Presentation Abstracts Day Two April 23, 2025

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 8:30 AM

Room: Columbia

Title: Shapes from the Field: GIS in the Response to Hurricane Helene

Presenter: Ryan Rhee & Scott Weir, Missouri Task Force 1/FEMA Incident Support Team

This past October, Hurricane Helene impacted several coastal states along the Southeastern US. As it unleashed torrential downpours as far north as North Carolina, it broke records as it became the costliest natural disaster in North Carolina's history. Prior to the start of the incident, FEMA rapidly mobilized its Urban Search and Rescue system, with 24 of 28 federal US&R teams from across the country deploying in some capacity over the course of the incident. The teams joined a long list of state and local US&R teams in the Southeastern U.S., ready to accomplish a shared mission, and at the center of these search and rescue efforts was SARCOP, helping to coordinate the movements, tactics and strategies of every one of those teams.

SARCOP, or the Search and Rescue Common Operating Platform, enabled teams to map out work areas, communicate hazards to one another, and document daily accomplishments. Relying on ESRI's ArcGIS Online COTS offerings, SARCOP offered an easy-to-learn suite of tools and applications designed to ensure that all teams can operate effectively and safely by ensuring that data is collected and shared as seamlessly as possible. With over 100 local, state, and federal teams operating in the region, this level of data sharing proved to be essential in the management of the response to an incident of this scale.

The incident posed several challenges and shortcomings that inspired changes after the incident, but the wealth of data, totaling nearly 400,000 data points collected in the span of three weeks, gave way to new practices and opportunities to utilize GIS in impactful ways. Map products drove tactical discussions, and became central cornerstones for planning meetings. New analyses and workflows were born from the requests of teams requiring products and insights that met the challenges they faced. Different approaches to how teams collected, edited, and published their data took shape organically. The US&R system is always keenly aware of the need to keep growing and shifting to always improve, and this incident provided ample opportunities to not only celebrate the victories that came, but also reflect heavily on the failures and hurdles.

While SARCOP is certainly not a new name in the field of US&R, we hope to provide a look into the critical role it, and more broadly, GIS played in the outcomes Missouri Task Force 1 and FEMA's Urban Search and Rescue branch had in the response to Helene.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 8:30 AM

Room: Pines

Title: Standing up the Missouri Hydrology Information Center

Presenter: Zackary Becker, Missouri Department of Natural Resources

Following the Great Flood of 2019, Governor Parson established the Flood Recovery Advisory Working Group (FRAWG) to provide input on the state's short-, medium- and long-term flood recovery priorities. The FRAWG's report identified a need to develop a flood monitoring program and became the seed for the Missouri Hydrology Information Center (MoHIC). Funded by the American Rescue Plan Act, MoHIC is tasked with expanding streamgage monitoring, expanding soil moisture and temperature monitoring, collecting new LiDAR, conducting aquifer supply studies in Northeast Missouri, and serving a flood model via the National Water Model. With all these data products and services to be displayed and served through an ESRI based website and mobile application. After spending 2023 & 2024 planning and contracting out MoHIC's future, the center is now working towards implementation and getting sensors into the field and data shared with the public.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 9:00 AM

Room: Pines

Title: Missouri 911 Service Board GIS Projects

Presenter: Shawn Penman, Missouri 911 Service Board

The Missouri 911 Service Board;s NG911 GIS Project has been investing in GIS in the state of Missouri. GIS data is a crucial component of the Next Generation 911 system. In partnership with the Missouri Departments of Conservation and Natural Resources 6-inch 4 band orthoimagery was acquired statewide between 2023 and 2024. Additionally the Board has awarded grants to 71 counties to remediate and improve their GIS data to meet NG911 Standards. Maintenance of the NG911 data is vital to the success of NG911 across the state of Missouri.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 9:30 AM

Room: Columbia

Title: Real-time soil moisture prediction across Missouri monitoring networks augmented by remote sensing and machine learning

