Building Illinois' Biological Memory

A Framework for Long-Term Ecosystem Monitoring

"If we could first know where we are and whither we are tending, we could better judge what we do and how to do it . . . ."

— Abraham Lincoln

George Ryan, Governor
State of Illinois

Brent Manning, Director
Illinois Department of
Natural Resources

Building Illinois' Biological
A Framework for Long-Term Ecosy

A product of the Critical Trends Assessment

Illinois Department of Natural Res
Office of Realty and Environmental I
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524 S. Second Street
Springfield, Illinois 62701

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Authors: Ben Barber, Dana Curtiss, Da
Publication Design: Carolyn P. N
Maps: Liane Suloway
Photos: Michael R. Jeffords, Carolyn P. Nixon, Philip
and Illinois EcoWatch Network reference photos

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Michael R. Jeffords

The state's ecosystems are evolving from complex natural systems to simple, less stable, managed ones.

"If we could first know where we are and whither we are tending, we could better judge what we do and how to do it . . . ."

Abraham Lincoln

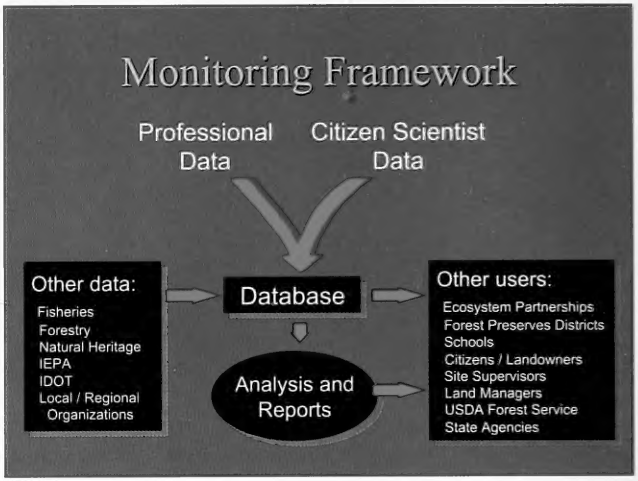
Monitoring the condition and extent of Illinois ecosystems was probably far from the mind of Abraham Lincoln when he made this simple yet powerful observation. Nevertheless, his words were the guiding principle on which the Department of Natural Resources' *Critical Trends Assessment Program (CTAP)* was conceived in 1992. This first-ever comprehensive assessment of Illinois' environment set the stage for an ongoing monitoring program involving conservation minded citizens and scientists dedicated to improving the state's scientific knowledge base. The program is already making large amounts of new information readily accessible to researchers, landowners, policy-makers, and the public. CTAP databases, reports, and other resources will be vital assets to public and private decision-makers as they consider strategies for managing environmental resources in a manner that benefits Illinois citizens now and in the future.

Where we are and whither we are tending . . .

Determining what is known and not known about ecological conditions was the focus of the first phase of CTAP. The results, detailed in a seven volume technical report released in 1994, documented a number of disturbing conditions. Although many conventional sources of pollution have been reduced in Illinois, the condition of the state's natural ecosystems is rapidly declining as a result of fragmentation and continual stress. More importantly, despite having amassed one of the largest and most comprehensive collections of environmental data anywhere in the world, state natural resource agencies lack sufficient information for accurately identifying and assessing statewide, regional, and site-specific trends in ecosystem health. Without knowing "where we are and whither we are tending," policy-makers and land managers alike are faced with making complex and often costly decisions without the benefit of sound scientific information.

Developing a Long-Term Monitoring Framework

Developing a system for the collection of such information is the goal of CTAP II—the second phase of CTAP. Specifically, CTAP has designed a multifaceted, ecosystem-based monitoring framework. This framework builds on a statistically valid sample of major natural ecosystems within Illinois. It assesses both the *condition* and *extent* of forest, grassland, wetland, and stream ecosystems at statewide and regional levels. These assessments establish baseline conditions against which future changes in ecological conditions can be measured. They also provide enhanced opportunities for ecosystem, habitat, or species-specific research and analysis.

