ILLINOIS NATURAL HISTORY SURVEY

by
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Since 1858, the Illinois Natural History Survey has been the guardian and recorder of the biological resources of Illinois—the state's biological memory. With a staff of over 200 scientists and technicians, it is recognized as the premier natural history survey in the nation. Over the years, its mission has remained fairly constant: to investigate the diversity, life histories, and ecology of the plants and animals of the state; to publish research results so that those resources can be managed wisely; and to provide information to the public in order to foster an understanding and appreciation of our natural heritage.

HISTORY

By 1858, Illinois had been a state for 40 years. Its pioneer period was over. Railroad lines crisscrossed the state, Chicago was the largest city, and Illinois State Normal University (later Illinois State University) was the only state-supported college. Illinois had an agricultural society and a horticultural society whose members were mainly interested in tools and farming methods. For those interested in the scientific study of the state's natural history, something new and broader in scope was needed. At the State Teachers Association meeting in December 1857, Cyrus Thomas, a lawyer, teacher, and self-taught entomologist from Carbondale, proposed that a Natural History Society of Illinois be established.

On June 30, 1858, the society was organized and housed at Illinois State Normal University in Normal. It was legally chartered by the state legislature on February 22, 1861. In its original charter, the society was given the dual purpose of preparing "a scientific survey of the State of Illinois in all departments of natural history," and establishing a museum of natural history at Illinois State Normal University. The society's first president was Jonathan Baldwin Turner, with Cyrus Thomas the first curator. With the establishment of a Natural History Museum in Springfield in 1877, the Natural
History Society became the State Laboratory of Natural History. The new title brought more responsibilities. The State Laboratory was responsible for providing materials for the new Natural History Museum, supplying educational institutions and high schools with material for instructional purposes, continuing plant and animal surveys, and was to begin studies in economic entomology.

In 1872, Stephen Alfred Forbes had become the fourth appointed curator of the museum, succeeding John Wesley Powell. He was named director of the new State Laboratory of Natural History in 1877, and in 1882 he became both the Director of the State Laboratory of Natural History and the State Entomologist. Forbes moved from Normal to Urbana in 1885 to accept a position with the Illinois Industrial University (soon to be called the University of Illinois). He was able to gain approval by the state legislature to transfer the State Laboratory of Natural History and its staff, library, and research collections to Urbana. In 1917, the State Laboratory of Natural History and the Office of the State Entomologist were combined by the General Assembly as the Illinois Natural History Survey (INHS). Stephen Forbes became director (chief) and held this position until his death in 1930. Today, the INHS is still housed on the campus of the University of Illinois, but it is a division of the Illinois Department of Natural Resources.

To Forbes the word survey meant more than a censusing of organisms or publishing lists showing their distribution. He felt that any study should define the relationships between living organisms and their environment—an ecological survey. This theory prevailed in his work and underlined the early research done at the INHS. In 1880 Forbes stated, “The first indispensable requisite is a thorough knowledge of the natural order—an intelligently conducted natural history survey. Without the general knowledge which such a survey would give us, all our measures must be empirical, temporary, uncertain, and often dangerous.” Many components make up the INHS, but its research, collections, publications, long-term studies, field stations, and educational outreach have made the INHS not only the largest, but the most successful, state biological survey in the country.

RESEARCH

The beginning of all scientific information is research. Throughout the years, the questions may have changed, but the objective is still to provide the citizens of Illinois with accurate information about its natural resources and to provide solutions to problems. Scientists at the INHS are currently involved in over 250 research projects. These projects fall under the broad categories of restoration ecology and management, invasive species, watershed management, integrated pest management, medical entomology, endangered and threatened species, fish and wildlife ecology, and taxonomic studies.

Entomology was one of the original areas of emphasis for the fledgling State Laboratory of Natural History. In 1915 Stephen Forbes wrote, “The struggle between man and insects began long before the dawn of civilization, has continued without cessation to the present time, and will continue, no doubt, as long as the human race endures. It is due to the
fact that both men and certain insect species constantly want the same things at the same time." One has only to read the headlines of today to see that insect problems still confront us, from mosquitoes bearing viruses to corn rootworms changing their habits and wreaking havoc in Illinois corn.

