Long Term Resource Monitoring FY22 BASE SOW

Enhancing Restoration and Advancing Knowledge of the Upper Mississippi River

Addressing the
FY2015–2025 UMRR Strategic Plan

The Upper Mississippi River Restoration (UMRR) Program for the Upper Mississippi River System (UMRS) is first comprehensive program for ecosystem restoration, scientific research, and monitoring on a large river system in the Nation and the world. The UMRS is one of this Nation's unique natural resources. The ecosystem provides habitat to a wide array of fish and wildlife species distributed among a complex assortment of flowing channels, floodplain lakes, backwaters, wetlands, and floodplain forests. With an ecosystem as diverse and complex as the UMRS, many of its processes and their interrelationships are not well known. One way to help understand this multifaceted system is through environmental monitoring. The UMRR Long Term Resource Monitoring (LTRM) data provides the scientific foundation required for sound management actions, effective river restoration projects, and informed environmental policy decisions for the UMRS.

The value of UMRR LTRM's long-term data set continues to grow. It serves as a foundation for the restoration of the UMRS by revealing patterns and trends, establishing benchmarks of the current state for comparison to future conditions, serving as an early warning of change, supporting planning and management through the identification of key issues and trends, and evaluating the effectiveness of restoration and management actions on the UMRS.

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FY22 UMRR LTRM (Base Monitoring) 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 Long Term Resource Monitoring (LTRM) element, authorized by Congress in the 1986 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 directly supports Upper Mississippi River System (UMRS) understanding, critical for successful UMRS restoration by the UMRR. This SOW complements those work items in the UMRR Science in Support of Restoration and Management SOWs.

A comprehensive monitoring program consists of environmental monitoring, research, systemic data acquisition, modeling, and information delivery to provide a solid scientific foundation upon which resource managers and policy makers base management actions and develop environmental policy.

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 understanding its status, trends, ecological functions, and responses to disturbances and UMRR restoration 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.

Products and Milestones

Tracking number	Products	Staff	Milestones
2022A1	Complete data entry and QA/QC of 2021 data; 1250 observations.		
	a. Data entry completed and submission of data to USGS	Lund, Carhart, Fopma	30 November 2021
	b. Data loaded on level 2 browsers	Schlifer	15 December 2021

	c. QA/QC scripts run and data corrections sent to Field Stations	Larson, Schlifer,	28 December 2021
	d. Field Station QA/QC with corrections to USGS	Lund, Carhart, Fopma	15 January 2022
	e. Corrections made and data moved to public Web Browser	Larson, Schlifer, Caucutt	30 January 2022
2022A2	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2021 data	Larson, Schlifer	31 July 2022
2022A3	Wisconsin DNR annual summary report 2021 that combines current year observations from LTRM with previous years' data, for the fish, aquatic vegetation, and water quality components.	Bartels, Hoff, Kalas, Carhart	30 Sept 2022
2022A4	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	Larson, Lund, Carhart, Fopma	31 August 2022
2022A5	Pool 4 Graphical summary and maps of aquatic vegetation current status and long-term trends.	Lund	30 Dec. 2022
2022A6	Pool 8 Graphical summary and maps of aquatic vegetation current status and long-term trends.	Carhart	30 Dec. 2022
2022A7	Pool 13 Graphical summary and maps of aquatic vegetation current status and long-term trends.	Fopma	30 Dec. 2022
Intended for distribution			
Manuscript: Estimated annual summer submersed aquatic macrophyte standing stocks (1998 - 2018) in three large reaches of the Upper Mississippi River. (2020A8; Accepted for publication with revisions; IP-122160; Kreiling et al.)			

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 understanding resource status and trends, ecological functions, and response to disturbances and UMRR restoration 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 from 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.

