NATIONAL SECURITY SCIENCES

# Geospatial Science and Human Security

*Answering questions about the world to advance human security*

To enhance US national security, federal agencies need new methods to understand our increasingly connected and digitally integrated infrastructure, anticipate population changes at global and local scales, and respond quickly to disasters that threaten physical and economic security. The Geospatial Science and Human Security Division's interdisciplinary research teams are advancing human security by helping communities around the world anticipate, analyze, mitigate, and respond to disasters.

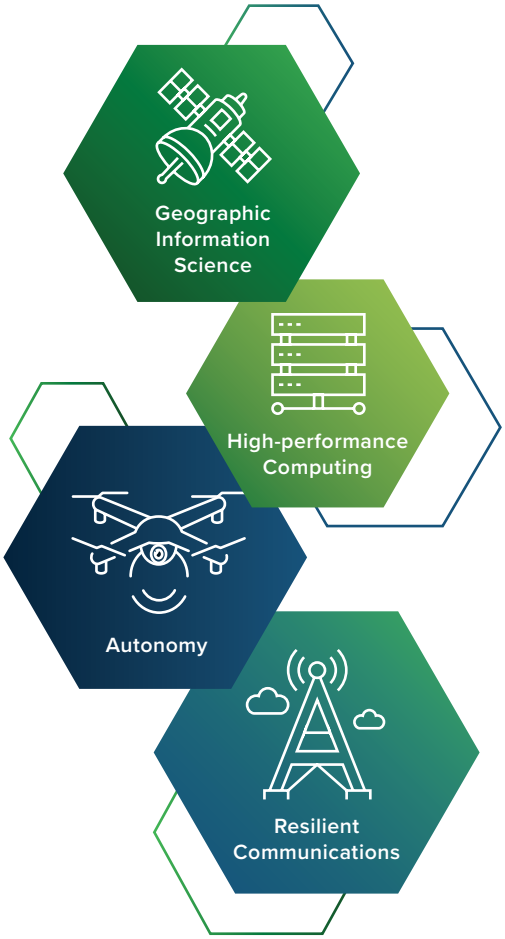
Our science—a unique integration of human dynamics, location intelligence, geospatial AI, remote sensing, autonomous systems, resilient communications, and high-performance computing—is transforming how we observe, analyze, and visualize landscape and human dynamics across the world to provide decision-makers with novel insights on human populations, the built environment, and critical infrastructures.

## RESEARCH FOCUS AREAS

Within our Geographic Data Science and Human Dynamics research sections, our scientists and engineers produce data, systems, and insights to deliver the full picture of human activities, natural and built environments, and the interactions among them—from local to planetary scales.

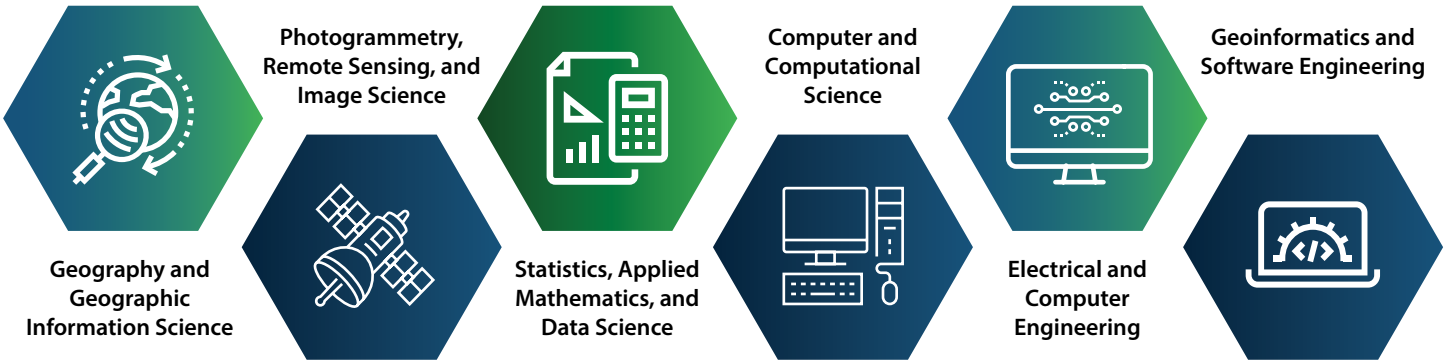
- ***High-Performance Geocomputation***—Utilizing high-performance computing, custom algorithms, novel datasets, and open-source information to collect, integrate, analyze, and visualize data on the planet, its structures, and its people
- ***Human Dynamics Modeling and Simulation***—Identifying trends and patterns in human settlements, migration, and future populations through novel human geography datasets
- ***Critical Infrastructure Resilience***—Characterizing the built environment, domestically and internationally, and assessing infrastructure resiliency through the curation of unique critical infrastructure datasets
- ***Remote Sensing and Autonomous Systems***—Developing algorithms for multimodal sensors and autonomous platforms to collect data and imagery while exploring strategies for resilient, integrated communications among edge devices
- ***GeoAI for Mapping and Monitoring***—Providing decision makers and emergency responders with near-real-time insights from spatio-temporal data through robust automation and scaling of artificial intelligence/machine learning from high-performance computing to the edge