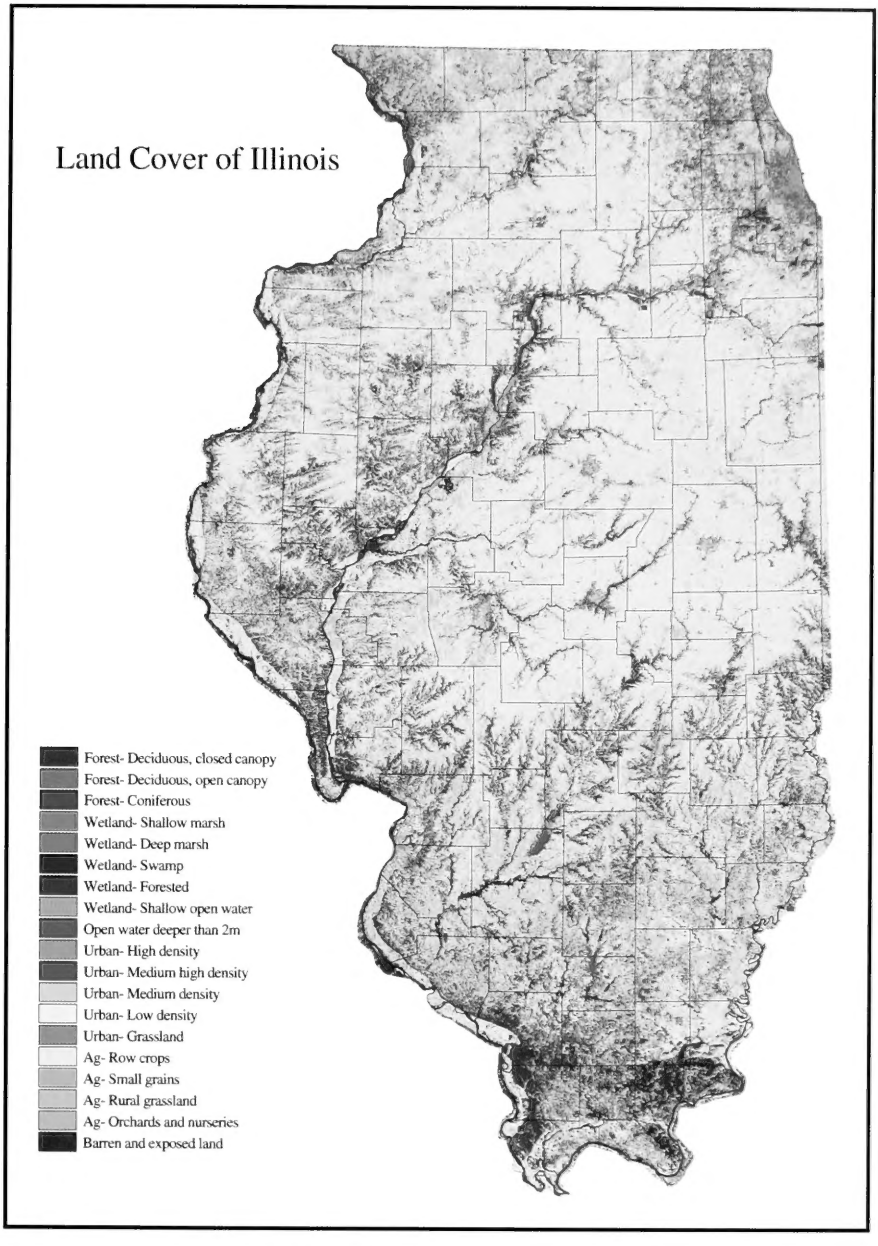


CTAP II combines professional and volunteer monitoring into a single, unified monitoring framework.

Within this framework, *extent* is measured by the Illinois Land Cover Database developed using satellite remote sensing systems with advanced computer technology such as geographic information systems (GIS). The database defines 20 broad categories, including three agricultural, five urban, five wetland, three woodland, one water, two grassland, and one barren/exposed land classes. A baseline Land Cover Atlas was initially developed in 1994–95. Different regions of the state are being updated annually, with the entire database being updated on a five-year cycle. *Condition* is measured using selected ecological indicators and composite indices collected from a random sample of sites throughout the state by professional scientists and citizen volunteers.

Vital to the success of this framework is the creation of a partnership that links the efforts of CTAP research scientists with Citizen Scientists trained through the Illinois EcoWatch Network (see sidebar "Illinois EcoWatch Network"). Each year, CTAP scientists conduct detailed biodiversity surveys on 30 randomly selected sites in each of 4 ecosystem types. At the same time, EcoWatch Citizen Scientists collect reliable scientific information on ecosystem conditions and biological indicators from hundreds of additional sites.

Both levels of monitoring present distinct advantages. Monitoring by CTAP scientists provides detailed information and the power of trend detection necessary to draw meaningful conclusions about ecosystem health. Citizen Scientist monitoring, on the other hand, allows for more frequent monitoring over many more sites. The value of these approaches is further enhanced through their integration under a single, unified monitoring framework. Combining the scientific community's expertise with well-trained, highly motivated volunteers increases CTAP's data collection capabilities from only a few dozen to literally hundreds of sites per year. The large volume of data produced as a result increases the speed and accuracy with which scientists can assess changes in ecosystem health. Key features of this monitoring partnership are summarized in the CTAP Monitoring Programs table on pages 6 and 7.



