



Turfgrass and Environmental Research Online

...Using Science to Benefit Golf



Golf courses are being increasingly recognized for their value as wildlife habitat thanks to the efforts of organizations like Audubon International, the European Golf Association's Ecology Unit, and USGA research funded through the National Fish and Wildlife Foundation.

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PURPOSE

The purpose of *USGA Turfgrass and Environmental Research Online* is to effectively communicate the results of research projects funded under USGA's Turfgrass and Environmental Research Program to all who can benefit from such knowledge. Since 1983, the USGA has funded more than 215 projects at a cost of \$21 million. The private, non-profit research program provides funding opportunities to university faculty interested in working on environmental and turf management problems affecting golf courses. The outstanding playing conditions of today's golf courses are a direct result of ***using science to benefit golf.***

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Golf Courses for Wildlife: Looking Beyond the Turf

Peter Stangel and Katie Distler

SUMMARY

Golf courses impact the environment. Determining whether those impacts are positive, negative, or neutral begins with an integrated research and monitoring program both on and off the course. The golf industry has an impressive history of measuring environmental impacts within the fairway's boundaries, but less attention has been directed to influences to out-of-play areas and "downstream" sites and the flora and fauna of these areas.

The USGA's Wildlife Links program was established in part to address this specific need. Projects funded through Wildlife Links focus on the impact of golf course operations on wildlife both on- and off-site. Although our knowledge of these influences is still preliminary, linking traditional turfgrass research with wildlife oriented programs could greatly accelerate our understanding of these issues. Expanding the research horizon from turfgrass to wildlife can help minimize potential negative impacts of course operations on wildlife and maximize opportunities for golf courses to contribute in a meaningful way to natural resource conservation.

Golf courses occupy discrete sites on our landscape, often with clearly defined and easily recognized physical boundaries. Much of the past concern and research regarding golf's environmental impacts has focused on issues within a course's perimeter. For example, through the United State's Golf Association's (USGA) Turfgrass and Environmental Research Program, tens of millions of dollars has been invested in environmental issues involving turfgrass, particularly the fate of chemicals used in the cultivation and management of this substrate.

Golf's increasing popularity and the accelerating increase in new course construction has placed the sport in the environmental spotlight. Courses are frequently located in urban centers and more natural sites where human welfare,

wildlife health, water quality, and other issues are of paramount importance. The increased scrutiny on golf course environmental practices has heightened the importance of quantifying these impacts.

Concomitant with golf's heightened visibility has been a dramatic increase in environmental awareness by the general public. Concern for the environment routinely ranks as a top priority for Americans. Environmental organizations have capitalized on this awareness to push an increasingly aggressive agenda for health and conservation concerns. Part of this agenda, which has been developed in large part by academic interests, is a more holistic view of the environment and conservation. This vision is manifested through an ecosystem or landscape level approach to conservation issues. Research and monitoring of environmental issues may still take place on individual components of an ecosystem, but the goal is increasingly to put the parts within the context of a bigger picture.

We encourage the golf research community to consider a more holistic or integrated approach to environmental studies. We also hope to raise awareness amongst ecologists as to the wealth of data available from golf courses, and its



Because of their water features and out-of-bounds areas, golf courses can provide needed habitat for a number of wildlife species.

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applicability to research on chemical and other impacts to fish, wildlife, and other natural resources.

In a broad sense, this means considering golf courses within a landscape-level context, and expanding consideration of environmental issues to include ecological impacts of construction and maintenance activities. Simply stated, it means looking beyond the edge of the fairway or rough to see how runoff and other activities impact the surrounding environment and wildlife. From the ecologists standpoint, it means mining the wealth of data already available on golf course environments, and using realistic parameters to determine impacts on fish and wildlife resources.

It became clear that ecologists with an interest in toxicology issues relating to golf courses were largely unaware of the wealth of empirical data already available. To avoid duplicating effort, and to ensure that toxicology studies on wildlife were undertaken with realistic applications, it was essential to link turfgrass scientists with ecologists. Wildlife Links was established to meet research needs.

