January 2025

2024 GIS Annual Report

Oct. 1, 2023 - Sept. 30, 2024 Report

Randy Fulweber and Rachel de Sobrino

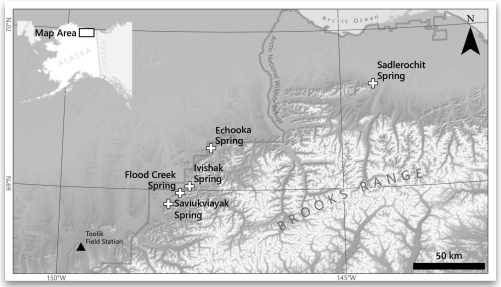
Overview

- Staffing
- Past Interns/Techs
- NACIS Annual Meeting
- Requests Fulfilled
- Project Support Highlights

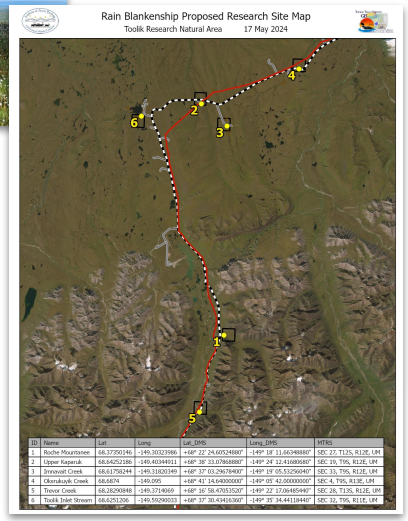
Jorge and Adam fly the ToolikGIS drone for Dr. Rocha at his Anaktuvuk Burn site.

GPS survey of thermokarst perimeter.

Mobile GPS kit deployed at Imnavait to support GPS surveys.



Black and white publication map.



Site selection map for Tundra Awardee Rain Blankenship.

Staffing

- We hired **Rachel de Sobrino** as our new GIS & Remote Sensing Analyst in April 2024.
  - B.S. in Geography from the University of Minnesota.
  - Strong background in cartography and optical remote sensing.
  - Ran the GIS office in McMurdo Station, Antarctica while at the Polar Geospatial Center.
  - Post-baccalaureate with drone and GNSS surveying fieldwork at Western Washington U.
- We expect Jorge Noguera to return as our summer senior GIS technician. Summer 2025 will be Jorge's 17th field season.
- We expect Adam Chavez, a junior undergraduate from the University of Alaska Southeast, to return for his 2nd season as our summer intern.

Rachel using her head to pack out a solar panel from our mobile GPS base station kit.

Past Interns/Techs: Where Are They Now?

- Reyce Bogardus (2017-2019)
  - PhD Student, UAF
- Olivia Cronin-Golomb (2021, 2023)
  - PhD student, MIT-WHOI
- Lyndee Weaver (2022)
  - Senior GIS Analyst, ICF
- Mary Stack (2023)
  - Currently applying to PhD programs.
  - Anyone interested in bringing another superstar into their team?
  - Interested in GIS applications in climate, snow, hydrology research.

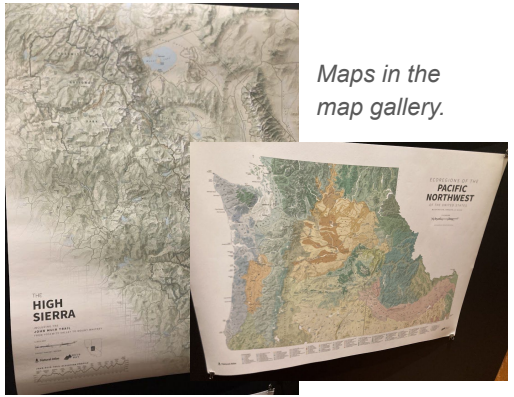
Lyndee Weaver ready to fly.

Mary (L) and Olivia (R) collecting bathymetry data on Toolik Lake.