Presenter: Varshini Kumanan, University of Missouri

Accurate and real-time prediction of soil water content is crucial for understanding soil water dynamics, but obtaining spatially continuous measurements across large, heterogeneous landscapes remains a significant challenge. In the United States, soil moisture modeling initiative is implemented to manage early fire risks and drought warning systems as well as part of broader municipal flood modeling efforts. A variety of approaches, including field moisture sensors, in-situ measurements, satellite-based Earth observations, and land-atmosphere process models, have been employed to estimate soil moisture across multiple scales, from individual fields to global coverage. Although these methods have significantly advanced soil moisture estimation, a comprehensive real-time mapping of soil moisture data at the state level has not been developed; the lack of consistent tracking and sparse in-situ measurements pose additional challenges beyond the existing monitoring network. In this research, we aim to create near real-time, gridded and user-friendly soil moisture maps and tools for Missouri through a collaborative effort, while exploring machine learning and remote sensing techniques to combine in-situ, remotely sensed and modeled data to predict soil moisture content at multiple depths. Datasets that represent these processes and elements are obtained and clustered into homogeneous regions based on the association between SM and biophysical controls. Climate variables evaluated will include precipitation, temperature, radiative heat, evaporative demand and others. Soil characteristics evaluated will include particle size distribution, bulk density, Soil Organic Carbon, available water capacity, and others. Additionally, topographical parameters evaluated will include wetness index, land use and station distance. Optimal site selection for new monitoring stations will be informed by station-distance maps, and a station deployment roadmap will be developed. Various controls on SM will be evaluated for their relative importance and their functional relationships with SM will be presented. The overarching goal of this project is to develop a web-based interactive map that provides daily soil moisture observations across Missouri, improving the understanding of antecedent soil moisture conditions for climate risk management, while enhancing the monitoring capabilities of in-situ sensor networks through real-time updates.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 9:30 AM

Room: Pines

Title: GIS Exploration with Python

Presenter: Colby Thrash, Missouri Department of Natural Resources

Computer programming tools offer many opportunities to increase efficiency and documentability of common GIS tasks. Some government agencies and universities (ex: USGS, USACE, and MSDIS) also make their public data programmatically accessible through an Application Programming Interface (API). High level tools are available to tap into these API resources without the need for any specific knowledge of web communications. The Missouri Department of Natural Resources (MoDNR) has utilized some of these tools to perform data analysis and visualization on projects ranging from drought monitoring to reservoir analysis. Many excellent tools exist in the Python programming language to access geospatial data through APIs and to perform GIS work. Some of the Python packages utilized at MoDNR to date include dataretrieval, HyRiver, and geopandas. The utilization of Python GIS tools to support specific MoDNR projects will be demonstrated.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 10:30 AM

Room: Columbia

Title: Developing a Multi-Modal Grain Transportation Network to Assess Disaster Impacts on Shipping Costs from the Midwest to U.S. Ports

Presenter: Justin Krohn, University of Missouri

The Midwest United States exports billions of dollars' worth of corn and soybeans annually to international markets. Transporting this grain relies on a multi-modal network of roads, rail, and rivers, but the exact routes from individual silos to export ports remain largely unknown. Additionally, the impact of natural disasters—such as hurricanes, tornadoes, floods, and winter storms—on these transportation routes has not been fully analyzed. Disruptions caused by these disasters can create significant delays, increase costs, and shift reliance between transportation modes. This study develops a theoretical least-cost transportation network and evaluates how disasters disrupt grain shipments from Midwest silos to major U.S. ports.

We constructed a custom transportation network integrating roads, railways, and four major rivers (Mississippi, Ohio, Illinois, and Arkansas) to model grain movement. Using nearly 5,000 silo locations as origins, we calculated least-cost routes to key export ports, including New Orleans, LA; Vancouver, WA; Norfolk, VA; Duluth, MN; Toledo, OH; and Laredo, TX. The network was built using ESRI's U.S. Major Roads (2021), the Bureau of Transportation Statistics' Rail Network (2021), and USGS' North America Rivers and Lakes (2021). Network edges were adjusted as needed to ensure seamless transitions between modes, particularly from rail to river and road to rail, where misalignments occurred due to mapping limitations such as river centerlines not intersecting with the silos that are situated along the river edge.

