Mission
To provide objective, integrated scientific research and service, in cooperation with other academic and research units of the University of Illinois and elsewhere, that allow citizens and decision-makers to make choices that ensure sustainable economic development, enduring environmental quality, and cultural resource preservation for the people, businesses, and governments of Illinois.

Vision
The Prairie Research Institute will serve as a model of proactive, multidisciplinary research and service as a key to economic development, environmental quality, and cultural resource preservation. The incorporation of the Institute into a major research university is a unique opportunity to integrate the University’s intellectual capital with the Institute’s ability to apply science to societal challenges as an example for the nation and the world.
It is a pleasure to celebrate the fifth anniversary of the Prairie Research Institute’s official move into the University of Illinois at Urbana-Champaign. But, of course, we know that the relationship among the Illinois State Scientific Surveys and the university is one that goes back far longer, back to our university roots. Jonathan Baldwin Turner—often acknowledged as the force behind the Morrill Act that led to our 1867 charter—was also the inaugural president of the Natural History Society of Illinois, which would become what we now know as the Illinois Natural History Survey. This is a proud legacy of scientific discovery in the public interest that continues today.

The five Surveys of the Institute comprise one of the most productive and most visible applied scientific research centers in the nation, if not the world. This unique collaborative organization of more than 1,000 staff and scientists is a driver of state and economic development as well as a leader in the exploration and preservation of the state’s natural and cultural resources.

The formal addition of the Prairie Research Institute to the university organization has opened new doors for interdisciplinary research, international collaboration, and new transformative educational opportunities for our students.

We have always been fortunate to have the Illinois Scientific Surveys physically located here on the Urbana-Champaign campus. This affiliation and cooperation that spans over 160 years has brought discovery after discovery about the world around us—and also below and above us. Together we have given a new model and definition to science in the public interest and expanded the idea of what a land-grant university should be and can do.

The legislative act that formalized this relationship five years ago only made that relationship stronger and opened new doors to what we can accomplish in our next century together.

Phyllis M. Wise  
Chancellor  
University of Illinois at Urbana-Champaign
FROM THE FOUNDING EXECUTIVE DIRECTOR

This edition of the Prairie Research Institute’s Annual Report marks our fifth anniversary (July 1, 2013) as an integral part of the University of Illinois. In that short time we have grown to be the largest Institute on the Urbana campus, with over 1,000 employees. From 2008 through Fiscal Year 2013, our annual external research funding has more than doubled, from $28 million to more than $60 million, evenly split between state and federal contracts and grants.

Our core state funding has remained steady at $15.8 million, and with that stable core, we generate one in every 10 research dollars that the university receives from external sources. Raw numbers do not adequately capture the value of the Institute to the state and university, however. As our various component Surveys have done throughout their 160+ year history, we provide a vitally important, focused source of objective natural and cultural resource data and expertise to our clients in Illinois and beyond.

As I approach my 50th anniversary of working with Scientific Surveys in Canada and the United States, I am reminded of how natural and cultural resource science serves society while providing a rewarding career for research scientists and individuals who deliver scientific and technical services. In my own case, the research that I conducted to address societal needs in the areas of mineral development and environmental security allowed me the tools and resources for amazing research opportunities while fulfilling my primary role of serving the public with objective data on which to base important decisions. In my experience, most of the employees of the 70 or more Scientific Surveys in North America are inspired by the same goals that have made my career so rewarding.

Over the spring and summer of 2013, the Institute has, in consultation with our staff, advisory board, and constituents from the university, government, business, and nonprofits, created a short, but comprehensive Strategic Plan which is designed to bolster and guide our employees as they pursue research projects and service. The plan is a blueprint for assuring our stakeholders that our work will be designed to fulfill the Surveys’ traditional expertise and information role while providing abundant opportunities for staff to grow professionally.

The plan establishes four broad goals designed to foster our already well-established inter-Survey multi-disciplinary research projects while improving collaboration with our colleagues on campus and among our external clients. The goals are:

- Enhance scientific knowledge through research applied to scientific and societal challenges
- Build on the Institute’s extensive data, information, and service to support science, policy development, and decision-making
• Enhance visibility and understanding of the Institute
• Ensure effective staffing and leadership, efficient administration, modern facilities and equipment, and adequate funding to support the work of the Institute.

We have thrived in our five years as full members of the University of Illinois community, and, with the strategic planning, we have laid the groundwork for even greater accomplishments in the decades ahead. We are celebrating our anniversary with special lectures and events throughout the year and look forward to our next big milestone in 2017, the 100-year anniversary of the placement of the original three Surveys under one governing board. This anniversary, commemorating the creation of the most unique state scientific research entity in the U.S., will correspond, coincidentally, with the 150th anniversary of the founding of the University of Illinois. The Institute and university have a long, unique, and fruitful relationship that is well worth recognizing as we plan for an exciting future.

William W. Shilts, PhD
Founding Executive Director

On August 14, Governor Quinn signed revisory legislation for the Prairie Research Institute, creating Public Act 098-0346. The Act updates Institute and Survey names which were changed or incomplete in prior legislation. It also establishes the Illinois State Archaeological Survey in state statute similar to the other Surveys and designates seven state scientists within the Institute.

The Illinois State Climatologist, Entomologist, and Geologist have been associated with the Scientific Surveys and have long histories of distinguished service to the state. This Act establishes these positions in statute and adds four new scientific designations: Illinois State Archaeologist, Biologist, Hydrologist, and Pollution Prevention Scientist.

The state scientists serve as the authoritative spokespersons in their fields for the Surveys, the Institute, and the state. They provide real time updates on natural and cultural resources and hazard developments in the state, such as drought and weather conditions, earthquakes, and disease outbreaks, and information on research to other scientists, industry, governmental agencies, the news media, and the public at large. The state scientist positions will enhance the delivery of scientific service to decision makers and the public, advancing the Institute’s tradition of science in the public interest in Illinois.

