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The Age of the Turkey

Depending on your perspective, it is a good time to be alive if you are a turkey, turkey hunter, or a turkey biologist in Illinois. With a population estimate of around 135,000 birds statewide, there are probably more turkeys roaming the woodlands of Illinois now than at any time prior to European settlement. Spring hunting is permitted in 96 counties, fall hunting is becoming increasingly popular, and the demand for hunting opportunities continues to increase in Illinois. The National Wild Turkey Federation (NWTf), a conservation organization dedicated to wild turkeys, boasts

450,000 members

nationally, and Illinois is its top state for number of local chapters (110) and members (>30,000). Through banquets and other fundraising efforts, NWTf has raised over \$168 million since 1985 for the conservation of turkeys and their habitat.

Despite the turkey's popularity and support for management programs, turkey biologists face new

challenges resulting from the adaptability of the species. These include conflicts in urban areas, concerns over crop depredation, and management of turkeys in novel landscapes. Central Illinois, dominated by intensive agriculture, is one example of a novel landscape. Research in the Illinois Natural History Survey

and roaming dogs were the primary predators of adult hens. Winter mortality is uncommon in Illinois but several mortalities during the winter of 1999–2000 were attributed to disease and parasites and point to a need for further research.

Winter severity also affects the number of hens that attempt



A pair of Eastern Wild Turkeys in a forest near Monticello, IL. Photo by Charlie Warwick, INHS Office of the Chief



Turkeys congregate at a dam site in Hardin County. Photo by Patrick Hubert, INHS Center for Wildlife Ecology

Center for Wildlife Ecology examined the ecology of turkeys in agricultural landscapes of Cass and Clark counties using radiotelemetry. Overall we found that turkeys in central Illinois have similar population characteristics as those in other parts of the Midwest in what is considered ideal habitat. During our study, approximately half the hens survived each year and the nesting season was the most dangerous time for hens. Coyotes, foxes,

to nest during the following year. Nearly all hens nest following mild winters while fewer hens nest after severe winters. Turkeys in central Illinois nest in a variety of habitats, from backyards to prairies, and from mature forest to clearcuts. Hens produce large clutches with 10–12 eggs and about half of all nest attempts are successful. In central Illinois, hens may attempt to nest twice. In areas with longer

Continued on back page

Genetic Diversity of Rare Illinois Plants

Of the approximately 3,000 species of plants found in Illinois, around 300 (10%) are threatened or endangered (T&E). Many T&E species in Illinois are considered rare because of habitat destruction, or they are in the periphery of their ranges in Illinois and exist as small and/or isolated populations in the state. Information about T&E species around the state comes from many sources, from amateur botanists to district heritage biologists to researchers. A significant source of information comes from the Illinois Natural History Survey (INHS). For over 20 years the Illinois Department of Transportation has contracted with the INHS to do biological surveys in the areas of future road projects and these surveys have greatly increased our knowledge of the distributions and abundances of T&E species (both plant and animal) throughout Illinois.

Part of my research program within the Center for Biodiversity at INHS is to investigate genetic variation of rare plant species. Understanding this variation provides additional information that cannot be obtained from ecological, morphological,



Eared false-foxglove (*Agalinis auriculata*), an Illinois plant whose population genetics are being investigated by INHS researchers. Photo by Jason Koontz, INHS Center for Biodiversity

or anatomical data. For example, chemical, protein, and molecular (genetic) markers can be used to determine levels of genetic diversity; genetic diversity can provide a buffer against the complications caused by small population sizes or inbreeding that could ultimately drive the species to extinction. Additionally, genetic markers can estimate a plant's breeding system (selfing vs. outcrossing), help explain its relationship to other species or populations, and decipher its evolutionary history. Another benefit of using genetic markers is that all these questions about populations can be addressed using just one or a few leaves or seeds from each plant sampled.