After validating the network, we computed baseline least-cost routes using the average cost per-bushel, per-mile transportation cost for each mode. We then introduced disaster-induced disruptions using FEMA county-level disaster declarations (2008–2022) for tornadoes, hurricanes, flash floods, winter storms, and mudslides. Counties with active disaster declarations were treated as barriers, forcing rerouting around affected areas. To maintain realistic river traffic, disaster barriers were modified to exclude a buffered river corridor, allowing continued barge shipments from upstream silos, unless extreme conditions warranted exceptions.

Results highlight the significant impact of disasters on transportation efficiency, with rerouted shipments increasing total travel distance and shifting reliance toward rail or river transport in certain scenarios. These findings provide insight into the resilience of the U.S. grain transportation network and can inform infrastructure planning, disaster response strategies, and future research on transportation resilience in agricultural logistics.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 10:30 AM

Room: Pines

Title: Deploying ArcGIS Dashboards for Public Data Transparency

Presenter: Morgan Hurt, Boone County Government

The ability to clearly communicate spatial data and associated attributes to the public and non-GIS users can be difficult without access to or training in desktop GIS software. Data is often buried within the body or appendices of lengthy annual reports in a non-spatial format. In the interest of data transparency and to provide the public with immediate and timely access to data on the stewardship and maintenance of Boone County roadways, ArcGIS Dashboards were created to intuitively display live data in a manner that elected officials and the broader public could easily access and understand. This presentation will outline how the Boone County GIS Department utilized ESRI's suite of products to expand its services and provide transparent data access to the public as well as County officials.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 11:00 AM

Room: Columbia

Title: Using Lidar to Map Geology and Natural Hazards

Presenter: Daniel Coe, Washington DNR

In the past two decades, the increasing prevalence of lidar data has allowed geoscientists to map landslides, faults, glaciers, and other geologic features with much greater detail and accuracy than with previous technologies.

Airborne lidar (light radar or light detection and ranging) systems collect billions of elevation measurements that are processed to create extremely detailed three-dimensional models of the Earth's surface. Vegetation and structures can be digitally removed to create a “bare earth” surface (also known as a digital terrain model) that reveals an intricate representation of the ground.

I will show different ways that the Washington Geological Survey has used lidar to map geologic hazards and landforms, particularly in places where vegetation would traditionally obscure these features. I will also discuss other ways that lidar can be used to map both the natural and built environment, including practical tips for visualizing elevation data.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 11:00 AM

Room: Pines

Title: ArcGIS Velocity: An Introduction

Presenter: Luke Finley, Esri

ArcGIS Velocity is a real-time and big data analysis capability in ArcGIS Online, enabling organizations to ingest, visualize, analyze, store, and act upon data from Internet of Things (IoT) sensors. Join the discussion on how to connect to virtually any type of streaming data, perform real-time analytics and processing, and automatically disseminate information and alert personnel when specified conditions occur. Learn how to create analytic models to process high-volume historical data to gain insights into patterns, trends, and anomalies in your big data.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 11:30 AM

Room: Columbia

Title: Strategic Strides: Modeling Tiger Movement in Urban Green Spaces Using Game Theory

Presenter: Anam Ahsan, University of Missouri

Anam Ahsan, DP Srivastava, Shekhar Kolipaka , Michael Byrne

Urban green spaces are becoming increasingly important habitats for migratory carnivores like tigers, which calls for a better knowledge of how they use these areas. Game theory is used in this study to simulate the presence and movement of tigers in urban environments, where interactions between tigers, people, and prey affect behavioural choices. We analyse tiger mobility patterns in corridors, green spaces, and human-dominated places by combining data from remote sensing, camera traps, and ground surveys. Land use and land cover (LULC), prey species, humans, and tigers are identified in the study along with their tactics, which include coexistence, avoidance, and habitat selection. We create a payoff matrix that includes factors like prey density, human disturbance, and landscape connectivity in order to determine equilibrium solutions for tiger mobility. To evaluate how tigers traverse dispersed urban environments, the model is tested using ground sign surveys and camera trap recordings. We assess how tigers maximise their movement while striking a balance between conflict reduction and survival needs by using Nash equilibrium and Markov decision processes. It is more applicable to conservation planning when validated using empirical data and occupancy modelling. The results offer a fresh framework for enhancing habitat connectivity, lowering conflicts between people and wildlife, and guiding sustainable conservation tactics in landscapes that have been altered by humans. When creating evidence-based urban wildlife management policy, this game-theoretic approach provides insightful information.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 1:00 PM

