

Armita Davarpanah, Ph.D.

Assistant Professor

Department of Environmental and Health Sciences

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EDUCATION

Ph.D., Geosciences (GIScience), Georgia State University	2014
M.S., Geology (Geochemistry), Georgia State University	2009
B.S., Applied Chemistry, Azad University, Tehran, Iran	2000

PROFESSIONAL APPOINTMENTS

Assistant Professor, Spelman College, Atlanta, GA 2020–Present

- Teach undergraduate courses in environmental science, geoscience, sustainability, and environmental health
- Mentor and advise students in research and career development; conduct interdisciplinary research in environmental justice, public health, and environmental hazards
- Develop innovative curricula integrating sustainability science, GIS, artificial intelligence (AI), ontology modeling, knowledge graphs, and data-driven approaches.
- Advance AI applications in Earth and environmental sciences, including critical minerals, flood and wildfire hazards, and environmental contamination analysis, while promoting interdisciplinary STEM education and environmental health literacy.

Research Fellow / Visiting Scientist, National Geospatial-Intelligence Agency (NGA) 2025

- Selected ORISE Faculty Research Fellow supported by the U.S. Department of Defense (DoD), Oak Ridge Institute for Science and Education (ORISE), Oak Ridge Associated Universities (ORAU), and the U.S. Department of Energy (DOE).
- Developed ontology-based knowledge graph and GraphRAG frameworks for geospatial data integration and flood-risk infrastructure analysis
- Contributed to multidisciplinary projects in geospatial interoperability, BioDDEx, and maritime navigation safety; and collaborated with NGA scientists and academic partners on AI-enabled geospatial analytics and decision-support systems.
- Completed specialized NGA training, including Intelligence Oversight (IO) certification. This appointment reflects national-level recognition and expertise in semantic technologies, artificial intelligence, geospatial analytics, and interdisciplinary federal research collaboration.

Lecturer, Georgia State University, Atlanta, GA 2019–2020

- Taught undergraduate and graduate geoscience courses; mentored students in the Sustainability Fellowship Program
- Supervised undergraduate and graduate research
- Conducted research on karst aquifer systems using GIS, geostatistics, and hydrogeological analysis; investigated Food-Energy-Water (FEW) systems using ontology-based modeling
- Developed curriculum in Sustainable Development and laboratory instruction; and served on departmental and college committees. This role strengthened the integration of geoscience education, sustainability, spatial analysis, and interdisciplinary research while preparing for tenure-track faculty responsibilities.

Adjunct Faculty, Multiple Institutions

2013–2019

- Taught undergraduate and graduate courses in geology, environmental science, GIS, sustainability, climatology, and mineralogy at Georgia State University, Spelman College, Emory University, Georgia Perimeter College, and Morehouse College TRIO Programs.
- Mentored undergraduate students in Earth and environmental science research, applied GIS and spatial analysis to environmental and geologic systems
- Developed ontology-based conceptual models in Earth and environmental sciences. This experience strengthened student-centered and inclusive teaching practices while deepening commitment to expanding access and success for underrepresented students in STEM.

Graduate Teaching Assistant, Georgia State University

2006–2014

- Thought laboratory and field components in Geosciences while conducting research in tectonics, structural geology, GIS, and quantitative spatial analysis.

TEACHING AREA AND INSTRUCTIONAL SCOPE

Interdisciplinary training in structural geology, geochemistry, GIScience, environmental science, and artificial intelligence (AI) enables me to teach a broad range of undergraduate Earth and environmental science courses at both introductory and advanced levels.

Earth Science Courses

- Introduction to Geosciences
- Geographic Information Science (GIS)
- Air and Atmospheric Science
- Geology I, II
- Introduction to Landforms
- Crystal and Optical Mineralogy
- Water Resources and Management

Environment Science Courses

- Introduction to Environmental Science
- Sustainable Development
- Industrial Ecology
- Sustainable Energy
- Environmental Biology
- Environmental Health
- Global Environmental Change
- Env Sci-Capstone Experience
- Research in Environmental Science

TEACHING PHILOSOPHY AND EFFECTIVENESS

Student-centered educator integrating GIS, Python, ontology-based modeling, and knowledge graphs into Earth and environmental science instruction to promote interdisciplinary problem-solving and data-driven learning. Committed to collaborative teaching, curriculum innovation, continuous instructional improvement, and student success.

COURSE AND CURRICULUM DEVELOPMENT

- Developed and implemented the interdisciplinary course *Energy Sustainability*, integrating sustainability science, climate resilience, and geospatial analysis.
- Redesigned and expanded *Global Environmental Change* course to incorporate climate datasets, GIS-based analysis, and sustainability-focused curriculum.
- Developed the summer research course *Research Inquiries in Health Science: Sustainability and the Beauty Industry*, integrating environmental science, sustainability, artificial intelligence (AI), geospatial analysis, and data-driven research approaches.

