TURTLES: Ancient Wildlife on Your Golf Course

USGA–funded research shows that golf course wetlands can play an important role in helping conserve these ancient reptiles.

BY JEFF NUS

As urban areas are expanding worldwide, new approaches are needed to provide adequate habitat for viable freshwater turtle populations.

Turtles are in trouble. Although this ancient group of reptiles has existed for over 220 million years, today nearly half of the approximate 300 turtle species are threatened or endangered. The situation is even worse when just freshwater species are considered, where 56 percent of those species are at risk. In the face of an ever-expanding urban population that eliminates much of their habitat and fragments the rest, wildlife biologists are searching for ways to slow or reverse this trend.

If your golf course has ponds or other wetland features, it is likely that turtles live there. In the urban environment, golf courses often are the predominant green space – protected green islands surrounded by busy streets, residential housing, and traffic-congested businesses. However, is the habitat value of golf course wetlands good enough that golf courses can help conserve turtles, which are increasingly threatened for their very existence in this modern world?

Scientists from Columbia University and the State University of New York wanted to find the answer to that question, and thanks to USGA funding through the Wildlife Links Program, they got their chance. During 2009 and 2010, researchers conducted detailed habitat analyses and surveyed wetlands from golf courses, urban areas,

Only two species were captured in the 88 wetlands studied: painted turtles (above) and snapping turtles (below). Both species were found in golf course wetlands.

and wildlife refuges for turtle populations near Syracuse, N.Y. The intent was to determine how well golf course wetlands compared to urban and wildlife refuge habitats, whether turtle populations in the golf course wetlands differed in specific population parameters, and determine which, if any, habitat characteristics could be the target of active management to improve turtle habitat on golf courses.

During the survey period, a total of 413 turtles were captured, including 164 painted turtles (*Chrysemys picta*) and 249 common snapping turtles (*Chelydra serpentina*) from wetlands in urban zones, golf courses, and wildlife refuges near Syracuse.

Was the fact that only two turtle species were caught during the two-year capture period a cause for concern? "Not really. These are the most common turtles of freshwater wetlands in the region. The other possible species either favor entirely different habitats or just don't like to enter traps," says Dr. James Gibbs, Professor and Associate Chair of the Department of Environmental Biology at the State University of New York, Syracuse, and project leader. "Painted and snapping turtles, despite being common, are still very much worthy of our efforts to help them," says Dr. Gibbs. "These turtles actually get abundant enough to play a role in the ecosystems they live in as consumers of others animals and plants. After fish come turtles in terms of overall amount of biomass in these wetlands."

As the study compared turtle populations and habitat characteristics among golf course, wildlife refuge, and urban wetlands, some interesting findings emerged. Although the abundance for both turtle species was lowest in golf course wetlands, the sex and age structure of turtle populations were primarily influenced by the density and proximity of roads.

"Most people don't realize that freshwater turtles rely on the surrounding land for nesting and other purposes. When turtles have to leave a golf course and travel across roads to find appropriate habitat for these activities, that exposure can kill them. Fortunately, the restricted access and sparse traffic

of golf courses is a very good thing for turtles," says Dr. Gibbs.

Kristin Winchell, of Columbia University, N.Y., who received her Master's Degree working on this project, adds, "While the roads result was encouraging to us because it suggests that golf courses may provide safety from the major threat of road mortality, other habitat measures (e.g., size, shape, and vegetation abundance of the wetland) fell short of the quality provided by wildlife refuges. Despite this, we did not note any major turtle population anomalies in the golf course wetlands,

Examples of wetlands studied in 2009 and 2010 near Syracuse, N.Y., to evaluate characteristics of wetlands and turtle populations among urban zones, wildlife refuges, and golf courses (aerial view left column, ground view right column; aerial images © Google 2010; ground images by Kristin Winchell).

(Above left) Kristin Winchell measures the carapace (upper shell) length of a snapping turtle. Carapace length was used to investigate size structure of populations and body condition of individual turtles. (Above right) The study region of Onondaga County, N.Y., contained over 70,000 acres of wetlands, of which one quarter were located in urban areas.

and we believe that some modest habitat enhancements can lead to big improvements in habitat for freshwater turtles on golf courses."

The presence of roads is a determinant factor affecting turtle populations because turtles roam much farther from their resident ponds than most people understand. "Females make annual nesting migrations, and both sexes will move between wetlands to find mates or higher quality habitat," explains Dr. Gibbs. "Painted turtles have been recorded to move more than 500 meters from their wetland. As long as there are no roads with heavy traffic in this zone, the turtles will manage."

Does the lack of busy roads mean that turtles living on golf course wetlands typically live longer than turtles in urban environments? "Turtles can attain long life spans. Painted turtles, for example, live upwards of 40 years in the wild," says Dr. Gibbs. "Since turtles on golf courses have a lower risk of being captured or killed on roads, they almost certainly have a better chance of living out their full lives in golf course wetlands."