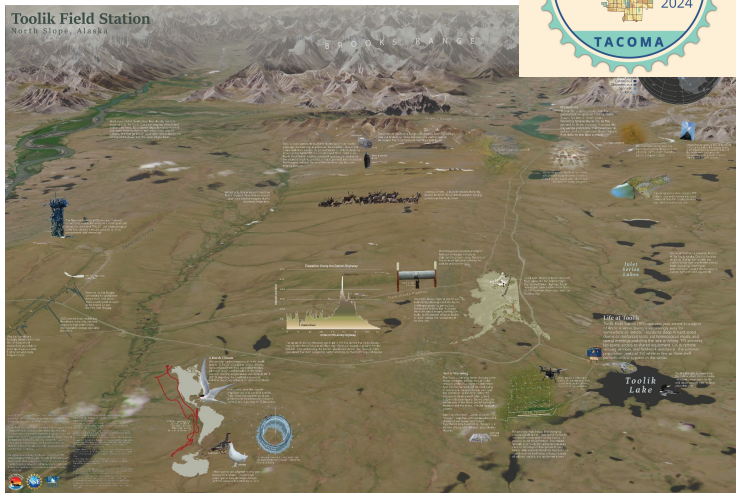
Reyce Bogardus reviewing our drone flight plan.

NACIS Annual Meeting

- Rachel attended the North American Cartographic Information Society's annual meeting in Tacoma, WA, Oct. 16-18, 2024.
- Meeting was jam-packed with 29 practical cartography talks and two days of sessions on tools, analyses, and creativity.
- Met with GIS and remote sensing professionals, developers, newsroom journalists, map librarians, and more.
- Highlights from attended sessions include:
    - Best practices in map design for accessibility (especially important for our journal figure requests!)
    - Tools in web mapping and new software releases
    - Plenty of beautiful parks and trails maps to serve as inspiration for an updated Toolik hiking map
- Conference attendance fully funded through external travel grants pursued by and awarded to Rachel.



Maps in the map gallery.



Rachel's poster at NACIS. A copy can be bid on during the ASM Silent Auction!

Requests Fulfilled

- 2020: 115 Requests from 23 Projects
- 2021: 88 Requests from 50 Projects
- 2022: 110 Requests from 39 Projects
- 2023: 79 Requests from 36 Projects
- 2024: 70 Requests from 34 Projects

ToolikGIS collecting drone imagery for Dr. Nic Jelinski near Galbraith Lake.

Project Support Highlights

Project Support Snapshot

- Provided support to 34 research groups (PIs + students) and 1 helo coordinator.
  - Site selection & permitting support for 17 projects.
  - UAS flights and processing for 16 projects.
  - RTK / GPS surveys for 8 projects.
  - Publication support (custom maps) for 2 projects.

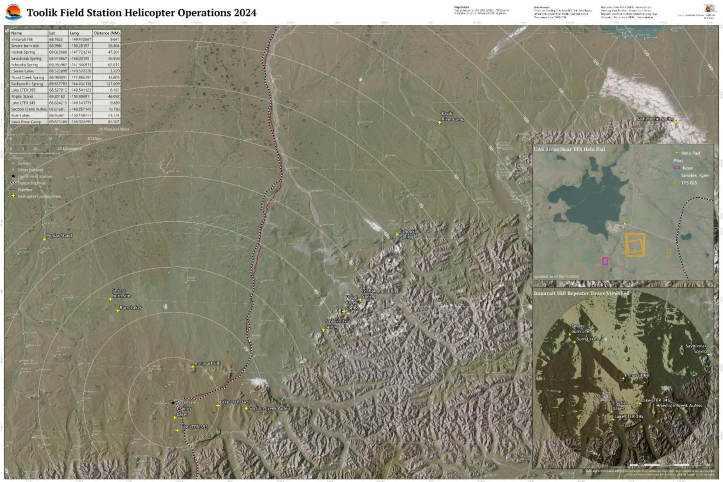
Rachel setting up our mobile GPS base station.

Adam conducting bathymetric survey of Lake GTH89.

Jorge getting creative by using his safety vest to provide a high-contrast surface to help calibrate our drone camera.

