

**NC STATE**  
UNIVERSITY

Center for  
**Geospatial** Analytics



**Annual Report**  
2021–2022



3-D virtual tour of the Geovisualization Lab  
Cover image: Topographic lines, by Nikki Inglis

## MESSAGE FROM THE CENTER DIRECTOR



Another exciting year has passed at the Center for Geospatial Analytics! In this annual report, I am pleased to share with you announcements from our leadership team and

highlights of our growing research and academic programs, acknowledge the achievements of our outstanding students, faculty and staff, thank all of our research and education partners and introduce you to some of our Center's newest members.

During Summer 2021, our Center successfully completed its second five-year review, receiving positive feedback from a panel of five external reviewers. With that encouraging news, we then turned to developing our strategic plan for the *next* five years (see pg. 4). I look forward to working with the entire Center community to implement its ambitious and forward-thinking initiatives.

This year, our Center also added a new associate director to its leadership team (pg. 4), launched a virtual tour and scholarship campaign (pg. 5), and released three new software packages (pg. 8). We also welcomed the fourth cohort of Geospatial Analytics Ph.D. students. The proportion of women and underrepresented minority students in our graduate programs also continues to grow (pg. 9).

This edition of the Center's annual report also spotlights our Service Center (pg. 16), which offers a range of resources and expertise to help solve geospatial problems both large and small.

Thank you, as always, for your support.

**Dr. Ross Meentemeyer**  
Director of the Center for Geospatial Analytics  
Goodnight Distinguished Professor of Geospatial Analytics

# Annual Report 2021–2022

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Geospatial Analytics Ph.D. student cohort starting Fall 2021

## About the Center

At the Center for Geospatial Analytics, we push the boundaries of spatial data science to advance discovery and inform real-world decision-making.

Our world-renowned researchers collaborate across disciplines to answer pressing questions about the world and address challenges.

Our signature academic programs train new generations of geospatial data scientists and GIS professionals to tackle emerging issues and leverage new technologies.

Through research, teaching and consulting, our community of experts work closely with industry, government, nonprofit and other community partners to produce data-driven solutions to real problems.

## Connect with Us

**Website:** [geospatial.ncsu.edu](https://geospatial.ncsu.edu)

**Phone:** 919-515-4000

**Social:**



NC State  
Center for Geospatial Analytics



@NCSUgeospatial

# NEWS FROM OUR LEADERSHIP

## New Strategic Plan Launches

As our Center continues to grow and expand its impact through research, academics and engagement, we strive to build a forward-thinking, inclusive future rooted in data justice and service. Our new **2022–2027 Strategic Plan** will guide that vision, following five goals aligned with NC State’s 2021–2030 Strategic Plan and nested within the strategic priorities of the College of Natural Resources’ 2021–2026 Strategic Plan.

The plan was created during late 2021 and early 2022, led by a Strategic Plan Subcommittee of the Center’s Steering Committee (see photo below). The subcommittee drafted goals and initiatives with Steering Committee input, then presented a range of suggested initiatives under each goal to the Center community for their anonymous comments, suggestions and votes. The initiatives with the most support under each goal were included in the final plan, reworded and reorganized in response to community feedback. We thank all of the students, faculty and staff who provided their time and ideas to help shape the Center’s strategic direction over the next five years.

View the entire 2022–2027 Strategic Plan at [geospatial.ncsu.edu/about/strategic-plan](https://geospatial.ncsu.edu/about/strategic-plan).

## Center Welcomes New Associate Director

In November 2021, the Center welcomed a new associate director to its leadership team, **Aaron Hipp, Associate Director of Social and Behavioral Science Applications**. In this new role, Hipp will lead initiatives at the intersection of the social sciences and geospatial analytics, complementing the ongoing work of our other associate directors focused on Earth and environmental sciences, computational sciences and educational innovation.

Adding the new position gave the Center’s Steering Committee an opportunity to also revise the existing associate director titles, to reflect how these positions have changed over time:

Helena Mitsova, previously Assoc. Dir. of Geovisualization, is now the Assoc. Dir. of Earth and Environmental Sciences Applications. Eric Money, previously Assoc. Dir. of Professional Education, is now the Assoc. Dir. of Educational Innovation. Raju Vatsavai, previously Assoc. Dir. of Spatial Computing and Technology, is now the Assoc. Dir. of GeoAI and Computational Science Applications.

Learn more about our leadership team at [geospatial.ncsu.edu/our-people/leadership](https://geospatial.ncsu.edu/our-people/leadership).



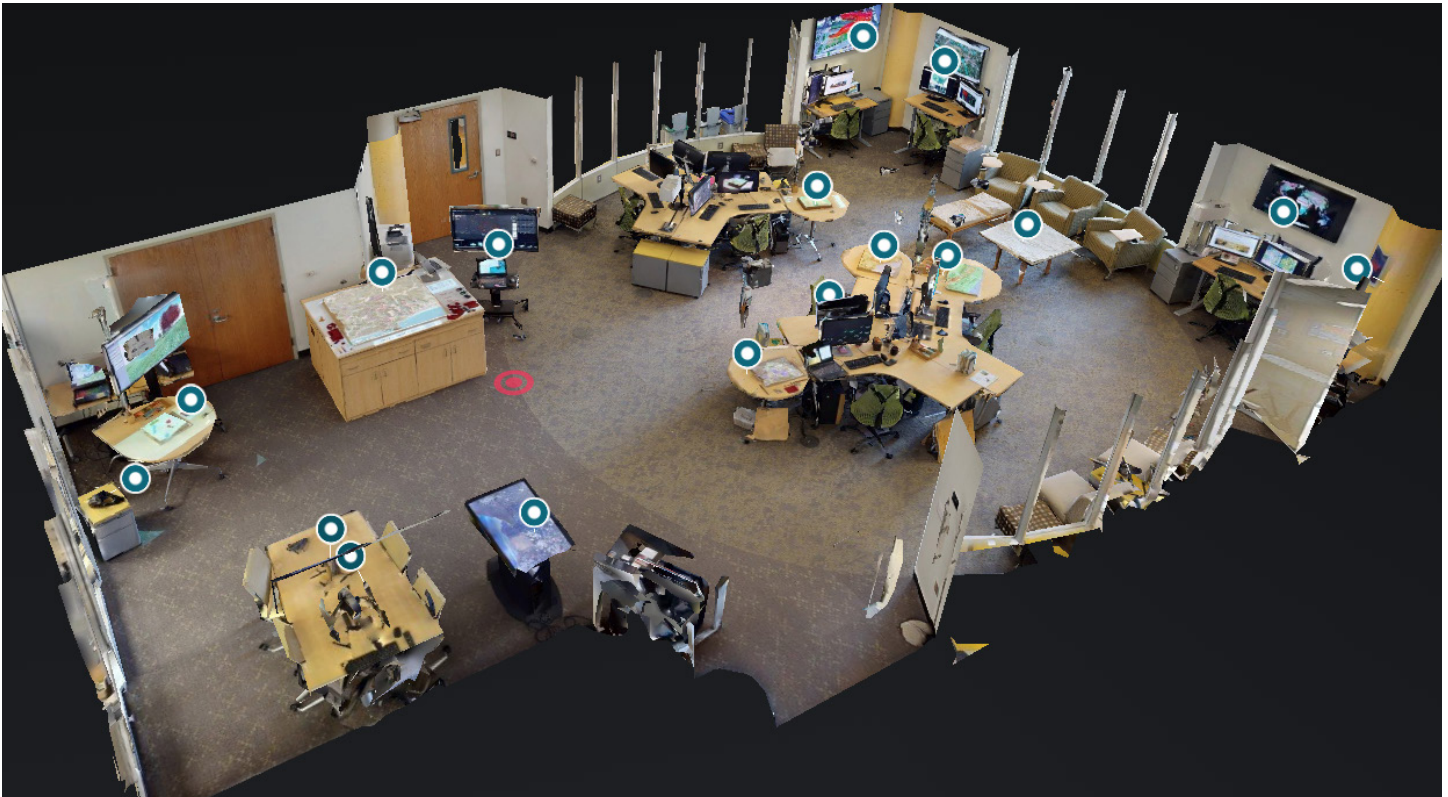
**The Center’s Steering Committee.** Top, left to right: Director Ross Meentemeyer, Associate Director Helena Mitsova, Associate Director Eric Money, Associate Director Raju Vatsavai, Associate Director Aaron Hipp. Bottom, left to right: Assistant Director Zac Arcaro, Faculty Fellow Mirela Tulbure, University Program Associate Rachel Kasten, Research Associate Georgina Sanchez, Science Communicator Megan Skrip.

