InterContinental St. Paul Riverfront
St. Paul, Minnesota

Upper Mississippi River Restoration Program Coordinating Committee

Quarterly Meeting

November 18, 2015

Agenda
with
Background
and
Supporting Materials

Upper Mississippi River Restoration Program Coordinating Committee

November 17-18, 2015

AGENDA

Tuesday, November 17 Partner Pre-Meetings

4:00 – 5:30 p.m. **Corps of Engineers**

4:00 – 5:30 p.m. **Department of the Interior**

4:00 – 5:30 p.m. **States**

Wednesday, November 18 UMRR Coordinating Committee

Time	Attachment	Topic	Presenter
8:00 a.m.		**Welcome and Introductions**	***Bob Clevenstine**, USFWS*
8:05	**A1-13**	**Approval of Minutes of August 5, 2015 Meeting**	
8:10	**B1**	**External Communications and Outreach**	
		▪ Goal 3 of the 2015–2025 UMRR Strategic Plan	
		– Branding and Logo Development	***Bill Wittland**, Gulf South Research Corporation*
		– Facilitated Discussion	***Kim Schneider**, Schneider Communications and **Ann Guissinger**, Gulf South Research Corporation*
		▪ Public Involvement and Outreach Activities	***All***
10:10		**Break**	
10:20	**C1-5**	**Regional Management and Partnership Collaboration**	***Marv Hubbell**, USACE*
		▪ FY 2015 Year-End Report	
		▪ FY 2016 Fiscal Update and Scope of Work	
		▪ FY 2017 Appropriations Outlook	
		▪ Principles of Efficient Execution for UMRR's Habitat Projects	
		▪ UMRR Strategic Operational Planning Update	
		▪ 2016 UMRR Report to Congress	***Kirsten Mickelsen**, UMRBA*
		– Overview of 9/11/15 First Draft Comments Received	
		– Partner Discussion on Any Major Comments	
11:10 a.m.		**Lunch**	

(Continued)

Wednesday, November 18, 2015
UMRR Coordinating Committee
(Continued)

Time	Attachment	Topic	Presenter
12:15 p.m.	**D1-29**	**Habitat Restoration**	
		▪ District Reports	***District HREP Managers***
		▪ Habitat Needs Assessment (HNA)	
		– Background of 2000 HNA	***Bob Clevenstine***, *USFWS*
		– Development Process Approach	***Tim Fox***, *USGS*
		– Knowledge Advances Since 2000	***Nate De Jager***, *USGS*
		– Partner Discussion on Needs for Next HNA	***All***
1:45	**E1-15**	**Long Term Resource Monitoring and Science**	
		▪ Highlights	***Jennie Sauer***, *USGS*
		▪ Developing Resilience Conceptual Models	
		▪ 2016 Science Coordination Meeting	
		▪ USACE Science Update	***Karen Hagerty***, *USACE*
		▪ A-Team Report	***Shawn Giblin***, *WI DNR*
		▪ Science Highlight: A New Hypothesis of SAV Dynamics in the UMR based on UMRR Long Term Resource Monitoring	***Yao Yin***, *USGS*
2:50		**Other Business**	
	F1	▪ Future Meeting Schedule	
3:00 p.m.		**Adjourn**	

[See Attachment F for frequently used acronyms,
UMRR authorization (as amended), and UMRR (EMP) operating approach.]

ATTACHMENT A

Minutes of the August 5, 2015
UMRR Coordinating Committee Meeting

(A-1 to A-13)

DRAFT
Minutes of the
Upper Mississippi River Restoration Program
Coordinating Committee

August 5, 2015
Quarterly Meeting

Upper Midwest Environmental Sciences Center
La Crosse, Wisconsin

Gregory Miller of the U.S. Army Corps of Engineers called the meeting to order at 8:05 a.m. on August 5, 2015. Other UMRR Coordinating Committee representatives present were Sabrina Chandler (USFWS), Mark Gaikowski (USGS), Dan Stephenson (IL DNR), Randy Schultz (IA DNR), Kevin Stauffer (MN DNR), Janet Sternburg (MO DoC), Jim Fischer (WI DNR), Ken Westlake (USEPA) via phone, and Marty Adkins (NRCS). A complete list of attendees follows these minutes.

Marv Hubbell introduced Miller, who is on a temporary assignment to MVD. Hubbell expressed his appreciation to Miller for chairing the meeting.

Minutes of the May 6, 2015 Meeting

Kevin Stauffer moved and Randy Shultz seconded a motion to approve the draft minutes of the May 6, 2015 meeting as written. The motion carried unanimously.

Regional Management and Partnership Collaboration

FY 2015 Budget Update and Scope of Work

Marv Hubbell reviewed UMRR's FY 2015 work plan under its $33.17 million appropriation, as follows:

- Regional Administration and Programmatic Efforts – $861,000
- Regional Science and Monitoring – $8,126,000
  - Long term resource monitoring – $5,495,000
  - Regional science in support of restoration – $1,907,000
  - Regional science staff support – $69,000
  - Habitat project evaluations – $655,000
- Habitat Restoration – $24,183,000
  - Regional project sequencing – $70,000
  - MVP – $7,234,000
  - MVR – $9,645,000
  - MVS – $7,234,000

Hubbell said UMRR's FY 2015 obligation rate for its habitat projects was 65 percent at the end of the third quarter, with MVP at a 95 percent obligation rate, MVS at 94 percent, and MVR at 41 percent. Hubbell explained that MVR's low obligation rate is because Pool 12 Overwintering Stage II construction award of $4.5 million is less than the estimated construction costs of $9 million. This funding is being reallocated to MVS for construction and to MVP for personnel on programmatic activities. The ability to execute funds quickly at the end of the fiscal year highlights the value of having contingency plans in place and the successful cooperation among Corps Districts and the Division.

FY 2016 Appropriations Report

Hubbell recalled that the House's FY 2016 energy and water appropriations bill matches the President's FY 2016 budget request by including $19.787 million for UMRR. This funding level is the Corps' current planning amount for the program, and represents a decrease of $13.383 million from FY 2015. The decrease is a result of increased competition from other Corps ecosystem restoration projects for construction funding, particularly the Everglades and Chesapeake Bay. Hubbell acknowledged that the final FY 2016 appropriation is unknown.

UMRR's internal allocations under the $19.787 million planning scenario are as follows:

- Regional Administration and Programmatic Efforts – $741,000
- Regional Science and Monitoring – $6,567,000
  - Long term resource monitoring – $4,500,000
  - Regional science in support of restoration – $963,000
  - Regional science staff support – $129,000
  - Habitat project evaluations – $975,000
- Habitat Restoration – $12,479,000
  - Regional project sequencing – $100,000
  - MVP – $3,425,000
  - MVR – $4,745,000
  - MVS – $4,209,000

[Note: The District habitat restoration funds are not reflective of the historical split based on river mileage, and instead are reflective of the project priorities as identified in the budget process.]

Dru Buntin explained that Congressional and Administration staff have provided some important insights into the current federal appropriations process. Several UMRS Congressional delegation members submitted FY 2016 appropriations requests for UMRR at its full annual authorized level of $33.17 million, indicating continued strong bipartisan support for the program in Congress. However, Congress has instituted a blanket policy against such appropriations request, defining an earmark as any increase above the President's budget. Buntin explained that additional funding may be provided for each of the Corps' program missions, such as ecosystem restoration and compliance. The Administration then has full discretion to allocate that additional funding. Buntin reported that he and Gretchen Benjamin visited with several Congressional members' staff in Washington, D.C. this summer to advocate for additional funding in the Corps' ecosystem restoration and compliance funding category, which UMRR is eligible to receive.

Buntin and Benjamin also met in-person with Headquarters' staff regarding UMRR. Staff clearly articulated support for UMRR, but said increased competition from other ecosystem restoration programs resulted in decreased funding in FY 2016. Headquarters staff observed that non-federal partners play an increasingly important role in communicating and showcasing the value of their interested programs and projects, including by providing detailed accounts of estimated budget requirements for optimal execution or the lost efficiencies and benefits under lower funding scenarios. Buntin said Headquarters staff advised that UMRR's non-federal partners should better articulate the need and capabilities for UMRR to execute at its full annual authorized funding amount in FY 2017. If the program is budgeted less than that amount, partners will need to articulate the funding level necessary to maintain optimal execution of projects.

FY 2017 Appropriations Status

Hubbell said MVD has submitted to Headquarters a proposed FY 2017 budget for UMRR. The budget includes several assumptions, including that UMRR's FY 2016 budget level remains its current planning amount of $19.787 million.

Headquarters Visit

Hubbell said that, on June 8-11, 2015, District staff hosted Mindy Simmons, Corps Headquarters ecosystem budget lead, on a helicopter tour of 15 habitat projects in three floodplain reaches, a driving tour of Lake Odessa courtesy of Illinois DNR, a boat tour of the La Grange Pool, and site visits to Corps' and partners' facilities, including the Havana Field Station. Brian Johnson and Marv Hubbell (Corps), Sabrina Chandler (USFWS), Jeff Houser (USGS), Mike Griffin (IA DNR), Dan Stephenson (IL DNR), Gretchen Benjamin (TNC), and Dru Buntin (UMRBA) joined the tour to provide partner perspectives and program knowledge. Simmons expressed appreciation to program partners for participating in the tour and acknowledged the depth and breadth of the program, as well as the value of partner engagement.

Principles of Efficient Execution

In response to budget discussions with Headquarters, Hubbell said District staff are developing draft principles of efficient funding for UMRR's execution of its habitat projects. [Note: These principles do not speak to the program's science efforts.] For example, a principle might describe the need for ensuring an appropriate, balanced stream of projects in planning, design, and construction in order to maintain staff and execution capacity. Hubbell clarified that, while District staff will continue to demonstrate the program's capacity to execute at its full annual authorized funding level (i.e., $33.17 million), these principles will be communicated under reduced budgets and when the Administration is considering reallocations.

In response to a question from Marty Adkins, Hubbell explained that the Corps prefers to maintain two to four habitat projects in each phase (planning, design, and construction) and in each of three UMRS Districts. Planning typically takes three years to complete and design takes about 12 to 18 months, while the timing required for construction varies quite a bit among habitat projects. A balanced and steady stream of projects in each of three phases provides flexibility for the Corps to maintain optimal execution capabilities, advancing and delaying projects as needed.

In response to a question from Olivia Dorothy, Hubbell explained that UMRR's optimal funding ranges from $28 million to $33 million for each of the next few years. Buntin clarified that District staff continue to communicate its execution capacity at $33.17 million, and articulate lost efficiencies when funded less than that amount. Hubbell explained that these principles are focused on UMRR's restoration only, but that the Corps may consider defining similar principles for optimal funding of the program's science in the future.

In response to a question from Jim Fischer, Hubbell explained that District staff are typically engaged in the Administration's deliberations regarding additional funding allocations (referred to as the work plan) shortly after the enactment of the federal budgets.

2016 UMRR Report to Congress

Kirsten Mickelsen said she is currently working with partners to develop the first draft 2016 UMRR Report to Congress. This primarily includes having program partners help develop messages and review the sections of the report that they are responsible for implementing or contribute to in a major way. Mickelsen expressed appreciation to the individuals who have provided input throughout the report's development, and requested that partners send her any ideas for programmatic successes, discoveries, advances, and so forth to include in the report. She said the first draft will be distributed to partners in late August/early September.

In response to a question from Janet Sternburg, Mickelsen said partners' letters of support will not be requested until late spring or early summer 2016 prior to the report undergoing professional graphics. Sternburg noted that the agency letters take some time to coordinate and obtain leadership signatures, but that the report content needs to be substantially completed before requesting such signatures. In response to a question from Ken Westlake, Mickelsen said partners will be given about 6 weeks to review the first draft. Thus, partner comments will be requested in mid- to late-October, depending on when the report is distributed. Hubbell explained that the Division and Headquarters will be solicited to review this first draft concurrently. This is in response to Headquarters' request to provide input on the draft report early in its development.

2015-2025 UMRR Strategic Operational Plan

Hubbell reported that the 2015-2025 UMRR Strategic Operational Planning Team held a conference call on June 26, 2015 to finalize a draft Operational Plan for the UMRR Coordinating Committee's review. He explained that the draft plan included a recommendation to create a habitat team that would be somewhat similar to the Analysis Team and would discuss systemic ecological restoration needs and implementation issues. However, a sub-group that was assigned to define a purpose statement and set of example responsibilities for the habitat team had conflicting ideas regarding its purpose and whether it was necessary to develop this new coordinating entity. Rather, some partners thought it might be better to utilize existing groups, such as the river team, to accomplish some of the operational plan's actions. The sub-group then agreed to reconvene the Operational Planning Team prior to sending the draft plan to the UMRR Coordinating Committee. The Team will likely convene its next conference call in late September or early October.

Kat McCain said she participated on the sub-group, which is proposing that the Operational Planning Team consider how to use existing groups and other interagency coordination mechanisms to address or implement the actions currently involving the habitat team. In the spirit of greater integration between habitat restoration and science efforts, Fischer suggested that the Operational Planning Team consider expanding the Analysis Team's role to also address the habitat team-identified actions. Tim Yager said program partners are involved in many UMRS-related interagency coordinating groups, including UMRR, that cumulatively have become somewhat challenging from a resource standpoint. There are many existing groups that could be utilized. Bob Clevenstine suggested re-invigorating the river teams that have been inactive or have had relatively little to address. Kraig McPeek noted that there has been substantial turnover in partner agencies and suggested identifying individuals serving on the various interagency committees.

Mickelsen said the Operational Planning Team plans to host a web-based conference call with the entire UMRR partnership to "roll out" the draft plan. The intention for this approach is to reduce confusion and mixed messaging by having a single conversation and question-and-answer opportunity.

Lean Six Sigma

Marv Hubbell recalled that, at its August 5, 2015 meeting, the UMRR Coordinating Committee agreed to use Lean Six Sigma techniques on a subsection of the program's habitat project development process. To facilitate the Committee's selection of that subsection, District staff developed a flow chart that represents a stylized depiction of the major phases, activities, and key decision points. The flow chart is provided on page B-7 of the agenda packet. Hubbell explained that the impetus of employing a Lean Six Sigma evaluation is to look for opportunities to improve the effectiveness and efficiency of UMRR's business processes that consistently generate high quality outputs. Nicole Lynch said Lean Six Sigma focuses on the customers' standpoint, which in this case would be non-federal project sponsors. Lynch asked that the UMRR Coordinating Committee identify a smaller increment of the habitat project development process that is of greatest concern or interest to focus initially. Lynch overviewed the flow chart in more detail.

Janet Sternburg noted that the flow chart does not include the fact sheet development and approval stages, but said these processes could benefit from improvements. Lynch recognized Sternburg's point, but explained that input received suggested focusing on habitat project planning and processes. This, at the least, allows for a starting point and the UMRR Coordinating Committee may subsequently select to evaluate fact sheet development processes or other areas of habitat project development. Sternburg agreed and requested that Lynch identify when and how projects sponsors are engaged in the habitat project development process, where key decisions are considered, and whether the steps can or cannot be modified.

Lynch said District staff will create a more detailed analysis of the selected process(es) prior to the UMRR Coordinating Committee's next meeting. Hubbell explained that the Corps is primarily responsible for developing the project management plan. Sponsors' involvement is robust in the initial feasibility stage as well as evaluating existing conditions of the project site, plan formulation, and the draft environmental assessment report. In latter stages, sponsors' responsibilities are substantially reduced.

Sabrina Chandler suggested identifying key points when the Corps should contact the sponsor, explaining that sponsors are sometimes not given sufficient lead time to mobilize resources and coordinate internally on important decisions. Hubbell agreed and emphasized the need for continual engagement with the project sponsors throughout project development to avoid systemic breakdowns. Ken Barr suggested that the process of defining ecological goals and objectives be evaluated.

In response to a question from Marty Adkins, Kirsten Mickelsen explained that Congress has continuously included provisions in appropriations measures precluding implementation of the Administration's 2013 Principle and Guidelines rules. Therefore, any potential implications to UMRR from these 2013 rules have not yet been realized. In response to a question from Bob Clevenstine, Kat McCain explained that a project's NEPA-related obligations are primarily completed during the first three stages of the plan formulation phase, as outlined in the flow chart.

In response to a question from Hubbell, the UMRR Coordinating Committee agreed to use Lean Six Sigma evaluation techniques to examine potential efficiency improvements to the following four stages of habitat project development: initial feasibility planning, evaluation of the existing ecological condition, plan formulation, and the draft environmental assessment report. Lynch said she will work with program partners to develop a fact sheet that explains these stages in greater detail, including partners' roles. At the UMRR Coordinating Committee's November 18, 2015 meeting, Lynch will present these fact sheets, outline a proposed process for undertaking the Lean Six Sigma evaluation, and request input regarding the composition of a smaller, interagency team to employ the review. Chandler requested that the fact sheets be distributed to the UMRR Coordinating Committee members well in advance of the November quarterly meeting to allow time for members to coordinate with their respective agency staff.

External Communication and Outreach

External Communications Plan (Goal 3)

Hubbell reviewed Goal 3 of the 2015-2025 UMRR Strategic Plan, which is to "engage and collaborate with other organizations and individuals to advance UMRR's vision." The Plan includes developing a UMRR external communications plan and forming a standing committee to prioritize and implement related activities. There are opportunities to use FY 2015 funds to develop new branding and messaging for the program. This will be an important first step in the programs' efforts to more strategically target outreach to external stakeholders, including watershed-based programs, decision makers, and the general public.

Kevin Bluhm said that, since the May 6, 2015 UMRR Coordinating Committee meeting, District staff have refined the scope of work and let a bid for the professional development of messages and images for use in external outreach. Bluhm reported that a bid has been submitted that is very competitive and matches the Corps' expectations. District staff are currently reviewing the contract. It is anticipated that a contract award will occur in late August.

In response to a suggestion from Marty Adkins, Kevin Stauffer explained that the 2015-2025 UMRR Strategic Plan includes engaging with watershed programs and projects. Partners will target that outreach based on UMRR's priorities related to its goals for restoration and better understanding the river ecosystem. That includes NRCS's watershed-related activities.

In response to a question from Janet Sternburg, Bluhm said the Corps still plans on employing a survey or other information request regarding communications and outreach priorities and messaging although he is unsure of the focus and questions. Sabrina Chandler discussed USFWS's recent UMRR-related public outreach successes. For example, Ranger Dusty regularly posts videos on "Theatrical Thursdays" that highlight various river-related events. On July 23, 2015, Ranger Dusty posted a video called "The Birth of an Island" featuring the construction of Harpers Slough and the collaborative work of the Corps, USFWS, the contractor, and other partners. It received very positive responses. These types of outreach are fairly inexpensive and can reach a broad range of stakeholders.

In response to a question from Dru Buntin, Bluhm emphasized that UMRR's current messaging and communications materials will be used as a starting point.

Hubbell said that a communications group is being established. So far, it includes Bluhm and Karla Sparks (Corps) and Randy Hines (USGS), and will also include representatives from USFWS and other volunteers. Bluhm requested that interested partners contact him to participate on the communications group.

Public Involvement and Outreach Activities

Hubbell said the August 2015 Biennial Symposium of the International Society for River Science (ISRS) is scheduled for August 23-28, 2015 at UMESC. It will feature several presentations of UMRR's science research and analysis. Hines said the Symposium will offer a great opportunity to share UMRR's work. He said USGS will have two booths, one highlighting UMESC and the other UMRR. On August 23, 2015, a public event is scheduled at Riverside Park. Hines asked partners to send him or Karen Hagerty ideas to showcase.

On behalf of Gretchen Benjamin, Mickelsen said this is the fourth ISRS biennial symposium. UMRR and UMR pool-scale drawdown work will be included on the program agenda. Benjamin will be hosting a special session about creating a more sustainable river that supports a healthy ecosystem and commercial navigation system. There will also be a session devoted to better communicating Mississippi River information, especially science information, in a meaningful way that will engage the public. In response to a question from Hines, Hagerty said abstracts of the symposium's presentation have not yet been distributed.

Fischer said Wisconsin Lieutenant Governor Rebecca Kleefisch participated in an air boat tour of the Mississippi River in early August. Lt. Governor Kleefisch has not yet provided feedback on the tour. Fischer distributed hard copies of the April 2015 Wisconsin Natural Resources magazine, which featured an article by Ruth Nissen titled "Mississippi River Monitoring" that describes UMRR's long term resource monitoring. Fischer said the Wisconsin DNR Upper Mississippi River Team received the agency's internal award for the best team in 2014.

Mark Gaikowski said the U.S. Department of Interior Secretary Sally Jewell is scheduled to visit the Upper Mississippi River, including UMESC and UMR Refuges, on August 14. Sec. Jewell's visit will also include a tour of Pool 7 and UMRR's restoration work in that area.

Hubbell said the July 6, 2015 Iowa Gazette in Cedar Rapids featured an article regarding environmental restoration building up on the Upper Mississippi. The article included interviews with the Iowa DNR Bellevue Field Station staff. It is included on pages C-1 to C-5 of the agenda packet.

In response to a question from Dan Stephenson, Hubbell recalled that Mindy Simmons (Lead of Headquarters Ecosystem Restoration budget) toured Lake Odessa and discussed the complications of that project due major flood events in 2011 and 2015. Hubbell said that project is a poster child for risk and uncertainty. While the Corps does not anticipate any major damage, staff have not be able to assess any damages to the project due to continued high water.

Jennie Sauer played USFWS Ranger Dusty's "Birth of an Island" video featuring Harper's Slough, which is available at: https://www.facebook.com/UpperMissNWFR/videos/988311034542433/.

Long Term Resource Monitoring and Science

Highlights

Jennie Sauer said pages D-1 to D-7 of the agenda packet include an updated scope of work for UMRR's long term resource monitoring-related activities and projects as of the third quarter of FY 2015. There are over 80 ongoing science-related projects that are in various stages of development. Sauer showed a Doppler image of the dense mayfly coverage in the La Crosse area this year.

Sauer said flooding on the Illinois River has impacted long term resource monitoring sampling in the La Grange Pool, Pool 26, and the open river reach. UMRR has sampling protocols for field stations to follow during flood events. The Big Rivers and Wetlands Field Station will use the flood conditions to sample fish communities in the inundated floodplain and evaluate comparisons among the fish assemblages in the floodplain and main channel. The data will also be compared to similar monitoring done during the 1993 flood. In response to a question from Olivia Dorothy, Sauer explained that the fish monitoring in the floodplain is random, and paired with the adjacent main stem. Sauer said USGS will distribute a summary paper on the sampling methods and results.

Sauer described the two manuscripts that were published in the third quarter of FY 2015, as follows:

1. Modeling results on the effects of over-harvesting (commercial) silver carp populations as a management control found that silver carp populations must be exploited at a small size (around 300-400 mm) in order to reduce the spawning potential ratio to 0.2, which is identified as a threshold for recruitment overfishing.

2. A suite of four to five continuous surface metrics using LiDAR data from Pool 9 that quantify topographic diversity is found to capture most aspects of floodplain surface complexity. This research will be used in developing new landscape indicators of topographic variation that is important for a variety of ecological processes.

Hubbell said the Corps issued a one-time certification to use the topographic diversity index for Huron Island. This use is a great example of applying research results to a restoration context.

Sauer said LiDAR data in Pool 9 was compared with seven other floodplains around the world to examine environmental influences on floodplain topography. The results were detailed in a recent completion report. The comparison illustrates that there are important geomorphology characteristics that restoration practitioners could potentially modify to change floodplain surface complexity.

Sauer reported that, after 20 years, the manufacturer has changed the housing of the filters used for measuring dissolved inorganic nitrogen (DIN). To ensure continued high data integrity, UMESC tested and found that the new filter housing had no impacts to the long term resource monitoring samples.

USACE Science Update

Karen Hagerty said that UMRR's FY 2015 science in support of restoration work includes research, analysis, model development, and the identification of ecosystem resilience indicators. The specific activities are listed on pages D-8 to D-12 of the agenda packet. Hagerty said the Corps, USGS, and the field stations are currently developing the FY 2016 scope of work for long term resource monitoring and science in support of restoration. The next planning call is scheduled for August 10, 2015. Hagerty reported that FY 2016 will benefit from FY 2014 and FY 2015 carry-over funds totaling $227,027. The potential for a five percent sequestration remains unknown. Depending on FY 2016 spending guidance, the Corps will obligate FY 2016 science funding to USGS and the field stations as soon as possible. In response to a request from Janet Sternburg, Hagerty said she will send the draft FY 2016 scope of work to the UMRR Coordinating Committee members. Hagerty announced that the Corps and USGS are planning for a winter 2016 science meeting. Field station staff's travel expenses will be reimbursed.

A-Team Report

Shawn Giblin reported that the A-Team held a July 28, 2015 call to discuss UMRR's FY 2016 budget as it relates to long term resource monitoring and science, a status report on FY 2015 work, an update on the resilience work group, and presentations about recent science publications on 1) ecological shifts in a large floodplain river transitioning from a turbid to a clear, stable state and 2) 50-year trends of common carp and sport fish in the Illinois River. Giblin said the A-Team's next meeting will be held on October 29, 2015, in conjunction with the UMRCC Water Quality Tech meeting.

NextGeneration Sequencing and eDNA to Information LTRM

Grace McCalla explained how UMRR could benefit from using NextGeneration Sequencing with eDNA to validate its long term resource monitoring sampling methods, compare community compositions in study and non-study reaches, and evaluate biological responses to habitat projects. McCalla said UMESC has been using eDNA to make targeted detections for:

1) Monitoring spawning events with minimal personnel effort – e.g., New Zealand mudsnail

2) Identifying new populations – e.g., invasive carp

3) Correlating eDNA detections with population abundances using statistical modeling and showing how communities change over time and how changes in land use affect the ecosystem or species of interest – e.g., impacts from water level management

McCalla explained that NextGeneration Sequencing is the process of determining the order of nucleotide bases within a stretch of DNA. It is a unique tool in that it enables rapid sequencing of large stretches of DNA base pairs and thus can answer a wide range of scientific questions. Determining the sequences of DNA in a sample, scientists can take a shotgun approach by simultaneously targeting all genetic regions of the DNA sample or take a targeted approach by evaluating specific regions of interest for multiple taxons. Further, scientists can integrate eDNA for one or two species with NextGeneration Sequencing to analyze genetic information on a broad community of organisms. McCalla overviewed the workflow of processing an eDNA sample with NextGeneration Sequencing. Integrating the two techniques provides information to determine community compositions within a sample region, including detecting rare taxons and assessing relative abundance, as well as assessing complex ecological questions, such as food web relationships and short- and long-term trends in ecological indicators. McCalla discussed an example of applying eDNA and NextGeneration Sequencing techniques to make conclusions about fish communities in the Wabash River in Indiana.

McCalla said this presentation is meant to initiate discussion among UMRR partners about the ways in which the eDNA and NextGeneration Sequencing techniques can inform the program's restoration and science. For example, these techniques can inform the comparisons of taxon compositions between long term resource monitoring sites and allow for extrapolating information in the study reaches to non-study reaches. In addition, eDNA samples from pre-and post-construction of habitat projects can inform how flow changes affect community compositions of bacteria, zooplankton, or fish. The techniques may also be used to monitor macroinvertebrates, better understand microbial ecology in the UMRS, detect pathogens, and evaluate community dynamics, including how the structure and function of plant communities and ecosystems might respond to environmental factors.

Marty Adkins asked for cost and time estimates associated with evaluating a soil sample to check for bacteria and fungi. McCalla explained that there are scaled approaches to using eDNA and NextGeneration Sequencing, depending on the research question. Adkins' example would be relatively straight forward and small-scale analysis. Mark Gaikowski said UMESC can supply Adkins with an estimated quote. In response to a question from Kraig McPeek, McCalla said the Wabash River example speaks to the scaleable analysis question. The Wabash River study was focused on evaluating biomass and was not able to detect rare species, which could be done with a larger sample size.

Science Highlight: Spatial and Temporal Dynamics of Phytoplankton in Pools 8, 13, and 26

John Manier presented research findings regarding spatial and temporal dynamics of phytoplankton assemblages in Pools 8, 13, and 26. There is relatively little research on the large scale patterns in the UMR's phytoplankton communities because they have been historically thought of as relatively less important. However, phytoplankton provide a significant source of organic carbon and therefore are a critical component of large river food webs and ecological function and structure. Manier explained that the purpose of this research was to examine the spatial and temporal dynamics of phytoplankton community composition across diverse aquatic areas of the UMR, and to determine stresses and other influencing forces on community composition such as blue-green algae.

Manier said he analyzed 224 of UMRR's long term resource monitoring phytoplankton and water quality samples that were collected during the summer months of 2006 to 2009. He explained the methods, noting the arduous task of analyzing the samples. Each sample took approximately eight hours to analyze. In all, 46 different species were detected with 20 being diatoms, 15 green algae, 8 cyanobacteria, and 3 euglenoids. The main channel and backwaters were dominated by a mixture of cyanobacteria and diatoms, and the main channel also had a large abundance of green algae. The backwaters were highly associated with flagellated species, such as cryptomonads and euglenoids. The impounded areas had very similar phytoplankton communities as the backwaters, but had a greater proportion of cyanobacteria. The main channel of Pools 8 and 13 were either dominated by cyanobacteria or diatoms depending on various conditions, and Pool 26 was more heavily populated with diatoms.

Manier said there exist strong correlations of phytoplankton community composition to discharge, where taxonomic richness is greater with increasing discharge. This is likely due to recruitment from off-channel areas and scouring of the periphyton. Cyanobacteria were present in 96 percent of the samples, with 17 percent considered in a minor bloom, 10 percent in a moderate bloom, and 1 percent in a severe bloom. Some larger bloom events occurred with moderate nutrient levels suggesting that physical conditions (e.g., discharge, turbidity, residence time) also play a major role. Manier noted that the research confirms previous observations that green algae is declining in the UMR. There was no detection of *Ulothrix* in the samples. This may be suggesting that cyanobacteria is causing the decline in green algae, which serves as a high nutritional food source. Manier proposed the question of whether green algae is currently at a tipping point of existing in the system.

In response to a question from Jim Fischer, Manier said there has not yet been an analysis of whether there would be any affect from the glucose solution on eDNA. Fischer suggested that it may be worth considering if eDNA could be used rather than using a microscope to assess community compositions. Jennifer Dieck said UMESC is working with Manier to obtain and automate high resolution images microscopic images of the phytoplankton samples.

Habitat Rehabilitation and Enhancement Projects

District Reports

<u>St. Louis District</u>

Tim Eagan reported that MVD is currently reviewing Rip Rap Landing's feasibility study. Pending MVD's approval, MVS anticipates initiating design work on the project in early FY 2016. Eagan explained that District staff have recently calibrated a physical model of Piasa and Eagles Nest Islands and will host a partnership meeting soon to review design alternatives using the model. The District will also soon host a habitat evaluation workshop for Harlow and Wilkinson Islands. Design work on Clarence Cannon continues while Ted Shanks's pump station has recently been finalized. MVS anticipates awarding a construction contract for the pump station late this fiscal year. Construction on most of Ted Shanks's features and Pools 25 and 26 Islands is ongoing, but has been delayed significantly this summer due to prolonged high water conditions. Batchtown will likely be completed this summer.

Marty Adkins asked whether there are any opportunities to leverage UMRR's restoration with the PL 84-99 program to repair levees. Gary Meden explained that the Corps is required to evaluate non-structural alternatives when assessing repair alternatives. However, the non-structural options typically do not generate a positive cost-benefit ratio. Thus agricultural lands are often not protected, unless there is another incentive for sponsors to consider these alternatives. Adkins said there are NRCS easements in areas along the floodplain that are not in cropland and could offer an opportunity to reconnect the floodplain.

Janet Sternburg expressed appreciation that MVD Commander Maj. Gen. Michael Wehr toured MVS's habitat project sites. Sternburg said Ted Shanks is a high priority for Missouri DoC, and noted the significant amount of planning time and resources devoted to the project.

<u>St. Paul District</u>

Tom Novak recalled that a sizeable amount of the District's habitat project constructing funding was awarded very early in the fiscal year that provided full funding at the outset of Harper Slough's construction. It served the District very well in terms of gaining substantial cost-efficiencies. Novak said MVP anticipates finalizing construction on Capoli Slough this fall and hosting a dedication for the project in October to coincide with USFWS's Refuge Week. He explained that North and Sturgeon Lakes is experiencing challenges due to its design showing potential minimal flood stage impacts and the lack of a project sponsor. The same planning team working on Harpers Slough and Capoli Slough will continue on Conway Lake, likely gaining significant efficiencies as the team members are well experienced and knowledgeable about these projects. In response to a question from Olivia Dorothy, Novak said the District has not yet received guidance of whether the closure of St. Anthony Falls L&D will affect UMRR's authorized geographic scope. However, it does not impose any practical limitations on planned habitat restoration.

Rock Island District

Marv Hubbell said MVR is maintaining an aggressive habitat project schedule, with three projects in planning, two in design, and six in construction. The District is investing heavily in the planning of Beaver Island so that it is ready for construction in FY 2017. Keithsburg is the District's next planning priority. MVR is hoping to finalize construction of Lake Odessa and Pool 12 Overwintering Stage I this fiscal year. Construction of Pool 12 Overwintering Stage II was recently awarded. As soon as possible after water levels lower, District staff will assess damages to Fox Island and Rice Lake from this year's flooding. The District is also evaluating the performance of Bay Island, Andalusia, and Brown's Lake.

Planning New Starts: Identifying Projects to Enhance Ecological Resilience

Hubbell recalled that, in April 2015, USACE executed a contract with USGS to lead an interdisciplinary team that will define indicators of ecosystem health and resilience and link the indicators to the process of identifying habitat projects. Kirsten Mickelsen said the team held its first conference call on July 14, 2015. The team includes Jeff Houser and Nate De Jager (USGS), Jon Hendrickson and Hubbell (USACE), Stephen Winter (USFWS), Andy Casper (Illinois DNR), and Mickelsen (UMRBA). Mickelsen said the team anticipates hosting a partnership workshop in winter 2016 to brainstorm conceptual models for applying resilience concepts to the UMRS as well as to identify and discuss fundamental questions. Currently, USGS is reviewing applications for a part time staff person to lead this effort.

