



Tuesday, October 17, 2023
University of Tennessee at Chattanooga, University Center
Eastern Fall Forum
Agenda at a Glance

- 8:30-9:00 am -- **Registration Opens**
- 9:00-9:20 am -- **TNGIC Welcome - Tennessee Room**
Charlie Mix & Sarah Sweat, Conference Chairs
- 9:20-10:00 am -- **Keynote: Automatic Segmentation of Remote Sensing Imagery with the Segment Anything Model – Tennessee Room**
Dr. Qiusheng Wu, University of Tennessee Knoxville
- 10:00-10:30 am -- **3D Hydrography and State Data Projects – Tennessee Room**
Paul Dudley, TN STS-GIS
- 10:30-10:45 am -- **Break**
- 10:45-11:45 am -- **Presentations – Tennessee and Chattanooga Rooms**
- 11:45-12:00 pm -- **Business Partner Spotlights – Tennessee Room**
- 12:00 - 1:00 pm -- **Lunch – Tennessee Room**
- 1:00 - 1:40 pm -- **Presentations – Tennessee and Chattanooga Rooms**
- 1:40 - 2:00 pm -- **Break**
- 2:00 - 2:40 pm -- **Presentations – Tennessee Room**
- 2:40 - 3:00 pm -- **Closing Remarks and Door Prizes (must be present) – Tennessee Room**

Time	Tennessee Room	Chattanooga Room
8:30-9:00	Registration	
9:00-9:20	Welcome	
9:20-10:00	Keynote <i>Dr. Qiusheng Wu</i>	
10:00-10:30	3D Hydrography and State Data Projects <i>Paul Dudley</i>	
10:30-10:45	Break	
10:45-11:05	Mapping Tree Canopy in Signal Mountain, TN Using Remote Sensing and GIS <i>Dr. Azad Hossain, Patrick Bassham, Jared Stein, and Spencer Cox</i>	Plantain Agroforestry in Uganda: Integrating Cultural Legacy into Multi-Criteria Decision Analysis <i>Joshua Russell</i>
11:05-11:25	Remote Sensing of Water Quality in the Tennessee River Using Landsat, Sentinel, and PlanetScope Imagery <i>Jacob Hart, Dr. Azad Hossain</i>	Exploring Chattanooga's urban forests using modern GIS, remote sensing, and high resolution imagery. <i>Charlie Mix</i>
11:25-11:45	Integration of Remotely Sensed Data into Watershed and Hydrodynamic Models to Study Suspended Sediment Concentrations in the Tennessee River and Surrounding Streams in Chattanooga, Tennessee <i>Connor Firat</i>	Mapping Invasive Barbed Goatgrass in Oak Woodland Savannas Using Multispectral Satellite Imagery <i>Mona Latil- Quinn</i>
11:45-12:00	Business Partner Spotlight	
12:00-1:00	Lunch	
1:00-1:20	From Points to Adventure: Development of the Tennessee RiverLine Digital Guide <i>Nyssa Hunt</i>	From Field to Attribute Table: Best Practices for Data Acquisition <i>Alex Lennon and Mark Crow</i>
1:20-1:40	Creating A Southern Appalachia Trout Passport Map <i>Matthew Snyder, Ben Lundberg, Dr. Brooke Persons</i>	ESRI File Based Geodatabases in QGIS <i>Randal Hale</i>
1:40-2:00	Break	

2:00-2:20	Empowering Freight-Dependent Communities through the Thrive Regional Infrastructure Portal (TRIP) <i>Shannon Millsaps</i>	
2:20-2:40	Exploring land cover change in the Alabama, Georgia, Tennessee tri-state region using NLCD data <i>Mimi White</i>	
2:40-3:00	Closing Remarks and Door Prizes	

Business Partners

True North Geographic Technologies is an award-winning GIS services firm in Murfreesboro, Tennessee, serving federal, State and local governments, utilities, and private sector organizations. True North is focused on creating solutions that help our customers leverage the Esri platform to meet their current and future business needs. True North delivers successful projects by utilizing our highly skilled staff and over 100 years of collective technical experience with the Esri platform. We excel in working with local GIS staff to maximize the existing hardware, software, and financial resources that are available while providing guidance and strategies to grow the local GIS programs through budget and new technology planning. We also provide the skills and expertise to integrate other enterprise data systems with GIS.