Room: Columbia

Title: Sensor-Enabled Decision Support System for Food Safety and Security

Presenter: Tom Vought, University of Missouri

Salmonella is a leading cause of foodborne illness in the United States and around the world, disproportionately impacting vulnerable populations. It cost the U.S. economy $4.1 billion annually, with 1.35 million infections, 26,500 hospitalizations, and 420 deaths, with unchanged rates for three decades despite national goals. Salmonella has become a “One Health” issue requiring collaborative efforts across the animal-human-environment interface, recognizing that all are interconnected. To resolve this issue, the proposed project, through collaboration with the end-to-end supply chain, food banks, and educators, will create SENS-D, a sensor-enabled decision support system. SENS-D will incorporate multiple rapid sensing technologies along with visualization, prediction, and optimization capabilities to provide data-driven solutions to mitigate foodborne pathogen risks for a safe, equitable, and resilient food system.

Our interdisciplinary team, consisting of investigators encompassing expertise in Public Health, Poultry Science, Food Science, Animal Science, Supply Chain Analytics, Engineering, Analytics, and ML/AI, is well-positioned to address this public health concern. This collaborative effort has allowed us to work toward our common goal - a timely solution for a safe, equitable food system. The research team is working alongside multisectoral partners for broader and faster adoption to address the unique needs of disadvantaged populations in food nutrition, accessibility, and equity.

This holistic approach deploys sensors across the supply chain and integrates real-time sensing results into a centralized “One Health” data environment encompassing population health, poultry/food production, and environmental data, that empowers the DSS. By combining results from samples collected throughout the food supply chain, the project ensures a comprehensive understanding of contamination dynamics. The DSS features (1) optimization models for sensor placement in the food supply chain, (2) intelligent distribution of perishable foods in cold chain operations while considering the predicted Salmonella levels and shelf-life of products, (3) workforce planning and targeted outreach to vulnerable populations at high-risk for Salmonella infections, and (4) analytical toolkit for evaluating policies and interventions to reduce and prevent the spread of Salmonella infections. SENS-D can potentially be adapted for detecting other foodborne pathogens in beef, pork, dairy, and green leaf products. Additionally, it can be used to diagnose bacterial and viral infectious diseases in clinical settings, potentially reducing the $152 billion economic burden of foodborne illness in the US.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 1:00 PM

Room: Pines

Title: GIS Data Preparation for NG9-1-1

Presenter: Richard Riemann, DATAMARK Technologies

The role GIS plays in Next Generation 911 - Discuss The State of Missouri vs National Standard best practices for GIS Data in NG9-1-1 and understanding of data maintenance requirements. What attributes are important and attribute maintenance with regard to NG9-1-1. What boundary layers are needed to meet NG9-1-1 standards and why they are important?

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 2:00 PM

Room: Columbia

Title: Visualizing the Commercial Fishing in Missouri, 1945-2021

Presenter: Dyan Pursell, Missouri Department of Conservation

Many times, an information manager may not be as connected to the data as the subject expert is. In these instances, data analysis can accelerate learning for that information manager by revealing information and providing insights that can be used to better contextualize information. Esri's Experience Builder is one of many data analysis tools utilized by information managers to build both tabular and spatial visualizations, allowing them to learn faster and ultimately provide more helpful results. Missouri Department of Conservation is using Experience Builder to visualize trends among commercial fisherman in Missouri over the last 76 years.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 2:00 PM

Room: Pines

Title: Flow Networks in a 3D Geospatial World – A Case for Connectors in US Geological Survey 3D Hydrography Program Datasets