Hubbell said the resilience conceptual model will be used to inform the next habitat needs assessment (HNA) as well as the identification and selection of the next generation of habitat projects. Hubbell said he anticipates convening a team in early winter 2016 to develop the new assessment and lead the project selection process. He said USACE and USFWS will co-chair the team. A more detailed overview of the process and expectations will be provided at the UMRR Coordinating Committee's November 18, 2015 meeting. Janet Sternburg suggested providing an overview of the 2000 HNA. Hubbell agreed, and mentioned that the first Assessment was developed in response to a call for a more rigorous systemic, scientifically-based process for selecting projects. Bob Clevenstine recalled that program partners were given only a year and $1 million to complete the first HNA, and incorporated the probability of occurrence model resulting in placing projects in areas of low habitat diversity and focusing projects on increasing diversity. He suggested inviting individuals who participated in developing the 2000 HNA to give their perspectives on the process and provide suggestions for this next assessment. In response to a question from Hubbell, Clevenstine suggested scoping the next HNA development over 18 months. He said the program will need to consider how to use the health and resilience indicators in the next assessment. The program now has much better data and analysis capabilities. Clevenstine said the 2000 HNA was not used to its full potential because the data was not widely accessible. The 2000 process was also clouded by concern that the HNA would affect the balanced geographic distribution of restoration projects. Clevenstine proposed that the UMRR Coordinating Committee include a presentation of lessons learned from the 2000 HNA at its November 18, 2015 meeting, including the knowledge gained since 2000 that can inform the next assessment.

Hubbell agreed with Mickelsen's suggestion to create a list of questions and a proposed schedule for developing the next HNA for the UMRR Coordinating Committee to consider at its November 18, 2015 meeting. Hubbell requested that partners send him any input on the next HNA or selection of next generation habitat projects.

Implementation Issues Assessment

Annual Review of Progress

Marv Hubbell and Kirsten Mickelsen recalled that UMRR Coordinating Committee agreed to include at its annual August quarterly meetings a review of progress in advancing the recommendations provided in the 2013 UMRR Implementation Issues Assessment (IIA). A table of these recommendations is included on pages E-1 to E-6 of the agenda packet. Kevin Stauffer noted that many of these recommendations are embedded in the 2015-2025 UMRR Strategic Plan.

Fischer asked whether the O&M-related recommendations are a part of the Corps' efficient funding discussions for UMRR. Gary Meden explained that UMRR is focusing on designing habitat project features that are more self-sustaining and have lower long term O&M requirements. Fischer agreed, and suggested considering a small project or two to protect aged features of older habitat projects.

In response to a question from Marty Adkins, Kirsten Mickelsen explained that the UMRR Coordinating Committee uses its annual February quarterly meetings to 1) consider evaluating how an emerging trend or issue might impact UMRR as well as how UMRR can add resilience to the UMRS in the face of that stressor and 2) evaluating findings of any such analysis from the prior year. For the last two years, for example, the UMRR Coordinating Committee agreed to evaluate Asian carp and ultimately developed the UMRR Invasive Species Policy Paper to explain UMRR's roles in understanding and addressing invasive species. This evolved in response to some confusion about the program's roles and responsibilities related to Asian carp research.

Other Business

Future Meetings

The upcoming quarterly meetings are as follows:

- **November 2015 — St. Paul**
    - UMRBA — November 17
    - **UMRR Coordinating Committee — November 18**
- **February 2016 — Quad Cities**
    - UMRBA —February 23
    - **UMRR Coordinating Committee — February 24**
- **May 2016 — St. Louis**
    - UMRBA — May 24
    - **UMRR Coordinating Committee — May 25**

With no further business, the meeting adjourned at 1:48 p.m.

UMRR Coordinating Committee Attendance List
August 5, 2015

UMRR Coordinating Committee Members

Gregory Miller	U.S. Army Corps of Engineers, MVD
Sabrina Chandler	U.S. Fish and Wildlife Service, UMR Refuges
Mark Gaikowski	U.S. Geological Survey, UMESC
Dan Stephenson	Illinois Department of Natural Resources
Randy Shultz	Iowa Department of Natural Resources
Kevin Stauffer	Minnesota Department of Natural Resources
Janet Sternburg	Missouri Department of Conservation
Jim Fischer	Wisconsin Department of Natural Resources
Marty Adkins	Natural Resources Conservation Service
Ken Westlake	U.S. Environmental Protection Agency, Region 5 [On the phone]

Others In Attendance

Chris Erickson	U.S. Army Corps of Engineers, MVP
Tom Novak	U.S. Army Corps of Engineers, MVP
Kevin Bluhm	U.S. Army Corps of Engineers, MVP
Gary Meden	U.S. Army Corps of Engineers, MVR
Ken Barr	U.S. Army Corps of Engineers, MVR
Marvin Hubbell	U.S. Army Corps of Engineers, MVR
Karen Hagerty	U.S. Army Corps of Engineers, MVR
Nicole Lynch	U.S. Army Corps of Engineers, MVR [On the phone]
Tim Eagan	U.S. Army Corps of Engineers, MVS
Kat McCain	U.S. Army Corps of Engineers, MVS
Bob Clevenstine	U.S. Fish and Wildlife Service, UMR Refuges
Kraig McPeek	U.S. Fish and Wildlife Service, RIFO
Sharrone Baylor	U.S. Fish and Wildlife Service, UMR Refuges
Tim Yager	U.S. Fish and Wildlife Service, UMR Refuges
Jennie Sauer	U.S. Geological Survey, UMESC
Brian Gray	U.S. Geological Survey, UMESC
Grace McCalla	U.S. Geological Survey, UMESC
John Manier	U.S. Geological Survey, UMESC
Shawn Giblin	Wisconsin Department of Natural Resources
Olivia Dorothy	American Rivers
Tim Schlagenhaft	Audubon, Minnesota
Tom Boland	AMEC Foster Wheeler
Brad Walker	Missouri Coalition for the Environment
Dru Buntin	Upper Mississippi River Basin Association
Dave Hokanson	Upper Mississippi River Basin Association
Kirsten Mickelsen	Upper Mississippi River Basin Association

ATTACHMENT B

Message from contractor (Gulf Research Corp. and Schneider Communications) to the UMRR Coordinating Committee re external communications and outreach efforts

(B-1)

External Communications and Outreach
UMRR Coordinating Committee Meeting

The Upper Mississippi River Restoration Program's (UMRR's) strategic plan, published in January 2015, laid out one goal and several objectives related to communications and outreach for the UMRR. One of those objectives stresses the need for the UMRR to better provide information to organizations and individuals whose actions and decisions affect the Upper Mississippi River ecosystem. Another objective is that program findings and knowledge be exchanged nationally and internationally, partly in the hope of broader recognition of the UMRR as a world river science leader.

The UMRR leadership recognizes that reaching the goals will require a multi-part strategy involving both traditional and new media tools. As a first step in the process, the UMRR has contracted with Gulf South Research Corporation (GSRC) and Schneider Communications and their team of experts in environmental projects, branding, writing, social media, and design.

Several challenges have been laid out for the team. A key challenge is to create more familiarity with the UMRR nationwide, including the relatively recent name change; project successes, innovations, and lessons learned; and the collaborative efforts among multiple agencies and organizations that have contributed to the UMRR's success.

The project team needs your input to better understand program successes, target audiences for the communications, and messages you believe are important to communicate. To gather this information, we will be conducting interviews with select team members and other key river leaders before, during, and following the November UMRR meetings.

One important step in accomplishing the goal will be a presentation at the UMRR Coordinating Committee meeting on November 18. The first stage of the presentation will lay out the basics of cohesive brand messaging. The project team will also share key themes we have heard in interviews with others involved in the UMRR, and we will be asking for active group discussion to identify key program traits and messages. The project team will draw heavily upon what we learn in the interviews and the meeting discussion to develop suggestions for a UMRR logo and branding messages.

Please come prepared to talk about the essence of the UMRR, current challenges in getting the word out, and the audiences you want to reach with program information.

A thoughtful brand has a core essence. A strategic approach to branding, which is what we will be doing with this exciting and successful program, ensures that the brand corresponds to and presents to others the very essence of the organization it represents. That is what the project team will be working to identify through the meeting and various participant interviews. We will then tackle the goal of presenting that essence verbally, visually, behaviorally, and in all other media the UMRR utilizes.

The project team is confident that the UMRR will benefit from the identification of this core essence as a first step in enhancing its brand presence, addressing multiple audiences, and maintaining an identity that is recognizable and memorable. That brand presence will provide lasting value in building loyalty and support for the UMRR among all its key target audiences.

ATTACHMENT C

UMRR Regional Management

- **UMRR FY 15 Year-End Report (9/30/2015)** *(C-1 to C-5)*

BUDGET SHEET

UMRR-EMP EXPENDITURES AND ALLOCATIONS

	FY15 ($ 000)				
	CARRY IN FROM FY 14	FY 15 ALLOCA.	TOTAL AVALIABLE TO EXP.	30 Sept 15 ACTUAL EXP.	30 Sept 15 ACTUAL OBLIG.
PROGRAM ELEMENTS					
HABITAT PROJECTS					
HREP PROJECTS	223	23,157	23,374	21,429	23,278
ARRA HREP PROJECTS	0	0	0	0	0
HABITAT EVAL/MONITORING	0	554	554	557	830
HABITAT NEEDS ASSESSMENT	0	0	0	0	0
PLANNING/PRIORITIZATION	0	0	0	0	0
USFWS HREP SUPPORT	0	380	380	486	432
PROGRAM COOR.(Includes District Habitat Coordination)	0	3,304	3,304	1,997	2,098
REPORT TO CONGRESS- 2014	0	0	0	26	82
REGIONAL INITIATIVES	0	201	201	164	164
LTRM (Includes LTRM Regional Technical)	0	5,575	5,575	6,623	6,319
ARRA LTRM PROJECTS	0	0	0	0	0
TOTALS	223	33,171	33,388	31,307	33,286
TOTALS BY ORGANIZATION					
MVR *	26	9,864	9,884	9,842	8,982
MVP	75	7,791	7,866	4,538	7,676
MVS	122	9,561	9,683	9,718	9,718
USGS	0	5,500	5,500	6,622	6,319
UMRBA Administration	0	75	75	75	76
USFWS (Multi-district funded)	0	380	380	486	432
REPORT TO CONGRESS- 2012	0	0	0	26	82
System Ecological Team (SET)	0	0	0	0	0
TOTAL	223	33,171	33,388	31,307	33,286
		*1			

* 1 Equals Work Allowance amount of $33,170,000.

30 Sep 2015
FY 2015

ADMINISTRATIVE, LTRM, and Non-Site Specfic Costs

	FY15 ($ 000)				
	CARRY IN	ALLOCA.	TOTAL SCHED EXP.	'30 Sept 15 Actual Exp.	'30 Sept 15 Actual Obl.
HABITAT (Rollup from district sheets)					
BASELINE MONITORING	0	100	100	94	94
HABITAT PROJ. EVALUATION	0	379	379	463	736
BIO-RESPONSE STUDIES	0	75	75	0	0
USFWS HREP SUPPORT (Multi-district funded)	0	380	380	486	432
PLANNING/SEQUENCING (PRIORITIZATION)	0	0	0	0	0
TOTAL HABITAT	0	934	934	1,043	1,262
PROGRAM COORDINATION (excludes District Habitat Coor.)					
UMRBA	0	75	75	75	76
System Ecological Team (SET)	0	0	0	0	0
PUBLIC INVOLVEMENT	0	60	60	4	104
EMP PROGRAM ADMINISTRATION	0	630	630	699	699
LTRM REGIONAL TECHNICAL	0	75	75	0	0
REGIONAL INITIATIVES	0	201	201	164	164
PROGRAM MGT TOTAL	0	1,041	1,041	942	1,044
REPORT TO CONGRESS (includes all organizations)	0	0	0	26	82
LTRM					
CORPS LTRM MANAGEMENT	0	0	0	0	0
LTRM (USGS & STATES)	0	5,500	5,500	6,622	6,319
CORPS BATHEMETRY & LiDAR (Multi-district funded)	0	0	0	0	0
ARRA - BATHEMETRY, LiDAR, & GIS (Multi-district funded)	0	0	0	0	0
CORPS APE'S ACTIVITIES	0	0	0	0	0
CORPS LTRM TECHNICAL SUPPORT (MSP)	0	0	0	0	0
SUBTOTAL	0	5,500	5,500	6,623	6,319

ST. PAUL DISTRICT

MVP	PROJECT ESTIMATE DESIGN	CONST	TOTAL W/O NON FED	NON-FED EST	EXP FOR FY 14	EXP THRU FY 14	FY15 ($ 000) CARRY IN	ALLOCA.	TOTAL AVALIABLE TO EXP.	'30 Sept 15 Actual Exp.	'30 Sept 15 Actual Obl.	(Federal) Scheduled $ To Complete	
HABITAT PROJECTS													
Capoli Slough, WI	500	8,750	9,250		1981	6413		168	168	327	165	6,942	CONSTRUCTION
Conway Lake, IA	462	2,050	2,512		141	254		291	291	268	268	2,103	DESIGN
Harpers Slough, IA	1,500	15,000	16,500		499	2185	75	6,266	6,341	3,028	6,316	12,973	CONSTRUCTION
Lake Winneshiek, WI	620	4,380	5,000			9			0			5,000	DESIGN
Lower Pool 10 Islands/Backwater, IA	920	5,200	6,120		27	0			0			6,093	DESIGN
McGregor Lake, WI	900	5,600	6,500		151	152		25	25	19	19	6,330	DESIGN
North & Sturgeon Lakes, MN	900	7,600	8,500	1,100	297	2172		448	448	408	420	7,795	DESIGN
ARRA PLANING, ENG & DESIGN	0	75	75	0		75			0			75	
Other Habitat (Carry over)	0	0	0	0		0			0			0	
HABITAT TOTAL	5,802	48,655	54,457	1,100	3,096	11,260	75	7,198	7,273	4,050	7,188	47,311	
									0				
HABITAT EVAL/MONITORING													
HABITAT NEEDS ASSESSMENT						57			0	0	0		
BASELINE MONITORING					104	582		40	40	20	20		
HABITAT PROJ. EVALUATION					138	1771		139	139	136	136		
BIO-RESPONSE STUDIES						1333			0				
USFWS HREP SUPPORT					107	1345		140	140	253	139		
PLANNING/SEQUENCING (PRIORITIZATION)						0			0				
SUBTOTAL	0	0	0	0	349	5,088	0	319	319	409	295	0	
PROGRAM MANAGEMENT													
PROGRAM COORDINATION					457	4889		414	414	332	332		
PUBLIC INVOLVEMENT - mipr $						0			0				
SUBTOTAL	0.0	0.0	0.0	0.0	457	4,889	0	414	414	332	332	0	
LTRM													
LTRM COORDINATION						455	0	0	0				
ADDITIONAL LTRM						484	0	0	0				
SUBTOTAL	0	0	0	0		939	0	0	0	0	0	0	
DIRECT MVP EXPENDITURES				1,100	3,902	22,176	75	7,931	8,006	4,791	7,815	0	
								*1					
MIPR & CROSS CHARGE LABOR EXPENDITURES													
Mipr for LTRM Travel						15.1			0	0	0		
Cross charge labor Technical & Bathemetry						31.7			0	0	0		
MIPR TOTALS (Includes Public Involvement)						47	0	0	0	0	0		
TOTAL MVP EXPENDITURES					3,902	22,223	75	7,931	8,006	4,791	7,815		
								*1					
NOTES:													

*1 Equals MVP work allowance of $7,930,500 (Initial Work Allowance was $7,419,00 plus an additional reallocation amount of $439,500)

ROCK ISLAND DISTRICT

MVR	PROJECT ESTIMATE DESIGN	CONST	TOTAL W/O NON FED	NON-FED EST	EXP FOR FY 14	EXP THRU FY 14	FY15 ($ 000) CARRY IN	ALLOCA.	TOTAL AVALIABLE TO EXP.	'30 Sept 15 Actual Exp.	'30 Sept 15 Actual Obl.	(Federal) Scheduled $ To Complete	
HABITAT PROJECTS													
BEAVER ISLAND, IA	1,500	11,000	12,500		232	411		540	540	605	576	11,663	PLANNING
FOX ISLAND, MO	700	4,300	5,000		446	5,675		140	140	293	83	4,261	DESIGN
HURON ISLAND, IA	2,100	8,400	10,500		639	2,285		773	773	2,750	283	7,111	PLANNING
LAKE ODESSA, IA	2,470	12,394	14,864		90	15,133		650	650			14,774	DESIGN
POOL 11 ISLANDS, WI	1,548	14,469	16,017			10,157			0			16,017	CONSTRUCTION
POOL 12 OVER WINTER, IA	2,500	16,500	19,000		1,811	3,939		3,814	3,814	3,387	5,145	13,801	DESIGN
RICE LAKE, IL	2,800	10,720	13,520	6,825	1,518	12,374	26	539	565	692	102	11,311	DESIGN
TURKEY RIVER BOTTOMS	2,900	15,800	18,700		0	2		4	4	0	0	18,700	PLANNING
BOSTON BAY	900	5,100	6,000		0	2		4	4	21	21	5,979	PLANNING
STEAMBOAT ISLAND	1,250	6,250	7,500		0	2		25	25	0	0	7,500	PLANNING
KEITHSBURG DIVISION	1,400	4,800	6,200		12	14		250	250	354	427	5,834	PLANNING
DELAIR DIVISION	1,750	7,750	9,500		0	2		4	4	0	0	9,499	PLANNING
SNYDER SLOUGH	1,800	15,000	16,800		14	16		4	4	0	0	16,786	PLANNING
EMIQUON	242	0	242	6,400	232	233		20	20	9	9	0	DESIGN
LAKE ODESSA, IA (Flood Recovery) (supplemental)		5,500	5,500		174	4,915			0	161	336	5,165	FLOOD RECONSTR.
ARRA ODESSA		236	236			158			0			236	ARRA
OTHER HABITAT		0	0			0			0			0	
HABITAT TOTAL	23,618	138,922	162,540	6,825	5,170	87,333	26.0	6,767.0	6,793	8,273	6,984	39,233	
HABITAT													
HABITAT NEEDS ASSESSMENT						0		0	0				
BASELINE MONITORING			268			254			0				
HABITAT PROJ. EVALUATION			938		150	3,514		225	225	288	561		
BIO-RESPONSE MONITORING			588			1,036		0	0				
USFWS HREP SUPPORT					166	1,049		170	170	150	210		
PLANNING/SEQUENCING (PRIORITIZATION)						39		0	0				
SUBTOTAL	0	0	1,794	0	316	5,893	0	395	395	438	771		
PROGRAM MANAGEMENT													
REGIONAL HREP SCIENCE SUPPORT			3,496	0	276	5,469		1,900	1,900	388	387		
PUBLIC INVOLVEMENT	0.0	20.0	20.0		41	244		60	60	4	104		
REGIONAL ADMIN				0	655	2,936		630	630	699	699		
LTRM REGIONAL TECHNICAL					69	1,813		75	75				
PROGRAM INITIATIVES					192	1,170		201	201	164	164		
SUBTOTAL			3,516	0	1,234	11,633	0	2,866	2,866	1,255	1,355		
REPORT TO CONGRESS					0	96	0	0	0	26	82		
LTRM													
CORPS BATHEMETRY & LiDAR(Multi-district funded)					8	463	0		0	0	0		
ARRA - BATHEMETRY, LiDAR, USGS, & GIS					0	2,811	0		0				
CORPS APE'S ACTIVITIES						165	0		0				
ADDITIONAL LTRM					0	927	0		0	0			
SUBTOTAL	0	0	530	0	8	4,365	0	0	0	0	0		
MIPRS & Contracts													
UMRBA					83	239	0	75	75	75	76		
ITRC					0	0	0	0	0	0	0		
USGS					6,088	20,286	0	5,500	5,500	6,622	6,319		
FY14 Reprogram						0		6					
SUBTOTAL					6,171	20,525	0	5,581	5,575	6,697	6,395		
TOTAL MVR EXPENDITURES					12,898	129,845	26.0	15,609	15,629	16,689	15,587		
								*1					

*1 Equals MVR work allowance of $15,609,000. Initial funding was $18,309,000. Funding was reallocated to MVS in the amount of $2,139,500 and to MVP in the amount of $439,500.

ST LOUIS DISTRICT

MVS	PROJECT ESTIMATE DESIGN	CONST	TOTAL W/O NON FED	NON-FED EST	EXP FOR FY 14	EXP THRU FY 14	FY15 ($ 000) CARRY IN	ALLOCA.	TOTAL AVALIABLE TO EXP.	'30 Sept 15 Actual Exp.	'30 Sept 15 Actual Obl.	(Federal) Scheduled $ To Complete	
HABITAT													
BATCHTOWN MGMT, IL	3,220	14,875	18,095	145	261	16,796		100	100	96	96	1,203	CONSTRUCTION
CLARENCE CANNON, MO	2,637	27,180	29,817		484	1,502		950	950	617	617	27,698	DESIGN
EAGLES NEST & PIASA IS., IL	1,057	4,500	5,557		216	432		350	350	280	280	4,845	FACT SHEET
GLADES WETLAND, IL	3,218	14,000	17,218			0		100	100	32	32	17,186	DESIGN
HARLOW ISLAND	750	3,750	4,500		22	60		400	400	330	330	4,110	DESIGN
RIP RAP LANDING	1,373	10,553	11,926	1,207	79	748		100	100	13	13	11,165	DESIGN
POOL 24 ISLANDS	1,373	8,119	9,492			8		10	10			9,484	DESIGN
POOLS 25/26, MO	875	1,600	2,475		272	1,076		100	100	143	143	1,256	CONSTRUCTION
REDS LANDING,	621	2,863	3,484			0		10	10			3,484	DESIGN
SCHENIMANN CHUTE, MO	691	2,800	3,491			396		10	10			3,095	DESIGN
SWAN LAKE, IL	2,377	13,246	15,623	262		15,204		25	25			419	CONSTRUCTION
TED SHANKS, MO	4,405	25,101	29,506		5,004	12,620	122	7,001	7,123	7,460	7,460	9,426	CONSTRUCTION
WILKINSON ISLAND	1,250	2,730	3,980	0	8	876		10	10			3,104	DESIGN
WEST ALTON ISLAND	805	5,727	6,532			17		10	10	4	4	6,511	DESIGN
HORSESHOE LAKE	1,520	12,750	14,270		40	40		10	10	9	9	14,221	DESIGN
FT. CHARTRES SIDE CHANNELS, IL	650	2,650	3,300			44			0			3,256	DESIGN
ESTABLISHMENT CHUTE SC, MO	650	2,250	2,900			24			0			2,876	FACT SHEET
KASKASKIA OXBOWS, IL	750	3,500	4,250			0			0			4,250	FACT SHEET
ARRA RIPRAP LANDING	0	319	319			319			0			0	ARRA
ARRA BATCHTOWN	0	3,405	3,405			3,261			0			144	ARRA
ARRA SWAN LAKE	0	1,109	1,109			1,109			0			0	ARRA
(Other Unexpended Carryover)	0	184	184		48	62			0	122	122	0	
HABITAT TOTAL	28,222	163,211	191,433	1,614	6,434	54,594	122	9,186	9,308	9,106	9,106	127,733	
HABITAT EVAL/MONITORING													
HABITAT NEEDS ASSESSMENT	1,000		1,000			0							
BASELINE MONITORING					530	1,372		60	60	74	74		
HABITAT PROJ. EVALUATION					14	666		15	15	39	39		
BIO-RESPONSE MONITORING					4	1,184		75	75		0		
USFWS HREP SUPPORT					156	614		70	70	83	83		
PLANNING/SEQUENCING(PRIORITIZATION)						4			0				
SUBTOTAL	1,000	0	1,000	28,347	704	3,840	0	220	220	196	196		
PROGRAM MANAGEMENT													
PROGRAM COORDINATION					199	2,285		225	225	499	499		
PUBLIC INVOLVEMENT					0	0			0				
SUBTOTAL	0	0	0	0	199	2,285	0	225	225	499	499		
LTRM													
LTRM COORDINATION					0	0			0				
ADDITIONAL LTRM					0	0			0				
SUBTOTAL	0	0	0	0	0	0	0	0	0	0	0		
DIRECT MVS EXPENDITURES	29,222	163,211	192,433	29,961	7,337	60,719	122	9,631	9,753	9,801	9,801		
								*1					
MIPR EXPENDITURES													
LTRM mipr for Travel					0	444	0		0	0	0		
LTRM Bathemetry & Technical cross chrg					0	28	0		0	0	0		
MIPR/ Cross charge totals					0	472	0		0	0	0		
TOTAL MVS EXPENDITURES					7,337	61,191	122	9,631	9,753	9,801	9,801		
NOTES:								*1					

*1 Equals MVS work allowance of $9,630,500 (Initial Work Allowance was $7,419,000 plus an additional reallocation amount of $2,139,500)

ATTACHMENT D

Habitat Needs Assessment Summary Report 2000

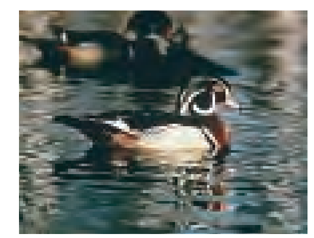
(D-1 to D-29)

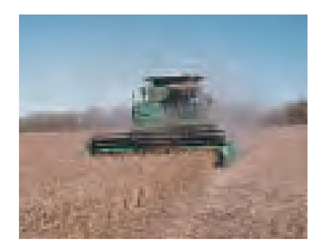
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce St.
St. Louis, MO 63103

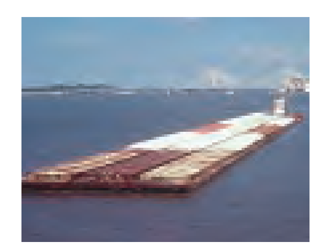
Upper Mississippi River System

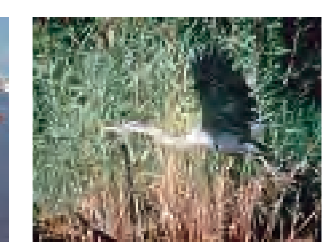
Habitat Needs Assessment

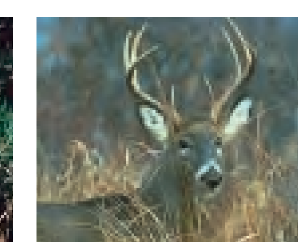
Summary Report 2000

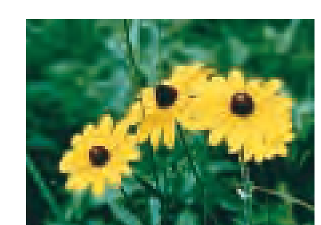












U.S. Army
Corps of Engineers

Upper Mississippi River Navigation System

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Aerial scene	U.S. Army Corps of Engineers
Wood duck	U.S. Army Corps of Engineers
Combine	U.S. Fish and Wildlife Service
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Heron	U.S. Fish and Wildlife Service
Flowers	U.S. Army Corps of Engineers
Deer	U.S. Fish and Wildlife Service
Catfish	U.S. Fish and Wildlife Service

Contents

Executive Summary

There is a broadly recognized need among resource managers and scientists for improved habitat quality, increased habitat diversity, and a closer approximation of the pre-development hydrologic regime.

This summary report describes the first Habitat Needs Assessment (HNA), in support of the Upper Mississippi River System (UMRS), Environmental Management Program (EMP). The EMP Habitat Needs Assessment was designed to help guide future Habitat Rehabilitation and Enhancement Projects on the UMRS. To identify habitat needs, historical, existing, forecast, and desired future conditions were compared. Issues of scale are important in this regard because ecological processes and needs vary at the system, reach, and pool levels. In addition, a wide variety of habitat characteristics must be addressed including habitat fragmentation, connectivity, and diversity. To accomplish this assessment, a GIS tool and a new floodplain vegetation successional model were developed. These tools allow geomorphic and land cover characteristics to be translated into the potential habitat areas for species to occur.

The Results

Over time, the landscape, land use, and hydrology of the Upper Mississippi River and its basin have changed. Much of the grasslands, wetlands, and forests have been converted to agricultural use, which now occupies 50 percent of the floodplain. Impoundment, channelization, and levee construction have altered the hydrologic regime and sedimentation patterns, resulting in loss of backwaters, islands, and secondary channels. While future changes in broad geomorphic features are expected to be relatively small, habitat degradation is expected to continue. There is a broadly recognized need among resource managers and scientists for improved habitat quality, increased habitat diversity, and a closer approximation of pre-development hydrologic regime.

The Habitat Needs Assessment identified clear differences in habitat types and conditions among river reaches. Those differences are largely related to the amount and distribution of public land, the degree of floodplain development, the geomorphic form of the river, and the effects of impoundment for navigation. The differences also suggest that habitat needs and restoration objectives will vary by river reach and pool.

The Habitat Needs Assessment yielded gross quantitative and qualitative estimates of habitat needs both system-wide and within river reaches. These estimates provide the first approximation of a set of system-wide objectives for Habitat Rehabilitation and Enhancement Projects. While they do not offer quantitatively precise goals, they will help focus future planning on the most important geomorphic processes both system-wide and in specific river reaches. However, perhaps the greatest contribution this first Habitat Needs Assessment has made is the development of new and improved tools for future planning for Habitat Rehabilitation and Enhancement Projects. In particular, the GIS Query tool will help evaluate the potential distribution of species and habitat area types throughout the UMRS. While the results of the Habitat Needs Assessment are not a substitute for the more detailed and spatially explicit planning that will be done at the pool scale, it has provided new tools for that planning.

The Future

This is the first Habitat Needs Assessment undertaken as part of the Environmental Management Program and it is anticipated to be updated on a regular basis. Future assessments will benefit from additional spatial data about the river system, improved ecological understanding, improved GIS and modeling tools, and additional public input.

Limitations of the Initial HNA

- The Habitat Needs Assessment simplifies access to, analysis of, and graphic display of vast amounts of data, but the results still require careful interpretation by individuals familiar with UMRS resources.
- Because there were schedule and cost constraints, this study relied heavily on existing studies and it is limited by the quality and uniformity of data contained within those studies. The HNA will continually evolve as new information is acquired and it will be periodically updated in accordance with the Water Resources Development Act of 1999. Its value will continue to increase as new and more comprehensive data is incorporated during subsequent updates.
- The HNA was limited to the use of existing system-wide data. System-wide habitat models used relatively uniform low resolution land cover data and are therefore very general, even in data rich areas.
- The HNA provides an additional tool to help determine how Habitat Rehabilitation and Enhancement Projects are identified and selected, but it does not replace the project planning process.

Introduction


U.S. Fish and Wildlife Service

Ducks in flight.


U.S. Army Corps of Engineers

Finger Lakes Habitat Rehabilitation and Enhancement Project.

This summary report describes the first Habitat Needs Assessment (HNA), in support of the Upper Mississippi River System Environmental Management Program (EMP). The UMRS-EMP was authorized by Section 1103 of the Water Resources Development Act (WRDA) of 1986. The two major parts of the EMP are the Long Term Resource Monitoring Program, and a program of Habitat Rehabilitation and Enhancement Projects.

The authorizing language in WRDA 1986 required an evaluation to determine the program's "effectiveness, strengths and weaknesses, and contain recommendations for the modification and continuance or termination" of the EMP. In response, in 1997, the Corps of Engineers, Mississippi Valley Division submitted a report to Corps Headquarters recommending a variety of changes to the program. One of these recommendations was that a HNA be done when Congress reauthorized the EMP in WRDA 1999, the HNA was recognized as an ongoing feature of the EMP.

Purposes of the Habitat Needs Assessment (HNA) include:

- achieve a collaborative planning process that produces technically sound and consensus based results;
- address a variety of habitat requirements including physical, chemical, and biological parameters;
- address the unique habitat needs of distinct river reaches and pools;
- describe historical, existing, and projected future habitat conditions, and identify objectives for future habitat conditions;
- define habitat needs at system, reach, and pool scales;
- provide additional tools for planning future Habitat Rehabilitation and Enhancement Projects.

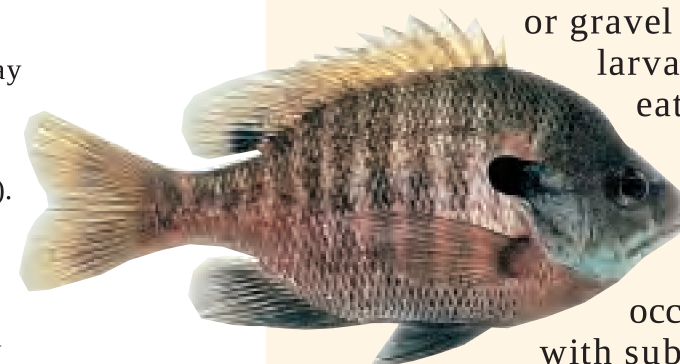
This HNA is the latest effort to document broad habitat protection and restoration needs to assist in planning future EMP habitat projects. This HNA begins to identify, at the system, reach, and pool scales, the long-term system-wide habitat needs. This HNA can also serve to focus future monitoring and research activities under the reauthorized EMP. Future refinements of this HNA will provide better estimates of habitat need as new information is acquired and additional public input is obtained.


U.S. Army Corps of Engineers

Lock and Dam 13, Clinton, Iowa.

Habitat

A habitat is an organism's "home." Defining the characteristics of the "home" for a host of river species is challenging. Many species may also have different habitat needs at different life stages and times of year (see sidebar). Habitat can be described in different levels of detail to narrow down the potential areas that may be occupied by an organism of interest. First, larger geographic areas and land cover types can be used. Next, other relevant attributes of habitat, such as current velocity, water depth, forest community type, etc. can be applied. For this HNA, habitats have been characterized broadly at the first level using floodplain land cover and aquatic area types. The "habitats" thus defined may be quite large, of low resolution, and only generally identify where species are likely to occur. Future refinements of this HNA will include additional physical and chemical habitat attributes and will define habitat for individual species in greater detail.



