

2020 Aerial Survey of Upper-Mississippi River System for Decadal LCU Mapping

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Abstract

The 2020 survey of the Upper-Mississippi River System (UMRS) was undertaken to develop and distribute land use/ land cover spatial datasets and orthoimages from aerial imagery collected during summer 2020 of the systemic UMRS of navigable pools and reaches including Pools 1 through 26, the Open River Reach, the entire Illinois River, and the navigable portions of the Minnesota, St. Croix, and Kaskaskia Rivers. The data products will be primarily for resource managers and researchers to make assessment and evaluation of current vegetation components and long-term vegetation trends within the UMRS.

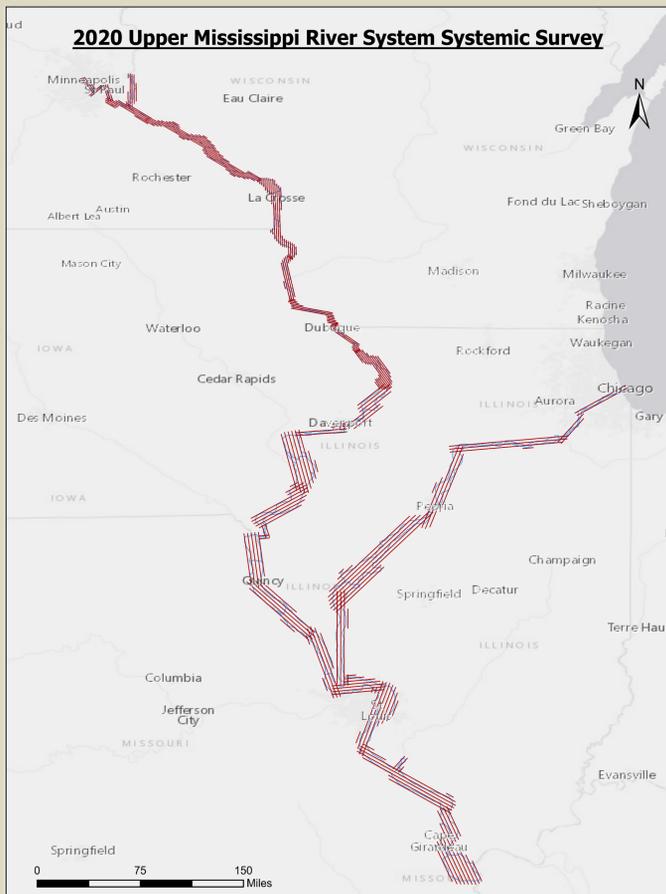
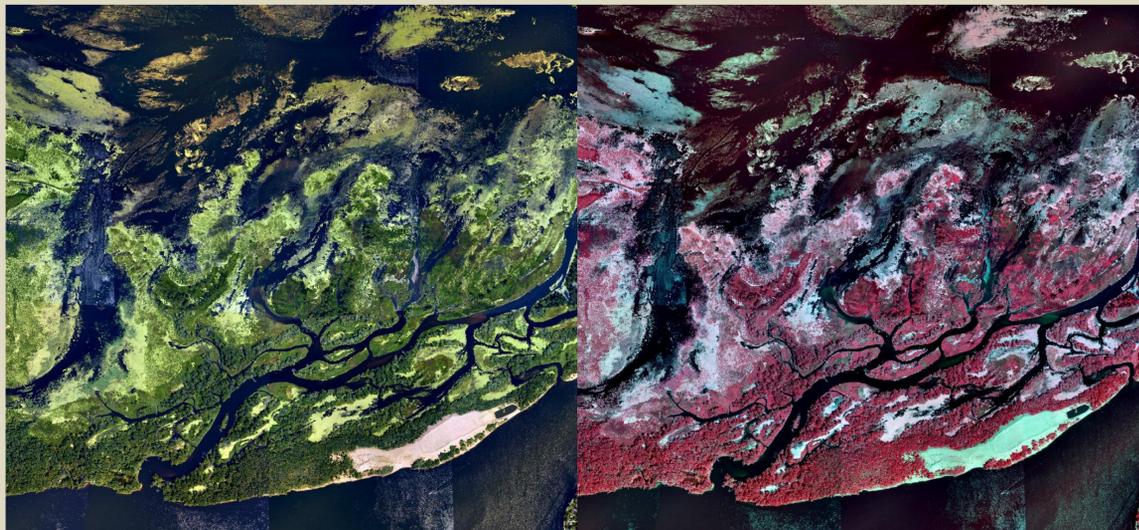


