Upper Mississippi River Restoration
Long Term Resource Monitoring Program Element

FY2015 Scope of Work

This Scope of Work (SOW) describes tasks in support of the US Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program (formerly the Environmental Management Program) Long Term Resource Monitoring Program (LTRMP) element, authorized by Congress in the 1986 Water Resources Development Act and reauthorized in the 1999 Water Resources Development Act, to be performed by the USGS-Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, and six state-operated field stations (Illinois, Iowa, Minnesota, Missouri, and Wisconsin). This long term monitoring and research directly supports Upper Mississippi River System (UMRS) understanding, critical for successful UMRS restoration.

The work in this SOW directly supports the Strategic Plan for the Upper Mississippi River Restoration Program, 2015-2015, Goal 2: Advance Knowledge for Restoring and Maintaining a Healthier and More Resilient Upper Mississippi River Ecosystem.

Aquatic Vegetation Component

The objective of the UMRR LTRM Aquatic Vegetation Component is to collect quantitative data on the distribution and abundance of aquatic vegetation in the Upper Mississippi River System (UMRS) and to conduct research related to aquatic vegetation for the purpose of understanding its status, trends, ecological functions, and responses to natural disturbances and anthropogenic activities. Aquatic vegetation in the UMRS is desirable because of its many values, most notably as food for migratory waterfowl (Korschgen et al. 1988) and habitat for fish. Monitoring data are collected within three LTRM study reaches in the UMRS (Pools 4, 8, and 13 on the Upper Mississippi River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols

Methods

For monitoring aquatic vegetation, sampling will be conducted following the LTRM aquatic vegetation standard sampling protocol (Yin et al. 2000). A total of 1,350 sites will be surveyed, including 450 in Pool 4, 450 in Pool 8, and 450 in Pool 13 (Table 1). The presence/absence and abundance of aquatic plant species at each site will be measured and recorded. Pool-wide estimates of abundance and percent frequency of occurrence will be derived by pooling data over all strata.

Product Descriptions

2015A7 and A8: Aquatic macrophyte communities and their potential lag time response to changes in physical and chemical variables in the LTRM vegetation pools

Aquatic vegetation is one of the key ecological drivers of the Upper Mississippi River (UMR) and greatly facilitates the transfer of energy among trophic levels and provides habitat and food for many species of fish and wildlife. The fact that aquatic macrophytes may have a lag time in responding to adverse environmental changes indicates a degree of resilience that is a key factor in measuring the ecosystem health of the system. Restoring and maintaining a more resilient UMR ecosystem is a major part of the UMRR vision. Demonstrating the resilience of aquatic macrophytes will affirm the contention that UMRR habitat projects, which enhance and restore aquatic vegetation, are advancing the UMRR's vision.

Previous work appears to suggest that aquatic macrophytes may have a delayed response to environmental change in rivers. We have observed that aquatic macrophytes on the UMR often take a year or more to respond to hydrologic and physical/chemical changes. However, this has not been demonstrated conclusively in any UMR studies.

The hypothesis to be explored is that submersed macrophytes show a delay in responding to changes in their environment, which can be a desirable trait when adverse conditions persist for one or more years. The Completion Report, "Analysis of spatial and temporal dynamics of submersed aquatic vegetation and metaphyton communities of Pool 4, Upper Mississippi River (1998-2011)", analyzed temporal and spatial aquatic plant community dynamics, but did not link changes in the plant communities directly to changes in environmental variables. The proposed study would use physical and chemical data that are more spatially and seasonally stratified to demonstrate relationships with aquatic plant metrics. Environmental conditions that occur in the fall, in addition to the spring and summer, likely play a role in subsequent years of macrophyte presence and abundance. Thus macrophytes not only respond to conditions of the current growing year, but likely have a lag time response to positive (delayed response to restoration) and a negative (community resilience) conditions.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015A1	Complete data entry and QA/QC of 2014 data; 1250 observations.		
	a. Data entry completed and submission of data to USGS	Moore, Langrehr, Vogeler	30 November 2014
	b. Data loaded on level 2 browsers	Schlifer	15 December 2014
	c. QA/QC scripts run and data corrections sent to Field Stations	Sauer, Schlifer	28 December 2014
	d. Field Station QA/QC with corrections to USGS	Moore, Langrehr, Vogeler	15 January 2015
	e. Corrections made and data moved to public Web Browser	Sauer, Schlifer, Caucutt	30 January 2015
2015A2	WEB-based annual Aquatic Vegetation Component Update with 2014 data on Public Web Server.		
	a. Develop first draft	Sauer	30 March 2015
	b. Reviews completed	Moore, Langrehr, Vogeler, Sauer, Yin	15 April 2015
	c. Submit final update	Sauer	30 June 2015
	d. Placement on Web with PDF	Sauer, Caucutt	31 July 2015
2015A3	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	Yin, Moore, Langrehr, Vogeler	31 August 2015
2015A4	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2014 data	Yin, Rogala, Schlifer	31 July 2015
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.	Fischer, Langrehr, Bartels, Giblin, Hoff	30 Sept 2015
2015A6	Final draft LTRM completion report: Fifteen years (1998–2012) of aquatic vegetation in Pool 4 of the Upper Mississippi River (2012A6).	Moore	31 December 2014
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	Moore	30 June 2015
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	Moore	30 June 2016
	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)	Yin	30 Dec 2014
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)	Yin	TBD
2014A6	Annual Field Station Data Summary Report Template Development	Popp, Bierman, Chick, Herzog, Casper, Hagerty	30 Sept 2015

Intended for distribution
Completion report: LTRMP Aquatic Vegetation Program Review (2007A9; Heglund)
LTRMP Technical Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12; Chick, Guyon, Battaglia)
LTRMP Technical Report; Experimental and Comparative Approaches to Determine Factors Supporting or Limiting Submersed Aquatic Vegetation in the Illinois River and its Backwaters (2008APE5, Sass)
LTRMP completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a; Yin)
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)
Manuscript: A statistical model of species occupancy using the LTRMP aquatic vegetation data (2013A7; Yin)
WI DNR annual 2013 data summary report (2014A5; Fischer, Langrehr, Bartels, Giblin, Hoff)

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Ickes, B. S., and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS PB2003-500042)

Korschgen, C. E., L. S. George, and W. L. Green. 1988. Feeding ecology of canvasbacks staging on Pool 7 of the Upper Mississippi River. Pages 237–250 in M. W. Weller, editor. Waterfowl in winter. University of Minnesota Press. Minneapolis.

McDonald L., T. McDonald, and D. Robertson. 1998. Review of the Denali National Park and Preserve (DENA) Long-Term Ecological Monitoring Program (LTEM). Report to the Alaska Biological Science Center Biological Resources Division, USGS. WEST Technical Report 98–7. 19 pp.

Moore, M., H. Langrehr, and T. Angradi. 2012. A submersed macrophyte index of condition for the Upper Mississippi River. Ecological Indicators 13:196–205.

Strayer, D., Glitzenstein, J. S., Jones, C. G., Kolasoi, J., Likens, G. E., McDonnell, M. J., Parker, G. G. and Pickett, S. T. A. 1986. Longterm ecological studies: an illustrated account of their design, operation, and importance to ecology. Occasional Publication of the Institute of Ecosystem Studies, No.2. Millbrook, New York.

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

Fisheries Component

The objective of the UMRR LTRM Fisheries Component is to collect quantitative data on the distribution and abundance of fish species and communities in the UMRS and to conduct research related to fishes for the purpose of understanding resource status and trends, ecological functions, and response to natural disturbances and anthropogenic activities. The UMRS is probably the most biologically productive and economically important large floodplain river system in the United States (Patrick 1998; U.S. Geological Survey 1999), and fish are one of the most important goods and services the UMRS provides to humans (Carlander 1954). Fishes within the UMRS are the subject of commercial and recreational fisheries, both of which contribute substantially to local economies (Fremling et al. 1989). Scientists and fishery managers also recognize fish communities as an integrative index for a complex set of physical and biological conditions on the UMRS.

Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, and 26 and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Ratcliff et al. 2014).

Methods

For monitoring fish, sampling will be conducted following the LTRM study plan and standard protocols (Ratcliff et al. 2014) as modified in 2002 (Ickes and Burkhardt 2002). Species abundance, size structure, and community composition and structure will be measured over time. Between 250 and 400 samples will be collected in each study area (Table 1). Sample allocation will be based on a stratified random design, where strata include contiguous backwaters, main channel borders, main channel wingdams, impounded areas, and secondary channel borders. Tailwaters in the impounded reaches and tributary mouths in the Open River will be sampled under a fixed site design. Sampling effort will be allocated independently and equally across 3 sampling periods (June 15–July 31; August 1–September 15; September 16–October 31) to minimize risks of annual data loss during flood periods and to characterize seasonal patterns in abundance and habitat use. Pool-wide estimates of abundance will be derived by pooling data over all strata.

Product Descriptions

2015B4: Asian Carp Age and Growth (This is a continuation of the work carried since in FY2013 (2013B6, 2014B7) by the Illinois River Biological Station [IRBS].)

Population age structure is critical to understanding about population responses of fishes. For invading species, growth is often an early indicator of changes in population density. Illinois River Biological Station (IRBS) staff began collecting and archiving unprocessed Asian Carp cleithral bone samples (the major bony component of the pectoral girdle of carp) in 2011 from LTRM and other projects for future age and growth analysis. Developing this archive was a low cost hedge against the programs future need to know what the response of this invasive species to activities might be. We will look to continue collaboration with Eastern Illinois University graduate student (Morgeson) on Asian carp population dynamics in the Illinois River basin. Preliminary analysis comparing Asian carp from the Illinois River with populations from selected tributaries has been completed by Mr. Morgeson and IRBS staff will continue to provide data and support. Annual Summary Letter and any additional products will be submitted as they are completed.

To ensure that a representative sample of the bighead and silver carp populations is obtained from the La Grange Reach, cleithrums are removed from Asian carp captured from all the major habitat strata within this reach of the Illinois River: main channel border, side channel border, and backwaters. Asian Carp cleithral bones are extracted from fish collected during routine LTRM fish sampling and processed in the laboratory. Age and growth analysis will follow established fisheries methods (Slipke and Maceina 2010: Fisheries Analysis and Modeling Stimulator). These collections will be supplemented by information and labor from other ongoing projects at the IRBS funded by the Illinois Department of Natural Resources. We will opportunistically seek funding to process these collections and analyze these data in future years, either through funding sources outside of LTRM or through a defined project under LTRM. Preliminary analyses of a limited number of cleithrum samples will be conducted in FY2014 with the goal of identifying and defining the logistics of laboratory processing efforts needed to age Asian carp with these structures.

The goals of this effort are: 1) to continue to develop an archive of Asian Carp cleithrum samples; 2) to develop written lab protocols; and 3) to perform exploratory analysis of the a sub-sample of the archive to validate laboratory methods. Understanding how Asian carp alter ecosystem processes and impact native species is important in order to restore the UMRS and design UMRR Habitat Rehabilitation and Enhancement Projects (HREP) to promote native species versus Asian Carp.

2015B5: Exploring Years with Low Total Catch of Fishes in Pool 26

In Pool 26 of the UMRS, the total number of fishes captured through LTRM sampling declined by 55 to 65% for the years 2009 – 2011, relative to our long-term average total catch. We will explore the underlying dynamics of this pattern, identifying which species showed declines and exploring whether unusual physical-chemical conditions were present that may have influenced gear performance (catchability), or the fish populations through ecosystem dynamics.

