Rescuing the Royal Catchfly

Three hundred fifty-six species of vascular plants are considered endangered or threatened in Illinois. Most have declined because of habitat destruction, which has been so extensive that certain plants persist only in disturbed locations, such as roadways. One endangered plant, the royal catchfly, survives at only four disturbed sites in Illinois.

A two-year study of the biology and ecology of the royal catchfly, *Silene regia*, was conducted by Survey researchers with funding from the Illinois Endangered Species Protection Board. The aims of this investigation included determining the current status of this plant and recommending management to prevent its extirpation.

The royal catchfly has apparently always had a restricted range in Illinois; it has been absent from the western and central parts of the state, despite seemingly suitable habitat there. Most reports of royal catchfly populations are from former prairie regions in southeastern and southwestern Illinois, which were among the first regions to be plowed by European settlers. There are few prairie remnants in these areas. At some locations, the well-drained soils are cultivated right to the road shoulder, leaving no roadside vegetation. Prairie remnants in railroad rights-of-way continue to be converted to cropland when the railroad lines are abandoned. In addition, urban development has destroyed many prairie remnants that were spared from conversion to cropland. The royal catchfly appears to be restricted to those portions of Illinois where destruction of prairies and prairie remnants is complete.

The four remaining locations of the royal catchfly are a cemetery and a roadside in Lawrence County, a fence-row in Clark County, and a railroad right-of-way in Madison County. None of these sites are prairie remnants, nor any kind of natural community. A few prairie plants are present at these sites, but the dominant forms of vegetation are herbs and shrubs typical of disturbed ground throughout Illinois. The royal catchfly probably colonized these locations before adjacent prairies were destroyed.

Extensive monitoring of the populations indicated that individual plants may be long-lived and vigorous, developing multiple stems with numerous flowers. Even during the drought of 1988, two of the four populations produced abundant seeds. Despite abundant seed production in some populations, however, almost no seedlings were found during monitoring of royal catchfly populations.

Some populations apparently have not received sufficient sunlight, which is necessary for seed germination, growth, and flowering. Experiments comparing the effects on royal catchfly of light levels, nutrient levels, and soil texture found that light was the most important factor for growth and flowering. Before the colonization of Illinois by Europeans, prairie fires normally removed dead vegetation and killed woody species that otherwise would have shaded royal catchfly plants and seeds. The lack of prairie fires today results in increased shade. In addition, frequent mowing of

Location of extant (●) and extirpated (○) populations of royal catchfly in Illinois. The plant is normally about 1 meter tall and has brilliant scarlet flowers. Photo by Eric Ulaszek.

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sites may have prevented flowering and seed production.

The dispersal of the royal catchfly may have been limited by the nature of its seeds, which lack structures that would aid in wind or animal distribution. When Survey researchers set up seed traps at selected distances from royal catchfly plants, seeds were captured only immediately beneath the plants.

The four remaining populations of the royal catchfly are not secure. During the monitoring period, the two Lawrence County populations were mowed, the Clark County population had a brush pile placed upon it, and the Madison County population was sprayed twice with herbicide. Shade from adjacent trees and shrubs has reduced flowering and seed set in two populations. The Clark County population was nearly destroyed in 1989 when the landowner bulldozed most of the site. Although one of the Lawrence County populations is adjacent to a cemetery whose directors have agreed to protect the site, this location, only 3 meters wide and 30 meters long, is vulnerable to vandalism and accidental destruction.

One way to prevent the extirpation of the royal catchfly from Illinois is to reestablish this species in prairies. Although there are few, if any, suitable prairie remnants near the surviving populations, there are proposals to create prairie restorations near several royal catchfly sites, and the plant could be introduced into a restoration. Survey researchers are now conducting an experimental introduction at a prairie reconstruction at the Survey arboretum. Royal catchfly seeds were sown in the autumn of 1987, but because of drought and competition from established prairie grasses, only two plants were successfully established. Subsequently, royal catchflies grown in greenhouses were transplanted into the restoration in September 1988. Fifty-five percent of these plants survived to 1990, and 45 percent of the survivors flowered and set seed in 1990. Searches for seedlings are being conducted in 1991. If the royal catchfly successfully reproduces at the Survey prairie, then its introduction into prairie restorations may prove important for preserving this endangered plant.

Eric Ulaszek and David Ketzner, Center for Biogeographic Information, and Louis Iverson, Center for Biodiversity

Of Sap Movement and Branch Pruning

The pattern of sap movement at the branch and stem juncture in trees and shrubs is not clearly understood. The function and anatomy of the branch base is important for determining where pruning cuts should be made.

The raised or swollen area at the base of a branch has been referred to as the shoulder, branch collar, or trunk collar. Previous Survey studies demonstrated that cuts through the shoulder close more quickly than cuts outside the shoulder, and some people also consider the former cuts to be more aesthetically pleasing. Nonetheless, a prominent tree expert, Alex Shigo, has recommended making the final cut outside the collar to avoid discoloration and decay of the stem.

Survey experiments in 1989 and 1990 investigated the hydraulic architecture of the branch-stem juncture by injecting a water-soluble dye into stems beneath branches. The branches were excised five to seven days later, and the patterns of dye translocation were traced from the stem into the branch. Eight species of trees were treated at eight dates throughout the growing season, but patterns of dye movement did not vary among species or with time of year.