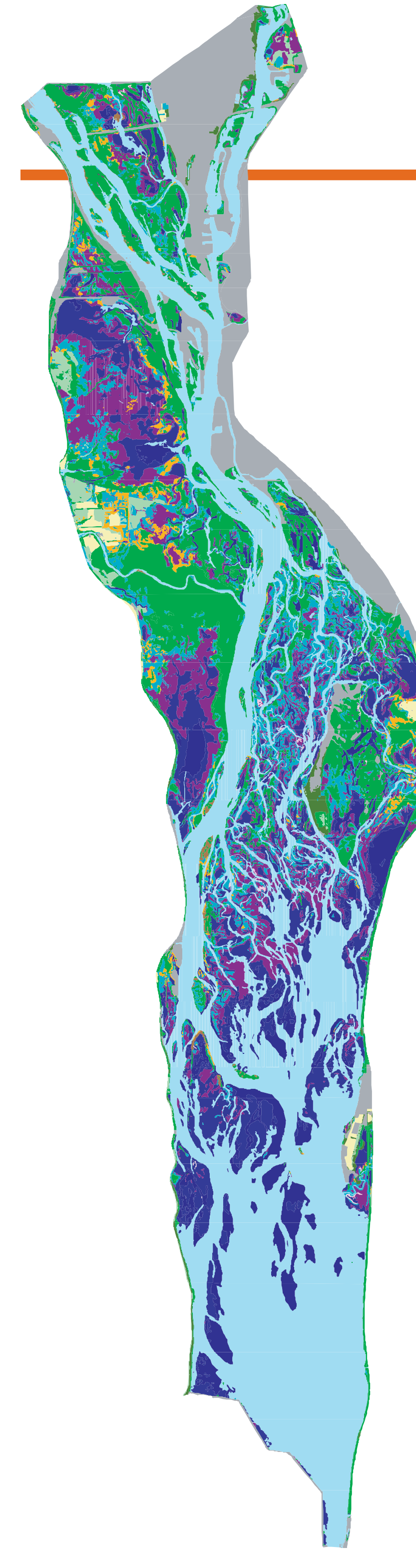
Bluegill sunfish

Bluegills in the UMRS spawn in shallow areas with sand or gravel bottom. The larvae hatch and eat plankton in open water areas for a time, then the juveniles occupy areas with submersed aquatic plants that provide shelter from predators; larger adults may move back to open water habitats. In winter, bluegills need warmer, well-oxygenated backwater areas out of the current.

New Hampshire Dept. of Inland Fisheries

Scott D. Whitney

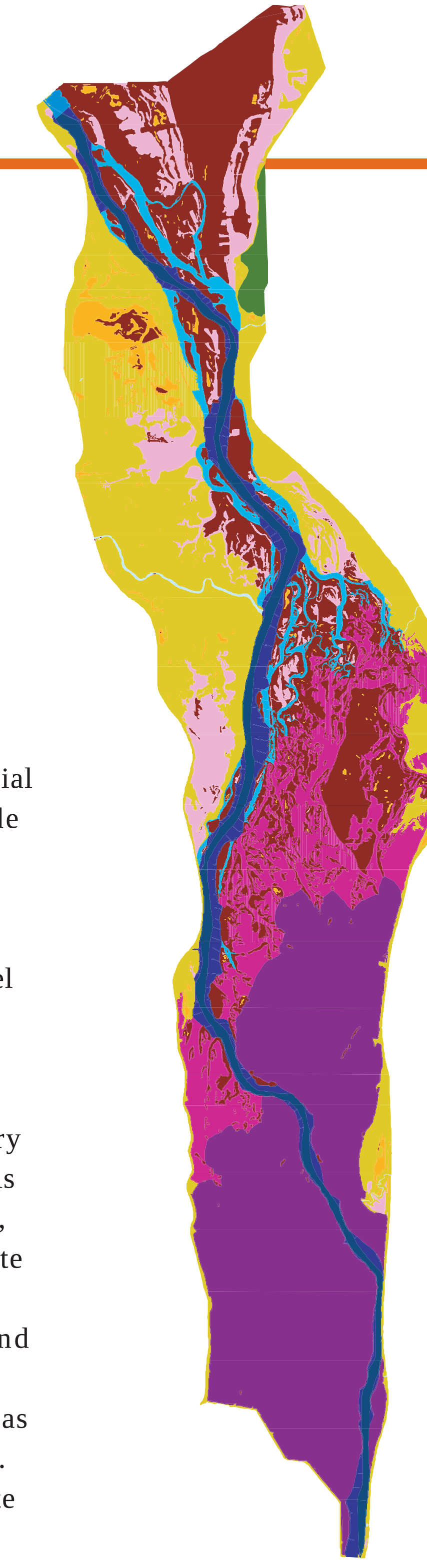
Bluegills guarding nests.



The higher level land cover classes are floodplain forest, grassland, marsh, developed, and agriculture. Forest and marsh are further separated into four classes each, and several additional aquatic classes create 17 total land cover classes (left).

Geomorphic areas describe physical habitats in the river floodplain system (right). The highest level geomorphic classification separates aquatic and terrestrial areas. Terrestrial areas include islands and connected and isolated floodplain areas.

Aquatic areas are separated into several channel and backwater classes. The main channel and channel border areas convey the greatest river flow. Secondary channels and tertiary channels are typically flowing habitats, but the amount of flow is quite variable depending on their location in the river system and their connectivity with the main channel. Backwater areas may be connected or isolated. In some areas, the dams create large contiguous impounded backwaters and shallow aquatic areas.



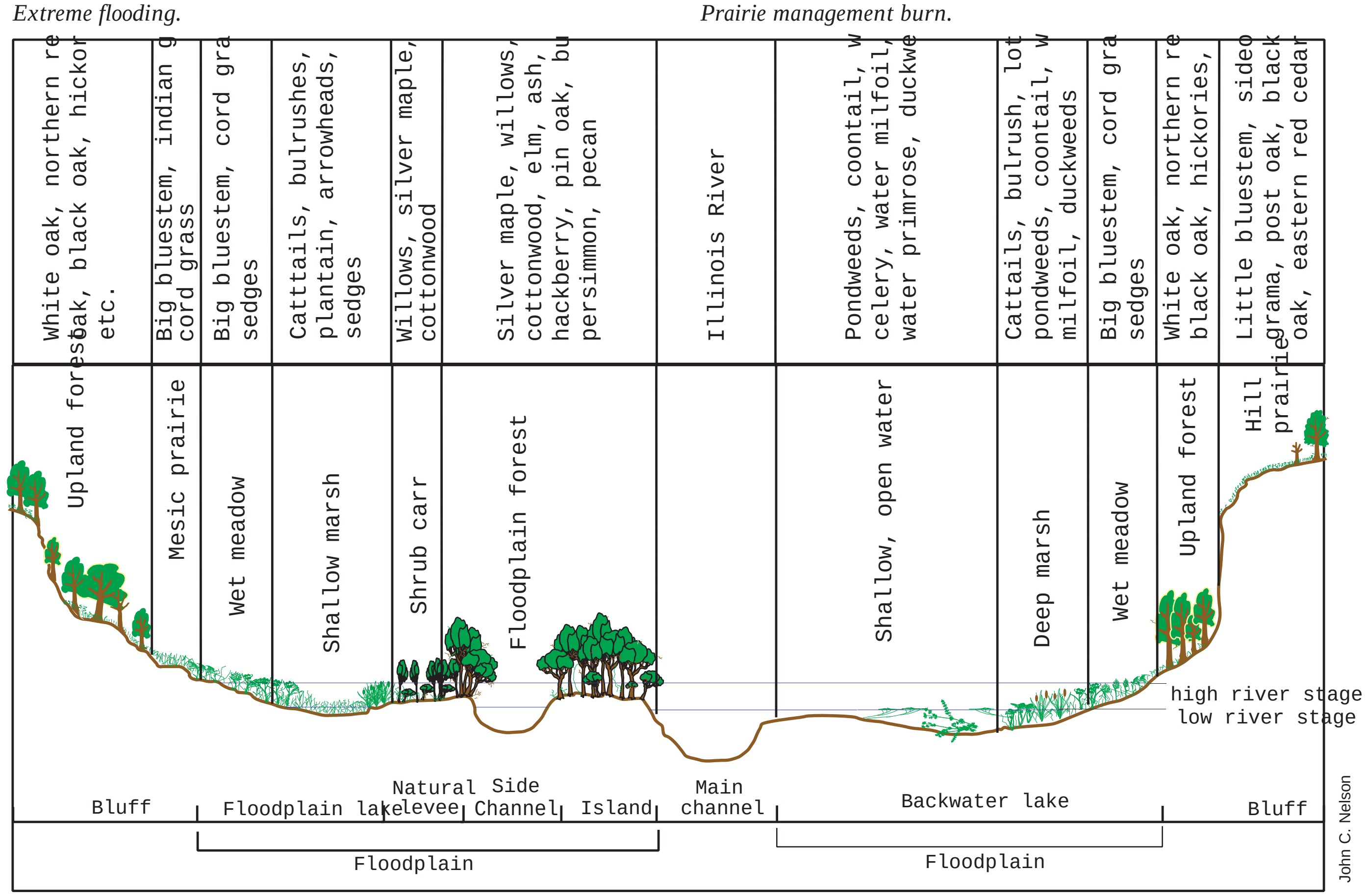
River floodplain ecosystems support a wide variety of species, which are distributed along flood frequency gradients (Fig. 1). Low elevation floodplain areas, which are usually inundated, support aquatic and wetland plants. Areas subject to frequent flooding support flood tolerant species. The least flood tolerant plant species occur on well-drained, high elevation areas. Flooding is the major disturbance on low elevation floodplains. Fire was once an influence on high elevation floodplains, but fires have been suppressed and agriculture is currently the major influence.


U.S. Army Corps of Engineers

Extreme flooding.


U.S. Army Corps of Engineers

Prairie management burn.



John C. Nelson

Fig. 1. Hypothetical floodplain cross-section.

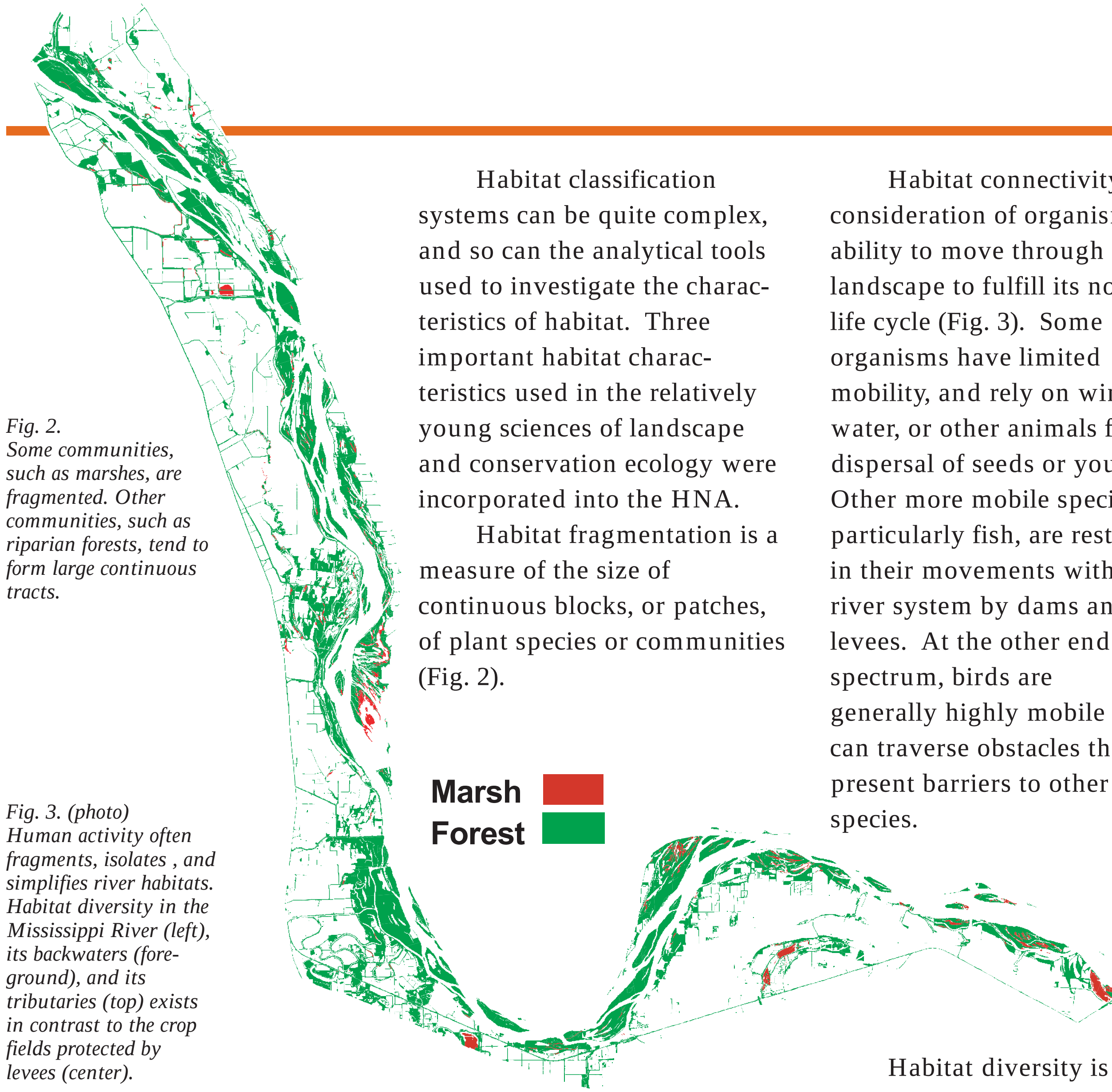
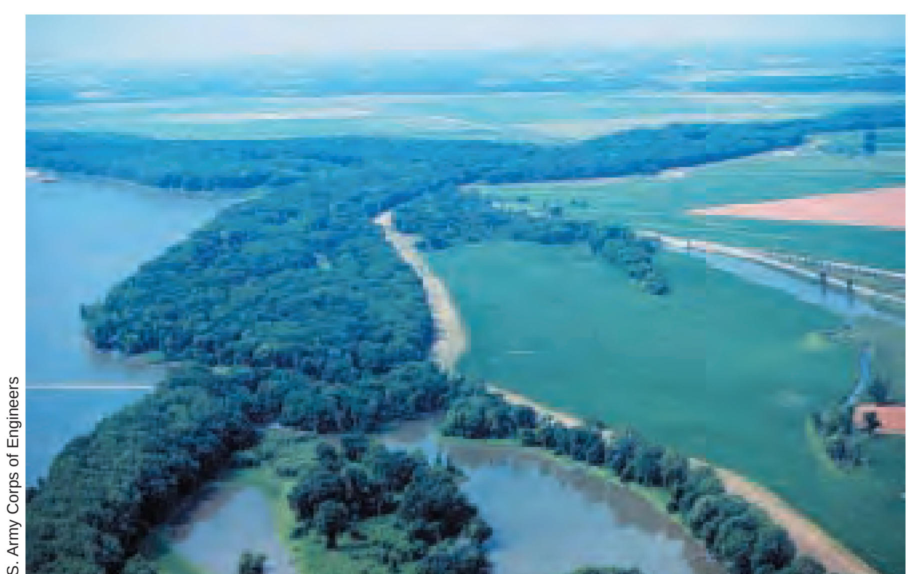


Fig. 2. Some communities, such as marshes, are fragmented. Other communities, such as riparian forests, tend to form large continuous tracts.

Fig. 3. (photo) Human activity often fragments, isolates , and simplifies river habitats. Habitat diversity in the Mississippi River (left), its backwaters (foreground), and its tributaries (top) exists in contrast to the crop fields protected by levees (center).


U.S. Army Corps of Engineers

Habitat classification systems can be quite complex, and so can the analytical tools used to investigate the characteristics of habitat. Three important habitat characteristics used in the relatively young sciences of landscape and conservation ecology were incorporated into the HNA.

Habitat fragmentation is a measure of the size of continuous blocks, or patches, of plant species or communities (Fig. 2).

Habitat connectivity is the consideration of organisms' ability to move through a landscape to fulfill its normal life cycle (Fig. 3). Some organisms have limited mobility, and rely on wind, water, or other animals for dispersal of seeds or young. Other more mobile species, particularly fish, are restricted in their movements within the river system by dams and levees. At the other end of the spectrum, birds are generally highly mobile and can traverse obstacles that present barriers to other species.

Habitat diversity is a measure of the mix of species or communities present in a given area. Low diversity habitats have large expanses of a single species or community type (e.g., sedge meadow). High diversity habitats support many species or communities. The classification system used to characterize habitat and the size of the area under investigation can greatly influence these types of analyses.

The Importance of Scale in Large River Ecosystems

Depending on their mobility and life requirements, the scale or geographic extent of habitats is important to river organisms. Aquatic and floodplain species in the UMRS have adapted to the size of river habitats and the dynamic set of river habitat conditions for millennia. The major landforms of the present UMRS developed over 11,000 years ago during the retreat of glaciers. The north-south orientation of the Mississippi River provided refuge for species during glacial times and continues to provide a corridor for migration and dispersal of many life forms.

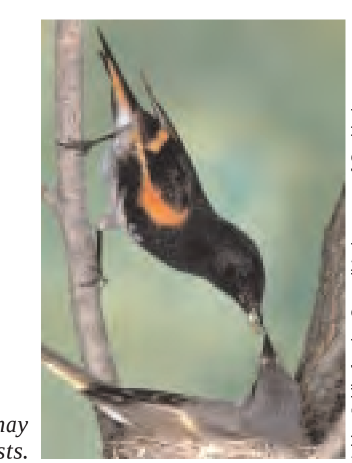
Basin and Continental Scales

The basin and larger scales are appropriate when considering the habitat needs of animals that migrate over long distances. Among fish, paddlefish, sturgeon, skipjack herring, and the American eel are notable long distance migrants. Many bird species migrate between North, Central, and South America. Although many species migrate beyond the UMRS, they all require specific habitat resources when they use areas along the rivers.

The UMRS basin is approximately 190,000 square miles. Within the mainstem rivers there are over 2.6 million acres of aquatic and floodplain habitat.

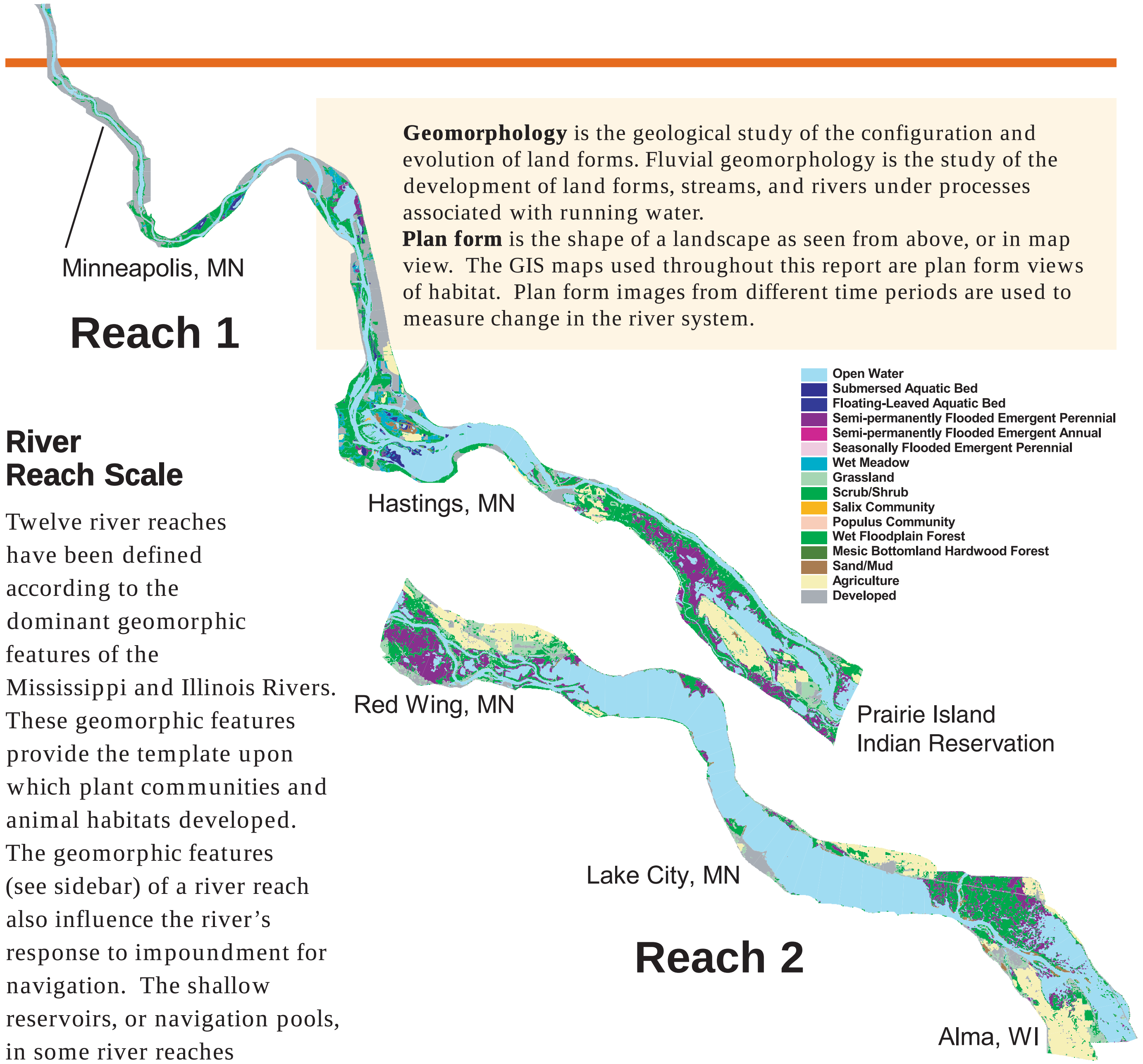
System Scale

The UMRS, as defined by EMP authorizing legislation, includes the Upper Mississippi River from Minneapolis, Minnesota to Cairo, Illinois, the entire Illinois River, and navigable portions of the Minnesota, St. Croix, Black, and Kaskaskia Rivers. This HNA covers the aquatic and floodplain areas of the UMRS.



Isidor Jeklin for the Cornell Laboratory of Ornithology

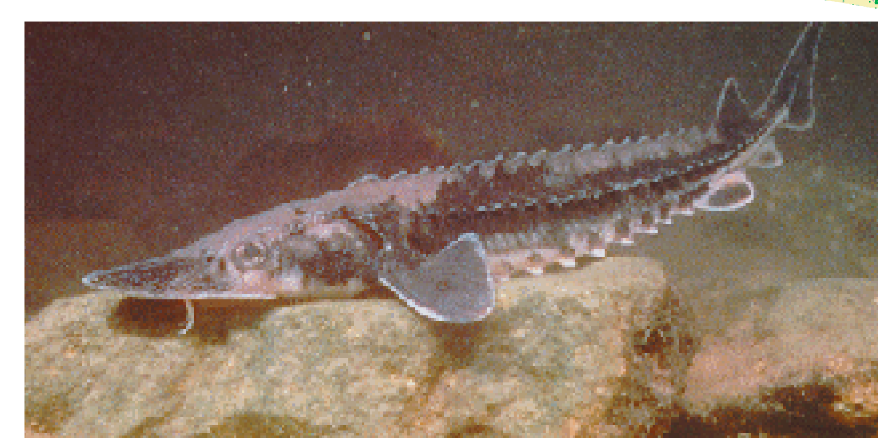
Neotropical migrants such as American redstarts may winter in South America and breed in UMRS forests.



Geomorphology is the geological study of the configuration and evolution of land forms. Fluvial geomorphology is the study of the development of land forms, streams, and rivers under processes associated with running water.
Plan form is the shape of a landscape as seen from above, or in map view. The GIS maps used throughout this report are plan form views of habitat. Plan form images from different time periods are used to measure change in the river system.

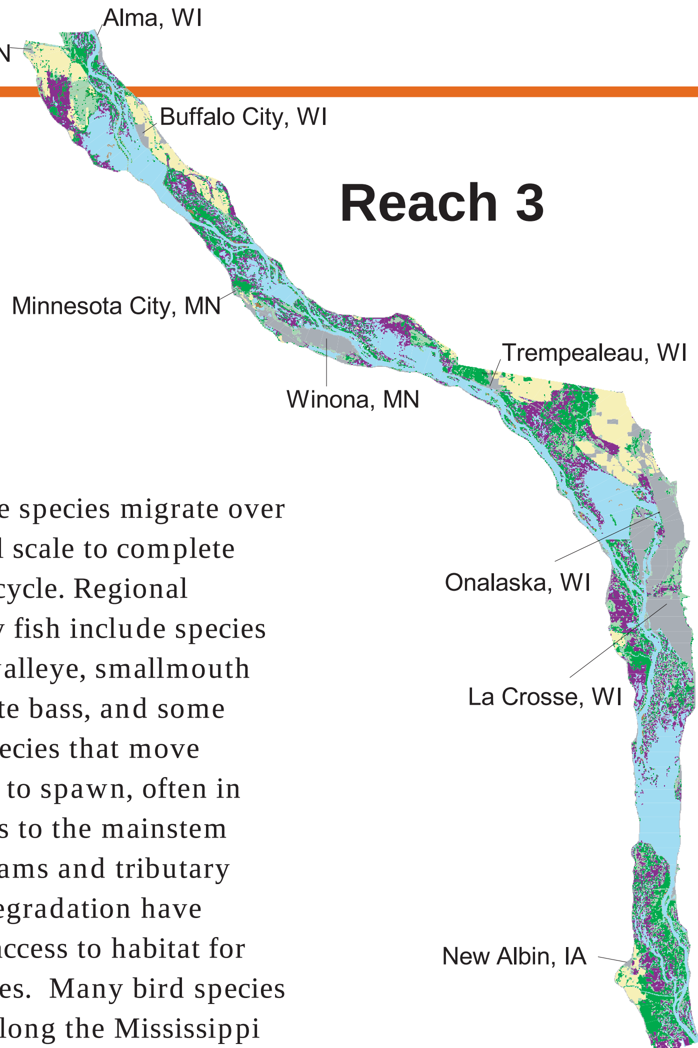
River Reach Scale

Twelve river reaches have been defined according to the dominant geomorphic features of the Mississippi and Illinois Rivers. These geomorphic features provide the template upon which plant communities and animal habitats developed. The geomorphic features (see sidebar) of a river reach also influence the river's response to impoundment for navigation. The shallow reservoirs, or navigation pools, in some river reaches developed broad, open-water impounded areas, whereas others show little apparent plan form (see sidebar) change due to impoundment. Habitats and the ecological communities they support differ among river reaches, thus resource opportunities, problems, and management differ among the river reaches.



U.S. Army Corps of Engineers

Lake sturgeon and other fish species may migrate hundreds of miles among river reaches.

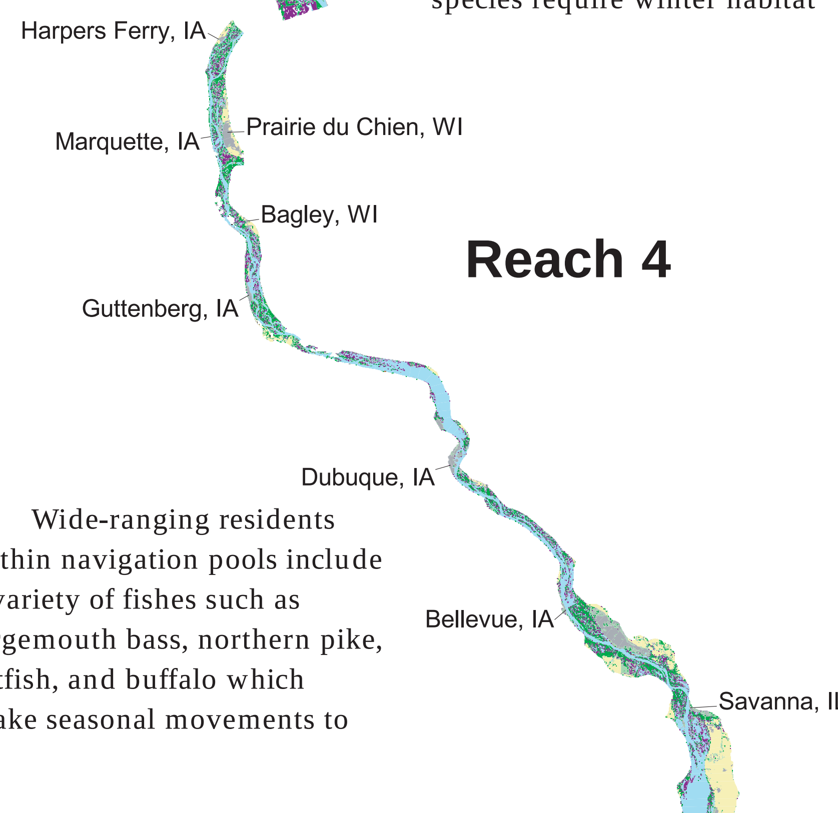


Locks and dams such as this one near Bellevue, Iowa establish boundaries of the navigation pools.

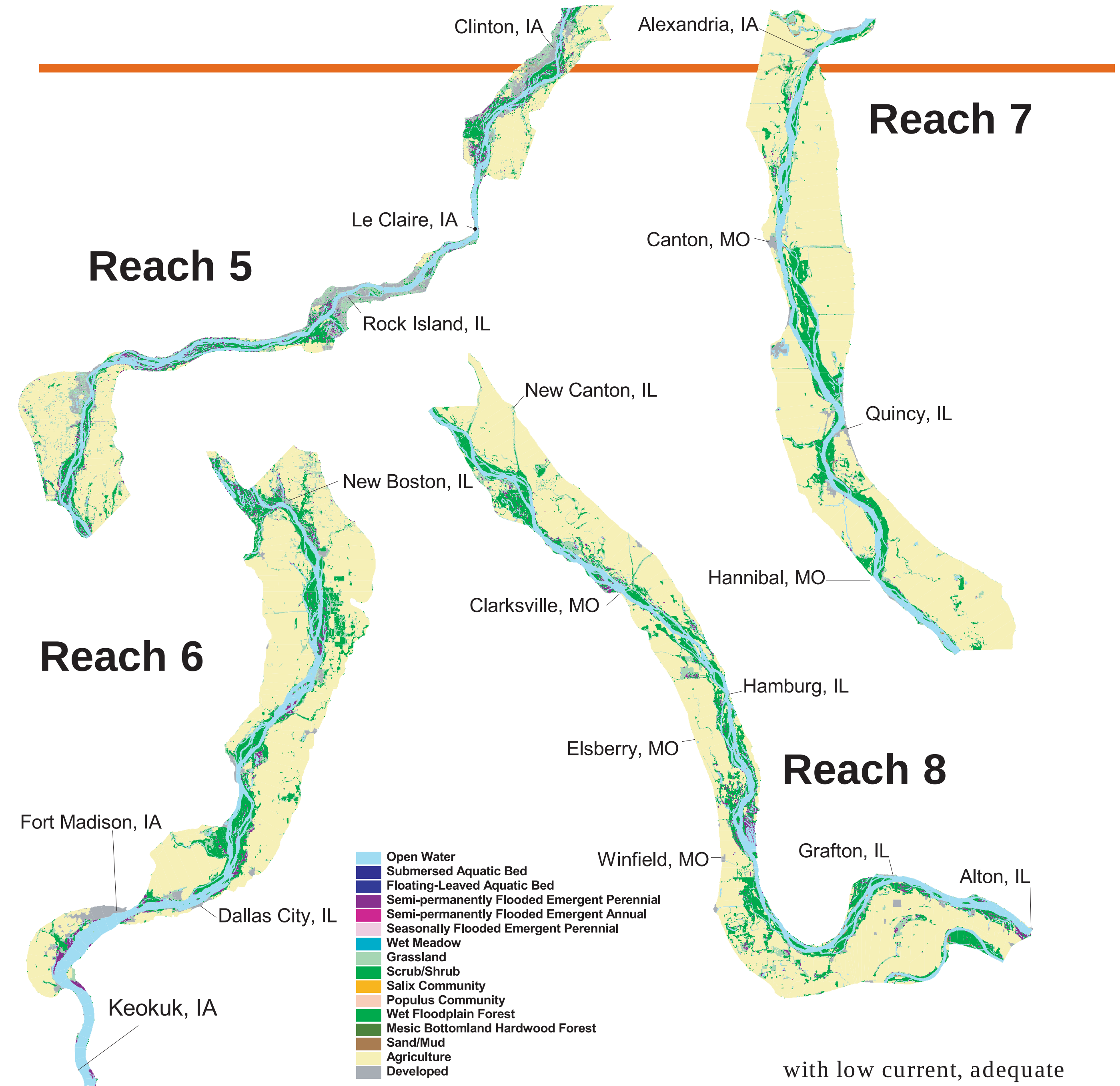
Some species migrate over a regional scale to complete their life cycle. Regional migratory fish include species such as walleye, smallmouth bass, white bass, and some sucker species that move upstream to spawn, often in tributaries to the mainstem rivers. Dams and tributary habitat degradation have reduced access to habitat for these fishes. Many bird species migrate along the Mississippi River to find warmer winter temperatures in southern states.

Navigation Pool Scale

The mainstem dams of the UMRS navigation project formed a series of shallow reservoirs called navigation pools. The pool scale is important in assessing the physical environment that defines habitat for species that display seasonal movements of about 20 miles or less. UMRS navigation pools differ in their mix of habitats among river reaches.



Wide-ranging residents within navigation pools include a variety of fishes such as largemouth bass, northern pike, catfish, and buffalo which make seasonal movements to find appropriate habitats to spawn, feed, or over-winter. Some species require flooded vegetation to spawn, others need structure and undercut banks, and some require firm bottom substrate. Most fish species require winter habitat with low current, adequate levels of dissolved oxygen, and water temperatures higher than freezing. All seasonal habitat needs for resident species must be met within a navigation pool because dams restrict access to other navigation pools. Resident birds maintain home ranges over many square miles. Cardinals, blue jays,



Largemouth bass and other species may make seasonal movements of 10-20 miles.