We will continue this work in FY2015. Our goal will be to identify topics and analyses that are worthy of being developed for a manuscript for a peer-reviewed scientific journal. We would then attempt to draft this manuscript in FY2016. This project will be limited to statistical analysis of LTRM fisheries data and physical-chemical data.

2015B6: Collection and archiving of age and growth structure for selected species in the La Grange Reach of the Illinois River

The Illinois River Biological Station staff will continue collection of age and growth data and structures (otolith, pectoral fin spines, etc.) for selected species on the La Grange Reach. Collections are made during routine sampling by removing spines (in the case of catfish) or field collection for later otolith removal in the lab (other species) and placing the structures in archive envelopes that are stored in the office for eventual processing. Depending on species, these bony structures have been collected over several years and the resulting age and growth calculations can be used to assess important population dynamics. This on-going data collection work will be secondary to the collection and processing of routine monitoring data and maintenance of field capability. We will opportunistically seek funding to process these collections and analyze these data in future years, either through funding sources outside of LTRM or through a defined project under UMRR. Age and growth analysis will follow established fisheries methods (Slipke and Maceina 2010: Fisheries Analysis and Modeling Simulator version 1).

2015B7: Pool 12 Overwintering HREP Adaptive Management Fisheries Response Monitoring

The Pool 12 Overwintering HREP is being designed and implemented using active adaptive management principles to assess fisheries benefits beyond individual backwaters, whereas prior HREP monitoring considered centrarchid condition and behavior within specific backwaters. This work ultimately aims to answer long-standing questions related to the spacing of fish overwintering HREP projects, and this is an ideal case to attempt this assessment for the reasons mentioned in the Introduction.

The Iowa DNR has been collecting pre-project data in these backwater lakes since 2006. We will have several years of pre-HREP project and post-HREP project fisheries data that will inform the adaptive management process that many UMRR partners are interested in as the evolves. The pre- and post-dredging fisheries monitoring of this HREP will inform other river managers who are working on topics such as standardized HREP monitoring protocols (USACE and USGS), bluegill overwintering models (USACE), and research frameworks associated with aquatic overwintering issues in the Upper Mississippi River Basin (USGS). This work falls within the USACE's priority research areas for FY15.

This is a continuous project that builds on several years of pre-project fisheries monitoring for the Pool 12 Overwintering HREP. We have been performing pool-wide electrofishing in Pool 12 since 2006. We have also been performing fyke netting in backwater lakes that will be rehabilitated, as well as other backwaters in Pool 12 that will not be rehabilitated (as a control). We also perform otolith extraction from bluegills from the lakes we net in to obtain aging, sexing, and mortality information. Field work/data collection, otolith extraction and aging, and annual summary reports are milestones and products of this work.

LEVERAGED PRODUCTS (L)

2015B8(L): Assessment of Asian Carp Exploitation by native Piscivores in the Illinois River

This is the second year of this leveraged work carried out in collaboration with Western Illinois University (WIU - Dr. James Lamer's laboratory) and the Illinois River Biological Station (IRBS). The funding, design and execution of this project are the responsibility of WIU. The IRBS will serve in a supporting role by providing LTRM expertise and building workspace. This is an independent project receiving no direct and is not requesting any funding; therefore this effort should not be part of the funding/timeline schedule. It is simply presented here to illustrate a leveraged LTRM expertise activity. Upon completion of this thesis project, could potentially gain knowledge on native-invasive interactions that may 1) help explain some of LTRM monitoring results; 2) guide future LTRM research frameworks; and 3) have implication for other LTRM activities and HREP design.

The LTRM staff at IRBS will assist with ongoing Master's thesis project through Dr. James Lamer at Western Illinois University. LTRM-funded staff will provide LTRM fisheries and water quality data, access to Survey funded space and equipment, and expertise to assist in investigations conducted by Dr. Lamer and his MS student to assess the likelihood that Asian Carp may be a food resource for native piscivores.

Goals and Objectives: Collection and gastric lavage of 30-50 individuals of 5 different native piscivores (Blue catfish, White Bass, Bowfin, Gar, and other depending on catch). This effort that leverages LTRM data from routine samplings with separate site-specific, ad-hoc analysis conducted as part of a Master's thesis at WIU (tentatively scheduled for FY15, but subject to change).

2015B9: State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2014

This State report contains summaries and analyses of selected features of fish communities and fish populations from data collected since the LTRM fish component was initiated on Pool 13. This report will focus on: 1) the relative abundance of commonly collected species; 2) trends in catch-per-unit-effort (CPUE) of selected game and prey species; and, 3) the detection of uncommon or rare species.

DONATED PRODUCTS (D)

2015B10(D): Database addition; Special Project—Stratified random day electrofishing samples collected in Pools 9, 10, and 11.

The Iowa DNR's Guttenberg Fisheries Management Station began collecting SRS fisheries data in Pools 9 - 11 this summer. These data will expand the spatial extent of the current LTRM sampling. Species richness and relative abundance are among some the fisheries metrics that can be gleaned from these data, and they can be directly compared to similar metrics in the LTRM key pools. These data may also serve as a control to assess natural variation when evaluating fisheries responses to HREP projects. At this time, this project only includes data storage. No plans currently exist within LTRM to analyze these data unless funding becomes available. Data are available by contacting the LTRM Data Manager at USGS-Upper Midwest Environmental Sciences Center.

2015B11(D): Database addition; Special Project—Stratified random day electrofishing samples collected in Pools 16–18

The Iowa DNR's Fairport Fisheries Management Station has six years of what may be the equivalent of LTRM "outpool sampling" data (2006–present) This data will potentially bridge the gap of the fundamental lack of consistent and standardized fisheries information between key LTRM pools—Pools 13 and 26, in this case. Species richness and relative abundance are among some the fisheries metrics that can be gleaned from this data, and they can be directly compared to similar metrics in the LTRM key pools. This data may also serve as a control to assess natural variation when evaluating fisheries responses to HREP projects. This is something that the larger contingencies of river managers have asked for a long time. At this time, this project only includes data storage. No plans currently exist within LTRM to analyze these data unless funding becomes available. Data are available by contacting the LTRM Data Manager at USGS-Upper Midwest Environmental Sciences Center.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015B1	Complete data entry, QA/QC of 2014 fish data; ~1,590 observations		
	a. Data entry completed and submission of data to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	31 January 2015

	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	Schlifer	15 February 2015
	c. Field Station QA/QC with corrections to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	15 March 2015
	d. Corrections made and data moved to public Web Browser	Sauer and Schlifer	30 March 2015
2015B2	Update Graphical Browser with 2014 data on Public Web Server.	Sauer, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton, Schlifer	31 May 2015
2015B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	Ickes, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	31 October 2015
2015B4	Summary letter on Asian carp age and growth: collection of cleithral bones	Solomon, Casper	31 January 2015
2015B5	Letter Summary: Exploring Years with Low Total Catch of Fishes in Pool 26	Gittinger, Ratcliff, Lubinski, Chick	30 Sept 2015
2015B6	Collection and archiving of age and growth structure for selected species in the La Grange Reach of the Illinois River	Solomon, Casper	31 January 2015
2015B7	Summary report: Pool 12 Overwintering HREP adaptive management fisheries response monitoring	Bierman, Bowler	30 September 2015
2015B8(L)	Advisory role for Assessment of Asian carp exploitation by native piscivores in the Illinois River (Western Illinois University)	Casper	NA (WIU product)
2015B9	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2014	Bowler	30 June 2015
2015B10(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9 - 11	Bowler	30 Sept 2015
2015B11(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	Bowler	30 Sept 2015
2014B10	Presentations, draft completion report: Paddlefish population characteristics in the Mississippi river Basin	Hupfeld, Phelps	1 Dec 2015
2014B11	Presentations, draft completion report: Examining recruitment patterns in Fishes in the Mississippi River	West, Sobotka, Hupfeld, Phelps	30 Nov 2014
2014AC2	Fish community structure: complete data analysis	Solomon, Pendleton, Casper	30 October 2014
2014AC3	Fish community structure: present results	Solomon, Pendleton, Casper	TBD
2014AC4	Fish community structure: draft manuscript	Solomon, Pendleton, Casper	30 December 2014

On-Going			
2006B6	Draft manuscript: Spatial structure and temporal variation of fish communities in the Upper Mississippi River. (Dependent on 2008B9 acceptance into journal)	Chick	30 Sept 2015
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)	Chick	30 September 2015
2014B6	Summary letter on Asian carp age and growth: collection of cleithral bones	Solomon, Casper	31 January 2015
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	Solomon, Casper	31 January 2015

Intended for distribution
Completion report: LTRMP Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings)
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.
LTRMP 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)
LTRMP technical report; Setting quantitative fish management targets for LTRMP monitoring (2008APE2; Sass)
LTRMP Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.)
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)
LTRMP Fact Sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16)
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.
LTRMP fisheries component procedures manual (2013B5; Ratcliff, Gittinger, Ickes). http://pubs.usgs.gov/mis/ltrmp2014-p001
LTRMP Program report: Ickes, B.S., Sauer, J.S., and Rogala, J.T., 2014, Monitoring rationale, strategy, issues, and methods: UMRR-EMP LTRMP Fish Component. A program report submitted to the U.S. Army Corps of Engineers' Upper Mississippi River Restoration-Environmental Management Program, Program Report LTRMP 2014–P001a. http://pubs.usgs.gov/mis/ltrmp2014-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

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Carlander, H. B. 1954. A history of fish and fishing in the Upper Mississippi River. Upper Mississippi River Conservation Committee Special Publication. Upper Mississippi River Conservation Committee, Rock Island, Illinois.

Fremling, C. R., J. L. Rasmussen, R. E. Sparks, S. P. Cobb, C. F. Bryan, and T. O. Claflin. 1989. Mississippi River fisheries: A case history. Pages 309–351 in D. P. Dodge, editor. Proceedings of the International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences 106. Department

Ickes, B. S. and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS #PB2003-500042)

Ickes, B. S., M. C. Bowler, A. D. Bartels, D. J. Kirby, S. DeLain, J. H. Chick, V. A. Barko, K. S. Irons, and M. A. Pegg. 2005. Multiyear synthesis of the fish component from 1993 to 2002 for the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. LTRMP 2005-T005. 60 pp. + CD-ROM (Appendixes A–E). (NTIS PB2005-107572)

Ratcliff, E.N., Gittinger, E.J., O'Hara, T.M., and Ickes, B.S., 2014, Long Term Resource Monitoring Program Procedures: Fish monitoring, 2nd edition. A program report submitted to the U.S. Army Corps of Engineers' Upper Mississippi River Restoration-Environmental Management Program, June 2014. Program Report LTRMP 2014-P001, 88 pp. including Appendixes A–G, http://pubs.usgs.gov/mis/ltrmp2014-p001

Patrick, R. 1998. Rivers of the United States. Vol. IV, Part A - The Mississippi River and Tributaries North of St. Louis. Part B. The Mississippi River and Tributaries South of St. Louis. John Wiley and Sons, Inc. New York. pp. 863.U.S. Fish and Wildlife Service. 1980. Habitat Evaluation Procedure (HEP) Manual (102 ESM). U.S. Fish and Wildlife Service, Washington, DC.

U.S. Geological Survey (USGS). 1999. Ecological status and trends of the Upper Mississippi River system 1998. A report of the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. LTRMP 99-T001. 236 pp.

