



Fore! Fairways for Wildlife

MANAGING GOLF COURSES AS WILDLIFE HABITAT

By Ryan Burdge
and Daniel Cristol



Credit: Joanna Hubbard

Ryan Burdge is a candidate for a Master of Science degree in Biology at the College of William & Mary in Williamsburg, Virginia.



Credit: Stephen Salpukas

Daniel Cristol is the Marjorie Curtis Distinguished Associate Professor of Biology at the College of William & Mary in Williamsburg, Virginia.

Proposals to harness the acreage of golf courses for promoting conservation generate mixed reactions. Opponents contend that golf courses are too highly fragmented, too disturbed, and too contaminated to provide quality habitat for wildlife (Gange et al. 2003). Some view golf courses as ecological traps where animals are lured to an untimely death rather than havens for wildlife. However, proponents argue that the abundance and vastness of these emerald acres could provide much-needed refuge for displaced wildlife in urbanized areas, including threatened species (Cristol and Rodewald 2005). As our remaining natural habitats are lost to development, the potential conservation value of each golf course increases. When golf courses exist in high densities, such as in the coastal Carolinas or Florida, they create a network that complements and connects existing natural patches. Furthermore, whereas privately-owned natural lands may fall to the bulldozer at any time, profitable golf courses are more permanent fixtures in the developed landscape.

Perhaps the strongest argument for golf courses is that whatever shortcomings they have as wildlife habitat may be correctable. Course designers and managers can, if motivated, retain larger out-of-play areas, minimize chemical applications, and landscape with native vegetation. Courses that are unfriendly to wildlife can be restored with wildlife corridors or wetlands. Indeed, many modern courses are pursuing green management practices from planting native trees to reducing pesticide use. Programs such as the United States Golf Association's Wildlife Links grants and Audubon International's Cooperative Sanctuary Program arose from the industry's desire to change public perception by reducing environmental impacts. In England, more than 100 courses have been classified as Sites of Special Scientific Interest, the highest possible recognition of wildlife habitat. But in the end, golf courses are designed for *golfers*, not wildlife. Conservation benefits will always be secondary to industry interests, but it may be possible to integrate sport and conservation in ways that benefit both. Golfers, in fact, have voted with their feet, as courses that boast the Audubon

International seal of approval garner a greens fee almost \$15 higher than uncertified courses (Limehouse 2003).

What We Know

In spite of the sport's long history, the potential of golf courses to support wildlife has only been studied recently. Golf courses can provide corridors for quadrupeds large and small. Wolves readily used a wildlife corridor added to a course in Canada, leading to reduced use by elk (Shepherd and Whittington 2006). Dispersal by radio-tracked salamanders was not impeded by the presence of fairways, and the predator-free ponds on some courses can provide valuable breeding habitat for vulnerable amphibians (McDonough and Paton 2007). However, an Australian study found fewer terrestrial vertebrates on golf courses than in nearby forests, suggesting they are less capable of thriving due to the high fragmentation (Hodgkison et al. 2007).

The bulk of what we know about wildlife on golf courses comes from studies of birds. Surveys have consistently suggested a comparable, if not higher, bird abundance on golf courses relative to reference sites (Terman 1997, Merola-Zwartjes and DeLong 2005, Tanner and Gange 2005, Sorace and Visentin 2007). This finding is ostensibly great news for golf course managers and conservationists alike, but it requires a second look. Although many individual birds are present on golf courses, they tend to be disturbance-adaptable species often associated with urban environments rather than species of conservation concern. For example, a recent Australian study found more individual birds on golf courses than in forest or suburbs, but significantly fewer species (Hodgkison et al. 2007). As in other studies, the amount of forest cover within and surrounding the Australian courses was closely related to species richness.

