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Wetland Mitigation and Amphibians: Preliminary Observations at a Southwestern Illinois Bottomland Hardwood Forest Restoration Site

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Much has been written on amphibian declines attributed to habitat loss or fragmentation. Much less is known about the response of amphibians to restoration of wetland habitat. Amphibians were monitored at a series of southwestern Illinois wetland mitigation sites from 1995–1998. By the end of the study period, all seven species of amphibians previously known from the site had been found within restored wetlands, and an eighth species had apparently colonized the site. Amphibian species associated with open sunlit wetlands were the first to enter the mitigation sites and were the most abundant. As trees mature and mitigation sites become more similar to nearby floodplain forest, relative abundances are expected to gradually change. Wetland mitigation sites can provide habitat for many amphibian species; habitat generalists and species tolerant of low levels of disturbance are most likely to benefit.

INDEX DESCRIPTORS: amphibians, wetland mitigation, forested wetlands.

Only a few hundred years ago, an estimated 80 million hectares of freshwater forested wetlands existed in the United States. Bottomland hardwood forest was once widespread in the southeastern U.S. and extended up the Mississippi embayment as far as southern Illinois (Gosselink and Lee 1989). At least 80 percent of the forests associated with the Mississippi River floodplain have been cleared or drained, and forested wetland losses are much higher in some regions (McDonald et al. 1979). Most losses resulted from conversion to agriculture (Tiner 1984). Much of the remaining bottomland hardwood forest has been fragmented into a patchwork of woodlots. Habitat fragmentation and isolation result in the loss of some wide-ranging, area sensitive, or forest-interior animal species, and the simultaneous increased abundance of habitat generalists (Sharitz and Mitsch 1993). Several authors have discussed the effects of clear cutting and forest fragmentation on amphibians (Ash 1988, de-Maynadier and Hunter 1998, Dupuis et al. 1995, Marsh and Pearman 1997, Means et al. 1996). However, less attention has been focused on amphibian response to intentional restoration of formerly clearcut areas.

Under Section 404 of the Clean Water Act, a permit from the U.S. Army Corps of Engineers is required for any discharge of fill material into wetlands or other waters of the United States. Typically, a mitigation and monitoring plan must be developed and approved before issuance of a permit. Amphibians are currently being monitored at a St. Clair County, Illinois site as one element of a long-term forested wetland mitigation plan.

Mid-America Airport was recently constructed adjacent to the existing Scott Air Force Base facilities. Work included construction of a 3,848-m civilian runway, a 2,134-m taxiway connecting the civilian and Air Force runways, a control tower, and civilian terminal facilities (Bodapati and Cornell 1993). The project site is located in southwestern Illinois approximately 32-km east-southeast of St. Louis (Fig. 1). The area is within the Effingham Plain Section of the Southern Till Plain Division (Schwegman 1973) and is characterized by gently rolling glaciated terrain, loess-derived soils and meandering, low-gradient streams within wide floodplains. There has been a long and well documented human presence in the region; the Ca-

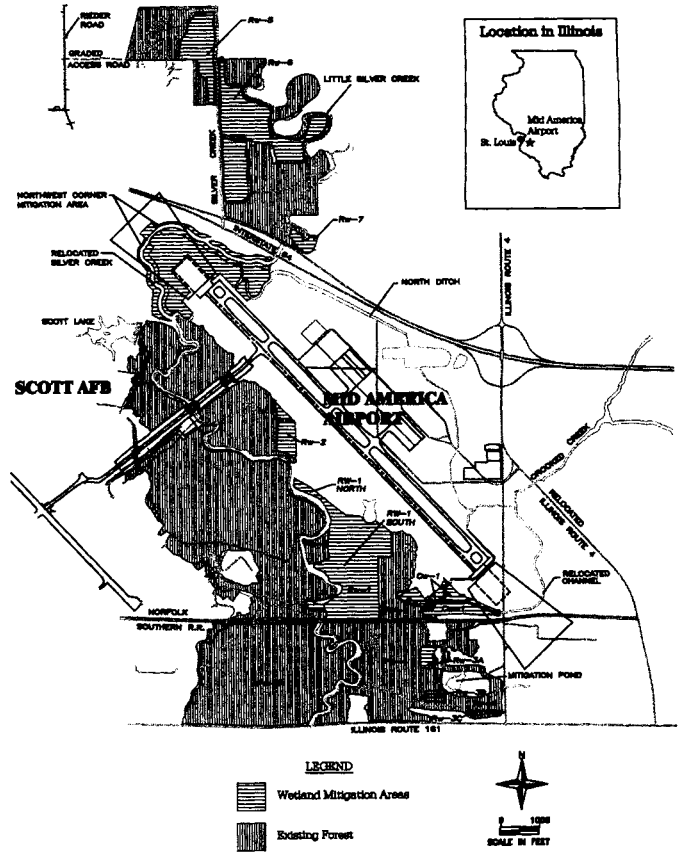

Fig. 1. Mid-America Airport, with existing forest and wetland mitigation sites.