Water Quality Component

The objective of the UMRR LTRM's water quality component is to conduct monitoring and research to obtain basic limnological information required to (1) increase understanding of the ecological structure and functioning of the UMRS, (2) document the status and trends of ecological conditions in the UMRS, and (3) contribute to the evaluation of management alternatives and actions in the UMRS. The water quality component focuses on a subset of limnological variables related to habitat quality and ecosystem function that includes physicochemical features, suspended sediment, and major plant nutrients known to be significant to aquatic habitat in this system.

Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, 26, and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Soballe and Fischer 2004).

Methods

For monitoring water quality, limnological variables (physicochemical characteristics, suspended solids, chlorophyll a, phytoplankton [archived], and major plant nutrients) will be monitored at both stratified random sites (SRS) and at fixed sampling sites (FSS) according to LTRM protocols.

Fixed site sampling
Fixed site sampling will be conducted as in FY2006 except for modifications made in 2010 for Pools 4 and 8 (Table 1).

Stratified random sampling
Stratified random sampling will be conducted at full effort levels (same as FY2000) for fall, winter, spring, and summer episodes (Table 1).

In situ data collection
For both FSS and SRS in situ data will be collected on physicochemical characteristics per the standard protocols (Soballe and Fischer 2004).

Laboratory analyses
Samples for chemical analysis (nitrogen (total N, nitrate/nitrite N, ammonia N), phosphorus (Total P, SRP), and silica) will be collected at all fixed sites and at approximately 35% of all stratified random sampling locations as specified in the sampling design. Samples for chlorophyll and suspended solids (total and volatile) will be collected at all SRS and Fixed sites Sampling and laboratory analyses will be performed following LTRM protocols (Soballe and Fischer 2004) and Standard Methods (American Public Health Association 1992).

Product Descriptions

2015D10, D11, and D12: Evaluation of water quality data from an automated sampling platform

This project continues activities initiated in FY2013 (2013D19, 2014D11). The National Great Rivers Research and Education Center has invested in automated sampling platforms for water quality data to establish the Great Rivers Ecological Observatory Network (GREON). The platforms are YSI Pisces platforms, originally equipped with YSI 6600 sondes, upgraded to EXO2 in FY14, for measuring water temperature, conductivity, dissolved oxygen, pH, turbidity, chlorophyll-a, and blue-green algae; and a Satlantic SUNA sonde (1 buoy) or a ion-selective electrode sensors (all other buoys) for measuring nitrate concentration. These platforms have been deployed in Pool 26 (Ellis Bay, an impounded backwater, adjacent to an LTRM fixed water quality site) and Pool 8 (Stoddard Islands, a habitat rehabilitation project site that includes an LTRM fixed site). In FY2015, the platforms will be deployed at these two backwater sites, and at a main channel site in both of these pools and in the main channel of the LTRM Open River reach. We will compare and contrast data collected from the GREON buoys with LTRM water quality data from the fixed sites.

There are two primary objectives for this work: 1) to assess the accuracy of the data collected from the GREON buoy, and 2) Explore the benefits and logistical feasibility of collecting continuous monitoring stations at multiple locations on the UMR to complement the data collected by ongoing LTRM.

Deploying these continuous monitoring buoys, purchased by NGRREC in Pools 8 and 26 and the Open River reach, provides an opportunity to test this technology in a large river and to learn substantially about the rivers function and health from otherwise unavailable high resolution data. In FY15 the buoys are tentatively scheduled for deployment during the receding limb of the spring flood through the end of September.

Fixed site data collection and sample processing will follow the normal methods, procedures, and timeline described in the water quality component section of this SOW. Routine maintenance and care for the GREON buoys will take place during fixed site sampling and other routine LTRM sampling events (i.e., water quality SRS, possibly fish sampling). Data from the GREON buoys will be downloaded remotely from our offices at NGRREC. The GREON Buoys will be placed in winter storage in December, 2014, and re-deployed in March 2015. Data analysis will be conducted from November 2014 through March 2015.

2015D13 and D14: Coherence in temporal variation of select water quality parameters across strata and study reaches

Spatial and temporal differences in water quality in the UMRS are the result of a variety of factors and include drivers such as climate/precipitation, discharge/stage, solar irradiance, hydrologic connectivity, and local biological processes. The extent to which variability through time is similar across strata and study reaches may provide insights into the scale at which the primary driver of those conditions operates, and the extent to which data collected in study reaches provides information on other reaches of the UMRS. For example, a variable that varies similarly through time across strata and pools (high coherence) is likely responding to large scale regional drivers such climatic variability; a variable that has little correlation through time across strata and study reaches is likely responding to local physical conditions and hydrological and biological processes. The use of coherence for understanding the mechanisms behind spatial patterns has been used previously in comparative studies of lakes (Baines et al. 2000, Webster et al. 2000), but not in large rivers. Previous analysis of data in the UMR for other purposes suggest that dissolved nitrogen exhibits high coherence across study reaches, especially in spring, whereas chlorophyll exhibits much lower levels (Gittinger and Houser 2005). This initial analysis only included main channel and backwater strata, addressed a limited set of water quality variables, and did not specifically investigate temporal coherence among study reaches and strata. Understanding

which variables vary similarly through time across strata and study reaches and which are more driven by local conditions will improve our understanding of the extent to which measurements in LTRM study reaches can inform our understanding of other reaches of the river.
The objective of this paper is to use LTRM data to compare the temporal coherence of a suite of water quality variables across strata and study reaches. It is hypothesized that variables linked closely to the physical effects of discharge (e.g., total nutrient concentrations, turbidity, suspended solids) will exhibit relatively high coherence where as those more strongly linked to local biological processes (chlorophyll and dissolved oxygen) will exhibit relatively low coherence. This project is the next logical step in building a strong understanding of spatial and temporal patterns in the water quality of the UMRS. It builds on the basic longitudinal patterns described by Houser et al. (2010), the persistent long-term spatial patterns described by De Jager and Houser (2012), and the association between discharge and channel vs. backwater contrasts described by Houser (submitted).

This work addresses sections 4.2.1 (Major nutrients), 4.2.2 (chlorophyll), 4.2.3 (Total suspended solids), and 4.2.4 (Dissolved oxygen) of the Indicators of Ecosystem Health for the Upper Mississippi River System report (Hagerty and McCain 2013).

2015D15: Analysis of Lake Pepin Rotifers

Rotifers are often a major component in the zooplankton community of river systems. Their short generation times and ability to function in turbid and turbulent conditions often make them the most abundant taxa in rivers. There is very little information about rotifer communities on the Mississippi River regarding community composition, abundance, and seasonal dynamics. Rotifers have been shown to be a common prey item it the diets of invasive carp on the Illinois and Mississippi rivers. Given that invasive carp have not yet become established in the upper reaches of the Mississippi River, data from this project will provide invaluable pre-invasion information on this important component of the zooplankton community. This work would build on previous work of Completion Report 2006D7, Summary of Zooplankton in Lake Pepin, Upper Mississippi River (1993-2006) and a manuscript in progress (2013D17) Zooplankton dynamics in a natural riverine lake, Upper Mississippi River.

Our objective is to provide rotifer community data on Lake Pepin prior to the invasion of Asian carp. In addition, future work would include analysis in conjunction with available phytoplankton and crustacean zooplankton data that would assess the entire plankton community and the interrelationships between the major groups. This work would augment current analysis being conducted on a LTRMP crustacean zooplankton data set from Lake Pepin. Rotifer collections began in 2012 with the anticipation of invasive Asian carp becoming established in the upper reaches of the Mississippi River at some later date. Zooplankton are an important link in the food web of most aquatic systems and are an important prey item for most larval game and forage fish as wells as adult planktivores. Research has shown a diet overlap exists between Asian carp and native fishes with zooplankton being the most common prey item. Providing a better understanding of the dynamics of this trophic level would seem invaluable to river managers. Lake Pepin may provide the ideal location to study the effects of Asian carp on the zooplankton community. Not only is there a long term data set for crustacean zooplankton available for Lake Pepin, but there is also a long term fisheries data set from the assessment program run by MN DNR Section of Fisheries. Lake Pepin has the potential to be ideal habitat for Asian carp given the lake's semi-lentic hydrological characteristics and abundant plankton, and thus become a major source of Asian carp recruitment downriver.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015D1	Complete calendar year 2014 fixed-site and SRS water quality sampling	Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	31 December 2014
2015D2	Complete laboratory sample analysis of 2014 fixed site and SRS data; Laboratory data loaded to Oracle data base.	Yuan, Schlifer	15 March 2015
2015D3	1st Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	30 December 2015
2015D4	2nd Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	30 March 2015
2015D5	3rd Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	29 June 2015
2015D6	4th Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	28 September 2015
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.	Schlifer, Rogala, Houser	30 March 2015
	b. Field Station QA/QC; USGS QA/QC.	Houser, Rogala, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	15 April 2015
	c. Corrections made and data moved to public Web Browser	Rogala, Schlifer, Houser	30 April 2015
2015D8	Complete FY2014 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool (Table 1)	Houser, Burdis, Giblin, Kueter, L. Gittinger, Cook, Sobotka	30 Sept 2015
2015D9	WEB-based annual Water Quality Component Update w/ 2014 data on Server.	Rogala	30 May 2015
2015D10	Letter Summary: Evaluation of water quality data from automated sampling platforms	Soeken-Gittinger, Lubinski, Chick, Houser	31 Sept 2015
2015D11	Draft report/manuscript: Developing continuous water quality monitoring methods in the UMR	Chick, Houser	1 Sept 2016
2015D12	Final report/manuscript: Developing continuous water quality monitoring methods in the UMR	Chick, Houser	1 Sept 2017
2015D13	Initial analyses and draft manuscript: Coherence in temporal variation of select water quality parameters across strata and study reaches	Houser	1 Sept 2015

2015D14	Draft manuscript: Coherence in temporal variation of select water quality parameters across strata and study reaches	Houser	1 Sept 2016
2015D15	Analysis of Lake Pepin rotifers; data from 2012-2014	Burdis, Hirsch	30 June 2015
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)	Popp, Burdis, DeLain, Moore	27 February 2015
2014D13	Presentations, draft completion report: A Comparison of Side and Main Channel Fish Community and Water Quality Characteristics	Sobotka, West, Phelps	Dec 2015
On-Going			
2013D17	Draft manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin	Burdis	Nov 2014

Intended for distribution
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites)
LTRMP report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik)
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: Lateral contrasts in nutrients, chlorophyll, and suspended solids within the Upper Mississippi River System (2012D10; Houser)
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis)
Manuscript: Trends in suspended solids, nitrogen, and phosphorus in select upper Mississippi River tributaries, 1991-2011 (Kreiling and Houser, 2013D14)
Manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin (2013D17; Burdis)
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)
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))

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Land Cover/Land Use with GIS Support

In FY2010-11, systemic digital aerial photography was collected by the UMRR LTRM in cooperation with USFWS Region 3. The main task under Land Cover/Land Use will be in processing these data (See Development of 2010/11 Land Cover/Land Use GIS Database and Aerial Photo Mosaics).