Using satellite remote sensing systems and advanced GIS technology, the Illinois Land Cover Database provides a dynamic tool for identifying critical changes in land use patterns over time.

Table 1. Sampling methods for CTAP scientists and EcoWatch Citizen Scientists closely resemble one another but va

CTAP/ EcoWatch Monitoring Programs

Ecosystem	Number of Sites Monitored *		Sampling Frequency and Timeframe	
	Professional	Volunteer	Professional	Volunteer
STREAMS	30 per year 150 total	100 per year 100 total	Every 5 Years April 1 – June 1	Every Year May 1 – June 30
FORESTS	30 per year 150 total	50 per year 100 total	Every 5 Years May 15 – June 30	Every 2 Years Spring: April 7 – May 25 Fall: August 1 – September 30
GRASSLANDS	30 per year 150 total	25 per year 50 total	Every 5 Years August 1 – August 31	Every 2 Years August 15 – October 1
WETLANDS	30 per year 150 total	25 per year 50 total	Every 5 Years July 1 – July 31	Every 2 Years July 1 – September 15

*Includes randomly selected priority sites only; does not include volunteer-selected Citizen Scientist sites.

Illinois EcoWatch Network: Linking Citizens with Scientists

As extensive as they are, existing state databases are insufficient to accurately assess ecosystem health on a statewide basis. The Illinois EcoWatch Network addresses this information gap by linking the efforts of CTAP research scientists and trained volunteers—referred to as Citizen Scientists—to collect the data necessary to track long-term trends in ecosystem health. In addition to broadening the scope of citizen involvement in ecological research efforts, EcoWatch provides state scientists with comprehensive information to supplement professional scientific databases.

RiverWatch is the largest and longest running program. It was established in response to citizen requests for a volunteer monitoring program that would provide standardized monitoring protocols and produce quality assured data. Since monitoring began in 1995, nearly 1,500 Citizen Scientists have collected data on more than 600 different stream sites.

ForestWatch was designed in 1996 and revised in 1997. Upland and bottomland forest sites are monitored once every two years. Since 1997, over 500 Citizen Scientists have monitored more than 102 sites.

PrairieWatch was developed in 1999. Due to the limited number and sensitive nature of Illinois prairies, suitable monitoring sites are limited as compared to RiverWatch and ForestWatch. Monitoring includes a census of indicator butterfly species.

WetlandWatch and **SoilWatch** are under development. WetlandWatch surveys wetland indicator plants and includes procedures specific to forested wetlands (swamps) in southern Illinois. SoilWatch focuses on soil ecology in terrestrial environments. It uses biological monitoring as a low-cost, low-tech approach to measuring soil quality on a continual basis.

UrbanWatch represents the nation's first large-scale, volunteer monitoring program focused on urban greenspaces. Developed in partnership with The Field Museum, it is designed to generate biodiversity profiles for urban parks, corporate campuses, golf courses, cemeteries, and other sites. UrbanWatch is an ideal springboard for more rigorous surveys offered through other EcoWatch monitoring programs. Piloting will take place in 2000 in Chicago.

n terms of sampling scale, monitoring frequency, and level of precision.

Sampling Unit and Size		What's Measured		Level of Identification	
Professional	**Volunteer**	**Professional**	**Volunteer**	**Professional**	**Volunteer**
Wadeable 50 m reach, minimum 10 m upstream from nearest bridge	Wadeable 200 ft reach, minimum 100 ft upstream from nearest bridge	Benthic macroinvertebrates, fishes, physical and chemical characteristics	Benthic macroinvertebrates, physical characteristics	Species	Order / Family
Three 50 m transects; circular study area with minimum 150 m radius	Three 50 m transects on sites measuring 150 m x 150 m; minimum 50% tree / shrub cover	Trees, shrubs, ground cover; birds and terrestrial insects; disturbance sensitive and non-native species	Trees, shrubs, disturbance-sensitive and invasive ground layer species	Species	Genus / Species
Twenty quadrats measuring $^1/_4$ m^2, generally along a single transect; 500 m^2 site with maximum 50% tree or shrub cover	One 50 m transect on a minimum 1000 m^2 site with maximum 50% tree or shrub cover	Trees, shrubs, ground cover (grasses, sedges and forbs); birds and terrestrial insects; native / non-native and disturbance sensitive species	Trees, shrubs, grasses, sedges, forbs, disturbance-sensitive and invasive ground layer species; butterflies	Species	Genus / Species
Twenty quadrats measuring $^1/_4$ m^2, generally along a single transect; 500 m^2 site with maximum 50% woody shrub or tree cover	One 50 m transect on a minimum 2500 m^2 site	Trees, shrubs, ground cover; birds and terrestrial insects; disturbance sensitive and non-native species	Trees, shrubs, disturbance-sensitive and invasive ground layer species	Species	Genus / Species