# Take Our 3-D Virtual Tour

In spring 2022, in partnership with DELTA, NC State's office of Digital Education and Learning Technology Applications, we launched a new three-dimensional virtual experience of our flagship research and innovation space, the Geovisualization Lab. This state-of-the-art lab features cutting-edge tools and technologies, including those that help stakeholders intuitively interact with spatial data, to explore patterns and make decisions.

The virtual tour includes over a dozen points of interest, from drones to Tangible Landscape stations to explorations of simulations used for forecasting urban growth and pest spread.

Explore the Geovisualization Lab yourself anytime by visiting [go.ncsu.edu/geoviz-scan](https://go.ncsu.edu/geoviz-scan).



## Support Our Enhancement Fund

Grants and contracts power research and innovation at our Center, while private support helps us respond quickly to the needs of students and partners, through gifts to the **Center for Geospatial Analytics Enhancement Fund**. On NC State's Day of Giving in March, we launched a new campaign to support scholarships for online and military students in our professional master's program, which has the second-highest military enrollment of any NC State graduate degree. With your gifts, our new scholarship will relieve tuition expenses not covered by the GI Bill or NC State's Yellow Ribbon Program.

Thank you to those who have already shown their support!

Give anytime online at [go.ncsu.edu/CGA-Enhancement-Fund](https://go.ncsu.edu/CGA-Enhancement-Fund).



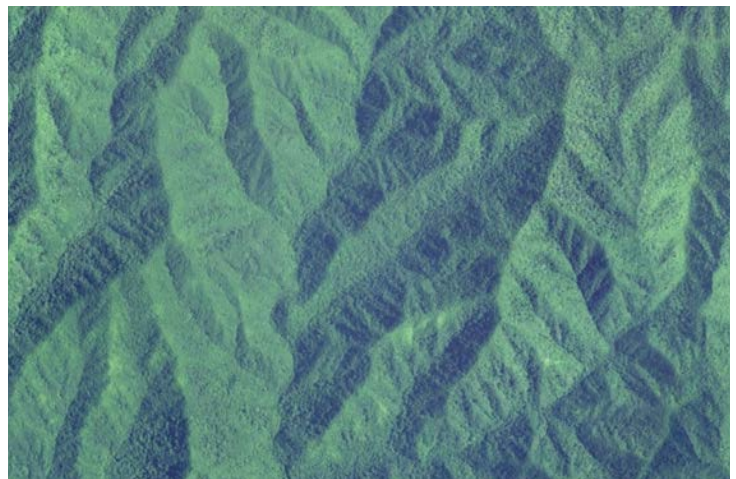
## Study: U.S. Flood Damage Risk Is Underestimated

In February, a team led by Geospatial Analytics Ph.D. candidate Elyssa Collins published their findings that flood maps from the Federal Emergency Management Agency (FEMA) do not capture the full extent of flood risk in the continental United States. Collins used artificial intelligence to predict where flood damage is likely to happen, based on 14 years of flood damage reports from the National Oceanic and Atmospheric Administration. She found that 68.3% of these reports were outside of FEMA's high-risk flood areas and 16.2% were in locations unmapped by FEMA. She also found a high probability of flood damage for more than a million square miles of land, more than 790,000 square miles greater than flood risk zones identified by FEMA's maps. The research was covered by CNN, *The News & Observer*, WUNC Public Radio, WNCT (CBS 9 Greenville, NC), CBS 17 (Raleigh, NC), *Mirage News*, *Futurity*, *OBXToday*, *Law 360* and the Association of Flood Plain Mappers.



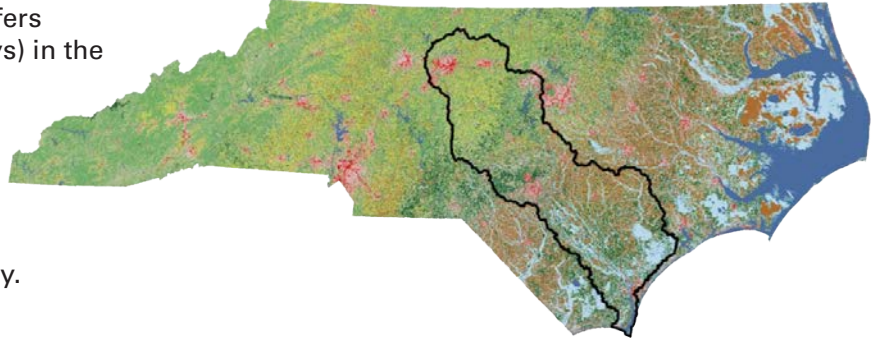
## During Droughts, Thirstier Mountain Forests Could Mean Less Water Downstream

In March, research led by Geospatial Analytics Ph.D. candidate Katie McQuillan was published, finding that higher elevation forests in the Blue Ridge Mountains are often maintaining, and sometimes even increasing, their water use during extreme droughts. These findings suggest that upstream forests' increased water consumption could leave less water downstream for forests, cities and wildlife during drought. Using remote sensing data gathered by satellites between 1984 and 2020, the researchers tracked whether forests used more or less water than normal for each pixel of mapped land (averaged based on elevation) in moderate, severe and extreme droughts. The research was covered by *Verve Times*, *Science Daily*, *Futurity*, and *Nature World News*.



## Identifying Land for Conservation in the Cape Fear Watershed

In April, WHQR Public Media (Wilmington, NC) reported on a project looking at riparian buffers (forest and other vegetation along waterways) in the Cape Fear watershed. Faculty Fellow Katie Martin and her student collaborators are using FUTURES, the Center for Geospatial Analytics' signature land change model, to predict urban growth in the area and identify places where strategic placement of riparian buffers could protect water quality.



## Invasive Insect That Kills Grapes Could Reach California Wine Region by 2027

In June, research led by Research Scholar Chris Jones was published, finding that if nothing is done to control the spread of spotted lanternfly in the United States, the species will likely invade California in nine years or less, placing the state's multi-billion-dollar grape industry at risk. The pest could even arrive in California within five years. The research team used PoPS 2.0 (see pg. 8) to predict where and when the pest is likely to spread. Their study was covered by NBC News, WRAL, Futurity, Yahoo News, The Hill, CNET, Patch.com, *The Sacramento Bee*, Nature World News and *USA Today*.