At INHS, one of the projects investigates the population genetics of the IL-threatened prairie species eared false-foxglove, *Agalinis auriculata* (= *Tom-anthera auriculata*, Orobanchaceae). It is a hemiparasite, that is, it can photosynthesize on its own, but uses a plant host for additional water and mineral nutrients. This species is considered rare throughout its range and is listed as endangered in Indiana, Kentucky, Maryland, Minnesota, Ohio, Pennsylvania, and Tennessee, and threatened in Oklahoma. In Illinois, the eared false-foxglove is presently found in 11 counties, but has historically occurred in 25. It is an annual, so plants grow and flower during one season and do not come back the following year (as do perennial plants). Because of its annual habit, the population size of the eared false-foxglove varies from year to year, and it can become locally extinct. This species is one of several being targeted for preservation and re-introduction efforts at the Midwestern National Tallgrass Prairie in Will County, IL. With Brenda Molano-Flores and Mary Ann Feist of INHS, I am assessing the levels and patterns of



Author Jason Koontz collects plant specimens. Photo by Mary Ann Feist, INHS Center for Wildlife Ecology

genetic variation among five populations of eared false-foxglove in Illinois. With allozyme markers we have found low levels of diversity, compared to more geographically widespread *Agalinis* species. The genetic data also indicate that eared false-foxglove tends to outcross, and that most of the genetic diversity found in Illinois can be found in individual populations. Allozymes are often not as variable as other genetic markers, so we are currently using RAPDs (Random Amplified Polymorphic DNAs) to assess levels and patterns of genetic variation.

Another project involves some very different questions about a rare species. With Bill Handel of INHS, I am exploring the population genetics of the IL-threatened cliff goldenrod (*Solidago sciaphila*, Asteraceae), which may be hybridizing with another, more common goldenrod, *Solidago hispida* (hairy goldenrod). Cliff goldenrod is endemic to the Driftless Areas of Illinois, Iowa, Minnesota, and Wisconsin. The Driftless Area escaped glaciation during the Pleistocene and therefore contains a

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Illinois, West Nile Virus, Mosquitoes, and Birds

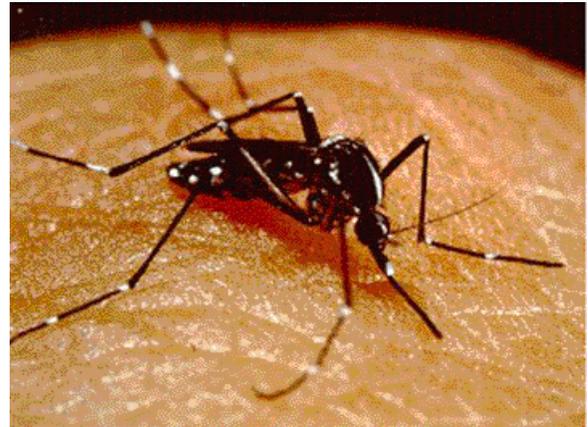
During the summer of 2002, the news was full of dead crows. These crows were the most obvious victims of West Nile encephalitis, the disease caused by West Nile virus (WNV). WNV first exploded onto the national news in late 1999 when numerous crow deaths and human cases in New York City were found to be caused by the same introduced mosquito-borne virus. Since then, WNV spread rapidly across the country by infected birds, arriving in Chicago and surrounding Cook County in 2001. In 2002, Illinois was the hardest hit state with 877 clinical human cases and 62 deaths from WNV. Virus positive birds, horses, and/or mosquitoes were found in all but two Illinois counties. The majority of human cases were in Illinois, Michigan, and Ohio, suggesting that the east-central states are particularly susceptible to WNV outbreaks. Not content to stop in the Midwest, WNV continued across the country making it as far as the West Coast in late 2002. The only states without cases in 2002 were Utah, Nevada, Arizona, and New Mexico. The upcoming mosquito season will probably fill in those remaining states with new records of WNV.



A crow decimated by West Nile Virus in 2002.
Photo by Gabe Hamer, UIUC

The primary transmission cycle of WNV is between mosquitoes and birds, with infected mosquitoes occasionally taking mammalian bloodmeals. The main vector for WNV transmission is thought to be the northern house mosquito (*Culex pipiens pipiens*), which prefers to feed on avian hosts. However, the Illinois Natural History Survey Medical Entomology Lab found 12 Illinois mosquito species carrying WNV in 2002, including species which readily bite birds, mammals, reptiles, and amphibians, as well as opportunistic species that feed on whatever vertebrates are abundant. Some of these potential bridge vectors may be responsible for the transmission of WNV to humans and horses. Although humans, horses, and mammals, like canines and squirrels are unable to pass WNV to uninfected mosquitoes, it is not known whether vertebrate species, other than birds, may be part of cryptic transmission cycles.