Michael R. Jeffords

Michael R. Jeffords

Even though the natural areas in Illinois are some of the most studied in the country, long-term, systematic data collection is needed to fully understand the changes that are taking place within our native habitats, such as forests (left), streams (center), and wetlands (right).

Ecowatch Citizen Scientists collect aquatic macroinvertebrates from an Illinois stream.

Ecological Indicators: Taking the Pulse of Ecosystem Health

Illinois is uniquely situated at America's ecological crossroads. Five distinct eco-regions or "biomes" come together within our state. They include the eastern deciduous forest, western great plain, northern boreal forest, Ozark uplift, and southern coastal plain. This patchwork of biomes is a melting pot for an extremely diverse range of flora and fauna. As host to more than 54,000 species of native organisms, Illinois contains some of the richest natural areas in the entire Midwest.

Given the abundance and variety of species throughout Illinois, using an inventory approach to track ecosystem health is both time consuming and expensive. Instead, scientists have devised a set of key ecological indicators to measure ecological trends and biodiversity. Indicators include native and non-native species known to reflect the condition of biotic integrity. Certain physical parameters describing habitat structure are also examined. Select species can be used as indicators themselves or as components of composite indices, which provide a snapshot of ecosystem health. Changes in the abundance or distribution of indicator organisms also reflect underlying changes in ecological factors influencing biodiversity.

Ecological indicators offer many advantages over other methods of measuring ecosystem health. They tend to be highly sensitive to small changes in ecosystem quality and allow conditions over a wide area to be assessed in a short period of time. Moreover, indicator-based monitoring methods are widely recognized and accepted among the scientific community, and are easily adapted for use by Citizen Scientists.

Five major taxanomic groups have been selected from which the primary CTAP/EcoWatch ecological indicators will be developed: vascular plants, birds, terrestrial insects, fishes, and aquatic macroinvertebrates (see Table 2 on page 10). Vascular plants are being monitored in forest, wetland, and grassland habitats to detect changes in biotic integrity. Encroachment by invasive and/or exotic species, disease, or altered fire regimes can lead to changes in community structure, the loss of sensitive native plant species, and the homogenization of historically diverse plant communities. Plant community indicators include the presence of "disturbance sensitive" native species, the diversity of native plant species, and the percent cover of exotic versus native plants. Other indicators are also being investigated. Long-term monitoring will reveal patterns of change within plant communities.

Bird populations are also being monitored in forests, wetlands, and grasslands. Indicators include, but are not limited to: the abundance and diversity of habitat specialists (for example, species that can only survive in wetlands); threatened and endangered species; species sensitive to fragmentation and other forms of habitat alteration; and the ratio of

cowbirds (brood parasites) to host species. Because birds are highly mobile, these indicators can reflect landscape conditions that extend beyond the boundaries of the habitat patches being investigated.

Terrestrial insects are the third taxa group being monitored in forests, wetlands and grasslands. They are the most diverse group of terrestrial organisms, both in number of species and in behavioral and ecological traits. CTAP is the first statewide, long-term monitoring program in the U.S. to incorporate data on a wide variety of arthropod taxa (primarily insects). Because insects are so diverse, CTAP research scientists are using indicators at two scales: the diversity of morpho-species (species that appear the same based on body structure) and the diversity of homopterans (leafhoppers, plant hoppers, cicadas, etc.). Homopterans are diverse, occupy a wide variety of habitats and exhibit a range of habitat specialization, making them a useful surrogate for insects as a whole.

In aquatic habitats, fishes are potentially good indicators of long-term impacts that occur over a range of scales, from individual stream sites to the watershed as a whole. They feed at various trophic levels (plants, insects, other fish), and are consumed by humans and other terrestrial species for food. Fishes are relatively easy to collect, are directly related to water quality standards used by many government agencies, and account for nearly half of the endangered vertebrate species and subspecies in the U.S. Moreover, environmental tolerance levels, life histories, and geographic distributions are better known for fishes than for any other group of freshwater organisms. Indicators generated from fish data include species richness, relative abundance, community structure (ratios of the different fish types in each sample), and the diversity and abundance of hybrids and exotic species.

