I-GUIDE
Institute for Geospatial Understanding through an Integrative Discovery Environment

Introduction to I-GUIDE

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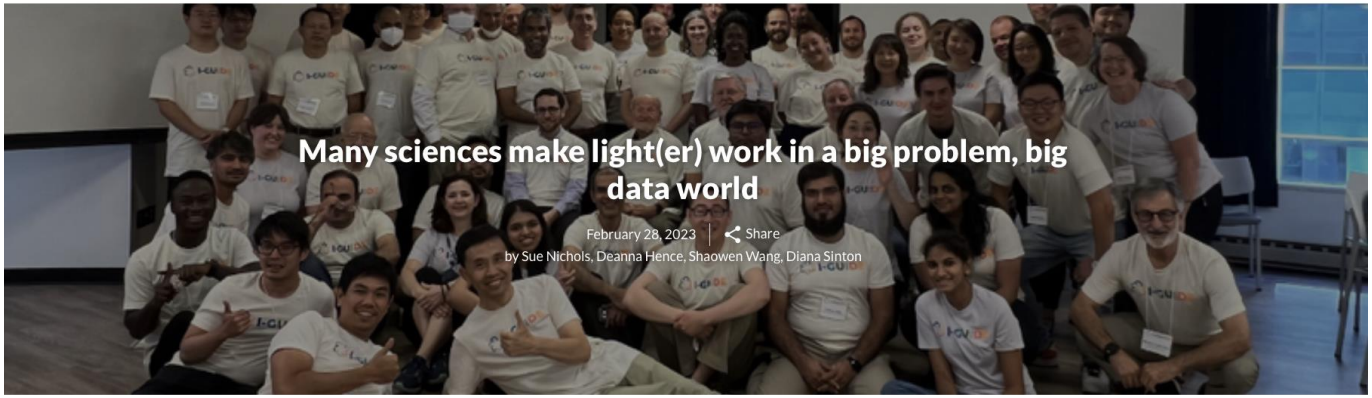
Award #: 2118329

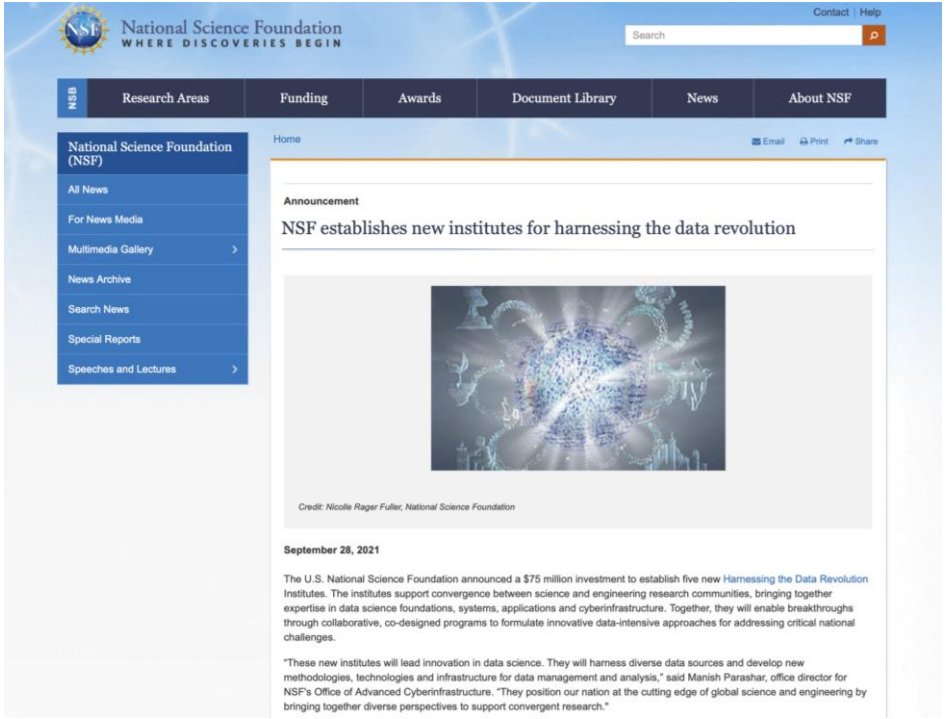


It's raining cats and dogs when a hydrologist, a climatologist, a statistician, an economist, and a geospatial scientist walk into a bar. The bar is just down the road from a big old dam and they'd each glanced toward it when they'd pulled into the parking lot.

After a few weeks of steady rain, the whole dam area has been on everyone's mind. The hydrologist is thinking about the last time this dam overtopped. The climatologist and the statistician are debating how extreme this amount of precipitation would be considered and what may come in the future. The economist is remembering how disruptive flooding in this area is to the local businesses that export their goods to distant places, and the geospatial scientist is estimating the extensive numbers of vulnerable neighborhoods downriver.

