve marginally by addressing the information need.
Moderate (2)	Ecosystem understanding is directly linked to the information need, but other information needs should also be addressed to significantly improve understanding. Thus, ecosystem understanding is predicted to improve moderately by addressing this information need.	Outcomes are largely determined by the information need, but other information needs should also be addressed to significantly improve outcomes. Thus, outcomes are predicted to improve moderately by addressing this information need.
Significantly (3)	Ecosystem understanding is directly and predominantly linked to the information need. Thus, ecosystem understanding is predicted to improve significantly by addressing this information need.	Outcomes are largely and predominantly determined by the information need. Thus, outcomes are predicted to improve significantly by addressing this information need.
Highly Relevant (4)	Ecosystem understanding is directly linked to the information need AND addressing this information need is necessary to improving ecosystem understand.	Outcomes are directly determined by the information need. Thus, outcomes can only be improved by addressing this information need.

Depth of Current Knowledge Criteria

Depth of current knowledge	Confidence that the underlying question or topic to be addressed by the information need is already well supported
Certain	Unquestioned confidence that the topic is fully understood and well-studied based on multiple and reliable evidence types
High	Topic is mostly understood and well-studied based on multiple and reliable evidence types
Moderate	Topic is partially understood and moderately studied based on multiple evidence types but with mixed results (variability in observed results)
Partial	Topic is poorly understood and moderately studied based on evidence that may not include multiple types and with low consistency in results (high variability in observed results).
Uncertain	Topic is poorly understood and little studied with limited to no evidence

Opportunity to Address Information Need Criteria

Opportunity to learn	Degree to which learning is anticipated based on reliability of inference
Infeasible	Learning is not feasible because 1) impractical to collect data for a robust study, or 2) inherently weak inference due to low signal-to-noise ratio (confidence in data is low)
Somewhat	Learning is feasible, but constrained by 1) important data collection limitations, or 2) challenging inference due to low signal-to-noise ratio
Moderate	Learning is feasible because methods for robust study are available AND signal-to-noise ratio is moderate
Strong	Learning is feasible and expected because methods for rigorous data collection and research design are available AND signal-to-noise ratio is strong (confidence in data is high)

Urgency and Unique Capacity Criteria

Urgency and Unique Capacity	Degree to which addressing the information need is urgent	Requires the unique capacity of the LTRM element
Not Urgent or Not Unique	The need is not pressing within the next 5 years	The need would likely be addressed by others adequately
Urgent or Unique	Information would support decisions or inferences that must be made in the near-term (within the next 5 years)	LTRM is most appropriate to address the information need.

ATTACHMENT E

Additional Items

- **Future Meeting Schedule** *(E-1)*
- **Frequently Used Acronyms (4-29-2022)** *(E-2 to E-8)*
- **UMRR Authorization (amended 12/23/2022)** *(E-9 to E-12)*
- **UMRR (EMP) Operating Approach (5/2006)** *(E-13)*

Quarterly Meetings
Future Meeting Schedule

May 2023	
	St. Paul, MN
May 23	UMRBA Quarterly Meeting
May 24	UMRR Coordinating Committee Quarterly Meeting

August 2023	
	La Crosse, WI
August 8	UMRBA Quarterly Meeting
August 9	UMRR Coordinating Committee Quarterly Meeting

Acronyms Frequently Used on the Upper Mississippi River System

AAR	After Action Report
A&E	Architecture and Engineering
ACRCC	Asian Carp Regional Coordinating Committee
AFB	Alternative Formulation Briefing
AHAG	Aquatic Habitat Appraisal Guide
AHRI	American Heritage Rivers Initiative
AIS	Aquatic Invasive Species
ALC	American Lands Conservancy
ALDU	Aquatic Life Designated Use(s)
AM	Adaptive Management
ANS	Aquatic Nuisance Species
AP	Advisory Panel
APE	Additional Program Element
ARRA	American Recovery and Reinvestment Act
ASA(CW)	Assistant Secretary of the Army for Civil Works
A-Team	Analysis Team
ATR	Agency Technical Review
AWI	America's Watershed Initiative
AWO	American Waterways Operators
AWQMN	Ambient Water Quality Monitoring Network
BA	Biological Assessment
BATIC	Build America Transportation Investment Center
BCOES	Bid-ability, Constructability, Operability, Environmental, Sustainability
BCR	Benefit-Cost Ratio
BMPs	Best Management Practices
BO	Biological Opinion
CAP	Continuing Authorities Program
CAWS	Chicago Area Waterways System
CCC	Commodity Credit Corporation
CCP	Comprehensive Conservation Plan
CEICA	Cost Effectiveness Incremental Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CG	Construction General
CIA	Computerized Inventory and Analysis
CMMP	Channel Maintenance Management Plan
COE	Corps of Engineers
COPT	Captain of the Port
CPUE	Catch Per Unit Effort
CRA	Continuing Resolution Authority
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program