Aquatic insects and other macroinvertebrates are also being monitored to assess the quality of aquatic habitats. Because sensitive aquatic insects are less mobile than fish and potentially respond more quickly to changes in stream health, they are better suited for interpreting site-specific impacts than are fish. Macro-invertebrates are abundant in most streams, while the numbers of fish in the smallest streams may be meager. Indicators include species richness, relative abundance, community structure, and dominance. These data form the basis for composite indices such as the Macroinvertebrate Biotic Index (MBI), the Hilsenhoff Biotic Index (HBI), and the Ephemeroptera (mayflies)-Plecoptera (stoneflies)-Trichoptera (caddisflies) index (EPT).

While the use of ecological indicators to track trends in ecosystem health is not a new concept, Illinois is unique in its comprehensive use of biological indicators to assess all major aquatic and terrestrial habitats. Many of the indicators have been borrowed or adapted from those used in other states; others are being tested for the first time in Illinois. The indicators and sampling methods for each ecosystem type are being reviewed and modified where necessary to ensure they are effective in measuring conditions in Illinois ecosystems.

Carolyn P. Nixon

Michael R. Jeffords

Michael R. Jeffords

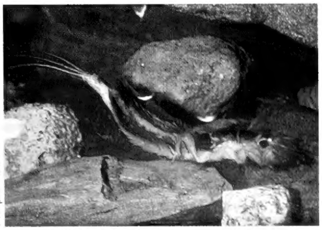
Garlic mustard (top) is an exotic weed that is replacing native wildflowers in Illinois forests; stoneflies (middle) are often abundant in clean, healthy streams; and pale purple coneflower (bottom) can disappear from a disturbed prairie.

Table 2. **Key ecological indicators can be examined independently and combined to produce additional indices for assessing ecosystem health.**

CTAP/EcoWatch Ecological Indicators

STREAMS	FORESTS	GRASSLANDS	WETLANDS
Fishes	**Plants**	**Plants**	**Plants**
Species richness Species dominance Percent exotic (non-native) species Index of Biotic Integrity (IBI)	Species richness Species dominance Community structure Coverage of non-native, sensitive and threatened / endangered species Species turnover (e.g., maple takeover) Index of Floristic Quality (IFQ)	Species richness Species dominance Community structure Coverage of non-native, sensitive and threatened / endangered species Species turnover Index of Floristic Quality (IFQ)	Species richness Species dominance Community structure Coverage of non-native, sensitive and threatened / endangered species Species turnover Index of Floristic Quality (IFQ)
Benthic Macroinvertebrates	**Terrestrial Insects**	**Terrestrial Insects**	**Terrestrial Insects**
Taxa richness Taxa dominance Macroinvertebrate Biotic Index Hilsenhoff Biotic Index	Richness of morpho-species * Presence of Auchenorrhychus Homoptera (leaf hoppers) Arthropod funcitonal diversity index Index of rarity, endemicity, and simplicity for Auchenorrhychus Homoptera (leaf hoppers)	Richness of morpho-species * Presence of Auchenorrhychus Homoptera (leaf hoppers) Arthropod funcitonal diversity index Index of rarity, endemicity, and simplicity for Auchenorrhychus Homoptera (leaf hoppers)	Richness of morpho-species * Presence of Auchenorrhychus Homoptera (leaf hoppers) Arthropod funcitonal diversity index Index of rarity, endemicity, and simplicity for Auchenorrhychus Homoptera (leaf hoppers)
Physical / Chemical Parameters	**Birds**	**Birds**	**Birds**
Stream width, depth, discharge Temperature Dissolved oxygen pH Conductivity Habitat Quality Index	Diversity / density of habitat dependent species Diversity / density of area sensitive species Presence of threatened / endangered species	Diversity / density of habitat dependent species Diversity / density of area sensitive species Presence of threatened / endangered species	Diversity / density of habitat dependent species Diversity / density of area sensitive species Presence of threatened / endangered species

*** Species that appear the same based on body structure**



Philip L. Nixon

Changes in abundance of indicator species, such as this burrowing mayfly nymph, can be tracked by CTAP's long-term monitoring programs.

Sampling sites are randomly selected using Geographic Information System and Global Positioning System technology.

Chuck Wheeler

Random Site Selection

Assessing the condition and extent of natural environments is a daunting task in a state as big as Illinois. Documenting changes in Illinois ecosystems requires that data be gathered over extended periods of time. They must also be gathered in a way that supports drawing conclusions from a representative sample of sites. To achieve this goal, a systematic, statistically reliable sampling design was developed using Geographic Information System technology, current land cover maps, and other databases to identify potential sampling locations.