https://www.directionsmag.com/article/12127

Harnessing the Data Revolution



https://www.nsf.gov/news/special_reports/announcements/092821.jsp

http://i-guide.io

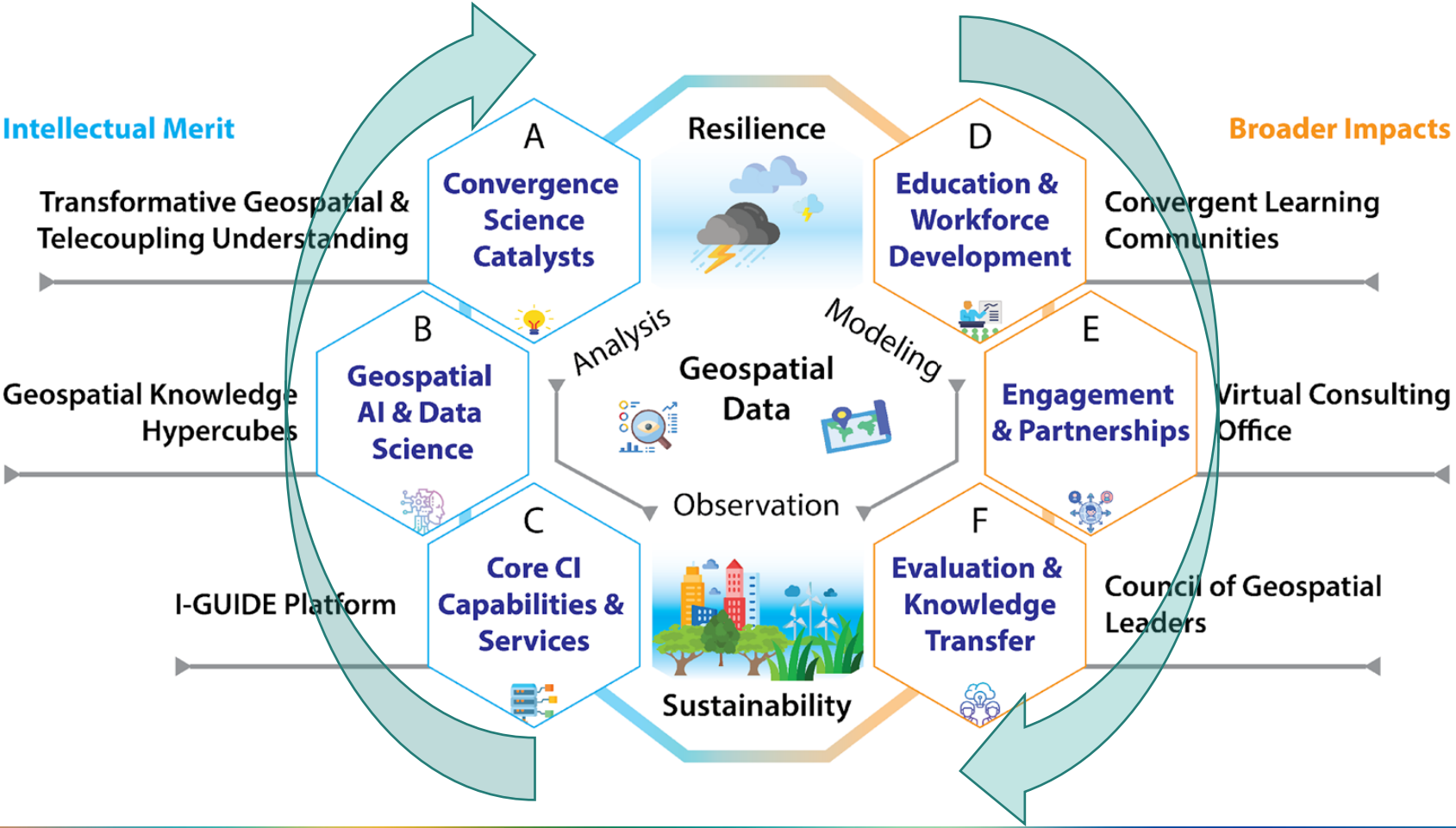
Collaborating Institutions

Vision

- Digital discovery and innovation through harnessing the geospatial data revolution

Mission

- Transform convergence and geospatial sciences for holistic sustainability solutions


Intellectual Merit
Broader Impacts
Transformative Geospatial & Telecoupling Understanding
Geospatial Knowledge Hypercubes
I-GUIDE Platform
Convergent Learning Communities
Virtual Consulting Office
Council of Geospatial Leaders
A
Convergence Science Catalysts
B
Geospatial AI & Data Science
C
Core CI Capabilities & Services
D
Education & Workforce Development
E
Engagement & Partnerships
F
Evaluation & Knowledge Transfer
Resilience
Analysis
Modeling
Geospatial Data
Observation
Sustainability

Convergence

"*integrating knowledge, methods, and expertise from different disciplines and forming novel frameworks to catalyze scientific discovery and innovation*"

https://www.nsf.gov/crssprgm/nano/reports/MCR_2020-1020_PrinciplesOfConvergenceInNatureSociety_JNR_27p.pdf

Diverse Disciplines

- Atmospheric science
- Computer science
- Data science
- Ecology
- Economics
- Environmental science and engineering
- Geographic information science
- Human-environment and geographical sciences
- Hydrology and water sciences
- Industrial engineering
- Information science
- Sociology
- Statistics

Map, Connect, Discover

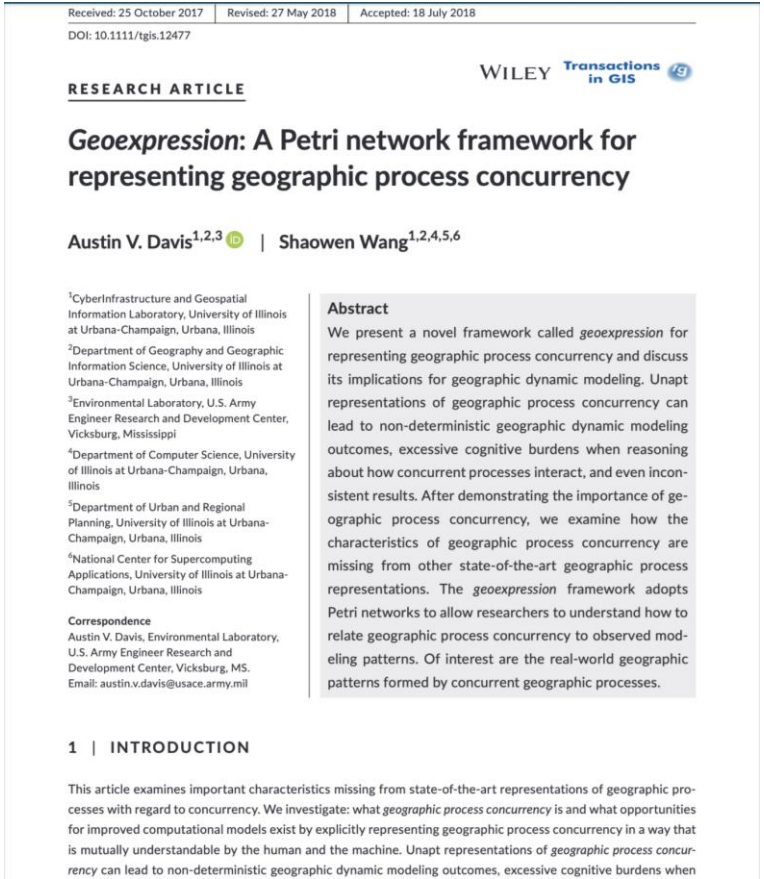
https://www.un.org/sustainabledevelopment/blog/2015/12/sustainable-development-goals-kick-off-with-start-of-new-year/#

Map

- Patterns
- Processes
- Pattern & process interactions
- Digital twins

https://medium.com/@thegeospatialnews/the-fascinating-world-of-gis-an-introduction-a0a48e160ffd

Causal inference



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DOI: 10.1111/tgis.12477

WILEY Transactions in GIS

RESEARCH ARTICLE

Geoexpression: A Petri network framework for representing geographic process concurrency