However, we will continue to provide on demand GIS technical assistance, expertise, and data production to the Environmental Management Program partnership including, but not limited to:

- Aerial photo interpretation
- Interpretation automation into a digital coverage
- Flight planning and acquisition of aerial photography
- Change detection and habitat modeling
- Georeferenced aerial photo mosaics (pool wide, Habitat Rehabilitation and Enhancement Projects (HREPs), land acquisition areas)
- Georeferenced archival map/plat mosaics (Brown Survey, Mississippi River Commission data, Government Land Office data)
- Produce graphics and summary tables for partnership publications, posters, and presentations
- Conversion of ASCII coordinate data from a GPS to a spatial data set
- Conversion of GIS data to KMZ (Google Earth) formats for ease of viewing and sharing (as requested).
- Maintain, update, and oversee the aerial photo library of over 50,000 print and digital images.
- Maintain, update, and enhance over 20 million acres of land cover/land use and aquatic areas data spanning the late 1800s through the year 2000. This includes improving existing or developing new crosswalks for comparison of existing data sets, cropping data sets to common extents, and ensuring that all data sets are in a common coordinate system.
- Assist in the maintenance and updating of the USGS-Upper Midwest Environmental Sciences Center's (UMESC) web based geospatial data repository.
- Provide hardware and software technical support to UMESC staff and partners, as needed.
- Continue to assess advances in computer technology (hardware and software) for accurate and efficient GIS data production.

Product Descriptions

2015LC1: Although the primary focus of this component is to provide technical assistance and maintain existing databases, *as time allows* work may occur on the following LTRM projects. As work is accomplished for each project, it will be reported in the quarterly activities. When a project is completed, that will be announced to the partners and reported in the quarterly activities. The percentage completion for each project will be updated in each subsequent scope of work.

- Continue to update the detailed spreadsheet of all LTRM aerial photography currently housed at UMESC, including date, pool location, format (color infrared, natural color, black-and-white), scan status (yes/no, dots per inch), interpreted status, photo scale, and extent of coverage (partial or complete). This document will be served on-line and updated as necessary. (70% complete)

- Complete summaries detailing differences in land cover between 2000 and 2010/11 for the key pools (50% complete)
- Create a Google Earth help page to assist partners and public in using Google Earth to view and query LTRM data being served in the KMZ format. (75% complete)
- Develop KMZ files for 2010/2011 aerial photo positions that include date, time, approximate water level at time of acquisition, and link to closest stream gage. This work will enhance the scope "Geospatial upgrades". (50% complete)
- Clip HREP boundaries (based on boundaries as defined in HREP web pages for individual projects, or through consultation with the Corps) across years and create a geodatabase for each HREP site. (50% complete)
- Assess automated terrain extraction software (Imagine Photogrammetry Suite) using 3"/pixel imagery and compare extracted elevation information to LiDAR-derived digital elevation models. This will help answer the question if using high-resolution aerial imagery can produce digital surface models on par with LiDAR elevation models.
- Assist Nate DeJager with his land cover/land use change assessment project using the systemic 2000 and 2010/2011 LCU products.
- Assess eCognition's ability to identify and classify floodplain vegetation to the 31-class level. This software has become the standard for automated and semi-automated land cover classification. The software must be 'trained' on vegetation class signatures initially but it can use that that training and ancillary datasets to derive land cover classes from digital aerial imagery. We hope to assess is usefulness at distinguishing floodplain land cover classes for future mapping efforts.
- Assist the USFWS Region 3 Office in evaluating and assessing enhanced remote sensing capabilities, including a larger-format digital aerial camera (80-megapixels versus the existing 39-megapixel sensor), and a high-resolution thermal infrared sensor (1,024 x 768 sensor). The increased aerial camera sensor size will allow for a more cost effective acquisition of floodplain landscapes. Among other potential uses, the thermal camera evaluation will assess the camera's ability to determine surface water heterogeneity, detect levee seeps, detect and count UMRS waterfowl and wildlife.

Products and Milestones

Tracking number	Products		Staff		Milestones
2015LC1	Updates on progress for land cover products listed above.		Robinson		New progress reported in the quarterly activities. Percent complete updated 30 Sept 2015.

2010–2011 Land Cover/Land Use Data Development

Development of the UMRR LTRM 2010/2011 Land Cover/Land Use (LCU) Geographic Information System (GIS) database will provide a third systemic dataset to compare the 1989 and the 2000 systemic coverages. Though a crosswalk was needed to compare 1989 and 2000 since different vegetation classification systems were used, the 2000 and 2010/11 LCU datasets will use the same classification and classifiers, making them directly comparable. Once completed, the 2010–2011 dataset will be invaluable in assessing and evaluating long-term vegetation trends and habitat changes over the past 20 years, and in assessing the current state of floodplain vegetation.

Objectives

Develop a 2010/11 LCU GIS database for Pools 1–26, the Open River Reach, the entire Illinois River, and the navigable portions of Minnesota, St. Croix, and Kaskaskia Rivers of the UMRS and provide an accuracy assessment and validation of select pools to determine the accuracy of this database. Note: Extensive flooding on the Middle Mississippi River below the Quad Cities required aerial photography on Pools 14-Open River to be postponed until the late-summer of 2011. The upper pools of the Illinois River (Lockport, Brandon, and Dresden Pools) were reflown in 2011 due to heavy cloud cover in 2010.

Methods

Aerial photographs of Pools 1–13 of the Upper Mississippi River (at 8”/pixel) and the Alton, La Grange, Peoria, Starved Rock, and Marseilles Pools of the Illinois River (at 16”/pixel) were collected in color infrared (CIR) in August of 2010 using a mapping-grade Applanix DSS 439 digital aerial camera. In August 2011, CIR aerial photographs for Pools 14-Open River South of the Upper Mississippi River and the Dresden, Brandon, Lockport Pools of the Illinois River were collected at 16”/pixel with the same camera. These CIR aerial photos were orthorectified, mosaicked, compressed, and served via the UMESC Internet site. The CIR aerial photos will be interpreted and automated using a 31-class LTRM vegetation classification (see Attachment A). The 2010/11 LCU databases will be prepared by or under the supervision of competent and trained professional staff using documented standard operated procedures and will be subject to rigorous quality control (QC) assurances (NBS, 1995).

The LTRM trend pools (Pools, 4, 8, 13, and the La Grange Pool of the Illinois River) were processed first in FY11. The trend pools whose imagery was collected in late summer 2011 (Pool 26 and Open River South) along with Pools 6, 9, 14, 18, and 19 were completed in FY12. In FY13, Pools 3, 5, 5A, 6, 7*, 10, 12, 14, 20, 21, 22, 24, 25, and the Starved Rock and Marseilles Pools of the Illinois River were completed. Open River North, at over 400,000 acres, is the largest pool in the UMRS and was completed in FY14. Pools 1, 2, 11, 15–17 of the UMR, the Lockport, Brandon, and Dresden of the Illinois River, and the navigable portions of the Lower Minnesota, Lower St. Croix, and Lower Kaskaskia Rivers will be completed in FY15.

Land Cover/Land Use data currently available include Pools 3–10, 12–14, and 18–26, Open River South, and Alton, La Grange, Peoria, Starved Rock, and Marseilles Pools on the Illinois River (http://www.umesc.usgs.gov/data_library/land_cover_use/2010_lcu_umesc.html).

Products and Milestones

Tracking number	Products	Staff	Milestones
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.	Robinson, Hoy, Hanson, , Ruhser, Nelson, Jakusz	31 August 2015

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ATTACHMENT A

LTRMP 31-Class General Vegetation Classification, Version 1.0

CODE	CODE DESCRIPTION	HYDROLOGY DESCRIPTION	DESCRIPTION
OW	Open Water	Permanently Flooded Non-Forest	Open Water; Default to Anderson Classification
RFA	Rooted Floating Aquatics	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
SV	Submerged Aquatic Vegetation	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
DMA	Deep Marsh Annual	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
DMP	Deep Marsh Perennial	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
MUD	Mud	Seasonally Flooded Non-Forest	Seasonally/Temporarily flooded mudflats
SMA	Shallow Marsh Annual	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SMP	Shallow Marsh Perennial	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SM	Sedge Meadow	Temporarily Flooded Non-Forest	Temporarily flooded temperate or subpolar grassland
WM	Wet Meadow	Saturated Soil Non-Forest	Saturated temperate or subpolar grassland
DMS	Deep Marsh Shrub	Semipermanently Flooded Shrubs	Semipermanently flooded cold-deciduous shrubland
SMS	Shallow Marsh Shrub	Seasonally Flooded Shrubs	Seasonally flooded cold-deciduous shrubland
WMS	Wet Meadow Shrub	Temporarily Flooded Shrubs	Temporarily flooded cold-deciduous shrubland
SS	Shrub/Scrub	Infrequently Flooded Shrubs	Temperate cold-deciduous shrubland
WS	Wooded Swamp	Semipermanently Flooded Forest	Semipermanently flooded cold-deciduous closed tree canopy
FF	Floodplain Forest	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
PC	Populus Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
SC	Salix Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
BHF	Bottomland Hardwood Forest	Temporarily Flooded Forest	Temporarily flooded cold-deciduous closed tree canopy
CN	Conifers	Infrequently Flooded Forest	Rounded-crowned temperate or subpolar needle-leaved evergreen forest
PN	Plantation	Infrequently Flooded Forest	Plantation
UF	Upland Forest	Infrequently Flooded Forest	Lowland or submontane cold-deciduous closed tree canopy
AG	Agriculture	Infrequently Flooded Non-Forest	Annual row-crop forbs or grasses
DV	Developed	Infrequently Flooded Non-Forest	Developed; Default to Anderson Classification
GR	Grassland	Infrequently Flooded Non-Forest	Tall sod temperate grassland
LV	Levee	Infrequently Flooded Non-Forest	Levee; Default to Anderson Classification
PS	Pasture	Infrequently Flooded Non-Forest	Perennial Grass Crops
RD	Roadside Grass/Forbs	Infrequently Flooded Non-Forest	Roadside Grass/Forb; Default to Anderson Classification
SB	Sand Bar	Temporarily Flooded Non-Forest	Temporarily flooded sand flats
SD	Sand	Infrequently Flooded Non-Forest	Dunes with sparse herbaceous vegetation
NPC	No Photo Coverage	n/a	No Photo Coverage; n/a

VEGETATION MODIFIERS

Density A = 10-33% B = 33-66% C = 66-90% D = > 90%

Height* 1 = 0-20 ft. 2 = 20-50 ft. 3 = > 50 ft. *Trees only

Bathymetry Component

The overall goal of the UMRR LTRM's Bathymetry Component is to complete a system-wide GIS coverage of UMRS bathymetry used to quantitatively and qualitatively assess the suitability of essential aquatic habitats. Bathymetric surveys of the UMRS have been completed. Presently, the data processing for nine pools (Pools 4, 7, 8, 9, 10, 13, 21, 26, and La Grange Pool) is complete, and these data are served in standard formats on the LTRM's website (www.umesc.usgs.gov/aquatic/bathymetry.html) The remaining unprocessed data have been delivered to UMESC, are available upon request, and will be processed into standard products under separate SOW's as funding becomes available. Under Output 1.1, the LTRM will maintain some level of expertise to provide basic assistance with using the existing bathymetry data, as described below. (Strategic Plan Outcome 1; Output 1.1 & 1.3 and Outcome 4)

Provide on demand technical assistance related to the bathymetric database to the EMP partnership including, but not limited to:

- Deliver data in non-standard formats, such as raw point data in GIS or text files.
- Adjust bathymetry data to selected water surface conditions (presently only available at "flat-pool" conditions)
- Calculate summary statistics (e.g., hypsographic curves and volume) for geographical subsets of the data
- Advise partner agencies on data collection methods and locations that meet LTRM need
- Assist in spatial modeling using the bathymetric data
- Processing of bathymetry point data available upon request as time allows www.umesc.usgs.gov/aquatic/bathymetry.html

Jim Rogala will be the principal investigator.