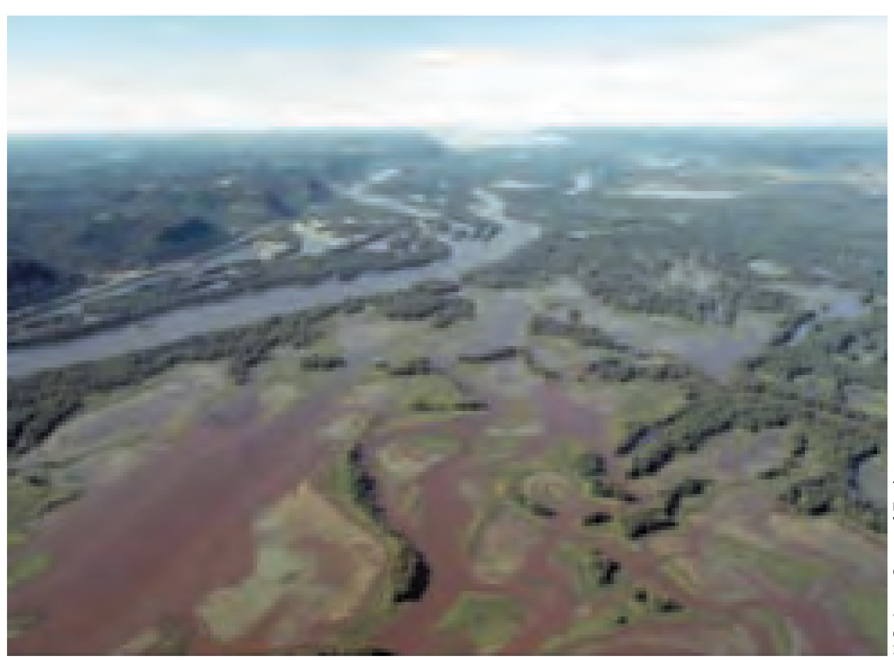
Cardinals and other resident birds have large local home ranges.

woodpeckers, crows, and many others may use both floodplain and upland habitats. Some bird species may nest in one floodplain habitat and feed in another which requires that important habitats are available within their home range.

Habitat Scale

The habitat scale is the level that is actually occupied by organisms. UMRS habitats must provide suitable resources to meet the needs of a variety of riverine organisms. Habitats for long-distance migrants and wide-ranging species are large, while relatively immobile organisms such as freshwater mussels have small habitat areas. Most riverine organisms have habitat needs that can be measured in square yards to tens of acres. Many river organisms require diverse habitat conditions, with multiple habitat types in close proximity. Most river processes act at the habitat scale and protection and restoration is generally focused at this scale.

Many animal species have small home ranges that meet all their life history needs. Even migratory species will use small home ranges within their seasonal habitats. For species with system-wide distribution it is important that critical habitats are available and of suitable quality to support local populations. Aquatic invertebrates are generally restricted to small areas, but may drift in currents or migrate during adult aerial stages. Freshwater mussels are a particularly threatened group of animals that have suffered greatly through harvest or pollution due to their lack of mobility. Many panfish and minnows and most small mammals have limited ranges.



Backwater areas support migrating species when they are present, but they also support many resident species throughout the year and throughout their life cycles.

Crappie, bluegills, and many minnows may live their entire life in one backwater lake.

Similarly, muskrats may stay in one marsh for their entire life.

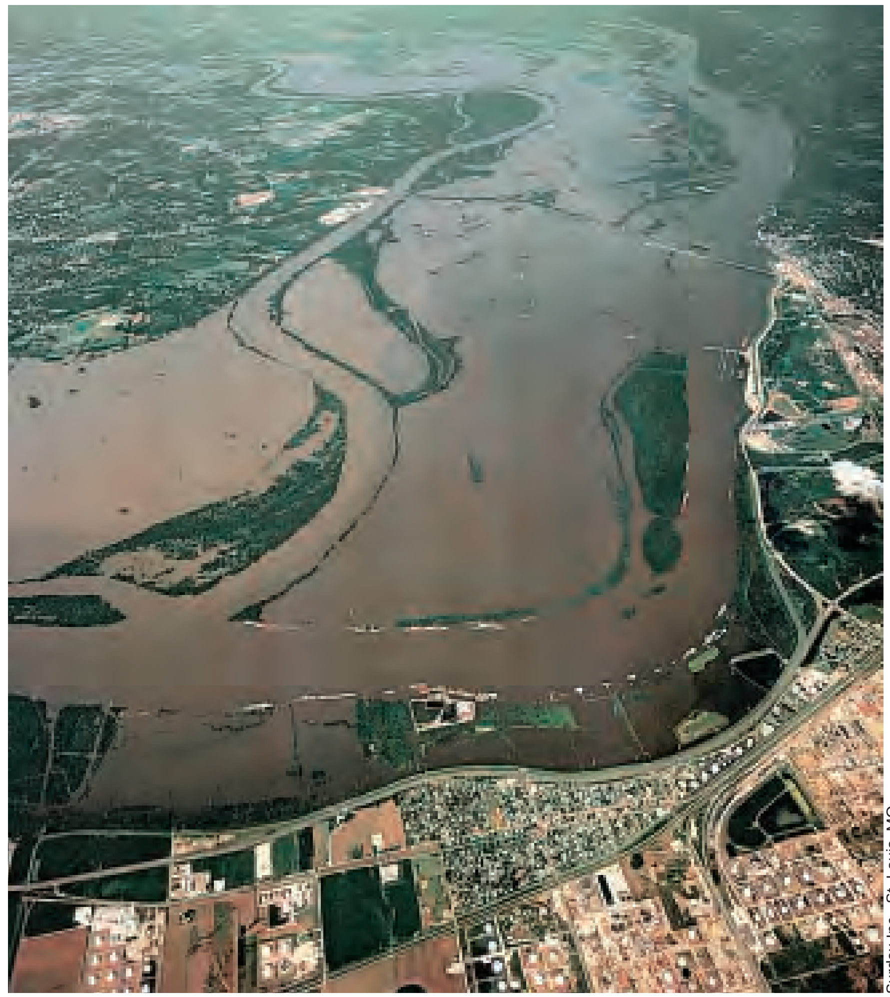
Freshwater mussels are channel bottom residents that rarely move.

The Role of Disturbance in the UMRS Ecosystem

Large rivers are dynamic ecosystems where habitats evolved and persist in response to a variety of natural and human-caused disturbances (Table 1). Floods and droughts are natural disturbances that occur seasonally, but exhibit an approximately decadal cycle of extreme events on the UMRS. Seasonal flooding drives a highly productive and diverse ecosystem.

Sediment transport and channel-forming processes are active continuously. Channel and floodplain geometry can change slowly over a period of decades or rapidly during extreme floods. Impoundment and river regulation for navigation have significantly modified the hydrologic regime and the pattern of sedimentation.

Fire was once a dominant force maintaining floodplain grassland-savanna landscapes. Ice flows, tree falls, and log jams are all natural occurrences that help define local habitats and maintain high habitat diversity. Biological disturbances (e.g., beavers) are important in the development of floodplain landscapes.


Surdex Inc., St. Louis, MO

The great flood of 1993 was one of the country's worst disasters.

Table 1. Ecological Disturbances

Natural	**Man Made**
Flood	Water level regulation
Drought	Dredging and dredged material disposal
Sedimentation	Channel training structures
Channel migration	Boat generated waves
Sediment resuspension	Levee construction
Fire	Agriculture
Ice shear	Nutrient enrichment
Tree wind-throw	Logging
Log jam	Urban development
Beavers	Contaminants

Impoundment, water level regulation, channelization, levee construction, logging, and urban and agricultural development are the dominant human activities affecting river habitats on the UMRS. Navigation dams converted free flowing rivers to a series of shallow impoundments. Portions of the floodplain were permanently flooded by the dams and backwater area increased significantly in some river reaches (Fig. 4). Since impoundment, sedimentation of backwaters, island loss, and loss of secondary channels have greatly modified the pattern of river habitats.

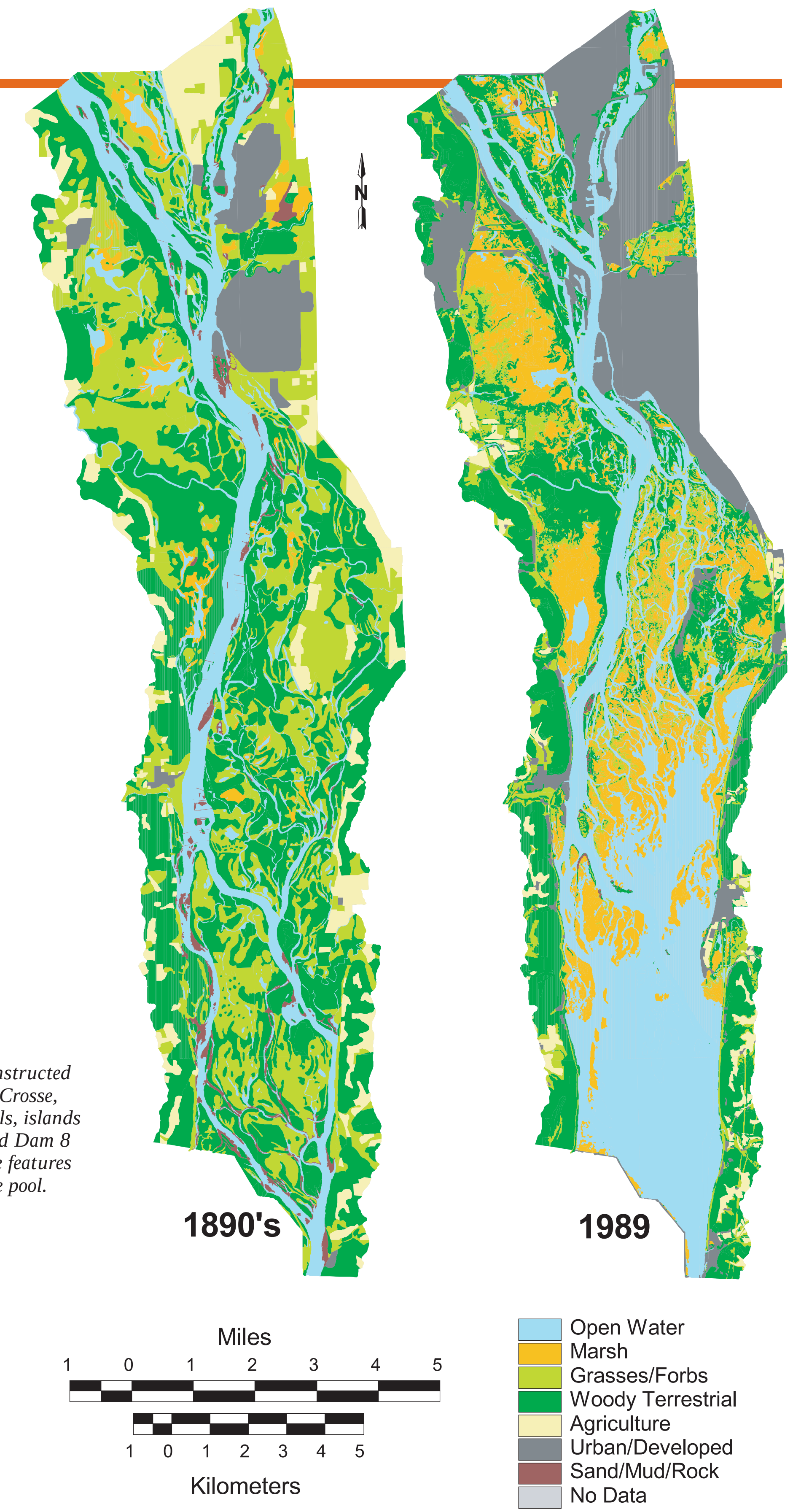
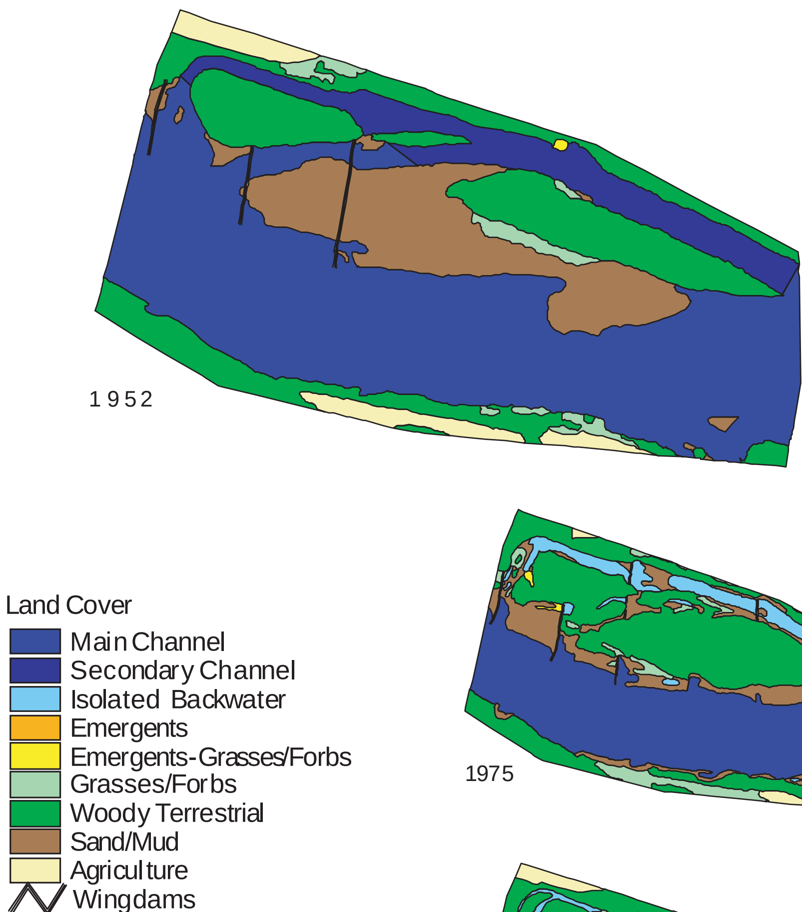


Fig. 4. Before dams were constructed (ca. 1890), the river near La Crosse, Wisconsin had many channels, islands forests and marshes. Lock and Dam 8 permanently inundated these features in the downstream half of the pool.



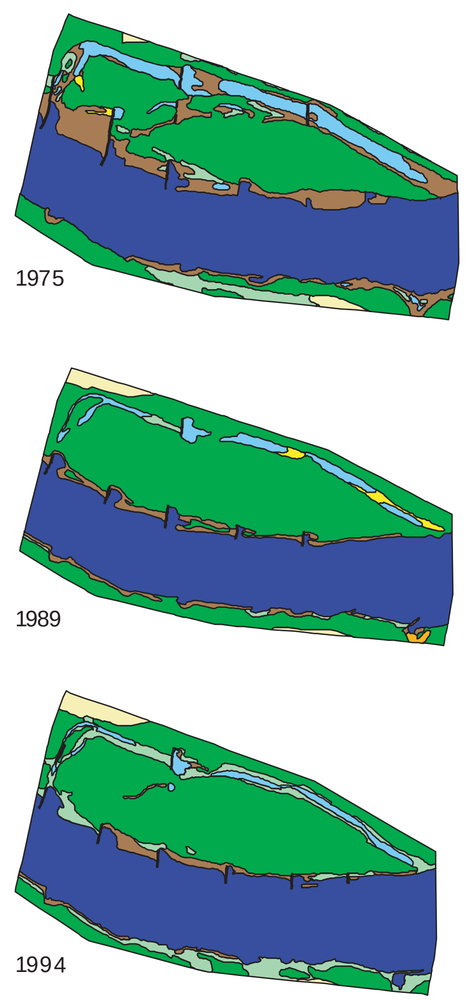


Fig. 5. An example of side channel loss south of St. Louis.

Rock wing dams, closing dams, and bank revetments are used to maintain the navigation channel and to reduce dredging requirements. These structures decrease bank erosion and force flow into the main river channel. In the Open River reach, channel training structures have greatly reduced the number and quality of secondary channels (Fig. 5). There has also been loss of channel area as sediment filled the area between wing dams.

Much of the floodplain south of Pool 16 on the Mississippi River and on the La Grange and Alton pools on the Illinois River has been isolated by levees (Fig. 6). The distribution of levees as proportion of total floodplain area is about:

- 3 percent north of Pool 13;
- 50 percent from Pool 14 through Pool 26;
- 80 percent in the Open River; and
- 60 percent of the lower 160 miles of the Illinois River.

In total, more than 1.1 million acres, mostly agricultural land, are protected from moderate floods by levees.

Logging has caused significant habitat degradation throughout the river floodplains and northern parts of the basin. Logging was necessary to supply fuel-wood for steamboats and railroads, firewood for heat and cooking, and lumber to build cities. In most floodplain areas deforested land was rapidly converted to agriculture. The impact is particularly dramatic below the Kaskaskia River where the densely forested floodplain was almost completely cleared (Fig. 7).

U.S. Geological Survey – Upper Midwest Environmental Sciences Center

Fig. 6. The photograph illustrates the difference between floodplain agricultural area protected by levees and natural floodplain habitat that remains connected to the river.

Deforestation and agricultural conversion throughout the basin increased sediment delivery to the mainstem rivers.

Urban development displaced native habitats, but also caused indirect impacts. Sewage and industrial pollution caused significant water quality problems that eradicated sensitive species downstream of large cities. The problem has subsided since the 1970s.

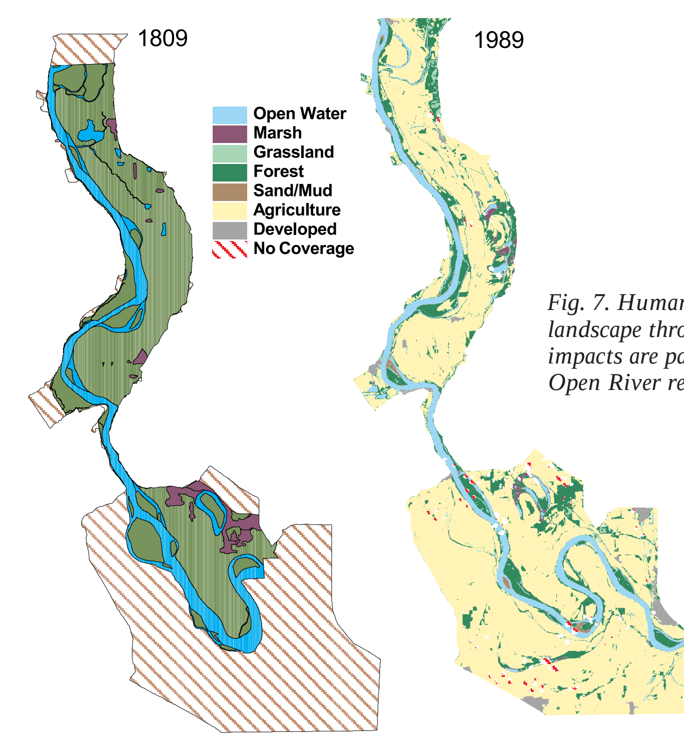


Fig. 7. Humans have altered the landscape throughout the UMRS. The impacts are particularly evident in the Open River reach south of St. Louis.

Habitat Needs Assessment Approach

Habitat needs were identified through comparison of existing, predicted, and desired future conditions. UMRS geomorphology and climate, historic land cover change, and ecological disturbances were reviewed in the context of their influence on habitat conditions. An evaluation of existing habitat conditions was also conducted throughout the UMRS, reviewed and refined forecast future habitat conditions, and attempted to identify ecologically and socially desired future habitat conditions. The HNA addresses the system-wide, river reach, and pool scales and includes the bluff-to-bluff extent of the floodplain.

A new Geographic Information System (GIS) query tool developed as part of the HNA allows queries of where species and their habitats are likely to occur throughout the UMRS. A second new tool completed for the HNA is a floodplain vegetation successional model to predict future land cover.

Existing Conditions

GIS Database

A systemic HNA Areas GIS database was developed from existing data to standardize geomorphic area (location in the river system) and land cover (plant communities and land use) classification systems (Fig. 8). The GIS database defines various aquatic areas, islands, and contiguous and isolated floodplain areas, as well as 17 ecologically relevant land cover classes. Aquatic habitat areas were further described using spatial data about proximity to shorelines, wing dams, and closing dams. The 1989 HNA land cover GIS database also includes boundaries for EMP habitat project areas. Links to habitat project fact sheets provide information on project goals and objectives.

Fig. 8. High resolution data derived from photos is available for much of the Mississippi River north of St. Louis, but low resolution satellite data only are available for much of the Open River reach and the Illinois River.

Habitat: Species Relationships

The UMR supports a large number of species including:

over 200 aquatic macroinvertebrate species, 44 mussel species, 143 fish species, 73 reptile and amphibian species, over 300 bird species, and over 50 mammal species, in addition to the hundreds more plant, insect, and microbe species. This large number of species was organized by combining species of aquatic macroinvertebrates, mussels, fish, reptiles and amphibians into groups of animals, called guilds, that have similar habitat requirements and habitat use. Birds, mammals, reptiles and amphibians, and some fish are considered at the species level because much is known of their life history.

Relational tables were developed to link species and guilds with the HNA Areas GIS database (Table 2). These relational tables provide a coarse system-wide overview of habitat areas that have the potential to support different species and guilds. Potential habitat for species and guilds was rated by regional experts using a 0 to 3 score:

0 = very low potential occurrence,

1 = low potential occurrence,

2 = moderate potential occurrence,

3 = high potential occurrence.

HNA Query Tool

The HNA GIS Query Tool was developed to assist the Habitat Needs Assessment (Fig. 9). It helps evaluate potential distribution of species and habitat area types throughout the UMRS. The user may query on a species and obtain habitat information, or may query on a habitat to obtain species information. These queries are accomplished using the matrices developed to associate a species' potential to occur within various types of habitat. The query tool presently incorporates land cover and geomorphic area data. An advanced version of the tool incorporates more data layers to define habitat in more detail and to create better habitat models. Application of the advanced tool is presently limited because spatial data about habitat attributes needed to use it to its full capability are still lacking for most of the river system.

The HNA GIS Query Tool was designed to generate information about user-specified species, guilds, or habitats for selected portions of the UMRS. This includes the production of GIS themes,

Table 2. Example of reptile and amphibian guild-by-habitat relation table.

	Habitat Modifiers (1 or 0)			Aquatic Channel Areas main							Backwater Areas contiguous				Terrestrial Islands	Floodplain	
Guild	shoreline	wing dam	rip-rap	nav. Channel	channel border	tailwater	secondary	tertiary	tributary	excavated	FP lake	shallow AQ	impounded	isolated		contiguous	isolated
Lotic Aquatic Salamanders	0	1	1	0	2	3	2	1	2	0	0	0	1	0	0	0	0
Lentic Aquatic Salamanders	1	0	0	0	0	0	0	0	1	0	1	3	1	3	2	3	1
Terrestrial Salamanders	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	1
Terrestrial Frogs and Toads	1	0	0	0	1	0	1	1	2	1	2	3	2	3	0	3	2
Semi-Aquatic Frogs	1	0	1	0	2	1	2	2	1	2	3	3	2	3	1	3	3
Aquatic Frogs	1	0	1	0	2	2	3	3	3	3	3	1	3	2	2	3	3
Arboreal Frogs	1	0	0	0	0	0	0	0	0	0	1	1	1	3	0	1	2
Lentic Turtles	1	1	1	1	2	1	3	1	2	2	3	1	3	2	3	3	2
Lotic Turtles	1	1	1	1	3	2	3	1	2	1	3	1	2	0	2	2	0
Terrestrial Turtles	1	0	0	0	1	0	0	0	1	0	1	1	1	1	0	3	3
Woodland Lizards	1	0	0	0	2	0	2	2	2	0	1	0	2	2	0	2	3
Prairie Lizards	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	2	3
Woodland Snakes	1	0	0	0	1	0	1	0	2	0	1	1	1	1	0	2	1
Prairie Snakes	1	0	1	0	1	0	1	1	2	1	2	3	3	3	0	3	3
Aquatic Snakes	1	1	1	0	3	1	3	1	2	1	3	1	2	2	1	3	1

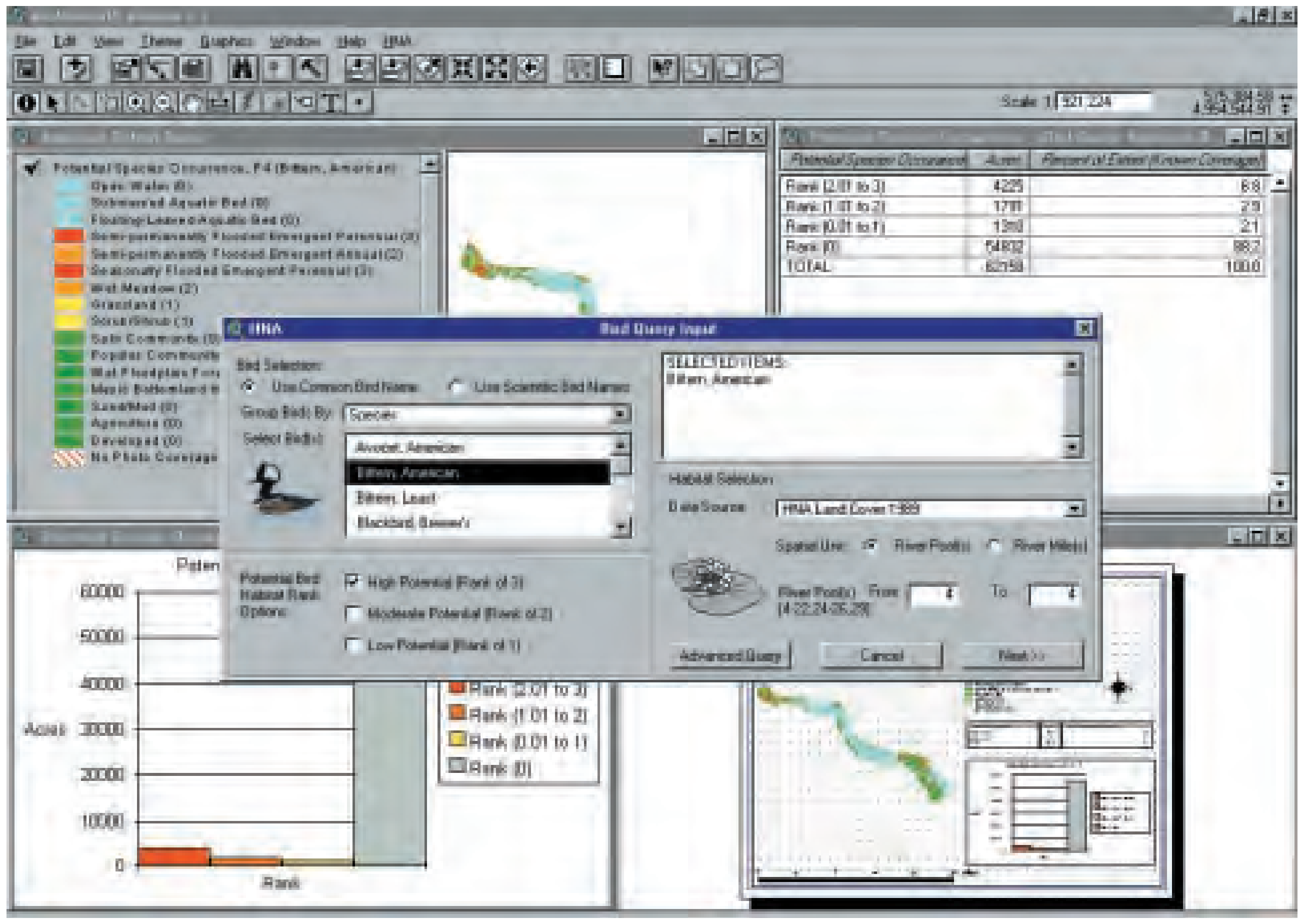


Fig. 9. The HNA query tool is an easy to use interface for natural resource managers to incorporate the power of GIS into their work.

tables, charts, maps, and text reports describing potential species habitat, occurrence, and diversity (Table 3).

Forecast Future Conditions

Quantitative Assessment of Forecast Geomorphic Change

A review of published reports was used to characterize forecast geomorphic changes in the UMRS over the next 50 years. The Cumulative Effects Study, completed for the Upper Mississippi River–Illinois Waterway Navigation Feasibility Study, was the most recent attempt to quantify a forecast of future conditions for the UMRS. The Cumulative Effects study team compiled historic maps, photos, channel bathymetry, sediment transport estimates, dredging statistics, and many other data to assess apparent geomorphic changes resulting from and incurred since impoundment to help predict plan form change over the next 50 years. The review was more comprehensive in Pools 4 – 26 than in the rest of the river system.

Qualitative Assessment of Site-Specific Geomorphic Change

Two methods were used to provide a qualitative site-specific assessment of geomorphic change. Both methods incorporated an analysis of historic change to predict future conditions. The first assessment was completed as part of the Cumulative Effects Study, in which the consultant team reviewed historic maps and photos to identify areas of extensive change. Using this method, only large plan form changes were detectable. The second method incorporated the knowledge and experience of natural resource managers, many with 20 or more years of experience working in specific regions of the river. Workshops were held to have managers locate areas showing past change or expected to change in the next 50 years on maps. The manager's local knowledge allowed a more detailed analysis because they could provide insight into changes occurring below the water's surface. For example, backwaters that may not have displayed discernable change in surface area may have lost significant depth that reduced their value as habitat.

Floodplain Vegetation Successional Model

A terrestrial vegetation successional model was developed to help predict land cover change. A rule-based approach was employed to estimate the system-wide percent change of one land cover class to other land cover classes over a fifty-year time period. An expert panel of Upper Mississippi River System foresters, botanists, and ecologists was convened to develop the rule based successional model. The panel first agreed on the set of plant

Table 3. HNA query tool output.

Products	Description
Textual Reports	
Query Report	A textual query report is produced with every query. It contains information about the query parameters and results.
Red Flag Report	A textual red flag report is produced with every query. It contains information about the specific habitat needs, ecological bottlenecks, and UMRS distribution of queried species.
Species Products	
Potential Species Occurrence	Displays potential species habitat within the selected extent Values range from 0 to 3. Zero is considered to have very low potential for species occurrence and 3 is considered to have high potential for species occurrence.
Potential Species Occurrence by River Mile or Pool	Products display average potential species occurrence by river mile or pool The values are determined by area-weighted-averaging. Values range from 0 to 3. Zero is considered to have very low potential for species occurrence and 3 is considered to have high potential for species occurrence.
Potential Species Richness	Displays potential species richness within the selected extent. The values represent the total number of species (selected by the user) that potentially exist in each habitat class.
Potential Species Richness by River Mile or Pool	Products display potential species richness values by river mile or pool. Values represent the total number of species (selected by the user) that potentially exist in each river mile or pool.
Habitat Products	
Potential Species Habitat or Potential Habitat	Displays potential species habitat for a species query. Displays selected habitat for a habitat query.
Potential Species Habitat or Potential Habitat by River Mile or Pool	Products display potential species habitat or selected habitat by river mile or pool. Habitat areas are noted as acres or percent.
Habitat Richness and Diversity by River Mile or Pool	Displays habitat richness and diversity by river mile or pool For a species query, the habitat richness values represent the total number of potential habitat types for the selected species that occur within each river mile or pool For a habitat query, the habitat richness values represent the total number of selected habitats that occur within each river mile or pool The habitat diversity values are determined using Simpson's Diversity Index which takes into account the proportion of each habitat within each river mile or pool. Values range from 0 to 1 with areas becoming more diverse as their values approach 1.

community types to be included in the analysis. The panel also agreed on a set of assumptions that would limit the range of future change under consideration. The assumptions include:

1) Land presently in agricultural use will remain in agricultural use,

2) Developed land will remain developed,

3) Existing plans for floodplain vegetation management will be implemented,

4) The climate and hydrologic regime will not change,

5) The present set of natural disturbances (wind, fire, flood, ice, diseases, etc.) will continue.

The panel then developed the basic pathways for change from early successional classes to later successional classes. A smaller team estimated the proportion of each land cover anticipated to change to other land cover classes using terrestrial area change estimates from the Cumulative Effects Study where available. The calculations were conducted at the pool scale and summarized in the HNA technical report appendices. Locations of change were not predicted.

Desired Future Habitat Conditions

Consultations With Resource Managers

Workshops were held to consider historic conditions, existing conditions, the available forecast of future conditions, and ongoing geomorphic processes to ultimately identify desired future habitat conditions. Information developed previously to assess historic, existing, and predicted UMRS plan form habitat changes was distributed to participants in advance of the workshops. A qualitative assessment asked five questions to elicit responses important to assessing: 1. the quality of the approach and information used in the description of historic, present, and predicted habitat, 2. desired habitat quality, 3. areas, processes, species, or habitat characteristics critical to maintaining habitat integrity, 4. threatened habitats, and 5. stressors or altered disturbance regimes limiting restoration potential. In an effort to quantify desired future habitat conditions, resource managers expressed their professional opinion regarding the proportion of geomorphic area classes in "desirable" condition for the present, predicted future and desired future.

Beth Whetsell, Illinois Natural History Survey

Lake Chautauqua, Illinois River, outside of the restoration project.

Beth Whetsell, Illinois Natural History Survey

Lake Chautauqua, Illinois River, inside of the restoration project.

These percentages were then transformed into an approximation of "desirable" acres needed for each geomorphic area type.

Public Involvement

Public involvement was recognized as a vital part of the Habitat Needs Assessment process. During this first HNA, several approaches were developed by a multi-agency HNA Public Involvement Team to assess the public's understanding, values, and expectations regarding desired future habitat conditions for the UMRS. These approaches were by no means comprehensive, but were

U.S. Fish and Wildlife Service

Fall waterfoul hunting is poular throughout the river system.

U.S. Army Corps of Engineers

Water skiing near Grafton, Illinois.

considered to be the most practical and effective means of engaging the public in the initial HNA.