Fig. 1 2020 Survey Flight Plan

Methodology

- Aerial Imagery Acquisition**
Four-band digital aerial imagery (red/green/blue, or RGB, and near infrared, or NIR) of the systemic UMRS was collected during peak biomass between the 11th and 26th of August, 2020 at 0.2 meters (8 inches)/pixel for Pools 1 through 13 and navigable portions of the Minnesota and St. Croix Rivers where complex aquatic vegetation requires greater detail, and at 0.4 meters (16 inches)/pixel for Pools 14 through 26, Open River Reach, navigable portions of the Kaskaskia River, and the Illinois River (fig.1). To capture complete stereo-view the imagery was collected at 60% forward lap and 30% side lap using a Phase One iXU-RS 1000 set in a Somag SSM270 3-axis gyro-stabilized mounting (fig. 2) ensuring that images are precisely co-registered, almost perfectly nadir, and smear-free.
- Image Post-Processing**
All digital aerial images required for mapping are having stereo model files developed for three-dimension (3D) viewing by mappers using computer workstations to develop the LCU database. Likewise, all aerial images that are required for orthoimage mosaicking will be individually orthorectified and processed into GIS-ready orthoimage mosaics. Orthoimage mosaics (fig.3) will be made for each navigable pool or reach of the systemic UMRS and usable in GIS to overlay, view, and compare with existing and future LCU data or orthoimagery.
- LCU Mapping**
The 2020 LCU database will be prepared using documented standard procedures at UMESC and are subject to rigorous quality control assurances. To maintain classification consistency to other systemic UMRS LCU databases (2000 and 2010/11, except 1989), the "LTRM 31-class general classification for floodplain vegetation" will be used to map and develop the 2020 LCU database. Standard mapping practices of interpretation, polygon delineation, and classification common to the UMESC Geospatial Sciences and Technologies Branch will be applied according to the 'General Classification Handbook for Floodplain Vegetation in Large River Systems' developed for the Upper-Mississippi River Restoration (UMRR) program Long-Term Resource Monitoring (LTRM) element, the primary sponsors of this project. Prior to mapping, image interpreters conducted field work (fig. 4) to visit vegetation types and discern their appearances in the aerial imagery. The mappers then compare ground conditions to vegetation signatures on the newly acquired aerial imagery. Four-band aerial images will then be viewed by interpreters to classify and map LCU features using computer workstations (fig. 5), which includes viewing imagery in 3D using specialized computer software, monitors, and glasses. With these 3D mapping systems, the image interpreters can then identify features using color, form, texture, height, and location on the landscape.



Pool 4 RGB and CIR, August 2020



Fig. 3 CIR mosaic of Starved Rock Pool, Illinois River, August 2020



Survey aircraft, Quest Kodiak N70B



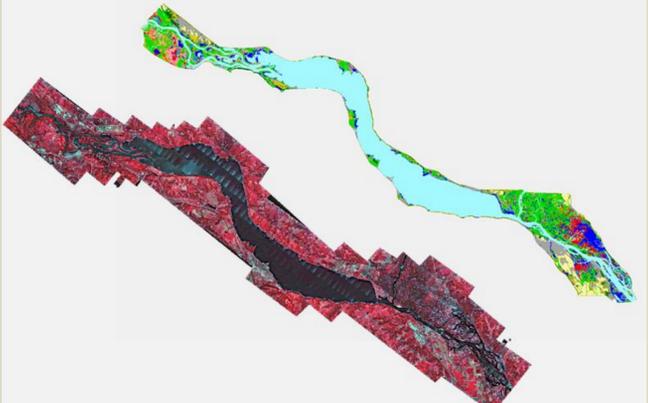
Fig. 2 Camera system and mounting



Fig. 4 Mapper performing fieldwork



Fig. 5 Mapper utilizing 3D workstation



Pool 4 CIR mosaic and corresponding mapped LCU dataset

Survey Results

- Fourth decadal imagery collection: 1989, 2000, 2010/11, 2020
- Over 9,638 Individual images taken at 8-inch (Pools 1-13 and St. Croix) and 16-inch (Pools 14 to Open River, and Illinois River) resolution
- 11,377 Linear miles flown over 70 hours and 16 minutes
- Natural color and near-infrared spectral imagery to produce land use/land cover dataset for use by resource managers and researchers to make assessment and evaluation of current vegetation components and long-term vegetation trends within the UMRS

Data Release Schedule

- FY 2021 (2,200 Frames)**
 - Pools 4, 8, 13, 26, & La Grange
 - ½ Open River South
 - FY 2022 (1,850 Frames)**
 - ½ Open River South
 - Pools 9–12 & Alton
 - FY 2023 (1,650 Frames)**
 - Pools 1–3, 5–7, & Peoria
 - St. Croix & Minnesota Rivers
 - FY 2024 (1,700 Frames)**
 - Pools 20–25 & Starved Rock to Lockport
 - Open River North & Kaskaskia River
 - FY 2025 (900 Frames)**
 - Pools 14–19
- Logos for participating agencies: USGS, USDA, NRC, US Army Corps of Engineers, US FWS, US EPA, Wisconsin DNR, Iowa DNR, Minnesota DNR, Missouri Dept. of Conservation, Illinois Natural History Survey, and others. A map of the river system shows the release areas. A 'PUBLIC' and 'NGO'S' logo is also present.
- Survey commissioned by the members of The UMRR LTRM

Acknowledgements

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Citations

Dieck, J.J., J. Ruhser, E. Hoy, and L. Robinson. 2015. General classification handbook for floodplain vegetation in large river systems (ver. 2.0, November 2015): U.S. Geological Survey Techniques and Methods, book 2, chap. A1, 51 p., <http://dx.doi.org/10.3133/tm2A1>.



Survey flight team Brian Lubinski (US FWS) and Benjamin Finley (USGS) upon survey completion, August 2020