

# Golf Course Maintenance and Amphibian Conservation

James Howard  
Frostburg State University

## Objectives:

1. To test the relative toxicity of the most commonly used pesticides (i.e., insecticides, fungicides and herbicides) with three diverse taxa of amphibians.
2. To develop a more complete and biologically realistic testing protocol including: (a) multiple species, (b) short-term acute and long-term chronic tests, (c) multiple life history stages, (d) multiple indicators of biological impact, and (e) an environment that provides the opportunity to detoxify or potentiate chemicals with more biological realism.

**Start Date:** 1997

**Project Duration:** 3 years

**Total Funding:** \$105,036

Some conservation biologists see opportunities to create new breeding habitat for rarer species of amphibians in conjunction with golf course construction. The development of wetlands on golf courses has resulted in large open bodies of water suitable for fish and a few species of amphibians that can tolerate fish predation (i.e. bullfrogs and newts).

The development of ephemeral wetlands that dry seasonally are more suitable for most amphibian species. We designed experimental wetlands suitable for a diverse assemblage of amphibians to compare colonization of those wetlands with more traditional golf course water features. We introduced two rarer species into these wetlands to test the efficacy of using designed wetlands to establish breeding populations.

We identified a low-lying area and constructed six small ponds, three pairs approximately the same surface area. One of each of the pairs was graded to a depth of 30-50 cm and one to a depth of 70-100 cm. The deeper ponds were expected to hold water year round. We also "stocked" each of the ponds with identical numbers of eggs of two target species (northern cricket frogs and Jefferson salamanders). We monitored hatching success, larval survivorship, percentage reaching metamorphosis and numbers returning to the wetlands as adults. Over 100 eggs of each of the target species were translocated into each of the experimental ponds in 1998 and 1999. High hatching success was observed in both years and 117 and 10 metamorphosed juvenile Jefferson salamanders were



*Dr. Jim Howard discusses how small, man-made wetlands were used to establish four amphibian species near a new golf course.*

marked and released in 1998 and 1999, respectively.

Our translocations have been successful and demonstrate that, with some attention to the appropriateness of terrestrial habitat and design of wetlands for breeding habitat, golf course wetlands can serve as release sites for rare amphibians and increase the number of breeding locations for species of special concern.

None of the six experimental ponds was occupied by predatory species (i.e. bullfrogs or fish), consequently we observed no significant differences in the number of colonizing amphibians. We observed a tendency for spring breeding amphibians to make more frequent use of shallow bodies of water and summer breeding amphibians to use deeper, more permanent water. Conventional water hazards had no emergent vegetation and were manicured to the water's edge, leaving no cover for adult amphibians and were rapidly colonized by bullfrogs.

Although several species did attempt to colonize the water hazards, they were not successful. In 1999, only one species,

American toad, successfully bred. By contrast, five frog species (included some rarer taxa) and one salamander species successfully colonized our experimental wetlands and produced metamorphs.

Traditional golf course wetlands (water hazards) are "death traps" for many amphibian species and point out the importance of rethinking wetland design for future golf course construction so these spaces may better serve wildlife conservation in addition to recreation.

## Summary Points

- Golf course wetlands can serve as release sites for rare amphibians and increase the number of breeding locations for species of special concern.
- Observed a tendency for spring breeding amphibians to make more frequent use of shallow bodies of water and summer breeding amphibians to use deeper, more permanent water.
- Conventional water hazards had little cover for adult amphibians and were rapidly colonized by bullfrogs.
- In 1999, only one species, American toad, successfully bred in conventional golf course water hazards.