Information was collected from the public at two levels: institutions, and the public at large. A compilation of mission statements and UMRS management plan objectives were reviewed to identify institutional priorities and activities related to river habitat. A series of 12 open public meetings conducted in April and May 1999 and a series of ten focus group meetings conducted in July and August 2000 were used to assess the general public's understanding, values, and expectations regarding desired future UMRS habitat conditions.

Information from governmental and non-government organizations with interests in and responsibilities for habitat management in the UMRS were obtained to identify institutional intent with respect to UMRS habitat. The institutional intent was evaluated by examining the mission statements of agencies and organizations, resources identified as being important or as the target of management activities, and statements in management plans about UMRS habitat.

During April and May 1999, the National Audubon Society and Upper Mississippi River Conservation Commission convened public meetings at 12 locations on the Upper Mississippi River System. Maps showing local river resources were provided prior to the formal program portion of each meeting. Following two informative presentations about the condition of the river system, meeting participants were invited to respond to the following questions:

I: What are the important natural resources in the Mississippi (Illinois) River ecosystem?

II: What do you think are the problems and opportunities in the river ecosystem?

III: How will you recognize successful restoration of the river ecosystem?

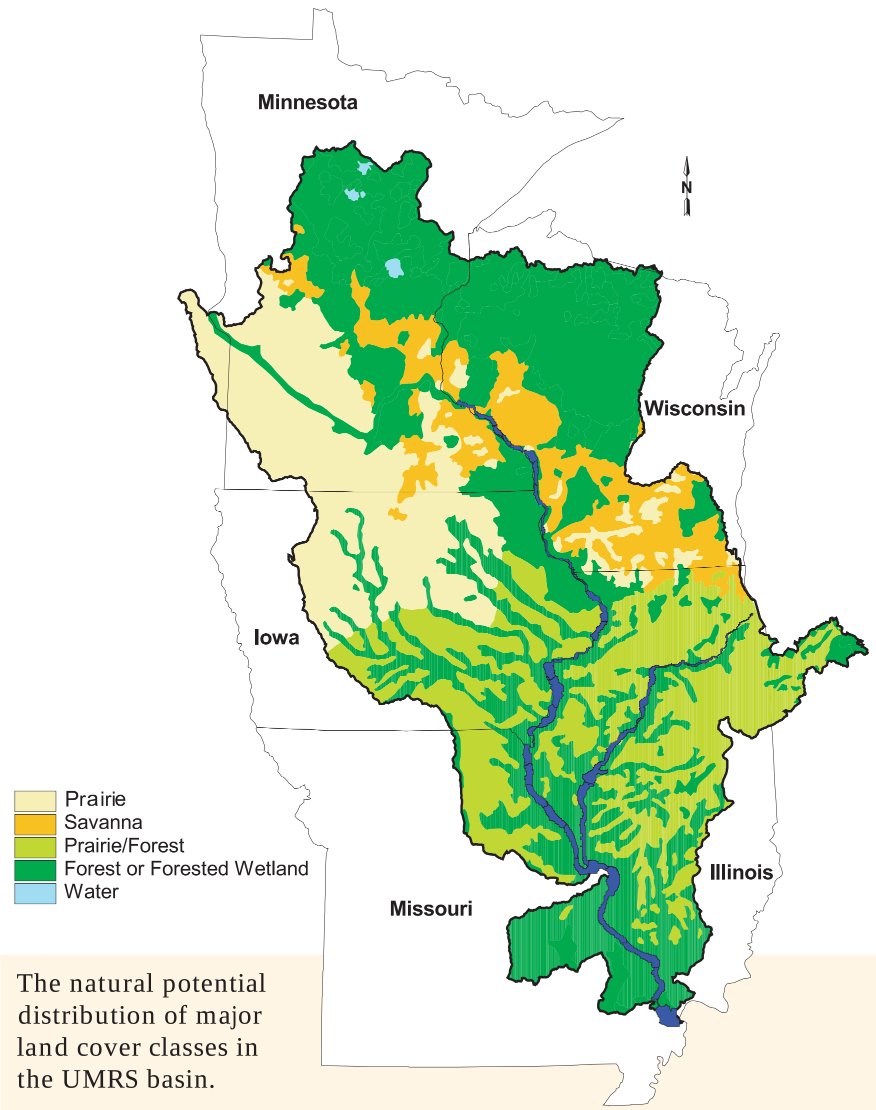
Focus groups convened by the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the Upper Mississippi River Basin Association were the second method used to obtain public views of UMRS resources and the HNA process. Various river interests were reflected in the 92 focus group participants, including perspectives from environmental groups, industrial and transportation groups, fishers and hunters, landowners, and river residents. A presentation on the HNA process and results was followed by facilitated discussions on three points developed by the HNA Public Involvement team: (1) to gauge public reaction to details of the HNA process; (2) to capture public perspectives of desired future habitat conditions; and (3) to capture perspectives and preferences for future public involvement in the HNA/EMP process.

Historical Change in Upper Mississippi River System Habitats

Prior to widespread European settlement of the region, the Upper Mississippi River Basin was a diverse landscape of tallgrass prairie, wetlands, savannas, and forests. Logging, agriculture, and urban development over the past 150 years has resulted in the present landscape that is more than 80 percent developed. Millions of acres of wetland drainage, thousands of miles of field tiles, road ditches, channelized streams, and urban stormwater sewers accelerate runoff to the mainstem rivers. The modern hydrologic regime is highly modified, with increased frequency and amplitude of changes in river discharge. Dams and river regulation throughout the basin also modify river flows. The modern basin landscape delivers large amounts of sediment, nutrients, and contaminants to the river.

At the system-wide scale there were natural gradients in habitat among river reaches. Northern river reaches were more forested and were composed of mixed silver maple forests, river channels, seasonally flooded backwaters, floodplain lakes, marsh, and prairie. Beginning around the northern Iowa border and along the lower Illinois River, grasslands and oak savanna dominated floodplain plant communities. Historic surveys reveal a higher proportion of oaks and other mast trees in the forest community than at present. Below the Kaskaskia River, the floodplain was heavily forested with species characteristic of southern bottomland hardwood communities. Impacts of river floodplain development include forest loss and water gain in northern reaches, and grassland and forest losses in the rest of the UMRS. (Table 4, Fig. 10).

At the pool scale since impoundment, sediment accumulation and littoral (i.e., wind and wave) processes in the navigation pools have greatly altered aquatic habitats.



The natural potential distribution of major land cover classes in the UMRS basin.

Table 4. Percent composition of land cover types in selected Upper Mississippi and Illinois River reaches in pre-settlement (ca. early 1800s) and contemporary (1989) periods.

Geomorphic Reach	Pool	Pre-Settlement Open Water	Pre-Settlement Marsh	Pre-Settlement Prairie	Pre-Settlement Timber	Pre-Settlement Swamp	Contemporary Open Water	Contemporary Marsh	Contemporary Prairie	Contemporary Timber	Contemporary Swamp	Contemporary Developed	Contemporary Agriculture
1	--	--	--	--	--	--	--	--	--	--	--	--	--
2	4	49.8	1.5	7.9	40.2	0.2	53.0	6.0	5.0	23.0	0.0	5.0	8.0
3	8	21.0	14.8	8.0	55.5	0.6	52.8	8.1	9.8	17.7	0.0	11.1	0.5
4	13	19.7	4.5	35.1	39.1	1.6	19.6	18.3	5.3	18.6	0.0	6.6	31.6
5	17	14.6	0.7	57.0	25.8	1.9	25.4	1.8	6.6	28.4	0.0	5.4	32.4
6	--	--	--	--	--	--	--	--	--	--	--	--	--
7	22	13.3	0.0	35.0	51.7	0.0	9.9	0.1	3.6	12.2	0.0	1.8	72.4
8	24	13.2	0.1	46.4	40.3	0.0	10.3	0.7	3.3	13.4	0.0	0.9	71.4
	25,26	18.3	0.4	46.3	35.0	0.0	17.9	1.3	5.6	18.6	0.0	3.1	53.4
9	--	--	--	--	--	--	--	--	--	--	--	--	--
10	OR	6.9	0.0	0.0	86.7	6.4	3.6	0.0	2.4	20.9	0.0	0.4	68.0
IR 2	LaGr	15.3	2.4	20.3	57.5	4.1	17.5	1.9	9.8	22.9	0.0	2.5	45.4

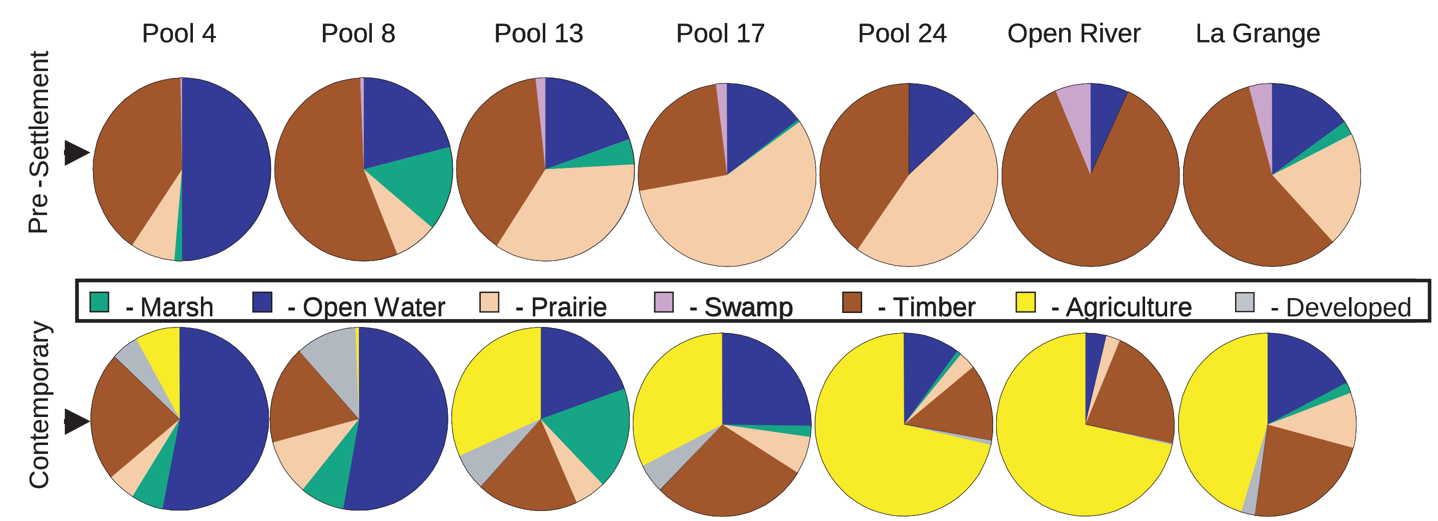


Fig. 10. Presettlement and contemporary land cover in selected Upper Mississippi and Illinois River reaches illustrates the conversion of natural communities to water and agriculture.

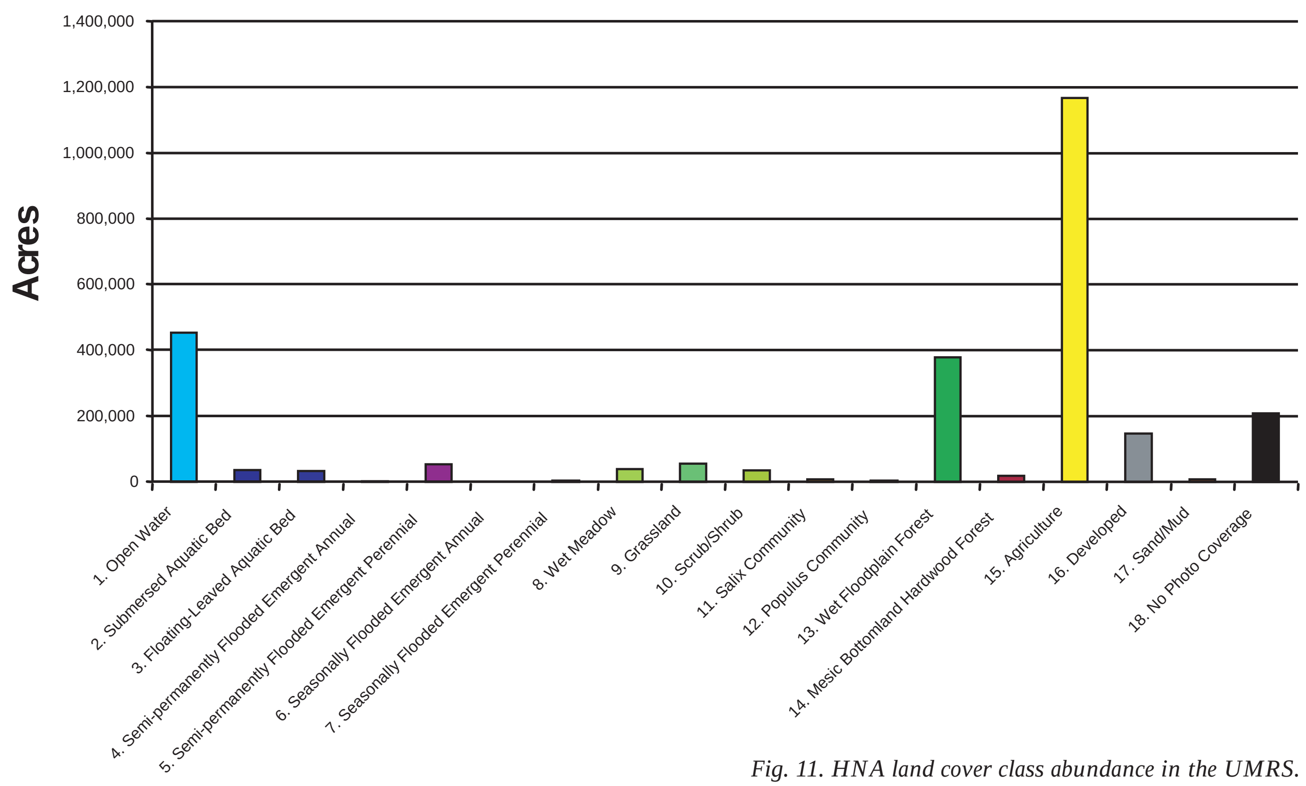


Fig. 11. HNA land cover class abundance in the UMRS.

Land Cover

The Upper Mississippi River System floodplain area encompasses over 2.6 million acres (Fig. 11). Agriculture is the dominant land cover class, occupying about 50 percent of the floodplain. Open water is the second dominant land cover class, covering 17 percent of the floodplain. Floodplain forests follow closely, occupying 14 percent of the floodplain. None of the other classes exceeds 10 percent of the floodplain area, and only developed land areas exceed 5 percent.

Land cover classes are unevenly distributed throughout the river system, and the absolute floodplain area of river reaches and pools may also differ greatly (Fig. 12). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture dominates the floodplain south of Rock Island, Illinois (Pool 14), and open water occupies a greater proportion of the floodplain between Minneapolis (Pool 1) and Clinton, Iowa (Pool 13). Wetland classes are generally more abundant between Minneapolis and Clinton. Grasslands are fairly evenly distributed but are rare throughout the river system. Woody classes are important throughout the river system and generally occupy between 10 to 20 percent of the floodplain.

Floodplain and Aquatic Areas

Geomorphic areas, or aquatic and terrestrial features within river reaches, are parts of the river system that have similar geologic origins, formed by similar river processes or manmade structures. They include channel, backwater, and floodplain areas. Aquatic areas are either contiguous (connected with the river) or isolated (normally not connected with the river). Similarly, floodplain areas are either contiguous or isolated from the river by levees. The geomorphic area data are limited to Upper Mississippi River Pools 4 through 26, the La Grange Pool, and the Cape Girardeau LTRMP study reach. The summary of the reach from Lake Pepin to St. Louis, Missouri shows that about 40 percent of the total floodplain area (including both aquatic

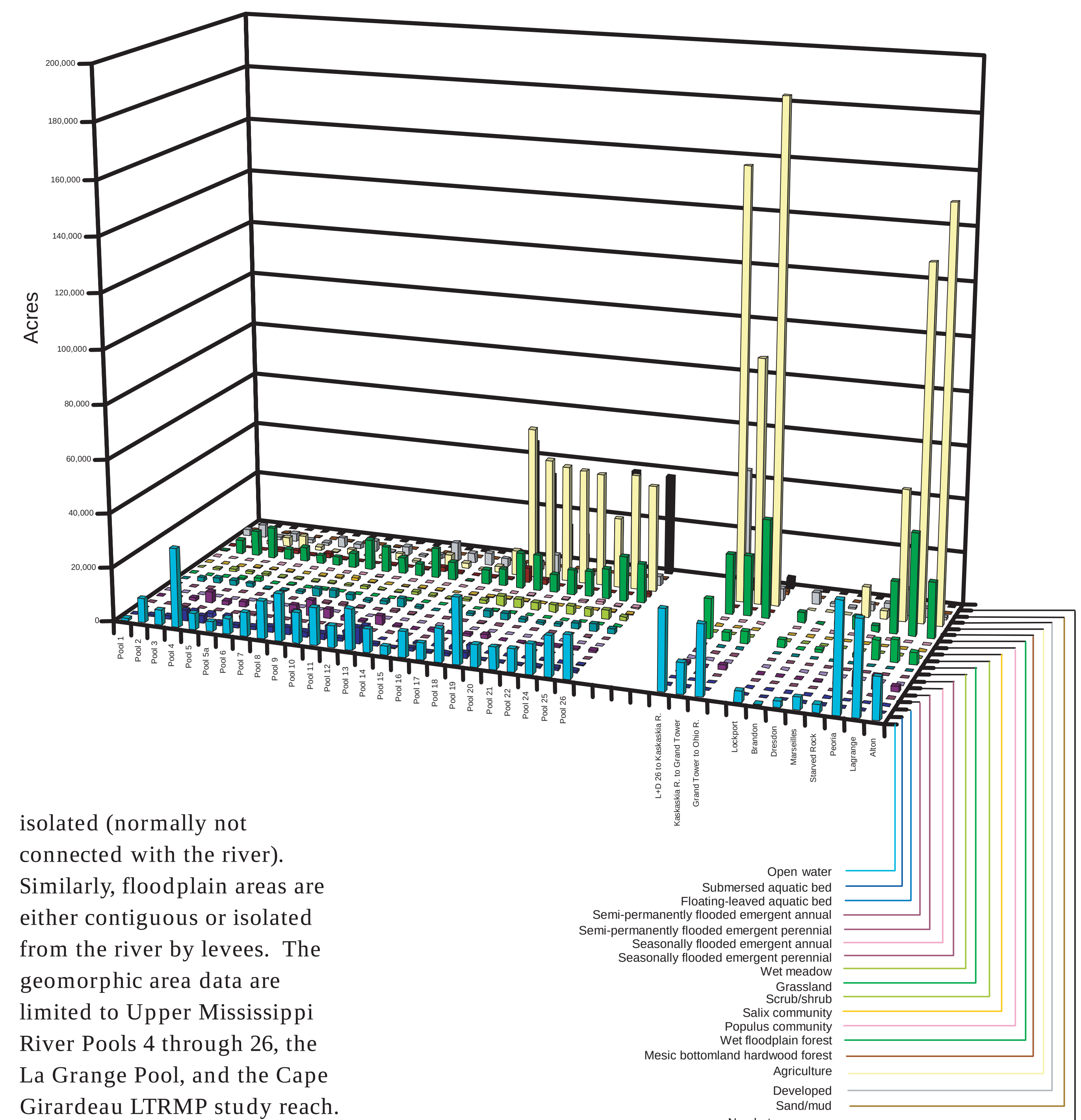


Fig. 12. System wide abundance of UMRS land cover classes.

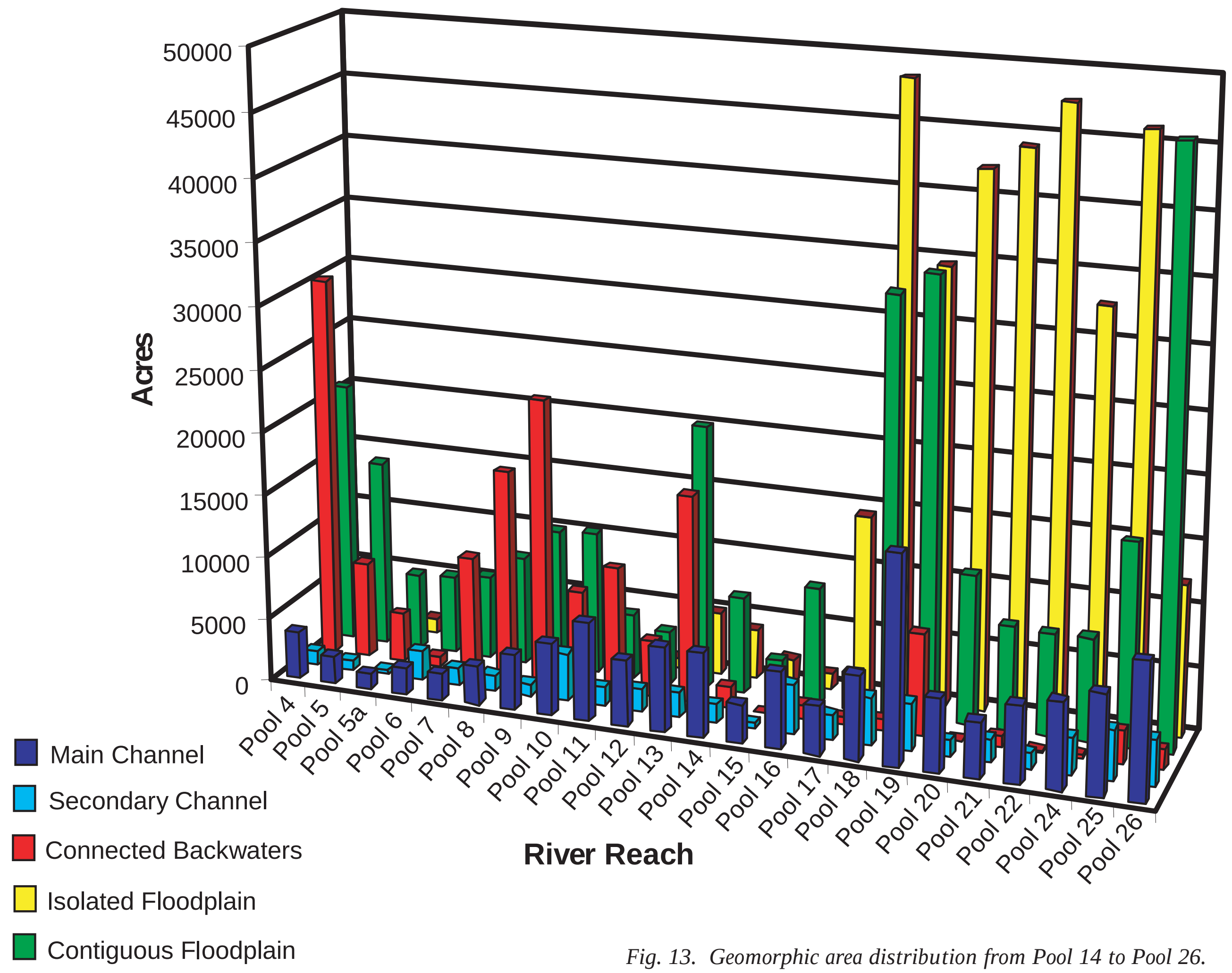


Fig. 13. Geomorphic area distribution from Pool 14 to Pool 26.

and floodplain areas) is leveed, but levees are concentrated south of Rock Island, Illinois (Fig. 13). This figure closely approximates the amount of agriculture in the floodplain. The distribution of leveed areas as proportion of total floodplain area is about:

- 3 percent north of Pool 13;
- 50 percent from Pool 14 through Pool 26;
- 80 percent in the Open River; and
- 60 percent of the lower 160 miles of the Illinois River.

Contiguous floodplain susceptible to seasonal flooding constitutes about 23 percent of the floodplain area system-wide. Islands are about 8 percent of the floodplain area, bringing the total terrestrial area to about 70 percent of the floodplain from Minneapolis to St. Louis.

The range of the proportional contribution of aquatic area types was 10 to 70 percent of the total river floodplain area, which is indicative of the geomorphic variability among river reaches and the differing effects resulting from impoundment. Backwater aquatic area classes are more prominent in the northern pooled reaches, and channel habitats are more prominent in the southern pooled reaches. Overall:

- channel border is 6.6 percent of the total area,
- impounded area is 4.6 percent,
- contiguous backwaters are 3.9 percent,
- secondary channels are 3.7 percent,
- navigation channel is 3.2 percent,
- shallow aquatic area is 2.8 percent,
- and isolated backwaters are 2.0 percent.

Tailwaters, tertiary channels, tributary channels, and excavated channels are 0.2 percent or less of the total floodplain area, respectively.

Terrestrial Habitat Distribution

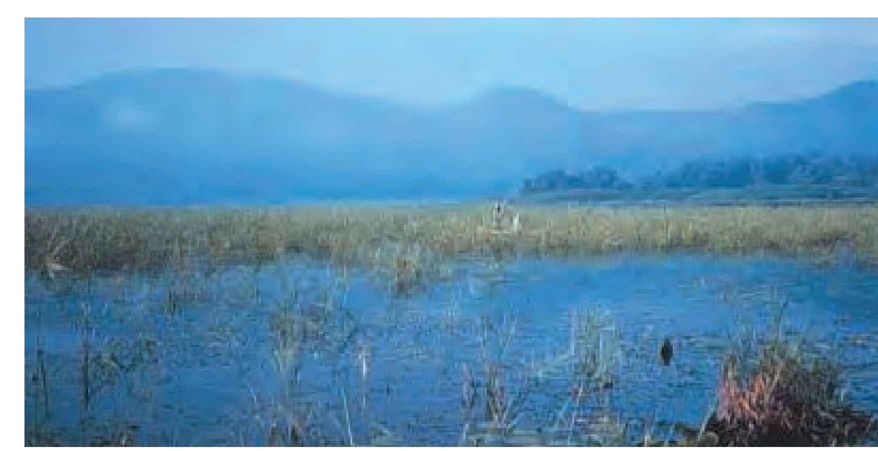
It is useful to examine the patterns of landscapes when assessing their ability to support desirable animal communities. An analysis of long-term change in several broad habitat classes helps assess general change over time. When examining existing conditions, or managing for discrete habitat or species, attention to fine details of habitat may be more appropriate.

U.S. Army Corps of Engineers

Grassland.

U.S. Army Corps of Engineers

Forest.



U.S. Geological Survey –
Upper Midwest Environmental Sciences Center

Marsh.

Grassland

The review of historic ecological change presented earlier clearly demonstrates the loss of grassland land cover from Iowa to southern Illinois. The extent of grassland fragmentation and conversion are the most extreme changes in many parts of the UMRS. Grassland patch connectivity has been highly reduced, and connectivity to other natural habitats has been reduced where agriculture or development are adjacent to grassland patches.

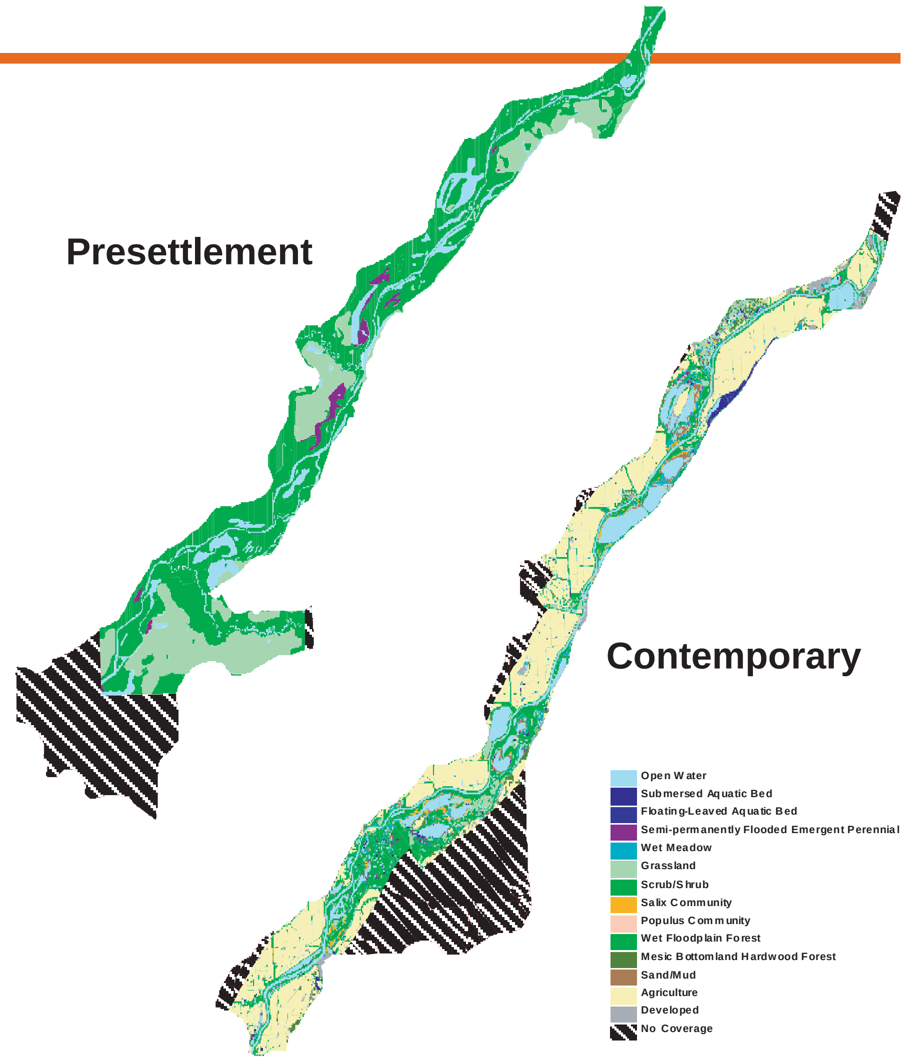
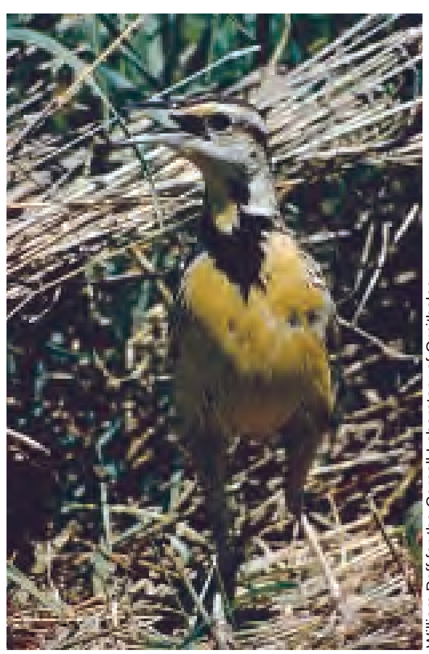


Fig. 14. As revealed in the historic land cover analysis, these maps illustrate the loss of grasslands in the La Grange Pool on the Illinois River south of Peoria.



William Paff for the Cornell Laboratory of Ornithology

Meadowlark.

Allen Blake Sheldon

Prairie Kingsnake.

Forest

Forest was and remains an important component of the floodplain landscape for many reptile, amphibian, bird, and mammal species. Contemporary forests are distributed differently and have different species composition than in the past. They are even aged and have low tree species diversity. Changes in response to river and floodplain development differ among geomorphic reaches. Floodplain forests in northern pooled reaches were replaced mostly by water impounded by dams and also by development. Forests remaining in the upper pooled reaches have species composition similar to the past. In the southern pooled reaches, the lower Illinois River, and the Open River south to the Kaskaskia River, open forests and grassland-oak savannas joining dense riparian forests and grasslands were eliminated, but riparian forests remain largely intact. In the Open River south of the Kaskaskia River, the floodplain was once almost completely forested, but was later cleared and levees were constructed to protect crops.

Christopher Crowley for the Cornell Laboratory of Ornithology

Red-Shouldered Hawk.

Allen Blake Sheldon

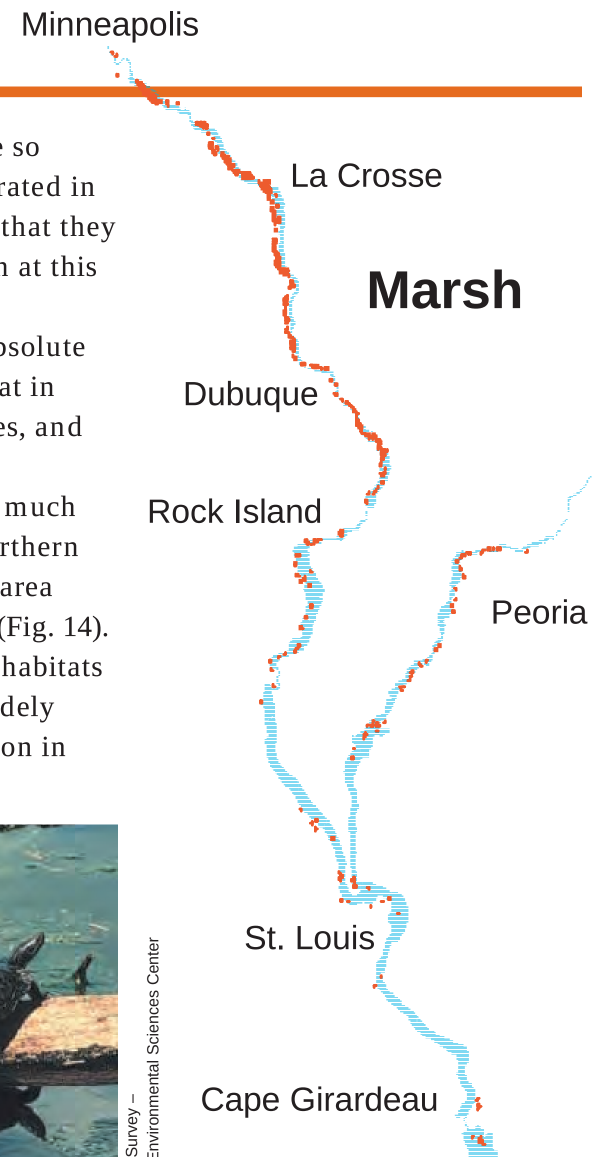
Tiger Salamander.