To select Citizen Scientist monitoring sites, Illinois' 56,000 public land survey sections (each covering approximately one square mile) were randomly ranked for each of the four ecosystem types. To select professional monitoring sites, more than 1,700 townships (each covering approximately 36 square miles) were used. In order of rank, several potential sampling locations were randomly identified within each section or township and subsequently evaluated in the field. Working from the resulting lists, sites that met safety, accessibility, size, and other habitat-specific criteria are considered suitable for monitoring. Sites are approved for monitoring once landowner permission to access the property was obtained.

One hundred sites each have been targeted for annual monitoring under the ForestWatch and RiverWatch programs. Due to the delicate nature and limited number of suitable prairie and wetland ecosystems, fewer sites are targeted under PrairieWatch and WetlandWatch. These randomly selected Citizen Scientist sites will be combined with more than 700 volunteer-selected sites contained in the EcoWatch Network database.

For professional monitoring sites, sampling occurs on 30 sites per year for 5 years. Scientists return to the initial sites on the sixth year, then repeat the cycle. This process results in 150 sites being monitored for each habitat once every 5 years.

With over 90% of Illinois' land in private ownership, the vast majority of selected sites are on private property. Prior to monitoring, landowner permission to access the property is obtained for all sites. Scientific collection permits and other special use permits are obtained where necessary. Since 1994, hundreds of Illinois landowners and land management agencies at all levels have supported the CTAP process by allowing research scientists and Citizen Scientists access to their land.

Each year 30 randomly selected sites are monitored by CTAP research scientists in each of 4 habitat types—forest, wetland, grassland, and stream. These sites are monitored on a five-year cycle; for example, sites sampled in 1997 will be resampled in 2002, etc. Site selection consisted of randomly ranking Public Land Survey Townships for each of the four habitat types, as illustrated on the four maps below. Within townships, potential sampling sites were also randomly selected and ranked. CTAP research scientists evaluate sites beginning with rank 1 until reaching the first suitable site; one site is sampled in each township.

FOREST

Forested land was identified using the deciduous, coniferous, and forested wetland classes of the Land Cover of Illinois database. For this monitoring program, forests had to be at least 20 acres in size and have a minimum width of 200 meters.

WETLAND

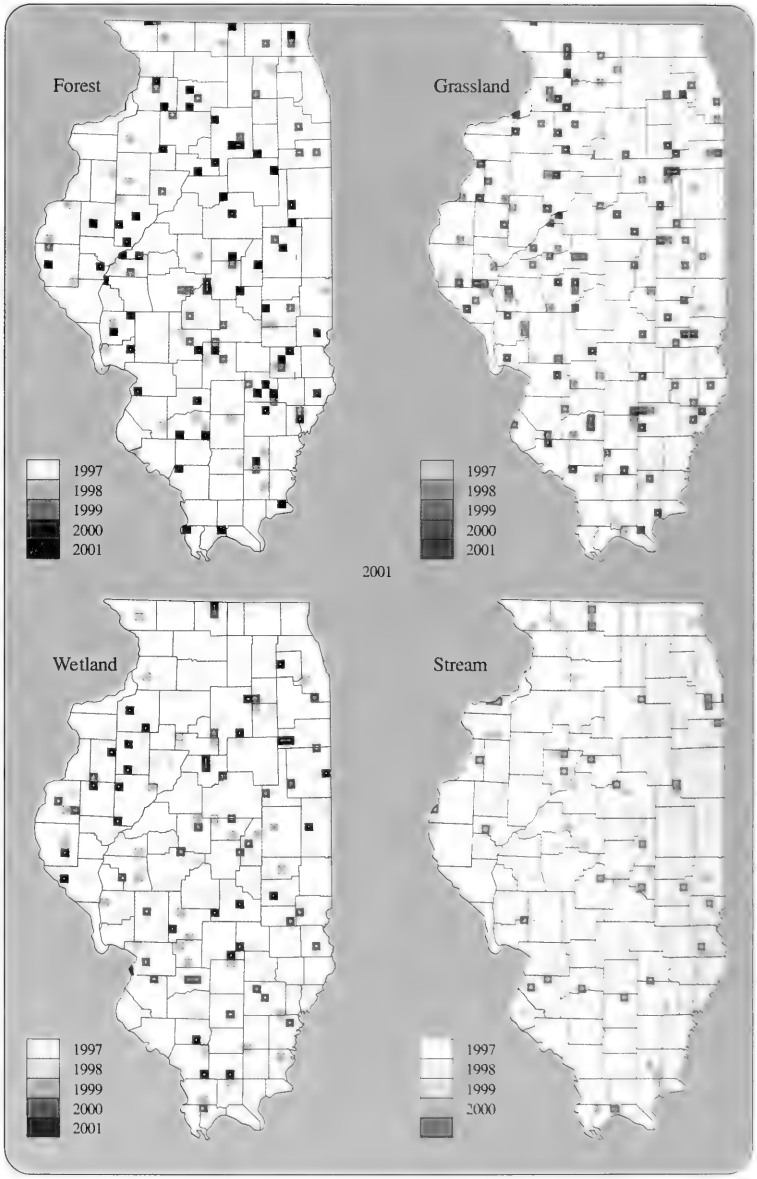
Potential sampling locations for wetlands were determined using the digital Illinois Wetlands Inventory database. Potential wetland sampling sites had to be dominated by emergent vegetation and greater than two acres in size.