Products and Milestones

Tracking number	Products	Staff	Milestones
2022B1	Complete data entry, QA/QC of 2021 fish data; ~1,590 observations		
	a. Data entry completed and submission of data to USGS	DeLain, Bartels, Kueter, Hine, Gittinger, West, Solomon, Maxson	31 January 2022
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	Ickes, Schlifer	15 February 2022
	c. Field Station QA/QC with corrections to USGS	DeLain, Bartels, Kueter, Hine, West, Solomon, Maxson	15 March 2022
	d. Corrections made and data moved to public Web Browser	Ickes and Schlifer	30 March 2022

2022B2	Update Graphical Browser with 2021 data on Public Web Server.	Ickes, DeLain, Bartels, Kueter, Hine, West, Solomon, Maxson, Schlifer	31 May 2022
2022B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	Ickes, DeLain, Bartels, Kueter, Hine, West, Solomon, Maxson	31 October 2022
2022B4	Sample collection and database increment on Asian carp age and growth: collection of cleithral bones	Solomon, Maxson	31 January 2022
2022B5	"IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River (2020 and 2021)	Keuter	30 Sept 2022
2022B8(D)	Database increment (2020 and 2021): Stratified random day electrofishing samples collected in Pools 9–11	Keuter	30 Sept 2022
2022B9(D)	Database increment (2020 and 2021): Stratified random day electrofishing samples collected in Pools 16–18	Keuter	30 Sept 2022

Intended for distribution
LTRM Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.) (in USGS review; minor grammatical corrections needed then will be posted on LTRM Fish page)
Manuscript: A synthesis on river floodplain connectivity and lateral fish passage in the Upper Mississippi River (2021B11; Submitted to USGS review; IP-123678)
LTRM Fact Sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16) (Programming code for TreeMap being re-written; once completed Fact Sheet will be edited)

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 fluorometric 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).

New product

2022D11: Phytoplankton analyses

Phytoplankton are critical components of aquatic food webs but their community dynamics are understudied in large river ecosystems. In the last two decades, the LTRM program has captured two potential regime shifts in the river, including a shift from a turbid to a clear state in upper pools (Bouska et al. 2020, Burdis et al. 2020, Houser et al, in press) and a shift to an invasive dominated fish community in lower pools (Bouska et al. 2020, Ickes et al, in press). The LTRM program has a large archive of phytoplankton samples that have not been identified, that if identified, could provide insight on how ecological communities at all levels of aquatic food webs respond to these type of ecosystem level shifts.

In FY22, as part of a longer-term effort to routinely identify samples from the archive and provide phytoplankton community data publicly as part of our LTRM dataset, we propose to focus on understanding the response of phytoplankton communities to the resurgence of aquatic vegetation in Pool 4. If funding continues to be available, we will develop similar proposals to focus on long-term dynamics in additional LTRM pools (e.g., FY23 – long-term change in phytoplankton communities in response to invasive carp in La Grange; FY24 – phytoplankton response to vegetation resurgence and recent decline in Pool 13).

Specifically, we will evaluate how phytoplankton communities have changed before, during, and after the recovery of aquatic vegetation. We are limited to a focus only on Lower Pool 4 since sample sizes in upper Pool 4 are not large enough to represent the community. We will analyze samples from backwaters and the main channel, in order to assess whether shifts in backwater communities are more substantial than long-term changes in main channel communities unaffected by vegetation recovery.

This dataset will be made public and therefore enable other types of analyses as well including tracking the occurrence of HABs species over time or characterizing seasonal dynamics (including winter phytoplankton communities which have rarely been examined in any river system).