The Wildlife Links Program

The Wildlife Links Program was launched in 1995 to address research needs involving wildlife conservation on golf courses. Wildlife Links complements the very successful Audubon Cooperative Sanctuary Program for Golf Courses and its corollary in Europe, the Committed to Green Program (sidebar). Both provide a stair-step approach to improving a variety of environmental issues on golf courses.

In North America, research and monitoring activities conducted through Wildlife Links will be used to update and strengthen management recommendations in the Cooperative Sanctuary Program for Golf Courses, and feedback from program participants is used to identify priority issues for funding through Wildlife Links. Thus, these two programs work in a coordinated fashion and provide an adaptive management approach to wildlife issues on golf courses.

Wildlife Links was created following an

international workshop on wildlife research issues on golf courses held in Washington, D.C., on November 2, 1994. The workshop was organized by Audubon International, and brought together conservationists and representatives from the golf industry who identified numerous wildlife topics requiring additional study. In particular, the conferees addressed research needs for amphibians, reptiles, birds, and mammals, as well as fish, insects, and invertebrates. Additional attention was given to site selection and development of program to address these research needs. Although some environmental issues were and still are being addressed by the USGA Turfgrass and Environmental Research Program, it was clear that a specific focus on wildlife issues was beyond the immediate scope of this program.

In 1995 the USGA formed a partnership with the National Fish and Wildlife Foundation and created Wildlife Links specifically to address wildlife issues on golf courses and fulfill the recommendations of the November workshop. National Fish and Wildlife Foundation entered into this partnership because of a firm belief that golf courses could contribute in a meaningful way to landscape-level conservation plans. For example, golf courses can provide habitat corridors between protected areas and can support populations of plants and animals that are part of regional conservation plans. The opportunity to demonstrate that golf courses can provide viable habitat for individual species and suites of species, partic-



Dr. Robert Blair at the University of Miami, Ohio, conducts bird counts on golf courses and adjacent woodlands.

ularly those that are declining, was especially appealing.

There are clear opportunities to integrate golf courses into local and regional conservation plans. Golf course construction continues to accelerate, often in areas that are ecologically sensitive. Given that a typical golf course occupies 100-200 acres, and that the majority of this land area is considered "out of play," there is space to work with. Golf courses become even more important for wildlife when the rate of habitat loss in most urban areas is considered. It is not unusual in some areas for golf courses to retain the best or only suitable habitat for wildlife. Balancing opportunities for wildlife conservation with the realities of golf course management and quality of play for members creates a challenging opportunity, but one with significant benefits for both

conservation and golf.

National Fish and Wildlife Foundation manages a competitive grant program through which Wildlife Links funds are distributed. A seven member advisory committee consisting of representatives from the U.S. Forest Service; U.S. Fish and Wildlife Service; Environmental Protection Agency; The Wildlife Society; Fairfax, Virginia, Park Authority; Audubon International; USGA; and National Fish and Wildlife Foundation, reviews and select proposals. The Wildlife Links program is a corollary to the USGA Turfgrass and Environmental Research Program, which has final approval on all projects. USGA currently contributes \$200,000 annually to this effort. To date, more than \$1.1 million has been contributed to 16 projects.

The primary goals of the Wildlife Links

The Audubon Cooperative Sanctuary Program for Golf Courses

Audubon International, a non-profit organization based in Selkirk, New York, has more than 2,200 golf courses enrolled in its Audubon Cooperative Sanctuary System Program for Golf Courses. This initiative provides education and assistance to promote environmental stewardship, conservation of biological diversity, and sustainable resource management

The key objectives of this program are:

- 1) Enhance wildlife habitats on existing golf courses by working with golf course personnel and providing advice for ecologically sound course management.
- 2) Encourage active participation in conservation programs by golfers, golf course superintendents, golf officials, and the general public.
- 3) Recognize the people who are actively participating in environmentally responsible projects.
- 4) Educate the public and golfing community about the benefits of golf courses and the role they play relative to the environment and wildlife.

