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Personal Profile

My Ph.D. research is focused on developing [PINGMapper](#), an open-source software for processing big datasets from recreation-grade sonar instruments and generating substrate maps with deep neural network segmentation models. I have experience coding (6 yrs), GIS analysis (12 yrs), and hydrographic data processing and mapping (8 yrs). I am interested in continuing to develop expertise in coding, software and tool development, big-data wrangling and analysis, machine and deep learning, and hydrologic data modeling and analysis.

Education

2019-Pres. Ph.D. in Ecological Informatics - [Northern Arizona University](#) - 4.0 GPA

Anticipated Graduation: Spring 2024

Relevant Courses: Large-scale Data Structures, [High Performance Computing](#), Software Development Methodologies, Modern Regression I/II, Multivariate Statistics, Data Mining, Team-based Research, and Machine Learning, and Survey in Ecological Tools.

2015 Graduate Certificate, GIS - [North Carolina State University](#)

Relevant Courses: Surface Water Hydrology with GIS, Introduction to Remote Sensing, Advanced Geospatial Analytics, and Introduction to Geographic Information Science.

2006-2011 Bachelor of Landscape Architecture and Environmental Planning - [Utah State University](#)

Relevant Courses: Calculus I

Relevant Employment

Aug 2019 - Present [Northern Arizona University | Flagstaff, AZ](#)

Graduate Research Assistant | 0.5 FTE

- Develop open-source software ([PINGMapper](#)) and reproducible workflows for processing big datasets from recreation-grade sonar instruments.
- Train and evaluate deep learning models for substrate segmentation and classification from sonar imagery.
- Identify suitable spawning reaches for the threatened Gulf Sturgeon in the Pearl and Pascagoula systems in Mississippi, USA.
- Author peer-reviewed manuscripts and present at national and regional conferences.
- Coordinate field campaigns with research partners.
- Provide bug patches and enhanced functionality based on end-users input.

Technologies: Python, C/C++, R, GitHub, Humminbird side-imaging systems, ArcGIS, QGIS, High Performance Computing, Linux.

Apr 2022 [Northern Arizona University | Flagstaff, AZ](#)

Multibeam Technician | 1.0 FTE

- Operated multibeam sonar system on the Colorado River (Grand Canyon) for USGS [channel mapping study](#).

Technologies: Qinsy, Qimera, Reson SeaBat 7125.

Sep 2014 - [FWC Fish and Wildlife Research Institute | Tallahassee, FL](#)

May 2019 *Biological Scientist II | 1.0 FTE*

- Interpret fine-scale side-scan sonar imagery and classify river substrates.
- Plan and conduct riverine field campaigns involving operation of recreation-grade side-scan sonar, GPS, motorized/non-motorized vessels, and trailering.
- Design and maintain ArcGIS REST Services and maps for distribution of [river substrate data](#).
- Develop Python scripts for batch processing, data management, and computations.
- Serve as agency point of contact for riverine side-scan sonar inquiries and requests.
- Prepare technical documents and present research at agency, regional, and national meetings.
- Formulate FWC boating policy as Watercraft Safety Advisory Board (WSAB) advisor.

Technologies: ArcGIS, Humminbird side-imaging systems, Python.

Jan 2014 - [FWC Fish and Wildlife Research Institute | Tallahassee, FL](#)

Sep 2014 *Research Associate | 1.0 FTE*

- Provide technical assistance on [Cooperative Land Cover](#) project.
- Develop custom Python workflows for batch processing and management of big datasets.
- Utilize ArcGIS 10.x to classify medium resolution imagery to edit and update landcover datasets.
- Enforce vector topology and domains for quality assurance.

Technologies: ArcGIS, Python.

Feb 2013 - [Czech University of Life Sciences | Prague, Czech Republic](#)

Dec 2013 *Teaching Assistant | 0.25 FTE*

- Courses: Geographic Information Systems I & II (Graduate Level).
- Co-develop course lectures with instructor for ESL students.
- Lead skill-based lab for students with varying technical experience.
- Respond to student questions and provide one-on-one tutoring.

Technologies: ArcGIS.

Publications

Bodine, C. S., Buscombe, D., Best, R. J., Redner, J. A., & Kaeser, A. J. (2022). PING-Mapper: Open-source software for automated benthic imaging and mapping using recreation-grade sonar. *Earth and Space Science*, 9, e2022EA002469. <https://doi.org/10.1029/2022EA002469>.

Buscombe, D., Goldstein, E. B., Sherwood, C. R., **Bodine, C.**, Brown, J. A., Favela, J., et al. (2022). Human-in-the-loop segmentation of Earth surface imagery. *Earth and Space Science*, 9, e2021EA002085. <https://doi.org/10.1029/2021EA002085>.

