Prairie Chicken Egg Exchanges

In the 1860s, there were millions of prairie chickens in Illinois. In succeeding years, the number of prairie chickens plummeted because of widespread conversion of prairie to farmland, heavy hunting pressure, and intense interactions with pheasants and nest predators on Illinois sanctuaries. The count fell to perhaps 25,000 by 1933, 2,000 by 1963, and only 40 in three isolated populations by spring 1992. The dwindling numbers probably led as early as the 1960s to drastic reductions in interpopulation mating and gene flow. A high level of inbreeding may be associated with declining fecundity, and Illinois seems to be a classic setting for such genetic problems.

In a 1943 publication, pioneer Survey wildlife researcher Ralph E. Yeatter presented evidence for relatively low levels of egg infertility and embryo mortality when the number of prairie chickens (Tympanuchus cupido pinicola) was still in the thousands and populations were interconnected. From a sample of 39 nests found in Jasper County in 1935–1936, Yeatter reported a hatch rate of 93% for 148 eggs in 12 clutches judged to have undergone normal incubation. Studies in other states, as well as the first seven years of the present Illinois project, found similar hatch rates.

Recently, a database covering more than 1,100 Jasper County nests over 29 years (1963–1991) was examined for changes over time in reproductive parameters that might be affected by inbreeding. Although clutch size appeared to remain normal, egg fertility, hatch rate of all eggs, and hatchability of fertile eggs showed significant downward trends with time. Because of infertility and embryo mortality, the hatch rate of all eggs during 7 of the past 11 years ranged from 70 to 79% and was only 55% in 1990. Such changes in reproductive performance may be symptomatic of inbreeding.

A host of factors other than inbreeding may also suppress fertility and hatching success of bird eggs. These include pesticides, oil contamination, and aflatoxin from moldy waste grain. Tissue analyses of more than 100 pheasants and a limited sample of salvaged prairie chickens (animals found dead, such as road kills) from Jasper County, however, found negligible levels of chlorinated hydrocarbons (pesticides). Environmental contaminants in general tend to be ruled out by the apparently normal reproduction of bobwhites and pheasants, which often nest near prairie chickens on Illinois sanctuaries and are largely ecological counterparts to prairie chickens. Thus, the available evidence is consistent with a theory of genetic problems—that is, inbreeding—among prairie chickens.

The Survey, the Illinois Department of Conservation, the Illinois Nature Preserves Commission, and the Illinois Endangered Species Protection Board have collaborated to address possible inbreeding depression in Illinois prairie chickens. An effort was undertaken in 1990–1991 to exchange clutches of eggs under incubation in Jasper and Marion counties. The objective was to enhance genetic variation in both gene pools.
Biologists and volunteers carefully searched 361 acres of sanctuary grasslands in 1990 and 178 acres in 1991. In 1990, unincubated clutches were found in both Jasper and Marion counties on April 25 and 27. Eggs from these nests, which were 40 miles apart, were exchanged on May 18. Both prairie chicken hens returned to their disturbed nests, and despite seemingly great odds (abandonment or predation), both clutches hatched in late May.

A second egg exchange was planned for 1991 but was stymied at the last minute by depredation (presumably by a coyote) of the Marion County hen and her 16 eggs. In a stroke of luck, a clutch of 13 eggs was salvaged by a farmer while plowing in Clay County. These eggs were added to two Jasper clutches estimated to be synchronized in incubation. Subsequently, one Jasper hen hatched both sets of eggs, though the other hatched only her own eggs.

If the foster young survive and breed, the genetic diversity of the two populations may be enhanced. If genetic enhancement and population recovery continue to lag, prairie chicken eggs or grown birds from large thriving populations in other states may be essential. Definitive tests of genetic diversity among salvaged specimens are under way, and more are planned. Documentation of concurrent increases in genetic diversity, egg fertility, hatching success, and prairie chicken numbers would signal a step forward in the genetic management of these birds in Illinois.

Ronald L. Westemeier, Center for Wildlife Ecology

New Publications Available
Several new Survey publications have been issued in recent months. One presents educational activities for junior and high school students. Organized around the concept of biodiversity, this 48-page publication includes introductory comments and explanatory notes for teachers as well as activity sheets that can be photocopied for classroom use. Written by the Survey’s Michael R. Jeffords, Biodiversity in Illinois: Activities for Young People includes drawings of plants and animals and a few black-and-white photographs of habitats. Published as Special Publication 13, it can be purchased for $3.