Approach

- Location: Lower Pool 4
- Aquatic Areas: Main channel and backwaters
- Timing: All four seasonal SRS episodes between 2001-2020. Specifically, we will identify all available SRS samples and supplement those with fixed samples taken during the same month as SRS to increase sample sizes (as in Manier et al. 2020). We will select samples from a subset of years (11-12 years) that span the vegetation/water clarity shift as documented in Burdis et al. 2020 (e.g., low vegetation = 2001, 2002, 2004; increasing vegetation: 2005, 2006, 2007, 2008; stable/high veg: 2010, 2012, 2014, 2018, 2020). Note: We may consider reducing the number of years from Lower Pool 4 and substituting those with Lake Pepin samples to address concurrent long-term changes in phytoplankton that "feed" communities downstream in Lower Pool 4.
- Total Samples = 445

Products and Milestones

Tracking number	Products	Staff	Milestones
2022D1	Complete calendar year 2021 fixed-site and SRS water quality sampling	Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	31 December 2021
2022D2	Complete laboratory sample analysis of 2021 fixed site and SRS data; Laboratory data loaded to Oracle data base.	Yuan, Schlifer	15 March 2022
2022D3	1st Quarter of laboratory sample analysis (~12,600)	Yuan, Burdis, Kalas, Johnson, L. Gittinger, Cook, Sobotka	30 December 2022
2022D4	2nd Quarter of laboratory sample analysis (~12,600)	Yuan, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	30 March 2022
2022D5	3rd Quarter of laboratory sample analysis (~12,600)	Yuan, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	29 June 2022
2022D6	4th Quarter of laboratory sample analysis (~12,600)	Yuan, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	28 September 2022
2022D7	Complete QA/QC of calendar year 2021 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, Jankowski	30 March 2022
	b. Field Station QA/QC; USGS QA/QC.	Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	15 April 2022
	c. Corrections made and data moved to public Web Browser	Schlifer, Jankowski	30 April 2022
2022D8	Complete FY2021 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool (Table 1)	Jankowski, Burdis, Kalas, Johnson, L. Gittinger, Kellerhals, Sobotka	30 Sept 2022
2022D9	WEB-based annual Water Quality Component Update w/2021 data on Server.	Schlifer, Jankowski	30 May 2022
2022D10	Operational Support to the UMRR LTRM Element. Serve as in-house Field Station for USGS for consultation and support on various LTRM-wide topics	Kalas, Hoff, Bartel, Carhart	30 Sept 2022
2022D11	Phytoplankton dataset	Jankowski	30 December 2022
	On-going		
2019D12	Draft LTRM Completion Report: Assessment of Phytoplankton Samples collected by the Upper Mississippi River Restoration Program-Long Term Resource Monitoring Water Quality Component	TBD and Jankowski	30 June 2022
2021D12	Final LTRM Completion Report: Assessment of Phytoplankton Samples collected by the Upper Mississippi River Restoration Program-Long Term Resource Monitoring Water Quality Component	TBD and Jankowski	30 December 2022
2017D10	Draft LTRM Completion report (changed to manuscript): Storm characteristics affect biogeochemical responses differently in lentic and lotic areas of a large river. (GREON Buoys)	Waite, Jankowski	30 September 2022

Intended for distribution
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis) (in USGS review; minor grammatical corrections needed then will be posted on LTRM WQ page)
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) (under revision)

Spatial Data Component

The objective of the UMRR LTRM's spatial data component (formerly Land Cover / Land Use with GIS support) is to develop spatial data sets and use them to investigate the ecological structure and function of the UMRS. Two basic data sets provide the template for nearly all other mapping and data collection efforts within LTRM: Land Cover / Land Use and Topo-bathymetry maps. These data sets also underpin several other derivative mapping products (e.g., vegetation community and habitat maps, flood inundation maps, aquatic areas maps) and spatial modelling platforms (e.g., sedimentation, forest succession, aquatic vegetation, wind and wave models), which are routinely used to investigate status and trends of various ecological structures and functions (USGS 1995, Johnson and Hagerty 2008, De Jager et al. 2018), document system-wide habitat needs (Theiling et al. 2000 , McCain et al. 2018), and evaluate potential impacts of habitat restoration projects.

The Spatial Data Component annually administers, maintains, and updates an ArcGIS server as needed. This includes installations of patches, new software installations, and server backups. Research is conducted to identify new software and hardware as needed. Web services are monitored and refreshed when DOI software updates are made to the server. In addition, the SRS data for each component is annually downloaded, formatted, and loaded to the spatial data query tools.