<https://www.tngeo.com/>



KCI is a 100 percent employee-owned engineering, consulting, and construction firm serving clients throughout the nation. KCI's corporate vision is to be the professional consulting firm of choice for our employee-owners, clients, and business partners. KCI is constantly driven by energy, passion, and talent. Solving customer challenges using innovative and proven technology is what drives us at KCI. With our roots in geospatial technology implementation, we embrace the power of location-based technology to answer the most challenging questions that affect our built and natural environment. Our skilled technologists provide system architecture and integration services, coupled with software development and low-code/no-code solutions to improve operational effectiveness and organizational decision-making. <https://www.kci.com/>

Skytec is a team of experienced geospatial and environmental professionals specializing in applications of drone mapping technologies, remote sensing, and Geographic Information Systems (GIS). Since 2015, Skytec has provided premium data capture, analysis, and information delivery services with a commitment to innovation, efficiency, and achieving clients' objectives. Skytec's solutions include UAS LiDAR and photogrammetry products, GIS consulting services, and Ranger - a global monitoring and change detection platform that measures and reports environmental change. Built on Esri's GIS technology, and powered by satellite imagery and machine learning, Ranger empowers users with actionable analytics on landscape changes such as boundary encroachments, natural disaster impacts, vegetation, stream and river erosion, agricultural expansion, construction, and more. <https://skytecllc.com/>





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We know just how important water is to daily life. It's somehow involved in everything thing we do, everything we use. When you need it, you expect it to be there — and you expect it to be clean and safe. That's what our skilled teams of experts care about most, and focus on every day. Our customers are our number one priority, and we are proud to deliver clean, safe, reliable and affordable water services. In Tennessee we serve about 380,000 people. To ensure your water is of the highest quality, we strictly follow regulations that are set by local authorities as well as federal standards set by the United States Environmental Protection Agency (USEPA). Water is an integral part of life, and we take great pride in taking care of it. <https://www.amwater.com/tnaw/>



Geographers study people and our environments across the globe and throughout time. Geographers bring together global and local perspectives to address today's challenges. Our faculty study everything from climate change over the past ten thousand years, to poverty and urban development, to how the internet is changing how we understand the places where we live. This big picture view of the world makes geography and sustainability degrees highly marketable: our graduates are helping with security management of the Boston Marathon, mapping global population for disaster readiness, and working as data scientists at the largest technology companies in the world. The UT Geography Department offers BA degrees in Geography and in Sustainability, BS in GIST, and an MS and PhD in Geography. Our students work alongside faculty, study abroad, and develop marketable skills while helping community organizations

and working in local governments, the private sector, and Oak Ridge National Laboratory. Geography is all around you! <https://geography.utk.edu/>



The University of Tennessee at Chattanooga is a driving force for achieving excellence by actively engaging students, faculty and staff, embracing

diversity and inclusion, inspiring positive change and enriching and sustaining our community. UTC is the campus of choice for over 11,700 students. Our four colleges offer over 49 bachelor's programs with 103 program concentrations. Our graduate school offers 20 master's programs with 45 program concentrations and 5 doctoral degrees with 6 program concentrations. UTC educates our students for success in a global society at a reasonable rate.

Presentation Abstracts

Mapping Tree Canopy in Signal Mountain, TN Using Remote Sensing and GIS

Azad Hossain, Patrick Bassham, Jared Stein, and Spencer Cox

Recent studies suggest that the Greater Chattanooga area in Tennessee has grown substantially during the last 10 years. The Town of Signal Mountain, TN does not have any information about the tree canopy coverage other than what was mapped in 2012. This study used high resolution color aerial photographs to update the canopy coverage map of the Town of Signal Mountain and the City of Walden applying different digital image processing techniques. The preliminary results suggest that the canopy coverage of the area increased since 2012.

Remote Sensing of Water Quality in the Tennessee River Using Landsat, Sentinel, and PlanetScope Imagery

Jacob Hart, Azad Hossain

This study will seek to evaluate both the effectiveness of an existing turbidity model (developed at UTC) and the effectiveness of multiple sensors (Landsat-8/9 OLI, Sentinel-2A/B MSI, and PlanetScope) in estimating turbidity in the TN River watershed. Near real time in-situ turbidity measurements will be collected in Southeastern TN within the TN River watershed (Nickajack, Chickamauga, and Parksville Reservoirs). These measurements will be used in conjunction with surface reflectance values to assess the existing Turbidity model quantitatively via root mean square error (RMSE) and qualitatively using the Normalized Difference Suspended Sediments Index (NDSSI) as a proxy for turbidity. Measurements and surface reflectance values will also be used to develop and assess sensor-specific turbidity models for future Sentinel and PlanetScope images. Here we will present some of the recently acquired in situ water quality measurements and satellite imagery, and their processing/analysis.