Marsh

Marsh fragmentation is difficult to assess because river marshes were not well mapped in early periods and they are inherently fragmented along backwater margins, wet meadows, and river banks. Generally, contemporary marsh communities are more abundant in northern river reaches than in southern reaches, where there are few backwaters, river water is turbid, and sediment quality is poor.

Marsh patches are so small and widely separated in southern river reaches that they can barely even be seen at this map scale.

There is greater absolute acreage of marsh habitat in northern pooled reaches, and the proportion of total floodplain area is very much greater, because the northern reaches have less total area than southern reaches (Fig. 14). In other words, marsh habitats are more abundant, widely distributed, and common in northern river reaches.



U.S. Geological Survey – Upper Midwest Environmental Sciences Center

Green Heron.

U.S. Geological Survey – Upper Midwest Environmental Sciences Center

Marsh turtles.

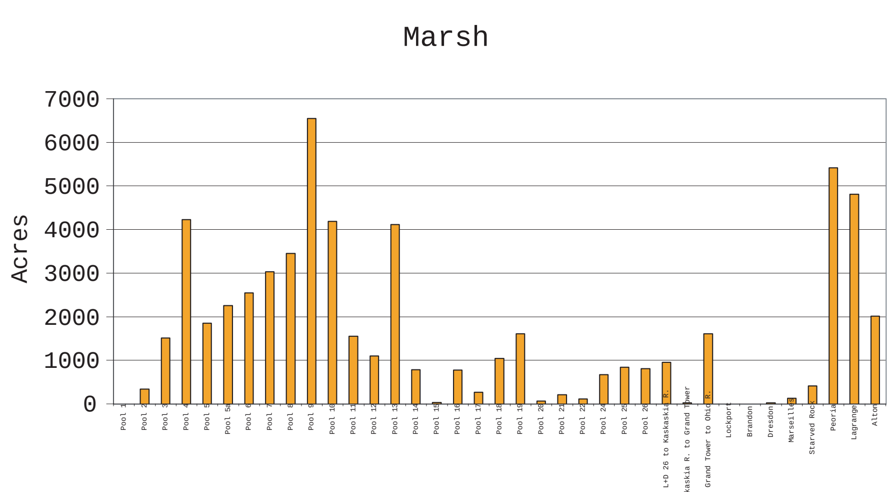
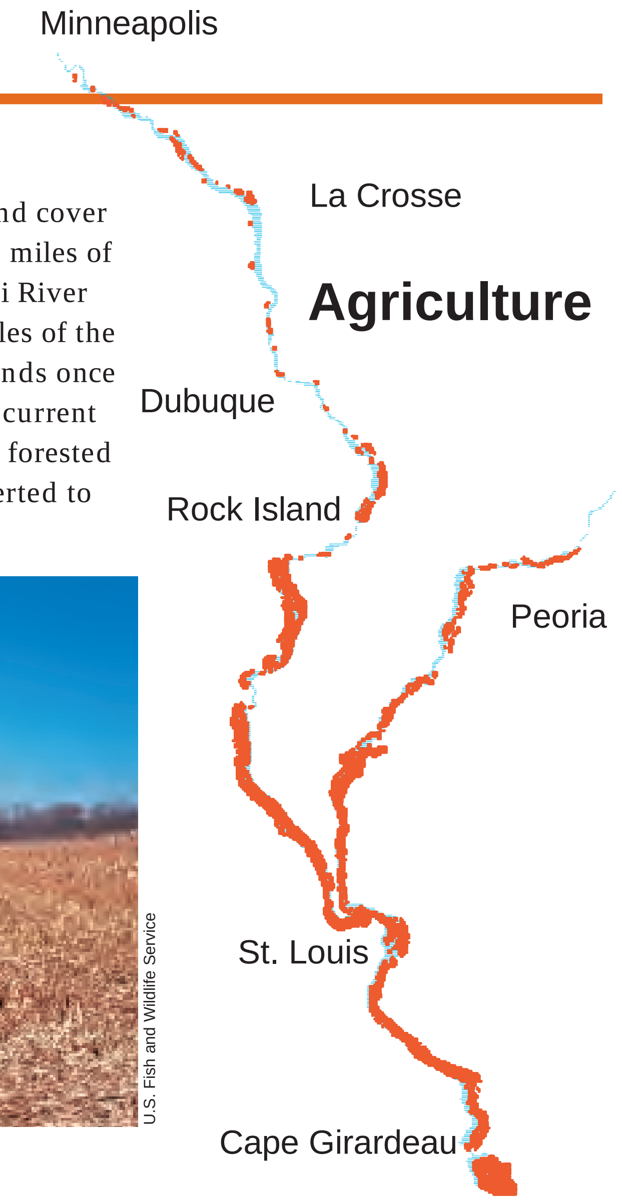


Fig. 14. Marsh distribution among UMRS reaches.

Agriculture

Croplands currently occupy about one-half of the total UMRS floodplain area, and agriculture is the dominant land cover class. Cropland distribution is skewed toward southern river reaches where levees protect the wide fertile floodplains. Agriculture is the largest continuous land cover class in the lower 500 miles of the Upper Mississippi River and the lower 200 miles of the Illinois River. Grasslands once occupied most of the current agricultural land, but forested areas were also converted to crops.



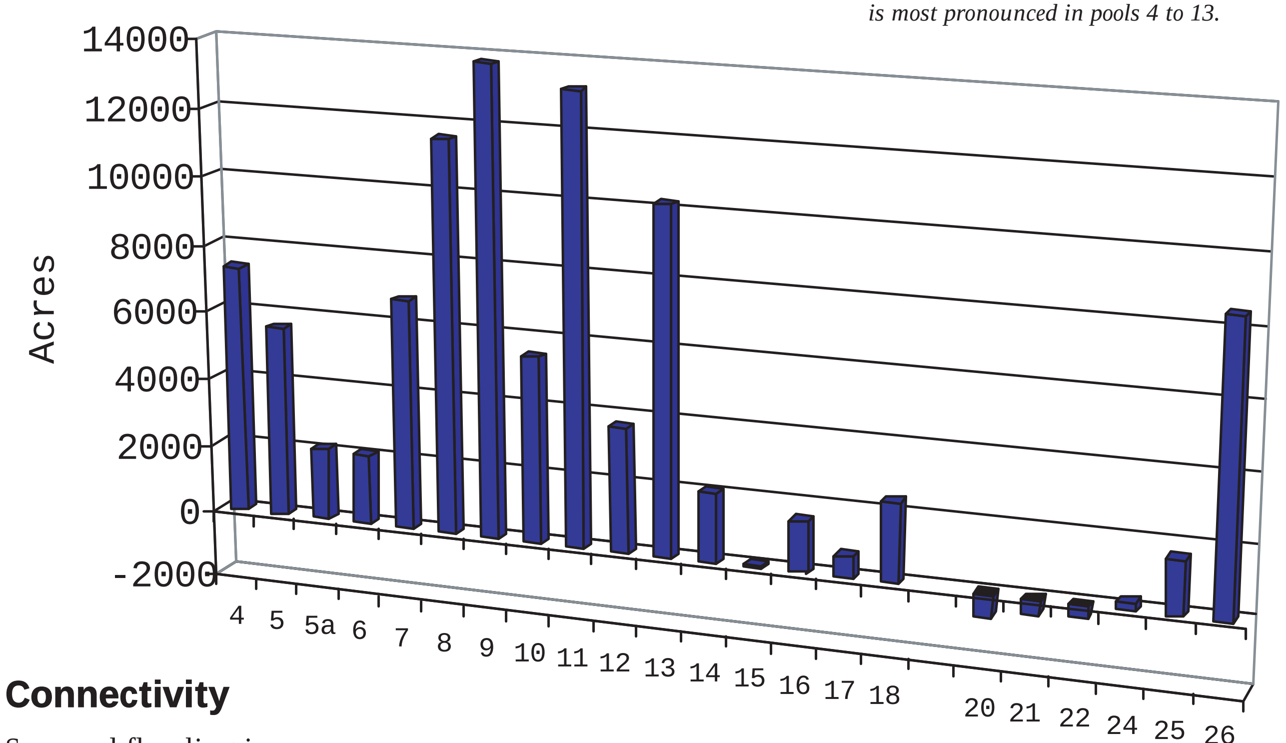
U.S. Fish and Wildlife Service

Corn harvest.

U.S. Geological Survey – Upper Midwest Environmental Sciences Center

Floodplain farms, south of St. Louis, dominate the landscape.

Fig. 15. The increase in aquatic area attributable to impoundment is most pronounced in pools 4 to 13.



Connectivity

Seasonal flooding is an ecologically important process in large river floodplain ecosystems because it connects the river with its floodplain. In the UMRS many low elevation floodplain areas are no longer subject to seasonal flooding because they are permanently flooded from impoundment by navigation dams. Comparing pre-dam and post-dam, total open water area has decreased or remained stable in Pools 5a, 6, 14 to 25, the Open River, and the Illinois River, but it increased in Pools 4, 5, 7 to 13, and 26 (Fig. 15). Stability implies that dams had little effect on the plan form outline and amount of open water area. Decreases in water area are attributable to several geomorphic processes including: loss of contiguous backwaters, filling of isolated backwaters, loss of secondary channels, filling between wing dams, and delta formation. Increases in water area are apparent where dam impacts inundated significant amounts of low elevation floodplain in lower pool areas.

Connectivity of UMRS aquatic habitats has also been modified by dams that block fish migration on the mainstem rivers and up into tributaries. Flood control and hydroelectric dams block access to over one-half of the length of tributary streams and rivers. Fish use tributaries for spawning and to seek refuge from harsh flow or water quality conditions on the main river. Upper Mississippi River System navigation dams are used to maintain low flow navigation, so the dams were constructed to allow high flows to pass freely through the dams with all gates open. Locks and dams 1 and 19 present nearly complete barriers to upriver fish migration because they are also hydroelectric dams with high fixed crests. The other dams are open from 1 to 30 percent of the time, which provides some opportunity for upriver fish passage (Fig. 16).

U.S. Army Corps of Engineers

Pool 5a clearly displays the impounded area and expanded backwaters created by the dam.

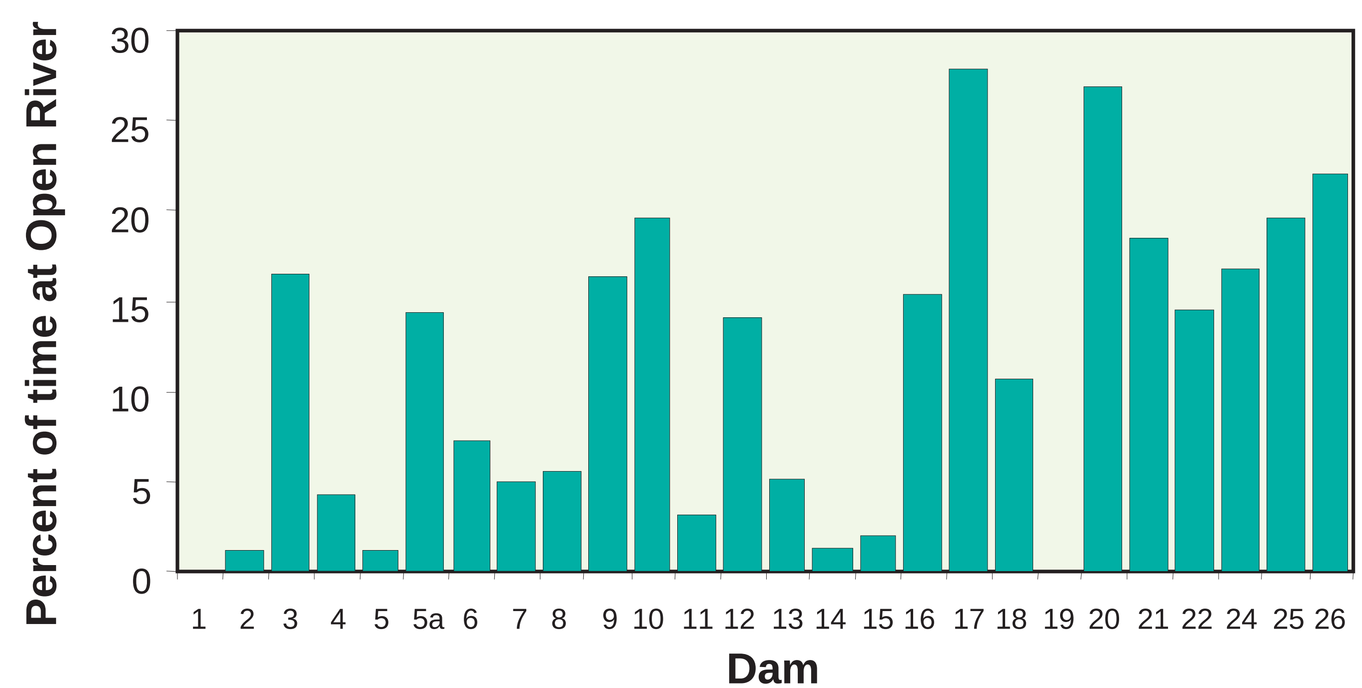


Fig. 16. Percent of time that UMRS dams have all gates open.

Fragmentation

Natural habitats are highly connected south of Minneapolis to Clinton, Iowa, because there is abundant public land (Fig. 17). However, discontinuity in the distribution of public lands and levees (Fig. 18) has resulted in significant habitat fragmentation south of Rock Island and along the lower Illinois River (Fig. 19). The riparian forest remains fairly contiguous in a narrow band along the longitudinal gradient of the rivers, but large tracts of other native floodplain terrestrial communities only remain as remnants in the national wildlife and fish refuges and state conservation areas.

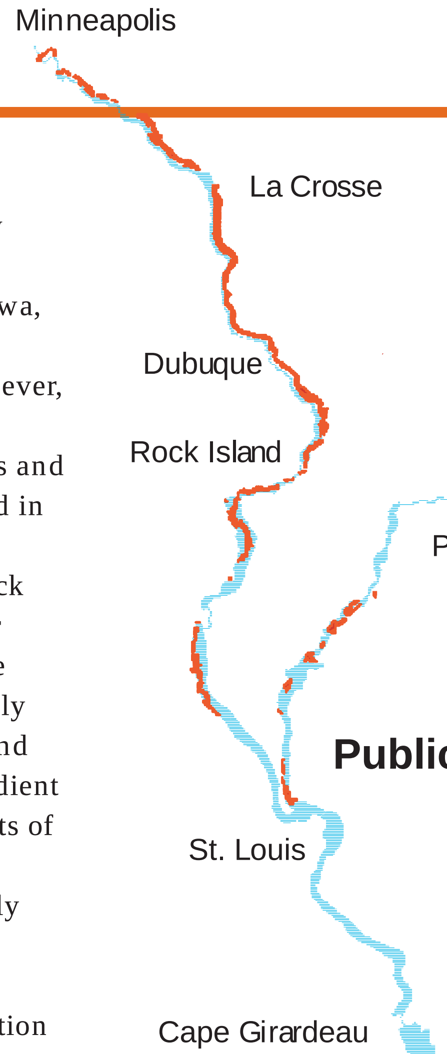


Fig. 17.
Public land distribution in the UMRS.

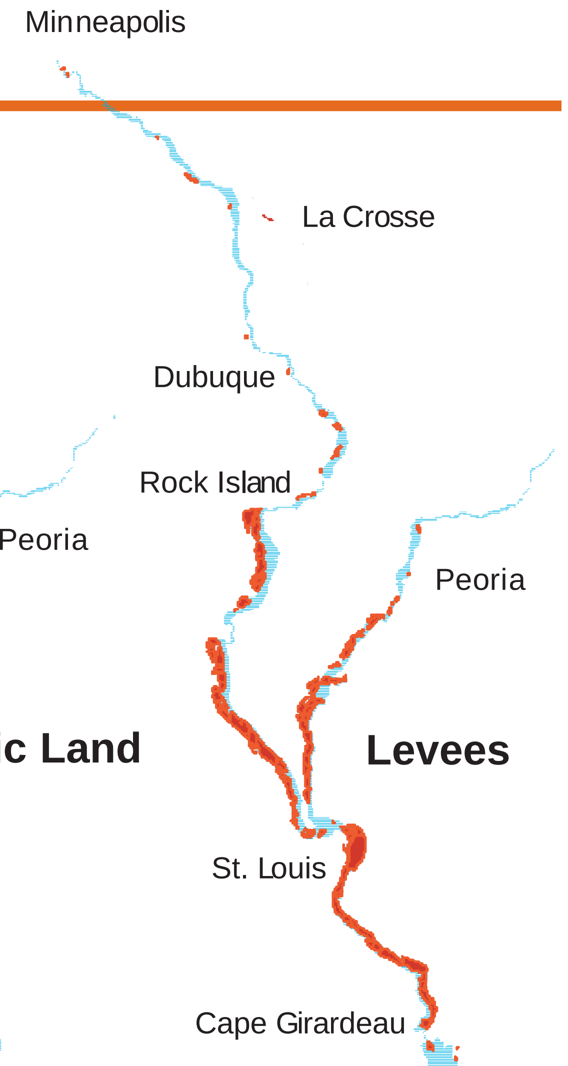


Fig. 18.
Levee distribution in the UMRS.

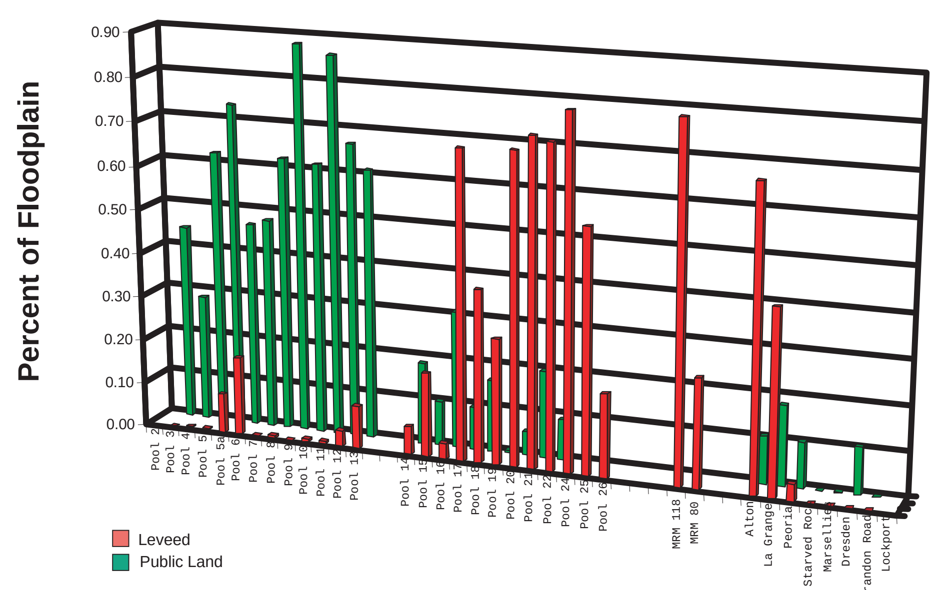


Fig. 19. Proportional abundance of leveed area and public land in the UMRS.

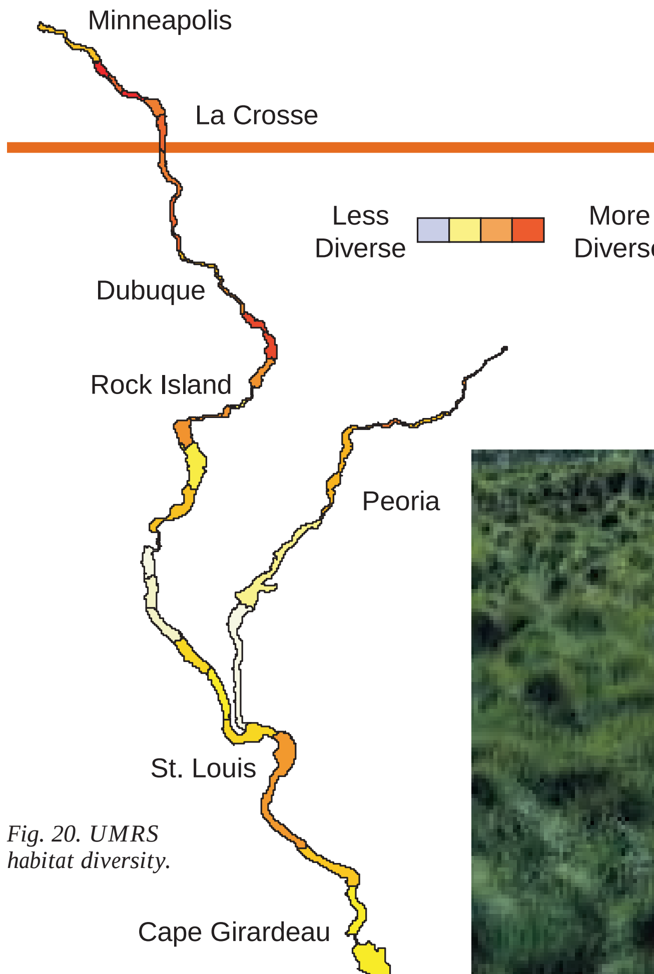


Fig. 20. UMRS habitat diversity.

U.S. Geological Survey – Upper Midwest Environmental Sciences Center

Agriculture is an obvious low diversity environment but even natural communities such as this sedge marsh can have few species.

Diversity

Habitat diversity is a measure of the different types of habitats, their size, and their relative abundance in a defined area. Habitat diversity can be calculated for both land cover and geomorphic areas. Land cover diversity is highest along Minnesota, Wisconsin, and northern parts of Illinois and Iowa (Fig. 20). Pools 1 to 4, 14 to 19, and the Illinois River have moderate diversity. Pools 1 and 15 are highly urbanized, Pool 18 and Alton Pool are highly agricultural and have incomplete data. Pool 20 and southward have the lowest diversity scores. These lower reaches are highly developed for agriculture. Geomorphic area diversity follows a pattern very similar to land cover diversity.

U.S. Geological Survey – Upper Midwest Environmental Sciences Center

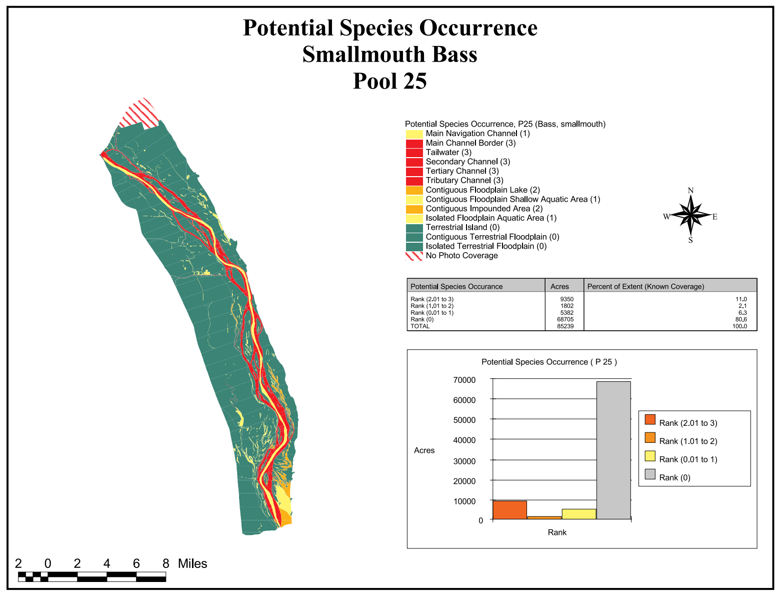
A more diverse marsh supports many different types of herbaceous and woody plants.

Query Tool Application

The HNA query tool represents a great advance in the application of GIS tools to UMRS natural resource management. However, this version of the tool was constructed to operate at the system-wide scale, and is therefore quite general due to the resolution of available system-wide data. The basic query tool calculates the potential acreage of occurrence for species or guilds based on their preferred land cover and geomorphic area classes (Fig. 21). It can also summarize land cover within a defined area and report the species likely to occur within the area (Fig. 22). The query tool was designed to allow users to select three levels of habitat preference (Fig. 23).

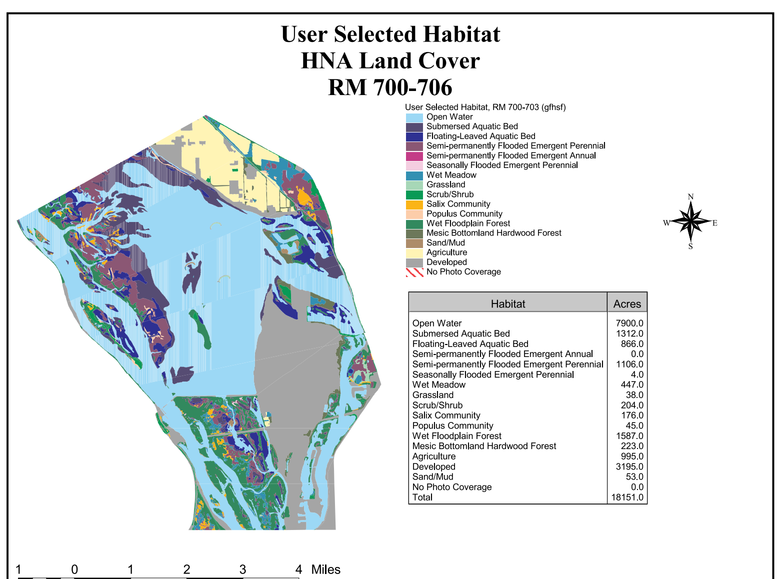
The variability of species life history requirements can greatly influence their potential habitat estimate. Widespread species, or "habitat generalists," have very large potential occurrence estimates (Fig. 24). For habitat specialists that are adapted to one or few land cover types potential habitat predictions may be quite small (Fig. 25).

The query tool presently incorporates land cover and geomorphic area data, an advanced version of the tool incorporates more data layers to define habitat in more detail and to create better habitat models. The application of the advanced tool is currently limited because data necessary to use it to its full capability are still lacking for most of the river system.



Potential Species Occurance	Acres	Percent of Extent (Known Coverage)
Rank (2.01 to 3)	9350	11.0
Rank (1.01 to 2)	1802	2.1
Rank (0.01 to 1)	5382	6.3
Rank (0)	68705	80.6
TOTAL	85239	100.0

Fig. 21. An example of a species query output.

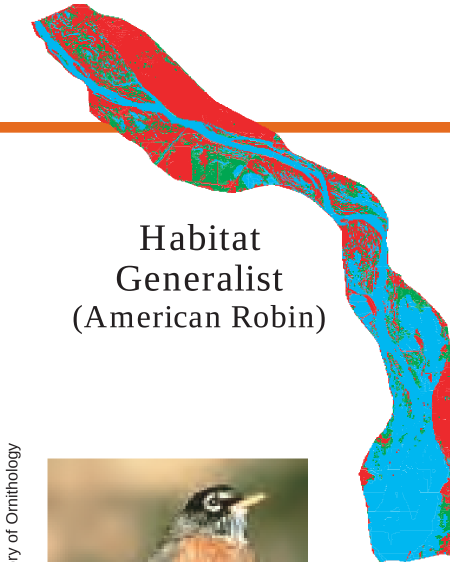


Habitat	Acres
Open Water	7900.0
Submersed Aquatic Bed	1312.0
Floating-Leaved Aquatic Bed	866.0
Semi-permanently Flooded Emergent Annual	0.0
Semi-permanently Flooded Emergent Perennial	1106.0
Seasonally Flooded Emergent Perennial	4.0
Wet Meadow	447.0
Grassland	38.0
Scrub/Shrub	204.0
Salix Community	176.0
Populus Community	45.0
Wet Floodplain Forest	1587.0
Mesic Bottomland Hardwood Forest	223.0
Agriculture	995.0
Developed	3195.0
Sand/Mud	53.0
No Photo Coverage	0.0
Total	18151.0

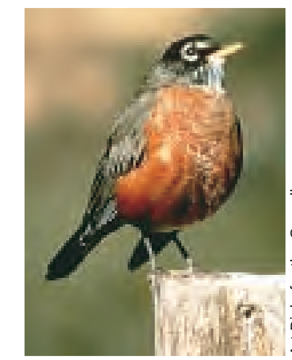
Fig. 22. An example of a habitat query. A list of species likely to occur within habitats is also provided.

O.S. Pettingill for the Cornell Laboratory of Ornithology

Red-winged blackbird.



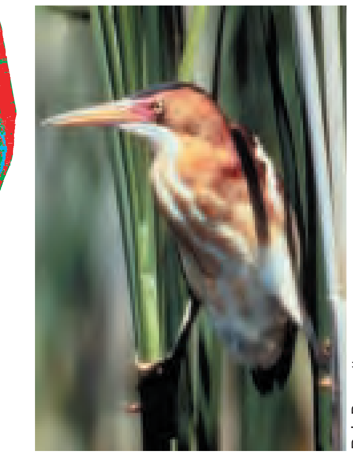
Habitat Generalist (American Robin)



Art Biale for the Cornell Laboratory of Ornithology

Fig. 24. Robins and other common birds tend to use many habitat types.

Habitat Specialist (Least Bittern)



Rob Bennetts

Fig. 25. Bittern and other uncommon birds may be specially adapted to a narrow range of habitats.

Pool 25 – Potential red-winged blackbird habitat

High 4,150 acres + Medium 44,199 acres + Low 459 acres = Total potential habitat 48,808 acres

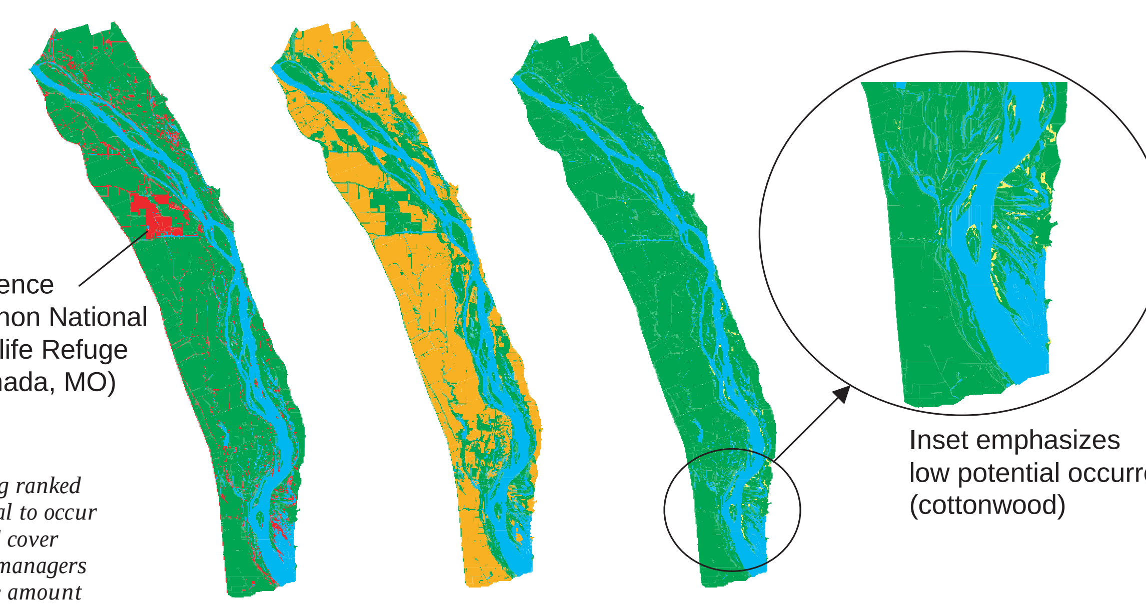


Fig. 23. Having ranked species potential to occur in specific land cover classes allows managers to visualize the amount of good or poor habitat.

High Potential Occurrence

Medium Potential Occurrence

Low Potential Occurrence

Forecast Future Condition

Quantitative Geomorphic Change

The plan form features of the UMRS are quite stable and are not projected to change much in absolute area over the next fifty years. The projected changes for all the pools along the UMR include a prediction that total water area will decrease by only 1.4 percent by the year 2050. The area of aquatic area classes is predicted to change as follows:

contiguous backwaters decrease by 2.1%;

isolated backwaters decrease by 3.6%

main channel decreases by 0.7%;

secondary channels decrease by 2.6%;

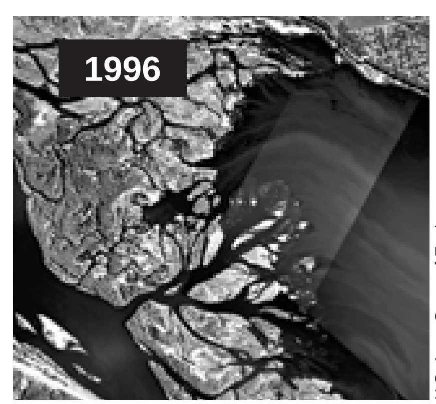
island area decreases by 2.0%.

Island loss is largely due to island erosion predicted to occur in Reach 3. For many other reaches, the area of islands actually increases. Overall, the total perimeter of islands is predicted to decrease by 3.7%. The acreage change predictions should not be considered to be precise estimates of change, but should rather be considered as indicators of the types and general amounts of changes likely to occur in the future. Also, it must be emphasized that the predictions include changes in surface area only, and do not account for many factors that affect habitat quality.

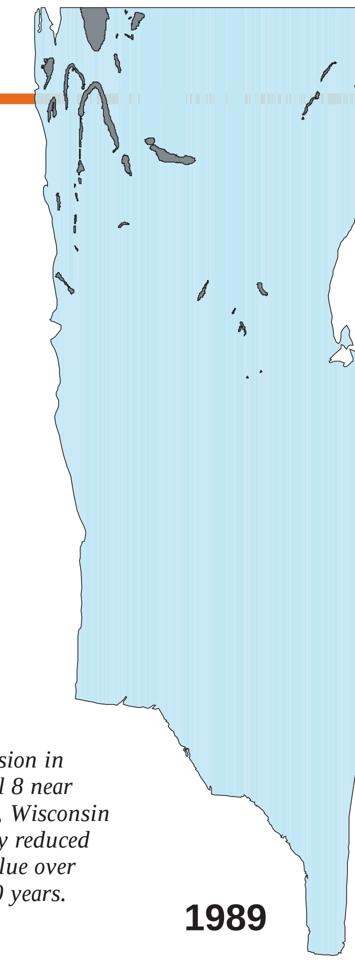
The Cumulative Effects Study projected geomorphic change for much of the UMRS and concluded that Reach 3 (Pools 5-9) has been and is predicted to continue to be dominated by island erosion. Reach 3 (Pools 5-9) is the only reach where total open water area is expected to increase. This is due to the predicted continued erosion of islands in the reach. In all other reaches, total water area is expected to decrease, including both isolated and contiguous backwater areas.