The Spatial Data Component also provides expertise to the UMRR partnership in the areas of lidar and bathymetric data collection, technological advancements in remote sensing methods, and spatial ecology.

The 2 main goals of LTRM's spatial data component are to:

1) Develop and maintain the LCLU and topobathymetry data sets, which includes ensuring their accessibility to the UMRR partnership and investigating new and emerging technologies for future use (Finley and Strange).
2) Use these data sets and associated derivative products and models to monitor status and trends in the ecological structure and function of the UMRS and better understand the causes and consequences of spatial and temporal change (De Jager).

Methods

Goal 1: Develop and maintain the LCLU and topobathymetry data sets, including ensuring their accessibility to the UMRR partnership and investigating new and emerging technologies for future use.

New 2022 Land Cover Products:

Land Cover / Land Use data are collected every 10 years using standardized protocols consisting of aerial photo acquisition and image interpretation, classification, and delineation (Dieck et al. 2014). While the majority of these efforts are funded through the Science in Support of

Restoration and Management scope of work, the spatial data component maintains remote sensing and resource monitoring expertise, manages existing data and infrastructure, and provides limited on-demand Geographic Information System (GIS) technical assistance to the UMRR partnership.

2022SD1: Orthorectification of scanned photos. Aerial photography of the UMRS was collected in 1975, 1989, 1994, and 2000. Hardcopy prints have been scanned into high resolution digital formats for the long-term preservation and usability of these historical datasets. In FY22, work will continue on photos from the Rock Island District Mississippi River pools to make these datasets accessible to researchers and the public in a useable digital format. This work entails orthorectifying the scanned images and generating mosaics for each year of acquisition and navigational pool/reach of the UMRS.

2022SD2: Flight Plan Content/Data Pack. Utilize Trimble R10 GPS survey system for the development of a "portable boresight" (camera calibrations) for the manned aircraft camera platforms to be used along the UMRS. By calibrating the camera, we can more accurately compare a pixel or group of pixels against the same group surveyed at a different date. The boresight calibrations can be done over various pools of the UMRS and surrounding floodplain. After the calibrations are complete the high-resolution color and thermal imagery could be added to UMRS photo inventory.

2022SD3: Fact Sheet or website text on UAS Rapid Response Imaging.
Collaborate with the UMRR partnership to develop a working group/team and related text and information products for a sUAS rapid response ready airborne imaging team. This team would ultimately be able to provide high resolution imagery and video of temporally sensitive events or phenomenon along the river system (invasives, flood, droughts, etc.) to aide in timely management decision making and contribute new forms of data to existing long-term records. Team capability and an informational product on their role(s) and their capabilities will be hosted on LTRM website or disseminated by more targeted means to UMRR groups.

2022SD4: Aerial Thermal Application Completion Report.
Investigate and develop a report on potential LCU applications for the FLIR A8303SC thermal camera system. Some examples may be the remote detection of surface water temperatures and input sources, possibly ground water sources, inlets from tributaries, and outfalls from manmade structures, and subsurface discharges as well as potentially assessing levees for seepage or other damage from unnatural flow or flooding.

2022SD5: Spatial Point Repository Tool of UMRS.
A tool will be created to publish data from real-time kinematic positioning surveys (2021D6) and work to grow both the data in the point repository while expanding knowledge and application of this dataset to other research needs across the UMRS. This is a continuation of our FY21 SOW. This dataset provides high-quality, high-accuracy datapoints with a 0.2 cm horizontal accuracy and a 0.4 cm vertical accuracy. Points of this quality are survey-grade and can be leveraged across other projects both for science and channel maintenance.