Statistical Evaluation

Statistical support for the UMRR LTRM provides guidance for statistical analyses conducted within and among components, for contributions to management decisions, for identifying analyses needed by the Program, for developing Program-wide statistical projects, and for reviewing LTRM documents that contain statistical content. The statistician is also responsible for ensuring that newly developed statistical methods are evaluated for use by LTRM. Guidance for management includes assistance with modifications to program design and with standardizing general operating procedures.

The statistical component will help ensure that potentially useful analyses of data from within and across components are identified, that methods for analysis are appropriate and consistent, and that, when possible, multiple analyses work together to achieve larger program objectives regardless of which group (UMESC, field stations, USACE, etc.) conducts analyses. The statistician is also responsible for reviewing LTRM documents that contain substantial statistical components for accuracy, and for ensuring that quality of analyses is consistent among products. A primary goal of statistical analyses is to avoid drawing inappropriate conclusions leading to ineffective or even harmful management actions. Within the UMR, there are a variety of confounding factors and conditions that could produce spurious correlations or lead to inappropriate conclusions regarding cause and effect. Appropriate statistical analysis and interpretation is critical to understanding the inferences from LTRM data. This, in turn, is critical in efforts to distinguish between natural variation and human effects and in evaluating the long-term effects of management actions, such as HREPs, water level manipulations, or increases in navigation.

Product Description

2015E1: Trend estimates for UMRR data summary pages

Trend estimation is one of the primary goals of the UMRR. However, the UMRR has not routinely reported trend estimates. For river managers, an inference on a long-term trend in a resource may lead to management action while such may not be the case with changes in annual status. Trends are easily inferred from inspecting a series of sample means. However, one person's trend estimate may not correspond to another person's estimate. Better is to select an accepted method of trend estimation, and apply that method for all potential visitors to a component's set of web pages. Such estimates may be used for hypothesis generation by scientists (e.g., by addressing why a resource appeared to change or stay the same), and for management action by resource managers. This work will provide trend estimates with annual descriptive statistics on the water component's web pages; report on methods for doing the same for the vegetation component and builds on 2014E1 (Long-term trend reporting, water quality component) and 2014E2 (Water quality web page: Depiction of trend estimates on water quality graphical browser pages).

Annual estimates with confidence intervals will be generated by variable, study pool, stratum and year. These statistics will be placed on water's data summary pages. Report on potential methods of estimating and depicting temporal trends in prevalence and abundance index statistics. This report will be similar to that cited above 2014E1 but will address potential serial correlation among annual vegetation means and that trend estimation for LTRM vegetation levels will require nonlinear models.

2015E2: Estimating trends in water temperature data from LTRM data

Trend estimation is one of the primary goals of the UMRR. Further, climate change concerns have stimulated interest in trends in water temperature in streams and rivers. Trend estimates should be as accurate as possible. Estimating trends in variables that vary diurnally or seasonally may require adjustment for trends in time of sampling or date of sampling. Estimated trends in water temperature may change importantly when adjusted for trends in time of sampling or date of sampling (2013E2).

The LTRM's data represent one of the world's largest and most extensive datasets on a large river with a priority to provide timely and useful information to natural resource decision makers in the UMRS Basin. To deliver sound scientific information, we need to ensure not only that data collection methods and procedures used are scientifically valid and comparable over time and space but also that the statistical methods used with those data are appropriate. This project enhances the proposed trend estimation method by allowing it to be reviewed externally in a scientific journal.

Products and Milestones

Tracking number	Product	Staff	Milestone
2015E1	Trend lines with confidence bands added to water quality data web summary pages	Gray, Schlifer, Houser, Rogala, Yin	30 Sept 2015
2015E2	Draft manuscript: Estimating trends in water temperature data from LTRM data (from 2013E2 completion report)	Gray, Lyubchich, Gel	30 Sept 2015
	On-Going		
	Intended for distribution		
Completion report that describes methods of estimating variance components from LTRMP water quality data (2008E1; Gray)			
Manuscript: Inferring decreases in among- backwater heterogeneity in large rivers using among-backwater variation in limnological variables (2010E1, Rogala, Gray, Houser)			
Completion Report: summer water temperature in the Upper Mississippi River (2012E2). Gray, Robertson, Houser, Rogala.			
Completion report: An assessment of trends in water temperature in La Grange Pool (2012E3; Gray, Robertson, Rogala, Houser)			
Completion report: Long-term trend reporting, water quality component (2013E1, Gray) http://www.umesc.usgs.gov/documents/publications/2014/gray_b_2014.html			

Data Management

The objective of data management for the UMRR LTRM is to provide for data collection, correction, archive, and distribution of a 90 million dollar database that consists of over 2.2 million records located in 195 tables. The 2.2 million data points currently in the system require regular maintenance and upgrading as technologies change. Also, having a publicly accessible database requires a significant level of security. This is accomplished by having the systems Certified and Accredited by a rigorous, formal process by the USGS Security team.

Methods

Data management tasks include, but are not limited to:

- Review daily logs to ensure data and system integrity and apply application updates.
- Develop and maintain field notebook applications to electronically capture data and begin the initial phase of Quality Control/Quality Assurance (QA/QC).
- Administer and maintain the Oracle LTRM database.
- Administer and maintain LTRM hardware, software, and supplies to support LTRM needs.
- Administer, maintain, and update the LTRM public and intranet data browsers to insure access to all LTRM data within USGS security policy.

Product Description

Products and Milestones

Tracking number	Products	Staff	Milestones
2015M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	Schlifer	30 May 2015
2015M2	Load 2014 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	Schlifer	30 June 2015
2014M3	Webinar on LTRMP data access and use	Sauer, Johnson, Houser, Ickes, Yin, Rogala, Schlifer, Lowenberg	27 Oct 2014

Landscape Pattern Research and Application

The goal of landscape pattern research on the Upper Mississippi River System is to develop concepts, maps and indicators that provide both regional-level decision makers and local-level resource managers with information needed to effectively manage the UMRS.

As described in the UMRR Landscape Pattern Research Framework (De Jager 2011), landscape pattern research on the UMRS focuses on linking decisions made at regional scales with restoration actions carried out at local scales. While regional program managers and decision makers are concerned with improving the overall ecological condition of the entire UMRS, local resource managers work to address site specific habitat and resource limitations. Landscape ecology, which focuses on the linkages between patterns visible at broad scales and ecological patterns and processes that occur at local scales, can help to integrate these two scale-dependent management activities. (Strategic Plan Outcome 2, Output 2.2, Outcome 4)

Objectives

1) To develop broad-scale indicators of habitat amount, connectivity and diversity for the purposes of a) identifying areas for ecosystem restoration across the entire system and b) to track status and trends in habitat area, diversity and connectivity.

2) To connect broad-scale landscape pattern indicators with local-scale ecological patterns and processes critical to restoration project development.

Projects

2015L1: Data Analysis: Examining changes in land cover and land use 2000-2010. Nathan De Jager (UMESC), Jason Rohweder (UMESC)

UMR system-wide 2010 Land cover data is scheduled for completion by the end of FY2015. We intend to examine the changes that have occurred over the past 10 years as the data become available. We will extend the temporal extent of previous land cover land use change analyses (De Jager et al. 2013a). We will focus on the 15-class data set because it allows for assessment of changes in vegetation classes important to resource managers. One question we are particularly interested in is how far south recent increases in SAV have extended? Other questions have to do with invasion by reed canarygrass, which is mapped as the ‘wet meadow’ class. This research addresses objective 1.2 of the landscape patterns research framework (patterns of land cover composition).

2015L2: Draft manuscript: Connectivity/Inundation tool for mapping spatial patterns in river-floodplain connectivity. Nathan De Jager (UMESC), Timothy Fox (UMESC), Jason Rohweder (UMESC).

River-floodplain connectivity is a fundamental driver of the patterns and processes that occur within riverine landscapes. As a consequence, flood inundation and hydrodynamic modeling have become commonplace in the design of river and floodplain restoration projects. Such modeling efforts result in multiple spatial data layers that depict the distribution and/or flow velocity of water at different discharge conditions. We developed a GIS based computer model that utilizes such outputs to simulate the effects of alternative hydrographs on spatial patterns of annual flood and flow durations. In 2015 we intend to draft a manuscript introducing this model to the broader scientific community and demonstrate how it can be used to evaluate the effects of alternative hydrological scenarios on ecologically meaningful measures of river-floodplain connectivity. This research addresses objective 1.1 of the landscape patterns research framework (patterns of floodplain inundation).

2015L3: Data Analysis: Effects of flooding, herbivory, and invasion by reed canarygrass on multivariate elemental cycling in a UMR floodplain forest. Rebecca Kreiling (UMESC), Nathan De Jager (UMESC), Whitney Swanson (UW-La Crosse), Eric Strauss (UW-La Crosse), Meredith Thomsen (UW-La Crosse).

2015L4: Data Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on decomposition and nitrogen cycling along the UMR Floodplain. Whitney Swanson (UW-La Crosse), Nathan De Jager (UMESC), Eric Strauss (UW-La Crosse), Meredith Thomsen (UW-La Crosse).

2015L5: Data Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on microbial enzyme activity along the UMR Floodplain. Julia Reich (Carleton College), Daniel Hernandez (Carleton College), Whitney Swanson (UW-La Crosse), Nathan De Jager (UMESC), Eric Strauss (UW-La Crosse), Meredith Thomsen (UW-La Crosse).

Since 2010, N. De Jager has been providing assistance and information to local US Army Corps of Engineers foresters (Randal Urich et al.) to guide forest restoration at a site just south of La Crosse, Wisconsin. In cooperation with personnel at the University of Wisconsin-La Crosse, studies were conducted from winter 2010 to summer 2011 on the role(s) herbivory by white-tailed deer and flooding play in forest recruitment and invasion by exotic reed canarygrass (De Jager et al. 2013b, Cogger et al. 2014). In 2012, a collaborative experiment involving Whitney Swanson (student) of the University of Wisconsin-La Crosse was initiated to examine rates of nitrification across the elevation gradient of the floodplain and in response to management actions that created different plant community types (De Jager et al. In Review). Additional data were collected as part of that study and consist of 13 available ions (NO3, NH4, Fe, Mn, P, B, Ca, Al, Mg, Pb, Cu, Zn, K). This data will be analyzed by N. De Jager and B. Kreiling in 2015 (2015L3).

At the same study site, W. Swanson initiated a new study for her Masters research that focuses on the effects of flooding, invasion, and increased nitrogen deposition on rates and patterns of organic matter decomposition and nitrogen cycling. She will collect final soil samples in 2014, with data analyses to follow in 2015 (2015L4). Additional soil samples will be collected in 2014 and examined for microbial enzyme activity by Julia Reich (student), under the supervision of Dr. Daniel Hernandez at Carelton College, MN. This data analysis will be Julia's senior thesis project (2015L5). Collectively, these studies (2015L3-L5) will help us better understand how management decisions that relate to river-floodplain connectivity, and establishment of different plant community types might alter important aspects of ecosystem function, including nutrient and elemental cycling, and the microbial communities that regulate those cycles. This research partially addresses objective 2.2 (floodplain soil nutrient dynamics) of the Landscape Patterns Research Framework.