CSP	Conservation Security Program
CUA	Cooperative Use Agreement
CWA	Clean Water Act
CY	Cubic Yards
DALS	Department of Agriculture and Land Stewardship
DED	Department of Economic Development
DEM	Digital Elevation Model
DET	District Ecological Team
DEWS	Drought Early Warning System
DMMP	Dredged Material Management Plan
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOC	Department of Conservation
DOER	Dredging Operations and Environmental Research
DOT	Department of Transportation
DPR	Definite Project Report
DQC	District Quality Control/Quality Assurance
DSS	Decision Support System
EA	Environmental Assessment
ECC	Economics Coordinating Committee
EEC	Essential Ecosystem Characteristic
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
EMAP-GRE	Environmental Monitoring and Assessment Program-Great Rivers Ecosystem
EMP	Environmental Management Program [Note: Former name of Upper Mississippi River Restoration Program.]
EMP-CC	Environmental Management Program Coordinating Committee
EO	Executive Order
EPA	Environmental Protection Agency
EPM	Environmental Pool Management
EPR	External Peer Review
EQIP	Environmental Quality Incentives Program
ER	Engineering Regulation
ERDC	Engineering Research & Development Center
ESA	Endangered Species Act
EWMN	Early Warning Monitoring Network
EWP	Emergency Watershed Protection Program
FACA	Federal Advisory Committee Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FDR	Flood Damage Reduction
FFS	Flow Frequency Study
FMG	Forest Management Geodatabase
FONSI	Finding of No Significant Impact
FRM	Flood Risk Management

FRST	Floodplain Restoration System Team
FSA	Farm Services Agency
FTE	Full Time Equivalent
FWCA	Fish & Wildlife Coordination Act
FWIC	Fish and Wildlife Interagency Committee
FWS	Fish and Wildlife Service
FWWG	Fish and Wildlife Work Group
FY	Fiscal Year
GAO	Government Accountability Office
GEIS	Generic Environmental Impact Statement
GI	General Investigations
GIS	Geographic Information System
GLC	Governors Liaison Committee
GLC	Great Lakes Commission
GLMRIS	Great Lakes and Mississippi River Interbasin Study
GPS	Global Positioning System
GREAT	Great River Environmental Action Team
GRP	Geographic Response Plan
H&H	Hydrology and Hydraulics
HAB	Harmful Algal Bloom
HEC-EFM	Hydrologic Engineering Center Ecosystems Function Model
HEC-RAS	Hydrologic Engineering Center River Analysis System
HEL	Highly Erodible Land
HEP	Habitat Evaluation Procedure
HNA	Habitat Needs Assessment
HPSF	HREP Planning and Sequencing Framework
HQUSACE	Headquarters, USACE
H.R.	House of Representatives
HREP	Habitat Rehabilitation and Enhancement Project
HSI	Habitat Suitability Index
HU	Habitat Unit
HUC	Hydrologic Unit Code
IBA	Important Bird Area
IBI	Index of Biological (Biotic) Integrity
IC	Incident Commander
ICS	Incident Command System
ICWP	Interstate Council on Water Policy
IDIQ	Indefinite Delivery/Indefinite Quantity
IEPR	Independent External Peer Review
IGE	Independent Government Estimate
IIA	Implementation Issues Assessment
IIFO	Illinois-Iowa Field Office (formerly RIFO - Rock Island Field Office)
ILP	Integrated License Process
IMTS	Inland Marine Transportation System
IPR	In-Progress Review
IRCC	Illinois River Coordinating Council