GRASSLAND

Grasslands were identified using rural and urban grassland classes of the Land Cover of Illinois database. Rural grassland includes pastures, hayfields, idle fields, and non-agricultural land such as reclaimed mineland, road and railroad right-of-ways, and remnant prairies. Urban grassland includes open space, parks, and golf courses in urban areas.

STREAM

The Illinois Streams Information System (ISIS), a digital database of Illinois streams, was used as the basis for identification of stream sampling sites. The database includes streams draining areas greater than 10 square miles and is based on USGS 1:100,000 data. Each stream is represented by discrete segments beginning and ending at the public land survey section lines or at stream confluences.



A CTAP botanist collects voucher specimens that will be added to the Illinois Natural History Survey's extensive herbarium collection.

For Citizen Scientist monitoring (RiverWatch and ForestWatch), 100 randomly selected sites are to be sampled throughout the state, as shown on the map above. Public Land Survey sections were randomly ranked for sampling order. The Land Cover of Illinois, the Illinois Streams Information System, the Illinois Wetlands Inventory, and other databases were utilized to determine potential sampling sites within the sections.

Quality Assurance

Producing reliable scientific information is central to CTAP's long-term monitoring program. Data quality is maintained through extensive quality assurance measures. Because some of the protocols developed for use with CTAP are being tested for the first time, on-going efforts to determine how well they measure ecosystem health are necessary. Most Citizen Scientists have no prior experience in the collection of scientific data. This makes training, review, and data verification especially important.

Many quality assurance efforts focus on the validity of data collected from Citizen Scientist sites, which compose more than two-thirds of all CTAP II monitoring sites. While quality assurance is stressed throughout EcoWatch, it begins with the monitoring procedures themselves. Equipment, sampling methods, and indicators for all EcoWatch monitoring programs are developed, tested, and reviewed by professional scientists. In many cases, Citizen Scientist sampling protocols are identical to those used by CTAP research scientists; others are streamlined versions of more complex

professional methods. This ensures a high level of compatibility between professional and volunteer data.

Citizen Scientists are required to complete a comprehensive training program before they can monitor and submit data. Training in each program typically lasts 6–8 hours and includes field- and lab-based learning. Follow-up practice and review sessions are offered periodically throughout the year. EcoWatch Trainers are routinely available to answer questions and provide technical support during monitoring periods. Citizen Scientists receive on-site assistance during their first monitoring season, and supervised open-lab sessions are available to assist all volunteers with specimen identification and data submission.

Data verification occurs at three levels. First, Citizen Scientist datasheets are reviewed for completeness and accuracy, once by Citizen Scientist group leaders and again by EcoWatch Trainers. Next, all data are entered through an on-line data entry system that includes automated quality control checks. Finally, approximately one-third of all Citizen Scientists are randomly selected to submit macroinvertebrate specimens or leaf collections for accuracy checks by program technical staff.

Data quality is also a chief concern of CTAP's professional monitoring program. CTAP research scientists have extensive experience and training in the systematics of the groups they are studying, and their professional opinions are relied upon for proper identifications. They also make extensive use of the collections housed at INHS to verify identifications. In many cases, samples collected from the field are incorporated into the Survey's permanent collections. Sampling protocols are well documented and designed to be repeatable in order to reduce observer-dependent differences in the data collection process. Cross checking and examination of outlier data points (both manually and with computer programs) help minimize data entry error. Finally, data analyses and research reports are peer reviewed by INHS and other colleagues prior to their official release.