2015L7 Draft manuscript: Measuring spatial patterns in floodplains: a step towards understanding the complexity of floodplain ecosystems. Murray Scown (UNE), Martin Thoms (UNE), Nathan De Jager (UMESC).

2015L8 Draft manuscript: The effects of survey technique and vegetation type on measuring floodplain topography from DEM's using surface metrics. Murray Scown (University of New England; UNE), Martin Thoms (UNE), Nathan De Jager (UMESC).

2015L9 Draft manuscript: Multi-scale measurement of topographic complexity in the Upper Mississippi River floodplain using surface metrics. Murray Scown (UNE), Martin Thoms (UNE), Nathan De Jager (UMESC).

2015L10 Draft manuscript: Comparing the physical complexity of floodplains in different geographical settings. Murray Scown (UNE), Martin Thoms (UNE), Nathan De Jager (UMESC).

For the past three years, Murray Scown (student at the University of New England, NSW Australia) has been using UMRR lidar data to develop new GIS methodologies to characterize spatial patterns along rivers and floodplains. These ecosystems have traditionally been conceptualized as patch-work mosaics of landforms, sediment assemblages, aquatic areas, and vegetation types. Yet few studies have incorporated techniques that allow such features (if they exist) to emerge from GIS data. Instead, most GIS analyses begin with data sets that pre-define such features using photo interpretation. As a consequence, the true physical structure of river-floodplain ecosystems can be lost in the interpretation process. M. Scown's work introduces new methods to characterize floodplains using continuous surface metrics at multiple scales. This approach allows patterns to emerge from the data itself, providing a more quantitative and unbiased classification of river-floodplains. To date, M. Scown has produced four draft manuscripts, with Dr. Martin Thoms and N. De Jager serving in advisory roles. In 2015, these papers will be submitted for publication.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015L1	Data Analysis: Examining changes in land cover and land use 2000-2010.	De Jager & Rohweder (UMESC)	30 September 2015
2015L2	Draft Manuscript: Connectivity/Inundation tool for mapping spatial patterns in river-floodplain connectivity.	De Jager, Fox, & Rohweder (UMESC)	30 September 2015
2015L3	Data Analysis: Effects of flooding, herbivory, and invasion by reed canarygrass on multivariate elemental cycling in a UMR floodplain forest	Kreiling & De Jager (UMESC), Swanson, Strauss & Thomsen (UW-L)	30 September 2015
2015L4	Draft Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on decomposition and nitrogen cycling along the UMR Floodplain	Swanson, Strauss, Thomsen (UW-L) & De Jager (UMESC)	30 September 2015
2015L5	Data Analysis: Effects of flooding, invasion by reed canarygrass, and increased nitrogen deposition on microbial enzyme activity along the UMR Floodplain	Reich & Hernandez (Carleton), De Jager (UMESC)	30 September 2015

2015L7	Draft manuscript: Measuring spatial patterns in floodplains: a step towards understanding the complexity of floodplain ecosystems	Scown & Thoms (UNE), De Jager (UMESC)	30 September 2015
2015L8	Draft manuscript: The effects of survey technique and vegetation type on measuring floodplain topography from DEM's using surface metrics	Scown & Thoms (UNE), De Jager (UMESC)	30 September 2015
2015L9	Draft manuscript: Multi-scale measurement of topographic complexity in the Upper Mississippi River floodplain using surface metrics	Scown & Thoms (UNE), De Jager (UMESC)	30 September 2015
2015L10	Draft manuscript: Comparing the physical complexity of floodplains in different geographical settings.	Scown & Thoms (UNE), De Jager (UMESC)	30 September 2015

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).
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)
Fact Sheet: De Jager, N.R. 2014. Landscape Ecology on the Upper Mississippi River: lessons learned, challenges, opportunities (2013L3).
Manuscript: Effects of flood inundation duration on letter decomposition and nitrogen cycling during different states of forest succession (2014L1; Strauss, Swanson, De Jager)
Manuscript: Differences in fish community composition between patches of high TN:TP and low TN:TP: the role of water flow velocity (2014L3; De Jager)

Literature Cited:

Cogger, B.J., De Jager, N.R. and Thomsen, M. 2014. Winter browse selection by white-tailed deer and implications for bottomland forest restoration in the Upper Mississippi River valley, USA. Natural Areas Journal. 34:144-153.

De Jager, N.R. 2011. Scientific Framework for Landscape Pattern Research on the Upper Mississippi and Illinois River Floodplains. June 2011. http://www.umesc.usgs.gov/ltrmp/ateam/landscape_patterns_research_framework_final_june2011.pdf

De Jager, N.R., Rohweder, J., Nelson, J.C. 2013a. Past and predicted future changes in the land cover of the Upper Mississippi River, USA. River Research and Application. 29:608-618.

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

Guyon, L., Deutsch, C., Lundh, J., Urich, R. 2012. Upper Mississippi River Systemic Forest Stewardship Plan. U.S. Army Corps of Engineers. 124 pp.

Thomsen, M., Brownell, K., Urich, R., Groshek, M., Kirsch, E. 2012. Control of reed canarygrass promotes wetland herb and tree seedling establishment in the Upper Mississippi River floodplain. Wetlands 32: 543–555.

Science Planning

The UMRR LTRM developed a Science Management Process that was presented to the UMRR CC in May 2012. The process is designed to help LTRM staff and managers prioritize and coordinate science effectively within the overall priorities defined in the 2010 Strategic Plan. We will continue the process begun FY2014 by prioritizing scientific questions and uncertainties that form the basis for advancing our knowledge of ecosystem structure and function relative to management and restoration needs. (Strategic Plan Outcome 2)

Products and Milestones

Tracking number	Products	Staff	Milestones
2013XY	Draft report: Critical questions for advancing ecosystem understanding and management capability on the UMRS	Johnson	31-Dec-14
2013XZ	Final Draft Critical Questions report to UMRR CC	Johnson	TBD
2014N3	Final Draft research plan to UMRR CC	Johnson	10 Nov 2014

UMRR LTRMP Team Meeting

To foster communication between USACE, USGS-UMESC and state field station staff, a joint meeting of all staff will be held in FY2015. The primary objectives of the meeting are to help maintain consistency in methods and procedures through time and across field stations, discuss new techniques, instruments, and any issues there may be.

This effort will require participation by all UMRR LTRM staff at USACE, USGS-UMESC, and the state field stations.

The meeting will be held at USGS, Upper Midwest Environmental Sciences Center in La Crosse, Wisconsin.

Products and Milestones

Tracking number	Products	Staff	Milestone
2015FM1	Meeting date coordination	All LTRM Staff	31 October 2014
2015FM2	Agenda development	All LTRM Staff, led by UMESC	31 December 2014
2015FM3	Meeting logistics	Sauer	On-Going
2015FM4	Meeting participation	All LTRM Staff	TBD

Involvement of UMRR LTRMP with monitoring on other rivers, nationally and internationally

Most large rivers in the world, including the UMRS, are greatly affected by human actions and ecological variability. Balancing objectives for social, economic, and ecological benefits in large rivers is a management concern worldwide. Understanding the structure and function of large rivers is critical for developing plans and actions that can achieve management goals. However, learning about structure and function of any large river is a slow process due to a general lack of information on ecological conditions in many rivers, difficulty of data collection on large rivers, high variability in these systems, and difficulty conducting controlled field studies. Although every large river has unique features, all large rivers share many driving variables and processes that underpin their structure and function.

Product Descriptions

Products and Milestones

Tracking number	Products	Staff	Milestone
2014P1	Draft white paper for review	Johnson	15 Nov 2014
2014P2	Final draft white paper	Johnson	15 Dec 2014
2014P3	Final Draft white paper to EMP-CC	Johnson	31 Dec 2014

Quarterly Activities

To enhance communication with the UMRR Partnership, LTRM staff at USGS-UMESC and the six state-run field stations will track activities not explicitly listed in this current scope of work. These quarterly activity lists will document activities and accomplishments by Program partners that are not tracked in the milestone table. Activities will include such items as presentations, outreach, technical assistance, data retrieval, and consultation for LTRM Partners including state and federal agencies, NGOs, and academia. These activities demonstrate the value of LTRM data and expert scientific knowledge to clients and customers, and help to identify potential new collaborations that will benefit EMP and river managers. Activity lists will be placed on the web under the A-Team Corner page (http://www.umesc.usgs.gov/ltrmp/ateam.html). This effort addresses a need for increased communication and dissemination of information.

Products and Milestones

Tracking number	Products	Staff	Milestone
2015QR1	Submittal of quarterly activities	All LTRM staff	30 January 2015
2015QR2	Submittal of quarterly activities	All LTRM staff	13 April 2015
2015QR3	Submittal of quarterly activities	All LTRM staff	13 July 2015
2015QR4	Submittal of quarterly activities	All LTRM staff	12 October 2015

A-Team and UMRR CC Participation

USGS-UMESC and Field Station staff are often called upon to participate at quarterly A-Team (http://www.umesc.usgs.gov/ltrmp/ateam.html) and UMRR CC (http://www.mvr.usace.army.mil/Missions/EnvironmentalProtectionandRestoration/UpperMississippiRiverRestoration/Partnership/CoordinatingCommittee.aspx) meetings. The field station team leaders, component specialists, and UMESC LTRM management staff are expected to participate in the A-Team meetings, if possible. Additional staff may participate as appropriate. Participation at EMP-CC meetings will be by request only. This participation could include sharing of scientific knowledge and/or presentations on current projects. Any participation by LTRM staff at A-Team and/or UMRR CC meetings will be listed in the quarterly activity products. .

USACE UMRR LTRM Technical Support

This paper describes the roles of the U.S. Army Corps of Engineers district LTRM Technical Representatives, which are supported by LTRM funds to help facilitate the two directional communications between each home district and the Regional Program (). These individuals shall serve as a point of contact with each district for LTRM data and information, and the use of LTRM data in the identification, formulation, and evaluation of HREPs.

This SOW captures an anticipated level of effort to accomplish the tasks herein, which is reflected in the funding allocated. This SOW represents approximately 190 hours for each representative (n=3) in fiscal year 2015; no change from FY2014.

[NOTE: In years when the annual appropriation is less than the amount needed to fully fund Base Monitoring (such as FY13), the amount available for the Corps' LTRM Technical Representatives will be reduced proportionately and the SOW will be adjusted accordingly.]

MAJOR DUTIES

1. <u>Technical Support to Regional LTRM Manager (high priority)</u>

Estimated Level of Effort (~40 hours)
For all Document Review – Each document review should be coordinated throughout home district as appropriate, all comments received should be consolidated, and transmitted to the LTRM Manager (copy furnish the other 2 district LTRM Representatives). A minimum of 2 weeks of review and comment preparation time should be provided, if possible.

   a. Annual SOW (translation of the 2010-2014 Strategic & Operational Plan annually for base and above base efforts) – participate in conf calls as needed (1-2)
   b. Other reports - varies, as needed, and could include research frameworks, research proposals, *ad hoc* Indicator Report, Science Coordination Plan
   c. Regular bimonthly conference calls with the UMRR (EMP) Regional Manager, LTRM Regional Manager, 3 HREP coordinators, 3 LTRM Technical Representatives (~6)

2. <u>Represent UMRR (EMP) LTRM and home district at all regular A-Team Meetings (high priority)</u>

Estimated Level of Effort (~40 hours)
Work under this heading includes two directional communications – regional coordination, bringing information back to the districts, and bringing local knowledge, issues, or questions to the A-Team. The level of effort hours will vary with length of meeting, meeting location, and level of prep/follow up.

   a. Conference calls – 2/year
   b. Meetings – ~2/year
   c. Support A-Team activities as appropriate

3. <u>Serve as LTRM data and resource contact for district PDTs (HREP-LTRM Integration</u>) (high priority)

Estimated Level of Effort (~80 hours)
Generally, each district's LTRM Technical Representative serves as a <u>proactive resource</u>, promoting the use and/or application of LTRM data (including research, models, etc) in their home district, primarily for project planning and monitoring. Knowledge of the available datasets

(online and others), models, graphical browsers, etc, and personnel at UMESC and the field station(s) is critical for this task.