## Study: People Are Most Physically Active When Their Environments are Both Highly Walkable and Very Green

Also in June, a study co-authored by Associate Director Aaron Hipp was published, finding that where people spend their time matters for physical activity. The research team used wearable sensors and satellite data to identify how the walkability and greenness of a person's environment affects their level of daily exercise. "Walkability" accounts for factors like street intersection density and mix of land uses, while "greenness" is an indicator of the abundance of vegetation in an area. The study was covered by Planetizen, Medical Xpress, and WRAL TechWire.



Learn more about the latest Center research at [geospatial.ncsu.edu/news/category/new-research](https://geospatial.ncsu.edu/news/category/new-research).

# SOFTWARE RELEASES

Our researchers and software engineers develop open source models and software to simulate patterns of landscape and environmental change and help decision-makers explore what may happen in the future under different scenarios. This year, our developers announced several new releases:

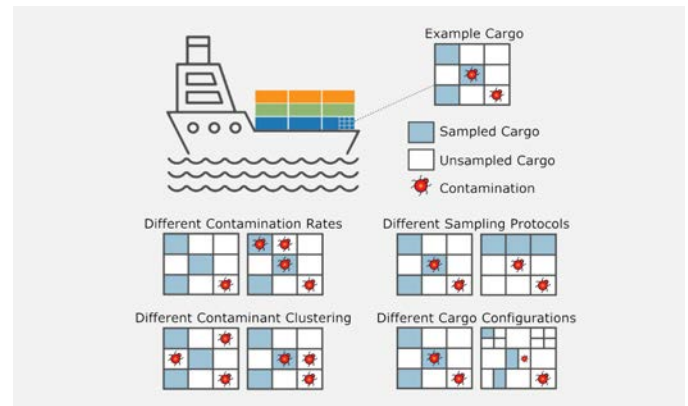
## Pest or Pathogen Spread (PoPS) 2.0

PoPS is our Center’s signature open source system for forecasting the spread of insect pests and disease and testing control strategies, requires no spatial modeling experience to run, and can be used to forecast the spread of practically any species. The newest version, PoPS 2.0, permits simulating spread through networks such as railroads and roads, outputs a new metric indicating how “infective” each pixel is across a landscape, and runs about four times faster than PoPS 1.0.



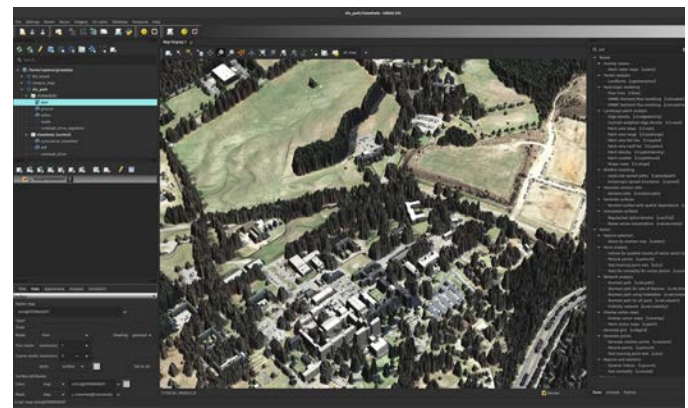
## PoPS Border 1.0

PoPS Border was developed to inform border inspections for insect pests and plant disease at ports of entry, by simulating the outcomes of border inspections—how many pests in a shipment are missed versus detected—depending on user-specified inputs. The simulation can be used to assess hypothetical scenarios of shipment contamination or can be based on records from real ports, using known sampling methods and pest detections to determine the potential for pests to slip through unnoticed.



## GRASS GIS 8.2

The newest version of GRASS GIS, an open source geospatial computation and modeling engine, was released with leadership by Center personnel. GRASS GIS 8.2 features integration with Jupyter Notebooks, a smoother user experience and parallel processing tools, innovations developed during the Google Summer of Code 2021 and now available to all GRASS GIS users.



Learn more about these and other software releases at [geospatial.ncsu.edu/news/tag/software-release](https://geospatial.ncsu.edu/news/tag/software-release).



# THE YEAR IN NUMBERS



**38+**

publications



**11+**

publications with a student first author



**32**

new and continued affiliated grants



**\$3.4+M**

new and continued affiliated funding

## Diversity of Our Graduate Programs

	Female Students (%)			Underrepresented Minority Students (% of Domestic)		
	2019 – 20	2020 – 21	2021 – 22	2019 – 20	2020 – 21	2021 – 22
Doctoral Degree	46	45	49	4	12	16
Professional Master's	34	32	39	14	14	13
Graduate Certificate	49	51	57	9	14	13



**11**

Geospatial Forum speakers



**33**

capstone community partners



**28**

at organizations

# MAKING CONNECTIONS

## Geospatial Forum Series

Due to the ongoing COVID-19 pandemic, the Geospatial Forum was held virtually during the 2021-22 academic year. We welcomed nine speakers from universities across the state and nation as well as two speakers from Esri.

Our Center also hosted a popular Geospatial Studio, at which our community was introduced to Planet Labs, a revolutionary satellite image provider. The Center for Geospatial Analytics has a license to use their data.

Recordings of past Geospatial Forums and Studios are available to watch anytime with closed captioning on the Center's YouTube channel: [www.youtube.com/ncstatecenterforgeospatialanalytics](http://www.youtube.com/ncstatecenterforgeospatialanalytics)



**Dr. Diego Riveros-Iregui** – UNC-Chapel Hill

Carbon Fluxes across Terrestrial and Aquatic Environments in a Tropical Alpine Watershed



**Dr. Catherine D'Ignazio** – MIT

Data Feminism and Mapping



**Dr. Daniela Jones** – NC State

Precision Agriculture to Decarbonize our National Energy Needs



**Dr. Marynia Kolak** – University of Chicago

The Next US Covid Atlas: Reanimating Data Analytics with Stories, Connection and Geographic Thinking



**GIS Week: Dr. Lauren Bennett and Ankita Bakshi** – Esri



Machine Learning Explained: Finding Spatial Clusters



**Dr. Peter Ojiambo** – NC State

Cucurbit Downy Mildew: A Model System for Understanding Long-Distance Spread of Plant Diseases



**Dr. Antonia Sebastian** – UNC-Chapel Hill

Attributing Flood Hazards to Anthropogenic Change: Insights from Hurricane Harvey and Southeast Texas



**Dr. Brian Miller** – USGS & North Central Climate Adaptation Science Center

Facilitating Climate Change Adaptation through Scenario Planning and Simulation Modeling



**Dr. Leila Hashemi Beni** – NC A&T State University

Toward Data-driven Geospatial Methods for Environmental Management



**Dr. Zhe Zhu** – University of Connecticut

Remote Sensing of Land Change: A Multifaceted Perspective



**Austin Stone** – Planet Labs

An Introduction to Planet Labs, Small Satellites and Daily Imagery

## A New GIS Week Tradition

The Geospatial Graduate Student Organization (GGSO) launched a new annual tradition by organizing a series of events for November's GIS Week, including a Spatial Connect Career Fair and UAS workshop. GGSO also organized the W.E.B. Du Bois Visualization Exhibit, a data visualization showcase to celebrate the visualization work of W.E.B. Du Bois and elevate data visualizations centered around racial justice and equity research. The exhibit debuted during GIS Week 2021 as both a physical installation at Hunt Library and an online gallery.