### ADVANCING HUMAN SECURITY THROUGH SCIENCE & TECHNOLOGY



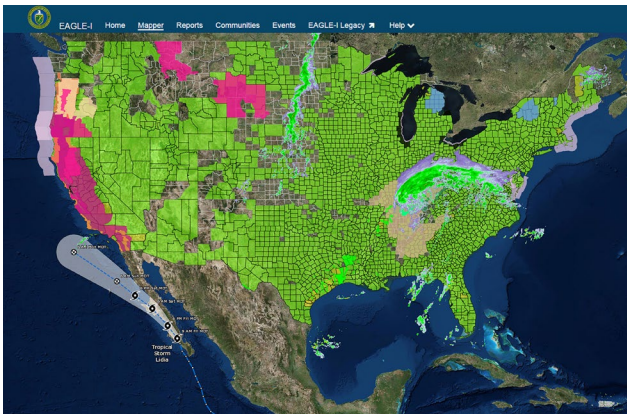

**Delivering data and scientific insights to build stronger, more resilient communities of secure and healthy populations across a sustainable planet**

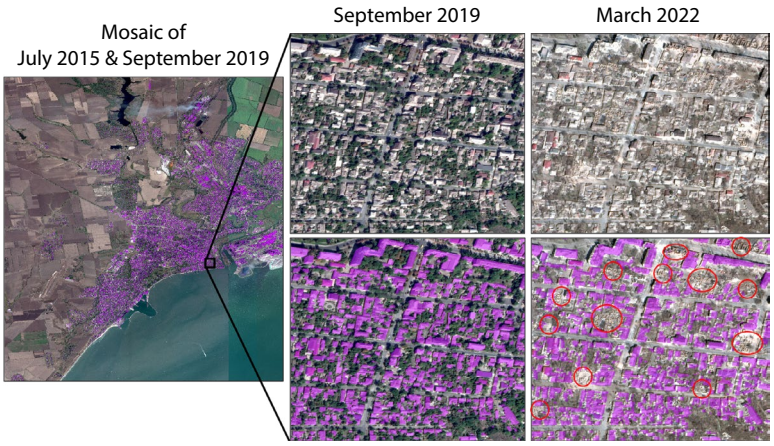
## SCIENTIFIC DISCIPLINES




## IMPACTS

- **Situational Awareness**—The interactive EAGLE-I platform helped DOE and the Federal Emergency Management Agency (FEMA) monitor energy outages and recovery efforts during 2021's Winter Storm Uri, Hurricane Ida, and the Colonial Pipeline disruption.
- **Damage Assessment**—Our USA Structures dataset—which provides feature extraction and attribution for all 125+ million US structures larger than 450 $ft^2$—was used by FEMA to plan efficient, effective responses following flooding events in Tennessee and tornado damage in Kentucky.
- **Decision Support**—ORNL's LandScan global population datasets have been used by the U.S. government, international partners, and the humanitarian community to guide recovery efforts following earthquakes in Iran, tsunamis in Sri Lanka, and other crises around the world.
- **Crisis Management**—We delivered broad situational awareness of the COVID-19 pandemic, predictive analyses based on diverse response scenarios, and a visualization platform to help officials understand the spread in their communities and the effects of intervention measures.




Automated change detection highlighted in March 2022 imagery, compared to September 2019.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