Reaches 4 through 10 (Pools 10 – Open River) have all experienced loss of contiguous backwater, especially reaches 6 through 10 (Pools 18 – Open River) where loss of isolated backwater has also been occurring. Generally, both of these processes are expected to continue for these reaches.

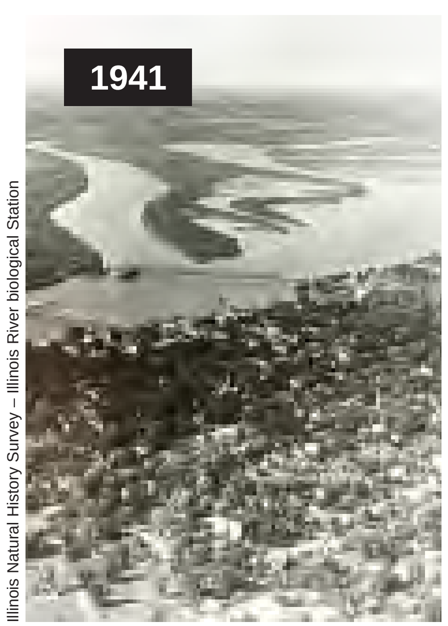
Filling between wing dams decreases main channel area.

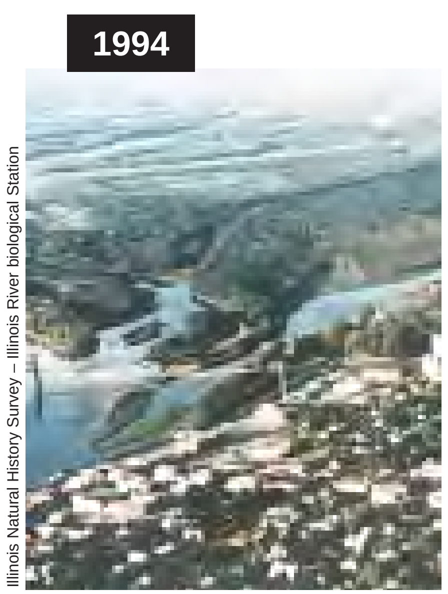


Deltas can encroach into a variety of aquatic habitats. This is sometimes beneficial to support high habitat diversity, but will also result in loss of aquatic area.



Island erosion in lower Pool 8 near La Crosse, Wisconsin has greatly reduced habitat value over the last 60 years.





These photos of Muscooten Bay near Beardstown, Illinois dramatically demonstrate the high sedimentation rate in the Illinois River Valley. Thousands of acres of backwaters have been lost or degraded.

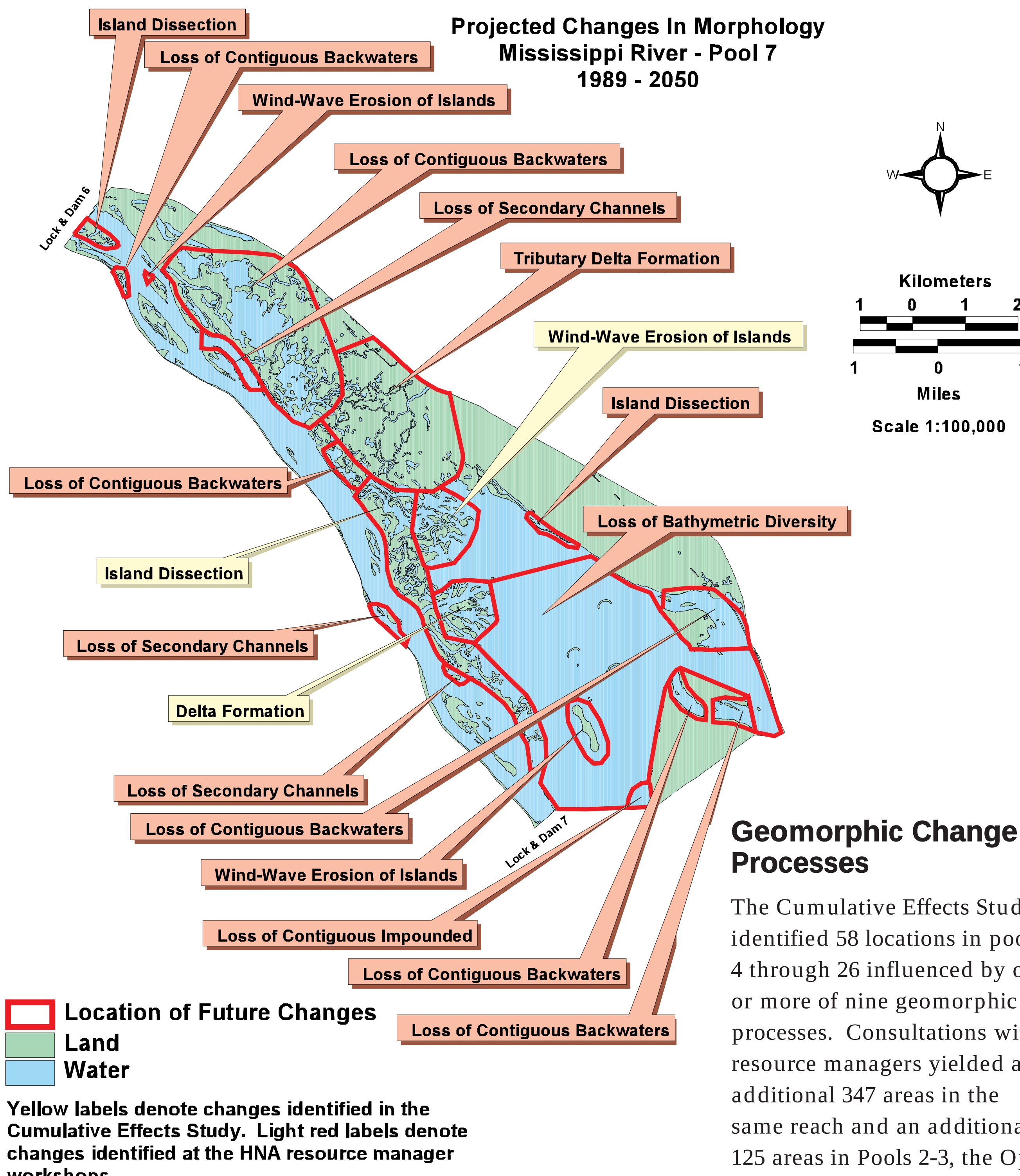


Fig. 26. Resource managers identified areas expected to change throughout the UMRS similar to this example from Pool 7 near La Crosse, Wi.

Geomorphic Change Processes

The Cumulative Effects Study identified 58 locations in pools 4 through 26 influenced by one or more of nine geomorphic processes. Consultations with resource managers yielded an additional 347 areas in the same reach and an additional 125 areas in Pools 2-3, the Open river, and the Illinois River. A total of 530 areas expected to change were plotted on maps (Fig. 26; Table 5).

Table 5. Projected UMRS geomorphic change.

Geomorphic Process	Number of Occurrences
Channel Formation	3
Delta Formation	3
Filling between Wing Dams	34
Island Dissection	15
Island Formation	20
Island Migration	4
Loss of Contiguous Impounded	9
Loss of Bathymetric Diversity	12
Loss of Continguous Backwaters	153
Loss of Isolated Backwaters	49
Loss of Cont / Iso Backwaters	32
Loss of Secondary Channels	116
Loss of Tertiary Channels	5
Shoreline Erosion	8
Tributary Delta Formation	43
Wind-Wave Erosion of Islands	25

Table 6. Land cover class change predicted by the UMRS terrestrial vegetation successional model.

HNA Class	Total Existing Acres	Predicted Change (acres)	Predicted Change (percent)
1. Open Water	452,587	–33,095	–7.3
7. Seasonally Flooded Emergent	3,750	4,281	114.2
8. Wet Meadow	38,449	10,389	27.0
9. Grassland	54,454	0	0.0
10. Scrub / Shrub	34,393	–14,142	–41.1
11. Salix Community	6,357	14,418	226.8
12. Populus Community	3,294	6,277	190.6
13. Wet Floodplain Forest	378,282	–6,376	–1.7
14. Mesic Bottomland Hardwood Forest	17,989	14,402	80.1
15. Agriculture	1,166,691	0	0.0
16. Developed	147,277	0	0.0
17. Sand / Mud	6,308	4,640	73.6
18. No Photo Coverage	207,808	0	0.0

Floodplain Vegetation Succession

Open water and scrub-shrub habitats are projected to decline. No change is predicted for grassland, agriculture, and developed area. Small increases are projected for wet meadow. Rather large changes are projected for early successional stage communities (i.e., willows and cottonwoods). Increased sand-mud is due to loss of open water area. The simple rule-based terrestrial vegetation successional model probably overestimates the amount of early successional species likely to occur on the UMRS.

Desired Future Habitat Conditions

A primary element of the Environmental Management Program Habitat Needs Assessment was to identify the various natural resource management agencies' and the publics' desired future mix of habitats throughout the Upper Mississippi River System. This effort was pursued through review of recent agency management plans, a series of meetings with the public, and a series of workshops with river scientists and natural resource managers. In general, agency management plans were found to lack specific quantified objectives for specific land cover or habitat classes. Certain documents such as the recently completed Partners in Flight Bird Conservation Plans and the Upper Mississippi & Great Lakes Region Joint Venture Implementation Plan articulate goals to restore avian populations to specified levels, and contain state-by-state objectives for habitat management and restoration. Through the resource manager meetings, we obtained rather uniform qualitative expressions for future desires, but quantitative estimates of desired future habitat conditions were more variable depending on the part of the river considered. The desired future conditions identified in this first Habitat Needs Assessment can be considered a good first approximation of goals for habitat protection and restoration for the UMRS. It is likely that future desires, and thus habitat needs, will be revised as new information is obtained and the public has an opportunity to provide additional input.

Consultations with Resource Managers and Scientists

The workshops with resource managers resulted in fairly consistent qualitative expressions of future desires. In particular, resource managers and scientists indicated that the future should be characterized by: improved habitat quality, habitat diversity, and a closer approximation of the pre-development hydrologic regime. They believe these changes are critical to the sustainable ecological integrity of the river ecosystem. Deep backwaters, grasslands, hardwood forests, and marsh habitats were rated the most threatened habitats. River regulation, sedimentation, and floodplain development were rated as the primary stressors affecting river habitats.

The qualitative assessments revealed which habitats are threatened or degraded and in need of preservation or restoration at the pool scale. However, quantitative results from the workshops differed among river reaches due to differences in the quality and amount of information about existing and forecast future conditions. In particular, resource managers found existing data inadequate for an in-depth, uniform, system-wide quantitative habitat needs assessment. Also, of note is the concern that not all future habitat changes are detected by using estimates of geomorphic change and by relying on one-time "snapshots" of habitat conditions.

Despite these limitations, a first approximation of quantitative desired future habitat was identified and used to calculate habitat needs (see HNA Technical Report). This information represents the first time system-wide objectives have been identified for use in planning Habitat Rehabilitation and Enhancement Projects on the UMRS.

Scott D. Whitney

Deepwater marsh habitat.

U.S. Army Corps of Engineers

Floodplain grasslands.

Public Involvement

In 1996, the Long Term Resource Monitoring Program published the results of a public expectations survey. While the survey was not designed specifically for use in the Habitat Needs Assessment (HNA), it revealed that:

- 99% of respondents value the rivers for future generations,
- 70% of respondents want to control industrial pollution,
- 55% of respondents want improved water quality,
- 45% of respondents want improved fish and wildlife habitat,
- 25% of respondents want improved sport fishing, and
- 15% of respondents want less barge traffic.

The public involvement meetings, convened in April and May 1999 and used as input to the HNA, revealed five themes or areas of interest for the future of the Upper Mississippi River System:

- more fish and wildlife in general (habitat diversity, species diversity, and abundance),

- clean and abundant water,
- reduced sediment and siltation,
- balance between the competing uses and users of the river, and
- restoration of backwaters, side channels, and associated wetlands.

While the five themes were clear, there appeared to be slight regional variations in how the respondents expressed their views. These differences may be related to the quality of the habitat in their area or the degree of access for recreation.

Respondents cited the assurance of acceptable water quality and quantity for human consumption, industrial processes, and aquatic habitat conditions as a priority. Sedimentation was cited as a concern because it jeopardizes features such as backwater lakes, the navigation channel, recreational access to various areas, water quality, and riverbed conditions. Among the habitats of interest, backwater lakes and associated wetlands are of particular concern as fish spawning and overwintering sites, food sources during key periods for migratory waterfowl, and critical linkages to both terrestrial and deeper aquatic environments. In addition to the difficult and essential task of balancing competing uses that affect resource quality, it is noteworthy that respondents cited other "social" aspects of the river: the need for more citizen awareness and initiatives related to the river and the need to improve government agency coordination for consistent management and project completion.

In July-August 2000, a series of focus groups offered insights into the public's view of the HNA process itself. Participants in the focus groups generally thought the HNA is another useful tool for river resource management in the UMRS. The concept of using habitat classifications to frame river management issues was acceptable to the majority of participants; they were generally comfortable that the specified habitat classes chosen by the HNA developers were workable and useful. However, participants wanted more definition of those habitats, and many participants felt that more factors needed to be considered, such as water quality and the impacts of dynamic river processes on static habitat classifications. While focus group participants tended to think of river issues at a local level, the majority agreed that a broader scale was necessary for planning, at least at the system if not at the watershed level. Participants also generally accepted the use of presettlement river system conditions as a reference point, although concerns were raised about the compatibility of older data sources and the utility of incorporating in the planning process a river condition that could never again be replicated. Administrative aspects of the HNA that participants found particularly important were further development of the HNA, multiagency cooperation, and continued public involvement in and access to the HNA. Many participants expressed confusion about the actual application and end result of the HNA.

The desired future river conditions participants expressed generally reflected the five themes from the spring 1999 public meetings. A "multi-use" river was the most frequently expressed desired condition. Two conflicting, overarching desired conditions were expressed: a return to more naturally variable conditions and a stabilization of existing conditions. Other desirable river conditions expressed included a sustainable, natural river ecosystem and increased biodiversity. Most participants felt strongly that a diverse public should be continually involved in river management programs.

Unique Habitat Areas

Despite the extensive habitat changes brought about by development of the navigation system and floodplains, there are many unique habitat areas in the UMRS that provide examples of presettlement habitat conditions, are relatively undisturbed, and support high biodiversity. Unique habitat areas on the UMRS range from channels with gravel and bedrock substrate, to tributary delta areas, clear vegetated backwater lakes, mast-bearing (oaks, hickories, pecan) floodplain forests, cypress swamp forests, and remnant floodplain prairies. State Natural Heritage inventories have identified most of the unique habitat areas.

Many of the unique habitat areas are in public ownership and are protected. Some should be expanded to make the unique habitat areas more complete and buffered from disturbance. Other unique habitat areas are not publicly owned and are in need of protection.

Some examples of unique UMRS habitat areas include:

- Rush River Delta State Scientific and Natural Area, Mississippi River Pool 4
- Kellogg-Weaver Dunes State Scientific and Natural Area, Mississippi River Pool 5
- Reno Bottoms, Mississippi River Pool 9
- Sanganois State Fish and Wildlife Area, Illinois River
- Remnant cypress swamps, Shawnee National Forest, southern Illinois

Robert J. Hurt, Architectural Environments

An urban riverfront park in La Crosse, Wisconsin.

Habitat Needs

The EMP Habitat Needs Assessment defines habitat "needs" as the difference between "existing conditions" and "desired future conditions." To calculate "need," a system-wide accounting of existing, predicted, and desired habitat conditions was thus developed. This effort revealed some clear differences among river reaches. For example, land cover analysis clearly documents an abundance of certain valuable habitat types in northern river reaches, versus a scarcity of those habitats in southern river reaches. The differences are largely related to the amount and distribution of public land, the degree of floodplain development, the geomorphic form of the river, and effects of impoundment for navigation. In addition, analysis of geomorphic changes indicates that some changes (such as loss of backwaters) are systemic, while other changes (such as island dissection) are more localized. Understanding these differences can help identify what types of restoration efforts are most appropriate for each river reach.

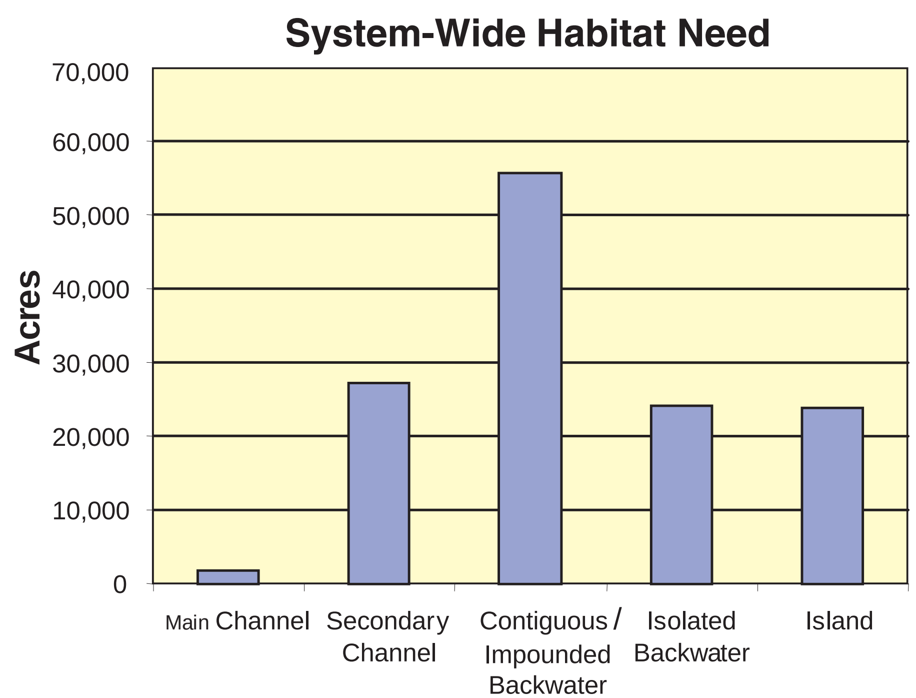
Though differences among reaches are significant, resource managers have generally concluded that habitats are currently degraded and expected to get worse. The factors responsible for degradation (e.g., sedimentation, impoundment, channelization, levees, etc.) also suggest the most promising avenues for ecological restoration.

Quantitative assessments of need are obviously difficult and thus do not provide precise estimates of change or need. Nor do the gross quantitative estimates suggest precisely where on the river changes are needed. Nevertheless this initial assessment, based on input from resource managers and scientists, identifies which types of geomorphic areas need emphasis in various river reaches and pools to achieve the broad restoration objectives.

Habitat Need* = Desired Future Condition – Existing Conditions

*Presumes existing desirable habitat is maintained.

- Main Channel
  - Main Navigation Channel
  - Main Channel Border
  - Tailwater
- Secondary Channel
  - Secondary Channel
  - Tertiary Channel
  - Tributary Channel
  - Excavated Channel
- Contiguous/Impounded Backwater
  - Contiguous Floodplain Lake
  - Contiguous Floodplain Shallow Aquatic Area
  - Contiguous Impounded Area
- Isolated Backwater
- Island



System-wide Habitat Needs

Create or restore:
– 1,700 acres of main channel habitat

– 27,000 acres of secondary channel habitat

– 55,500 acres of contiguous backwater habitat

– 24,000 acres of isolated backwater habitat

– 24,000 acres of island habitat

Upper Impounded Reach (Pools 1-13) Needs

Create or restore:
– 3,500 acres of main channel (i.e., main channel, channel border, and tailwater) habitat

– 9,300 acres of secondary channel habitat

– 24,000 acres of contiguous backwater or impounded backwater habitat

– 5,800 acres of isolated backwater habitat

– 1,000 acres of island habitat

Lower Impounded Reach (Pools 14-26) Needs

• Reduce main channel habitat by 1,800 acres

• Create or restore:
  – 9,000 acres of secondary channel habitat

  – 10,500 acres of contiguous backwater habitat

  – 5,000 acres of isolated backwater habitat

  – 3,000 acres of island habitat

Open River Reach Needs

• Create or restore 25,000 acres of backwater and secondary channel habitat, of which 7,000 acres should be isolated backwaters

• Increase the amount of prairie, marsh, and forest by about 100,000 acres

• Restore geomorphic processes that create and maintain sand bars and shoals

Illinois River Needs

• Restore existing backwaters so that 25 percent of backwater lakes (19,000 acres) have an average depth of 6 feet

• Increase depth diversity and connectivity throughout the river

• Restore hydrologic variability needed to restore and maintain existing backwater habitats

Estimates of needs are expected to nearly double by 2050 if no action is taken.

Information Needs

This first Habitat Needs Assessment for the UMRS reveals clear needs for additional information that is necessary to characterize river habitats. As an example, more detailed information is needed to improve the rule-based approach to predicting successional change of UMRS plant communities. Such a model should incorporate site characteristics (geomorphic unit type, hydrologic regime), and information on plant community response to disturbances (flood, wind, fire). Better information on existing floodplain plant communities is also needed. A list of information needs is presented below to help improve future UMRS Habitat Needs Assessments.

1. System-Wide High Resolution Topographic Data.
2. System-Wide Bathymetric Data
3. Numerical Hydraulic Models of all Navigation Pools
4. Substrate Type Characterization
5. Habitat Spatial Structure Metrics
6. Floodplain Inundation Models.
7. Floodplain Geomorphic Classification and Survey
8. Surveys of Existing Floodplain Plant Communities
9. Characterization of the Existing and Pre-Impoundment Hydrologic Regime
10. Confirmation / Validation of Species:Habitat Models Using Stratified Random Sampling Data
11. Development of Refined Life History Information
12. Development of Refined Species:Habitat Models
13. Analysis of Seasonal Habitat Availability

Conclusion

The Approach

The EMP Habitat Needs Assessment was designed to help guide future Habitat Rehabilitation and Enhancement Projects on the UMRS. To identify habitat needs, historical, existing, forecast, and desired future conditions were compared. Issues of scale are important in this regard because ecological processes and needs vary at the system, reach, and pool levels. In addition, a wide variety of habitat characteristics must be addressed including habitat fragmentation, connectivity, and diversity. To accomplish this assessment, a GIS tool and a new floodplain vegetation successional model were developed. These tools allow geomorphic and land cover characteristics to be translated into the potential for species to occur.

The Results

Over time, the landscape, land use, and hydrology of the Upper Mississippi River and its basin have changed. Much of the grasslands, wetlands, and forests have been converted to agriculture use, which now accounts for 50 percent of the floodplain. Impoundment, channelization, and levee construction have altered the hydrologic regime and sedimentation patterns, resulting in loss of backwaters, islands, and secondary channels. While future changes in broad geomorphic features are expected to be relatively small, habitat degradation is expected to continue. There is a broadly recognized need among resource managers and scientists for improved habitat quality, increased habitat diversity, and a closer approximation of pre-development hydrologic variability.

The Habitat Needs Assessment identified clear differences in habitat types and conditions among river reaches. Those differences are largely related to the amount and distribution of public land, degree of floodplain development, the geomorphic form of the river, and the effects of impoundment for navigation. The differences also suggest that habitat needs and restoration objectives will vary by river reach and pool.

The Habitat Needs Assessment yielded gross quantitative and qualitative estimates of habitat needs both system-wide and within river reaches. These estimates provide the first approximation of a set of system-wide objectives for Habitat Rehabilitation and Enhancement Projects. While they do not offer quantitatively precise goals, they will help focus future planning on the most important geomorphic processes both system-wide and in specific river reaches. However, perhaps the greatest contribution this first Habitat Needs Assessment has made is the development of new and improved tools for future habitat planning. In particular, the GIS Query tool will help evaluate the potential distribution of species and habitat area types throughout the UMRS. While the results of the Habitat Needs Assessment are not a substitute for the more detailed and spatially explicit planning that will be done at the pool scale, it has provided new tools for that planning.

Jeff Janvrin

An accurate assessment of habitat needs today will help ensure that river resources are preserved for future generations.

The Future

This is the first Habitat Needs Assessment undertaken as part of the Environmental Management Program and it is anticipated to be updated on a regular basis. Future assessments will benefit from additional spatial data about the river system, improved ecological understanding, improved GIS and modeling tools, and additional public input.

Acknowledgements

HNA Technical Committee

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ATTACHMENT E

<u>Long Term Resource Monitoring and Science</u>

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Aquatic Vegetation Component						
2015A1	Complete data entry and QA/QC of 2014 data; 1250 observations.					
	a. Data entry completed and submission of data to USGS	30-Nov-14		9-Oct-14		Moore, Nissen, Vogeler
	b. Data loaded on level 2 browsers	15-Dec-14		31-Oct-14		Schlifer
	c. QA/QC scripts run and data corrections sent to Field Stations	28-Dec-14		14-Nov-14		Sauer, Schlifer
	d. Field Station QA/QC with corrections to USGS	15-Jan-15		28-Nov-14		Moore, Nissen, Vogeler
	e. Corrections made and data moved to public Web Browser	30-Jan-15		30-Jan-15		Sauer, Schlifer, Caucutt
2015A2	WEB-based annual Aquatic Vegetation Component Update with 2014 data on Public Web Server.					
	a. Develop first draft	30-Mar-15		13-Apr-15		Sauer
	b. Reviews completed	15-Apr-15		15-Apr-15		Moore, Drake, Vogeler, Sauer, Yin
	c. Submit final update	30-Jun-15		30-Jun-15		Sauer
	d. Placement on Web with PDF	31-Jul-15		31-Jul-15		Sauer, Caucutt
2015A3	Complete aquatic vegetation sampling for Pools 4, 8, and 13	31-Aug-15		31-Aug-15		Yin, Moore, Nissen, Vogeler
2015A4	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2014 data	31-Jul-15		31-Jul-15		Yin, Rogala, Schlifer
2015A5	Wisconsin DNR annual summary report 2014 that combines current year observations from LTRM with previous years' data, for the fish, aquatic vegetation, and water quality components.	30-Sep-15		16-Oct-15		Fischer, Drake, Bartels, Giblin, Hoff
2015A6	Final draft LTRM completion report: Fifteen years (1998–2012) of aquatic vegetation in Pool 4 of the Upper Mississippi River (2012A6).	31-Dec-14		24-Mar-15	Delivered to UMRR Partnership	Moore
2015A7	Data compilation and analysis: Aquatic macrophyte communities and their potential lag time response to changes in physical and chemical variables in the LTRM vegetation pools	30-Jun-15	30-Jun-16		Delayed due to Walt Popp's retirement and M. Moore serving as acting Team Leader	Moore
2015A8	Draft completion report or manuscript: Aquatic macrophyte communities and their potential lag time response to changes in physical and chemical variables in the LTRM vegetation pools	30-Jun-16			See 2015A7	Moore
On-Going						
2013A8	Draft report: Identification of maximal flow velocity threshold for colony of *Vallisneria americana* along the channel border of the Upper Mississippi River–Extension of modeling capabilities for aquatic vegetation (contract award July 2013)	15-Jun-14	15-Sep-15	17-Jul-15		Yin
2014A7	Final draft report: Identification of maximal flow velocity threshold for colony of *Vallisneria americana* along the channel border of the Upper Mississippi River (2013A8)	15-Sep-14	TBD	20-Oct-15		Yin
2014A6	Annual Field Station Data Summary Report Template Development	30-Sep-14	30-Sep-15		Removed from SOW	Hagerty, Popp, Bierman, Chick, Herzog, Casper
Intended for distribution						
Completion report: LTRM Aquatic Vegetation Program Review (2007A9; Heglund) Completed 7/1/2015						
LTRM Technical Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12; Chick, Guyon, Battaglia) (in USGS review)						
LTRM Technical Report; Experimental and Comparative Approaches to Determine Factors Supporting or Limiting Submersed Aquatic Vegetation in the Illinois River and its Backwaters (2008APE5, Sass) (in USGS review)						
LTRM completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a; Yin) (in USGS review)						
Manuscript: Have the recent increases in aquatic vegetation in Pools 5 and 8 been the result of water level management drawdowns, HREPs, or natural fluctuations? (2009APE1a; Yin) (in USGS review)						

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Manuscript: A statistical model of species occupancy using the LTRM aquatic vegetation data (2013A7; Yin) (in USGS review)						
WI DNR annual 2013 data summary report (2014A5; Fischer, Drake, Bartels, Giblin, Hoff) Completed						
Fisheries Component						
2015B1	Complete data entry, QA/QC of 2014 fish data; ~1,590 observations					
	a. Data entry completed and submission of data to USGS	31-Jan-15		31-Jan-15		DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	15-Feb-15		15-Feb-15		Schlifer, Ickes
	c. Field Station QA/QC with corrections to USGS	15-Mar-15		15-Mar-15		DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton
	d. Corrections made and data moved to public Web Browser	30-Mar-15		30-Mar-15		Ickes, Sauer and Schlifer
2015B2	Update Graphical Browser with 2014 data on Public Web Server.	31-May-15		30-Mar-15		Ickes, Sauer, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton, Schlifer
2015B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool	31-Oct-15		31-Oct-15		Ickes, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton
2015B4	Summary letter on Asian carp age and growth: collection of cleithral bones	31-Jan-15		6-Jan-15		Solomon, Casper
2015B5	Letter Summary: Exploring Years with Low Total Catch of Fishes in Pool 26	30-Sep-15	15-Nov-15			Gittinger, Ratcliff, Lubinski, Chick
2015B6	Collection and archiving of age and growth structure for selected species in the La Grange Reach of the Illinois River	31-Jan-15		16-Jan-15		Solomon, Casper
2015B7	Summary report: Pool 12 Overwintering HREP adaptive management fisheries response monitoring	30-Sep-15		30-Apr-15		Bierman, Bowler
2015B8(L)	Advisory role for Assessment of Asian carp exploitation by native piscivores in the Illinois River (Western Illinois University)	NA (WIU product)				Casper
2015B9	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2014	30-Jun-15		31-Mar-15		Bowler
2015B10(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9 - 11	30-Sep-15		30-Sep-15		Bowler
2015B11(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	30-Sep-15		30-Sep-15		Bowler
2014B10	Presentations, draft completion report: Paddlefish population characteristics in the Mississippi river Basin	1-Dec-15				Hupfeld, Phelps
2014B11	Presentations, draft completion report: Examining recruitment patterns in Fishes in the Mississippi River	30-Nov-14		25-Nov-14		West, Sobotka, Hupfeld, Phelps
2015B12	Draft Book Chapter: The Mississippi River: A place for fish past, present, and future	30-Jul-15		30-Jun-15		Ickes, Schramm
2015B12a	Final Book Chapter: The Mississippi River: A place for fish past, present, and future	30-Sep-15		18-Sep-15		Ickes, Schramm

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2015B13	Assemble requisite data: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	8-Jun-15		8-Jun-15		Ickes
2015B14	Perform Trajectory Analysis: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	30-Aug-15		4-Sep-15		Ickes, Minchin
2015B15	Summary letter on results: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	30-Oct-15		30-Oct-15		Ickes, Minchin
2015B16	Draft Manuscript: Trajectory Analysis	30-Sep-16				Ickes, Minchin
2014AC2	Fish community structure: complete data analysis	30-Oct-14		30-Oct-14		Solomon, Pendleton, Casper
2014AC3	Fish community structure: present results	TBD		30-Oct-14		Solomon, Pendleton, Casper
2014AC4	Fish community structure: draft manuscript	30-Dec-14	30-Jun-15	30-Jun-15	Submitted to Biological Invasions	Solomon, Pendleton, Casper
On-Going						
2006B6	Draft manuscript: Spatial structure and temporal variation of fish communities in the Upper Mississippi River. (Dependent on 2008B9 acceptance into journal)	30-Sep-15				Chick
2008B9	Draft manuscript: Standardized CPUE data from multiple gears for community level analysis (a previous manuscript was submitted and rejected by the journal, 2006B5; 2008B9 is a revised manuscript) (Chick)	30-Sep-15	15-Dec-15		90% complete	Chick
2014B6	Summary letter on Asian carp age and growth: collection of cleithral bones	31-Jan-15		6-Jan-15		Solomon, Casper
2014B12	Database increment, letter summary: Collection and archiving of age and growth structure for selected species in the La Grange Reach of the Illinois River	31-Jan-15		31-Jan-15		Solomon, Casper

Intended for distribution
Completion report: LTRM Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings) (in USGS review)
Evaluating the effectiveness of a mandatory catch and release regulation on a riverine largemouth bass population (2007B7; Bowler). Iowa Department of Natural Resources, Bureau of Fisheries Conservation & Recreation, Division Fisheries Management Section, 2013 Completion Reports, pp 149-169.
LTRM Report: An Evaluation of Macroinvertebrate Sampling Methods For Use In The Open River Reach of The Upper Mississippi River; Kathryn N. S. McCain, Robert A. Hrabik, Valerie A. Barko, Brian R. Gray, and Joseph R. Bidwell (2005C2) (in USGS review)
LTRM technical report; Setting quantitative fish management targets for LTRM monitoring (2008APE2; Sass) (in USGS review)
LTRM Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.) (in USGS review)
Manuscript: Determining environmental history of three sturgeon species in the Upper, Middle, and Lower Mississippi Rivers. (2013B22; Phelps)
Manuscript: Sauger life history in the lower portion of the Upper Mississippi River (2013B20, Phelps). The Prairie Naturalist 46:44–47
Manuscript: Age-0 sturgeon habitat associations in the free flowing portion of the Upper Mississippi River (2012B5; Tripp, Phelps, Herzog)
LTRM Fact Sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16) (in USGS review)
IA DNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2013 (2014B14). Iowa Department of Natural Resources, Bureau of Fisheries Conservation & Recreation, Division Fisheries Management Section, 2013 Completion Reports, pp 85-115.
IA DNR Report: Sex-Specific Age Structure, Growth, and Mortality of Black and White Crappie in Pool 13 of the Upper Mississippi River (Bowler, M. C., K. A. Hansen, K. S. Hausmann, and B. J. Reed) 2014. Iowa Department of Natural Resources, Bureau of Fisheries Conservation & Recreation, Division Fisheries Management Section, 2013 Completion Reports, PP 117-125.
Manuscript: American eel population characteristics in the Upper Mississippi River (2012B7; Phelps) The American Midland Naturalist, 171(1):165-171. 2014.
LTRM fisheries component procedures manual (2013B5; Ratcliff, Gittinger, Ickes). http://pubs.usgs.gov/mis/LTRM2014-p001