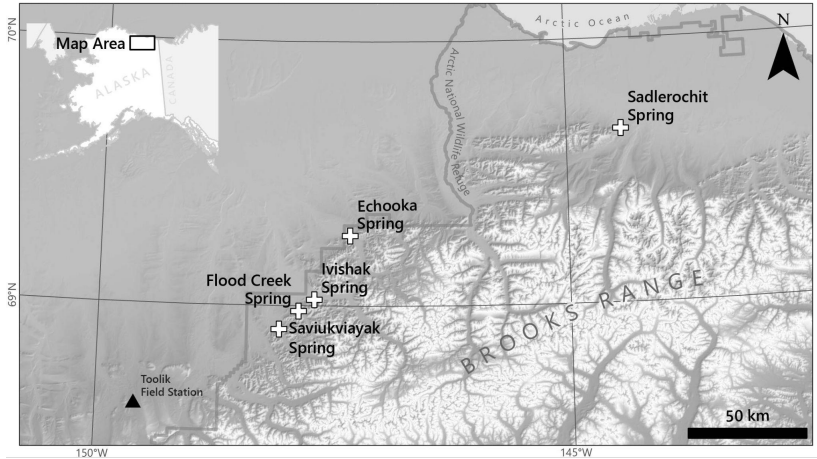
Project Support: Helicopter Coordinator Map

- Updated map with 2024 helicopter (helo) landing sites, table of distances to each site, areas of high drone activity, and a viewshed map to show generalized areas where researchers in the field could expect radio communications to reach the repeater tower.
- ToolikGIS facilitated meetings and communicated SOPs to helo coordinator, helo pilots, and drone pilots
- 7 projects (incl. ToolikGIS) and 1 field trip operated their own drones at different times this past season. Most ever. No issues.

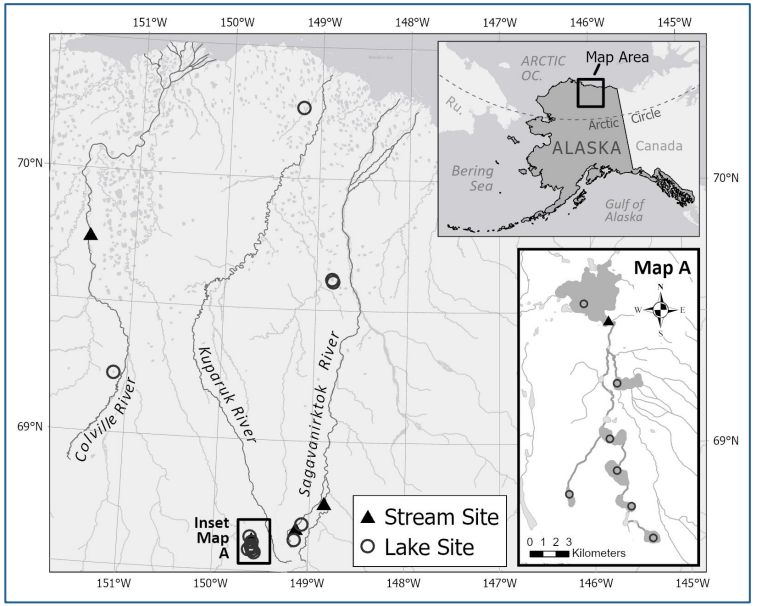


Project Support: Publication Maps

- Adam Hensley: updated publication-ready map for field sites
- Nathan LaFramboise. M.S. Thesis. PI: Dr. Rose Cory. "Controls on the photochemical production of hydrogen peroxide in arctic surface waters". https://dx.doi.org/10.7302/22760.



Map of sampling sites for Freeze or Famine: The Ecology of Arctic Springs *project (PI: A. Huryn).*



Map for Nathan LaFramboise showing the location of select sample sites near TFS and across the North Slope.

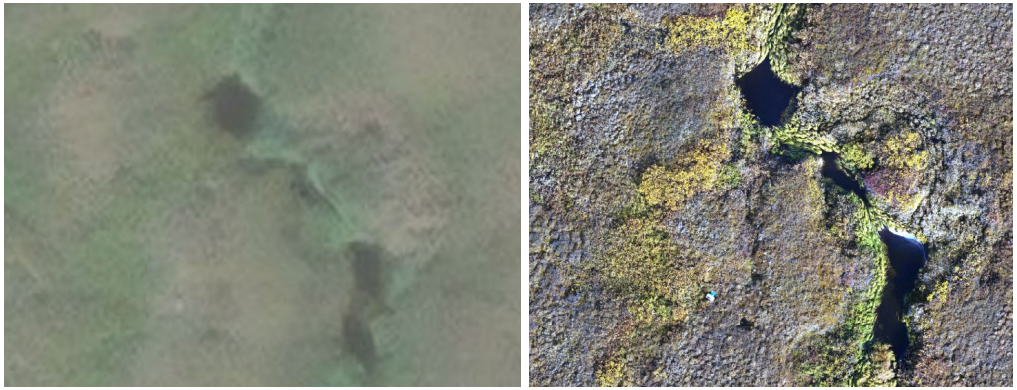
Project Support: Insubria Vegetation Map