Also available is a set of 40 high-quality color slides designed to supplement the biodiversity publication. Twelve of the slides provide an overview of the biological diversity found in Illinois; the rest relate more closely to specific activities presented in the publication. A four-page booklet describes each photograph. The slide set and booklet can be purchased separately for $6.

Another recent publication is a how-to manual for researchers studying the spread of zebra mussels, which are causing serious problems in North American lakes and rivers. Written by J. Ellen Marsden of the Survey’s Lake Michigan Biological Station, Standard Protocols for Monitoring and Sampling Zebra Mussels contains sections on zebra mussel biology, methods for sampling mussels at various stages in their life cycle, and reporting of results. Information on equipment and chemicals used in monitoring and examples of various forms and labels are included in appendices. This 40-page publication, issued as Biological Notes 138, is available for $3.

In addition, two new articles in the Bulletin series were published in May 1992. Systematics of Leptosphaeria Species Found on the Rosaceae, authored by Sabine Huhndorf, was issued as article 5 of volume 34. This 60-page publication includes 21 figures. Catalog of Types of the Illinois Natural History Survey Mycological Collections (ILLS), authored by J.L. Crane and Pamela P. Tazik, was issued as article 6 of volume 34. Each of the new Bulletin articles sells for $4.

To obtain any of the Survey’s publications, please write to Distribution Center, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820 (phone 217-333-6880).

John Ballenot, Publications Office

Illinois Wetlands
Wetlands once covered over 8 million acres in Illinois, or 23% of the state. With modification of the landscape by humans, 90% of the state’s wetlands have been destroyed. Documenting the status of this rapidly disappearing resource was difficult without a comprehensive inventory. Through joint efforts of the Natural History Survey, the U.S. Fish and Wildlife Service, and the Illinois Department of Conservation, the Illinois Wetlands Inventory (IWI) has been developed to locate and classify wetland and deeperwater habitats.

The IWI is a computerized database that stores spatial (map) data on the location, size, and shape of wetland and deeperwater areas, as well as descriptive information about each feature. It contains information on ecological and physical characteristics such as area, perimeter, dominant vegetative form (e.g., forest, emergent), substrate type (e.g., rock bottom, unconsolidated bottom), hydrology (e.g., temporary, seasonal, permanent), and human impacts (e.g., impounded, excavated, partially drained).

An analysis of the character, extent, and distribution of the state’s wetlands was conducted using the IWI. Data were
Bald cypress and tupelo swamp in Alexander County. Swamp is one of the rarest types of wetland in Illinois.

aggregated and summarized by U.S. Geological Survey 7.5-minute quadrangles, counties, and river drainage basins. A variety of ecological habitat types—such as bottomland forest, swamp, scrub-shrub, shallow marsh/wet meadow, deep marsh, open water (ponds), and lacustrine and riverine wetlands—were summarized in map and table formats.

Of the nearly 36 million acres of land in Illinois, shallow-water wetlands occupy 1.25 million acres, or 3.5% of the total. The most abundant wetland habitat types are bottomland forest (759,000 acres, or 60.5%), shallow marsh/wet meadow (163,000 acres, or 13.0%), and open water (143,000 acres, or 11.4%); these three habitat types account for 85% of all shallow-water wetlands. Deep marshes and swamps are relatively rare in Illinois. "Natural" wetlands (that is, those not modified by dikes, impoundment, or excavation) account for approximately three-fourths of the 1.25 million wetland acres.

Wetlands are concentrated in northeastern Illinois and along the Illinois, Kaskaskia, Big Muddy, Little Wabash, Cache, and Mississippi rivers. The concentration of wetlands along the rivers and in southern Illinois reflects the fact that a large percentage of the wetlands are bottomland forests. Other wetland types exhibit different distribution patterns. For example, wetlands dominated by emergent vegetation (i.e., marshes and wet meadows) are heavily concentrated in northeastern Illinois, an area undergoing heavy development.

The IWI is unprecedented in its comprehensiveness and accessibility. Among its advantages is an ability to analyze data in a timely manner at levels ranging from local to state-wide. This capability recently made Illinois one of the few states able to quickly provide federal agencies with figures for the amount of land that would be affected by proposed revisions to the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands. The proposed changes to this manual, which defines wetlands for regulatory purposes, would exclude about 80% of the state’s wetlands from federal regulation.