Change the word **insect** in Forbes' quote to **exotic species**, and we have an updated quote for what is now facing Illinois ecosystems—garlic mustard replacing spring forbs in woods; zebra mussels spreading down the Illinois River; **Daphnia lumholtzi**, a small water flea, moving up the Illinois River; and the state's newest invader, the Asian longhorned beetle, posing a serious threat to hardwood trees in northeastern Illinois. Currently, quarantine and destruction of infected trees are the only ways to control its spread. As with many of the state's invasive species, INHS scientists are studying the problem and looking for solutions. Some good news on the research front with exotics is the work the INHS is doing with a beetle that feeds exclusively on purple loosestrife—a showy weed from Europe that has taken over many of our wetlands. Beetles are reared at the INHS and sent to cooperators throughout northern Illinois for release and establishment in a classical biological control effort. It is showing great promise in controlling purple loosestrife populations.

In 1961, INHS zoologist Philip Smith wrote in *Amphibians and Reptiles of Illinois*, "The state [Illinois] could be described as a great corn desert containing remnants of many habitat types." Illinois' natural habitats are relatively small (less than one-tenth of 1% of the state is high-quality natural habitat) and suffer threats not only from non-native invasive species, but also from problems associated with their improvement. These projects all fall in the broad area of restoration ecology.

Fire has become an essential management tool to help eliminate plant invaders and restore ecosystem health, but is all fire good? INHS scientists are studying the effects of fire on insect populations, on prairie annuals, and on bird communities. Other questions involve the reproductive differences between prairie plants in restorations versus reconstructions, and the value of earthworms as indicators of soil health. Perhaps the largest study of restoration ecology will be conducted at two relatively new sites for INHS field staff—Midewin National Tallgrass Prairie and the Savanna Army Depot. These two sites are the focal points for major restoration efforts for tallgrass and sand prairies. These huge areas will provide a vital connection between research and the "real world," as scientists oversee the monitoring efforts and conduct research related to restoration.

Jonathan Baldwin Turner, the first president of the Illinois Natural History Society, said in his inaugural address, "A true philosophy, as it seems to me, would never let us rest content till we had truly and fully learned not the bare name and form, but the final cause and use, the good and evil, the full relation of each thing, object and being, to all other beings." When the INHS was first organized, the goal was to collect, document, and study relationships of Illinois species. One hundred forty years later, floral and faunal surveys are still conducted. Many times these surveys are in conjunction with wetland mitigation and highway and bridge construction sites where biologists are looking for high-quality natural
Researchers collect mussels from the bed of Phelps Lake near Havana (1894).

Collections

The biological collections of the INHS can be likened to a library of natural history, only one made up of carefully preserved specimens instead of books. Each specimen consists not only of plant or animal material, but also contains a record of the date, locality, habitat, and often other data about the organism. First established in the mid-19th century for the purpose of documenting the flora and fauna of Illinois, the collections preserve some of the earliest natural history specimens collected in the midwestern United States. Due to natural events and human activities, the environment is ever-changing, and these collections serve as irreplaceable historical records of our natural heritage. For example, collections of sensitive aquatic insects—mayflies, stoneflies, and caddisflies—were amassed from 1930 to 1950, before major changes in stream quality took place, and represent irreplaceable evidence of the existence of a former widespread sensitive fauna.

All major groups of organisms are represented in the collections, but the INHS's strengths are its insect, fish, mollusk, crustacean, amphibian and reptile, vascular plant, and fungi collections. These collections represent not only the largest collections of their kind in Illinois; they also rank high in North America. The insect collection, with over 6,250,000 curated specimens, is the eighth largest in North America. The fish collection, with its 761,000 specimens, is the 15th largest collection. Many of the collections have a heavy concentration of specimens from the last third of the 1800s, making them some of North America's oldest collections. While most of the specimens are from Illinois, biological populations do not respect political boundaries, and the INHS's collections contain species from throughout North America and the world.

Many of the INHS's research endeavors use its collections and the data from them, which are stored in computer databases for easy access. Scientists use the records to determine which species are found in Illinois. This information can then be used by the citizenry in controlling pests, protecting communities or threatened and endangered species. Some surveys are done looking for remnant populations of a species thought to no longer occur. Other surveys are sampling large forest tracts in search of rare birds or to determine the nesting success of decreasing forest birds. New native species—such as the redside dace, a minnow recently discovered in Winnebago County—are still being found.