Dye injected directly beneath a branch moved distally straight up into the branch. Dye injected below but not directly beneath a branch moved into the sides or top of the branch. The greater the lateral distance from directly beneath the branch, the more likely the dye would move from the side of the branch to the top of the branch. Dye injected beyond the branch shoulder moved around the branch and continued up the stem.

Most textbooks illustrating the juncture of stem and branch show a direct connection between wood on top of the branch and wood on the stem directly above the branch. Shigo recently established, however, that there is little or no direct structural or conductive tissue in this branch crotch area. His observations were confirmed by the present studies. In addition, Shigo documented the abrupt turning into the branch of stem xylem from below the branch, also confirmed in our study. This “ball and socket” arrangement in trees is readily observed when excessive weight is applied to branches.

Shigo has further stated that the collar at the base of a branch is composed of branch tissue early in the growing season and stem tissue late in the season, but this hypothesis was refuted by the present study. The stem and trunk tissues remained separate and distinct throughout the study.

I believe that a “collar” forms only around dead or dying branches as callus tissue of the stem attempts to overgrow branch tissue. I also believe that “shoulders” at the base of all vigorously growing branches are the result of food materials being available from both stem and branch tissues, which leads to the enlargement.

Dan Neely, Center for Biodiversity
New Publications Roundup
Several new Survey publications have been issued in recent months. One is the proceedings of a symposium held in association with Earth Day 1990. Titled Our Living Heritage: The Biological Resources of Illinois, this book is divided into sections on forests, prairies and barrens, wetlands, streams and caves, and agro-urban ecology. Twelve full-length articles and seven summaries of symposium presentations describe the status of biological resources in each of the Illinois ecosystems. An appendix lists all native Illinois taxa and numbers of species in each taxon; it also notes the number of threatened or endangered species in each taxon and identifies 115 species presumed extirpated from the state. Edited by Survey scientists Lawrence Page and Michael Jeffords, this 120-page, illustrated publication is article 4 of Survey Bulletin volume 34. It is available from the Survey for $3.

A new Survey publication for experts on fungi is titled A Nomenclator of Leptosphaeria V. Cesati & G. de Notaris. Written by Survey mycologist J.L. Crane and University of Illinois plant biologist C.A. Shearer, this book lists nearly 1,700 species, varieties, and forms within the genus and indexes the taxa by host, host family, substrate, and geographic area. This 160-page book, which is article 3 of Bulletin volume 34, is available from the Survey for $3.

A third recent publication is titled A Survey of the Freshwater Mussels (Bivalvia: Unionidae) of the Sangamon River Basin, Illinois. Also known as Survey Biological Notes 137, this 28-page publication describes the abundance and distribution of individual species in the Sangamon River basin and compares the current status with that documented by earlier studies, dating back to 1910. Written by Robert Schanzle of the Illinois Department of Conservation and Kevin Cummings of the Survey, it is distributed for $2.

A 24-page booklet titled Forests of Illinois is also now available. Produced by the Survey in cooperation with the Illinois Council on Forestry Development, this nontechnical publication is designed to increase understanding and appreciation of the forests of the state. Illustrated with numerous beautiful color photographs, the booklet is available free of charge in limited quantities from the Survey.

Finally, Survey ichthyologist Lawrence Page and Brooks Burr of Southern Illinois University in Carbondale recently authored A Field Guide to Freshwater Fishes: North America North of Mexico. This is the first guide to cover all 790 species in the United States and Canada, and it includes more than 700 illustrations and nearly 400 detailed maps. This Peterson field guide is published by the Houghton Mifflin Company and is not available from the Survey.

To order any of the first four publications mentioned, please write to Distribution Center, Illinois Natural History Survey, 607 E. Peabody Drive, Champaign, Illinois 61820 (or call 217-333-6880). A free catalog of all Survey publications can be obtained by writing to the same address.

John Ballenot, Publications Office

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Species Spotlight: The Creek Chub
One of the most common fishes in Illinois, the creek chub is also one of the most interesting. The nest-building and other spawning-related behaviors of this large minnow make for quite a show in late spring and early summer in small streams and ditches throughout the state.

For the breeding season, males change from olive green to rosy pink and develop tubercles on the head, body, and fins. The tubercles function like the antlers of deer and are shed at the end of the breeding season. The head tubercles are used symbolically to assert dominance over competing males and to attract females.

Males build nests by digging small pits in the stream bed with their mouths and then depositing mouthfuls of gravel at the upstream side of the pit. When a female comes to spawn, the male grasps her with his fin and body tubercles as she releases the eggs, which he fertilizes and covers with gravel. The nest expands as the male spawns with other females.

Although only one male is dominant over a nest at any one time, the dominant male is often challenged by others. If the challenger is small, the dominant male may rebuff the contender simply by turning his head to display his large tubercles. But if the challenger is about the same size as the dominant male, a long ritualistic display called a parallel swim ensues. The dominant male usually returns to find that he must chase away a small male that has taken over the nest. Small males do not build nests of their own but wait for dominant males to leave and then take over. This is called a satellite male strategy and is common throughout the animal kingdom.

Found throughout eastern North America, the creek chub, Semotilus atromaculatus, is a hardy fish that eats insects and other small aquatic organisms. To observe its springtime activities, just put on a pair of polarized sunglasses, pick a spot next to a stream, and wait for the show to begin.

Carol Johnston, Center for Biodiversity

Editor's Note
The previous article inaugurates our "Species Spotlight" series. Henceforth, each issue will include a "Species Spotlight" article on a particularly interesting or important Illinois species, often a threatened or endangered organism.