The report generated by the IWI analysis provides an overview of the status of Illinois wetlands and serves as a reference document for resource planners, managers, environmental scientists, policy makers, and others. The Illinois Wetlands Inventory will provide valuable baseline data for future analyses of the state’s wetland resource.

Liane Sulway, Center for Biogeographic Information
Illinois Desert: Sand Prairie—Scrub Oak Nature Preserve

The gently rolling dune sand of the Sand Prairie—Scrub Oak Nature Preserve in Mason County contrasts sharply with the black soil of most of central Illinois. Deposited in the Illinois River valley a few thousand years ago by the meltwaters of the Wisconsinan glacier, this sand creates a special home for a unique collection of plant and animal species.

The flora here is a combination of plants common to the tallgrass prairie of Illinois and western plants usually associated with drier, open habitats. The western species probably arrived in Illinois thousands of years ago, when the climate was warmer and drier. As Illinois became cooler and moister, these species died out in most areas but persisted here because of the special environment provided by the desert-like sand.

The vegetation of the dry sand prairie is strikingly different from that found on the black-soil prairie. Although the sandy areas receive the same amounts of heat, light, rainfall, and wind as the rest of the state, they experience larger variations in temperature from day to night and from surface to subsoil; the water-holding capacity of the sandy soil is also very low. In open areas, the surface sand is constantly shifting, sometimes forming dunes or blowouts (areas where the sand and vegetation are blown away by the wind).

To survive in the sand, plants have evolved several strategies. Visitors to the preserve should note that the leaves of many plants are narrow or small, thereby reducing the amount of surface exposed to the sun. Leaves may have a protective covering of silvery hairs or scales, giving them a grayish-green color. Perennials have developed deep roots in response to the limited supply of surface water and frequently grow in tufts or bunches to reduce exposure to the wind. Plants such as the prickly pear cactus have thick, succulent leaves and form mats that grow close to the sand and that tend to spread over a larger area each year.

Spring usually comes early to Sand Prairie—Scrub Oak. At first, the plants are small, growing in clumps that allow the sand to show through. As a result, the area has a tufted appearance similar to that of a true desert. The first blossoms to appear are those of the sand phlox, followed by the pansylike bird's-foot violet. Each succeeding day adds not only to the floral display but also to the greenery as bunch grass begins to cover the sand. Spring is the only season that is truly green in the sand prairie. By late spring, the luminous yellow-orange blossoms of puccoon mingle with the various shades of violet spiderwort, whose long, linear leaves help to conserve moisture.

By summer, yellow is the color of the sand prairie. Dwarf dandelion, coreopsis, black-eyed Susan, the bright orange of butterflyweed, and the waxy-yellow blossom of prickly pear cactus dominate the landscape. The large, silken cactus flowers provide much-needed nectar and pollen for insects during June, and butterflyweed provides an abundant summer nectar source for many species of butterflies, including tiger swallowtails. Specimens of each showy plant are scattered through the ever-present June, grama, and needle grass.

By late summer, the dryness of the sand is evident. Grasses are beginning to turn brown and the landscape is broken only by tall, slender, pink spikes of blazing-star. Some are so top heavy they fall over, making perfect arcs in the coarse sand. The drone of katydids and the summer wind are the only sounds; the

Practical Information

Sand Prairie—Scrub Oak Nature Preserve is about 40 miles northwest of Springfield and is near the town of Bath. From Bath, located on state route 78, take a blacktop road east 3.6 miles, then turn right and go south for 1.3 miles. The preserve is west of the road. For additional information, contact Site Superintendent, Sand Ridge State Forest, Forest City, IL 61532 (phone: 309-597-2260). The 1,460-acre site is owned by the Illinois Department of Conservation.
oppressive heat rises in rippling waves over the rapidly browning landscape. The common six-lined racerunner lizard and occasional bull snake leave their sinuous marks in the undulating sands.

Fall is dominated by brown bunch grasses and the occasional scrub oak growing on an ancient dune. When the vegetation withers with the coming of frost, the sandy soil becomes visible once more.

The migration of tree species onto the sand prairie eventually results in sand savannas. These two-layer communities have a 10–80% canopy coverage of trees and a nearly continuous ground layer of prairie plant species. Sand savannas, like other savanna communities, were maintained by fire in pre-settlement times. The rhythmic dunes and ridges limited the severity of fires and allowed a savanna to develop instead of a sand prairie.