In addition to its direct effect to reduce turtle populations, road mortality can also affect the sex ratio of the remaining population, which can affect the long-term survival of the population. "Road mortality most commonly happens to adult females when they are killed on roads during nesting migrations," explains Ms. Winchell. "This has implications for population persistence since the adult population must remain abundant and fewer adult females mean fewer offspring next year."

However, besides higher road mortality of migrating females, sex ratios of turtle populations can be affected by other factors. Ms. Winchell explains, "The sex ratio of a turtle population is determined by nest temperature. In some species, such as the painted turtle, warmer parts of the nest will produce females and colder parts of the nest will produce males."

This astonishing fact leads to the first suggestion from Dr. Gibbs for superintendents wanting to help bolster their resident turtle populations. "Golf course superintendents might consider providing artificial nesting areas (piles of loam-sand mix) with some partly overhanging tree limbs and leaves. This mix lets a female turtle lay her eggs in shade or full sun and thereby choose the sex of her offspring," explains Dr. Gibbs. "Painted turtles actually do this. If there are lots of one sex in the population they will lay their eggs in warmer or cooler situations to produce more of the other sex. It's pretty remarkable, really."

Like other wildlife, turtles need the capacity to roam, so habitat corridors are important. Wildlife biologists often talk about "connectivity" between habitat zones as a crucial factor in supporting wildlife populations. Ms. Winchell explains that connectivity between wetlands is an important factor for turtle populations, as well.

"When we talk about connectivity between wetlands, we are referring to the ease with which a turtle can move between two wetlands. Barriers such as roads decrease connectivity and make it less likely for turtles to migrate between wetlands," notes Ms. Winchell. "This has important implications for long-term survival of turtles on a regional scale. Declining populations can be 'rescued' by immigrating turtles,

which can bolster the resident population. Exchange of individuals between wetlands also increases genetic variability and reduces potentially harmful repercussions of inbreeding.

"Finally, when habitats become unsuitable, it is important that individuals can migrate to new wetlands of acceptable quality," says Ms. Winchell. "Maintaining landscape connectivity is one of the main reasons why creating quality habitat in urban regions is important since an uninhabitable zone could isolate populations in and around urban centers."

Another factor that favors the long-term survival of turtle populations is the vegetation in and surrounding the wetland. "Vegetation in a wetland seems to be important for several population parameters we sampled. Two vegetation types stood out: emergent and rooted vascular. Emergent vegetation is the fringe vegetation along the shoreline (e.g., cattails) and rooted vascular vegetation is the submerged vegetation that is rooted to the bottom of the pond but may extend all the way to the surface (e.g., lily pads)," noted Ms. Winchell.

"Our study suggests that allowing the emergent vegetation around a wetland and the rooted vegetation within the wetland to grow may be beneficial to establishing and maintaining abundant turtle populations. Although many golf course managers we spoke with actively remove vegetation in wetlands and mow the shoreline vegetation, we recommend against this, if possible. Other activities aimed at decreasing aquatic vegetation, such as installing fountains and adding growth-inhibiting dyes to the water, may decrease the quality of the habitat by reducing vegetation needed for foraging. In our study, we did not catch any turtles in any of the wetlands we sampled with fountains or dyes."

The study concluded that golf course wetlands provide major protections to turtles from road mortality and over-harvest, but can be enhanced by increasing wetland area, varying wetland shape, promoting the growth of emergent and rooted vascular vegetation, and increasing the proportion of forest and native grassland nearby while continuing to limit access and maintain minimal automobile traffic near wetlands.

The study also identified other important factors in a successful wetland area. Ms. Winchell explains, "When planning development around wetlands, urban planners and golf course architects should keep two things in mind: (1) wetland size and shape and (2) providing a favorable mosaic of terrestrial habitat. Larger wetlands and wetlands that vary from basic circular shapes were associated with higher occurrence and greater numbers of turtles in our study. Varying the shape of a wetland away from basic circular shapes can improve the suitability of a wetland when making it larger is not an option.

"The surrounding terrestrial habitat is just as important. Reducing turtle encounters with roads should be a high priority and can be achieved by distancing wetlands from roads and providing a mosaic of suitable land types nearby. Providing small patches of these alternate land types near the wetland allows turtles to travel less distance to find the terrestrial habitats they need," says Ms. Winchell.

Dr. Gibbs sums up the importance of this study very nicely. "You have to think really long term when you are trying to manage turtle populations," says Dr. Gibbs. "It only takes one offspring to replace one adult to have a stable population, but even that can be hard to accomplish in today's environment. That's why we were interested in the role golf courses play as safe, quality habitat for freshwater turtles."

For the entire report of this project, readers are urged to visit: http://usgatero.msu.edu/v11/n04.pdf

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