PEDAGOGICAL INNOVATION:

Redesigned and enhanced core and elective courses in Environmental Science major to integrate GIS, environmental datasets, artificial intelligence (AI), Python, ontology-based knowledge systems, and knowledge graphs.

Examples of instructional innovation:

- Developed an introductory GIS-based hazard modeling lab using FEMA’s HAZUS-MH platform, integrated into existing coursework, where students simulate hurricane and flood scenarios using digital elevation (DEM) data to analyze storm surge and flood risk.
- Introduced a Python-based epidemic modeling activity (SIR model) to examine COVID-19 dynamics and public health response.
- Engaged students in the UrbanHeatATL community science project, integrating climate science, geospatial analysis, and environmental justice to investigate urban heat island patterns in Atlanta.
- Integrated National Uranium Resource Evaluation (NURE) datasets into coursework to support student analysis of critical mineral resources in Georgia.
- Applied ontology-based frameworks (e.g., Climate System Ontology, Critical Minerals Ontology) and knowledge graph approaches to support structured learning and advanced data interpretation.

TEACHING, MENTORSHIP, AND EXPERIENTIAL LEARNING

- **First-Year Experience (FYE)** 2020-2024
Taught and mentored first-year students through interdisciplinary learning, academic advising, leadership development, reflective writing, and community engagement activities designed to support student transition and academic success.
- **WiSTEM Program Summer Bridge Program** 2026
Developed and facilitated the *Environmental Data Science & AI for Real-World Problems* module for incoming STEM majors, integrating sustainability, geospatial analysis, environmental data science, and artificial intelligence through hands-on interdisciplinary learning activities.
- **Co-Director, Gordon-Zeto Center Global Education / IES Abroad Program, Milan, Italy** May 2025
Organized, supported, and led an interdisciplinary experiential learning program for 24 students from diverse academic majors, promoting cross-cultural engagement, global perspectives on sustainability and interdisciplinary education, and student development through immersive international learning experiences.

PROFESSIONAL DEVELOPMENT ACTIVITIES (PEDAGOGICAL IMPACT)

- Completed advanced professional development and training in data science, artificial intelligence (AI), machine learning, geospatial analysis, GeoAI, sustainability, environmental justice, and knowledge graphs to strengthen interdisciplinary teaching and student research training.
- Selected as a Sloan Data Science Faculty Fellow at Michigan State University (2023–2024), completing graduate-level training in Applied Machine Learning and computational methods.
- Participated in professional training and workshops through NGA, ESRI, Neo4j Graph Academy, NSF, DOE, AGU, Georgia Tech, FOSS4G, and SDG Academy focused on AI, geospatial analytics, ontology engineering, critical minerals, sustainability, and workforce development.
- Integrated professional development experiences into curriculum design, student mentoring, GIS and AI instruction, environmental justice education, and interdisciplinary environmental science coursework.

MENTORSHIP OF INDEPENDENT STUDENT RESEARCH

- Mentor undergraduate students in interdisciplinary research spanning environmental science, geoscience, sustainability, environmental justice, public health, climate change, and data-driven environmental analysis.
- Integrate research projects across courses using GIS, Python, artificial intelligence (AI), ontology modeling, and geospatial analysis to address real-world environmental challenges.
- Guide students through all stages of research development, including topic design, data analysis, visualization, scientific writing, and professional presentation.
- Mentored student presentations at institutional, regional, and national venues including Spelman College Research Day, the HBCU Climate Change Conference, ABRCMS, the U.S. DOE McNair Program, and the Atlanta University Center research community.
- Support undergraduate research opportunities for students from diverse and underrepresented backgrounds in STEM through interdisciplinary and applied environmental research experiences.