Without a doubt, the primary victims and hosts of WNV are birds. So far, over 180 bird species have been found positive for WNV in the US. For some species, such as American Crows, WNV is frequently fatal, for others, including Pigeons, there are no visible signs of illness. The relative lethality of WNV to a species does not necessarily mean that species is important in maintaining transmission. Current research is narrowing the field of important bird hosts to a more manageable level.



An Asian tiger mosquito takes a blood sample from the thumb of Dr. Robert Novak, Director of the INHS Medical Entomology Program. Photo by Michael Jeffords, INHS Office of the Chief

The most important species in this region appear to be the American crow, American Robin, Blue Jay, Brown Thrasher, Common Grackle, Gray Catbird, House Finch, House Sparrow, Northern Cardinal, and Red-winged Blackbird. These species are either efficient transmitters of the virus under laboratory conditions or among the most frequently infected under field conditions. Although many bird species may not be important hosts for WNV transmission, its impact on them may be severe, not only in terms of direct mortality, but also in regard to long-term effects on the reproduction, foraging, and other behaviors of survivors. This is especially true for endangered or threatened species, where a small decrease in population size or reproductive success may be enough to push them towards extinction. Understanding the transmission dynamics of WNV is crucial in determining the risks to particular species as WNV finishes its spread across the country.

In the near future, WNV is likely to become more abundant

in avian populations, and under the right conditions, epizootic and epidemic outbreaks may occur; however, steps are being taken to reduce the risk to humans and horses. Birds on the other hand, will have to continue to rely on their natural immune responses to survive their encounters with WNV. With continued research, efforts to limit transmission and reduce important vectors in key habitats have the potential to keep humans and horses out of the transmission cycle.

Adam Ringia, Richard Lampman, Weidong Gu, and Robert Novak, Center for Economic Entomology

Aquatic Nuisance Species Outreach: Damming the Pathways by Which Organisms Are Spread

Eurasian zebra mussels blanketing a river bottom, Asian silver carp leaping from the water, Brazilian water hyacinth choking out native plants—sounds like some bizarre exhibit at a museum. Unfortunately these are actual examples of aquatic nuisance species (ANS) that have invaded Illinois waters. A total of 89 species have been introduced into Illinois through a variety of pathways such as recreational water users and the bait fish, plant, and pet industries. In order to prevent the introduction of new species and limit the spread of those already established, behaviors of people connected with each of these pathways must be changed. This can be done largely with outreach. Through a partnership between the Illinois Natural History Survey (INHS) and the Illinois-Indiana Sea Grant Program, we are targeting these pathways via a variety of outreach projects originating from the INHS Lake Michigan Biological Station.

- Recreational water users have transported from lake to lake a variety of organisms including Eurasian water milfoil

Lake Michigan access sites, which remind boaters to clean their equipment and avoid carrying unwanted exotic hitchhikers inland. We have conducted workshops, developed a CD-ROM, and produced a fact sheet specifically for lake associations. These tools facilitate the associations' abilities to educate users of their lakes about ways to prevent the introduction and spread of ANS. We also have created interactive displays for use at conferences (e.g., Illinois Lake Management Association) and outdoor shows (e.g., Chicagoland Outdoors Show) to reach a large number of individuals in this target audience.

- The bait fish industry in Illinois primarily distributes and sells aquacultured fish from Arkansas, which generally are free of ANS. However, some bait suppliers and bait shop dealers supplement their products with wild-caught bait. In order to ensure that the bait they sell is not contaminated with ANS, several outreach materials have been developed for bait suppliers and dealers. Each wholesale bait facility in Illinois has received a copy of our *Hazard Analysis and Critical Control Point (HACCP)* training handbook and video, which describe step-wise protocols that each facility can implement to reduce risk of ANS contamination. Each bait shop has received a sign encouraging



Father and daughter try to determine "What's wrong with this picture?" at the Chicagoland Outdoor Show ANS display created by INHS and Illinois-Indiana Sea Grant Program. Photo by INHS staff

employees to inspect all bait being packaged for consumers. As a final safeguard, each shop has also received bait bucket stickers to distribute to customers, which remind anglers to dispose of bait rather than releasing it into a natural waterway. These stickers have also been distributed to anglers by creel clerks at boat shows and through lake associations.