Fig. 2. A wetland mitigation site at Mid-America Airport, with floodplain forest visible in the background. Tree seedlings planted in the mitigation site are within plastic tubes intended to minimize deer browsing; *Hyla chrysoscelis* is occasionally found inside the tubes.

hokia site is 24-km to the northwest, and smaller Native American settlements are known from the Silver Creek valley (Holley 1993).

The military and civilian sides of the project site are bisected by Silver Creek and associated wet to wet-mesic floodplain forest (palustrine forested wetlands). Floodplain forest runs the full length of the project site and is typically 0.5–1.0 km in width. The area immediately east of Scott Air Force Base was clearcut in the 1940s, and smaller scale logging has continued to the present. The existing forest consists largely of 30–60 year old even-age stands dominated by silver maple (*Acer saccharinum*), box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanicus*), and cottonwood (*Populus deltoides*). Prior to construction adjacent upland was almost entirely in agricultural use.

A total of 95.2 hectares of wetlands are being restored to mitigate for impacts associated with construction of the connecting taxiway and related facilities. Restoration sites are former cropland areas which fragment the existing forest. Work includes removal of low levees to restore hydrology and planting of native hardwood tree species, especially several types of oaks (*Quercus* sp.) and hickories (*Carya* sp.). Amphibians and other vertebrates were inventoried before construction as part of an environmental impact statement and associated baseline studies (TAMS Consultants, Inc., 1995). Post-construction inventory efforts emphasize the mitigation areas.

METHODS

During baseline studies, most amphibians were observed from late March-early June (Mierzwa and Palis 1998), so all post-construction sampling was done within that time frame. Drift fences were installed in one of the mitigation sites and in adjacent forest, with each fence 100-m from the forest edge. Drift fences were constructed from 15-m lengths of 51-cm high aluminum flashing. A 20-l plastic bucket was buried flush with the soil surface at the midpoint of each fence, and a funnel trap made from aluminum window screen and a plastic funnel was placed at each end (Corn 1994). Drift fences were open in May and early June of 1995 and in May of 1996.

In 1997 and 1998 amphibians were sampled primarily by time-constrained visual encounter surveys (Crump and Scott 1994). Observers walked through mitigation sites and nearby stands of forest, turning cover objects and watching for surface active animals. Observations were made on May 8–9 and May 29–30, 1997, and on March 31 and April 2, 1998.

RESULTS

Four species of amphibians were captured in drift fences placed at control sites within existing forest, but only two species were taken

Fig. 3. A southern leopard frog, *Rana sphenocephala,* from Mid-America Airport.

Table 1. Drift fence captures during 1995–1996 at Mid-America Airport, St. Clair County Illinois (total captures, equal effort at each site).

Species	Mitigation Sites	Control Sites
Ambystoma texanum	0	10
Bufo americanus	1	0
Acris crepitans	0	1
Hyla chrysoscelis	2	4
Rana sphenocephala	0	2

in mitigation site drift fences. More individuals were captured in forested sites, but the total sample size was relatively low (Table 1). Drift fence success was limited because repeated flood events washed out fences and restricted access. As a result, drift fence efforts were discontinued after 1996.

All species of amphibians previously known to occur within the project area (Mierzwa and Palis, 1998) were observed during visual encounter surveys. An additional species not found in pre-construction efforts but known to occur nearby (Fowler's toad, *Bufo fowleri*) was collected on-site for the first time in 1997. All eight amphibian species were found in mitigation sites; *Acris crepitans, Rana sphenocephala,* and *B. americanus* were the most frequently observed species (Table 2). Seven amphibian species were observed in forested control sites; *R. catesbeiana, R. sphenocephala,* and *A. crepitans* were the most frequently observed species. Four species (*B. americanus, B. fowleri, A. crepitans* and *R.. sphenocephala*) were encountered most often on mitigation sites; four species (*Ambystoma texanum, Hyla chrysoscelis, Pseudacris triseriata,* and *R. catesbeiana*) were seen most often on forested sites.

DISCUSSION

In 1995 and 1996, mitigation sites had relatively little vegetation cover and were subject to occasional disturbance related to tree planting. Although drift-fence data for those years were limited, it appears that some amphibian colonization of mitigation sites had occurred. However, most species were more easily found in adjacent forest. By 1997 and 1998, most mitigation areas had dense herbaceous cover and tree seedlings. Visual encounter surveys provided a larger sample and several species were frequently observed within mitigation sites.

In general, amphibians able to tolerate early successional conditions colonized mitigation sites quickly. Two species characteristic of open, sunlit wetlands (*Acris crepitans, Rana sphenocephala*) were par-

Table 2. Visual encounter survey observations during 1997–1998 at Mid-America Airport, St. Clair County, Illinois (observations per person-hour).