The current state scientists appointed by the Executive Director of the Institute are:

Brian D. Anderson, PhD, State Biologist
James R. Angel, PhD, State Climatologist
Misganaw Demissie, PhD, State Hydrologist
Christopher H. Dietrich, PhD, State Entomologist
Thomas E. Emerson, PhD, State Archaeologist
E. Donald McKay III, PhD, State Geologist
Kishore Rajagopalan, PhD, State Pollution Prevention Scientist

ILLINOIS STATE SCIENTIFIC SURVEYS ACT
Between FY2012 and FY2013, total expenditures for the Prairie Research Institute increased by $2.8 million or 3.5 percent to over $82.3 million. Since FY2008, total annual expenditures have increased by 62 percent. This growth has been mostly in grants from both federal and state agencies.

State appropriations of General Revenue Funds (GRF) and three special funds have remained steady. Federal grant funding increased from just under $10 million in FY2008 to just over $30 million in FY2013. Most of that increase has been in programs with the U.S. Department of Energy. Over the same period, state grant funding increased from about $16 million to $27 million. State granting agencies include the departments of Transportation, Natural Resources, and Commerce and Economic Opportunity.

The Institute receives almost as much grant and contract funding from state agencies as it does from federal agencies. This is a demonstration of the important partnerships the Prairie Research Institute establishes to address urgent issues for the people of Illinois.

In FY2013, the $15.8 million state GRF appropriation leveraged over $66.3 million in external funding (federal, state, local, and private grants), which was a 4.2:1 multiplier on the state’s investment.

The Prairie Research Institute has a total FY2013 payroll of $43.6 million, supporting over 1,000 staff. About 234 of these staff are supported directly by GRF. External funding (80 percent) and three special state funds (1 percent) support an additional 668 staff, plus 142 students, who are either supervised or led by the GRF staff on hundreds of active Institute projects across the state.
SCIENTIFIC SERVICE FOR CITIZENS AND DECISION MAKERS

Among the Institute’s most enduring and valuable services are our legislative mandates to collect, curate, analyze, and publish information for the public. Major services are highlighted here. Institute researchers maintain 60 databases and data clearinghouse programs.

**Prairie Research Institute Library**
The Institute library is a portal to the work of the Institute and the best starting point for our holdings. Our large print collection focuses on the Illinois environment and the surrounding regions. Our website features guides and research aids on a wide variety of topics. Professional librarians with subject expertise assist on-site and online.

library.illinois.edu/prairie

**Illinois State Water Survey Public Service Laboratory**
The Public Service Laboratory has provided information to Illinois citizens about their water for over 100 years. Originally testing for disease, the lab’s current focus is mineral content, including trace contaminants such as arsenic.

isws.illinois.edu/chem/psl

**Geological Records Unit and Domestic Well Data**
The public may access data on historic and active wells throughout Illinois from the Geological Records Unit (ISGS) and Domestic Well and Groundwater Data Unit (ISWS).

isgs.illinois.edu/geological-records-unit
isws.illinois.edu/data/gwdb/

**Weather and Climate Tracking**
The Illinois State Climatologist, Midwestern Regional Climate Center, and Water and Atmospheric Monitoring Program provide current and historical data on climate and weather. Data are available via the ISWS website, and the Illinois State Climatologist provides regular analyses via news outlets statewide.

isws.illinois.edu/atmos/statecli
mrcc.isws.illinois.edu
isws.illinois.edu/warm

**Flood Mapping**
Property owners, buyers, planners, and others can consult online Flood Insurance Rate Maps developed by ISWS to assess flood risk and the need for flood insurance.

isws.illinois.edu/fpi

**Institute Publications, Fact Sheets, and More**
The Institute’s publication program includes a wide range of products. For example, ISTC produces fact sheets designed to help businesses reduce waste and citizens appropriately handle household waste. We produce field guides on Illinois geology, plants, and animals and sell hundreds of maps, books, and other products at our sales office and online.

shop.inrs.illinois.edu

**Identification Service**
The scientists of the Illinois Natural History Survey provide an identification service for insects, plants, and more encountered by Illinois citizens in their homes or on their properties.

inhs.illinois.edu/resources/askus

**Archaeological Exhibits**
The Illinois State Archaeological Survey documents and exhibits early Illinois history in context. ISAS recently displayed artifacts uncovered during development of the Chicago/Rockford International Airport.

isas.illinois.edu/public_engagement/exhibits.shtml

**Traveling Science Center**
Illinois Natural History Survey staff use the Traveling Science Center to provide hands-on learning experiences for children and families throughout the state.

inhs.illinois.edu/outreach/tsc
Databases and data clearinghouse programs administered by the Institute include:

- Alternative Crop Suitability Mapping, ISWS
- Cahokia Archaeological Artifacts Database, ISAS
- Cook County Precipitation Network Daily Data Archive, ISWS
- Creel Surveys, INHS
- Critical Trends Assessment Program, INHS
- Cultural Resource Management Report Archives, ISAS
- Earth Systems Visualization Laboratory, ISGS
- Flood Discharge Database, ISWS
- Floodplain Model Data Inventory, ISWS
- Gamma Ray Logs Database, ISGS
- Geologic Quadrangle Maps, ISGS
- Great Lakes Pollution Prevention Roundtable, ISTC
- Historical Aerial Photography, ISGS
- Illinois Climate Normals, ISWS
- Illinois Cooperative Agricultural Pest Survey, INHS
- Illinois Drought, ISWS
- Illinois Historic Bridges Database, ISAS
- Illinois Inventory of Burial Sites, ISAS
- Illinois Mines: Coal Mines Viewer, ISGS
- Illinois Natural Areas Inventory, INHS
- Illinois Natural Resources Geospatial Data Clearinghouse, ISGS
- Illinois Oil and Gas Resources, ISGS
- Illinois Rivers Decision Support System Water Quality Database, ISWS
- Illinois Streamflow Assessment Model, ISWS
- Illinois Water Inventory Program, ISWS
- Imperial Valley Precipitation Network Daily Data Archive, ISWS
- Inventory of Resource Rich Areas in Illinois, INHS
- LiDAR Elevation Data and Maps, ISGS
- Long-Term Illinois River Fish Population Monitoring Project / Long-Term Electrofishing Project, INHS
- Long-Term Resource Monitoring Project, INHS
- Midwestern Regional Climate Center, ISWS
- National Atmospheric Deposition Program, ISWS
- Ammonia Monitoring Network
- Atmospheric Integrated Research Monitoring Network
- Atmospheric Mercury Network
- Mercury Deposition Network
- National Trends Network
- Natural History Collections Databases, INHS
- Nitrogen Cycles Project, ISWS
- Printers’ National Environmental Assistance Center, ISTC
- Project Notification System for Tribes, ISAS
- Public Land Survey System, ISGS
- Seismometer Data, ISGS
- Water and Atmospheric Resources Monitoring Program, ISWS
- Illinois Climate Network
- Illinois Water and Climate Summaries
- In-Stream Sediment
- Provisional Monthly Streamflows
- Shallow Groundwater Wells
- Waterfowl Inventories, INHS
- Watershed Monitoring Data, ISWS
- Wells and Related Boreholes (oil, water, coal, and engineering), ISGS
ADDRESSING CLIMATE CHANGE