# THANK YOU FOR YOUR SUPPORT!

## MGIST Capstone Service-Learning Partners

Our professional master's degree in Geospatial Information Science and Technology (MGIST) has partnered with dozens of organizations to provide client-focused solutions through capstone projects. Thank you to our 2021-2022 partners!

- > Archeo-Tec
- > Cabarrus County, NC
- > City of New Bern
- > City of Raleigh
- > City of Roxboro
- > Cypress Creek Renewables
- > Davie County Technology Solutions
- > Environmental Defense Fund
- > Esri
- > General Dynamics Information Technology
- > Geographic Technologies Group
- > Globalstratos
- > Greensboro Parks and Recreation
- > Growers
- > Lifting Inspirations, LLC
- > Mosquito Range Heritage Initiative
- > National Geospatial Intelligence Agency
- > NC Center for Geographic Information and Analysis
- > NC Emergency Management
- > NC Office of State Budget and Management
- > NC Pandemic Recovery Office
- > NC State University Dept. of Parks, Recreation and Tourism
- > NC State University Center for Geospatial Analytics
- > Person County, NC
- > The Nature Conservancy
- > Union County Public Works
- > VHB
- > Winston-Salem Forsyth County Utilities

## Service Center Clients

Through our Service Center, government agencies, private companies and other clients gain payment-based access to resources and expertise at the Center for Geospatial Analytics. Thank you to our 2021-2022 clients!

- > Czech University of Life Sciences
- > Lee Moore Capital Company
- > Northern Arizona University

## Day of Giving 2022 Donors

Day of Giving in March 2022 saw the launch of the Center for Geospatial Analytics Enhancement Fund. Thank you to all of our donors!

- > Zachary Arcaro
- > Sarah Barr
- > John C.
- > Sarah Corica
- > Hipp Family
- > Albert D. Lee
- > Lois Jean Utt
- > Walden-Schreiner Family

“The Center for Geospatial Analytics had an enormous impact on who I am today.”

**John. C.,** MGIST '13  
2022 Day of Giving donor

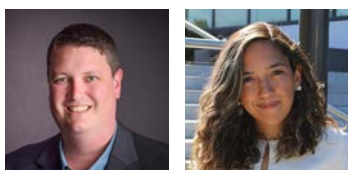
# NEW FACES AT THE CENTER

## Faculty Fellows

The Faculty Fellows program at the Center for Geospatial Analytics is a touchstone of excellence for faculty pushing the frontiers of geospatial data science. The program unites interdisciplinary collaborators who jointly develop innovative grant proposals and find new ways to address grand challenges with spatial thinking.

This academic year, we welcomed two new fellows:

- > Justin Baker, Forestry and Environmental Resources
- > Ashly Cabas, Civil, Construction and Env. Engineering

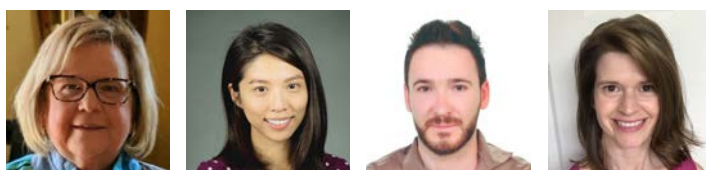


## Staff, Postdoctoral Scholars and Researchers

Our dedicated staff keep the Center for Geospatial Analytics running smoothly, and our postdoctoral scholars and researchers bring invaluable experience to scholarly projects at the Center, developing new approaches to complex problems.

Welcome to our newest personnel:

- > Lois Utt, Executive Assistant
- > Jing-Huei Huang, Postdoctoral Scholar
- > Adem Kurtipek, Research Associate
- > Shannon Jones, Frontend Research Software Engineer

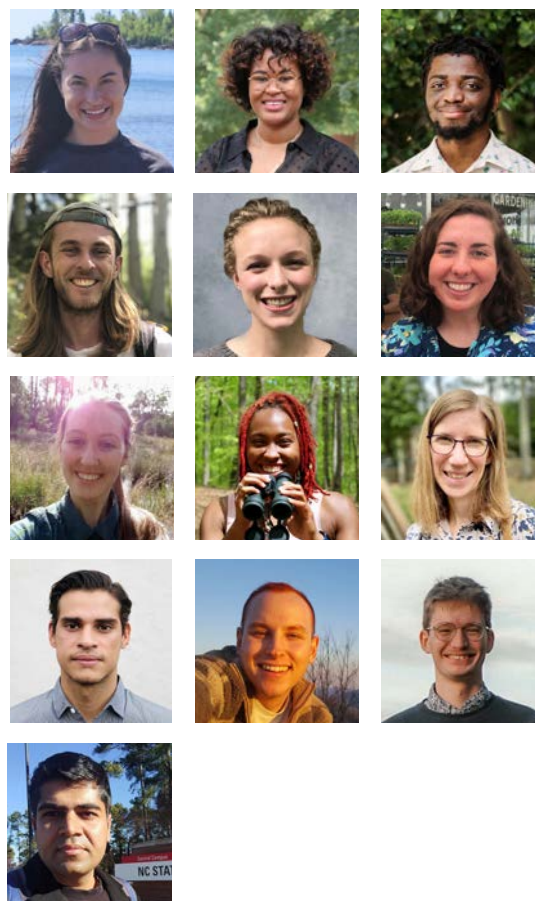


## Geospatial Analytics Ph.D. Students

The Geospatial Analytics Ph.D. is an on-campus, experiential degree program that brings together departments from across the university to train a new generation of interdisciplinary data scientists.

This year, we welcomed our fourth student cohort:

- > Jenna Abrahamson
- > Randi Butler
- > Christopher Dunstan
- > Louis Goodall
- > Margaret Lawrimore
- > Shannon McAvoy
- > Annie Paulukonis
- > Deja Perkins
- > Stacie Reckling
- > Felipe Sanchez
- > Andrew Shannon
- > Owen Smith
- > Varun Tiwari