SCHOLARLY / CREATIVE ACTIVITY

Research focuses on ontology-driven knowledge systems, graph databases, and AI-enabled analytical frameworks for integrating environmental and geospatial datasets related to sustainability, critical minerals, environmental justice, and flood risk. Developed domain ontologies and knowledge graphs for geoscience and environmental systems using BFO and CCO frameworks to support semantic interoperability, geospatial analytics, and environmental informatics. Scholarly work citations on [ResearchGate](#)

Selected Publications

- Davarpanah, A.,** Babaie, H. A., Elliott, W. C., Tang, Y., Schroeder, P. A. (2026). GraphRAG and LLM-driven semantic exploration of critical mineral data. *Computers & Geosciences*, 214, 106197. <https://doi.org/10.1016/j.cageo.2026.106197>
- Davarpanah, A.,** Babaie, H. A. (2026). An ontology-driven query system for mineral identification in virtual geoscience labs. *Environmental Modelling & Software*, 199, 106936. <https://doi.org/10.1016/j.envsoft.2026.106936>
- Davarpanah, A.,** Babaie, H. A., Shafiei, F., & Jelks, N. O. (2025). Semantic knowledge and data modeling of environmental justice. *Engineering Applications of Artificial Intelligence*, 159, 111736. <https://doi.org/10.1016/j.engappai.2025.111736>
- Davarpanah, A.,** Babaie, H. A., & Elliott, W. (2024). Knowledge-based decision support system for critical minerals. *Applied Computing and Geosciences*, 22, 100167. <https://doi.org/10.1016/j.acags.2024.100167>
- Davarpanah, A.,** Lipscomb, M. R., Scully, E. J., & Morris, A. L. (2025). Flood-risk governance through hybrid LLM–Graph RAG: A query framework for the National Levee Database. *Semantic Technology for Intelligence, Defense, and Security (STIDS) Conference*
- Davarpanah, A.,** Babaie, H. A., Dhakal, N. (2023). Semantic modeling of climate change impacts on the implementation of the U.N. sustainable development goals related to poverty, hunger, water, and energy. *Earth Science Informatics*, 16, 929–947. <https://link.springer.com/article/10.1007/s12145-023-00941-9>
- Davarpanah, A.,** Babaie, H. A., Huang, G. (2023). Climate System Ontology: A formal specification of the complex climate system. In M. SaberiKamarposhti & M.

- Sahlabadi (Eds.), *Latest Advances and New Visions of Ontology in Information Science*. IntechOpen. <https://www.intechopen.com/chapters/86794>
- Babaie, H. A., **Davarpanah, A.**, & Elliott, W. C. (2023). Ontology of the complex rare-earth mineral system. In X. Ma, M. Mookerjee, L. Hsu, & D. Hills (Eds.), *Recent Advancement in Geoinformatics and Data Science* (Geological Society of America Special Paper 558, pp. 29–44). [https://doi.org/10.1130/2022.2558\(03\)](https://doi.org/10.1130/2022.2558(03))
- Babaie, H. A., **Davarpanah, A.**, Dhakal, N. (2019). Projecting pathways to food-energy-water systems sustainability through ontology. *Environmental Engineering Science*, 36, 808–819. <https://www.liebertpub.com/doi/10.1089/ees.2018.0551>
- Davarpanah, A.**, Babaie, H. A., Dai, D. (2018). Spatial autocorrelation of Neogene–Quaternary lava along the Snake River Plain, Idaho, USA. *Earth Science Informatics*, 11, 59–75. <https://doi.org/10.1007/s12145-017-0315-5>
- Babaie, H. A., **Davarpanah, A.** (2018). Semantic modeling of the experimental plastic deformation of polycrystalline rock. *Computers and Geosciences*. <https://doi.org/10.1016/j.cageo.2017.11.002>
- Davarpanah, A.**, Babaie, H. A. (2013). Anisotropy of fractal dimension of normal faults in northern Rocky Mountains: Implications for the kinematics of Cenozoic extension and Yellowstone hotspot's thermal expansion. *Tectonophysics*, 608, 530–544. <https://doi.org/10.1016/j.tecto.2013.08.031>

RESEARCH FUNDING (SELECTED/SUMMARY)

External Funding (PI/Co-PI): Approximately \$665,921 Awarded/Selected for Award

- **Critical Minerals in Atlantic Seaboard Plain**, U.S. Department of Energy (DOE). Co-PI. **Selected for Award:** \$169,570. Multi-institutional initiative investigating critical minerals and rare earth elements through geospatial analysis, machine learning, and semantic data integration to support critical mineral supply chains, clean energy technologies, and workforce development.
- **AI-Assisted Knowledge Graph Construction for GEOINT Data**, National Geospatial-Intelligence Agency (NGA) / Oak Ridge Institute for Science and Education (ORISE) Faculty Research Participation Program. PI. **Funded:** \$148,185. Supported ontology-driven knowledge graph development, GraphRAG frameworks, and AI-assisted semantic modeling for geospatial intelligence applications.
- **Building Performance Toolkits (BIT) for Resilient HBCUs / Sustainable Infrastructure Learning Lab (SILL)**, Sustain Our Future Foundation. Co-PI and Faculty Advisor. **Funded:** Approximately \$100,000. Multi-year initiative supporting sustainability, climate resilience, infrastructure planning, student mentoring, and sustainability-focused curriculum and research development at Spelman College.
- **6th Annual Climate Change Symposium: Climate Justice—Equity for Every Breath**, Oak Ridge Associated Universities (ORAU) Innovation Partnerships Grant. PI. **Funded:** \$4,000. Supported climate justice programming, interdisciplinary engagement, and student participation.
- **Knowledge Representation of Flood Management Systems**, Intelligence Community–HBCU Faculty Fellowship, National Geospatial-Intelligence Agency (NGA). PI. **Funded:** \$50,000. Supported ontology development and semantic modeling for geospatial intelligence and infrastructure systems.
- **Semantic Modeling of Flood Infrastructure Systems: Impacts of Climate Change and Environmental Justice**, IC-HBCU Summer Faculty Research Fellowship, National Geospatial-