- ToolikGIS flew the Insubria research site with our drone and three different sensors during three different time periods during the summer 2024 field season.
    - Two of the sensors (a thermal and a near infrared camera) were on loan from Insubria and were 'plug-n-play' compatible with our drone.
- Insubria team requested a large imagery mosaic map printed out for use in the field so they could delineate vegetation communities on the map by hand.
- Rachel used the ToolikGIS plotter to print 6 large sheets, each 24x36", to create a giant mosaic map.

Close-up of drone imagery and full-scale map.

Project Support: Kazem Bakian-Dogaheh

- Kazem Bakian-Dogaheh, PhD student, USC.
- Project title: “High Resolution Mapping of Surface Soil Freeze Thaw Status and Active Layer Thickness for Improving the Understanding of Permafrost Dynamics and Vulnerability”.
- ToolikGIS completed 5 drone flights of Kazem’s 5 research sites in 1 day at Imnavait.



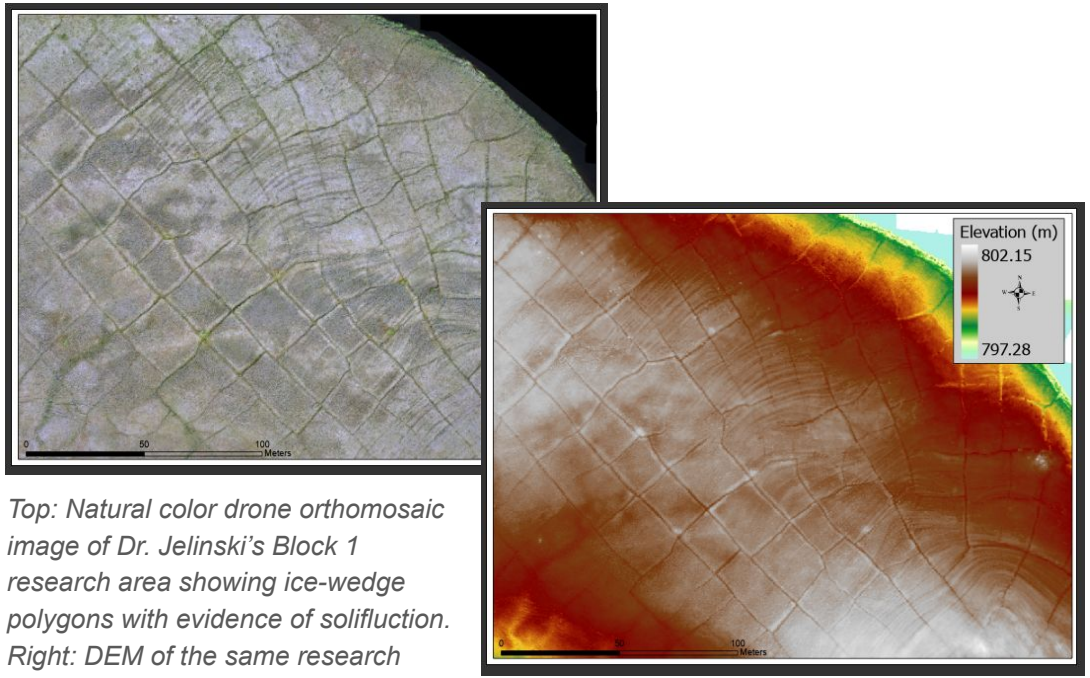
(L): Publicly-available satellite image of Kazem’s research area Block 5.
(R): Natural color orthomosaic image of the same research area from the ToolikGIS drone.

(Shameless share): “And to be honest, nothing comes close in the quality of the product compared to what you guys do.”- KB

Project Support: Dr. Nic Jelinski

- Dr. Nic Jelinski, Associate Professor, University of Minnesota.
- Project title: Ice Wedge Polygon Carbon Stocks.
- ToolikGIS flew four sites in the Galbraith Lake area.