# OUR GRADUATES

## Professional Master's of Geospatial Information Science and Technology

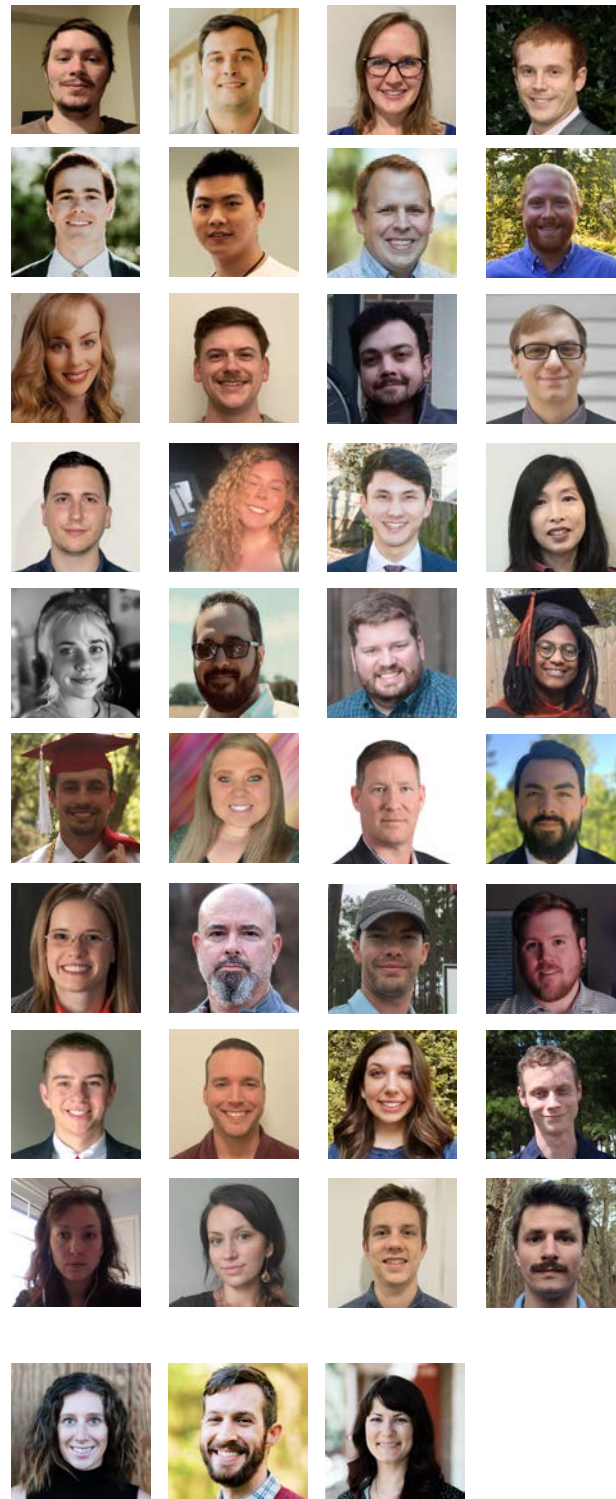
Congratulations to our newest MGIST alumni!

### Fall 2021

- > Jacob Daunais
- > Sam Davis
- > Judy Dorner
- > Peter Erlenbach
- > Sean Farrell
- > Zekun Lin (Summer '21)
- > William Meyers
- > Matthew Moy
- > Jaimie Nevins
- > Hank Pelfrey
- > Marcus Perry
- > Wyatt Pesta
- > Jared Poe
- > Alexandra Scott
- > Michael Spear
- > Samantha Tan
- > Aidan Thurling
- > Coty Welch
- > Caleb Williams
- > Chantel Williams
- > Dylan Wingler
- > Brittany Yoder

### Spring 2022

- > Eric Adams
- > Cody Garcia
- > Amy Gelletich
- > Bill Herzig
- > Russell Hill
- > Scott Hill
- > Trey Hinton
- > Aaron Jones
- > Katie Kolcusky
- > Chad Leftwich
- > Rachel Porter
- > Elizabeth Rutkowski Gonzalez
- > Ben Van Wagener
- > Brian Van Wyk



## Geospatial Analytics Ph.D.

Congratulations to our newest doctoral alumni!

- > Nikki Inglis
- > Nick Kruskamp
- > Kellyn Montgomery

# CELEBRATING OUR COMMUNITY

## Annual CGA Awards

On March 31 at the JC Raulston Arboretum, the Center for Geospatial Analytics celebrated its third Awards Ceremony, honoring 2021 achievements by our exceptional students, faculty and staff. These awards, established in 2019, honor members of the Center community whose efforts exemplify Center ideals of collaboration, inclusion and excellence in research, teaching and service. Students and faculty/staff were nominated by other Center members for the awards, and winners were selected by the Awards Committee.

### Advocate Award

- > Student: Alex Yoshizumi
- > Staff: Eric Money

### Beacon Award

- > Student: Elyssa Collins
- > Staff: Georgina Sanchez
- > Alum: Chelsey Walden-Schreiner

### Collaboration & Innovation Award

- > Team: MUTATED, led by Josh Gray, with Laura Wendelberger, Jenna Abrahamson and Owen Smith

### Creativity in Teaching Award

- > Student: Caitlin Haedrich
- > Faculty: Perver Baran

### Interdisciplinary Advancement Award

- > Awardee: Laura Wendelberger

### Gladys West Award

- > Student: Bill Herzig
- > Staff: Zac Arcaro

Learn more about each award and awardee at [go.ncsu.edu/CGA-awards-2022](https://go.ncsu.edu/CGA-awards-2022)



## Esri Innovation Program Student of the Year

As a member of the Esri Innovation Program, the Center for Geospatial Analytics can select one student each year to be NC State's EIP Student of the Year. The honoree receives a cash prize, a certificate of award and a free Esri Press book. Their name is engraved on a plaque at the Center and entered in the worldwide EIP Student of the Year competition.

NC State's 2022 EIP Student of the Year was Rachel Porter, a Fall 2021 MGIST graduate. For her capstone service-learning project, she developed a groundbreaking new way for Winston-Salem / Forsyth County Utilities to explore and analyze their water infrastructure, and ultimately minimize losses from pipe breaks and leaks.

Porter used historical information about past pipe failures and water usage, and performed analyses to predict future water main breaks and identify hotspots of water consumption demand, to ultimately determine how to "get the most value out of the least number" of new water pressure sensors in the utility network. Her work—"3RIV: A Three Pronged GIS Centric Framework for Responding to Water Infrastructure Failure"—involved a sophisticated combination of custom modeling and geoprocessing, enhanced visualizations, and interactive, easy-to-use web based tools, developed from the ground up, to support the local government and their decision-making processes.

# MGIST Poster Competition

Each semester, our graduating MGIST students create a stunning array of digital posters summarizing their service-learning capstone projects for the MGIST Digital Symposium and Professional Showcase. Congratulations to this year's poster competition winners:

## Fall 2021

> Aidan Thurling

## Spring 2022

> Katie Kolcuský

# Diversity, Equity and Inclusion

We are pleased to recognize Center faculty and staff who participated in NC State training this year to promote a welcoming and inclusive environment:

- > University Program Specialist Rachel Kasten participated in the GLBT Advocate program; she is also Chair of the Center's DEI Committee.
- > Associate Director of Educational Innovation Eric Money completed Project Safe Zone training and continues to participate in Green Zone training to support military students.
- > Science Communicator Megan Skrip graduated from the Inclusive Excellence Certificate Program.

# SERVICE CENTER SPOTLIGHT

Through our Service Center, government agencies, private companies and other clients gain payment-based access to resources and expertise at the Center for Geospatial Analytics. We welcome both campus and external partners to use our Service Center, to solve problems both large and small.

## For example, we...



> build 2-D and 3-D web mapping applications with cutting-edge technology



> create custom geospatial databases to house tabular and spatial data



> offer flexible and robust spatial data hosting for web mapping applications



> provide various remote sensing services, including land use classification



> create high-quality maps (both physical and electronic), tailored to meet client specifications and cartographic standards

## We can also help you...



> perform your big-data analyses faster through batch automation



> process your geospatial imagery, including scanning and georeferencing hard copy imagery



> install and run your own tangible user interface for geospatial analysis



> launch your drone research with mission planning, imagery processing and analytics



> build the skill set of your own team through personalized training

To learn more and get started, visit [geospatial.ncsu.edu/engage/service-center](https://geospatial.ncsu.edu/engage/service-center).