- One of the water garden industry's top-selling plants, water hyacinth (*Eichhornia crassipes*) is considered one of the world's worst invasive aquatic plants. To prevent this and other harmful plants from invading Illinois waters from this growing industry, we are involved in a national project targeted at all aspects of the aquatic plant industry—wholesalers, retailers, and consumers, including water gardeners, natural resource managers, and landscape designers. As part of this project, we produced a brochure for backyard water gardeners, which has been distributed widely throughout Illinois and the U.S. Our next endeavor will be to partner with



A smattering of our ANS outreach products. Photo by INHS staff

(*Myriophyllum spicatum*) and zebra mussels (*Dreissena polymorpha*). We have addressed this pathway through several outreach tools including boat-landing signs at

Continued on next page

ANS Outreach

continued from previous page

Illinois nurseries to educate consumers about aquatic nuisance plants.

• The introduction of the Oriental weatherfish (*Misgurnus anguillicaudatus*) and Eurasian water milfoil in Illinois' inland waters are just two examples of ANS introductions that can be traced back to home aquarium owners. This problem of invasive plants and animals introduced via the pet/aquarium industry pathway will be addressed through a new national project partnering the pet industry with state and federal agencies. As part of this project, a unified, national, "Don't release!" message will be developed and delivered to consumers on products (e.g., bags in which consumers



Nia Haller of INHS helps an Inland Lake Association member identify invasive zooplankton at an "Exotic Species in Inland Lakes" workshop. Photo by INHS staff

take fish home) distributed through retail outlets. Outreach tools will also be created to educate retail employees about ANS, so that they in turn can educate their customers. INHS will be

involved in this project at both the national and state levels.

Whether preventing anglers from releasing unwanted bait into the water or encouraging water gardeners to use

noninvasive plants in their ponds, outreach plays an essential role in changing ANS-risky behavior and thus can "dam" pathways by which ANS are spread. The outreach projects outlined above are just a few of those in which INHS is involved. Combined, these projects compose a comprehensive initiative to protect our natural resources from invasion by ANS.

Patrice Charlebois and Kristin TePas, Center for Aquatic Ecology

Genetic Diversity

continued from page 2

unique assemblage of plants, many of which are rare and northern relicts left behind during the last ice age. In Illinois, cliff goldenrod is presently known from only three northwestern counties, and historically from four. Cliff goldenrod is restricted to sandstone and limestone cliffs and outcroppings. The hairy goldenrod occurs above the cliff faces where cliff goldenrod grows and we have observed morphological intermediates. This may indicate that hybridization is occurring between individuals of these two species, as has been suggested by other scientists. Hybridization could be a problem if cliff goldenrod is becoming genetically assimilated into hairy goldenrod. If hybridization is occurring, cliff goldenrod could be hybridized out of

existence, or the hybrids could replace both the cliff and hairy goldenrods. We received funding from the Illinois Wildlife Preservation Fund of the Illinois Department of Natural Resources to develop genetic markers to test the hybridization hypothesis. Using several genetic markers, we hope to identify unique fingerprints for the two species. Then we can look at the pattern of markers in the morphologically intermediate individuals to see if they are actually one species or the other. However, if they combine unique markers then hybridization would be supported. The genetic data will help clear up the confusion created by morphologically intermediate individuals readily observed in the field.

Ultimately, knowledge of genetic variation in T&E plant species can help land managers and scientists develop sound conser-



Goldenrod (*Solidago* species) under investigation by INHS. Photo by Jason Koontz

vation plans for ensuring these species will be around for future generations to enjoy or use. One set of data will not give us all the answers, and for rare species it is important to collect many kinds of data (e.g., demography, reproductive ecology, morphology, and genetics) to gain a broader perspective on the biology of rare species.

Jason Koontz, Center for Biodiversity

Species Spotlight

Compass Plant

Susan Post

Look at this vigorous plant that lifts its head from the meadow, See how its leaves are turned to the north, as true as the magnet; This is the compass flower. . . (Henry Wadsworth Longfellow, *Evangeline*)

Compass plant is the common name of *Silphium laciniatum*, a member of the daisy family. Once common in mesic and drier prairies, today it is often found along roadsides and slightly disturbed sites from Michigan and Indiana, south to Alabama, west to Texas,



Compass plant (*Silphium laciniatum*). Photo by Michael Jeffords, INHS Office of the Chief

and north to North Dakota. In 1777, William Bartram, an early botanist and traveler described the plant as, “the most conspicuous both for its beauty and novelty . . . The flower stem, which is eight or ten feet in length, terminates upwards with a long heavy spike of large golden yellow flowers.”