Climate change is a defining issue of our time, and Prairie Research Institute researchers are working on it from all angles—prediction, mitigation, and adaptation. As applied scientists, we use long-term data, modeling, innovative technologies, field and lab expertise, and collaborative partnerships to help Illinois and the world manage the challenge of climate change.

Reducing CO2

Over the past ten years, the ISGS-Advanced Energy Technology Initiative (AETI) has successfully led one of the world’s largest demonstrations of geologic carbon sequestration, the Illinois Basin-Decatur Project, funded by the U.S. Department of Energy (U.S. DOE) and the Illinois Department of Commerce and Economic Opportunity, with partners Archer Daniels Midland Company (ADM) and Schlumberger Carbon Services. As leader of the Midwest Geologic Sequestration Consortium (MGSC), the team is working on behalf of its partners to find a balance between our growing energy needs and climate concerns by capturing carbon dioxide (CO2) created in industrial processes and storing it safely underground in geological formations.

In May, the project reached a major milestone, its halfway point, injecting 500,000 metric tons of CO2 into the Mount Simon Sandstone, a deep saline formation, 7,000 feet beneath the surface at the ADM ethanol facility in Decatur.

“Deployment of carbon capture and sequestration is critical to achieving deep reductions in greenhouse gas emissions in the U.S. and around the world,” said Julio Friedmann, U.S. DOE Office of Fossil Energy. “This project, supported by ADM, ISGS, and MGSC, stands as a critical example of scientific excellence and what successful commercial CCS should achieve for any point source—safe, effective, low-cost storage.”

“While the industrial processes required to make carbon sequestration possible have been known for some time, they have never been applied at the scale required to significantly reduce the atmospheric build-up of CO2,” said Robert Finley, leader of the ISGS-AETI team. “Our challenge is to show the value of these technologies within our region to demonstrate that CO2 can be stored safely and economically deep underground.”

Scientists from Australia, China, Japan, Norway, South Korea, Spain, and Taiwan have come to Illinois to see the project and learn from the team. In October 2012, the international Carbon Sequestration Leadership Forum recognized the project for significant contributions to the development of global carbon dioxide mitigation technologies.

Researcher Wei Zheng at ISTC is sequestering carbon by producing biochar from yard waste and crop residue and using it as fertilizer. Adding biochar to soil can reduce up to one-half the need for chemical fertilizers, which require fossil fuels and release CO2 to manufacture. Scientist B.K. Sharma is investigating technologies that curtail CO2 emissions such as powering cars and factories with biofuels converted from plants such as Miscanthus, switchgrass, and corn stover, which emit less CO2 than oil, gas, and coal.

Weather Data

David Kristovich, an atmospheric scientist at ISWS, and his group conduct studies of lake-effect snow patterns which confirm that the annual accumulation has increased around all of the Great Lakes except Lake Michigan. “The frequency of extreme weather events is increasing throughout most of the country. We see a general increase in atmospheric water vapor associated with global warming that is exacerbated by CO2 emissions from the burning of fossil fuels,” said Kristovich.

Robert LaPlante, science operations officer at the National Oceanic and Atmospheric Administration (NOAA) at Cleveland uses data generated by the
group. LaPlante is attempting to answer questions such as why storm behavior varies when storms cross the Great Lakes and what causes lake-effect snow and why is it increasing.

“Dave provides very thorough observational studies and accurate short-term predictions,” said LaPlante. NOAA provides Kristovich with airport observational data; temperature, moisture, and wind data; and satellite and radar imaging to make the predictions.

**Biologic Trends**

The INHS’ Critical Trends Assessment Program (CTAP) asks questions such as how plant and animal populations relate to their geography and which species are migrating due to a warming climate. Now in its fourth five-year cycle, the program has created a unique dataset of both baseline and trend lines for the state’s plant and animal communities. The data can indicate the vulnerability of species to climate change and help conservation managers focus on habitats and species of concern.

Jeffrey Matthews, assistant professor of Natural Resources and Environmental Sciences at the U of I, said, “CTAP data not only have great value for monitoring the success of wetland restorations, but also they can help in modeling and predicting the effects of extreme events such as flooding upon wetlands and how they might respond to various changes in the global climate,” he said.

**RELATED PUBLICATIONS**


MANAGING WATER RESOURCES

The management of water resources involves planning, prediction, and protection. Institute scientists and engineers map sources such as streams, reservoirs, and aquifers; model flow and predict future needs; and address water quality using our own scientific data as well as other sources. We assist communities that want to study their water supply and work with neighboring communities to avoid future conflicts over water.