Integration of Remotely Sensed Data into Watershed and Hydrodynamic Models to Study Suspended Sediment Concentrations in the Tennessee River and Surrounding Streams in Chattanooga, Tennessee

Connor Firat

Excessive suspended sediment has the impact to obstruct water treatment processes, degrade natural habitats, cause aesthetic impairments for recreation, increase costs for dredging on dams, picks up nutrients that can lead to the over reproduction of microorganisms, and can carry harmful chemicals. Two approaches to quantify suspended sediments are using remote sensing technology and numerical models. Remotely sensed data and Numerical models both have their strengths and weaknesses in estimating suspended sediment concentrations (SSC) in water bodies. Remotely sensed data has been proven to provide reasonably accurate suspended sediment concentrations, but is limited to cloud coverage, ground truthing, and variable spatial and temporal resolutions. Numerical models can provide hydrodynamically computed water quality data on the water surface as well as in the water column, but they have issues with initializations, boundary conditions, calibration, and validation. This study aims to apply both techniques together (integrated) on a section of the Tennessee River that is known for excessive suspended sediment concentrations coming out of the South Chickamauga creek tributary.

Plantain Agroforestry in Uganda: Integrating Cultural Legacy into Multi-Criteria Decision Analysis

Joshua Russell

The assurance of food security and a decent livelihood for smallholder farmers in Sub-Saharan Africa is an ever-increasing challenge. Agroforestry is seen as one solution that has been promoted by numerous agencies and organizations to improve food and livelihood security without undue negative impacts on the environment. The widespread adoption and "up-scaling" of agroforestry requires consideration of whether the agroforestry planting scheme is not only suitable for a given ecosystem but also if cultural practices/traditions in an area will favor the up-take of that technology. GIS-MCDA is an effective tool for structuring and evaluating criteria for decision support, though there is a noted absence in current literature illustrating the integration of cultural legacy or indigenous knowledge into MCDA. The implementation of a methodological framework for gleaning cultural legacy from ethnographic works and other pertinent research is critical for developing an output of suitability that is culturally appropriate. By accounting for cultural criteria in MCDA suitability analysis and identifying sites where cultural traditions favor a given intervention, the potential for up-take of promoted interventions is likely to be improved.

Exploring Chattanooga's urban forests using modern GIS, remote sensing, and high resolution imagery.

Charlie Mix

Urban Tree Canopy (UTC) provides residents with numerous benefits, including positive mental and physical health, mitigation and prevention of urban heat islands, and a sense of place. Previous studies have found that as the wealth of a community decreases, so does the amount of UTC found in the community, thus wealthier communities are more likely to enjoy the benefits that UTC provides. The current extent of UTC for Chattanooga was previously unknown until now. In this study, 50-centimeter multispectral imagery was used with remote sensing and GIS software in an object-based image analysis to create a thematic raster layer representing land cover types for the city. Forest land cover was then overlaid with demographics at the neighborhood scale to investigate relationships with residents and UTC. This study shows the utility of modern GIS, remote sensing tools, and high-resolution imagery in assessing the distribution of UTC in Chattanooga and its relationship with residents.

Mapping Invasive Barbed Goatgrass in Oak Woodland Savannas Using Multispectral Satellite Imagery

Mona Latil- Quinn

Barbed goatgrass (*Aegilops triuncialis*) is a threat to wildlife welfare, biodiversity, the productivity of grazing lands, and the health of domesticated grazing animals in oak woodlands across California. Goatgrass has a distinct phenology and coloration from the surrounding native grass populations, especially late in the growing season when invasive species stay green into late May and early June while native species turn gold and senesce. This phenological difference makes it viable to sense remotely. The Hopland Research and Extension Center (HREC), part of the Department of Agriculture and Natural Resources at the University of California: Davis, suffers from mild to severe goatgrass infestations across the site. The distribution of goatgrass at HREC was mapped using a time series of PlanetScope imagery covering March - May 2023. The Normalized Difference Vegetation Index (NDVI), NDVI difference across the growing season, and Soil Adjusted Vegetation Index were

performed on three imagery dates, and each resulting raster was individually compared to ground truth data gathered at the Hopland Research and Extension Center in late May, 2023 by running a simple Linear Regression and Maximum Likelihood Classification.