Compass plant is one of the largest-leaved plants of the prairie. It has huge basal leaves and a 3- to 8-foot flower stalk. On top of the hairy stalk are several alternate

flower heads, each 2.5 to 4.5 inches wide with many yellow petal-like ray flowers surrounding a yellow center with disk flowers. The basal leaves are broadly triangular in

general outline, and can be over 1 foot long and deeply divided into a series of narrow segments. The plant’s species name, *laciniatum*, is Latin for deeply cut or lacerated and refers to the basal leaves, which resemble a masterpiece worthy of Edward Scissorhands. The basal leaves of the compass plant align themselves in a north-south orientation; this allows the broad leaves to have maximum exposure to the morning and evening sun and minimal exposure to the hot drying noon sun. During a 90° day, put your hands on the sides of the leaves, they are cool to the touch.

The plant blooms from June to September and usually flowers before big bluestem or Indian grass have reached their mature sizes, making the plant an unmistakable prairie landmark. Compass plant or polar plant (it’s other common name) was a plant many pioneer travelers used to find their way across the prairies. A clan of Osage Native Americans, who called themselves Walkers-in-the-Mist, used the tall compass plants to plot their routes across fog-bound prairies. Early wagon train scouts marked trails for their followers by tying flags to the flower’s stalks.

The plant’s root is equally impressive, attaining a depth of 10 to 15 feet. This enables it to weather prairie droughts and survive prairie burns. Left un-

disturbed, compass plant can attain a height of 6 to 8 feet every year, die back, and begin the growth cycle again, all due to its incredible root system.

Compass plant is one of 14 species of the genus *Silphium* to be found in the eastern United States. Members of this genus are tall and sturdy and have sunflowerlike blossoms.

Silphium is the ancient name of a resinous plant, and plants of this genus have a pine-scented resinous sap. William Bartram also described the stems of compass plant when split, noting they “exude a resinous substance which the sun and air harden in semi-pellucid drops or tears of a pale amber colour.

This resin possesses a very agreeable fragrance and a bitterish taste, somewhat like frankincense or turpentine; it is chewed by Indians and traders to cleanse their teeth and mouth and sweeten their breath.” Beware before you try it as Illinois author John Madison wrote, “Pioneers found that compass plant produced a pretty good brand of native chewing gum. It has an odd pine-resin taste that’s pleasant enough, but must be firmed up before its chewed. A couple summers ago I tried some of this sap while it was still liquid. It’s surely the stickiest stuff in all creation and I literally had to clean it from my teeth with lighter fluid.”

Teachers Guide to “The Naturalist’s Apprentice”

Answers:

1. K
2. A, B, C, F, L
3. D, E, H, M
4. B, F, H
5. A, B, F, I, L
6. A, D, H, N
7. D, E, H
8. A, D

9. A, C
10. F, G, M
11. D, H
12. C, D, I, M
13. D
14. H
15. D, O

To read more about uses of Illinois plants, check out the following book from the library: *Life and Lore of Illinois Wildflowers* by William E. Werner, Jr. 1988. Illinois State Museum.

Credits for Images on Next Page

- Carie Nixon—Compass plant
- *Prairie Plants of Illinois* by John W. Voigt and Robert H. Mohlenbrock, illustrations by Miriam Wysong Meryer. Illinois Department of Conservation, Division of Forestry—Blazing star, Goldenrod, Wild strawberry, and Pale purple coneflower
- Dover clipart—Pokeweed, Solomon’s-seal, Bloodroot

Practical Uses of Native Illinois Plants

Many native Illinois plants were used by the Native Americans and later by the European settlers. Some are still used today. See how many of the plants in the left column you can match with the uses in the right column. Some plants have more than one use, and some uses apply to more than one plant! You may even know other uses not listed below for some of these plants.