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
LTRM Program report: Ickes, B.S., Sauer, J.S., and Rogala, J.T., 2014, Monitoring rationale, strategy, issues, and methods: UMRR-EMP LTRM Fish Component. A program report submitted to the U.S. Army Corps of Engineers' Upper Mississippi River Restoration-Environmental Management Program, Program Report LTRM 2014–P001a. http://pubs.usgs.gov/mis/LTRM2014-p001a/						
Manuscript: Comparing commercial and recreational harvest characteristics of paddlefish Polyodon spathula (Walbaum, 1792) in the Middle Mississippi River, (2013B24; Phelps) J. Appl. Ichthyol. (On-line First) DOI: 10.1111/jai.12552						
Manuscript: Hupfeld, R. N., Q. E. Phelps, M. K. Flammang and G. W. Whitledge. 2014. Assessment of the effects of high summer water temperatures on Shovelnose sturgeon and potential implications of climate change. River Res. Applic. (On-line First) DOI: 10.1002/rra.2806						
Water Quality Component						
2015D1	Complete calendar year 2014 fixed-site and SRS water quality sampling	31-Dec-14		31-Dec-14		Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D2	Complete laboratory sample analysis of 2014 fixed site and SRS data; Laboratory data loaded to Oracle data base.	15-Mar-15		30-Mar-15		Yuan, Schlifer
2015D3	1st Quarter of laboratory sample analysis (~12,600)	30-Dec-14		30-Dec-14		Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D4	2nd Quarter of laboratory sample analysis (~12,600)	30-Mar-15		30-Mar-15		Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D5	3rd Quarter of laboratory sample analysis (~12,600)	29-Jun-15		29-Jun-15		Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D6	4th Quarter of laboratory sample analysis (~12,600)	28-Sep-15		28-Sep-15		Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D7	Complete QA/QC of calendar year 2014 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-15		30-Mar-15		Schlifer, Rogala, Houser
	b. Field Station QA/QC; USGS QA/QC.	15-Apr-15		30-Apr-15		Houser, Rogala, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
	c. Corrections made and data moved to public Web Browser	30-Apr-15		5-May-15		Rogala, Schlifer, Houser
2015D8	Complete FY2014 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool (Table 1)	30-Sep-15		30-Sep-15		Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka
2015D9	WEB-based annual Water Quality Component Update w/ 2014 data on Server.	30-May-15		30-May-15		Rogala
2015D10	Letter Summary: Evaluation of water quality data from automated sampling platforms	30-Sep-15		15-Nov-15		Soeken-Gittinger, Lubinski, Chick, Houser
2015D11	Draft report/manuscript: Developing continuous water quality monitoring methods in the UMR	1-Sep-16				Chick, Houser
2015D12	Final report/manuscript: Developing continuous water quality monitoring methods in the UMR	1-Sep-17				Chick, Houser
2015D13	Initial analyses: Coherence in temporal variation of select water quality parameters across strata and study reaches	1-Sep-15	1-Sep-16		Delayed due to position change to UMRR Science Director	Houser
2015D14	Draft manuscript: Coherence in temporal variation of select water quality parameters across strata and study reaches	1-Sep-16	1-Sep-17		Delayed due to position change to UMRR Science Director	Houser
2015D15	Analysis of Lake Pepin rotifers; data from 2012-2014	30-Jun-15	30-Mar-16			Burdis, Hirsch

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2015D16	Draft manuscript: Temporal trends in water quality and biota in segments of Pool 4, above and below Lake Pepin, UMR; indications of a recent ecological shift (from 2010D6 completion report)	27-Feb-15	31-Dec-15		Delayed due to Walt Popp's retirement. Rob Burdis has lead. Also new analysis being done on data	Popp, Burdis, DeLain, Moore
2014D13	Presentations, draft completion report: A Comparison of Side and Main Channel Fish Community and Water Quality Characteristics	1-Dec-15				Sobotka, West, Phelps
Intended for distribution						
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites) (in USGS review)						
LTRM report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik) (in USGS review)						
Manuscript: Ecosystem metabolism in the main channel and backwaters of the Upper Mississippi River: the role of submersed vegetation and hydraulic connectivity. (2008D8; Houser et al.) (Manuscript revised and resubmitted to journal)						
Manuscript: Lateral contrasts in nutrients, chlorophyll, and suspended solids within the Upper Mississippi River System (2012D10; Houser) (Review comments received from journal)						
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis) (in USGS review)						
Manuscript: Trends in suspended solids, nitrogen, and phosphorus in select upper Mississippi River tributaries, 1991-2011 (Kreiling and Houser, 2013D14) (in USGS review)						
Manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin (2013D17; Burdis) (ready for submission to Journal)						
Completion report: Temporal trends in water quality and biota in segments of Pool 4 above and below Lake Pepin, Upper Mississippi River: indications of a recent ecological shift" (2010D6; Popp, Burdis, Moore) Completed						
Manuscript: Nutrients and dissolved oxygen in the UMRS: improving our understanding of winter conditions and their implications for structure and function of the river (2014D12; Houser) (in USGS review)						
Land Cover/Land Use with GIS Support						
2014LC1	Updates on progress for land cover products (See SOW)				New progress reported in the quarterly activities. Percent complete updated 30 Sept 2015.	Robinson
Development of 2010–2011 Land Cover/Land Use GIS Database and Aerial Photo Mosaics						
2015V1	Complete 2010/11 LCU database for UMR Pools 1, 2, 11, 15-17, the Illinois River's Lockport, Brandon, and Dresden Pools, and the Lower Minnesota, Lower St. Croix, and Lower Kaskaskia Rivers.	31-Aug-15		31-Aug-15	Data in review	Robinson, Hoy, Hanson, , Ruhser, Nelson, Jakusz
Statistical Evaluation						
2015E1	Trend lines with confidence bands added to water quality data web summary pages	30-Sep-15		2-Sep-15		Gray, Schlifer, Houser, Rogala
2015E2	Draft manuscript: Estimating trends in water temperature data from LTRM data (from 2013E2 completion report)	30-Sep-15		12-Mar-15	Accepted for publication 8/20/2015; Statistical Methods and Applications	Gray, Lyubchich, Gel
Intended for distribution						
Completion report that describes methods of estimating variance components from LTRM water quality data (2008E1; Gray) (in USGS review)						
Manuscript: Inferring decreases in among- backwater heterogeneity in large rivers using among-backwater variation in limnological variables (2010E1, Rogala, Gray, Houser) (Submitted to journal)						
Completion Report: Summer water temperature in the Upper Mississippi River (2012E2). Gray, Robertson, Houser, Rogala. (in USGS review)						
Completion report: An assessment of trends in water temperature in La Grange Pool (2012E3; Gray, Robertson, Rogala, Houser) Completed						
Completion report: Long-term trend reporting, water quality component (2013E1, Gray) http://www.umesc.usgs.gov/documents/publications/2014/gray_b_2014.html						

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Data Management						
2015M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	30-May-15		30-May-15		Schlifer
2015M2	Load 2014 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	30-Jun-15		30-Jun-15		Schlifer
2014M3	Webinar on LTRM data access and use	27-Oct-14		27-Oct-14		Sauer, Johnson, Houser, Ickes, Yin, Rogala, Schlifer, Lowenberg
Landscape Pattern Research and Application						
2015L1	Data Analysis: Examining changes in land cover and land use 2000-2010.	30-Sep-15		30-Sep-15	Analysis done were data are available. Remaining Pools will be completed in 2016.	De Jager & Rohweder (UMESC)
2015L2	Draft Manuscript: Draft manuscript: The Upper Mississippi River Floodscape: spatial patterns of flood inundation and assosciated plant community distributions.	30-Sep-15		10-Feb-15	Applied Vegetation Science. Doi: 10.1111/avsc.12189	De Jager, Fox, & Rohweder (UMESC)
2015L3	Data Analysis: Effects of flooding, herbivory, and invasion by reed canarygrass on multivariate elemental cycling in a UMR floodplain forest	30-Sep-15		5-Feb-15	Wetlands 35: 1005-1012.	Kreiling & De Jager (UMESC), Swanson, Strauss & Thomsen (UW-L)
2015L4	Draft Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on decomposition and nitrogen cycling along the UMR Floodplain	30-Sep-15		30-Sep-15		Swanson, Strauss, Thomsen (UW-L) & De Jager (UMESC)
2015L5	Data Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on microbial enzyme activity along the UMR Floodplain	30-Sep-15		30-Sep-15	Funding by USGS and UMRR	Reich & Hernandez (Carleton), De Jager (UMESC)
2015L6	Presentation: Developing methods to map floodplain functions and ecosystem services	30-Jul-16			Presentation at the LRI-EcoFIM Conference	Morlock, Johnson, De Jager
2015L6a	Draft Manuscript: Developing methods to map floodplain functions and ecosystem services	30-Sep-16				Morlock, Johnson, De Jager
2015L7	Draft manuscript: Measuring spatial patterns in floodplains: a step towards understanding the complexity of floodplain ecosystems	30-Sep-15		30-Sep-15	In Press: *River Science: Research and Applications for the 21st Century*	Scown & Thoms (UNE), De Jager (UMESC)
2015L8	Draft manuscript: The effects of survey technique and vegetation type on measuring floodplain topography from DEM's using surface metrics	30-Sep-15		30-Sep-15	Submitted to Earth Surface Processes and Landforms	Scown & Thoms (UNE), De Jager (UMESC)
2015L9	Draft manuscript: Multi-scale measurement of topographic complexity in the Upper Mississippi River floodplain using surface metrics	30-Sep-15		30-Sep-15	Geomorphology 245:87-101	Scown & Thoms (UNE), De Jager (UMESC)
2015L10	Draft manuscript: Comparing the physical complexity of floodplains in different geographical settings.	30-Sep-15		30-Sep-15	Geomorphology 245: 102-116	Scown & Thoms (UNE), De Jager (UMESC)
2015L11	Draft manuscript: An index of floodplain surface complexity.	30-Sep-15		30-Sep-15	Submitted Hydrology and Earth Systems Science	Scown & Thoms (UNE), De Jager (UMESC)

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Intended for distribution						
Manuscript: De Jager, N.R., Swanson, W., Strauss, E.A., Thomsen, M., Yin, Y. In review. Reed canarygrass invasion overrides flood-pulse effects on nitrification in and Upper Mississippi River floodplain forest. Ecosystems (2014L1). (Accepted Wetlands Ecology and Management, New title: Flood Pulse Effects on Nitrification in a Floodplain Forest Impacted by Deer Browsing and Invasion by *Phalaris Arundinacea*)						
Manuscript: De Jager, N.R. In Prep. Differences in fish community composition between patches of high TN:TP and low TN:TP: the role of water flow velocity. (2014L3) (Submitted to journal River Research and Applications; New title: Patchiness in a large floodplain river: associations among hydrology, nutrients, and fish communities)						
Fact Sheet: De Jager, N.R. 2014. Landscape Ecology on the Upper Mississippi River: lessons learned, challenges, opportunities (2013L3). In Press						
Science Planning						
2013XY	Draft report: Critical questions for advancing ecosystem understanding and management capability on the UMRS	30-Sep-13	31-Mar-15		Removed from SOW; replaced by Resilience Work	Johnson
2013XZ	Final Draft Critical Questions report to UMRR-CC	20-Nov-13				Johnson
2014N3	Final Draft research plan to UMRR-CC	1-Aug-14	10-Nov-14	10-Nov-14		Johnson
UMRR LTRM Team Meeting						
2015FM1	Meeting date coordination	31-Oct-14		31-Oct-14		All LTRM Staff
2015FM2	Agenda development	31-Dec-14		31-Dec-14		All LTRM Staff, led by UMESC
2015FM3	Meeting logistics	On-Going		Completed		Sauer
2015FM4	Meeting participation	TBD		Completed		All LTRM Staff
Involvement of LTRM with monitoring on other rivers, nationally and internationally						
2014P1	Draft white paper for review	15-Jun-14	31-Dec-15			Johnson
2014P2	Final draft white paper	30-Sep-14				Johnson
2014P3	Final Draft white paper to UMRR-CC	Nov. 2014				Johnson
Quarterly Activities						
2015QR1	Submittal of quarterly activities	30-Jan-15		30-Jan-15		All LTRM staff
2015QR2	Submittal of quarterly activities	13-Apr-15		13-Apr-15		All LTRM staff
2015QR3	Submittal of quarterly activities	13-Jul-15		13-Jul-15		All LTRM staff
2015QR4	Submittal of quarterly activities	12-Oct-15				All LTRM staff
Science Management						
2015ER1	Property inventory and tracking	15-Nov-15				LTRM staff as needed
Mussel Research Framework						
2015MRF1	Establish selection criteria, identify existing data sets, and re-format to a common database suitable for spatial analyses	1-Apr-16				Ries, Newton, De Jager, Zigler
2015MRF2	Brief summary letter, including the compiled dataset, GIS layers, and a map	1-Jun-16				Ries, Newton, De Jager, Zigler

UMRR Science in Support of Restoration and Management
FY2014 Scope of Work
October 2015 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Seamless Elevation Data						
2014LB1	LiDAR Tier 1, processing and meta data, data on line: Pools 15-19, Pool 25 – Open River, Kaskaskia, IL River all pools	30-Mar-15		18-Dec-14		Dieck, Rohweder, Nelson, Fox
2014LB2	LiDAR Tier 3, processing and meta data, data on line: Pools 4, 5, 7, 8, 9, 10, 13, and 21	30-Mar-15		7-Apr-15		Dieck, Rohweder, Nelson, Fox
Land Cover / Land Use data and Accuracy Assessment/Validation for UMRS						
2014V2	Complete remaining 70% of the 2010/11 LCU database for UMR Open River North	30-Sep-14	30-Jan-15	21-Jan-15		Robinson, Hoy, Hanson, Langrehr, Ruhser, Nelson
2014V4	Final LTRMP Completion Report on Accuracy Assessment	30-Sep-14		17-Nov-14	In USGS SPN for Publication	Ruhser, Jakusz
Standardized HREP Non-forested Wetland Plant Sampling Protocol						
2014NFW1	draft NFW monitoring protocol	28-Feb-14		28-Feb-14		McCain
2014NFW2	Final draft NFW monitoring protocol	30-Mar-14		31-Mar-14		McCain
2014NFW3	A-Team review	1-Apr-14		7-Apr-14		McCain
2014NFW4	completed NFW monitoring protocol available	30-Sep-14		completed		McCain
Standardized HREP Forested Wetland Plant Sampling Protocol						
2014FW1	draft FW monitoring protocol	30-Nov-13		30-Nov-13		McCain
2014FW2	Final draft FW monitoring protocol	30-Mar-14		31-Mar-14		McCain
2014FW3	A-Team review	1-Apr-14		7-Apr-14		McCain
2014FW4	completed FW monitoring protocol available	30-Sep-14		completed		McCain
Predictive Model for Aquatic Cover Types						
2014AQ1	Complete hydraulic model of existing conditions	30-Apr-14	11-Jul-14	11-Jul-14		Hendrickson
2014AQ2	Compile vegetation data and develop empirical equations, Stoddard as pilot	31-Aug-14		31-Aug-14		Yin, Rogala, Ingvalson, Potter
2014AQ3	Apply equations to Pool 3 for pre-existing conditions, North & Sturgeon	30-Sep-14	28-Nov-14	completed		Yin, Rogala, Ingvalson, Potter
2014AQ4	Final model and outputs	31-Dec-14		completed		Yin, Rogala, Ingvalson, Potter
UMRS Vegetation Handbook						
2014VH1	Acquire new field images for handbook	30-Sep-14		30-Sep-14		Dieck, Langrehr, Hoy, Robinson, Ruhser
2014VH2	Draft updates to technical sections and vegetation descriptions	31-Dec-14		31-Dec-14		Dieck, Langrehr, Hoy, Robinson, Ruhser
2014VH3	Finalize handbook and submit for USGS review	31-Mar-15		31-Mar-15	In USGS SPN for Publication	Dieck, Langrehr, Hoy, Robinson, Ruhser
Phase 2 Geospatial Data Upgrades						
2014GDU1	Complete geodatabases by pool for the entire UMRS	30-Sep-14	30-Apr-15	4-May-15		Nelson, Robinson
20144GDU2	Complete KMZ files for river miles, levees, boat access points, wing dams, aquatic areas, and remaining land cover data	30-Sep-14	31-Jul-15	30-Sep-15		Nelson, Robinson

UMRR Science in Support of Restoration and Management
FY2014 Scope of Work
October 2015 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Spatial Data Query Tool						
2014SDQ1	Compile all LTRMP sampling data collected through 2013 and convert to a useable format	1-Aug-14		1-Aug-14		Rohweder, Fox
2014SDQ2	Create a web-based platform that contains all spatial data; convert all queries to ArcGIS	31-Dec-14	30-Aug-15	30-Sep-15		Rohweder, Fox
2014SDQ3	SDQT beta tested and ready for USGS review	31-Mar-15	30-Nov-15		New ArcGIS server was needed, original server was taken offline because of compliance issue	Rohweder, Fox
UMRS Data Map						
2014DM1	Include all UMRR-EMP data created at UMESC in the data map	30-Sep-14	30-Nov-14	31-Dec-14	UMESC will update as new datasets come online in the future	Nelson, Ruhser
2014DM2	Include all UMRR-EMP publications from http://umesc.usgs.gov/reports_publications/ltrmp_rep_list.html in the data map	31-Dec-14	9/31/2015	31 Sep 15	The tool still needs UMRR branding, waiting to get logo or something official from Karen. Modifications and updates will continue. Tool will also be linked to the UMESC web page	Nelson, Ruhser
2014DM3	Include additional state and federal data references in the data map	31-Mar-15		30-Jun-15	Not all state and federal data sources have the same metadata available making it more difficult than initially expected. New OMB guidelines will correct this. UMESC will continually updated site as new metatadata are made available	Nelson, Ruhser
Assessing System-wide Hydrodynamic Model Availability						
2014SHM1	Kick off Email to workshop participants	30-Apr-14		21-Apr-14		Theiling
2014SHM2	Compile list of UMR-IWW hydrologic models	31-May-14		31-May-14		Theiling
2014SHM3	Complete read-aheads	15-Jun-14	14-Jul-14	14-Jul-14		Theiling
2014SHM4	Conduct workshop/webinar	1-Jul-14	12-Aug-14	21-Aug-14	July dates did not work for attendees	Theiling
2014SHM5	Summarize webinar	31-Jul-14	31-Aug-14	30-Sep-14		Theiling
2014SHM6	Draft white paper	31-Aug-14	15-Aug-14	30-Sep-14		Theiling
2014SHM7	*draft* Final white paper	30-Sep-14	31-Dec-14	31-Dec-14	draft final submitted 31 Dec 14. Additi	Theiling
2014SHM8	final white paper	1-Apr-15		4-Apr-15		Theiling
Development of Mussel Vital Rates						
2014MVR1	Brief summary report	30-Sep-15		30-Sep-15	completed, in UMESC review	Newton, Zigler, Davis
2014MVR2	Brief summary report	30-Sep-16				Newton, Zigler, Davis
2014MVR3	Completion report on a vital rates of native mussels at West Newton Chute, UMRS	30-Sep-17				Newton, Zigler, Davis

UMRR Science in Support of Restoration and Management
FY2014 Scope of Work
October 2015 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Validation of Mussel Community Asessment Tool						
2014MCA1	Workshop of mussel experts in UMRS	1-May-15		19-Feb-15		Newton, Zigler, Dunn, Duyvejonck
2014MCA2	Draft completion report on a validated mussel community assessment tool for use by river managers	1-Dec-15	1-Mar-16		state biologists are still ranking beds as part of validation	Newton, Zigler, Dunn, Duyvejonck
2014MCA3	Final completion report on a validated mussel community assessment tool for use by river managers	1-Mar-16	1-Jun-16			Newton, Zigler, Dunn, Duyvejonck
Effects of Nutrient Concentrations on Zoo- and Phytoplankton						
2014NC1	Counting of phytoplankton samples	13-Mar-15		2-Mar-15		Giblin, Campbell, Houser, Manier
2014NC2	Database completed and analysis completed	13-Mar-16				Giblin, Campbell, Houser, Manier
2014NC3	Full manuscript completed	13-Mar-17				Giblin, Campbell, Houser, Manier
Ecological Shifts Turbid to Clear States						
2014ES1	Literature review and initial analyses competed	13-Mar-15		15-Nov-14		Giblin, Ickes, Langrehr, Bartels
2014ES2	Refined analyses and draft manuscrpt prepared	13-Mar-16			All analyses complete, manuscript in draft and co-author review 2 April 2015	Giblin, Ickes, Langrehr, Bartels
2014ES3	Manuscipt submitted for publication	13-Mar-17				Giblin, Ickes, Langrehr, Bartels
Invasive Carp Population Demographics (#1)						
2014CPD1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014CPD2	Manuscript	31-Mar-16		1-Jul-15	Management of Biological Invasions (2015) Volume 6; http://www.reabic.net/journals/mbi/2015/Accepted.aspx	Phelps, Mccain
Asian Carps Recruitment Sources (#2)						
2014CRS1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014CRS2	Manuscript	31-Mar-16				Phelps, Mccain
Effects of Asian Carps on Native Piscivore Diets (#3)						
2014NPD1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014NPD2	Manuscript	31-Mar-16				Phelps, Mccain
Early Life History of Invasive Carps (#4)						
2014CLH1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014CLH2	Manuscript	31-Mar-16				Phelps, Mccain

UMRR Science in Support of Restoration and Management
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Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Seamless Elevation Data						
2015LB1	Tier 2 LiDAR for Pools 14-19	31-Mar-15		15-Apr-15		Dieck, Hanson
2015LB2	Tier 2 LiDAR for Pool 25-OR & Kaskaskia	30-Jun-15		30-Jun-15	All pools but Pool 26 are complete.	Dieck, Hanson
2015LB2b	Tier 2 LiDAR for Pool 26	30-Jun-15	30-Nov-15		It has been discovered that Pool 26 lidar has serious problems. Still working to resolve. Separate line item created.	
2015LB3	Tier 2 LiDAR for the Illinois River	30-Sep-15	30-Nov-15		The lidar was not classed to ASPRS specifications, resulting in the need to reclassify a lot of the data	Dieck, Hanson
2015LB4	All remaining Bathymetry	30-Sep-15		1-Apr-15		Dieck, Hanson
2015LB5	Seamless Elevation for Pools 2, 5a, 6, 10-12, St Croix, and Pool 14	31-Dec-15				Dieck, Hanson
2015LB6	Seamless Elevation for Pools 15-19, 20, and 22-24	31-Mar-16				Dieck, Hanson
2015LB7	Seamless Elevation for Pools 25-OR & Kaskaskia	30-Jun-16				Dieck, Hanson
2015LB8	Seamless Elevation for the Illinois River	30-Sep-16				Dieck, Hanson
Producing NED ready LiDAR products						
2015NED1	Perry County, MO	31-Jul-15		30-Sep-15	Data sent to USGS NGP, no word from them	Nelson, Dieck
2015NED2	Remaining portions of the middle Mississippi (OR1 & 2)	31-Jul-15		30-Sep-15	Data sent to USGS NGP, no word from them	Nelson, Dieck
2015NED3	Area of the Upper Mississippi (Pool 25-26)	30-Sep-15	6-Nov-15		In USGS review, waiting for HD from NGP to send this data	Nelson, Dieck
2015NED4	Illinois River area	30-Sep-15	11-Dec-15		Delays with pool 26 set everything back	Nelson, Dieck
Pool 12 AM monitoring (crappie telemetry)						
2015AM1	Capture fish and affix radio tags to white crappies in study lakes	1-Nov-14		2-Apr-15		Bierman, Hansen, Bowler, Theiling
2015AM2	Location of tagged fish and update in-house project database	Ongoing through FY		30-Sep-15		Bierman, Hansen, Bowler, Theiling
2015AM3	Complete tracking portion of study	30-Sep-15		30-Sep-15		Bierman, Hansen, Bowler, Theiling
Fish Indicators of Ecosystem Health						
2015FI1	Preliminary set of species identified for the different assemblages by study reach submitted to A-Team as status update and for review	30-Aug-15	15-Nov-15		Post doc hiring delay resulted in project delayed	McCain
2015FI2	Draft recommendation for the best attainable or target for each assemblage by study reach submitted to A-Team for Review	1-Oct-15	1-Dec-15			McCain
2015FI3	Initial draft Project Report submitted to A-Team for review	1-Dec-15	30-Dec-16			McCain
2015FI4	Final draft Project Report submitted to A-Team for review and endorsement at April meeting	1-Mar-16	30-Mar-16			McCain
2015FI5	Final draft Project Report submitted to UMRR CC for endorsement at August meeting	15-Jul-16	15-Jul-16			McCain
2015FI6	Final Report	1-Jun-16	30-Aug-16			McCain
Plankton community dynamics in Lake Pepin						
2015LPP1	Phytoplankton processing; species composition, biovolume	30-Dec-15				Burdis
2015LPP2	draft manuscript: Plankton community dynamics in Lake Pepin	30-Sep-16				Burdis
Estimating trends in UMRR fish and vegetation levels using state-space models						
2015SST1	Draft completion report: Evaluation of trend estimation methods for LTRM fish and vegetation indices	30-Sep-15	15-Dec-15		Project delayed by computing challenges.	Gray
2015SST2	Final completion report: Evaluation of trend estimation methods for LTRM fish and vegetation indices	31-Dec-15	15-Mar-16			Gray
2015SST3	Provide trend estimates for fish and vegetation web browser pages	30-Sep-16				Gray, Schlifer

UMRR Science in Support of Restoration and Management
FY2015 Scope of Work
October 2015 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Generating and serving presumptive habitat maps for 28 UMRS fish species						
2015FI1	Assemble requisite data resources	28-Feb-15		15-Jan-15		Ickes
2015FI2	Generate "point" maps of predictions	30-Mar-15	15-May-15	15-May-15		Hlavacek
2015FI3	Generate "splines with barriers" interpolated maps	15-May-15	30-Jul-15	on schedule		Hlavacek
2015FI4	Post maps to the UMRR LTRM fish component homepage	15-Jun-15	15-Sep-15	15-Sep-15	maps completed, under USGS review	Ickes
2015FI5	Issue/publish a brief communication on their availability and prospective usage	15-Sep-15	31-Oct-15			Ickes
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				Yin, Rogala
2015AQ3	Detailed summary of work for Phases I & II	31-Dec-15				Yin, Rogala, Ingvalson
Landscape Pattern Research on the UMRS: synthesis and significance, FY16-18						
	Milestones will be coordinated through the UMRR annual scope of work process					De Jager
Developing and Applying Indicators of Ecosystem Resilience to the UMRS						
	Milestones will be coordinated through the UMRR annual scope of work process					work group, post doc

Upper Mississippi River Restoration (UMRR) Program

Guidance for Crediting the UMRR Program and its Long Term Resource Monitoring element

In 1986, Congress declared the Upper Mississippi River as "a nationally significant ecosystem and a nationally significant commercial navigation system." Following from this declaration, in Section 1103 of the 1986 Water Resources Development Act (WRDA), Congress authorized the Upper Mississippi River Restoration (UMRR) Program to address the river's ecological needs. The UMRR Program became the first federal program to combine ecosystem restoration with scientific monitoring and research on a large river ecosystem. The program was named the Environmental Management Program in its authorization. In 2006, the Office of Management and Budget and Congress began referring to the Program as UMRR in its budgeting and appropriations documents.

Many people within the UMRS Partnership, including the public and private sectors, are unaware of basic information about the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program and its two elements; Habitat Rehabilitation and Enhancement Projects (UMRR HREP or HREP) and Long Term Resource Monitoring[1] (UMRR LTRM or LTRM). One area of confusion stems from not having standardized language to refer to the UMRR Program, and/or its elements, in documents and other communications. This has led to a lack of recognition for all the ways the UMRR LTRM element contributes to products and activities on the river.

The UMRR LTRM element should be recognized for the products it produces, and for those produced by funding from LTRM to other agencies. However, there are many other products, river activities, planning efforts, etc., to which LTRM makes significant contributions, including direct use or leveraging of LTRM data, staff, expertise, equipment, facilities, etc., that often go unrecognized. Many of these efforts would not be possible without the contributions provided by the UMRR Program. Giving proper credit to the UMRR Program helps those unfamiliar with the UMRR Program understand how LTRM supports and enables other important work on the Upper Mississippi River System and other large rivers.

We need to work together to help alleviate any confusion and increase the understanding of what the UMRR Program is and does. This applies to any communication with partner agencies, scientists, resource managers, program managers, the public, stakeholder groups,

[1] Formerly referred to as the Long Term Resource Monitoring Program

NGO's, the media, and congressional personnel. While the focus here is on the LTRM element, this identification concept applies equally to the HREP element.

Based on the concepts above, the following are <u>examples</u> of text for your use to properly give credit to the UMRR LTRM element.

1) <u>For reports, papers, posters, and other documents:</u>

   "The U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program Long Term Resource Monitoring (LTRM) element is implemented by the U.S. Geological Survey, Upper Midwest Environment Sciences Center (UMESC), in cooperation with the five Upper Mississippi River System (UMRS) states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers (Corps) provides guidance and has overall Program responsibility."

   "This study was funded as part of the U.S. Army Corps of Engineers' Upper Mississippi River Restoration Program, Long Term Resource Monitoring (LTRM) element." (*You could also expand this when appropriate with information like*, "implemented by the U.S. Geological Survey …," *or* "in collaboration with [*your state or agency name*] ...")

   "This study was conducted by the U.S. Army Corps of Engineers' Upper Mississippi River Restoration Program Long Term Resource Monitoring (LTRM) element. The LTRM is a cooperative effort between the U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Fish and Wildlife Service, and the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin."

2) <u>For crediting staff</u>:

   "…would like to thank [list scientists/staff/experts] of the [list employing agency] with support from the [or "in cooperation with the"] Upper Mississippi River Restoration (UMRR) Program's Long Term Resource Monitoring (LTRM) element for …."

3) <u>For identifying on Field Station web sites homepage:</u>

   "The [field station name] is one of a network of six field stations on the Upper Mississippi River System (UMRS) funded by the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program as a key part of the Long Term Resource Monitoring (LTRM) element. The mission of the LTRM is to provide river managers with information and understanding needed to maintain the Upper Mississippi River System as a sustainable multiple-use river ecosystem. Funding and overall management responsibility of the UMRR Program is vested with the U.S. Army Corps of Engineers.

The LTRM element is administered by the U.S. Geological Survey, Upper Midwest Environmental Sciences Center, in La Crosse, Wisconsin."

Please use the 'official' field station name as listed at the web link below: http://www.umesc.usgs.gov/field_stations/fs_directory.html

4) <u>For crediting data served on the UMRR LTRM web pages:</u>
This language should be posted on each LTRM web page where data can be cited, used or copied and in the metadata, if identified]

There are no restrictions on the use of data from the UMRR LTRM website (www.usgs.umesc.gov/ltrmp.html). However, when citing, copying, or otherwise using these data, we request that the following statements be used to properly acknowledge and credit UMRR LTRM. Any acknowledgement of specific data used in an analysis should include the name of the database and date it was accessed:

"Data available from the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program, Long Term Resource Monitoring (LTRM) element, at [*give web address*]".

"The data used in this study were collected through the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program Long Term Resource Monitoring (LTRM) element. Data from the [*identify data type*] component of UMRR LTRM were accessed on [*give date accessed*] at [*give web address*]".

"These data are a product of the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program Long Term Resource Monitoring (LTRM) element, as distributed by the U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin [*give web address*]."

5) <u>HREP/LTRM Integration efforts, products, etc</u>
All HREP/LTRM integration products and efforts should be credited to the U.S. Army Corps of Engineers' Upper Mississippi River Restoration Program.

ATTACHMENT F

Additional Items

QUARTERLY MEETINGS
FUTURE MEETING SCHEDULE

FEBRUARY 2016	
Rock Island, Illinois	
February 23	UMRBA Quarterly Meeting
February 24	UMRR Coordinating Committee

MAY 2016	
St. Louis, Missouri	
May 24	UMRBA Quarterly Meeting
May 25	UMRR Coordinating Committee

Acronyms Frequently Used
on the Upper Mississippi River

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
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
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
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
DALS	Department of Agriculture and Land Stewardship
DED	Department of Economic Development
DEM	Digital Elevation Model
DET	District Ecological Team
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
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
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
HEL	Highly Erodible Land
HEP	Habitat Evaluation Procedure
HNA	Habitat Needs Assessment
HQUSACE	Headquarters, USACE
H.R.	House of Representatives
HREP	Habitat Rehabilitation and Enhancement Project
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
IIA	Implementation Issues Assessment
ILP	Integrated License Process
IMTS	Inland Marine Transportation System
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
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
LTRMP	Long Term Resource Monitoring Program
M-35	Marine Highway 35
MAFC	Mid-America Freight Coalition
MARAD	U.S. Maritime Administration
MARC 2000	Midwest Area River Coalition 2000
MICRA	Mississippi Interstate Cooperative Resource Association
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
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
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
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	Preliminary 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
RM	River Mile
RP	Responsible Party
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
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
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.]
UMRS	Upper Mississippi River System
UMRSHNC	Upper Mississippi River Sub-basin Hypoxia Nutrient Committee
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
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), and
Section 3177 of the Water Resources Development Act of 2007 (P.L. 110-114).

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 $22,750,000 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 $10,420,000 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.