IRPT	Inland Rivers, Ports & Terminals
IRTC	Implementation Report to Congress
IRWG	Illinois River Work Group
ISA	Inland Sensitivity Atlas
IWR	Institute for Water Resources
IWRM	Integrated Water Resources Management
IWS	Integrated Water Science
IWTF	Inland Waterways Trust Fund
IWUB	Inland Waterways Users Board
IWW	Illinois Waterway
L&D	Lock(s) and Dam
LC/LU	Land Cover/Land Use
LDB	Left Descending Bank
LERRD	Lands, Easements, Rights-of-Way, Relocation of Utilities or Other Existing Structures, and Disposal Areas
LiDAR	Light Detection and Ranging
LMR	Lower Mississippi River
LMRCC	Lower Mississippi River Conservation Committee
LOI	Letter of Intent
LTRM	Long Term Resource Monitoring
M-35	Marine Highway 35
MAFC	Mid-America Freight Coalition
MARAD	U.S. Maritime Administration
MARC 2000	Midwest Area River Coalition 2000
MCAT	Mussel Community Assessment Tool
MICRA	Mississippi Interstate Cooperative Resource Association
MDM	Major subordinate command Decision Milestone
MIPR	Military Interdepartmental Purchase Request
MMR	Middle Mississippi River
MMRP	Middle Mississippi River Partnership
MNRG	Midwest Natural Resources Group
MOA	Memorandum of Agreement
MoRAST	Missouri River Association of States and Tribes
MOU	Memorandum of Understanding
MRAPS	Missouri River Authorized Purposes Study
MRBI	Mississippi River Basin (Healthy Watersheds) Initiative
MRC	Mississippi River Commission
MRCC	Mississippi River Connections Collaborative
MRCTI	Mississippi River Cities and Towns Initiative
MRRC	Mississippi River Research Consortium
MR&T	Mississippi River and Tributaries (project)
MSP	Minimum Sustainable Program
MVD	Mississippi Valley Division
MVP	St. Paul District
MVR	Rock Island District
MVS	St. Louis District

NAS	National Academies of Science
NAWQA	National Water Quality Assessment
NCP	National Contingency Plan
NIDIS	National Integrated Drought Information System (NOAA)
NEBA	Net Environmental Benefit Analysis
NECC	Navigation Environmental Coordination Committee
NED	National Economic Development
NEPA	National Environmental Policy Act
NESP	Navigation and Ecosystem Sustainability Program
NETS	Navigation Economic Technologies Program
NGO	Non-Governmental Organization
NGRREC	National Great Rivers Research and Education Center
NGWOS	Next Generation Water Observing System
NICC	Navigation Interests Coordinating Committee
NPDES	National Pollution Discharge Elimination System
NPS	Non-Point Source
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRDAR	Natural Resources Damage Assessment and Restoration
NRT	National Response Team
NSIP	National Streamflow Information Program
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	Operation and Maintenance
OHWM	Ordinary High Water Mark
OMB	Office of Management and Budget
OMRR&R	Operation, Maintenance, Repair, Rehabilitation, and Replacement
OPA	Oil Pollution Act of 1990
ORSANCO	Ohio River Valley Water Sanitation Commission
OSC	On-Scene Coordinator
OSE	Other Social Effects
OSIT	On Site Inspection Team
P3	Public-Private Partnerships
PA	Programmatic Agreement
PAS	Planning Assistance to States
P&G	Principles and Guidelines
P&R	Principles and Requirements
P&S	Plans and Specifications
P&S	Principles and Standards
PCA	Pollution Control Agency
PCA	Project Cooperation Agreement
PCX	Planning Center of Expertise
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PgMP	Program Management Plan

PILT	Payments In Lieu of Taxes
PIR	Project Implementation Report
PL	Public Law
PMP	Project Management Plan
PORT	Public Outreach Team
PPA	Project Partnership Agreement
PPT	Program Planning Team
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RCP	Regional Contingency Plan
RCPP	Regional Conservation Partnership Program
RDB	Right Descending Bank
RED	Regional Economic Development
RIFO	Rock Island Field Office (now IIFO - Illinois-Iowa Field Office)
RM	River Mile
RP	Responsible Party
RPEDN	Regional Planning and Environment Division North
RPT	Reach Planning Team
RRAT	River Resources Action Team
RRCT	River Resources Coordinating Team
RRF	River Resources Forum
RRT	Regional Response Team
RST	Regional Support Team
RTC	Report to Congress
S.	Senate
SAV	Submersed Aquatic Vegetation
SDWA	Safe Drinking Water Act
SEMA	State Emergency Management Agency
SET	System Ecological Team
SMART	Specific, Measurable, Attainable, Risk Informed, Timely
SONS	Spill of National Significance
SOW	Scope of Work
SRF	State Revolving Fund
SWCD	Soil and Water Conservation District
T&E	Threatened and Endangered
TEUs	twenty-foot equivalent units
TIGER	Transportation Investment Generating Economic Recovery
TLP	Traditional License Process
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSP	Tentatively selected plan
TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
TWG	Technical Work Group
UMESC	Upper Midwest Environmental Sciences Center