Water Supply Planning
In recent years, the sustainability of water supplies has become a serious concern. Since 2006, ISWS researchers and collaborators have undertaken and completed comprehensive regional water supply management studies for three areas of the state: northeastern Illinois, east-central Illinois, and, in 2013, the 22-county Kaskaskia River Basin in southwestern and south-central Illinois. These studies to determine the adequacy of supply for population growth, agriculture, industry, and ecology involve local stakeholders with representation from water use and public-interest sectors.

Using hydrological modeling, combined with data on water resources, population, and development, ISWS researchers develop forecasts of how water supplies will fare in the next 35 years. In the Kaskaskia region, most community reservoirs appear to have an adequate supply but six are considered at risk of water shortages (Altamont, Breese, Coulterville, Fairfield, Farina, Wayne City).

The modeling and analysis for the Kaskaskia study was a cooperative effort among ISWS, the Illinois Department of Natural Resources Office of Water Resources, Southern Illinois University-Carbondale, and the Kaskaskia Basin Water Supply Planning Committee, the local stakeholder group.

Mapping Aquifers
3-D hydrogeologic maps created by ISGS scientists for McHenry County will give stakeholders a better understanding of what’s under their feet, according
to Jason Thomason, ISGS hydrogeologist. For a growing, developing county that is 100 percent dependent on groundwater for potable water, information about local aquifers will provide critical insights into current and future water supply conditions.

The McHenry County Department of Planning and Development is incorporating the 3-D maps into land-use regulations. “The regulations utilize the maps to help reduce the potential for aquifer contamination and will help in maintaining aquifer recharge,” said Cory Horton, water resources manager. “The flow model created from the geologic data will allow us to analyze water use conflicts and assist us in proactively managing our water resources.”

Eastern McHenry County is already undergoing significant groundwater resource stress due to suburban expansion. A study to the year 2030 shows that the more westerly portions of the county may also experience these challenges unless water resources are protected.

“If we can understand where aquifers are distributed in the subsurface, how much water is there, where it’s coming from, and where it’s moving, planners can make better management decisions,” Thomason said. “Water usage in McHenry County is only expected to increase.”

The 3-D maps, which have also been created for Lake, Kendall, and Kane Counties at varying resolutions, depict new information on the thickness, distribution, sedimentology, and hydraulic characteristics of sand and gravel aquifers.

A highly detailed predictive groundwater flow model, developed by ISWS, will allow the county to manage its future water use to minimize drawdown in wells and the subsequent impacts to the natural environment.

**Water Quality**
Tim Loftus, water resource planner at the Chicago Metropolitan Agency for Planning (CMAP) which serves as regional planning agency for seven counties in northeastern Illinois, uses a comprehensive water resources plan compiled with data and advice from Institute researchers. The plan delineates watershed and water quality parameters for the Chicago region.

“ISWS is a key partner with us in water-related work that is driven by data,” said Loftus. ISWS researchers help CMAP make informed recommendations to decision makers. According to Loftus, his agency’s recommendations are defensible because they are developed by scientists.

Loftus also works with ISWS to help integrate the water quality management plans of the Fox River Study Group at the regional and statewide level. ISWS researchers provide data and analyses to both groups.

**RELATED PUBLICATIONS**


HELPING COMMUNITIES MANAGE RISK

Local governments, businesses, insurance companies, and individuals call on the Prairie Research Institute to help understand and manage risk and exposure to natural and human-caused hazards such as extreme weather, earthquakes, drought, floods, and invasive species. Institute researchers provide expertise, technology, and comprehensive data resources to advise decision makers at every level, from the governor and CEO to the farmer and homeowner.

**Floodplain Mapping**

ISWS helps Illinois communities predict and prepare for floods, which account for more than 90 percent of declared disasters in Illinois, according to the Federal Emergency Management Agency (FEMA). Sally McConkey, water resources engineer with the Survey, leads the FEMA-funded effort to produce new floodplain maps for communities across Illinois. McConkey’s team has updated maps in 79 counties and performed hydraulic studies, risk analyses, and stakeholder consultations in dozens of localities statewide.

The team includes engineers and hydrologists who interpret detailed information about watershed, land use, and climate trends to generate detailed river stage forecasts. Combining scientific expertise with computer models and new maps using LiDAR-enhanced elevation data has enabled a huge leap forward in precision floodplain mapping, analysis, and management.

According to Derrick Martin, a senior water resources engineer with the consulting firm V3 Companies in Chicago, the ISWS’s commitment to excellent service matters, too. “The map revision process used to take a year or more,” he said. “The Water Survey has reduced that drastically. Their whole attitude is, ‘let’s solve the problem.’ Resolving issues efficiently is good for all the parties involved.”

Communities that adopt a floodplain ordinance, update their maps, and take action to mitigate risk become eligible for federal flood insurance through the National Flood Insurance Program.

**Focus: Freeport**

Shelly Griswold, the community development director and floodplain manager for Freeport, Illinois, had a serious problem. “The Pecatonica River and Yellow Creek are prone to flooding, and our floodplain maps were inaccurate and out of date.” Serious floods in the summers of 2010 and 2011 confirmed her fears. Neighborhoods and commercial districts well outside the officially delineated floodplain were inundated. “Residents, businesses, city planners, and regulators all needed better information about flood risk to move forward.” Griswold appealed to Sally McConkey and her team at ISWS, which partnered with city and federal agencies to fast-track new maps.

They pioneered a series of dynamic web-based maps that show the extent and depth of flooding at different river stages. Linked to the official river stage forecast, these real-time inundation maps are a powerful tool to communicate and manage flood risk. “We developed this tool to meet a specific need in Freeport, but now we are able to extend this approach to other communities in Illinois,” said McConkey.