# Publications (Not an exhaustive list)

Agostini Ferrante, D., **Vukomanovic, J.**, & **Smart, L.S.** (2021). Uncovering trends and spatial biases of research in a U.S. National Park. *Sustainability*, *13*, 11961. <https://doi.org/10.3390/su132111961>

Barnhart, T.B., **Vukomanovic, J.**, Bourgeron, P., & Molotch, N.P. (2021). Future land cover and climate may drive decreases in snow wind-scour and transpiration, increasing streamflow at a Colorado, USA headwater catchment. *Hydrological Processes*, *35*(11), e14416. <https://doi.org/10.1002/hyp.14416>

Bergeson, C.B., **Martin, K.L.**, Doll, B., & **Cutts, B.B.** (2022). Soil infiltration rates are underestimated by models in an urban watershed in central North Carolina, USA. *Journal of Environmental Management*, *313*, 115004. <https://doi.org/10.1016/j.jenvman.2022.115004>

Bruni, E.T., Ott, R.F., Picotti, V., Haghipour, N., **Wegmann, K.W.**, & Gallen, S.F. (2021). Stochastic alluvial fan and terrace formation triggered by a high-magnitude Holocene landslide in the Klados Gorge, Crete. *Earth Surface Dynamics*, *9*, 771-793. <https://doi.org/10.5194/esurf-9-771-2021>

Caijiao, D., **Leung, Y.**, Tejedo, P., Barbosa, A., Reck, G., & Benayas, J. (2022). Behavioural responses of two penguin species to human presence at Barrientos Island, a popular tourist site in the Antarctic Peninsula region. *Antarctic Science*, 1-13. <https://doi.org/10.1017/S0954102021000559>

**Coffer, M.M.**, Schaeffer, B.A., Foreman, K., Porteous, A., Loftin, K.A., Stumpf, R.P., Wedell, P.J., Urquhart, E., Albert, R.J., & Darling, J.A. (2021). Assessing cyanobacterial frequency and abundance at surface waters near drinking water intakes across the United States. *Water Research*, *201*, 117377. <https://doi.org/10.1016/j.watres.2021.117377>

**Coffer, M.M.**, Whitman, P.J., Schaeffer, B.A., Hill, V., Zimmerman, R.C., Salls, W.B., Lebrasse, M.C., & Graybill, D.D. (2022). Vertical artifacts in high-resolution WorldView-2 and WorldView-3 satellite imagery of aquatic systems. *International Journal of Remote Sensing*, *43*(4). <https://doi.org/10.1080/01431161.2022.2030069>

**Collins, E.**, **Sanchez, G.M.**, **Terando, A.**, Stillwell, C.C., **Mitasova, H.**, Sebastian, A., & **Meentemeyer, R.K.** (2022). Predicting flood damage probability across the conterminous United States. *Environmental Research Letters*, *17*, 034006. <https://doi.org/10.1088/1748-9326/ac4f0f>

**Gaines, M.D.**, **Tulbure, M.G.**, & **Perin, V.** (2022). Effects of climate and anthropogenic drivers on surface water area in the Southeastern United States. *Water Resources Research*, *58*(3), e2021WR031484. <https://doi.org/10.1029/2021WR031484>.

Gaydos, D.A., **Jones, C.M.**, **Jones, S.K.**, **Millar, G.C.**, **Petras, V.**, **Petrasova, A.**, **Mitasova, H.**, & **Meentemeyer, R.K.** (2021). Evaluating online and tangible interfaces for engaging stakeholders in forecasting and control of biological invasions. *Ecological Applications*, e02446. <https://doi.org/10.1002/eap.2446>

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# Student Presentations

(Not an exhaustive list)

## American Ornithological Society; virtual, Aug. 2021

**Perkins, D.J.**, Cooper, C.B., Katti, M. Bias in birdwatchers: Does neighborhood incomes affect estimates of bird richness?

## MEAS-FER-CGA Research Symposium; Raleigh, NC, Sep. 2021

**Allen, L.** Contextualizing observations of snowstorms using aircraft-mounted radar

**Dunstan, C.** Spatiotemporal models of the evolution of dance trends

**Saffer, A.**, Tateosian, L.G., Walden-Schreiner, C. Pest tracking with GDELT, Google News, and Twitter

**Vivek Nanda, V.M.** Realistic modeling of trees using aerial LiDAR and deep learning

## Coastal & Estuarine Research Federation Biennial Conference; virtual, Nov. 2021

**Ricci, S.W.**, Bohnenstiehl, D.R. Assessment of visitation trends at North Carolina artificial reefs using high-resolution satellite imagery.

## International Fire Ecology and Management Congress; virtual, Nov.–Dec. 2021

**Jones, K.**, Loudermilk, L., Robbins, Z., Vukomanovic, J., Scheller, R. Forecasting prescribed fire smoke in Southern Appalachian communities

## American Geophysical Union (AGU) Annual Meeting; New Orleans, LA, Dec. 2021

**Allen, L.**, Miller, M.A., Yuter, S.E., **Tomkins, L.** Analysis of 1 Hz, high precision pressure sensor data to identify gravity waves

**Das, R.**, Wegmann, K.W. Machine learning-based landslide detection using different satellite sensors: A case study in Chimanimani District, Zimbabwe

**Gao, X.**, **McGregor, I.**, Gray J. Satellite observations underestimate the effect of growing season length on global vegetation productivity

**Gaines, M.**, **Talbure, M.G.**, **Perin, V.** Projecting surface water in the Southeastern U.S. under three climate and development scenarios

Gray, J., **Gao, X.** Observing long-term annual land surface phenology at medium spatial resolution

**Hinks, I.**, Gray, J. Monitoring crop development in smallholder farms using remotely sensed time series data augmentation

**McGregor, I.**, Gray, J. We can't have it both ways: Accepting the trade-off of detection time and accuracy in multi-source, near real-time deforestation monitoring

**Perin, V.**, **Talbure, M.G.**, **Gaines, M.**, Reba, M.K., Yaeger, M.A. A multi-sensory satellite imagery approach to monitor on-farm reservoirs

Terando, A.J., Sanchez, G., Petrasova, A., **Collins, E.**, Vogler, J., Vukomanovic, J., Mitsova, H., Meentemeyer, R.K. Forecasting land change in response to sea-level rise and frequent flooding

**Tomkins, L.**, Yuter, S.E., Miller, M.A., Peters, M., **Allen, L.**, Aponte-Torres, A. Image muting of mixed precipitation to improve identification of regions of heavy snow from radar data

Talbure, M.G., Brioch, M., **Gaines, M.**, Stehman, S.V., Pavelsky, T., **Perin, V.** Towards global flood mapping with machine learning based on the harmonized Landsat-Sentinel 2 data

Vinod, N., Slot, M., **McGregor, I.**, et al. Thermal sensitivity across forest vertical profiles: Patterns, mechanisms, and ecological implications

## CNR Graduate Research Symposium; Raleigh, NC, March 2022

**Haedrich, C.** Integrating GRASS GIS and Jupyter Notebooks to facilitate advanced geospatial modeling education

**Ifediora, B.** Identifying activity patterns by volunteer organizations active in disaster using space-time permutation scan statistics

**McGregor, I.** Beyond the binary - improving near-real time deforestation monitoring by understanding trade-offs between latency and accuracy

**Tiwari, V.** Evaluation of spectral reconstruction technique for mineral and snow grain size mapping; **1st place poster in Sustainable Materials, Technologies, and Economics**

## NC State Graduate Research Symposium; Raleigh, NC, April 2022

**Collins, E.**, Sanchez, G.M., Terando, A., Meentemeyer, R.K. Modeling future flood probabilities using a scenario-based approach

**Dunstan, C.** Modeling the spatiotemporal evolution of dance trends and styles

**Gao, X.**, Gray, J.M. Does chilling explain the divergent response of spring phenology to urban heat islands?

**Perin, V.** Fresh water stored by on-farm reservoirs (OFRs) is an important component of surface hydrology and is critical for meeting global irrigation needs

# Awards and Honors

(Not an exhaustive list)

## Students

**Jenna Abrahamson** was on the team that won the Center's Collaboration & Innovation Award.

**Randi Butler** won first place in the Homegrown category of the PackPics infographics and research showcase competition hosted by the NC State Graduate School

**Elyssa Collins** accepted a summer internship with the NASA Jet Propulsion Laboratory in Pasadena, California, working with the Water & Ecosystems lab on the project "Open Science for Hydrology." She also won the Center's Beacon Award.