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Abstract

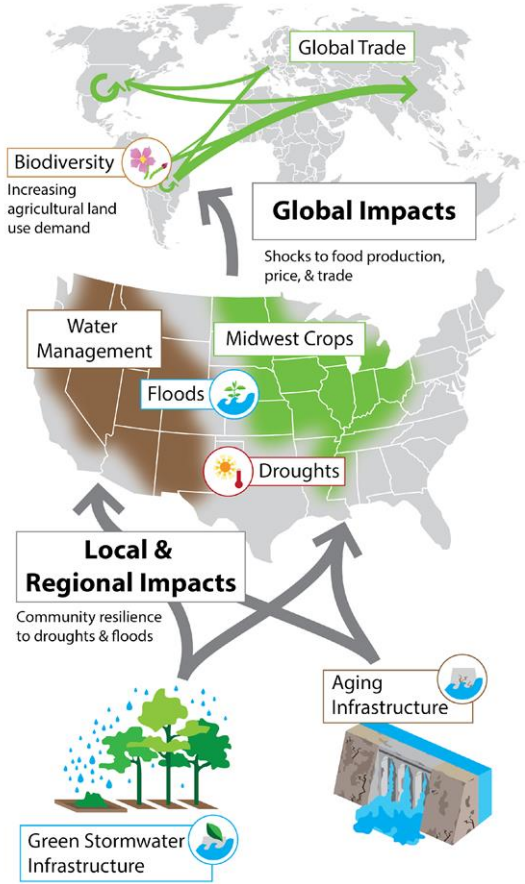
We present a novel framework called *geoexpression* for representing geographic process concurrency and discuss its implications for geographic dynamic modeling. Unapt representations of geographic process concurrency can lead to non-deterministic geographic dynamic modeling outcomes, excessive cognitive burdens when reasoning about how concurrent processes interact, and even inconsistent results. After demonstrating the importance of geographic process concurrency, we examine how the characteristics of geographic process concurrency are missing from other state-of-the-art geographic process representations. The *geoexpression* framework adopts Petri networks to allow researchers to understand how to relate geographic process concurrency to observed modeling patterns. Of interest are the real-world geographic patterns formed by concurrent geographic processes.

1 | INTRODUCTION

This article examines important characteristics missing from state-of-the-art representations of geographic processes with regard to concurrency. We investigate: what *geographic process concurrency* is and what opportunities for improved computational models exist by explicitly representing geographic process concurrency in a way that is mutually understandable by the human and the machine. Unapt representations of *geographic process concurrency* can lead to non-deterministic geographic dynamic modeling outcomes, excessive cognitive burdens when

Convergence Science Catalysts

- Hydroclimatic extremes and associated vulnerability
- Socioeconomic impacts of potential climate induced disasters
- Global-local-global analysis of sustainability from the perspectives of biodiversity, fertilizer, and land use
- Telecoupling, food commodity (soybean/corn), production and trade, disasters, and land use/cover change in distant regions

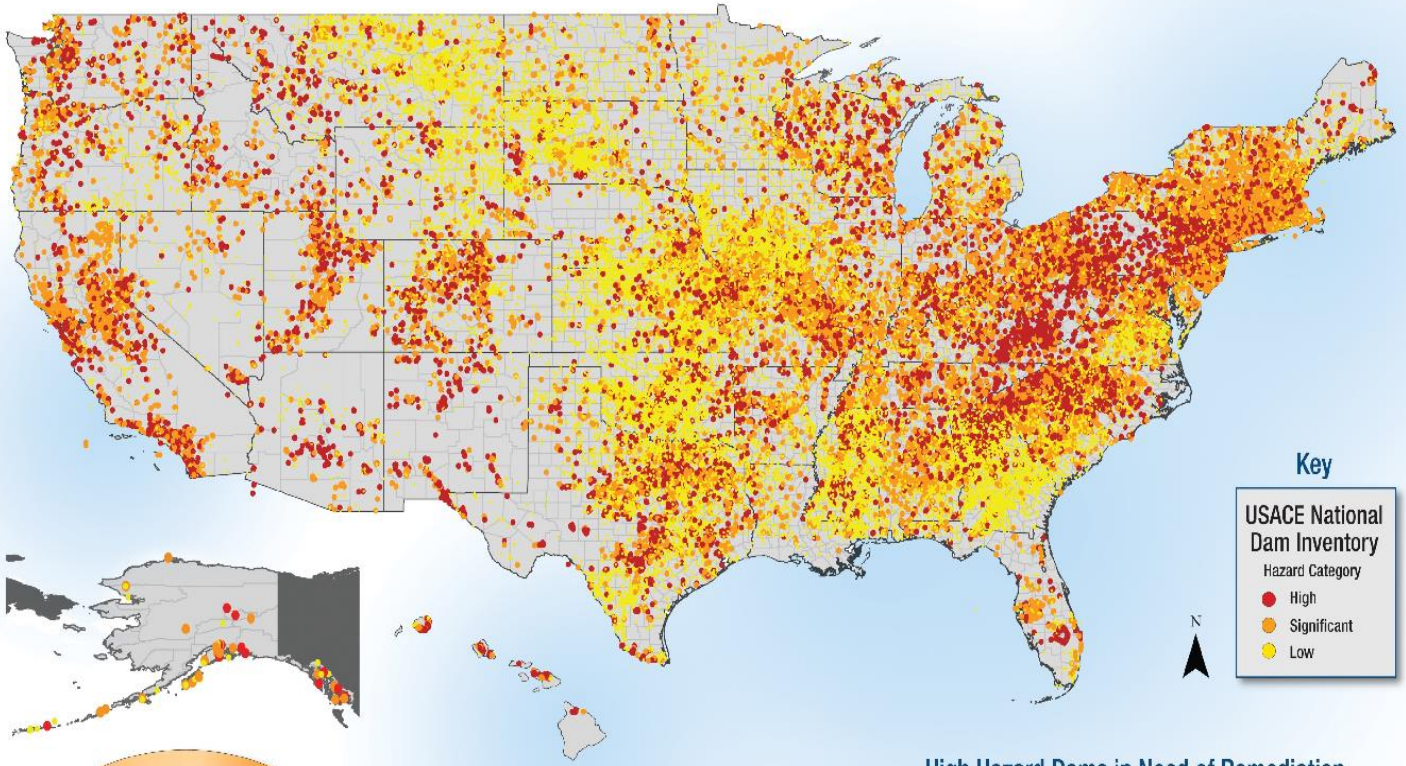


Aging Dams

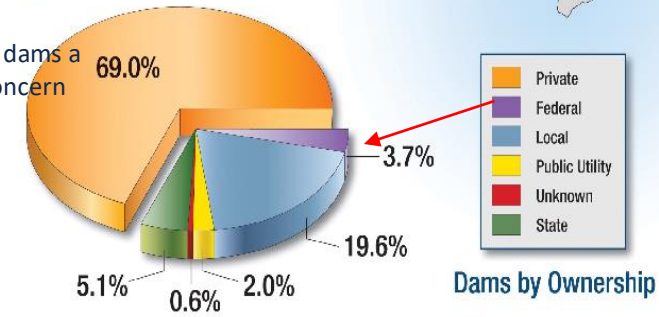
...