**Invasive Species**

INHS expertise with Asian carp has made it an integral partner in the multi-state, multi-agency effort to keep the invasive species from colonizing the Great Lakes. Biologists with INHS developed a simulation model that suggests Asian carp may not thrive in the deep, open water regions of Lakes Michigan, Superior, or Huron, but could become established in shallower lakes and near shores, inlets, and bays.
INHS research contributes to the ongoing design of nonpermanent barriers to Asian carp migration. State and federal agencies and elected officials have begun to discuss a more permanent physical barrier between the Great Lakes and Mississippi River watershed. Expertise from across the Institute will be vital to integrated solutions that best balance the economic and environmental functions of these public waterways.

The Illinois Cooperative Agricultural Pest Survey (CAPS) is coordinated by INHS in collaboration with state and federal departments of agriculture and is designed to detect and evaluate the risk to the state’s agricultural and natural resources from invasive pests, diseases, and weeds that have eluded first-line defense inspections. “The efforts of coordinator Kelly Estes and the CAPS team are vital in helping Illinois succeed and grow in the global commodity export arena. Their dedication and devotion to detail is instrumental in the growth and safeguarding of the Illinois agricultural economy,” said Mark Cinnamon, state plant regulatory officer with the Illinois Department of Agriculture.

**RELATED PUBLICATIONS**


**Leveraging Technology**

ISGS, working with the Illinois Department of Transportation, National Oceanic and Atmospheric Administration, U.S. Geological Survey, U.S. Army Corps of Engineers, counties, and other agencies, has acquired LiDAR-enhanced elevation data for approximately three-quarters of Illinois counties to make high resolution maps of the earth’s surface, accurate within inches. These maps provide the ISWS flood mapping team with elevation data which are 100 times more detailed than the best prior data, and enable them to assist communities and citizens with flood planning much more effectively. LiDAR-based maps are also valuable for managing risks from subsidence, sinkholes, and karst terrain as well as for land use and development issues.
Land use planning in Illinois encompasses research from all divisions of the Prairie Research Institute and integrates our past, present, and future. Whether the need is to maintain the purity of water resources, ensure sustainable development of land, find and protect rare species and their habitats, or preserve Native American historic sites, Institute science supports these efforts and other land use goals of citizens and decision makers throughout the state.

Jo Daviess County
Jo Daviess County in northwest Illinois is not a typical Illinois landscape. Its unglaciated topography holds forested hills; high, rocky river bluffs; and unique plants, animals, and habitats. Native Americans lived off its natural resources and left behind artifacts, dwellings, and large earthen mounds. The lead and zinc mining town of Galena thrived in the late nineteenth century then fell into decline, leaving a rare combination of an exceptionally preserved historic downtown surrounded by beautiful forested countryside.

Today, the citizens of Jo Daviess County link their economic development goals to tourism and the preservation of natural and cultural resources that attract thousands of visitors each year. Through land use planning, based upon scientific data and sustainable practices, Jo Daviess County has shown that preservation of resources and economic development can be mutually supportive endeavors.

Passionate citizens like Beth Baranski turned to the Prairie Research Institute for its wealth of scientific data, educational and outreach resources, and its researchers, whom she says are always accessible. “The depth and breadth of the Prairie Research Institute’s data and the knowledge of its researchers helped us understand the science that goes into land planning, which gave us an objective foundation on which to build our own development plans.” Baranski is a board member of the county’s League of Women Voters, which has spearheaded a number of environmental initiatives and works to promote civic collaboration.

Cultural Sites
ISAS archaeologist Phil Millhouse advised the Jo Daviess Conservation Foundation’s efforts to acquire and preserve historic cultural sites in and around Jo Daviess County. Millhouse explained that one challenge is how to provide access with the least amount of impact to the site and surroundings. “Ideally, planning for cultural sites will attract tourists who will patronize local businesses and utilize the area’s recreational and cultural resources over and over,” he said. Under his guidance, 640 acres containing 53 Native American burial and effigy mounds have been acquired. At each site, the Foundation, Millhouse, and others identify cultural resources, create walking trails, and establish plans to make sites available to the public. According to Steve Barg, executive director of the Foundation, “The knowledge and passion, and the ability of ISAS staff to convey information is outstanding.”
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Water Quality
Citizens of Jo Daviess County sought the advice of Institute scientists when the county was considering approval of a large-scale dairy with thousands of cows. Institute hydrologists and geologists verified that the proposed site overlay a porous karst rock formation through which groundwater seeped. Their data showed that without significant changes to the dairy’s development plan, waste from thousands of dairy cows would contaminate the area’s water supplies. The dairy owners decided that the requisite alterations were too costly to build on the site.

According to ISGS geochemist Sam Panno, “Anything you do to land affects and changes its water quality.” Everything from treated sewage discharges to applying silage to farmland to salting roads in winter can overload streams, springs, and wells with harmful substances. Panno works closely with Walt Kelly, a geochemist at ISWS, to characterize the hydrology and geology of Jo Daviess County. Using a combination of historic data, field investigations, and the creation of groundwater quality databases, Panno and Kelly provide valuable information used by developers, agencies, landowners, and citizens to help determine the best ways to manage and use land while protecting water resources.

Natural Habitat
Steve Barg of the Jo Daviess Conservation Foundation said one of the most useful resources of the Prairie Research Institute is the Illinois Natural Areas Inventory led by INHS. Barg explained that the inventory is vital to him in his efforts to preserve natural areas such as the Apple River corridor. “We turn to Institute researchers to help us interpret data and to utilize their biological collections for stewardship of our natural areas.”

Tom Benson, director of the Critical Trends Assessment Program (CTAP) of INHS, says that his group has worked closely with the Foundation to assist them in their preservation efforts. His staff samples sites for threatened, endangered, and rare species and generates a species list for clients who range from private landowners to state and federal resource managers. Land development consulting firms regularly turn to CTAP for assistance in developing environmental impact statements.

RELATED PUBLICATIONS


REDDING ILLINOIS’ ENVIRONMENTAL FOOTPRINT

Institute scientists and engineers work with businesses, utilities, government agencies, and citizens to prevent pollution, conserve natural resources, and reduce waste to protect human health and the environment of Illinois and beyond. Using applied research, technical assistance and demonstrations, and information services, we help implement solutions to today’s and tomorrow’s environmental and economic challenges.