4. Other Meeting Attendance (if funding and time allow)

Supported Level of Effort (~30 hours)

Work under this heading includes dissemination of information, etc, from meeting/conference attendance to district personnel, PDT's, as appropriate. Discretion in choosing meetings is strongly recommended since the **funding level does not support attendance at all of these listed below**.

a. MRRC–Held in conjunction with April A-Team meeting
b. UMRCC –annual and/or technical session meetings
c. FWWG, FWIC or RRAT (tech) for meetings in home district

REPORTING

Each LTRM Technical Representative will provide quarterly activity reports to the LTRM Regional Manager; due one week after the end of each quarter of the fiscal year. These reports will capture specific activities under any of the items above and any other significant LTRM activity.

BUDGET

Labor Budget per Representative

a. Salary for 190 hours annually for each Technical Representative, resourced annually but distributed quarterly, for regular duties described above. The individual dollar amounts allocated reflect the different pay grades of the Technical Representatives. The total labor amount budgeted for all 3 Representatives for FY15 is $76,870.
b. Travel funds of $1,000 each representative will also be resourced annually, with a partial distribution in the 1st quarter, and full distribution upon receipt of final appropriation.

TOTAL estimated commitment

Approximately (190 hours each)

$76,870 labor + $ 3,000 travel = **$79,870**

POC for the LTRM Technical Representatives is the UMRR LTRM Project Manager, Karen Hagerty.

UMRR Strategic Planning

The FY2015–2019 UMRR Strategic Plan will be focused on ensuring that the Program will continue to be regionally relevant, nationally significant, internationally engaged, and technically sound.

The core team, estimated to be 17 individuals representing the makeup of the Partnership and key program functions, will consist of the following:

- 5 State members (EMP-CC, A-Team or Field Stations
- 2 USFWS member (Refuges and Ecological Services)
- 1 NGO member
- 1 member from USEPA, NRCS or Coast Guard
- 3 USGS members (LTRM management staff, scientist)
- 1 UMRBA member
- 4 USACE members (EMP & LTRM management, HREP/district managers)

The anticipated planning timeframe will be from April 2013 through September 2014 and will entail approximately 7–9 meetings with half being face-to-face.

For FY15, active participation in 1 meetings or conference call to finalize the Plan after public comments have been addressed is anticipated in late 2014.

Science Management

Randy Hines is the Partnership Coordinator for UMESC and oversees the science communication program. He is responsible for coordinating the exchange of scientific and technical information requested by other agencies, organizations, and the general public. He also assists with outreach programs to provide educational opportunities and increase community awareness of Center and UMRR LTRM activities.

Since the inception of USGS in 1879, the agency has maintained comprehensive internal and external policies and procedures for ensuring the quality and integrity of its science. This has led to the reputation of USGS being noted for science excellence and objectivity. In 2006, the scientific policies and procedures were updated, and are now known as USGS Fundamental Science Practices (FSP), a set of consistent practices, philosophical premises, and operational principles to serve as the foundation for research and monitoring activities related to USGS science. The FSP clarifies how USGS science is carried out and how the resulting information products (including maps, imagery, and publications) are developed, reviewed, approved, and released. Carol Lowenberg oversees the FSP process for LTRM. Carol also coordinates the entry and tracking of all LTRM abstracts, presentations, reports, and manuscripts, in the USGS Information Product Data System.

Tracking number	Products	Staff	Milestone
2015ER1	Property inventory and tracking	LTRM staff as needed	15 Nov 2015

Equipment Refreshment

UMRR LTRM field equipment (boats, motors, sampling equipment, etc.) need to be well maintained and replaced when necessary to maintain a safe and functional work environment.

Lake City	ms5 -- upgrade sonde
Lake City	ms5 -- replace sonde
Lake City	AED+case*
La Crosse	flow meter (FH950)
La Crosse	turbidity meter (2100Q)
La Crosse	ms5-- upgrade sonde
La Crosse	ms5-- upgrade sonde
La Crosse	AED+case*
Bellevue	Power Ice Auger
Bellevue	ms4a--replace sonde
Bellevue	ms5--replace sonde
Bellevue	AED+case*
Open River	GPS/depth
Open River	ms5--upgrade sonde
Open River	ms5--replace sonde
Open River	Field rugged laptop
Open River	O'Haus Fish scale
Open River	AED+case*
NGRREC	Field Rugged Laptop
NGRREC	Trailer
NGRREC	75-125 HP outboard
NGRREC	ms4a--replace sonde
NGRREC	ms5--replace sonde
NGRREC	AED+case*
IRBS	GPS/depth
IRBS	GPS/depth
IRBS	ms5--upgrade sonde
IRBS	ms5--upgrade sonde
IRBS	1 manifold – 6 outlet
IRBS	3 - 25mm filter funnels
IRBS	5 - Magnetic, 47mm, 300ml filter funnels
IRBS	AED+case*

* **Purchase of AEDs for placement on UMRR LTRMP electroshocking boats**

There are 220,000 victims of sudden cardiac arrest (SCA) per year in the United States; about 10,000 sudden cardiac arrests occur at work. SCA is a condition in which the heart suddenly stops beating with causes including electrocution. Time-to-treatment is critical to SCA victim's chance of survival and waiting for the arrival of emergency medical system personnel results in only 5-7% survival of SCA victims. Ninety-five percent of those who experience SCA die because they do not receive life-saving defibrillation within four to six minutes, before brain and permanent death start to occur. The average response time for paramedics to arrive on the scene is 8 to 10 minutes (OSHA). This response time can increase dramatically when staff are working in remotes sites (like the UMRS). In addition, LTRMP staff are also working at sites where lightning strikes could occur causing SCA.

Even though the LTRMP fisheries protocols has extensive safety features in place when staff are electrofishing (see page 15 and 29; Ratcliff et al. 2014), accidents that could lead to electrocution and SCA could occur when electrofishing is being undertaken. The power supply for electrofishing is a 5,000 watts (W) or higher with the potential of a transfer of 3,000 W from water to fish. It has been recommended by USGS (http://www.usgs.gov/usgs-manual/handbook/hb/445-2-h/ch42.html) and Tri-State Ambulance Operations Supervisor, Darin Wendel (pers. Communication to J. Sauer on 9/3/2013) that automated external defibrillator (AEDs) be carried on LTRMP electrofishing boats. An (AED) is a portable device that checks the heart rhythm. If needed, it can send an electric shock to the heart to try to restore a normal rhythm. AEDs are used to treat SCA.

AED suggested models for use in the marine environment are: Philips Heartstart FRx AED, Zoll AED Plus, and Heartsine Samaritan AED. A waterproof case such as those from Pelican (http://www.pelican.com/) will need to be purchased to carry and protect the AEDs.

Training for use of the AEDs and maintenance will reside with the State agencies with funding being accounted for in the State UMRR yearly budget submittal.

Ratcliff, E.N., Gittinger, E.J., O'Hara, T.M., and Ickes, B.S., 2014, Long Term Resource Monitoring Program Procedures: Fish monitoring, 2nd edition. A program report submitted to the U.S. Army Corps of Engineers' Upper Mississippi River Restoration-Environmental Management Program, June 2014. Program Report LTRMP 2014-P001, 88 pp. including Appendixes A–G, http://pubs.usgs.gov/mis/ltrmp2014-p001 (Abstract)

Addendum

Book Chapter, “"The Mississippi River: A place for fish past, present, and future”

Solicited from the authors by the American Fisheries Society, the chapter is based on Brian Ickes and Hal Schramm's symposium presentation at the 2013 AFS meeting in Little Rock, AR. The chapter discusses the ecology of the Mississippi River that flows through four biomes, seven physiographic regions, and cool temperate to subtropical climates. The chapter will look at the primary drivers that affect fish and fish habitat of river systems--climate, geomorphology, and hydrology.   In particular, it discusses the headwaters, upper impounded, lower impounded, upper free flowing, and lower free flowing reaches. There will be a section on fish habitat exploring geomorphology and hydrology and how despite extensive river alteration, the Mississippi River provides diverse habitat for fishes. The final section explores issues and needs for a healthy and productive fisheries resource again looking at all reaches, the impounded reach, and the free-flowing reach.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015B12	Draft book chapter	Ickes, Schramm	30 July 2015
2015B12a	Final book chapter	Ickes, Schramm	30 September 2015

Fish Trajectory Analysis

Brian will be working with Dr. Peter Minchin at Southern Illinois University. Brian and Peter will be usingTrajectory Analysis, a new method developed by Peter, to evaluate fish community (multi-metric) indicators and to test the hypothesis that community composition is changing in a manner that indicates successful restoration. The methods they produce will apply to any multivariate indicator including those that will be derived from the FY15 UMRR science proposal “Fish Indicators of Ecosystem Health” (McCain et al. 2015).   Trajectory analysis was first used in the Everglades. (Sah, J.P., M.S. Ross, S. Saha, P. Minchin, and J. Sadle. 2013. Trajectories of vegetation response to water management in Taylor Slough, Everglades National Park, Florida. Wetlands, DOI 10.1007/s13157-013-0390-4). This project builds on and complements, the fish indicators project led by McCain. The methods that will be developed will allow us to evaluate changes overtime in multivariate fish community indicators to test the hypothesis that community composition is changing toward the recommended target or along an environmental gradient.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015B13	Assemble requisite data: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	Ickes, Minchin	8 June 2015
2015B14	Perform Trajectory Analysis: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	Ickes, Minchin	30 August 2015
2015B15	Summary letter on results: Developing and applying trajectory analysis methods for UMRR Status and Trends indicators	Ickes, Minchin	30 October 2015
2015B16	Draft Manuscript: Trajectory Analysis	Ickes, Minchin	30 September 2016

2015L6: Developing methods to map floodplain functions and ecosystem services

A collaborative project with the USGS (Morlock) and The Nature Conservancy (Kris Johnson), with in kind assistance and additional funding from USGS.

Flooding is a primary driver of riverine ecosystem functions, including plant succession and diversity; nutrient availability, cycling, and flux; and aquatic and terrestrial animal habitat quantity and quality. These ecosystem functions directly impact the ecosystem services that floodplains provide to society, such as: clean water, recreational opportunities, and flood protection. The flood-ecosystem connection is becoming a major focus of Upper Mississippi River Restoration efforts, USGS science, and The Nature Conservancy's efforts to valuate freshwater riverine ecosystems.