The seedlings of only a few species of trees can withstand the extreme conditions of the shifting sand—the hot surface in summer and the lack of protection against winter winds. Oaks dominate the early stages of a sand savanna, and to a large extent they, and a few hickories, determine the ecological nature of the forest that may subsequently develop on the sandy soil. Because of the arid nature of the soil, the trees remain small and “scrubby.” The herbaceous flora consists of familiar perennial herbs, such as spiderwort and puccoon.

Although there are no formal trails through the 1,460-acre preserve, the area is open and makes for easy walking. Visitors who hike the preserve are rewarded with vistas with no evidence of human disturbance. Such views allow one to experience a part of Illinois as the early settlers did, in pristine, quiet solitude and contemplation.

Text and photos by Michael Jeffords, Center for Economic Entomology, and Susan Post, Center for Biodiversity.
Pileated Woodpecker

The old adage that a lumberman is known by his chips certainly applies to the pileated woodpecker. When it attacks with powerful staccato blows, a dead tree or limb can be reduced to a blanket of splinters and chips in half an hour or less!

The pileated, Dryocopus pileatus, is the largest woodpecker in Illinois. This very active and noisy bird, with its imposing size and striking colors, is very conspicuous in its forest environment. About the size of the common crow, this black bird has a bright, poppy-red crest and white bars that flash on its wings as it flies. The pileated has several calls, including the strident kik-kik-kik, but perhaps the most distinctive is the drum. The mellow yet powerful boom of a hollow tree struck by the hammerlike beak resonates throughout the forest—a solemn, ancient sound.

Arboreal in its habits, the pileated is a permanent resident in the remaining heavily forested areas of the state, preferring bottomland forests over the uplands. When the wild expanses of forest dwindled to tame wood lots by the turn of the century, the pileated—along with the wild turkey, barred owl, and raven—began to disappear. By the 1920s, though, pileated populations had begun to rebound as the birds slowly became accustomed to civilization and the second-growth timber became large enough to supply food and nesting sites. Today, these woodpeckers can even be found near some Illinois cities, including Champaign-Urbana.

Although the pileated will eat fruit, most of its diet consists of grubs, wood-boring beetles, and, possibly, ants found in decayed wood or stumps. A bird will stay with a tree until all food has been consumed. The pileated’s control of forest tree insect pests is of considerable value to the forest.

Pileateds, like all woodpeckers, are adapted to an arboreal lifestyle. Their legs are short and stout, and their toes have strong, sharp claws. Two of their four toes point forward and two, backward. Their tails are composed of stiff feathers, terminating in sharp spines that can be pressed against the bark to prop up the bird while it is at work. The stout beak, with its chisel-shaped point, is effective for cutting wood. All these adaptations enable the woodpecker to easily cling to trunks and branches and to strike hard, effective blows.

Pileateds usually nest in a dead tree or tall stump. The hole is 7 or 8 inches long and 4 to 5 inches wide and may be 3 feet deep. A pair usually works for a month on the nest. Although the woodpeckers may return to the same nesting tree year after year, a new nest hole is always constructed. After abandonment, old nesting cavities are used by flying squirrels, owls, and tree-nesting ducks.

These denizens of forests and swampy areas connote wildness. A glimpse of a pileated is a tremendous thrill, whether it be the observer’s first sighting or the thousandth. For the novice birdwatcher, a sighting evokes the inevitable cry “there goes Woody Woodpecker!”

Teacher’s Guide to “The Naturalist’s Apprentice” (facing page)

OBJECTIVE: to learn about the forests of Illinois through math problems

SKILLS/PROCESSES: problem solving, graph and chart interpretation

GLOSSARY: deforestation, second- or third-growth timber, woody, nonwoody

MATERIALS: copies of “The Naturalist’s Apprentice”

COMMENTS: Although Illinois originally had about 14 million acres of forest, forests today cover only about 4 million of the state’s 36 million acres. Also, much of today’s forest represents second- or third-growth timber or pine plantations; only about 13,500 acres of relatively undisturbed forest remains. Two obvious benefits of forests are wood products and recreational opportunities for hiking and camping. More subtle benefits include the role forests play in controlling erosion, preserving water quality, and maintaining biodiversity. Sixty-one percent of the plants native to Illinois and 75% of its wildlife habitat are found in forests.

PROCEDURE: Distribute copies of “The Naturalist’s Apprentice” and have students work the problems in class or at home.