**Christopher Dunstan** was accepted to the Data4Justice Accelerator program and received a Witherspoon Graduate Fellowship for Summer 2022.

**Peter Erlenbach** was profiled by DELTA News and was chosen to represent the Center for Geospatial Analytics as student speaker at the December 2021 graduation ceremony.

**Caitlin Haedrich** won the Center's Creativity in Teaching Award.

**Bill Herzig** won the Center's Gladys West Award.

**Kimia Karimi** won first place at the 2022 American Water Resources Association (AWRA) Geospatial Water Technology Conference Paper Competition.

**Joe Kepler** was selected for a Defense and Intelligence student intern position for the 2002 Summer Conference on Applied Data Science (SCADS), hosted by the Laboratory for Analytic Sciences at NC State.

**Katie Kolcuskusky** won the Center's MGIST capstone poster competition in Spring 2022.

**Deja Perkins** was honored by North Carolina Governor Roy Cooper as a Black STEM leader. She also won the National Wildlife Federation's 2022 National Conservation Achievement Award in the category of Young Leader, was featured in NC State Alumni Magazine, and received a Witherspoon Graduate Fellowship for Summer 2022.

**Rachel Porter** was named NC State's 2022 Esri Innovation Program Student of the Year.

**Owen Smith** was on the team that won the Center's Collaboration & Innovation Award.

**Aidan Thurling** won the Center's MGIST capstone poster competition in Fall 2021.

**Varun Tiwari** won the poster competition in the "Sustainable materials, technologies, and economics" category (for Ph.D. students) at the CNR Graduate Research Symposium with his poster "Evaluation of Spectral Reconstruction Technique for Mineral and Snow Grain Size Mapping."

**Laura Wendelberger** won the Center's Interdisciplinary Advancement Award and was on the team that won the Center's Collaboration & Innovation Award.

**Alex Yoshizumi** received an Energy Data Analytics Ph.D. Fellowship and won the Center's Advocate Award.

## Faculty and Staff

Assistant Director **Zac Arcaro** won the Center's Gladys West Award.

Faculty Fellow **Perver Baran** won the Center's Creativity in Teaching Award.

Faculty Fellow **Josh Gray** led the team that won the Center's Collaboration & Innovation Award. He was also promoted to Associate Professor with tenure.

Research Associate **Justyna Jeziorska** was named a finalist of the Women and Drones 2021 Women to Watch in UAS Global Awards

Associate Director **Eric Money** won the Center's Advocate Award.

Faculty Fellow **Jennifer Richmond-Bryant** was appointed to the World Health Organization's (WHO) Global Air Pollution and Health (GAPH) Technical Advisory Group (TAG).

Research Associate **Georgina Sanchez** and Research Scholar **Chelsey Walden-Shreiner** each won the Center's Beacon Award.

Science Communicator **Megan Skrip** won Second Place in the Institutional Division of the SCONC (Science Communicators of North Carolina) Science Communication Contest.

Faculty Fellow **Adam Terando** was named Federal Coordinating Lead of the Earth System Processes Chapter of the Fifth National Climate Assessment.

Assistant Teaching Professor **Vaishnavi Thakar** received a DELTA Course Design Grant for GIS 550: Geospatial Data Structures and Web Services.

Research Scholar **Chelsey Walden-Shreiner** won the Center's Beacon Award.

# New Grants (Not an exhaustive list)

PIs: Rada Chirkova, **Ranga Vatsavai**

IARPA Space-Based Machine Automated Recognition Technique (SMART)

Applied Research Associates, Inc. (ARA) (Prime–Intelligence Advanced Research Projects Activity (IARPA))

\$240,745 (5-10-2021 to 12-21-2023)

PIs: Erin Seekamp, **William Slocumb**

Supporting the Development of an Archeology Climate Adaptation Prioritization Framework

US National Park Service

\$98,585 (6-1-2021 to 9-30-2024)

PIs: **James A. Hipp**, Kyle Bunds

Mapping Playspace Inequity in Three Locally-focused Colorado Communities

KABOOM! (Prime–The Colorado Health Foundation)

\$70,050 (7-1-2021 to 12-31-2022)

PIs: **Christopher Jones, Ross K. Meentemeyer**

Develop Algorithms for Determining Optimal Pest Management Solutions

US Dept. of Agriculture – Animal and Plant Health Inspection Service (USDA APHIS)

\$131,989 (8-1-2021 to 7-31-2022)

PIs: **Ross K. Meentemeyer, Christopher Jones**

Developing Integrated Geospatial Architectures to Support Enterprise Deployment of Geographic Information Systems Products at USDA

US Dept. of Agriculture – Agricultural Research Service (USDA ARS)

\$200,000 (8-1-2021 to 7-31-2022)

PI: **Natalie Nelson**

CAREER: Characterizing the Unseen Water Quality Consequences of Sunny-Day Floods in Nearshore Waters  
National Science Foundation (NSF)

\$419,752 (8-1-2021 to 7-31-2026)

PI: **Robert Scheller**

Forecasting Prescribed Fire Smoke within Vulnerable Communities in Southern Appalachia

Bureau of Land Management

\$25,000 (8-3-2021 to 6-30-2023)

PI: **Mirela Tulbure**

Towards Global Flooding Dynamics in Near Real-time: A Multi-sensor Fusion Approach Based on Public Domain Time-series of Optical and Radar Data

National Aeronautics & Space Administration (NASA)

\$230,180 (8-15-2021 to 8-14-2024)

PI: **Katherine Martin**

Investigating Whether Forest Management Can Improve Water Supply Resilience to Drought and Ensure Adequate Baseflow for Aquatic Species in the Southern Blue Ridge

The Nature Conservancy

\$72,494 (8-16-2021 to 8-15-2023)

PI: **Joshua Gray**

Does Chilling Explain the Divergent Response of Spring Phenology to Urban Heat Islands?