In 1927 Stephen Forbes commented at a meeting of the Committee on Agriculture of the National Research Council, “The rivers of the country have received so little comprehensive attention from our biologists that I do not know of a single attempt anywhere in America to develop and disclose the complete biology of a river system except that which has been made by us in Illinois.” With three field stations on the Illinois River, one on the Kaskaskia River, and one on Lake Michigan, biologists of the INHS are still leaders in the area of watershed ecology. The field stations provide biologists with the access and facilities they need to do the intensive studies required to understand the ecology of the state's large bodies of water. With problems such as sedimentation, invasive species, increased barge traffic, and the manipulation of water levels below dams, more detailed studies are needed to understand both the dynamics of these systems and how best to manage the species that are surviving under these changing conditions.


Herpetologist examines a southern leopard frog along the Kaskaskia River (1998).
rare species, or merely looking for a particular organism for whatever reason. Ecologists and conservation biologists use the collections to understand the temporal changes taking place in biological communities. To document changes in species distribution, they again look to collections. The data associated with the biological collections of the INHS provide some of the most effective means for providing the public with information about changes that are taking place in the Illinois environment.

**LONG-TERM STUDIES**

One of the early publications by the INHS was *The Fishes of Illinois* (1909), done by Stephen Forbes and Robert E. Richardson. During their first survey, 187 native and 1 non-native fish species were documented; a second survey was carried out in 1979 with 179 native and 6 non-native fish species found. Soon, the third survey will be published showing 176 native and 12 non-native fishes. Due to the INHS’s extensive collections and databases, long-term studies (investigations exceeding 10 years) such as these are possible. These studies permit comparisons and evaluations that are otherwise rarely possible. The “fishes of Illinois” study will enhance the state’s ability to protect and restore its aquatic communities and is just one example of the long-term studies at the INHS.

Several long-term projects involve the Illinois River. For the past 50 years, populations of waterfowl and other birds migrating through the Illinois River Valley have been monitored by aerial censuses conducted by INHS scientists. These data provide a useful index to the waterfowl populations in the region and are an indicator of wetland habitat quality and the quantity remaining in the Illinois River system. Another study on the Illinois River is resurveying areas that were sampled 30 years ago for mussels. While there has been an overall net decline in mussels found throughout the basin, mussels are again being found in the upper reaches of the Illinois River where 30 years ago they were absent due to pollution.

Perhaps the most exciting of the INHS’s long-term projects is still in its infancy—the Critical Trends Assessment Project (CTAP) statewide monitoring. The monitoring has two parts—data collected by volunteers and data collected by INHS biologists. Through this project, the health of the state’s rivers and streams, forests, grasslands, wetlands, and soils will be monitored more comprehensively than ever before. This is the first statewide effort to randomly sample these habitats and to begin to look at longer-term changes.

All of the long-term data sets are conceptually similar to the INHS’s biological collections—they transcend individual investigators, and their value increases as years pass and as additional material is added.

**FIELD STATIONS**

The INHS has its main offices and laboratories on the campus of the University of Illinois at Urbana-Champaign, but its research is strengthened by studies conducted throughout the state. The first field station was established by Stephen Forbes at Havana in 1894, known today as the Forbes Biological Station. The Havana station was originally not stationary, but afloat as it carried out “continuous investigation of the aquatic life of the Illinois River and its dependent waters.” It was the first inland aquatic biological station in America equipped for continuous investigation and the first in the world to undertake the serious study of the biology of a river system.

Today, the Havana station works in three areas: river and wetland ecology, population studies of aquatic organisms and migratory birds, and toxicological and habitat studies. The station’s studies of the wood duck, waterfowl migrations, and lead poisoning are considered landmarks in the field. The investigation of the effects of lead shot on waterfowl spanned a period of 40 years and was instrumental in
developing a federal program implemented nation-wide in 1991 for eliminating lead shot for waterfowl hunting.

Ridge Lake Biological Station near Charleston, Sam Parr Biological Station near Kinmundy, and the Kaskaska Biological Station at Sullivan all work together for the understanding of fisheries ecology and management. Sam Parr station has a complex of large experimental ponds; Ridge Lake is a 14-acre drainable lake and was the first lake where scientists were able to control the water level. The Kaskaska station is located on Lake Shelbyville, a large flood-control reservoir. The research at these three stations can be used to modify and improve fisheries management for the benefit of all anglers in Illinois. The Great Rivers Field Station in Alton and the Long-term Resource Monitoring Station at Havana were established on the two large floodplain rivers (Mississippi and Illinois). They are components of an upper Mississippi River basin network of six stations operated by five states to collect and analyze data on fish populations, vegetation, and water quality with the purpose of long-term monitoring to establish trends. The Lake Michigan Biological Station at Zion deals with the aquatic interactions in the Lake Michigan ecosystem. Field presences were established at the Savanna Army Depot in northwestern Illinois and at Midewin National Tallgrass Prairie in Will County in 1998. These two sites are the focal points for major restoration efforts for tallgrass and sand prairies with the emphasis on the effectiveness of restoration efforts in establishing viable populations of prairie plants and grassland bird habitat.