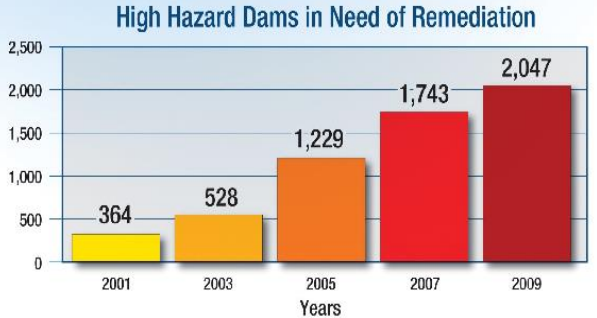
Median Age (57 years > Design Life (50 years)

State of Maintenance Largely Unknown

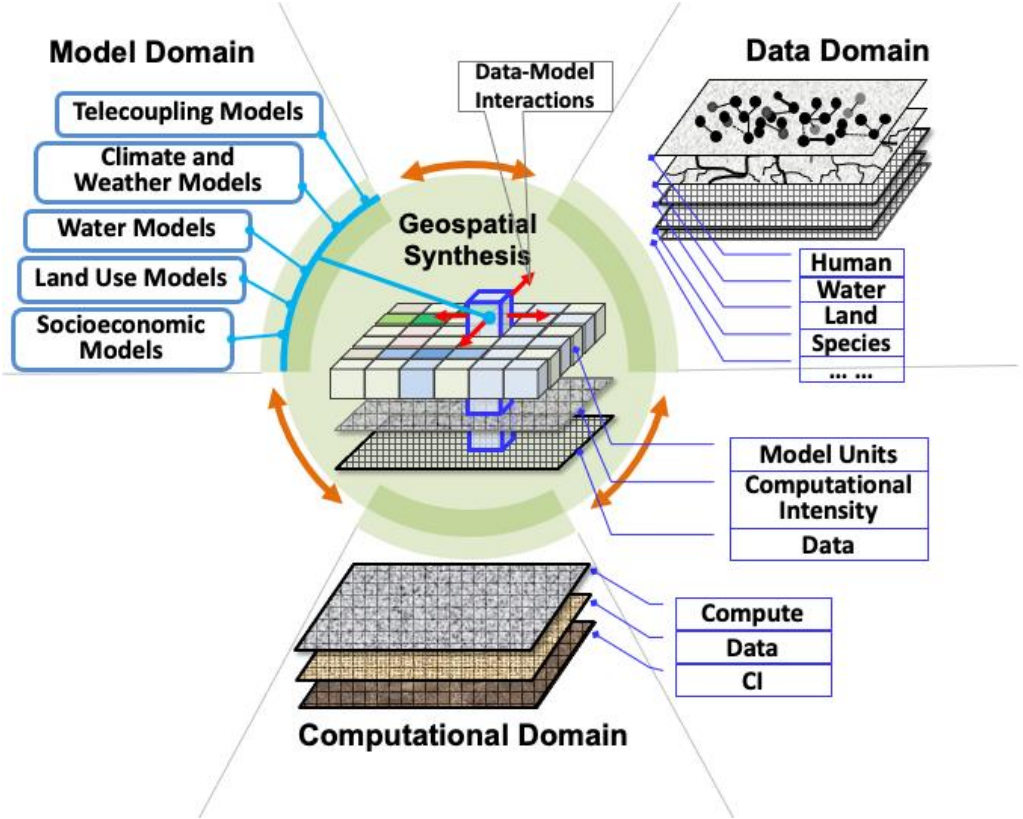


Non-federal dams a particular concern





Geospatial Knowledge Hypercube