Dr. Jelinski's research area near Galbraith Lake.

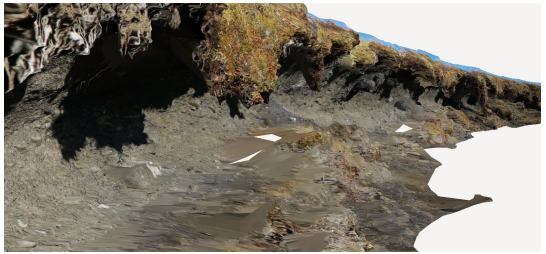


Top: Natural color drone orthomosaic image of Dr. Jelinski's Block 1 research area showing ice-wedge polygons with evidence of solifluction. Right: DEM of the same research area.

Project Support: Dr. Cansu Culha

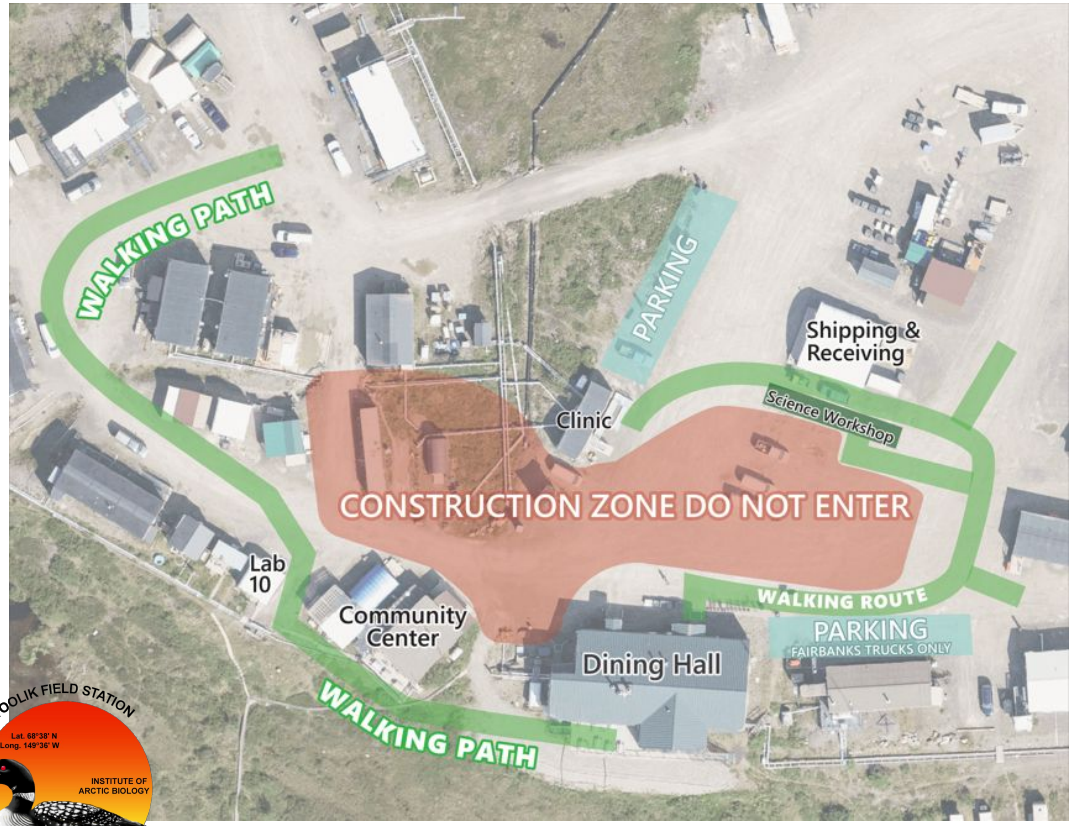
- Dr. Cansu Culha, Post-Doc, UBC.
- Project title: “Zero-order to first-order: Hydrologic drivers of surface-subsurface storage dynamics in thawing permafrost landscapes”.
- ToolikGIS completed 5 top-down drone flights of Cansu’s 5 research sites.
- Cansu was also interested in extreme close-up images of thermokarst headwalls.
  - ToolikGIS experimented with holding our drone to take close-up images. Software was unable to properly mosaic the photos.
  - Cansu used her iPhone’s LiDAR camera to produce better results.