National Aeronautics & Space Administration (NASA)

\$45,000 (9-1-2021 to 8-31-2024)

PI: **Joshua Gray**

Long-Term Changes and Variability in Global Ecosystem Phenology From MODIS

Boston University (Prime–National Aeronautics & Space Administration (NASA))

\$42,385 (9-1-2021 to 8-31-2024)

PIs: **Christopher Jones, Ross K. Meentemeyer**, Yu Takeuchi

Testing Inspection Strategies for the Cut Flower Release Program using PoPS Border Simulation

US Dept. of Agriculture – Animal and Plant Health Inspection Service (USDA APHIS)

\$41,000 (9-1-2021 to 8-31-2022)

PI: **Mirela Tulbure**

Quantifying On-Farm Reservoirs Impacts on Surface Hydrology Using a Multi-Sensor Approach

National Aeronautics & Space Administration (NASA)

\$45,000 (9-1-2021 to 8-31-2023)

PI: **Jelena Vukomanovic**

Communicating Prescribed Fire Management through Virtual Public Engagement Strategies Post-COVID

US National Park Service

\$70,000 (9-1-2021 to 8-15-2023)

PI: **Natalie Nelson**

Coupling Lake, Watershed, and Estuarine Models to Better Understand the Role of Engineered Freshwater Discharges in Driving the Severity, Location, and Timing of Harmful Algal Blooms  
University of Florida (Prime–Engineer Research and Development Center (ERDC))

\$234,609 (9-29-2021 to 8-28-2023)

PIs: **Ross K. Meentemeyer, Chris Jones, Chelsey Walden-Schreiner**

DSFAS: Leveraging Multi-scale, Multi-purpose Open Big Data and Machine Learning to Improve Forecasts of and Decision Support for Emerging Pest Threats

US Dept. of Agriculture (USDA) – National Institute of Food and Agriculture

\$649,977 (1-15-2022 to 1-14-2027)

# MGIST Capstones

PI: **Bethany Cutts**

Justwater: Policy Leadership And Environmental Justice  
During Disaster Recovery  
NCSU Sea Grant Program  
\$59,999 (2-1-2022 to 1-31-2023)

PIs: Elizabeth Savage, Erin Seekamp, Whitney Knollenberg,  
Kangjae Lee, **Stacy Supak**

Promoting Sustainable State Park Management in North  
Carolina through the Identification of Equitable Pricing  
Strategies  
NC Department of Natural and Cultural Resources  
\$285,388 (2-2-2022 to 1-31-2023)

PIs: **Natalie Nelson**, Angela Harris, **Christopher Osburn**

Towards Real-Time Fecal Indicator Bacteria Monitoring in  
Coastal Waters  
US Army – Corps of Engineers  
\$290,783 (3-4-2022 to 3-4-2025)

PI: **Christopher Osburn**

Determine the Causes of and Potential Solutions to the Algal  
Blooms in the Chowan River and Albemarle Sound  
Albemarle Resource Conservation and Development Council  
Inc. (Prime–NC Department of Justice (NCDOJ))  
\$41,000 (4-1-2022 to 12-31-2024)

PI: **Jelena Vukomanovic**

Interdisciplinary Energy Data Analytics Ph.D. Fellows Program  
Phase II: Training the Next Generation of Energy Data Scholars  
Duke University (Prime–Alfred P. Sloan Foundation)  
\$12,756 (5-1-2022 to 8-31-2022)

## Fall 2021

**Jacob Daunais**

Data Standardization and Database Management for  
Endangered Plant Species in the Mosquito Range Mountains  
in Colorado  
Mosquito Range Heritage Initiative

**Sam Davis**

Assessing the Social Impacts of Flooding in the Mississippi  
River Basin  
Environmental Defense Fund

**Judy Dorner**

Simplifying User Access to Parcel Tax Queries in Person  
County, NC  
Person County, NC

**Peter Erlenbach**

NC Pandemic Recovery Office COVID-19 Loan Analysis  
NC Pandemic Recovery Office

**Sean Farrell**

Trauma Vulnerability and Wellness Program Implementation in  
Mecklenburg County, NC, Neighborhoods  
Lifting Inspirations, LLC

**Matthew Moy**

Quantifying the Urban Tree Canopy within Greensboro's  
Regional Parks  
Greensboro Parks and Recreation

**Jaimie Nevins**

Exploring ArcGIS Field Maps as a Tool for Archeological  
Survey Data Collection  
Archeo-Tec

**Hank Pelfrey**

Quantifying Demographic Trends in NC's Digital Divide  
NC Center for Geographic Information and Analysis

**Marcus Perry**

Updating Davie County, NC, Land Cover Classification Data  
Davie County Technology Solutions

**Wyatt Pesta**

Urbanization Probability and Agricultural Land Change in North  
Carolina by 2100  
NC State University Center for Geospatial Analytics, Urban  
Systems Group

**Jared Poe**

Assessing Accessibility of Parks and Recreation Facilities  
Using Network Analysis  
Cabarrus County, NC

**Rachel Porter**

3RIV: A Three-Pronged, GIS Centric Framework for Responding  
to Water Infrastructure Failure  
Winston-Salem Forsyth County Utilities

**Alexandra Scott**

Developing a Web Solution to Expose Artificial Intelligence/  
Machine Learning Capabilities for GIS  
Esri

**Michael Spear**

Constructing a Roadway Intersection Spatial Data Inventory  
for North Carolina  
VHB

**Samantha Tan**

Identifying Over- and Under-count of NC Housing Units in  
Census 2020  
NC Office of State Budget and Management

**Aidan Thurling**

Determining Thermal Event Risk Factors at Solar Energy  
Operations Sites  
Cypress Creek Renewables

**Coty Welch**

Burn Analysis Using Imagery: ArcGIS Image for ArcGIS Online  
and Image Server  
Esri

**Caleb Williams**

Predicting Flow After Rainfall Events in Union County  
Union County Public Works

**Chantel Williams**

Visualizing Change in Greenness Between 2010 and 2020 with  
NDVI in Louisville, KY  
NC State Dept of Parks, Recreation and Tourism

**Dylan Wingler**

City of New Bern: Utility Network Analysis  
City of New Bern

**Brittany Yoder**

Cabarrus County Narcan Deployment  
Cabarrus County, NC

**Spring 2022****Eric W. Adams**

Automated Mobility Analysis  
General Dynamics Information Technology

**Cody Garcia**

An Open-Source Geospatial Infrastructure to Support  
Regenerative Development in Africa  
Globalstratos

**Amy Gelletich**

Wildfire Trends in Russia  
National Geospatial Intelligence Agency

**Bill Herzig**

NC Building Footprint Database Modernization  
NC Emergency Management

**Russell Hill**

Suitable Riparian Buffer Development in the Mississippi  
River Basin  
Environmental Defense Fund

**Scott Hill**

Precision Agriculture Performance & Sustainability Tool  
Growers

**Trey Hinton**

Fire Incident Analysis to Locate High-Risk Areas  
Geographic Technologies Group

**Aaron Jones**

Esri Support to Education  
Esri

**Katie Kolcusky**

Identifying Ideal Locations for Greenways and Trails in  
Roxboro, NC  
City of Roxboro

**Chad Leftwich**

State Parks — Pricing Structures and Equity Statistics  
NC State University Center for Geospatial Analytics & Dept. of  
Parks, Recreation, Tourism Management

**Elizabeth Rutkowski Gonzalez**

Clean Energy and Socioeconomics in the United States  
The Nature Conservancy

**Ben Van Wagener**

Covid-19 Business Loan and Census Data Analysis  
NC Pandemic Recovery Office

**Brian Van Wyk**

Temperature Modeling and Heat Island Extraction in Raleigh, NC  
City of Raleigh

**NC STATE**  
UNIVERSITY

Center for  
**Geospatial** Analytics