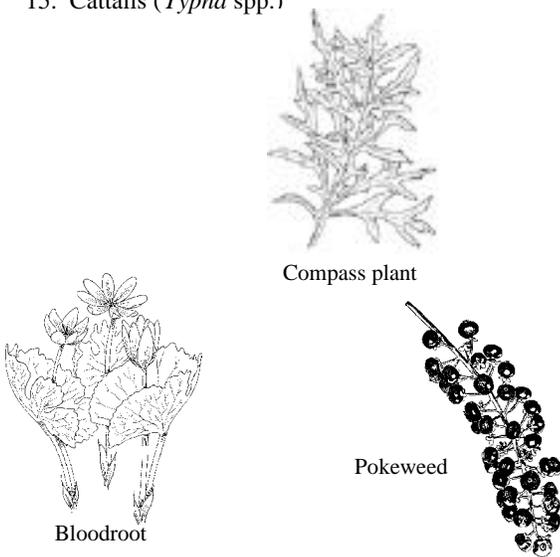
- | | |
|---|-----------------------------|
| 1. Compass plant (<i>Silphium laciniatum</i>) | A. Stains or dyes |
| 2. Bloodroot (<i>Sanquinaria canadensis</i>) | B. To treat toothaches |
| 3. Violets (<i>Viola</i> spp.) | C. Treatment for poison ivy |
| 4. Purple coneflowers (<i>Echinacea</i> spp.) | D. Food |
| 5. Goldenrods (<i>Solidago</i> spp.) | E. Cancer treatment |
| 6. Sunflowers (<i>Helianthus</i> spp.) | F. Treat colds or fever |
| 7. Blazing stars (<i>Liatris</i> spp.) | G. Treatment for malaria |
| 8. Pokeweed (<i>Phytolacca americana</i>) | H. Ornamental |
| 9. Touch-me-nots (<i>Impatiens</i> spp.) | I. Treating wounds |
| 10. Boneset (<i>Eupatorium perfoliatum</i>) | J. Basket weaving |
| 11. Morning glories and sweet potatoes (<i>Ipomoea</i> spp.) | K. Chewing gum |
| 12. Solomon's-seal (<i>Polygonatum</i> spp.) | L. Control bleeding |
| 13. Wild strawberry (<i>Fragaria virginiana</i>) | M. Pain relief |
| 14. Phlox (<i>Phlox</i> spp.) | N. Insecticide |
| 15. Cattails (<i>Typha</i> spp.) | O. Basket weaving |



Blazing star



Goldenrod



Bloodroot

Pokeweed



Compass plant



Solomon's-seal



Pale purple coneflower



Wild strawberry

ILLINOIS
NATURAL
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SURVEY

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Turkeys

continued from front page

growing seasons, hens may try up to three nests.

The most limiting factor we observed in central Illinois was the survival of poults. Young turkeys have specific habitat requirements for foraging. Similar to other gallinaceous birds, ideal brood habitat is grass or leguminous vegetation with abundant insects that is tall enough for concealment, short enough for the hen to see over, and open enough at the surface to allow movement. In addition, weather can have a major effect on survival of poults. Two weeks of wet, spring weather that wiped out almost an entire year of reproduction, combined with limited brood habitat in our study areas, resulted in a poult survival rate to six weeks of less than 10%.

While turkeys are not migratory, they roam widely during the course of a year. Annual home

ranges averaged about 7 km², and several were larger than 25 km². The period with the greatest movement is in the spring when winter flocks break up and hens begin searching for nesting areas. Hens show considerable fidelity to winter flocks and often return to the same group each winter. Those that switch winter flocks are important for genetic exchange.

Eastern Wild Turkeys have shown the ability to adapt to a range of habitat conditions, including those of east-central Illinois, but they are forest birds and their ecology is related to forest conditions. Not surprisingly, analysis of habitat selection for turkeys in our study showed that the birds selected forested areas over other available habitats, and that upland forest was consistently preferred to riparian forest. Movement patterns clearly showed the importance of riparian forest for travel corridors. While row crop

fields were ubiquitous in our study areas, and waste grains can be an important food source during winter, turkeys confined much of their activity to natural habitats.

Our research suggests a simple model for turkeys in intensively farmed landscapes—that forests determine distribution and grasslands drive abundance. With woodland communities in mind, the status and popularity of the turkey is good news for a number of reasons. Turkeys are an important, and natural, part of our woodlands and their return should lead to better functioning ecosystems. From a management perspective, the popularity of the turkey should be viewed as an opportunity and turkeys thought of as an “umbrella” species to promote conservation of riparian forest communities throughout the state.

Patrick Hubert, Center for Wildlife Ecology

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