ESRI File Based Geodatabases in QGIS

Randal Hale

There is always fear that using QGIS is going to lock up your data. At anytime in qgis you can build a geopackage, spatialite, and the trusty shapefile and share it with ESRI Software. What about ESRI's File Based Geodatabase? Previous to 2022 qgis could edit them with additional drivers but the process was a bit worrisome. In 2022 the GDAL developers reverse engineered the format and QGIS can now easily edit and create ESRI's file based geodatabase format. This talk will walk you through using the format with QGIS.

From Field to Attribute Table: Best Practices for Data Acquisition

Alex Lennon and Mark Crow

Often overlooked and under appreciated, data acquisition is a key aspect of GIS; therefore, it is important that data collection methods are efficient, accurate, and verifiable. While every GIS project has its own specific needs, we plan to share some “best practices” that can: improve workflow efficiency, having your approach match your needs, making sure your accuracy is verifiable, having pre-prepared field maps on hand, and a well-refined workflow. Utilizing these best practices will improve both the quality of your data and productivity of data collection.

Creating A Southern Appalachia Trout Passport Map

Matthew Snyder, Ben Lundberg, Dr. Brooke Persons

This presentation tells the story of what was originally requested, the responses received, and how it let to the creation of the Trout Streams GIS tool. We hope that this presentation will inspire more work toward a unified understanding and collaboration between, State and Federal agencies, Biologists, Foresters, Fish & Wildlife, outdoor enthusiasts, anyone who has a passion to work together to preserve and enjoy these pristine headwaters, and the life they support.

From Points to Adventure: Development of the Tennessee RiverLine Digital Guide

Nyssa Hunt

In 2019, Tennessee Valley Authority recognized the need to re-inventory and document their available recreational sites along the Tennessee River, and partnered with the University of Tennessee at Chattanooga to digitize these features. The Interdisciplinary Geospatial Technology Lab (IGTLab) undertook the task of identifying all of the publicly available boat ramps, canoe/kayak launches, marinas, and campgrounds along the Tennessee River and its adjacent reservoirs. These features were hosted on ArcGIS Online and made publicly available in an Esri web application, publicly released as the Tennessee RiverLine Digital Guide.

Exploring land cover change in the Alabama, Georgia, Tennessee tri-state region using NLCD data

Mimi White

As development increases in the tri-state region of Alabama, Georgia, and Tennessee, the loss of forest and agricultural land to development is an ever-present concern. To detect areas of greatest change I designed a simple pilot study using the Change Detection Wizard tool in ArcGIS Pro to analyze NLCD data in a time series from 2001 to 2021. I joined the results to HUC-12 watershed data for the region and created a graduated color map to highlight watersheds that contain the most acreage of forest and agricultural land cover change. Finally, I utilized an optimized hotspot analysis tool, which uses the Getis-Ord G_i^* statistic to detect areas with statistically significant values of change. The results indicated 27 watersheds with high levels of forest loss and 15 watersheds with high levels of agriculture loss.

Empowering Freight-Dependent Communities through the Thrive Regional Infrastructure Portal (TRIP)

Shannon Millsaps

In 2019, with no other existing organization covering the Thrive geographic footprint, the Federal Highway Administration included our region in a study of freight movement. FHWA issued a call to action for Thrive's Freight Mobility Coalition to advance policy and project recommendations for the movement of freight through the tri-state region. Knowing this could not be accomplished effectively without an accurate, updated database, Thrive led the development of a robust GIS tool to support data-driven analysis and improve informed decision-making. This platform, called the Thrive Regional Infrastructure Portal, is important for assessing the condition of the tri-state, greater Chattanooga freight and transportation system, identifying its problems, and setting priorities on actions to resolve those problems. Areas of emphasis include, but not be limited to, freight efficiency, effectiveness, capacity, safety, security, infrastructure condition, congestion, energy, and environment. The TRIP platform has already had an enormous impact outside of its original purpose, informing curriculum development and inspiring additional research at Cleveland State Community College.