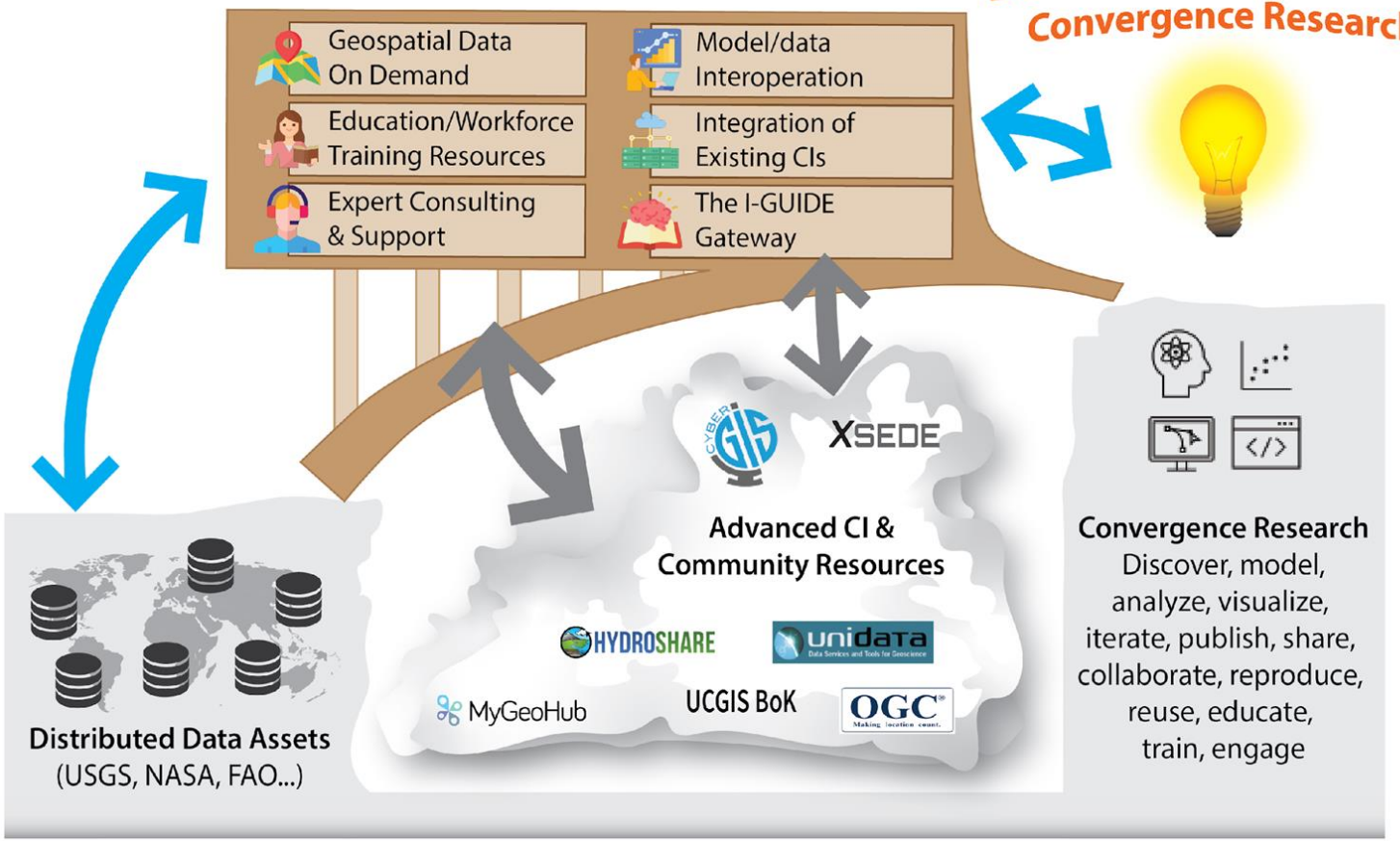


Connect

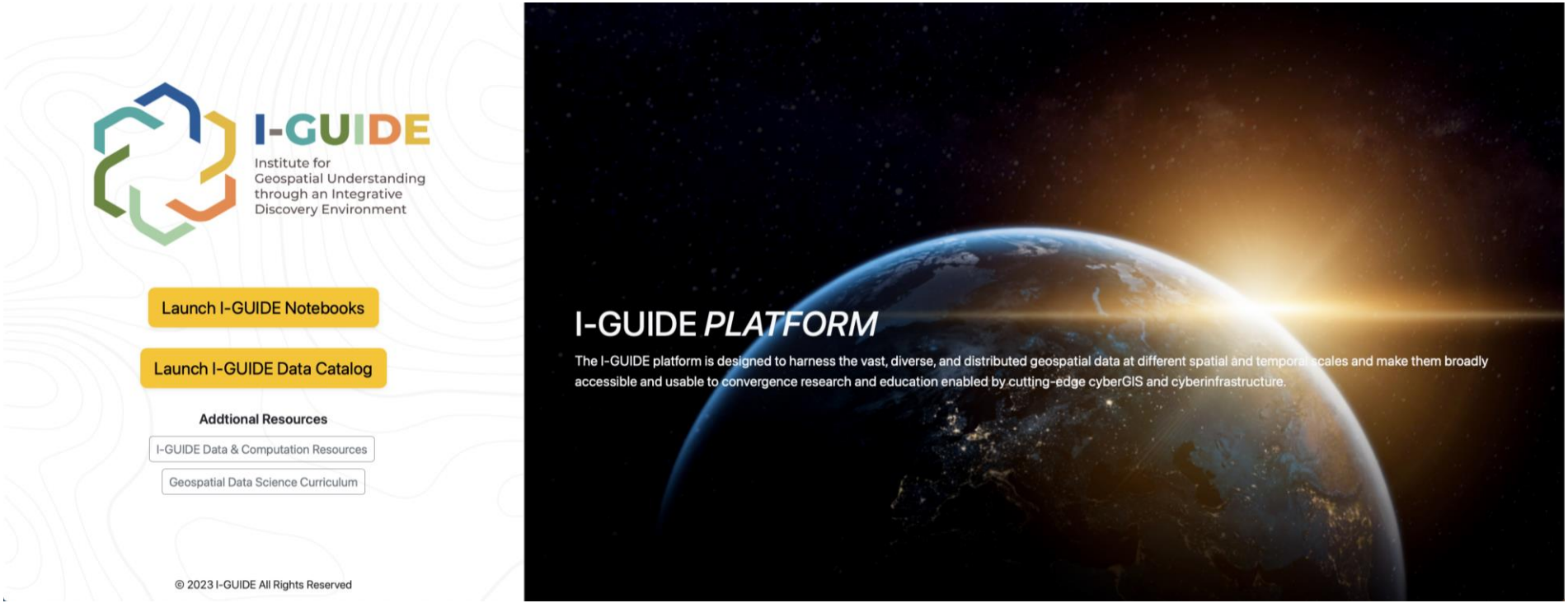
- Data
- Communities
- Domain knowledge
- Learning resources
- Partners

I-GUIDE Platform

The I-GUIDE Platform (The "missing middle")