Answers: 1. 12%, 6.7%, 7.2% 2. 82.3% 3. 69%, 1,414, 2,818, 12.6%, 46.6% 4. 1,880, decreasing, increasing, about 1.5% 5. 8 million, 0.2%, 7,975,000.

EVALUATION: Have students write a brief explanation of the following quotation by Robert O. Petty, including an interpretation of the last sentence: “Like the first farmsteads, towns of the frontier were built in stumpland meadows. The trees were gone. The civic landscapes sweltered in the sun. Never so quick an afterthought: fast-growing black locust trees were imported and planted everywhere, from college campuses to courthouse squares, to provide a promise of shade. What irony—the sons of the world’s most incredible axemen planting seedlings in the shadow of stumps five feet across.”
Arithmetic of the Forest Resources of Illinois

Complete the following problems with information from the text or figures.

1. The pie chart below shows the amount of land in Illinois that is devoted to various uses. Values are given in millions of acres. The total area of Illinois is about 36 million acres.

Cropland 24.7
Forestedland 4.3
Urban 2.6
Pasture 2.4
Other 1.2
Nonforest with trees 0.9

What percentage of Illinois is forestland? _________
Pasture? _________ Urban areas? _________

2. Illinois has about 1.94 billion trees, including 344 million elms.

What percentage of the trees in Illinois are elm? _________

3. Use the information below to complete the short paragraph that follows.

About 500 species of trees, shrubs, and woody vines are found in Illinois; 345 are found in forests.
At least 61% of the 2,318 species of nonwoody plants that occur in Illinois are found in forests.
In Illinois, 356 species of plants are considered threatened or endangered, and 166 of these are found in forests.

Of the trees, shrubs, and vines found in Illinois, ________% of species are found in forests. In addition, ________ species of nonwoody plants occur in forests. A total of ________ plant species are found within the state. Many of Illinois’ plants are very rare, and ________% of the total number of species are considered threatened or endangered. Among these threatened or endangered species, ________% live in forests.

4. Environmentalists are now concerned about the cutting of trees in tropical rain forests. The following graph compares rates of deforestation in tropical forest areas with deforestation rates in Illinois in years past. The rate of deforestation (left axis) is expressed as the percentage of forest lost each year.

The rate of deforestation in Illinois reached its peak in ________.
The rate of deforestation in Costa Rica is [increasing, decreasing, reaching its peak], (circle one)
In Brazil, the rate of deforestation is [increasing, decreasing] and is currently at ________% per year.

5. The bar graph below shows the number of acres of primary (undisturbed) forest in Illinois at various times in the past.

Approximately how many acres were covered by primary forest in 1870? ________
About what percentage of the primary forest of 1820 remained as primary forest in 1948? ________
How many acres of primary forest were lost between 1870 and 1948? ________

“The Naturalist’s Apprentice” presents educational activities for middle school students. Teachers are invited to photocopy this feature for classroom use.
Ash Yellows Disease

Ash species constitute one of the most important tree groups in urban areas. Although ashes currently rank below maples in importance as street trees, this may soon change because ashes, unlike maples, are resistant to attack by gypsy moth caterpillars, which eat tree leaves. Other qualities that enhance the desirability of ashes include an ability to grow in clay soils and a tolerance to air pollution.

A factor that could decrease the desirability of ash species is a recently discovered disease called ash yellows, caused by a bacteria-like organism. Discovered in the Midwest in 1986, this disease has caused a serious decline in the numbers of ashes in the Northeast. Symptoms of ash yellows include a loss of tree vigor, branch dieback, and in advanced stages the development of witches'-brooms (abnormal tufted growths of small branches) on the trunk near the root collar. Once a tree is infected, there is a general decline in vigor over several years, followed eventually with the death of the tree.

There is no known cure for an infected tree, although recent studies at Cornell University have shown that watering during dry weather and fertilizing in the spring may help an infected tree to survive for a longer period of time.

To investigate the distribution of the disease in Illinois, a recent survey was conducted in cooperation with the Illinois Department of Conservation and the U.S. Forest Service. Nineteen sites throughout Illinois with substantial ash stands were visited, and samples were taken and analyzed at Cornell University. The eight stands found to be infected were located in seven counties, ranging from Ogle County in the north to Pope County in the south.

How the disease is transmitted remains a mystery, but insects are suspected as potential vectors. Further studies at the Natural History Survey will be conducted to improve our understanding of this disease.

James E. Appleby, Center for Economic Entomology

Ash yellows disease was found in seven Illinois counties.