Map Gallery

Total Eclipse of the Heartland: Seeking Totality in 2024

Benjamin Lundberg

On the afternoon of April 8, 2024, the central U.S. will experience a total solar eclipse. This poster illustrates the path of the total solar eclipse across the U.S. Will you be there?

Chattanooga Parks and Outdoors Plan

Charlie Mix

This map of Chattanooga, Tennessee's new Parks and Outdoors Plan illustrates a bold vision of "a city within a park" where every resident is within a 10-minute walk of a park or urban nature preserve, connected by a network of greenways and blueways. This vision from Chattanooga's Parks and Outdoors Department aims to bring the rich ecosystems, biodiversity, and world class outdoor recreation of the surrounding mountains to residents of Chattanooga. The design of this maps nods to the renowned landscape architect John Nolan, who one hundred years ago drafted a vision for Chattanooga's park system.

Accelerating Climbing Access in Tennessee

Charlie Mix and Mathew Mollica

This map shows the most complete inventory to date of public and private climbing areas in Tennessee, compiled by the University of Tennessee at Chattanooga GIS lab. This rich geospatial data is being used by the Access Fund to make data driven decisions to secure access for at risk crags preserving both recreation and biodiversity. The climbing areas identified in this project represent some of the best rock climbing and highest biodiversity in the world.

Red Hot and Getting Hotter: Analysis of Post-Pandemic Home Prices in Tennessee

Alex Lennon

Across the nation, single-family home prices have dramatically increased since the COVID-19 pandemic. Utilizing ArcGIS's Pro 3D extrusion methods, we can help visualize that change in single-family home prices across the state. Additionally, this poster displays data provided by Zillow, whereby mapping the average values of single-family homes prices from 2022. To provide a greater detail of the percent change in home prices from 2019 to 2022, these analyses use map insets of Tennessee's four largest metro areas.

Geology of Tennessee

Tracy Homer

This map shows the age of the bedrock across the state of Tennessee. Easily visible are the folds that create the Appalachian mountains, the large expanse of the Central Basin, and the youngest bedrock that borders the Mississippi River in West Tennessee. Data was obtained from the USGS, and processed through QGIS and CStitch to create a cross-stitch pattern that was then hand stitched over several months. Knoxville is marked with an orange french knot stitch. This map is mounted on 1/2 inch foamboard and can not be taped to a wall or display board. It is fairly light so could be attached to a vertical surface with T pins. Will gladly assist in mounting for display.

Hamilton County Flood Zone Changes Data from FEMA

Philip Early

Hamilton County Flood Insurance Rate Map depicts Flood risk changes from previous years. Map shows 100 and 500 Year Flood events as well as floodway changes. I created a web application for the public to use (linked below). This application allows homeowners to look up their address to see if they are in an area where insurance rates will increase. I using GIS I have created a mailing list to the homeowners that will be affected by the new rates (Aprox. 10,000 homeowners).

<https://chattgis.maps.arcgis.com/apps/instant/basic/index.html?appid=0996d998e880466eaf2c4923a91d6974>

Developing a Predictive Habitat Suitability Model for Barking Treefrog (*Hyla gratiosa*) in the Greater Chattanooga, Tennessee Region

Nyssa Hunt

Throughout the state of Tennessee, the Barking Treefrog (*Hyla gratiosa*) has been observed as a habitat specialist with a fragmented population distribution. Past studies have revealed that this species

prefers lowland, open canopy wetlands, which are areas often targeted and developed for anthropogenic purposes. Rapid development continues to occur around urban areas, where isolated populations are especially at risk of decline with habitat destruction and alteration, disease, and invasive species. Citizen science efforts have assisted in documenting sightings of *H. gratiosa* in recent years, allowing conservationists to understand their presence further. As the greater Chattanooga region continues to experience growth and agencies are actively seeking to conserve lands, a greater understanding of the habitats that serve these populations may aid land conservation priorities. The machine learning algorithm MaxEnt was utilized to create a predictive habitat suitability model for this tri-state region, considering observation points from iNaturalist. Model results are aimed to guide conservation efforts and inform regional stakeholders, and further understand species preference and distribution in a region that has variable habitat availability compared to more southern ranges. This model can also be used to ground truth presence and further measure habitat preferences, especially in cases of atypical habitat context.

Jeffery Brown's Legacy

Noah Croy

This story map goes over UTC's Jeffery Brown's Institute of Archaeology history and some of its most significant field work.