A number of activities are coming together to make it possible to link state-of-the-art hydrological models with recent findings from landscape-scale ecological studies, and new ways to valuate ecosystem functions. The Upper Mississippi River Restoration (UMRR) Program has invested a significant amount of effort in acquiring LiDAR and bathymetric data and merging these data sets to create tier 3 topo-bathymetric data. At the same time, the Program has invested in studies that characterize and quantify the distribution of primary river and floodplain ecological attributes. Most recently, the Program funded a project proposal to begin linking these efforts by developing predictive models of landscape-scale distributions of flooding and associated ecological properties. Meanwhile, scientists within the USGS Flood Inundation Mapping Program (http://water.usgs.gov/osw/flood_inundation/) have been developing new ways to model and map flood inundation at landscape scales. Finally, scientists with The Nature Conservancy have been producing new tools to help place value on rivers and restoration actions that go beyond acres of habitat.

The objective of this project is to identify the linkages among hydrodynamic and flood inundation modeling efforts, ecosystem studies, and ecosystem services assessments. The project scope includes developing a scientific publication that reviews the current state-of-the-art in hydrodynamic modeling, river-floodplain ecosystems ecology, and ecosystem services assessments and clearly establishes the linkages among these disciplines. From this investigation, new methods will be developed to link hydrological models with results from ecological studies, and ecosystem services assessments to better predict effects of restoration actions on ecosystem functions and the services they provide.

The work constitutes a major first step toward synthesizing results of previous landscape-scale ecological investigations. It also makes use of recent technological and data advancements (i.e., tier 3 topo-bathymetry data), and should provide some insights into how UMRR might begin to valuate restoration actions in ways that go beyond simply documenting acres of habitat.

Products and Milestones

Tracking number	Products		Staff		Milestones
2015L6	Presentation: Developing methods to map floodplain functions and ecosystem services		Morlock, Johnson, De Jager		30 July 2016
2015L6a	Draft Manuscript: Developing methods to map floodplain functions and ecosystem services		Morlock, Johnson, De Jager		30 September 2016

Spatial patterns of native mussels in the UMRS

North America contains an impressive diversity of native freshwater mussels (Unionoida)—more species of mussels occupy the Mississippi river basin than the entire continent of Europe. However, the density and diversity of freshwater mussel assemblages have substantially declined in many river systems, presumably due to exploitation, urbanization, habitat degradation and fragmentation, and pollution. Over the past 50 years, about 20 species have been extirpated or greatly diminished from the Upper Mississippi River System (UMRS). Conservation and restoration efforts towards mussels are hampered by a lack of knowledge on how mussels are distributed across the UMRS landscape. Mussels occur in aggregations termed mussel 'beds', however little is known about the structure of these beds or at what scale they occur. Recently, UMESC scientists have been exploring spatial patterns of native mussels in the UMRS using data from pool-wide mussel surveys in Pools 3, 5, 6 and 18. These data suggest that spatial patterns are present at large scales (i.e., 300 m), but the patterns vary among pools and between adult and juvenile mussels. The next logical step is to zoom in and assess the spatial patterns at a smaller spatial scale, such as the scale of the mussel bed. Data on how mussels are distributed across the landscape will help managers design effective surveys for mussels, aid in selecting sites for restoration projects, and may provide insights into the role of spatial heterogeneity in the functioning of river ecosystems (i.e., identify hotspots for diversity). The objective of this study is to quantify the degree and spatial scales of patchiness in the distribution of juvenile and adult mussels at small spatial scales.

Preliminary results of spatial patterns at the large scale (pool wide, >300 m scale) suggest that no single mechanism appears to structure freshwater mussels. If the primary variable(s) structuring mussel assemblages across the four sampled pools is related to hydrology and hydraulic patterns (which is reasonable given the recent work of the UMESC native mussel team), then these features can be manipulated by resource managers to benefit native mussel assemblages. Successful restoration efforts for native mussels will depend on knowledge of where these aggregations occur, where the highest density areas occur, and how they are spatially structured. Quantifying the spatial patterns of mussels will help us answer these questions and will lead to more informed habitat rehabilitation and enhancement projects (HREPs) to benefit mussels. The proposed research supports question 1a (What are the spatial and temporal patterns in mussel assemblages in the UMRS?) of the "Scientific Framework for Research on Unionid Mussels in the UMRS" as well as question 2.3 (What are the ecological consequences of landscape patterns on aquatic community composition?) of the "Scientific Framework for Landscape Pattern Research on the Upper Mississippi and Illinois River Floodplains".

Methods:
We will identify existing datasets that have quantitative data on mussel assemblages at smaller spatial scales (i.e., within a mussel bed). For example, we are aware of datasets in Pool 5 (2013) and Pool 8 (2001) that could be used to assess small scale spatial patterns. We will also coordinate identification of datasets with Heidi Dunn (Ecological Specialists, Inc.) and the Mussel Coordination Team. We will establish criteria for the types of data we need to ultimately perform spatial statistics. Once we receive the data, we will re-format the datasets into a common format suitable for obtaining spatial statistics. Although the current budget is only sufficient to compile and summarize key datasets, we intend this work as a first step toward a detailed analysis of

spatial patterns of mussels at smaller scales relevant to many HREPs and will seek additional funds to complete this project.

Products and Milestones

Tracking number	Products	Staff	Milestones
2015MRF1	Establish selection criteria, identify existing data sets, and re-format to a common database suitable for spatial analyses	Ries, Newton, De Jager, Zigler	1 April 2016
2015MRF2	Brief summary letter, including the compiled dataset, GIS layers, and a map	Ries, Newton, De Jager, Zigler	1 June 2016

Table 1. Sampling effort within the UMRR Long Term Resource Monitoring Program element and data collected by each component.

Component	Study Area						Summary of data collected[1]
	4	8	13	26	La Grange	Open River	
Aquatic Vegetation	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	—[2]	—[2]	—[2]	Species, abundance, frequency, distribution, depth, substrate, detritus
Fisheries	~242 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~262 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~300 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~272 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~390 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~247 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	Species; catch-per-effort; length; subsample for weight, age, & diet; secchi; water depth, temperature, velocity, conductivity; vegetation density; substrate; dissolved oxygen
Water Quality	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 14 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 19 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 12 fixed sites[3]	121 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3]	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 9 fixed sites[3]	Suspended solids, major plant nutrients, chlorophyll a, silica, pH, secchi, temperature, dissolved oxygen, turbidity, conductivity, vegetation type & density, wave height, depth, current velocity, depth of snow/ice, substrate, phaeophytin, phytoplankton (archived),
Land Cover/Land Use	Land Cover/Land Use digital aerial photography was acquired in 2010-2011 and processed in subsequent years. Systemic land cover data for the Upper Mississippi River System is collected approximately every 10 years. To date, systemic land cover has been mapped three times through the Long Term Resource Monitoring Program, in 1989, 2000, and 2010/2011.						

[1]A full list and explanation of data collected by each component is available through the UMRR LTRM data web site at http://www.umesc.usgs.gov/data_library/other/ltrmp_monitoring.html.
[2]Aquatic vegetation is not sampled in Pool 26 and La Grange because previous sampling revealed very low abundance, or in Open River due to a lack of suitable habitat.
[3]Frequency of fixed site sampling is bi-weekly in April, May, and June, and monthly in all other months, with no sampling in December and February (i.e., winter sampling in January only)

Product Definitions

Draft: A draft that has been submitted to the UMRR LTRM's USGS Science Leader or his designee which is ready for review by USGS, USACE, A-Team, or blind review, as needed. This step begins the process of formal USGS peer-review unless the Science Leader deems the product needs more work by the author(s).

Final draft: A document that the authors have edited based on review comments and has been submitted to the LTRM's USGS Science Leader or his designee.

Intended for Distribution: Indicates a final printed version or Web-based report is awaiting distribution and USGS final approval. For other products (i.e., manuscripts) this indicates submission to a journal. *Staff time is still expended at this stage of the report process.*

Summary Letter: A summary letter is a communication to Corps management and associated staff that provides quick information regarding progress on a project or product. They are often based on preliminary data and analyses, and represent interim information. Summary letters are reviewed internally by UMESC, but do not go through USGS peer review. Thus, they are not citable and should not be widely distributed. Summary letters are used only when a more complete and peer reviewed product is expected after more work on a specific project.

Leveraged Product: A product produced by LTRM staff and others outside of LTRMP; may include funding from non- sources.

Donated Product: A product produced by others, without including the LTRM staff and without investment of UMRR funds.

UMRR Science In Support Of Restoration and Management, FY2014 SOW Milestones

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				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				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-Nov-14			Robinson, Hoy, Hanson, Langrehr, Ruhser, Nelson
2014V4	Final LTRMP Completion Report on Accuracy Assessment	30-Sep-14		competed; in FSP review		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			Yin, Rogala, Ingvalson, Potter
2014AQ4	Final model and outputs	31-Dec-14				Yin, Rogala, Ingvalson, Potter
UMRS Vegetation Handbook						
2014VH1	Acquire new field images for handbook	30-Sep-14		completed		Dieck, Langrehr, Hoy, Robinson, Ruhser
2014VH2	Draft updates to technical sections and vegetation descriptions	31-Dec-14				Dieck, Langrehr, Hoy, Robinson, Ruhser
2014VH3	Finalize handbook and submit for USGS review	31-Mar-15				Dieck, Langrehr, Hoy, Robinson, Ruhser
Phase 2 Geospatial Data Upgrades						
2014GDU1	Complete geodatabases by pool for the entire UMRS	30-Sep-14				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				Nelson, Robinson

Tracking	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		completed		Rohweder, Fox
2014SDQ2	Create a web-based platform that contains all spatial data; convert all queries to ArcGIS	31-Dec-14				Rohweder, Fox
2014SDQ3	SDQT beta tested and ready for USGS review	31-Mar-15				Rohweder, Fox
UMRS Data Map						
2014DM1	Include all UMRR-EMP data created at UMESC in the data map	30-Sep-14	30-Nov-14			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				Nelson, Ruhser
2014DM3	Include additional state and federal data references in the data map	31-Mar-15				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	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	Final white paper	30-Sep-14	31-Dec-14			Theiling
Development of Mussel Vital Rates						
2014MVR1	Brief summary report	30-Sep-15				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
Validation of Mussel Community Asessment Tool						
2014MCA1	Workshop of mussel experts in UMRS	1-May-15				Newton, Zigler, Dunn, Duyvejonck
2014MCA2	Draft completion report on a validated mussel community assessment tool for use by river managers	1-Dec-15				Newton, Zigler, Dunn, Duyvejonck
2014MCA3	Final completion report on a validated mussel community assessment tool for use by river managers	1-Mar-16				Newton, Zigler, Dunn, Duyvejonck
Effects of Nutrient Concentrations on Zoo- and Phytoplankton						
2014NC1	Counting of phytoplankton samples	13-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				Giblin, Ickes, Langrehr, Bartels
2014ES2	Refined analyses and draft manuscrpt prepared	13-Mar-16				Giblin, Ickes, Langrehr, Bartels
2014ES3	Manuscipt submitted for publication	13-Mar-17				Giblin, Ickes, Langrehr, Bartels

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Invasive Carp Population Demographics (#1)						
2014CPD1	Summary letter	31-Jan-15				Phelps, Mccain
2014CPD2	Manuscript	31-Mar-16				Phelps, Mccain
Asian Carps Recruitment Sources (#2)						
2014CRS1	Summary letter	31-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				Phelps, Mccain
2014NPD2	Manuscript	31-Mar-16				Phelps, Mccain
Early Life History of Invasive Carps (#4)						
2014CLH1	Summary letter	31-Jan-15				Phelps, Mccain
2014CLH2	Manuscript	31-Mar-16				Phelps, Mccain