UMIMRA	Upper Mississippi, Illinois, and Missouri Rivers Association
UMR	Upper Mississippi River
UMRBA	Upper Mississippi River Basin Association
UMRBC	Upper Mississippi River Basin Commission
UMRCC	Upper Mississippi River Conservation Committee
UMRCP	Upper Mississippi River Comprehensive Plan
UMR-IWW	Upper Mississippi River-Illinois Waterway
UMRNWFR	Upper Mississippi River National Wildlife and Fish Refuge
UMRR	Upper Mississippi River Restoration Program [Note: Formerly known as Environmental Management Program.]
UMRR CC	Upper Mississippi River Restoration Program Coordinating Committee
UMRS	Upper Mississippi River System
UMWA	Upper Mississippi Waterway Association
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VTC	Video Teleconference
WCI	Waterways Council, Inc.
WES	Waterways Experiment Station (replaced by ERDC)
WHAG	Wildlife Habitat Appraisal Guide
WHIP	Wildlife Habitat Incentives Program
WIIN	Water Infrastructure Improvements for the Nation Act
WLM	Water Level Management
WLMTF	Water Level Management Task Force
WQ	Water Quality
WQEC	Water Quality Executive Committee
WQTF	Water Quality Task Force
WQS	Water Quality Standard
WRDA	Water Resources Development Act
WRP	Wetlands Reserve Program
WRRDA	Water Resources Reform and Development Act

Upper Mississippi River Restoration Program Authorization

Section 1103 of the Water Resources Development Act of 1986 (P.L. 99-662) as amended by
Section 405 of the Water Resources Development Act of 1990 (P.L. 101-640),
Section 107 of the Water Resources Development Act of 1992 (P.L. 102-580),
Section 509 of the Water Resources Development Act of 1999 (P.L. 106-53),
Section 2 of the Water Resources Development Technical Corrections of 1999 (P.L. 106-109),
Section 3177 of the Water Resources Development Act of 2007 (P.L. 110-114),
Section 307 of the Water Resources Development Act of 2020 (P.L. 116-260), and
Section 8345 of the Water Resources Development Act of 2022 (P.L. 117-263).

Additional Cost Sharing Provisions

Section 906(e) of the Water Resources Development Act of 1986 (P.L. 99-662) as amended by
Section 221 of the Water Resources Development Act of 1999 (P.L. 106-53).

SEC. 1103. UPPER MISSISSIPPI RIVER PLAN.

(a)(1) This section may be cited as the "Upper Mississippi River Management Act of 1986".

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes.

(b) For purposes of this section --

(1) the terms "Upper Mississippi River system" and "system" mean those river reaches having commercial navigation channels on the Mississippi River main stem north of Cairo, Illinois; the Minnesota River, Minnesota; Black River, Wisconsin; Saint Croix River, Minnesota and Wisconsin; Illinois River and Waterway, Illinois; and Kaskaskia River, Illinois;

(2) the term "Master Plan" means the comprehensive master plan for the management of the Upper Mississippi River system, dated January 1, 1982, prepared by the Upper Mississippi River Basin Commission and submitted to Congress pursuant to Public Law 95-502;

(3) the term "GREAT I, GREAT II, and GRRM studies" means the studies entitled "GREAT Environmental Action Team--GREAT I--A Study of the Upper Mississippi River", dated September 1980, "GREAT River Environmental Action Team--GREAT II--A Study of the Upper Mississippi River", dated December 1980, and "GREAT River Resource Management Study", dated September 1982; and

(4) the term "Upper Mississippi River Basin Association" means an association of the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, formed for the purposes of cooperative effort and united assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River System.

(c)(1) Congress hereby approves the Master Plan as a guide for future water policy on the Upper Mississippi River system. Such approval shall not constitute authorization of any recommendation contained in the Master Plan.

(2) Section 101 of Public Law 95-502 is amended by striking out the last two sentences of subsection (b), striking out subsection (i), striking out the final sentence of subsection (j), and redesignating subsection "(j)" as subsection "(i)".