(Top): Rachel, Jorge (holding the camera),and Randy taking close-up, experimental hand-held drone photos of Galbraith thermokarst headwall.



Results from Cansu’s iPhone LiDAR camera

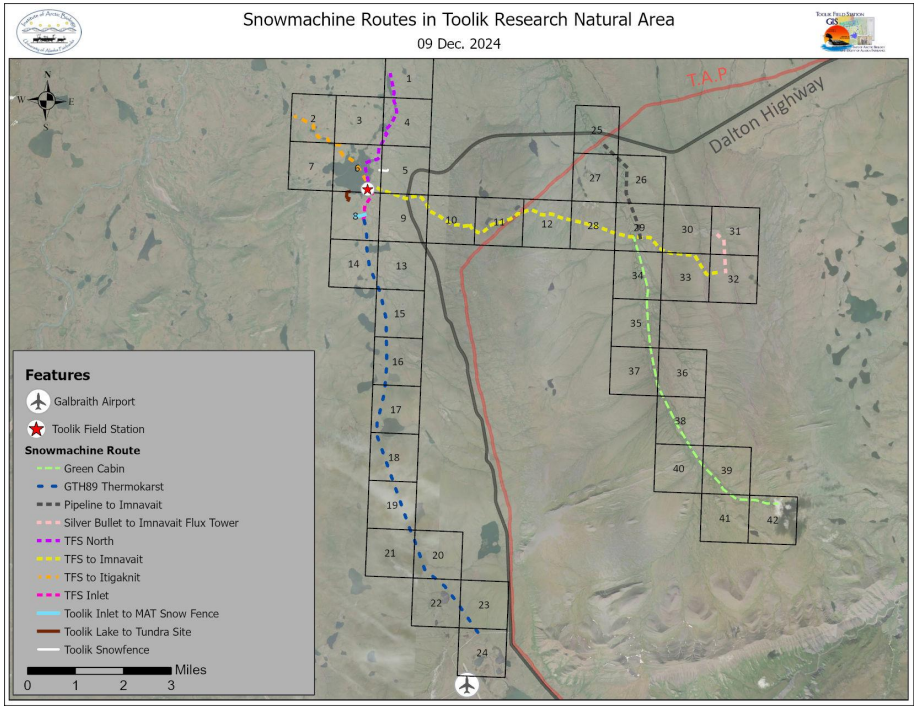
Map of Safe Walking Paths During Waste Tank Replacement



- Toolik Management requested a map that identified safe walking paths for Toolik residents to use that avoided the construction area during the Waste Tank Replacement project.
- With PFS, Toolik Safety Officer, and Toolik Camp Manager input, Rachel created the map shown.
- The map was shared during orientations and on Dining Hall wall and TVs.

Snowmachine Route Authorization Map

- Toolik Management is concluding work with the BLM on a ‘common-use’ snowmachine route Right-of-Way authorization.
- Once approved, any Toolik-based project or contractor will be able to use these common-use routes (assuming snow-depth requirements are met) without applying (and paying!) for their own snowmachine permit.
- This will be a significant time and cost savings to Toolik projects.
- Special thanks to BLM Realty Specialists Matt and Melissa for all their help and guidance with this effort!



TOOLIK FIELD STATION
Lat. 68°38' N
Long. 149°36' W
INSTITUTE OF ARCTIC BIOLOGY
UNIVERSITY OF ALASKA FAIRBANKS

Questions for the Steering Committee

- Proposed new charges for for drone services:
  - Charge users for Toolik GIS' time spent collecting and processing drone imagery.
  - Suggest that the first 40 hours are free for each project (the same as remote access).
  - Funds would be used to pay for replacement drones in the future and to potentially rent sensors in the short term.
- We will need to replace our DJI (Chinese) drones before Dec. 2025 to meet new federal regulations in the American Security Drone Act.
- What sensors would best support the Toolik research community?

*Drone-mounted **methane** sensor. Data available real-time and post-collection.*

*Drone-mounted **GPR** kit. Model shown can penetrate 12m below ground surface.*

***Thermal** and **RGB** sensors integrated into small drone platform.*

*Handheld **LiDAR** sensor also mounts onto some drone platforms!*