



INDIANA  
GEOLOGICAL SURVEY



# Addressing Indiana's Critical Issues

Energy  
Water  
Geologic mapping  
Environment  
Mineral resources  
Geologic hazards



# Geoscience information for Indiana's future

High-quality geologic information is essential for making sound decisions about the complex issues that face Indiana. The future of our energy, water, and mineral resources, as well as the health of our environment, concerns us all. As a research institute of Indiana University, the Indiana Geological Survey is able to provide unbiased and authoritative earth science information to benefit

Indiana's economy and quality of life. The IGS accomplishes this by offering data and information to a wide variety of technical and nontechnical users in the public and private sectors. Advanced technology, a dedicated staff, and productive cooperation with many other organizations all combine to enhance the IGS's effectiveness in fulfilling its public service mission.



Shallow geothermal energy using ground-source heat pumps is an important renewable resource. IGS hydrogeologist Shawn Naylor is involved in a study near the two largest population centers in Indiana — Indianapolis and Fort Wayne. He and his team installed equipment that takes continuous measurements of thermal properties and moisture content of the soil. This information will allow heat pump installers to tailor systems for specific geologic conditions and seasonal changes, resulting in greater efficiency and energy savings.



Coal, oil, natural gas. Scientists at the IGS are involved in assessing the distribution and quality of the state's energy resources and determining the feasibility of developing new ones like shale oil, coal-bed methane, and geothermal energy. The IGS's important sources of information—geologic maps, rock and core collections, and well records—help geologists refine our understanding of these vital resources to help Indiana sustain a viable economy.

## Energy resources: Sustaining an economic engine

IGS coal geologist Maria Mastalerz and her team investigate the chemical properties of various Indiana coals for use in new technologies of energy production, such as integrated gasification combined cycle systems and underground coal gasification. These processes use coal in new ways to maximize energy production with fewer environmental costs.



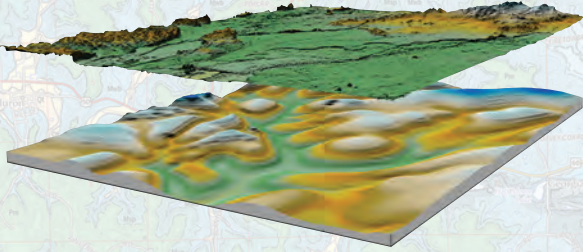
Hydrogeologist Sally Letsinger uses numerical and geospatial analytical techniques to study surface flow and to estimate groundwater recharge for different geologic settings in Indiana. Using hydrologic and geologic data, she also examines the susceptibility of aquifers to contamination. Dr. Letsinger mentors several graduate students, who assist her with the design of field experiments to understand the role of evapotranspiration to drought and groundwater-flow models, which are computer programs that predict the movement of water underground.



## Hydrology: Understanding our water resources

IGS hydrogeologists study the relationship between surface- and groundwater to better understand the water cycle in Indiana, information that is vital to responsible water management. They investigate the sources of supply and discharge of streams, lakes, and rivers; how precipitation, weather, and climate affect water levels; and how we can better protect our surface water resources from agricultural, industrial, and residential pollution. IGS scientists also map the extent of groundwater supplies and their surrounding rock strata; these maps are then used to help protect aquifers from contamination.





Geologic mapping is one of the critical tools needed to plan for greater economic development in Indiana. Accurate geologic maps assure that the state continues to prosper, and that Indiana's land, water, energy, and mineral resources are adequate for the present and sustainable for times ahead. Using advanced techniques to produce high-quality maps, the IGS analyzes the present to predict the future: the future of our drinking water, infrastructure, agricultural land, environment, and demographic makeup. Such information is important to every citizen of Indiana, from those responsible for making decisions about the use of our resources, to high school students learning the earth sciences.