Technical Assistance
ADOP2T (Accelerated Diffusion of Pollution Prevention Technologies) is a model for greening Illinois industry developed by ISTC engineers.

“The ADOP2T approach has been a great success in our region,” according to Christine Anderson, pollution prevention coordinator for the U.S. Environmental Protection Agency’s Region 5. “During the onsite trial period, businesses get to observe the environmental and economic benefits these technologies provide their business,” Anderson explained. “Once businesses witness how these technologies can reduce their environmental footprint while saving them money, they are much more likely to invest in and integrate these technologies into their operations for the long-term.”

During FY2013, ISTC staff led an effort focused on suburban Chicago’s DuPage County businesses and saved $335,674 in energy costs, 1.8 million gallons of water, and 6,800 gallons of wastewater among other environmental benefits.

“Companies have really embraced a green business paradigm,” said Deb Jacobson, manager of the program. “Lean manufacturing is the major motivation, but 95 percent of manufacturers have environmental benefits on their radar screens.”

Tim Lindsey, global director of sustainable development for Caterpillar Inc., who developed the ADOP2T model while at ISTC in the 1990s, agreed. “There is a continuous struggle with respect to value, bottom line, and investments, so sustainability projects have to compete,” he said. “One of the big drivers for sustainability is reputation. Top management will go to great lengths to protect and enhance the brand.”

Focus: Manufacturing
Matt Bochantin loves to save money. He calls every incremental cost savings at Eaton’s B-Line division manufacturing plant in Highland—a kiss. His career has been built partly on the aggressive use of new technologies to cut waste, save money, and make his company more competitive. For this, he has had the close assistance of the Emerging Technology Assistance Program (TAP) at ISTC.

TAP uses early adopters like Bochantin to test and demonstrate sustainable technologies and processes, creating real-world examples that help speed adoption statewide and beyond.

“Back then I was under the gun to cut energy costs,” he said. Now, he oversees operations at seven facilities and travels to B-line plants nationwide to deliver waste-to-profit lessons.

Eaton’s B-Line business involves milling metal, painting, and electroplating. They use large quantities of water, paint, solvents, and coolants and have learned to reuse and recycle all of those.

At the recommendation of ISTC’s Kishore Rajagopalan, an expert in the reuse of industrial effluents, the company was among the first to apply ultrafiltration. Bochantin once discharged paint-laced water from his line about nine times a year. With ultrafiltration, he has been able to recover the paint, recycle the water, and replace the water in the system less than once a year. This translates into nearly $45,000 a year in reduced costs, 78 percent less water used and wastewater generated, a 7 percent cut in paint purchases, and 32 percent reduction in chemical use.
"The ISTC relationship has made a difference for Eaton being a good neighbor in our communities and a good steward of the environment, “said Bochantin.

**Technology Demonstrations**
In June, ISTC scientists demonstrated a new technology to help Chicago’s Metropolitan Wastewater Reclamation District (MWRD) meet its ambitious goal of becoming energy neutral. A “drop-in” in-stream hydrokinetic turbine captures energy produced when water falls through various tanks during the treatment process and converts it to electricity.

“It’s exciting to see new innovations helping us achieve this goal,” said MWRD Commissioner Frank Avila. The demonstration facility is the world’s largest waste water treatment plant.

**Weatherization Training**
Passive weatherization nationwide would produce a $45.5 billion boost to the economy, a reduction in energy consumption, and a significant cut in greenhouse gas emissions, according to recent estimates. With the first accredited program in the state, ISTC’s Indoor Climate Research and Training group (ICRT) helps professionals prepare for certification under the U.S. Department of Energy’s Weatherization Assistance Program which distributes $200-250 million to weatherize about 100,000 homes nationwide each year.

**Reducing Mercury Emissions**
New rules limiting mercury emissions from coal-fired power plants in the U.S. took effect in 2013 covering 600 power plants, the dominant emitters of mercury. ISGS scientists and chemical engineers have pioneered more cost-effective technologies to reduce mercury emissions and costs by up to 50 percent. Technologies for on-site production of activated carbon and calcium-based sorbents to remove mercury and acid gases in coal combustion flue gases were developed and patented with support from the Electric Power Research Institute. Several U.S. and international companies are negotiating commercialization and licensing agreements.

**RELATED PUBLICATIONS**


Institute scientists and engineers anticipate, develop, and deliver science and information in a form and timeframe which decision makers can use. Our science is especially valued for its objectivity. We provide the best available science and data related to decisions, alternatives, and expected outcomes. We work closely with state and local governments, industry, nonprofits, and citizens to ensure that our research portfolio and information products align with current priorities and future needs. Our goal is to enable our constituents to meet their own goals, including public health and safety, sustainable economic development, environmental and cultural resource stewardship, efficiency, and waste reduction.

**Hydraulic Fracturing**


ISGS scientists provided information on areas for hydrocarbon exploration, potential seismicity, drilling practices, wastewater management, and groundwater contamination studies from other parts of the country. The Illinois Hydraulic Fracturing Regulatory Act was passed and signed by the General Assembly and Governor in June. It includes what the Environmental Law and Policy Center call “the strongest protections against water pollution in the nation.”

Groundwater contamination is one of the biggest concerns regarding hydraulic fracturing. Robert Bauer, an engineering geologist at ISGS, said lessons learned in other states informed the Illinois law. “The best studies are those in which folks go in before drilling and sample water supplies and groundwater wells in the area, and then after drilling and hydraulic fracturing have taken place, conduct additional sampling,” he said. “Those types of studies are required in the new act.”

Another public concern with hydraulic fracturing is earthquakes. “There’s a misimpression that the fracturing process itself can cause earthquakes,” said Bauer. “We directed attention instead to risks associated with underground disposal of large volumes of wastewater. Illinois’s new law is the first in the nation to adopt the National Research Council’s best practices for seismic screening and monitoring of wastewater injection sites.”