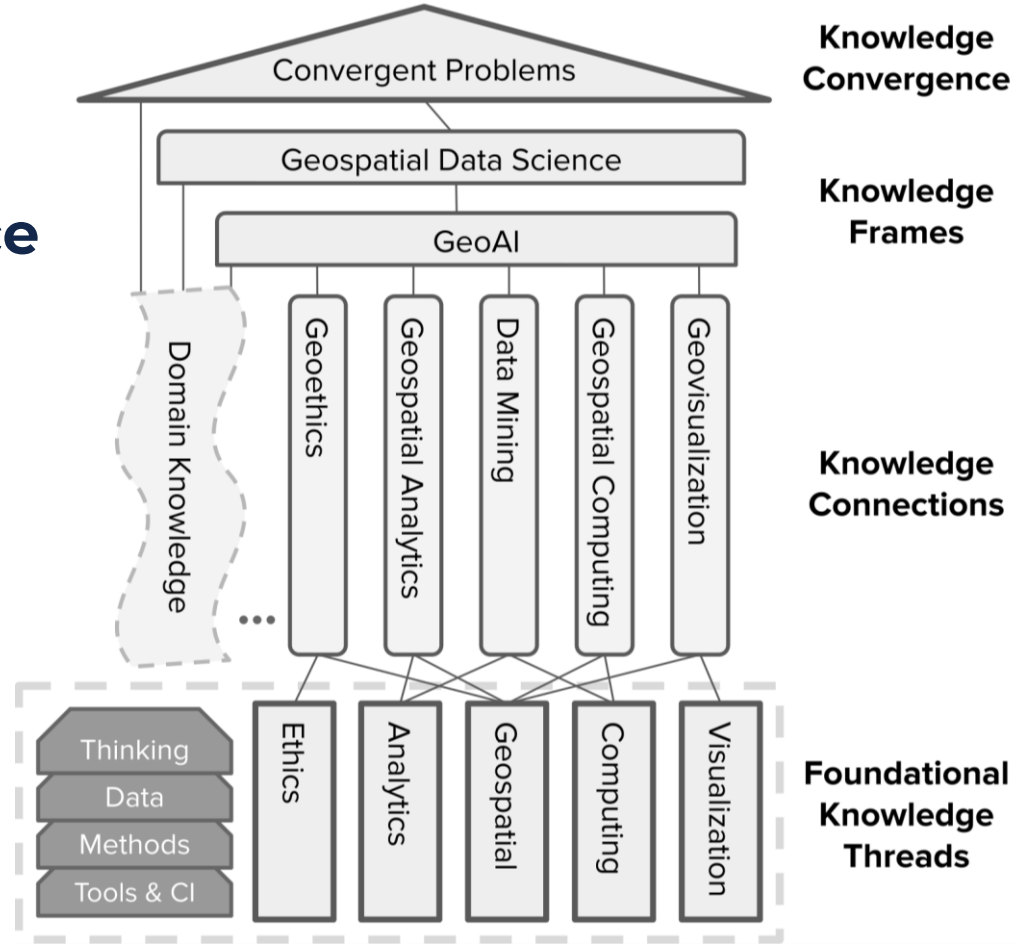
https://iguide.illinois.edu/platform/



Partners


AAG
Association of American Geographers
AGU
Advancing Earth and Space Science
AGILE
DPI
Discovery Partners Institute
EarthCube
NASA
Google
NWC
National Water Center
MAXAR
Technologies
Microsoft
Midwest Big Data Hub
California Academy of Sciences
museum of science+industry chicago
Oak Ridge National Laboratory
outlier
Research & Evaluation
SGCI
Science Gateways Community Institute
The HDF Group
TLP
Thomas Lucas Productions Inc.
USGS
science for a changing world
WGIC
World Geospatial Industry Council

Convergence Curriculum for Geospatial Data Science



Council of Geospatial Leaders

Richard Butgereit
Geospatial Insurance Consortium

Charles Catlett
Argonne National Laboratory

Damandeep Kochhar
HERE Technologies

Daniel Sui
Virginia Tech University

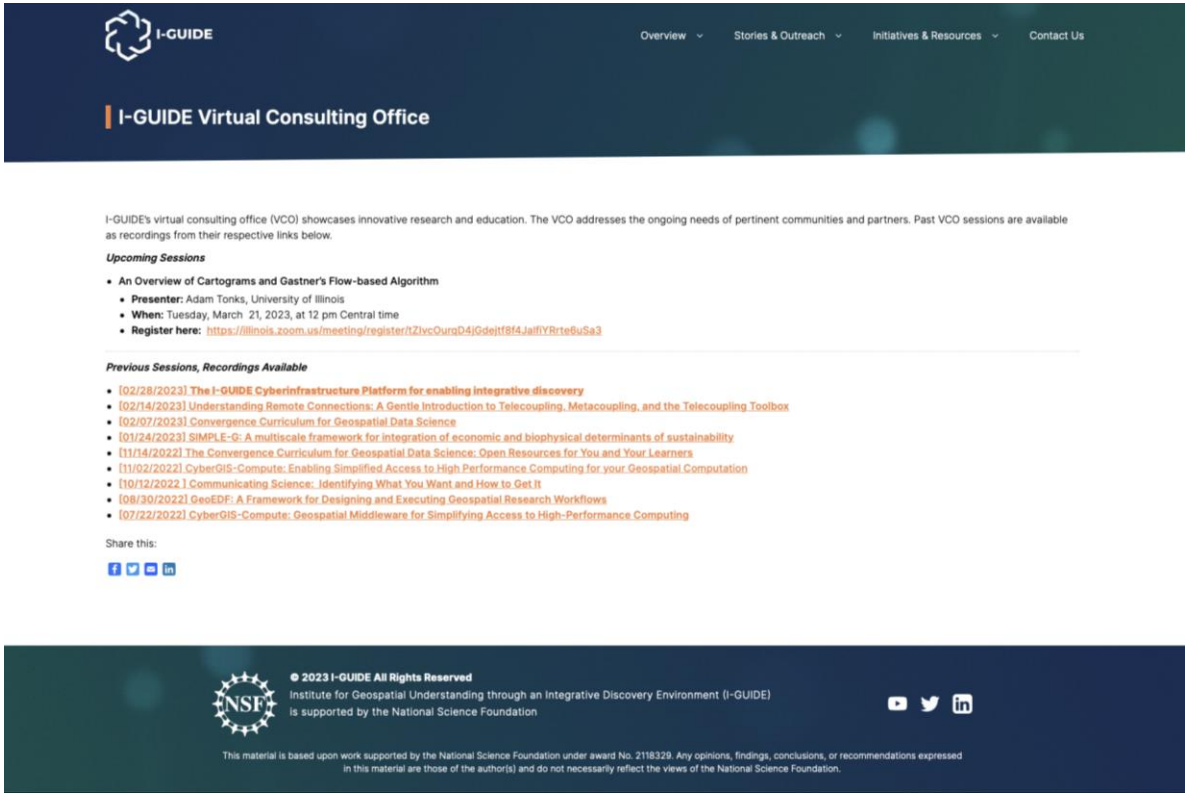
Susan Paddock
NORC at the University of Chicago

Barbara Ryan
World Geospatial Industry Council

Siva Ravada
Oracle

Dan Reed
University of Utah, and the National Science Board

Virtual Consulting Office (https://iguide.illinois.edu/i-guide-vco/)



I-GUIDE

Overview | Stories & Outreach | Initiatives & Resources | Contact Us

I-GUIDE Virtual Consulting Office

I-GUIDE's virtual consulting office (VCO) showcases innovative research and education. The VCO addresses the ongoing needs of pertinent communities and partners. Past VCO sessions are available as recordings from their respective links below.

Upcoming Sessions

- **An Overview of Cartograms and Gastner's Flow-based Algorithm**
  - **Presenter:** Adam Tonks, University of Illinois
  - **When:** Tuesday, March 21, 2023, at 12 pm Central time
  - **Register here:** https://illinois.zoom.us/meeting/register/tZIvcOurqD4jGdejtf8f4JaIfiYRrte6uSa3

Previous Sessions, Recordings Available

- [02/28/2023] **The I-GUIDE Cyberinfrastructure Platform for enabling integrative discovery**
- [02/14/2023] Understanding Remote Connections: A Gentle Introduction to Telecoupling, Metacoupling, and the Telecoupling Toolbox
- [02/07/2023] Convergence Curriculum for Geospatial Data Science
- [01/24/2023] SIMPLE-G: A multiscale framework for integration of economic and biophysical determinants of sustainability
- [11/14/2022] The Convergence Curriculum for Geospatial Data Science: Open Resources for You and Your Learners
- [11/02/2022] CyberGIS-Compute: Enabling Simplified Access to High Performance Computing for your Geospatial Computation
- [10/12/2022] Communicating Science: Identifying What You Want and How to Get It
- [08/30/2022] GeoEDF: A Framework for Designing and Executing Geospatial Research Workflows
- [07/22/2022] CyberGIS-Compute: Geospatial Middleware for Simplifying Access to High-Performance Computing