Presenter: Christy-Ann Archuleta, US Geological Survey

The U.S. Geological Survey 3D Hydrography Program (3DHP) is implementing a new generation of hydrography as a component of the wholistic and integrated 3D National Topography Model. In traditional two-dimensional representations of hydrographic flow networks, connectivity is represented by coordinate-matched nodes. The three-dimensional representations of hydrographic flow networks found in 3DHP data need to take more factors into consideration and many elevation features require special treatment. In the 3DHP, flow networks will not only be matched at nodes by horizontal coordinates but be matched with vertical coordinates relative to a digital elevation model surface. There are certain instances where vertical coordinates cannot match the surface elevation value while still maintaining the downhill flow of water (monotonicity). In some cases, there may be obstructions on the landscape that prevent water from continuing to flow downhill and in other cases, a stream channel may disappear from the surface only to seemingly pick up again further downstream. This presentation explores the variety of circumstances where special connector features are needed to create a monotonic three-dimensional flow network that stays true to the digital elevation model from which it was derived.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 2:30 PM

Room: Columbia

Title: Precision Unveiled: A Guide to High-Accuracy GNSS Data Collection, Validation, and Tips

Presenter: Joe Madej, GISP, Seiler Geospatial

This focuses on the meticulous process of collecting high-accuracy GNSS data. It outlines essential steps, including receiver selection and optimal field procedures, emphasizing the significance of adherence to best practices. This highlights the critical testing phase against control points, discussing statistical analyses and error assessment techniques for

data validation. Additionally, it touches upon advanced GNSS collection methods like differential correction and real-time kinematic solutions. Practical tips and tricks, addressing challenges like multipath interference providing a comprehensive guide for professionals seeking precise and reliable GNSS data.

Missouri GIS Conference 2025 Abstracts

Date: Wednesday, April 23, 2025

Time: 2:30 PM

Room: Pines

Title: An Update on Developing Elevation Derived Hydrography in Missouri

Presenter: Frank Nelson, Missouri Dept. of Conservation

Authors: Missouri Department of Conservation: Frank Nelson, Jon Podoliak, Tim Bixler, Matt Matheney, Aerial Services Incorporated: Logan Pennington and Nathan Eick

Accurate spatial data is critical in planning for and responding to natural disasters like drought and floods, which are common occurrences in Missouri. The Missouri Governor's 2020 Flood Recovery Advisory Working Group report identified the need for state agencies to provide leadership in implementing improvements to flood protection infrastructure and management of major river systems. As such, multiple agencies must coordinate and contribute funds towards flood recovery programs and strategies. Missouri's geospatial hydrography data is part of the digital framework that is essential for these programs and strategies to be successful. Much of Missouri's geospatial data was generated in the 1980's. In recent years, state and federal agencies have been leveraging more current and higher resolution remote sensing data with new computer processing tools. Missouri Department of Conservation (MDC) is leading a multi-agency effort to incrementally update the state's digital streamflow network as part of U.S. Geological Survey's 3D Hydrography Program, which included the Elevation Derived Hydrography (EDH) dataset. This is in alignment with other national efforts that include the 3D National Topography Model (3DNTM), Internet of Water Coalition, and Flood Inundation Mapping (FIM) to help local, state, and federal agencies be better prepared for natural hazards moving forward. First, this has required collaboration among agencies to update lidar and imagery that are needed as base layers. Secondly, as contractors use the base layers to develop the EDH flowlines, water bodies, and stream areas, engaged partners have had the opportunity to review and provide input on the final data product. This has resulted in a coordinated progression of data development across watersheds over the last 3 years. The project will continue to work its way across the state in coming years.

Aerial Services Inc (ASI) has the privilege of working on the EDH project through three phases of watershed collection at this point in time. As the primary contractor, ASI is utilizing recent existing high resolution spatial data involving QL2 lidar and 12 inch leaf-off orthoimagery in combination with existing geospatial datasets and semi-automated workflows in order to develop the Missouri elevation derived dataset (EDH). Using skilled manual editing, quality checks with advanced automated processes, ASI readies Hydrologic Units (HUC) for USGS integration, to be used within the 3DHP program. Not only is ASI mapping more accurate flowlines with USGS classifications, but correcting inaccurate culvert data and updating NHD features.