**Drought Response**

ISWS scientists and engineers contributed extensive data and expertise to *The Drought of 2012: A Report of the Governor’s Drought Response Task Force*, published in March. The report documents the drought in Illinois and its impacts on agriculture and water supplies, as well as on other environmental and economic concerns. It also identifies areas in which further planning and preparation for future drought should occur, including policy and technology issues and limitations in governmental response.

The Drought Response Task Force was activated by the Governor in June 2012 on the recommendation of ISWS when records and growing impact made it clear that Illinois was in drought. The interagency group monitored the state’s water resources and coordinated the state’s response to drought impacts.

The Water Survey’s long-term, comprehensive data on precipitation, streamflow, lake levels, and groundwater were critically important to state and local managers, who needed to understand impacts and risk as they formed action plans for conservation and contingency supplies. In addition, the Water Survey’s State Climatologist, an expert on
drought, gave numerous presentations to organizations and groups and responded to countless media interview requests.

**Tribal Communications**

This year, as a direct result of cooperative discussions under new protocols, a major burial discovery in the East St. Louis right-of-way of the new Stan Musial Veteran’s Memorial Bridge was recognized, consolidated, and preserved as the Feature 2000 Preservation Area. Thanks to award-winning consultation protocol developed with the help of ISAS, discoveries of cultural artifacts, sites, and burial grounds associated with Illinois Department of Transportation (IDOT) projects are now handled via mutually agreed upon procedures for tribal notification, consultation, and disposition.

IDOT-ISAS tribal consultation efforts for the New Mississippi River Bridge project “exemplify effective consultation” and IDOT and ISAS “staff were respectful, an important factor in tribal consultation,” according to the tribal historic preservation officer of the Miami Tribe in a 2013 study conducted by the National Cooperative Highway Research Program.

The Memorandum of Understanding for Tribal Consultation was ratified by 26 federally recognized tribes with an interest in Illinois, IDOT, the Illinois Historic Preservation Agency, and the Federal Highway Administration.

**RELATED PUBLICATIONS**


- **Angel, J. R. 2013.** The 2012 drought in Illinois: Its development and impacts. 20th Conference on Applied Climatology, Jan 5-10, 2013, Austin, Texas.


The Illinois Natural History Survey has studied the natural world since 1858. Over the years, its mission has remained to investigate the diversity, life histories, and ecology of plants and animals both locally and globally and to provide scientific information so that these resources can be managed wisely.

From the Director
In the five years since the Illinois Natural History Survey became part of the Prairie Research Institute and the University of Illinois, our research portfolio and the extramural funding which supports it have grown significantly. Over the past few years, we have made modest but strategic investments designed to provide the institutional support to continue to broaden the scope and impact of our research.

Among other things, we restructured our support for web services; re-focused our education and outreach efforts to better share and communicate our scientific programs with a new emphasis on videography and social media; and broadened our administrative support for scientists in procuring equipment, tracking project budgets, and hiring project staff. We also established revolving funds to upgrade and replace scientific equipment and information technology, and to repair facilities damaged by floods, tornados, or other unforeseen events.

Last year, we piloted a new Competitive Postdocs program inviting some of the best and brightest early career scientists to write proposals for cutting-edge research in the natural sciences. With supplemental financial support from the Institute and the Office of the Vice Chancellor for Research, we hired five postdoctoral scientists who will conduct their research over the next two years and use their results to seek follow-up funding.

These may seem like mundane efforts, and it may be a few years before we see the fruits of our investments. But, those fruits will be more and better information about the biotic resources of Illinois—information that will contribute to the Illinois economy and the quality of life of all Illinoisans.
For nearly a century, archaeologists at the University of Illinois have studied the state’s archaeological heritage, while protecting, preserving, and interpreting irreplaceable sites and artifacts. The newest Scientific Survey in the Prairie Research Institute, the Illinois State Archaeological Survey, conducts multiple-scale field and laboratory research projects, serves as a major repository and source of scientific archaeological information, and collaborates with industry, government agencies, and the public to assist them in making informed decisions involving the state’s heritage resources.

**From the Director**

ISAS scientists continue to document the contributions of the wide diversity of peoples who have contributed to Illinois’ rich cultural history, ranging from its first inhabitants 10,000 years ago to the more recent French, English, and American immigrants of the past few hundred years. Our researchers play a key role in facilitating the development and expansion of the state’s transportation infrastructure. This year, ISAS concluded more than five years of excavations at a 1,000-year-old prehistoric mound center that was to be impacted by the new, much needed, Stan Musial Veterans Memorial Bridge between St. Louis and Illinois. These excavations, the largest in the nation, revealed more than 1,400 houses and ceremonial monuments lying under the foundations of the present-day East St Louis metropolis.

We have expanded our activities to assist communities in managing aspects of local preservation, protection, and interpretation of heritage resources. A significant aspect of this work is our collaborative partnerships with those concerned with the preservation of natural resources, especially through the state’s Land and Water Reserve program. These joint efforts with private landowners and state and not-for-profit organizations ensure the long-term preservation of important natural and archaeological areas for future Illinoisans, particularly in the northern part of the state.

Since its inception, ISAS has focused on engaging the public and the business community to better serve them. To that end, the Survey is dedicated to the collection and interpretation of data on the state’s heritage resources to help business and community leaders understand the impacts of development on such resources and, with our sister Surveys, to assist them in making informed decisions about the development and management of Illinois’ most important resource—the land itself.
The Illinois State Geological Survey serves the citizens of Illinois by upholding the highest standards for scientific research, service, and professionalism in providing earth science information relevant to the state’s environmental quality, economic vitality, public health, and safety. Its staff of approximately 180 scientists and technical and support personnel conduct basic and applied geological research, create new geologic maps, and gather and manage the state’s geological data. ISGS provides technical assistance and information to industry, government agencies, and the public about the geology, earth hazards, groundwater, and energy and mineral resources of Illinois.