- Intelligence Agency (NGA). PI. **Funded:** \$35,000. Supported ontology-driven flood infrastructure, climate resilience, and environmental justice research.
- **Semantic Modeling of Route Reconnaissance**, U.S. Army DEVCOM Army Research Laboratory / Defense Threat Reduction Agency Fellows Program. PI. **Funded:** \$11,000. Supported ontology development for autonomous route reconnaissance systems and undergraduate research mentoring.
 - **Evaluation of Compound Weather Extremes in a Changing Climate**, U.S. Department of Energy Minority Serving Institutions Partnership Program (MSIPP). Co-PI. **Funded:** \$211,886. Supported climate extremes analysis, geospatial modeling, and student training in high-performance computing and data science.
 - **NSF Sustainable Regional Systems Research Network Planning Grant**, National Science Foundation (NSF). Co-PI. **Funded:** \$36,280. Supported interdisciplinary sustainability research and regional systems collaboration.

Internal Funding (PI/Co-PI): \$57,542.91 Awarded

- **Analysis of Socio-economic, Environmental, and Health Disparities in the Proctor Creek Watershed: An Environmental Justice and Sustainable Development Perspective**, ORIC Interdisciplinary Research Group (IRG) Grant, Spelman College. PI. **Funded:** \$24,977. Supported GIS-based environmental justice research, undergraduate mentoring, and development of the Proctor Creek Watershed Environmental Justice Ontology (PUSH-EJ).
- **Enhancing STEM Education with a Web-based Query and Visualization Framework for Rock-Forming Minerals**, NSM Seed Award, Spelman College. PI. **Funded:** \$30,732.91. Supported development of the Rock-Forming Minerals Ontology (RMO) and ontology-driven educational tools for geoscience education and STEM learning.
- **Development of a Course in Sustainability: A Strategy to Enhance Spelman's Global Studies Curriculum in the STEM Disciplines**, Department of Education Title VI NRC Grant, Gordon-Zeto Center for Global Education, Spelman College. **Funded:** \$1,833. Supported sustainability curriculum development and integration of climate data analysis into environmental science education.

Pending Funding / Submitted Proposals (\$353,868.92)

- **AI-driven Scientific Discovery and Waste Valorization of Rare Earth Elements from Ion-Adsorption Clays via Knowledge Graphs and Physics-Informed Machine Learning (DE-FOA-0003612)**, U.S. Department of Energy. PI. **Pending:** \$96,737.
- **Ontology-Grounded AI for Explainable and Uncertainty-Aware Critical Mineral Systems Analysis**, National Science Foundation Collaborations in Artificial Intelligence and Geosciences (CAIG). PI. **Pending:** \$177,791.
- **Integrated Knowledge Framework for Cosmetic, Energy, and Environmental Critical Minerals**, Faculty Development Grant, Spelman College. PI. **Pending:** \$3,975.
- **AI-driven Analysis of Critical Minerals Across Energy, Environment, and Cosmetic Applications**, Simons Foundation Fellows Program. PI. **Pending:** \$75,365.92.

INVITED PRESENTATIONS (SELECTED)

- May 2026. Flood-risk governance through hybrid LLM–Graph RAG: A query framework for the National Levee Database. Presented at *Semantic Technology for Intelligence, Defense, and Security (STIDS) Conference*
- November 2025. *Comparison of Traditional Ontology Construction and AI–Generated Ontology*, Washington, DC. Presented AI and ontology approaches for geoscience data integration.