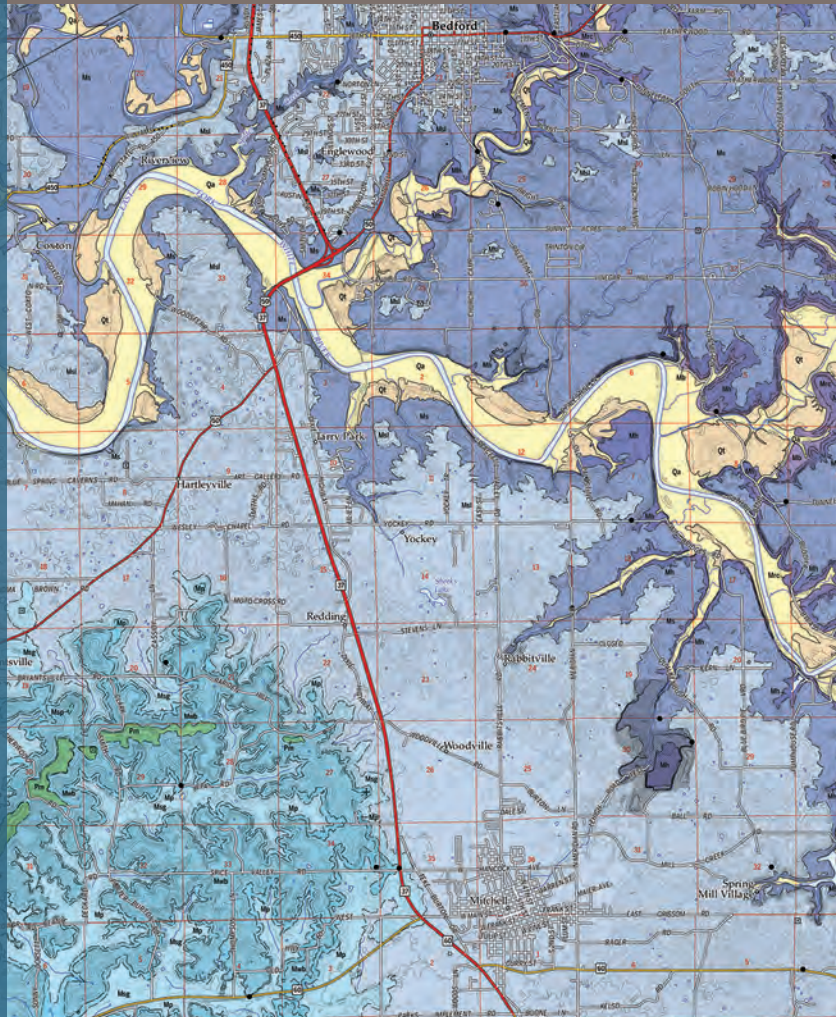
# Geology of Indiana: Mapping the fundamental layers

"As economic development continues in Indiana, the need for basic surficial and bedrock geology maps will become more acute. I am impressed with the 3-D modeling techniques being developed and refined by the IGS.... Only with such high-quality data can the state move toward environmentally sensible and sustainable development."

– Dr. Kathy Licht, Professor of Geology, Indiana University–Purdue University Indianapolis

"The fundamental research and understanding made possible by the [IGS'] STATEMAP products provide baseline insights for various environmental vulnerabilities and potential consequences. Understanding vulnerabilities and consequences are central to our ability to assess risks and manage those risks in a prudent manner on behalf of the citizens of Indiana."

– Roger Koelpin, Chief, Critical Infrastructure Section, Indiana Department of Homeland Security



Surface mining, energy production, and industrial development have long-lasting effects that not only alter the state's landscape but influence our quality of life as well. For decades, IGS investigators have measured the chemical effects of these activities and have developed methods to minimize or remediate long-term outcomes.



## Environmental geology: Reducing our impact on the Earth



IGS scientist John Rupp and his team are investigating the possibility of using the deep subsurface to store carbon dioxide from fossil fuel usage — a practice known as geological sequestration. They are evaluating the character of the state's geology to determine its suitability for long-term, secure storage of CO<sub>2</sub>. The knowledge gained from their research is of broad value to government, industry, and researchers working on the various types of technologies used in carbon capture, utilization, and storage.



# Mineral resources: Assessing Indiana's mineral wealth



Rocks and mineral resources are essential for Indiana's continued economic development. Rich deposits of limestone, dolomite, gypsum, and sand and gravel are source materials for concrete and mortar used in building foundations, roadways, and bridges. Because these are bulky, heavy materials, the cost of transporting them from source to use is important in determining their economic value. The IGS mapping program accurately locates these mineral commodities so that effective routing and shipping keeps their cost as low as possible.