From the Director

When persistent summer drought occurred in 2012, farmers in northwestern Illinois reported unusual crop patterns to ISGS, which led to a rare opportunity for our scientists to observe natural cracks in near-surface bedrock in the region. These “crop lines” in alfalfa fields had resulted from moisture stress where thin soil overlay fractured rock. Long taproots in buried fractures sustained overlying plants, but elsewhere the crop was stunted. A study of new aerial photography identified nearly 18,000 fractures at more than 100 locations, providing insight into the bedrock fracture systems that control recharge and function as karst aquifers.

In its spring session the Illinois General Assembly passed, and in June 2013 the Governor signed, the Illinois Hydraulic Fracturing Regulatory Act. ISGS had participated in the process as the bill was drafted in a series of meetings involving environmental activists, industry representatives, and state regulatory and enforcement authorities. Our scientists provided input on geologic settings of Illinois petroleum production, seismicity, water resources, and relevant research findings from Illinois and elsewhere. The resulting law has been described as one of the toughest in the nation regulating hydraulic fracturing.

Striving to help home and business owners determine proximity of their properties to underground mines, which may pose a subsidence hazard, ISGS created an online map viewer (ILMINES) on its website that provides views of mines near any given street address in Illinois.
The Illinois State Water Survey has been a leader in the study of water resources for more than a century. Founded in 1895, its original mission was to survey Illinois waters to trace the spread of waterborne disease and help develop sanitary standards for drinking water. Over the years, the ISWS mission and scope have expanded to include scientific research and service programs related to water and atmospheric resources in Illinois.

From the Director
2013 was a very productive year for ISWS. Not only did we secure funding for major programs, such as the Midwestern Regional Climate Center and the Coordinated Hazard Assessment and Mapping Program, but we also received grants for new projects. Research funded by the National Science Foundation will investigate the influence of upwind lakes on the intensity of lake-effect snowstorms over downwind lakes. The results of the study will greatly improve computer models that predict lake-effect snowstorms, benefiting millions of residents in the Great Lakes region.

Our scientists continue to collaborate with the Illinois Department of Natural Resources, the Illinois and U.S. Environmental Protection Agencies, and other federal, state, and local agencies, to provide science-based data on cost-efficient ways to manage our natural resources. In addition, policy and decision makers continually turn to Water Survey scientists for their expertise, seeking answers to challenging questions on resource sustainability. Current issues—water supply planning, flood risk mitigation, climate change, and watershed and stream restoration—remain a priority.

As the drought continued in many areas of Illinois, so did our efforts to monitor its effects. Scientists participated in the Governor’s Drought Task Force meetings and drafted publications to provide information on current drought conditions and future outlooks. The ISWS website is a valuable resource for updated drought information, maps, and data.

On the regional level, the Midwestern Regional Climate Center launched a new online climate data system where users can access data in various spatial and time scales for free. Real-time and historical climate data from across the U.S. are available as well as value-added tools, such as customizable charts of climate data, growing season statistics, degree day products and graphs, freeze statistics, ranking of climate values, gridded maps of climate data and averages over various regions, and much more.
Since 1985, the Illinois Sustainable Technology Center (ISTC) has helped organizations and citizens implement sustainable solutions to environmental and economic challenges. ISTC’s mission is to encourage and assist citizens and businesses to prevent pollution, conserve natural resources, and reduce waste to protect human health and the environment in Illinois and beyond. Our vision is to be a catalyst for change toward more sustainable technologies, processes, and practices through our integrated program of research, demonstration projects, technical assistance, and communication.

From the Interim Director
In 2013, we continued our efforts in water resource protection and conservation. Our research focused on emerging threats to water quality, such as the persistence and effects of triclosan, a commonly used compound in antibacterial soap and other products. We are also tracing the fate and transport of hormones and pharmaceuticals as well as plastic micro-particles pollution in wastewater.

In the area of water conservation, this past year our technical assistance team saved almost 2 million gallons of water for DuPage County businesses and helped save 58 million gallons over a four-year period for businesses and communities participating in our Illinois Conservation of Resources and Energy (ICORE) program. That program received a Most Valuable Pollution Prevention award from the National Pollution Prevention Roundtable. In addition, we are developing new techniques for water desalination and evaluating uses for saline wastewater.

The ICORE project also helped its participants reduce energy use by 49 million kilowatt hours in the same four-year period. Our technology demonstration of a new pico-turbine at the Stickney waste water treatment plant in Chicago, which is using the effluent to power the turbine, is expected to help the Metropolitan Water Reclamation District meet its sustainability goals.

Other highlights include projects which will encourage more electronics recycling/reuse; production of value-added products from waste biomass; a zero-waste initiative at ISTC which we have expanded to assist the U of I campus in their waste reduction efforts; and our Indoor Climate Research and Training Group earning national accreditation for its training programs, the first accredited weatherization training center in Illinois.

Public engagement continues to be important to our mission. We enjoy closer ties with the U of I through collaboration in public events, guest lectures, and sustainability presentations. We continue to enhance sustainability education, research, and practices in Illinois and beyond.
AWARDS AND HONORS, FY2013

Sarah Baires, Erin Benson, and Ian Fricker, ISAS
Charles J. Bareis Research Assistantship Awards

Nani Bhownik, ISWS
Volunteer Service Award (Chair, Science Advisory Committee, Illinois River Coordinating Council)
Illinois Lt. Governor Sheila Simon

Jamie Cater, ISAS
Charles J. Bareis Award in North American Archaeology
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Pat Charlebois, INHS
Lake Guardian Award
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George Czapar, ISWS
Fulbright Specialist Grant

Matt Diana, INHS
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Duane Esarey, ISAS
2013 Manning Award for Outstanding Dissertation in Anthropology
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Illinois Invasive Species Awareness Award

Jared Freiburg and Hannes Leetaru, ISGS
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Randy Locke, ISGS
2013 Illinois Groundwater Scientific Research Achievement Award
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B.K. Sharma, ISTC
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