- August 2025. *Ontology-Based Modeling of Maritime Port Infrastructure and Sea-Web Data*, National Geospatial-Intelligence Agency. Presented semantic modeling for maritime infrastructure and interoperability.
- July 2025. *Levee System Ontology (LSO)*, National Geospatial-Intelligence Agency, St. Louis. Presented ontology-driven flood-risk infrastructure modeling.
- May 2025. *Applications of Artificial Intelligence in Sustainability*, IES Abroad Global Institute, Barcelona. Presented AI applications in sustainability research and education.
- November 2024. *Knowledge- and Data-Driven Environmental Justice Analyses of the Proctor Creek Watershed*. Regional Centre of Expertise Greater Atlanta Sustainable Development Research Seminar, Atlanta Global Studies Center.
- April 2024. *Python-Based Automated Classification of Biochemical Analysis Equipment*, BioDDEx–Interlink collaboration.
- August 2023. *Semantic Representation of Maritime Safety Information*, National Geospatial-Intelligence Agency. Presented the Maritime Safety Ontology (MSO).
- March 2023. *Socioenvironmental Justice in the Proctor Creek Watershed through Ontology*. 6th Annual EQUINOX Symposium, Kennesaw State University.

REFEREED CONFERENCE PRESENTATIONS (Selected)

- December 2025. *LLM-Powered Natural Language Question Answering over Critical Mineral Data Using Knowledge Graphs and Hybrid Retrieval-Augmented Generation (RAG)*, American Geophysical Union Fall Meeting, New Orleans.
- December 2024. *Data-Driven Environmental Justice Analysis Applying Knowledge Graph*, American Geophysical Union Fall Meeting, Washington.
- December 2024. *Constructing the Knowledge Graph for Minerals with NLP and LLMs*, American Geophysical Union Fall Meeting, Washington.
- April 2024. *Semantic and Spatial Proximity Modeling of Equitable Sustainability in Proctor Creek, Atlanta*, European Geosciences Union General Assembly, Vienna.
- April 2023. *Knowledge Representation of Levee Systems: An Environmental Justice Perspective*, European Geosciences Union General Assembly, Vienna.

SYNERGISTIC ACTIVITIES

- **Associate Editor, *Earth Science Informatics* (2022–present)**
Serve as Associate Editor for *Earth Science Informatics* (Springer), contributing to peer review, editorial decision-making, and advancement of interdisciplinary research at the intersection of geoscience, data science, and informatics.
- **Faculty Fellow, National Geospatial-Intelligence Agency (2022–2026)**
Conduct research as an ORISE Faculty at the National Geospatial-Intelligence Agency (NGA), supporting applied geospatial, semantic modeling, and AI-enabled geoscience research through the DoD Research Participation Program. Engagement includes summer appointments in 2022, 2023, and 2024–2025 (part-time), and service as a Visiting Scientist during a sabbatical in 2025–2026.
- **NSF–NSFC Joint Review Panelist (2022)**
Served as a reviewer for the NSF–NSFC Joint Research on Sustainable Regional Systems (SRS) program, evaluating interdisciplinary proposals addressing sustainability, Earth systems, and data-driven modeling.
- **Faculty Co-Director, Gordon–Zeto Study Abroad Program (2025-present)**
Provide academic leadership and co-direct program development and implementation for an international study abroad program emphasizing environmental science, sustainability, and place-based learning.
- **Curriculum Development and Applied Research Integration (2020-present)**
Developed and taught undergraduate courses in Sustainable Energy and co-developed ontology-

driven query systems for mineral identification and critical-mineral analysis used in classroom, virtual laboratory, and field-based learning settings. Developed an ontology and query system at the National Geospatial-Intelligence Agency (NGA), aligned with the National Levee Database, within an explainable, graph-based AI framework for levee safety and scalable flood-risk analysis.

AWARDS AND RECOGNITIONS

2025–2026-Visiting Scientist, NGA (DOD)
2025-Faculty Excellence in Global Education, Spelman College
2025-Faculty Representative, IES Abroad (Barcelona)
2020-TRIO Faculty Award
2013-2014-Graduate Teaching Award, Sigma Gamma Epsilon

CERTIFICATIONS AND PROFESSIONAL DEVELOPMENT

2025-NSF Proposal Development Certification (2025)
2025-Intelligence Oversight Certification, NGA/DoD
2022-ArcGIS Pro Certification (Esri), 2022
2020- Mastering Online Teaching (UDL), Georgia State University

PROFESSIONAL AFFILIATION

2006- Geological Society of America (GSA)
2006- American Geophysical Union (AGU)
2006- American Chemical Society (ACS)
2006- European Geosciences Union (EGU)
2019- GIS Community Directory
2021- ORISE Connection Team
2020- RCE Greater Atlanta
2023- The Ecological Society of America (ESA)
2023-Growing Partnerships for Essential Minerals (GEMs)
2023-DoD and Intelligence Community Ontology Working Group (DIOWG)