Species	Mitigation Sites	Control Sites
Ambystoma texanum	0.24	0.33
Bufo americanus	0.40	0.11
B. fowleri	0.16	–
Acris crepitans	2.56	0.78
Hyla chrysoscelis	0.16	0.33
Pseudacris triseriata	0.08	0.33
Rana catesbeiana	0.24	1.00
R. sphenocephala	1.12	1.00
Number of species	8	7
Number of individuals	62	35
Individuals per person-hour	4.96	3.89
Search effort (person-hours)	12.5	9.0

ticularly abundant. Species which require more heavily wooded habitat could presumably move in only as trees mature; however, the project site has a long history of habitat disturbance, and no sensitive amphibian species are thought to be present. The relatively large size of the mitigation areas and the presence of contiguous wooded habitat certainly contributed to rapid colonization. It is unlikely that a small, isolated site would support many amphibian species. The apparent arrival of an additional species in the post-construction period may be related to the removal of upland areas from agriculture, thus opening a dispersal corridor. Upland buffer is a frequently neglected aspect of wetland mitigation, but may be important for habitat diversity.

As tree seedlings mature over the next several decades, mitigation sites will become structurally more similar to the surrounding forest. Eventually, large blocks of protected forest interior habitat will be present. Over time the density of snags, deadfall and other microhabitat features will likely increase. While the sunlit emergent wetlands preferred by some amphibian species will probably persist only as small openings or lightgaps in the forest, the site as a whole is expected to be relatively diverse and capable of sustaining a stable amphibian assemblage.

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LITERATURE CITED

ASH, A. N. 1988. Disappearance of salamanders from clearcut plots. Journal of the Elisha Mitchell Scientific Society 104:116–122.

BODAPATI, N. and D. M. CORNELL. 1993. Streamlining modern airport projects. Construction Business Review Nov/Dec: 74–77.

CORN, P. S. 1994. Straight-line drift fences and pitfall traps. Pages 109–117. *In* Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. W. R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster, eds. Smithsonian Institution Press, Washington, D.C.

CRUMP, M. L. and N. J. SCOTT JR. 1994. Visual encounter surveys. Pages 84–92. *In* Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians W. R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. FOSTER, eds. Smithsonian Institution Press, Washington, D.C.

DEMAYNADIER, P. G. and M. L. HUNTER, Jr. 1998. Effects of silvicultural edges on the distribution and abundance of amphibians in Maine. Conservation Biology 12:340–352.

DUPUIS, L. A., J. N. M. SMITH, and F. BUNNELL. 1995. Relation of terrestrial-breeding amphibian abundance to tree stand age. Conservation Biology 9:645–653.

GOSSELINK, J. G. and L. C. LEE. 1989. Cumulative impact assessment in bottomland hardwood forests. Wetlands 9:83–174.

HOLLEY, G. R. 1993. Observations regarding sedentism in central Silver Creek and the enduring significance of the FAI-64 archaeological mitigation program. *In* Highways to the Past: Essays on Illinois Archaeology in Honor of Charles J. Bareis. T. E. Emerson, A. C. Fortier, and D. L. McElrath, eds. Journal of the Illinois Archaeology Survey 5:276–284.

MARSH, D. M. and P. B. PEARMAN. 1997. Effects of habitat fragmentation on the abundance of two species of Leptodactylid frogs in an Andean montane forest. Conservation Biology 11:1323–1328.

MCDONALD, P.O., W. E. FRAYER, and J. K. CLAUSER. 1979. Documentation, Chronology, and Future Projections of Bottomland Hardwood Forest Habitat Losses in the Lower Mississippi Alluvial Plain. U. S. Fish and Wildlife Service, Washington, D.C. Two volumes.

MEANS, D. B., J. G. PALIS, and M. BAGGETT. 1996. Effecrs of slash pine silviculture on a Florida population of flatwoods salamander. Conservation Biology 10:426–437.

MIERZWA, K. S. and J. G. PALIS. 1998. The amphibians and reptiles of Scott Air Force Base and Mid-America Airport, St. Clair County, Illinois. Bulletin of the Chicago Herpetological Society 33:237–242.

SCHWEGMAN, J. 1993. The Natural Divisions of Illinois. Illinois Nature Preserves Commission, Springfield, Illinois.

SHARITZ, R. R. and W. J. MITSCH. 1993. Southern floodplain forests. Pages 311–372. *In* Biodiversity of the Southeastern United States: Lowland Terrestrial Communities. W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. John Wiley and Sons, Inc., New York.

TAMS CONSULTANTS, INC. 1995. Mid-America Airport Scott joint-use project. Ecological monitoring report: Baseline and early construction conditions, 1991–1993. Public Building Commission, St. Clair County, Illinois.

TINER, R. W. 1984. Wetlands of the United States: Current Status and Recent Trends. U. S. Fish and Wildlife Service, Washington, D.C.