(d)(1) The consent of the Congress is hereby given to the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, or any two or more of such States, to enter into negotiations for agreements, not in conflict with any law of the United States, for cooperative effort and mutual assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River system, and to establish such agencies, joint or otherwise, or designate an existing multi-State entity, as they may deem desirable for making effective such agreements. To the extent required by Article I, section 10 of the Constitution, such agreements shall become final only after ratification by an Act of Congress.

(2) The Secretary is authorized to enter into cooperative agreements with the Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection to promote and facilitate active State government participation in the river system management, development, and protection.

(3) For the purpose of ensuring the coordinated planning and implementation of programs authorized in subsections (e) and (h)(2) of this section, the Secretary shall enter into an interagency agreement with the Secretary of the Interior to provide for the direct participation of, and transfer of funds to, the Fish and Wildlife Service and any other agency or bureau of the Department of the Interior for the planning, design, implementation, and evaluation of such programs.

(4) The Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection is hereby designated by Congress as the caretaker of the master plan. Any changes to the master plan recommended by the Secretary shall be submitted to such association or agency for review. Such association or agency may make such comments with respect to such recommendations and offer other recommended changes to the master plan as such association or agency deems appropriate and shall transmit such comments and other recommended changes to the Secretary. The Secretary shall transmit such recommendations along with the comments and other recommended changes of such association or agency to the Congress for approval within 90 days of the receipt of such comments or recommended changes.

(e) Program Authority

(1) Authority

(A) In general. The Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may undertake, as identified in the master plan

(i) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement; and

(ii) implementation of a long-term resource monitoring, computerized data inventory and analysis, and applied research program, including research on water quality issues affecting the Mississippi River (including elevated nutrient levels) and the development of remediation strategies.

(B) Advisory committee. In carrying out subparagraph (A)(i), the Secretary shall establish an independent technical advisory committee to review projects, monitoring plans, and habitat and natural resource needs assessments.

(2) REPORTS. — Not later than December 31, 2004, and not later than December 31 of every sixth year thereafter, the Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall submit to Congress a report that —

(A) contains an evaluation of the programs described in paragraph (1);

(B) describes the accomplishments of each of the programs;

(C) provides updates of a systemic habitat needs assessment; and

(D) identifies any needed adjustments in the authorization of the programs.

(3) For purposes of carrying out paragraph (1)(A)(i) of this subsection, there is authorized to be appropriated to the Secretary $75,000,000 for fiscal year 1999 and each fiscal year thereafter.

(4) For purposes of carrying out paragraph (1)(A)(ii) of this subsection, there is authorized to be appropriated to the Secretary $15,000,000 for fiscal year 1999 and each fiscal year thereafter.

(5) Authorization of appropriations.—There is authorized to be appropriated to carry out paragraph (1)(B) $350,000 for each of fiscal years 1999 through 2009.

(6) Transfer of amounts.—For fiscal year 1999 and each fiscal year thereafter, the Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may transfer not to exceed 20 percent of the amounts appropriated to carry out clause (i) or (ii) of paragraph (1)(A) to the amounts appropriated to carry out the other of those clauses.

(7)(A) Notwithstanding the provisions of subsection (a)(2) of this section, the costs of each project carried out pursuant to paragraph (1)(A)(i) of this subsection shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with the provisions of section 906(e) of this Act; except that the costs of operation and maintenance of projects located on Federal lands or lands owned or operated by a State or local government shall be borne by the Federal, State, or local agency that is responsible for management activities for fish and wildlife on such lands and, in the case of any project requiring non-Federal cost sharing, the non-Federal share of the cost of the project shall be 35 percent.

(B) Notwithstanding the provisions of subsection (a)(2) of this section, the cost of implementing the activities authorized by paragraph (1)(A)(ii) of this subsection shall be allocated in accordance with the provisions of section 906 of this Act, as if such activity was required to mitigate losses to fish and wildlife.

(8) None of the funds appropriated pursuant to any authorization contained in this subsection shall be considered to be chargeable to navigation.

(f) (1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, is authorized to implement a program of recreational projects for the system substantially in accordance with the recommendations of the GREAT I, GREAT II, and GRRM studies and the master plan reports. In addition, the Secretary, in consultation with any such agency, shall, at Federal expense, conduct an assessment of the economic benefits generated by recreational activities in the system. The cost of each such project shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with title I of this Act.

(2) For purposes of carrying out the program of recreational projects authorized in paragraph (1) of this subsection, there is authorized to be appropriated to the Secretary not to exceed $500,000 per fiscal year for each of the first 15 fiscal years beginning after the effective date of this section.