One goal of the courses involved in the program includes certification, which involves three steps: registering the course, completing a resource inventory and environmental plan, and obtaining certification. Activities required for certification include environmental planning, wildlife and habitat management, integrate pest management, water conservation, water quality management, and outreach and education. Audubon International provides a wide variety of other educational services to golf courses that enable them to become more environmentally healthy.

For more information, contact Audubon International at 46 Rarick Road, Selkirk, NY 12158; phone: 518-767-9051; www.audubonintl.org.

Program are to:

- 1) Facilitate research on wildlife issues of importance to the golf industry.
- 2) Provide scientifically credible information on wildlife management to the golf industry.
- 3) Develop wildlife conservation education materials for the golf industry and golfers.
- 4) Implement wildlife monitoring programs that will improve management on golf courses.

Overview of Funded Projects

Although Wildlife Links is a relatively new program and results from multi-year research projects are just now becoming available, several topics of interest to both the golf industry and the conservation community have been addressed.

Projects funded through Wildlife Links can be grouped into four general categories: education, landscape-level conservation planning, species and habitat conservation, and chemical impacts on wildlife. Following are brief descriptions of projects funded in each of these areas, with an emphasis on the latter two, which have particular relevance to this symposium and turfgrass issues.

A primary goal of Wildlife Links is to provide superintendents and golf course architects with the best available information on wildlife conservation issues. A particular focus of Wildlife Links is to move beyond more generic recommendations such as butterfly gardens and bird houses and provide relevant information on conservation biology principles as they apply to golf courses. Bird Conservation on Golf Courses (Gillihan 1999) addresses preserve design concepts such as habitat corridors, minimum habitat requirements for individual species, the importance of structural diversity, and priority species for conservation on golf courses, among others. It is worth noting that this book is one of the most comprehensive available for managing birds in an urban landscape, and its value extends well beyond golf courses to include parks, green spaces, and other managed areas. Although it was not funded through Wildlife Links, Managing

Wildlife Habitat on Golf Courses (1) is an excellent companion volume that addresses a broader variety of wildlife issues.

Funding has also been provided for a management manual for golf course wetlands, which will provide information needed to help make water features viable ecosystems for aquatic life; this volume is expected to be completed in 2002. The final grant to date in this category allowed Audubon International to create a database for information on wildlife habitat on golf courses. This database can be accessed by the general public and includes information collected through the Cooperative Sanctuary System for Golf Courses, Wildlife Links, and other formal and anecdotal studies.

Landscape-level conservation planning: three projects funded in this category address the



Research is being conducted by the United States Forest Service to determine the role of golf courses in mitigating the loss of riparian wetlands for resident and migratory birds.

role of golf courses in a broader geographic context. David Gordon, Clemson University, began a three-year project in 1998 to examine species richness of avian communities occupying a gradient of golf course landscape units along the coast of South Carolina. The goal of this project is to examine the influence of landscape context and characteristics of golf courses on the composition and species richness of bird communities. Results from this study should provide architects and managers with specific information that can improve habitat conservation and management for birds.

Committed to Green

In Europe, the leading golfing organizations have been addressing environmental issues primarily through the European Golf Association Ecology Unit. This unit was established in 1994 to provide a coordinated and professional approach to technical environmental issues relevant to golf course construction and management. The Committed to Green program was launched to put discussion and theory about environmental issues on golf courses into action on the ground.

Committed to Green seeks real improvements in environmental performance on Europe's 5,200 golf courses. It builds awareness and is open to all golf facilities on a voluntary basis. It emphasizes continual improvement, and clubs that implement a full environmental program can qualify for Committed to Green recognition through independent verification. Committed to Green has a modular structure built through a series of five steps: policy, environmental review, environmental management program, audit, and recognition.

For more information, contact the European Golf Association Ecology Unit, Chaussee de la Hulpe 110, B-1050 Bruxelles, Belgium; phone:32-2-675-87-43; ega.golf.ecology@dial.pipex.com.