Although studies on four continents have shown that birds, including some species of conservation concern, readily settle on golf courses, their success in these areas remain largely unknown (Cristol and Rodewald 2005, Hodgkison et al. 2007, Tanner and Gange 2005, Yasuda and Koike 2006). Certainly for a migrating bird flying over a highly

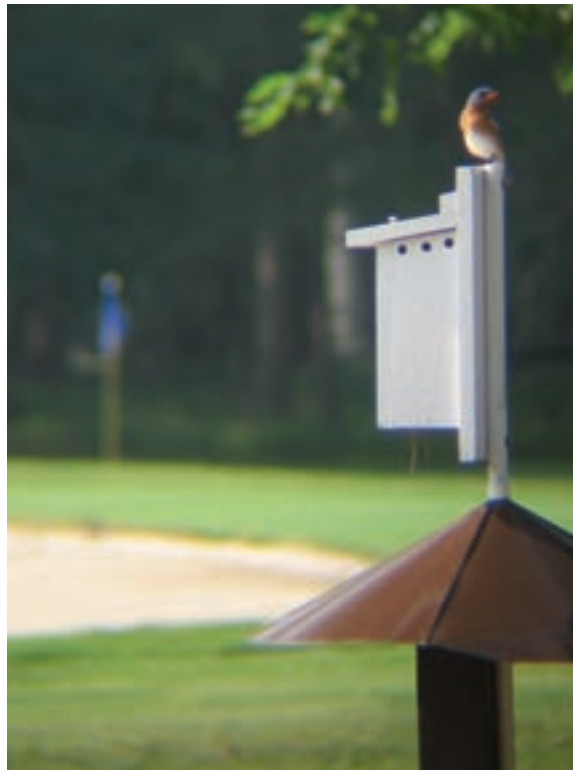


developed landscape, the green space and water on a golf course offer an enticing place to stop and rest before continuing the long journey. Birders and urban conservationists are quite familiar with the bounty of neotropical migrant songbirds found in urban parks each spring and fall, and the same can be said of golf courses. But do the birds drawn to nest on golf courses also reproduce, survive, and recruit as successfully as in other habitats? If they do not, then the abundance of birds on golf courses may be misleading. For example, waterbirds were abundant on Florida golf courses but there was no observed nesting or reproductive behavior among the thousands of individuals observed (White and Main 2005).

Where surveys fall short, reproductive metrics can provide an alternative and perhaps more meaningful indication of habitat quality. At least one species of bird, the formerly rare eastern bluebird (*Sialia sialis*), is capable of breeding successfully on golf courses, but may do slightly less well than bluebirds nesting in other habitats. Five years of monitoring bluebirds nesting at the College of William and Mary in Virginia has revealed no difference in clutch size or fledging success, while a similar study at Davidson College in North Carolina determined that golf course birds laid smaller clutches (LeClerc et al. 2005, Stanback and Seifert 2005). Both studies also suggest that birds nesting on golf courses exhibit a poorer body condition. Possible reasons why nesting birds may be at a disadvantage include pesticides used for turf management and elevated levels of predation in the fragmented woodlands strung across courses, but these hypotheses have not yet been fully tested.

What We Don't Know

One attribute of golf courses that looms large in the eyes of conservationists is their intensive turf management. A standard golf course applies numerous chemicals each season, including fungicides, herbicides, and insecticides. The highest intensity of chemical application is on putting greens, followed by the tee boxes, fairways, and the rough and out-of-play areas. Although one would expect the out-of-play areas to harbor the majority of wildlife, many species have the opportunity for exposure through spray drift or dispersal of contaminated prey items. Although these pesticides undergo extensive testing prior to entering the market, lab studies demonstrate that some legal pesticides have both lethal and sub-lethal effects on wildlife, including behavioral and reproductive impairments (Grue et al. 1997). For example, many popular insecticides kill pests by overwhelming



Credit: Ryan Burdge

A male eastern bluebird (*Sialia sialis*) sits atop a nest box with his young inside on the Newport News Golf Club at Deer Run in Virginia. The bird is part of a study by the College of William and Mary investigating the effect of golf course chemical regimes on avian reproductive health.



Credit: Josh LeClerc and Dan Cristol

Carolina chickadee (*Poecile carolinensis*) nestlings huddle together in a nest box located on a golf course.



the nervous system, in particular by inhibiting the proper function of a neurotransmitter that is critical to all species of animals. In addition to possible direct effects of pesticides, changes in prey communities due to insecticide use may also impact reproductive success and survivorship.