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Institute for Geospatial Understanding through an Integrative Discovery Environment (I-GUIDE) is supported by the National Science Foundation

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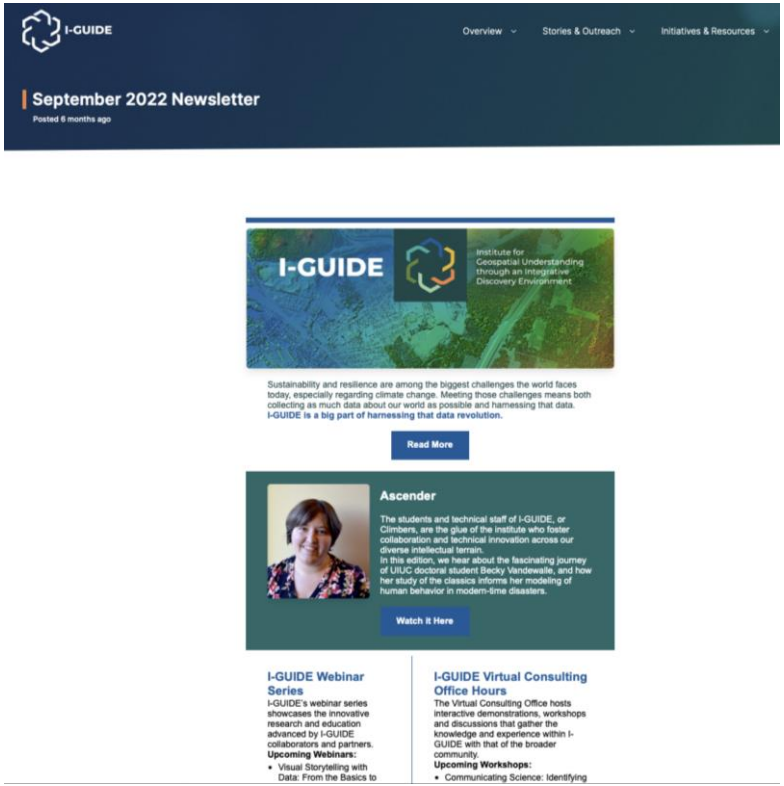
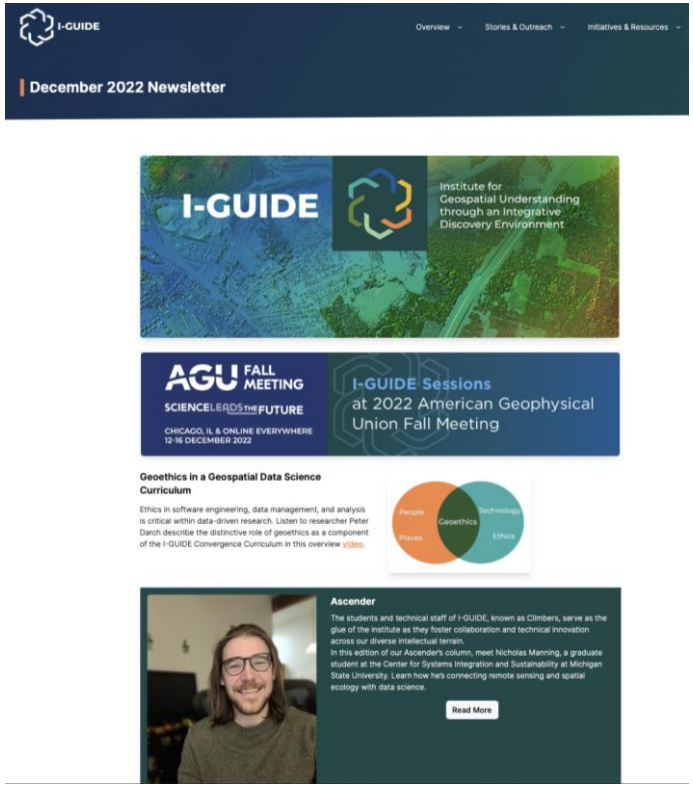
Community Newsletters (http://i-guide.io)





Discover

- Scientific knowledge
- Convergence science in action
- GeoEthics

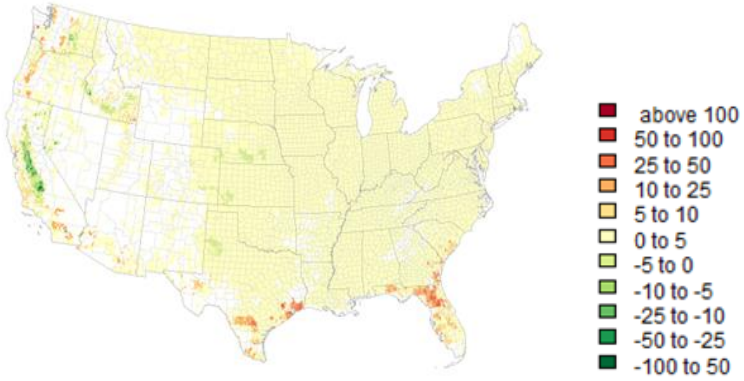
Global drivers of groundwater sustainability stress in the US

(1) Significant implication of global food demand for US water resources

Spillover effects of groundwater sustainability policy

(2) Fruit and vegetable production is likely to move from California to Florida in response to water restriction policy in the Western US