A second three-year program, begun in 2000 by Michele Zwartes of the U.S. Forest Service Rocky Mountain Research Station, will evaluate the role of golf courses in mitigating the loss of riparian wetlands for resident and migratory birds. In particular, this project will determine how the type and distribution of vegetation on golf courses many influence its value as habitat for resident and migratory birds.

The final grant is supporting Robert Blair of Miami University in Ohio, who will determine what small- and large-scale landscape features within and around golf courses are important to



Preliminary results from a Washington State University study suggest that burrowing owls readily accept artificial burrows on golf courses and that their reproductive success is as good as in other areas.

birds and butterflies. This three-year project launched in 2000 will also compare and contrast these two taxa to see if design guidelines can be developed to increase the number of native species of both groups on golf courses.

It is important to note that all three of these projects consider golf courses within a much larger landscape, and that management recommendations are being developed within that context. This is in contrast to many previous studies that addressed management issues only within the course boundaries. This is a critical distinction, as a primary value for golf courses as wildlife habitats is within broader landscape needs.

Species and habitat conservation: Eight projects have been funded to date, ranging from habitat restoration projects that benefit endangered and declining species to research examining the impact of turfgrass on amphibian migrations. In the Florida Keys, the endangered Schaus swallowtail butterfly is benefitting from landscaping with native plants that provide nectar sources and larval food sources. This three-year effort by Thomas Emmel at University of Florida will help create a habitat corridor on the Ocean Reef Golf Course for adult butterflies migrating between Biscayne National Park and populations on Key Largo.



A Xerxes Society project is investigating the potential to use native plants on out-of-bounds areas of golf courses to maintain and restore populations of native pollinators, such as bees and wasps.

Courtney Conway, of Washington State University, is using Wildlife Links funding for a three-year program to determine if declining burrowing owls will reproduce successfully in artificial nest burrows installed on golf courses. Burrowing owls are indigenous to prairie habitats, much like the turfgrass found on golf courses. Preliminary results from this project, which was initiated in 2000, suggest that these terrestrial owls readily accept artificial burrows on golf courses and that their reproductive success is as good as in other areas.

The potential for golf courses to contribute to conservation of native pollinators was the goal of a three-year award to the Xerxes Society in 1997. Pollinators such as bees, butterflies, wasps, and flies play a critical role in agriculture and natural ecosystems. Habitat loss and chemical poisoning have been linked to declines in many species, prompting concern from the conservation community. The goals of the Xerxes Society project were to inventory pollinators on golf courses, and to investigate the potential to use native plants to maintain and restore their populations. This project also included experimental procedures to introduce pollinators to golf courses and an information campaign directed at superintendents and golfers.

Projects funded in 2001 include habitat restoration efforts in Colorado for the declining boreal toad, research and surveys to identify golf course habitat features most important to the declining red-headed woodpecker in the midwest, and surveys to quantify golf course wetland habitat features most important to wading birds in Florida.

Reported worldwide declines in amphibians have accelerated efforts to benefit these species on golf courses. At the University of Georgia, J. Whitfield Gibbons began in 1999 a two-year project to collect census data and conduct experiments related to amphibian and reptile use of seasonal wetlands on golf course. Seasonal wetlands are critically important for these and other species, but are also one of the most difficult habitats to identify and protect. Preliminary results suggest that golf courses lacking seasonal wetlands have only 30% to 50% as many species of amphibians as sites where these habitats are present.

The effect of golf course construction on amphibian movements is the topic of a three-year effort launched in 1998 by Peter Paton of the University of Rhode Island. Amphibians breed in water, but adults and metamorphs move across dry land to and from these wetland sites. Paton is gathering baseline data on how forested corridors and turf fields impact amphibian movements.



Researchers at the University of Georgia are evaluating the importance of seasonal golf course wetlands to enhance amphibian and reptile populations.

Results from the project will provide guidance on how both wetland and upland habitats can be managed to conserve amphibian populations. These species and habitat conservation projects epitomize the National Fish and Wildlife vision for the role of golf courses in wildlife conservation.