EDUCATIONAL OUTREACH

In 1891 Stephen Forbes wrote, “Children must be drawn toward and not away from the woods, fields, and waters, and must be led to see more clearly . . . that a man cut off from the fellowship with the creatures of the open air is like a tree deprived of all its lateral roots and trimmed to a single branch. He may grow down and up, but he cannot grow out. His resources of enjoyment are so narrowed that he is often an object of pity when seen away from the city street.” Forbes knew the importance of introducing all ages to natural history, and the INHS continues the tradition of providing the citizens of Illinois with scientific information about the biological resources of the state. This often involves translating complex science into understandable and usable forms such as popular articles, teaching materials, non-technical reports, workshops, traveling exhibits, and large-scale science days. While it may seem that the educational efforts are heading in many different directions, they all share the common goal of teaching this and future generations about Illinois, its biological resources, and issues it will face in the coming years. In the words of a former chief of the INHS, “Without question, the educational outreach program of the Survey will continue to grow and will prove one of our best investments in the biological future of Illinois.”
FUTURE
Throughout its existence, the INHS has attempted to meet the needs of Illinois with an eye to the state's future requirements. In 1907 Forbes wrote, "I shall be governed by the reflection that we are today looking forward and not back—that we are preparing for the future..."

A great challenge of today is that we must protect those natural areas we still have and restore highly disturbed lands where we can, so that we might leave for future generations some of the biological legacy of the past. To do this will require the research of the trained ecologist who can provide the knowledge and tools we will need to meet this daunting task. The INHS stands poised to lead this effort in the 21st century. Given the diversity of today's Survey programs, in all likelihood, Forbes would be pleased.

PUBLICATIONS
Prior to the establishment of the State Laboratory of Natural History, there were few outlets for scientific publications in the United States. One of the few was the Prairie Farmer. When Stephen Forbes became director of the State Laboratory, he considered presenting knowledge in a form accessible to all citizens one of the laboratory's most important duties. To quote Forbes in 1889, "It will be our main final object to furnish the materials for a full and accurate picture of the native plant and animal life of Illinois as it actually exists in our fields, woods, and waters."

In 1876 Forbes issued the first Bulletin; it was a List of Illinois Crustacea by S.A. Forbes. With subsequent title changes to fit administrative reorganizations, Bulletins have been published continuously since then. One of the most recent is The Fishes of Champaign County, Illinois, During a Century of Alterations of a Prairie Ecosystem. Throughout its existence, the Bulletin has reported the results of original research aimed toward technical workers in the biological sciences.

For a less technical slant, the Circular series, published at irregular intervals, featured practical information such as how to control diseases of trees or insect pests of shade trees. This series was discontinued in 1995.

Biological Notes, published continuously since 1933, are a hybrid between the two previous publications. Some Biological Notes are progress reports of extensive projects that could later be subjects of articles in the Bulletin, some are final reports of projects, while others are how-to articles. A fascinating series of Biological Notes was done by INHS ornithologists Richard and Jean Graber on Illinois birds.

In 1936, the INHS began to publish Manuals. Published for all ages, Manuals resemble a field guide in both size and content. The first was Fieldbook of Illinois Wild Flowers. The recently published Field Guide to Northeastern Longhorned Beetles is number 6 in the series.

A relatively new category of publications is Educational Materials. These may be slide sets with a narrative text, a video on Illinois diversity, coloring posters with accompanying workbooks, classroom curricula, or sets of cards about insect pests and natural enemies.

Survey Reports, published six times a year, provide readable accounts of research done by scientists at the INHS. They also include a "Species Spotlight" on an Illinois organism and "The Naturalist's Apprentice," a classroom activity dealing with the biodiversity of Illinois. To be on the mailing list for Survey Reports or to receive a publications catalog, write to the Illinois Natural History Survey, 172 Natural Resources Building, 607 East Peabody Drive, Champaign, IL 61820.

For more information about the Illinois Natural History Survey, check its web site at www.inhs.uiuc.edu.