Bodine, C. S., Buscombe, D., Hocking, T. D. (in preparation). Efficient and reproducible substrate mapping with recreation-grade side scan sonar systems. Intended for *Remote Sensing of the Environment*.

Bodine, C. S. & Buscombe, D. (in preparation). Automated landscape-level substrate mapping: Case study in locating suitable Gulf Sturgeon spawning substrates in Pearl and Pascagoula watersheds, Mississippi. Intended for *Transactions of the American Fisheries Society*.

Presentations at Conferences, Workshops, and Seminars

**indicates presenter*

Bodine, C.* (2015, November 2) Landscape-level in-stream habitat mapping: "Side Scan Sonar" [Poster Session]. Southeastern Association of Fish and Wildlife Agencies, Asheville, NC, United States.

Bodine, C.* (2017, August 21-24) Findings from Landscape Level in-Stream Habitat Mapping Using Side Scan

Sonar in Florida [Conference Session]. American Fisheries Society Annual Meeting, Tampa, FL, United States.

Bodine, C.* (2019, September 9-12) Leveraging low-cost side scan sonar to map in-stream habitat features in Florida rivers at a landscape scale [Poster Session]. 15th Biennial Conference of Science and Management for the Colorado Plateau and Southwest Region, Flagstaff, AZ, United States. https://in.nau.edu/wp-content/uploads/sites/94/2022/09/16th-Biennial-Conference-Abstract-Book_FINAL.pdf

Bodine, C.S.* (2020, February 25-27) Gulf Sturgeon Spawning Habitat Project: Side Scan Sonar & Automated Classification [Workshop Session]. Gulf Sturgeon Annual Workshop, Gainesville, FL, United States.

Bodine, C.S.* (2022, September 20-22) Open-source tools for mapping with recreation-grade sonar [Workshop Session]. High Resolution Rivers Workshop, Columbia, MO, United States. <https://sites.google.com/view/high-resriversworkshop>

Bodine, C.S.* (2022, December 7-8) Open-source tools for mapping with recreation-grade sonar: Case study on Gulf Sturgeon Spawning in the Pearl and Pascagoula River Systems [Workshop Session]. Gulf Sturgeon Annual Workshop, Panama City Beach, FL, United States.

Bodine, C.S.* (2022, May 25) PING-Mapper: An open-source framework to transform recreation-grade sonar systems into scientific mapping instruments [Virtual Seminar]. U.S. Department of the Interior Open Source Geospatial Software Subcommittee Seminar Series.

Bodine, C.S.*, Buscombe, D. (2023, May 16-18) PING-Mapper: An open-source framework to transform recreation-grade sonar systems into scientific mapping instruments [Poster Session]. Community Surface Dynamics Modeling System 2023 Annual Meeting, Boulder, CO, United States. https://csdms.colorado.edu/wiki/2023_CSDMS_meeting-115

Bodine, C.S.*, Buscombe, D., Kaeser, A. (2023, August 20-24) PING-Mapper: Reproducible Substrate Mapping with Recreation-grade Sonar Systems [Conference Session]. American Fisheries Society Annual Meeting, Grand Rapids, MI, United States.

Redner, J.A.*, **Bodine, C.S.**, Buscombe, D., Kaeser, A. (2023, October 4) PING-Mapper: Reproducible Substrate Mapping with Recreation-grade Sonar Systems [Conference Session]. Organization of Fish and Wildlife Information Managers, Fort Collins, CO, United States.

Software

Bodine, C. S. & Buscombe, D. (2023).

Models

Bodine, C. S. & Buscombe, D. (2023). Sidescan Sonar Substrate, Depth, and Shadow Models for PINGMapper v2.0.0 (v1.0.2). Zenodo. <https://doi.org/10.5281/zenodo.10093642>.

Datasets

Bodine, C. S. (2023). Sidescan Sonar Substrate, Depth, and Shadow Image-Label-Pairs (v1.0.0). Zenodo. <https://doi.org/10.5281/zenodo.10119320>.

Bodine, C. S. (in preparation). Substrate maps for Pearl and Pascagoula watersheds, Mississippi.

Relevant Skills & Training

- **Programming Languages**

Python - Tensorflow, Keras, NumPy, Scikit-image, Pandas, GDAL, ArcPy.
C, C++.
R - dplyr, ggplot, lidR, geoknife, dataRetrieval.

- **Miscellaneous**

OS - Windows, Linux, MacOS.

CLI - Powershell, Linux command line.

Source Version Control - GitHub, git.

Package & Environment Management - Conda, pip.

High Performace Computing - Slurm, Bash, OpenMPI.

GIS - ArcGIS, QGIS, ERDAS IMAGINE.

Reverse Engineering - [Humminbird binary files](#)

Multibeam Sonar Training - [MBCourse](#) | New Orleans, LA | 2020.

References

Available upon request.