Beyond the data verification process, CTAP staff periodically conduct replication and comparison studies to analyze specific data quality issues over the long term. These studies require the collaborative efforts of Citizen Scientists, EcoWatch Trainers and CTAP research scientists. In replication studies, EcoWatch Trainers replicate Citizen Scientist sampling at randomly selected monitoring sites and compare the resulting data sets to measure how well Citizen Scientists are adhering to standardized data collection procedures. In comparison studies, research scientists compare Citizen Scientist data to their own from the same site to determine how accurately volunteer data reflect ecosystem health.

To date, quality assurance reviews have produced encouraging results. Citizen Scientist data verification has documented identification accuracy rates that exceed 80%. Replication studies have identified ways to reduce variability in stream habitat characterization. Comparison studies have confirmed high levels of precision and significant correlation between Citizen Scientist and professional data for certain key parameters. Data quality review and additional quality assurance measures will continue to be implemented where appropriate to assure the highest quality data possible.

Quality Control Measures Implemented by CTAP

Volunteer QA/QC
- Professional review of equipment, protocols, and indicators
- Certified trainers
- Comprehensive training
- Practice and review sessions
- On-site field assistance
- Supervised specimen identification sessions
- Electronic data entry
- Random verification of sample collections

Professional QA/QC
- Use of Survey collections to verify samples
- Vouchering
- Automated cross checks
- Examination of outliers
- Peer review

Joint Professional / Volunteer QA/QC
- Replication studies (trainer / volunteer)
- Comparison studies (professional / volunteer)

To ensure high quality data, extensive quality assurance and control (QA/QC) measures have been instituted. Many of these efforts focus on the validity of Citizen Scientist data, while others are common to both professional and volunteer monitoring.

Data Analysis and Use

Compiling, analyzing, and reporting the results of CTAP research can be as challenging as collecting the data itself. Professional and volunteer data from hundreds of sites covering four different ecosystems must be merged into a series of reports and other products that present research findings in easy-to-use formats for a variety of audiences. Charged with this task is a data analysis team consisting of CTAP research scientists at the Illinois Natural History Survey and DNR's Office of Realty and Environmental Planning. The team also includes specialists in GIS mapping, statistical analysis, technical writing, and editing. Their products include annual research summaries, statewide and regional assessment reports, and ecosystem updates designed to address a range of questions concerning the condition and extent of the state's ecological resources. For example:

- Where are the state's highest quality ecosystems?
- How are the state's disturbance-sensitive species faring in forests, prairies, wetlands, and streams?
- Which habitats are most disturbed by human activities?
- What are the most threatening invasive species? Where are they located and how is their distribution changing over time?
- How successful are regional and watershed-based ecosystem management and restoration efforts in improving ecosystem quality?
- How successful are local restoration projects such as streambank stabilization, buffer strips, or controlled burns in increasing ecosystem health and biodiversity?

CTAP's Phase I summary and technical reports, Illinois Land Cover Atlas, Inventory of Resource Rich Areas in Illinois, and regional assessment reports provide a firm foundation for addressing these and other concerns. These reports will culminate in a comprehensive Critical Trends Assessment Report released once every three to five years.

CTAP reports and data files are currently available through the internet on the Illinois Natural Resources Information System (INRIN). Additional on-line features, such as on-line mapping, user-defined data queries, and integration of CTAP data with other statewide and regional databases, will be developed as resources allow.

In the future, data collected through the CTAP/EcoWatch long-term monitoring program will be accessible through a centralized data-sharing framework. Development of this framework will incorporate the efforts of a diverse team of data management technicians, GIS specialists, scientists, and other natural resource professionals. It will also rely heavily on a wide variety of information management and other tools made possible by the internet. These tools will provide structure for the continued collection, analysis, and dissemination of biological resource information for a variety of audiences.

Michael R. Jeffords

Tracking the changes that are taking place in a habitat, such as this Illinois prairie, is important when developing a management plan.

. . . what we do and how to do it.

CTAP represents Illinois' first attempt at establishing meaningful baseline information against which future ecological conditions can be measured. As the first phase of CTAP described the reality of ecosystem decline in Illinois, a more comprehensive approach emerged under CTAP II for assessing the condition of the state's ecological resources. Data generated from the use of biological indicators is supporting voluntary, incentive-based programs focusing on whole ecosystems to provide a blueprint for "what we do and how to do it." Through CTAP II, professional and volunteer monitors will continue to provide reliable scientific information essential for the long-term preservation of Illinois' rich biological heritage.

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EcoWatch
NETWORK

ILLINOIS
NATURAL
HISTORY
SURVEY