In 1973, cattails were present among a variety of other native species in a 7-acre area of Gardner Marsh (Irwin 1973, Figure 1). Today, cattails dominate more than 30 acres of Gardner Marsh, and nearly all other species have been lost in the wake of this invasion. Did this happen overnight, or was it a slow, steady process? Students in Dr. Frank Scarpace’s Environmental Studies 600 seminar investigated how fast cattails expand. They collected aerial photos from 1976 to 2006 (Figure 2), digitized the photos and orthorectified the images (i.e., they removed distortions), and then mapped the area dominated by cattails using GIS software (Figure 3).

Distinguishing plant species on the ground is hard enough; doing so from air photos is even more challenging. Nevertheless, students were able to outline the boundaries of cattail clones on several photos over the past three decades.

Once boundaries were drawn, students superimposed the successive outlines of the cattail clones and used GIS software to run transects from the historical to current boundaries. In the patch with the consistently clearest boundary over time (Figure 4), cattails expanded about 80 cm per year.

The 80 cm/year rate is lower than that measured by Aaron Boers (2006) in a population of invasive cattails at Eagle Spring Lake on the Mukwonago River. He followed a number of clones that expanded an average of 390 cm/year.

**Which cattail is marching over the marsh?**

Only small patches of our native cattail, *Typha latifolia*, remain in Gardner Marsh. Some of the plants are the alien parent, *T. angustifolia*, but most of the current invasion appears to be the hybrid, *Typha x glauca*. It takes over other habitats by growing dense and tall, outgrowing native vegetation both below and above ground (Figure 5).

Most of the invasion is vegetative, as hybrid cattail seeds are mostly (but not entirely) sterile. Still, new clones are establishing, most likely...continued on back page
Figure 2. Gardner Marsh, 1976–2006.

Figure 3. Changes in *Typha x glauca* boundaries, 1980–2006.

Figure 4. Successive outlines of cattail clones, 1976–2006.

Figure 5. Control plot invaded by cattail.

Figure 6. *Carex stricta*. 
Figure 2. Gardner Marsh, 1976–2006.

Figure 4. Successive outlines of cattail clones, 1976–2006.

Figure 6. *Carex stricta* remnant.

Figure 8. Cattail and sedge meadow boundary.
from seed, as field surveys showed several small (but dense) hybrid cattail clones amid sparse native cattails.

**What habitats did cattails displace?**

Cattails have replaced wet meadow dominated by bluejoint grass (*Calamagrostis canadensis*) and sedge meadow dominated by several species of *Carex* (Figure 6), according to Irwin’s 1973 map. Northern Gardner Marsh thus lost the majority (over 75%) of its sedge meadow and wet meadow over the past 30 years.

**Is any native sedge meadow left?**

A small remnant of sedge meadow is still visible near the easternmost boardwalk, where Isa Woo (2000) carried out her fertilizer-addition experiments with cattails in 1999. At that time, the cattails had advanced from the south and reached the north end of the boardwalk. The sedge meadow was easy to view. Now cattails extend several meters beyond the boardwalk, and you have to stand on the bench to see the native sedge-dominated vegetation.

Other wet meadow and sedge meadow remnants remain in central Gardner Marsh, which is difficult to access because it is surrounded by channels and ponds (Figure 7). These are threatened by buckthorn, reed canary grass, and cattail invasions, and much of their historical diversity (cf. Irwin 1973) appears lost.

**What is the Arboretum doing to manage cattails?**

After students in Joy Zedler’s Botany 670 class (with help from Paul Zedler) cut a wide band of cattails around the advancing edge of the cattails in Northern Gardner Marsh (Figure 8), Steven Hall, Land Resources M.S. student, established 40 experimental plots to test alternative control methods. In 2006, with help from Botany Ph.D. student Beth Lawrence, Steven began cutting (Figure 9)—hoping that subsequent flooding would smother rhizomes—and herbiciding (Figure 10), followed by monitoring to compare outcomes. It was a wet summer and cattail regrowth was vigorous. The idea is to work from the edge toward the core of the invasion, honing techniques over time. If we could push back the infestation at least 80 cm per year, we would hold the line; any further progress would represent a net loss of cattails for us.

Proceeding slowly makes sense, because we cannot expect native plants to regain their habitat as rapidly as they lost it. Native sedges grow more slowly than invasive cattails, and it might take years for the sedges to regain dominance under cattail-control efforts. Nor can we expect plantings of natives to keep cattails at bay (Boers 2005); we will need to control cattails indefinitely. We know a long-term commitment is needed, but we are not sure what the parameters of that commitment need to be. Thus, our approach is adaptive, with each year’s results guiding the next year’s actions.

**Acknowledgements**

Dr. Frank Scarpace guided students in ES600 in their remote sensing project. We are indebted to him for his expertise, time, and enthusiasm, and to Dr. Galen Smith for help in distinguishing cattail species. We thank the ES600 cattail team, Elizabeth Appleby, Steven Hall, Angela Kosivsk, and Katherine Welch, for their hard work locating, orthrectifying and analyzing aerial photos.

This leaflet was compiled by Joy Zedler and Steven Hall. Layout by Kandis Elliot. A PDF of Leaflet 11 is available at www.botany.wisc.edu/Zedler/leaflets.html

This and earlier leaflets are also locatable as a link from the Arboretum web site: http://uwarboretum.org/research

**References**