In the past, pesticides have been implicated in cases of major bird kills on golf courses. In 1985, 700 Brant geese (*Branta bernicla*) died from ingesting a now-banned granulated insecticide (Stone and Gradoni 1985). Although several other cases of waterfowl deaths have been documented, less is known about the exposure risk to songbirds. The lone bird exposure study, conducted at a single golf course, concluded that songbirds may be at risk of pesticide exposure and that more research is needed (Rainwater et al. 1995). This study did not monitor the effects of exposure and it, therefore, remains unknown how often the birds found abundantly on most golf courses are in fact suffering sub-lethal effects of pesticides. In another study, voles from golf courses appeared as healthy as voles elsewhere, despite some pesticide expo-

sure (Knopper and Mineau 2004). Fortunately, pesticide studies conducted in agricultural settings have detected few sub-lethal effects on wild birds, but until this question is investigated more fully on golf courses, uncertainties and suspicions about the industry's chemical impacts will persist.

Building a Home Away from Home

While golf courses cannot yet be considered adequate replacement habitat for displaced wildlife, they may play a role in mitigating habitat loss. Further consideration for a role in bird conservation is warranted due to the fact that many birds currently nest on, and migrate through, golf courses, including rapidly declining bird species such as burrowing owls (*Athene cuniculari*) in North America and ortolan buntings (*Emberiza hortulana*) in Europe (Smith et al. 2005, Dale 2004). The same may be true of other fauna, in particular amphibians, reptiles, and invertebrates that have small ranges. Research is needed to determine reproductive rates and survivorship on and off golf courses to reveal whether golf courses are population sources or sinks. Long-term studies are necessary to measure

Tamarack Resort, Donnelly, Idaho



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possible effects of chemical management on survival, condition, and reproduction. In addition, more research is required to determine predation rates, as much of what is known about golf course bird nests is from birdhouses with effective anti-predator devices. A recent study found that golf courses contained more nest predators than surrounding urban areas (Jones et al. 2005), supporting anecdotal observation of 100 percent nest predation at a course lacking predator-guards.

As research and monitoring continue, an important question remains: Should golf courses be compared to the pristine habitats they replace, to surrounding habitats with variable levels of disturbance, or to other golf courses with different management regimes? As golf courses are complex, heterogeneous landscapes, the selection of a “reference” site is crucial to ensure that appropriate interpretations and recommendations can follow. Various reference sites have been applied in past research, likely causing some of the observed incongruence in the literature.



Credit: Louise Gava

The Virginia Department of Game and Inland Fisheries led an effort to round up Canada geese (*Branta canadensis*) on golf courses for banding and recapturing. They were banded mid-summer after breeding and molting their flight features, making them easier to catch for sexing, aging, and banding.



Credit: Gary Weisbrodt



Credit: U.S. Golf Association

A gopher tortoise (*Gopherus polyphemus*) stands guard over a golf ball at The Old Collier Golf Club in Naples, Florida.

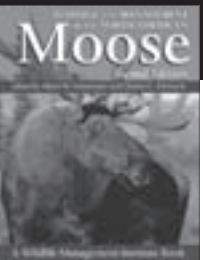
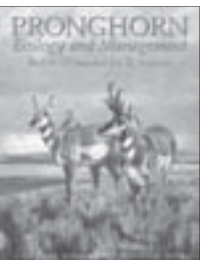

Management Recommendations

Although the jury is still out, there are already some design and management changes that can improve golf courses for wildlife. First, the standard axiom of “bigger is better” can be applied to out-of-play areas, in particular forested areas. The specific eco-region needs to be taken into consideration, but multiple studies have found abundance and diversity of bird communities to be correlated with the percentage of forested area on the course

and the immediate surroundings (Sorace and Visentin 2007, Jones et al. 2005, LeClerc and Cristol 2005, Porter et al. 2005). Courses in arid areas may play a different role, with amount of wetland and riparian habitat being most critical.

Second, minimizing chemical use would reduce any possible exposure risks or impact on prey availability. In particular, reducing applications of insecticides during the breeding season should reduce reproductive impacts. Course managers will likely already be interested in reducing expenses associated with maintaining pristine turf and any additional reason to use alternatives to chemical inputs will be welcomed by the industry.

Third, generating specific management recommendations for species of concern would boost the conservation value of golf courses. Golf courses certainly offer more habitat than some other urban landmarks, such as shopping malls and business centers, and if guided appropriately by ecologists, could contribute to conservation efforts for certain species. It is imperative that golf course managers institute research-based recommendations in order to maximize the supportive value of their lands for regionally appropriate wildlife. ■

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An eagle, a birdie, oh deer.

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