In each of the cases described above, golf courses are contributing to broader conservation goals for wildlife. The Schaus swallowtail butterfly is an excellent example. Federal and state parks form the core of habitat for this species, and will provide permanently protected refuges where the butterfly's needs are a top priority. Long-term survival of the species depends, however, on regular genetic exchange among populations on these refuges. Although butterflies can fly and cover considerable distances, they are less likely to cross inhospitable habitat where food and shelter are not found. By using native food plants for landscaping, the Ocean Reef Golf Course is contributing to a corridor of desirable habitat that will facilitate butterfly movement. This is an essential component of the species' recovery plan.

Amphibian conservation provides an equally compelling reason to "look beyond the turf" when considering golf courses in regional conservation plans. For the past several years, scientists have been highlights the widespread and dramatic declines in many species of amphibians. Although a variety of causes contribute to



Frostburg State researchers are determining how small, man-made wetlands can be used to establish amphibian populations near golf courses.



University of Florida researchers are determining how golf courses can aid the survival of the Schaus swallowtail, an endangered butterfly in the Florida Keys.

declines, habitat loss and chemical poisoning are two leading factors.

Most golf courses include wetlands and water features that are or could be well suited for a variety of amphibians. Maintaining or improving these wetlands for amphibians may require some special management, but is not likely to require actions outside the realm of possibility for superintendents. Through Wildlife Links funded research, the specific habitat requirements for key species are being assessed, with the goal of providing this information in an appropriate form to the golf industry. If superintendents can be encouraged to protect and enhance habitat for amphibians, then golf courses can play a key role in the conservation of these economically and ecologically important species.

Chemical impacts on wildlife: this topic engenders greater interest than any other from the conservation community and the public. Regardless of facts, golf courses are seen as heavy users of a variety of chemicals that could harm wildlife. A common criticism of Wildlife Links and other conservation programs for golf courses is that wildlife is put at risk by exposure to toxic chemicals.

Despite toxicity concerns, relatively little research has been directed at the specific case of golf course chemicals and their impact on wildlife (USGA 1994). To better understand this topic,

three projects have been funded through 2001. A three-year grant to James Howard, of Frostburg State University in Maryland permitted him to test the relative toxicity of common pesticides with three taxa of amphibians. Howard also developed a more complete and biologically realistic testing protocol that included multiple species, short-term acute and long-term chronic tests, multiple life-history stages, multiple indicators of biological impact, and an environment that provides the opportunity to detoxify or potentiate chemicals with more biological realism. Another component of Howard's work included an examination of how small, man-made wetlands were used to establish amphibian populations near golf courses. This latter point is particularly important where wetland mitigation projects are included in golf course construction.

In a related two-year project initiated in 1998, William Lamp of the University of Maryland investigated the effect of pesticides and nutrients in surface waters and their effects on benthic macroinvertebrates. Lamp's goals were to determine if surface waters and their sediments associated with golf courses are contaminated by pesticides and fertilizers, and if stream macroinvertebrates can be used as long-term indicators of water quality. The most recently funded project in this category will address sublethal effects of golf course pesticides on amphibian larvae.

Although there are numerous environmental variables to be considered, research on golf course chemicals and on-site and off-site impacts to wildlife are essential. Without these studies, it is impossible to make a convincing case for continued development of wildlife conservation programs for golf courses.

Conclusion

A holistic approach to environmental studies on golf courses will provide more and better information on impacts to human and wildlife health. Integrating research on turfgrass and other golf course specific issues with research on ecology will save time and money, and reduce duplication. It may also create a synergy that

accelerate a more complete understanding of golf's impacts, both positive and negative, on the environment.

References

1. Dodson, R.G. 2000. *Managing Wildlife Habitat on Golf Courses*. Sleeping Bear Press, Chelsea, Michigan. (TGIF Record 62907)
2. Gillihan, S.W. 2000. *Bird Conservation on Golf Courses: A Design and Management Manual*. Sleeping Bear Press, Chelsea, Michigan. (TGIF Record 56336)
3. United States Golf Association. 1994. *Golf and Wildlife*. United States Golf Association, Far Hills, New Jersey. (TGIF Record 35176)