(g) The Secretary shall, in his budget request, identify those measures developed by the Secretary, in consultation with the Secretary of Transportation and any agency established under subsection (d)(1) of this section, to be undertaken to increase the capacity of specific locks throughout the system by employing nonstructural measures and making minor structural improvements.

(h)(1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, shall monitor traffic movements on the system for the purpose of verifying lock capacity, updating traffic projections, and refining the economic evaluation so as to verify the need for future capacity expansion of the system.

(2) Determination.

(A) In general. The Secretary in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall determine the need for river rehabilitation and environmental enhancement and protection based on the condition of the environment, project developments, and projected environmental impacts from implementing any proposals resulting from recommendations made under subsection (g) and paragraph (1) of this subsection.

(B) Requirements. The Secretary shall

(i) complete the ongoing habitat needs assessment conducted under this paragraph not later than September 30, 2000; and

(ii) include in each report under subsection (e)(2) the most recent habitat needs assessment conducted under this paragraph.

(3) There is authorized to be appropriated to the Secretary such sums as may be necessary to carry out this subsection.

(i) (1) The Secretary shall, as he determines feasible, dispose of dredged material from the system pursuant to the recommendations of the GREAT I, GREAT II, and GRRM studies.

(2) The Secretary shall establish and request appropriate Federal funding for a program to facilitate productive uses of dredged material. The Secretary shall work with the States which have, within their boundaries, any part of the system to identify potential users of dredged material.

(j) The Secretary is authorized to provide for the engineering, design, and construction of a second lock at locks and dam 26, Mississippi River, Alton, Illinois and Missouri, at a total cost of $220,000,000, with a first Federal cost of $220,000,000. Such second lock shall be constructed at or in the vicinity of the location of the replacement lock authorized by section 102 of Public Law 95-502. Section 102 of this Act shall apply to the project authorized by this subsection.

SEC. 906(e). COST SHARING.

(e) In those cases when the Secretary, as part of any report to Congress, recommends activities to enhance fish and wildlife resources, the first costs of such enhancement shall be a Federal cost when--

(1) such enhancement provides benefits that are determined to be national, including benefits to species that are identified by the National Marine Fisheries Service as of national economic importance, species that are subject to treaties or international convention to which the United States is a party, and anadromous fish;

(2) such enhancement is designed to benefit species that have been listed as threatened or endangered by the Secretary of the Interior under the terms of the Endangered Species Act, as amended (16 U.S.C. 1531, et seq.), or

(3) such activities are located on lands managed as a national wildlife refuge.

When benefits of enhancement do not qualify under the preceding sentence, 25 percent of such first costs of enhancement shall be provided by non-Federal interests under a schedule of reimbursement determined by the Secretary. Not more than 80 percent of the non-Federal share of such first costs may be satisfied through in-kind contributions, including facilities, supplies, and services that are necessary to carry out the enhancement project. The non-Federal share of operation, maintenance, and rehabilitation of activities to enhance fish and wildlife resources shall be 25 percent.

EMP OPERATING APPROACH

2006 marks the 20th anniversary of the Environmental Management Program (EMP). During that time, the Program pioneered many new ideas to help deliver efficient and effective natural resource programs to the Upper Mississippi River System (UMRS). These included the creation of an effective partnership of five states, five federal agencies, and numerous NGOs; a network of six field stations monitoring the natural resources of the UMRS; and the administrative structure to encourage river managers to use both new and proven environmental restoration techniques.

EMP has a history of identifying and dealing with both natural resource and administrative challenges. The next several years represent new opportunities and challenges as Congress considers authorization of the Navigation and Environmental Sustainability Program (NESP), possible integration or merger of EMP with NESP, and changing standards for program management and execution.

We will continue to learn from both the history of EMP and experience of other programs. Charting a course for EMP over the next several years is important to the continued success of the Program. EMP will focus on the key elements of partnership, regional administration and coordination, LTRMP, and HREPs.

The fundamental focus of EMP will not change, however the way we deliver our services must change and adapt. This will include:

- further refinements in regional coordination and management,
- refinement of program goals and objectives,
- increased public outreach efforts,
- development and use of tools such as the regional HREP database and HREP Handbook,
- exploring new delivery mechanisms for contracting,
- continued refinement of the interface between LTRMP and the HREP program components, and
- scientific and management application of LTRMP information and data.

The focus of these efforts must benefit the resources of the UMRS through efficient and effective management.