2022SD6: Pattern of Wild Rice Colonization and Retreat Dataset.
Utilize the Trimble GPS RTK (Real-time kinematic positioning) system to collect data on repeating, identifiable vegetation patches across Pools 04 and 08 to closely monitor their position and spread rate while collecting ancillary data on landform characteristics, hydrologic position, and associated vegetation to understand the recurring emergence and retreat of patches on these pools. This RTK work will allow us to gain experience with utilizing the system for more advanced vegetation monitoring. This work will also align with thesis work being completed at UWL. [Leveraged with USGS funds]. Finley is leading this effort with LTRM guidance from Carhart, Lund, and Larson. Opportunities for collaboration are being explored.

2022SD8: Replacement for Three Dimensional Land Use/Land Cover Mapping Hardware
Produce a final cooperator report detailing plans for transitioning to new software and hardware platforms for 3-dimenisional (3D) desktop mapping of habitat, specifically vegetation, within the UMRS.

2022SD9: 3D Digital Environment from Aerial Imagery using Structure from Motion Workflow Documentation
Produce a final cooperator report, USGS Standard Operating Procedure (SOP), or USGS job aid for converting aerial imagery into 3D surfaces using Structure from Motion (SfM) processing software. These 3D surfaces are needed for desktop mapping of habitat, specifically vegetation, within the UMRS.

2022SD10: Active Remote Sensing Capability Addition to Crewed Aerial Survey Assets 2022
Produce a report or communication on incorporating active remote sensing, such as LIDAR or Synthetic Aperture Radar (SAR), alongside existing and state or the art medium and large format digital 4-band photography. Such an arrangement of sensors would provide high-accuracy colorized 3D and elevation products in simultaneously collection. These products would provide the fine-scale detail needed for planning and management for both natural resources and channel maintenance.

Goal 2: Use these data sets and associated derivative products and models to monitor status and trends in the ecological structure and function of the UMRS and better understand the causes and consequences of spatial and temporal change.

Similar to the other LTRM components, the Spatial Data component both collects and analyses data to determine status and trends and investigate their causes and consequences. The spatial data component often develops and uses derivative products that rely on land cover / land use and/or topobathymetric data, such as flood inundation, aquatic areas, sedimentation, submersed aquatic vegetation, and floodplain forest models to investigate patterns and processes and make predictions about the future land and aquatic cover of the UMRS. In addition, the Spatial Data component maintains expertise in the field of landscape ecology and provides this expertise to UMRR through HREP project delivery teams, the science planning team, with the focus of assisting the partnership in the interpretation of remote sensing data for ecological applications.

2022SD11: Report to Congress (Sections)
This effort will focus on leading writing of various sections of the Report to Congress that relate the land cover use and topobathy data, including but not limited to: UMRR Habitat Needs Assessment II, forest simulation modelling, and landscape ecology on the UMRS.

2022SD12: Data Analysis: Land Cover Change in the UMRS Key Pools 1989-2020
This data analysis effort will focus on developing methods to understand and quantify land cover changes in the LTRM key pools (where data could be available first) using the newest (2020) land cover data. Additional resources will be directed to this effort from the UMRR Science in Support of Restoration SOW (Landscape Patterns), to support J. Rohweder's assistance.