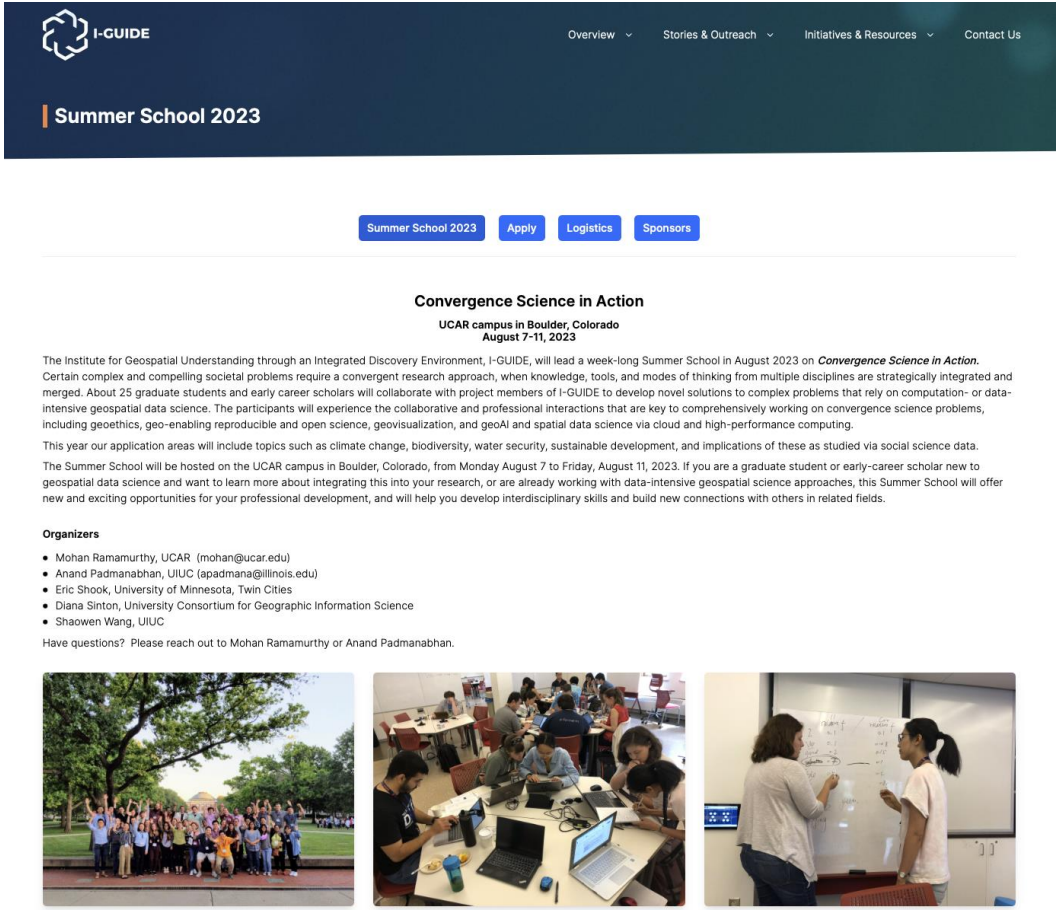
% change in cropland area due to groundwater sustainability restrictions



Haqiqi, I., Bowling, L. C., Jame, S. A., Hertel, T., Baldos, U., & Liu, J. (in review). **Global Drivers of Local Water Stresses and Global Responses to Local Water Policies in the United States**. *Environmental Research Letters*.

I-GUIDE Summer School

https://iguide.illinois.edu/summer-school-2023/

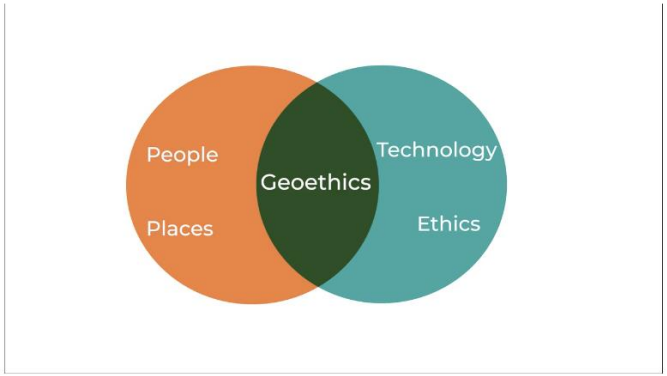


Geoethics

The lack of computational reproducibility support and data ethics guidance is a major challenge for integrative knowledge infrastructure. This key area of activity for I-GUIDE involves supporting the process of decision-making around sharing data and data-driven research outcomes. These include issues of privacy, consent, equity, assessment of benefits and harms, transparency, and integrity in research practices and use of AI algorithms.

Geoethics is a central area of our Convergence Curriculum for Geospatial Data Science. Listen to I-GUIDE researcher Peter Darch explain why integrating this structural guidance for computational reproducibility and data ethics from the start is so important.

An overview of geoethics from I-GUIDE's Peter Darch.



Geoethics Resources

- GIS Ethics Case Studies, https://gisethics.org. This recently updated and expanded collection of case studies is a classic contribution for this field, curated and maintained by Penn State University.
- Data and Society, https://datasociety.net. Data & Society advances public understanding of the social implications of data-centric technologies and automation.
- AI Now, https://ainowinstitute.org. The AI Now Institute at New York University is an interdisciplinary research center dedicated to understanding the social implications of artificial intelligence.

Share this:

I-GUIDE Forum 2023

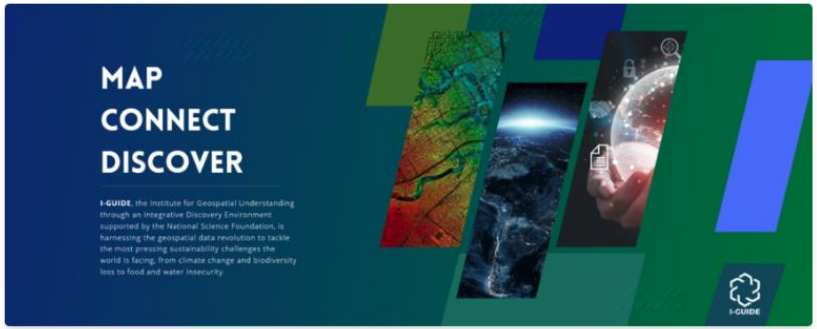
- Location: The Forum at Columbia University, New York City, USA
- Time: October 4th – 6th, 2023
  - Pre-conference workshops on October 4th
  - Main conference on October 5th and 6th
- Theme: Harnessing the geospatial data revolution for sustainability solutions

https://iguide.illinois.edu/forum-2023/

Forum 2023

Harnessing the Geospatial Data Revolution for Sustainability Solutions

October 4 - 6, 2023



Join us at the I-GUIDE Forum 2023, an international conference for a groundbreaking event focused on "Harnessing the Geospatial Data Revolution for Sustainability Solutions." As the world becomes increasingly interconnected, harnessing the power of geospatial data is more critical than ever before. At this Forum, we'll explore innovative ways to leverage geospatial data to tackle some of the most pressing sustainability challenges of our time.

With a diverse range of speakers and topics, I-GUIDE Forum 2023 is an exciting event for anyone interested in the intersection of geospatial science & technology and sustainability. Don't miss out on this opportunity to connect with like-minded peers, learn from leading experts, and gain insights that will help make the world more sustainable.

Information about speakers, sessions, and registration will be announced soon!

The I-GUIDE Forum 2023 will be held at:

The Forum at Columbia University

601 W 125th St, New York, NY 10027.

Map of The Forum at Columbia University

I-GUIDE Team

Thanks!

- **Comments / Questions?**
- **Contact: shaowen@illinois.edu**
- **Twitter: swuiuc**