Another valuable resource is Indiana limestone, renowned the world over as a premier building stone. Survey scientists carefully map, test, and assess this valuable mineral resource to benefit the state's economy.

Earthquakes, landslides, mine subsidence, and sinkholes are dangerous and costly events that directly affect Indiana's populace. The IGS researches the causes and maps the locations of these hazards. Informing citizens and governmental agencies about these risks and how to respond to them is an important part of the IGS mission.

IGS Education and Outreach Coordinator Walter Gray runs one of the IGS's most successful educational programs — the Quake Cottage — a simulator that gives people a safe but realistic experience of the intense shaking that can occur during an earthquake. Individuals come away with a heightened awareness of seismic risk, a deeper understanding of the science of earthquakes, and information about how to prepare for an earthquake.

## Geologic hazards: Making citizens safer



On Mt. Baldy, a huge sand dune in the Indiana Dunes National Lakeshore, IGS geologists Todd Thompson and William Monaghan are investigating the cause of mysterious and dangerous holes, which seem to appear and vanish within the span of just 24 hours. In 2013, a 6-year-old boy fell into one and barely survived being buried under 11 feet of sand for 3½ hours. The dune has been closed since the accident. The scientific team's working theory is that old trees — buried in the dune as the sands shifted inland — have disintegrated and are now causing the sand to collapse.



# Outreach and education: Sharing geoscience information

Through their diverse outreach activities, IGS scientists interact directly with the people of Indiana to help them understand how geology affects their lives. Besides offering presentations, workshops, and exhibits, staff members create content and materials for K–12 teachers and provide practical training and work opportunities for undergraduate and graduate students. By engaging schoolkids in the classroom, we hope to inspire the next generation of geoscientists.

## Committed to community engagement

- Classroom presentations
- Scouting and 4-H demonstrations
- Teacher workshops and short courses
- Quake Cottage demonstrations and earthquake preparedness exercises
- GeoFest at the Indiana State Museum
- County Commissioner presentations
- Earth Science Week
- Science Olympiad
- Fossil Fest at Falls of the Ohio State Park
- Hoosier Association of Science Teachers, Inc., conference
- Gem, mineral, and fossil shows
- Indiana GIS Conference and GIS Day at Indiana University
- Indiana Master Naturalist Program
- Indiana Mineral Aggregates Association Teacher's Workshop
- Indiana Academy of Science
- Midwest Groundwater Conference



# Delivering vital data to the public

The Survey has always published reports about the state's geology, but in today's fast-paced world, easy access to data is a must. At [igs.indiana.edu](http://igs.indiana.edu), you will find interactive mapping sites and databases, articles, project reports, and an online bookstore, with both technical and general interest content for all types of users.



## IndianaMap

The IGS has a vital role in the creation and operation of IndianaMap—the largest publicly available collection of Indiana geographic information system (GIS) map data. This GIS is used by government agencies and citizens across the state for transportation planning, economic development, environmental assessment, and emergency response, among many other uses.



## IGSMAP

IGSMAP is the public source for geologic maps and data in Indiana. The Map Gallery helps people find commonly used maps and information to better understand Indiana's geologic materials, resources, and issues.



## Petroleum Database Management System

The IGS PDMS is a Web application that contains data on more than 75,000 petroleum-related wells. It includes information on well locations, completion zones, geophysical logs, operators, lease names, tests, hydrocarbon shows, samples, cores, and geologic formations.



## Coal Mine Information System

The Indiana Coal Mine Information System—an online GIS collection of historical mine maps and data—shows the location and extent of documented coal mines in Indiana that operated since the late 1800s. This powerful tool can be used in evaluating abandoned mine sites and when assessing properties for subsidence risk.



## IGS Bookstore

Access the IGS online catalog of more than 2,000 IGS-published reports, books, maps, and posters that are available to order or download in a variety of digital and printed formats.

# Geologic collections: Indiana's library of the Earth

Throughout years of research and study, the IGS has collected rocks, minerals, sediment and rock cores, drill cuttings, oil and gas histories, coal mine maps, petrophysical analyses, and data derived from field sampling and investigations. These collections constitute a valuable "library of the Earth" that is used by IGS geologists in their daily work to efficiently serve diverse clientele and respond to inquiries. All the materials are catalogued, archived, and freely available for public inspection and examination.