Products and Milestones

Tracking number	Products	Staff	Milestones
2022SD1	Orthorectification of scanned photos (Rock Island District - Mississippi River)	Strange	30 September 2022
2022SD2	Flight Plan Content/Data Pack	Finley	31 December 2021
2022SD3	Fact Sheet or website text on UAS Rapid Response Imaging	Finley	30 June 2022
2022SD4	Aerial Thermal Application Completion Report	Finley	30 September 2022
2022SD5	Spatial Point Repository Tool of UMRS	Finley	30 September 2022
2022SD7	Pattern of Wild Rice Colonization and Retreat Dataset	Finley	30 September 2022
2022SD8	Maintenance ArcGIS server	Fox, Rohweder, Hlavacek	30 September 2022
2022SD9	3D Digital Environment from Aerial Imagery using Structure from Motion Workflow Documentation (SOP)	Finley	31 March 2022
2022LD10	Active Remote Sensing Capability Addition to Crewed Aerial Survey Assets 2022	Finley	30 June 2022
2022SD11	Draft Report: Report to Congress Sections	De Jager	30 September 2022
2022SD12	Data Set: Land Cover Change in the UMRS Key Pools 1989-2020	De Jager	30 September 2022
2022SD13	Final 3D Vegetation Mapping Solution SOP (draft 2021SD2)	Finley	31 March 2022
2022SD14	Survey Capability and Historic Spatial Database for LCU Mapping in-house report (draft 2021D6)	Finley	31 March 2022
	On-going		
2021SD7	Topobathy strategic plan	Strange, De Jager	30 September 2022
2021SD10	Draft manuscript: Testing the driver vs passenger model for reed canarygrass invasion under different hydrological regimes (Evaluating effects of alternative flooding scenarios on forest succession and landcover in the UMRS.)	De Jager	30 September 2022

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 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.

Products and Milestones

Tracking number	Products	Staff	Milestones
2022M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	Schlifer	30 May 2022
2022M2	Load 2021 component sampling data into Database tables and make data available on Level 2 browsers for field stations to QA/QC.	Schlifer	30 June 2022
2022M3	Assist LTRM Staff with development and review of metadata and databases in conjunction with publishing of reports and manuscripts	Schlifer	On-going

Status and Trends 3rd edition

UMRR LTRM has completed two previous syntheses of status and trends of the UMRS with the most recent being completed in 2008 (Johnson and Hagerty, 2008). A third Status and Trends Report will provide an opportunity to communicate the important changes that have occurred in the UMRS over the LTRM period of record. During 2020 the analysis and writing will be completed and the draft submitted to SPN.

One or more conference calls and possibly a face-to-face meeting will be needed for the requisite discussions.

References

Johnson, B. L., and K. H. Hagerty, editors. 2008. Status and trends of selected resources of the Upper Mississippi River System. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, December 2008. Technical Report LTRMP 2008-T002. 102 pp + Appendixes A–B

Products and Milestones

Tracking number	Products	Staff	Milestones
2022ST4	Reconcile edits and review galley proofs	Authors, Sauer	30 May 2022
2021ST4	Publish Status and Trends	Authors, Sauer	15 June 2022
2020ST4	Draft S&T3 Fact Sheet; based on publishing report	Authors, Sauer	31 December 2022

FY22 Equipment refreshment

Field Station	Equipment	Component
La Crosse	flow meter	WQ
La Crosse	Airboat and trailer	Vegetation
Bellevue	Airboat	Vegetation
Bellevue	Airboat trailer	Fish
Bellevue	Field Rugged Laptop (1)	Vegetation
Bellevue	115 HP outboard motor (Fully rigged)	Fish
Big Rivers	175 HP outboard motor	Fish
Big Rivers	15 HP kicker outboard	Fish
Big Rivers	150 HP outboard motor	Fish
Big Rivers	GPS/depth (shock boat)	Fish
Big Rivers	Hydrolab Minisonde	Fish
Big Rivers	Surveyor	Fish
Big Rivers	Field Rugged Laptop	WQ
Big Rivers	2100P portable turbididmeter	WQ
IRBS	Electrofishing boat trailer	Fisheries
IRBS	GPS/depth (3)	Fisheries/WQ
IRBS	Remaining balance on truck	All
Great Rivers	Field Rugged Laptop (1)	WQ
UMESC	DI system	WQ lab

Literature Cited

American Public Health Association, American Water Works Association, and Water Environment Federation. 1992. Standard methods for the examination of water and wastewater. 18th edition, American Public Health Association, Washington, D.C. 981 pp. + 6 color plates

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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.	~204 samples; 3 periods: June 15–Oct. 30, 5 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 UMRR Long Term Resource Monitoring element, 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).

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