



Golf and the Environment: Guidelines for the 21st Century

***The United States Air Force
Golf course Environmental
Management (GEM) Handbook***

January 2008

Conservation Section

This Handbook is a slightly revised version of the 2006 Comprehensive Golf course Environmental Management (GEM) Planning booklet written and copyrighted by William H. Bushman/Ecodesigns.

San Antonio, Texas



Combine the natural beauty of Kauai with Jack Nicklaus' design expertise and you get the awesome Kiele Course.

Environmental Compatibility Categories

Many diverse and complex aspects of golf course management have been revealed through the literature search conducted to compile this study. In order to simplify the process, these aspects have been summarized into eight main topics and incorporated into five distinct environmental compatibility categories.

- Planning & Compliance
- Operations & Maintenance
- Water Resource Management
- Conservation
- Pesticides & Pollution Prevention

The environmental compatibility quotient (ECQ) checklists have been compiled from several sources (Audubon International, 2000) (AFCEE, 2001) (Smart, et al, 1999). The ECQ checklists represent the best method currently available to determine the actual relative environmental compatibility of a golf course's management practices. The ECQ checklists can be completed through interviews with the golf manager and the golf course superintendent, a professional examination of the course's golf course management process, and review of the available environmental or planning documents.



Excessive runoff from a housing area upstream is the culprit here.

Conservation

“By their very nature, golf courses provide significant open spaces and opportunities to provide needed wildlife habitat in increasingly urbanized communities across North America” (Mackay, 2002). Audubon International, quoting the United States Golf Association’s Green Section, says “The average course covers 150 acres, yet just 30% is generally used for greens, tees, fairways, and buildings, leaving 70% as rough, woods, water, and other habitats. These non-play areas provide significant opportunities to enhance and protect wildlife and native habitats, provide corridors that link to other natural areas, filter pollutants, produce oxygen, and stabilize soils” (Mackay, 2002). Among the other natural resources that can be potentially impacted by golf course management operations are soils, air, water, and wildlife and their habitats.

Soils

“Properly maintained turfgrasses stabilize topsoil, reduce erosion, and improve and restore soil structure” (Beard and Green, 1994). Since most quality golf courses maintain turfgrass cover on nearly 100% of their grounds, soil impacts are usually not a major issue. It is when turfgrass quality lags and soil is bared to the effects of weather and artificial inputs such as fertilizers and pesticides do potentially adverse impacts become possible. Soil testing is a common task for golf course

superintendents as they strive to maintain the best possible conditions for turfgrass cultivation. Erosion control, compaction, and contamination are some of the potential impacts to golf course soils.

Air

Although it may seem an insignificant contributor to air emission problems, golf course tools and machinery, chemical use, and gas-powered golf carts are being scrutinized. Even though most courses cover no more than 150 acres, air emissions can be notable. Studies are on going to develop solar-powered golf carts. Cleaner, more efficient engines are more likely to be seen on fairway mowers. And, skirted pesticide sprayers inhibit volatilization and wind drift during applications. Recent modifications to The Clean Air Act that change how the United States Environmental Protection Agency (EPA) determines how dirty our air is may lead to changes at the course. In cities where the region's air quality is already poor, golf course equipment will likely be subject to annual emission testing.

The state of California is currently examining the emissions of nearly every turf industry-related tool from string trimmers to small tractors. It is just a matter of time before new rules are enacted requiring emissions controls and regular testing. If the past holds true, the U. S. EPA will in all likelihood adopt these rules and aggressively enforce them in at least the non-attainment, or bad air quality, areas of the United States.

Wildlife and their habitats

“It is critical to be aware of potential golf course lands which are biologically productive areas rich in wildlife and unique vegetation. Urban areas continue to expand as natural wildlife habitat dwindles in the United States. Wildlife is given the ever-burgeoning problem of finding natural areas in which to survive. Golf courses can provide a critical natural habitat. Enjoying the game of golf and preserving our wildlife heritage are mutually compatible goals” (Balough & Walker, 1992).

According to Audubon International (Mackay, 2002), “Golf courses have tremendous opportunities to provide valuable open space for people and wildlife and become part of local green spaces within their communities.” Ironically, this can become an additional complication for some golf course managers when the golf course attracts waterfowl and other birds that can foul turfgrass and water bodies with their actions.



Turkeys and other desirable species are abundant on many courses.

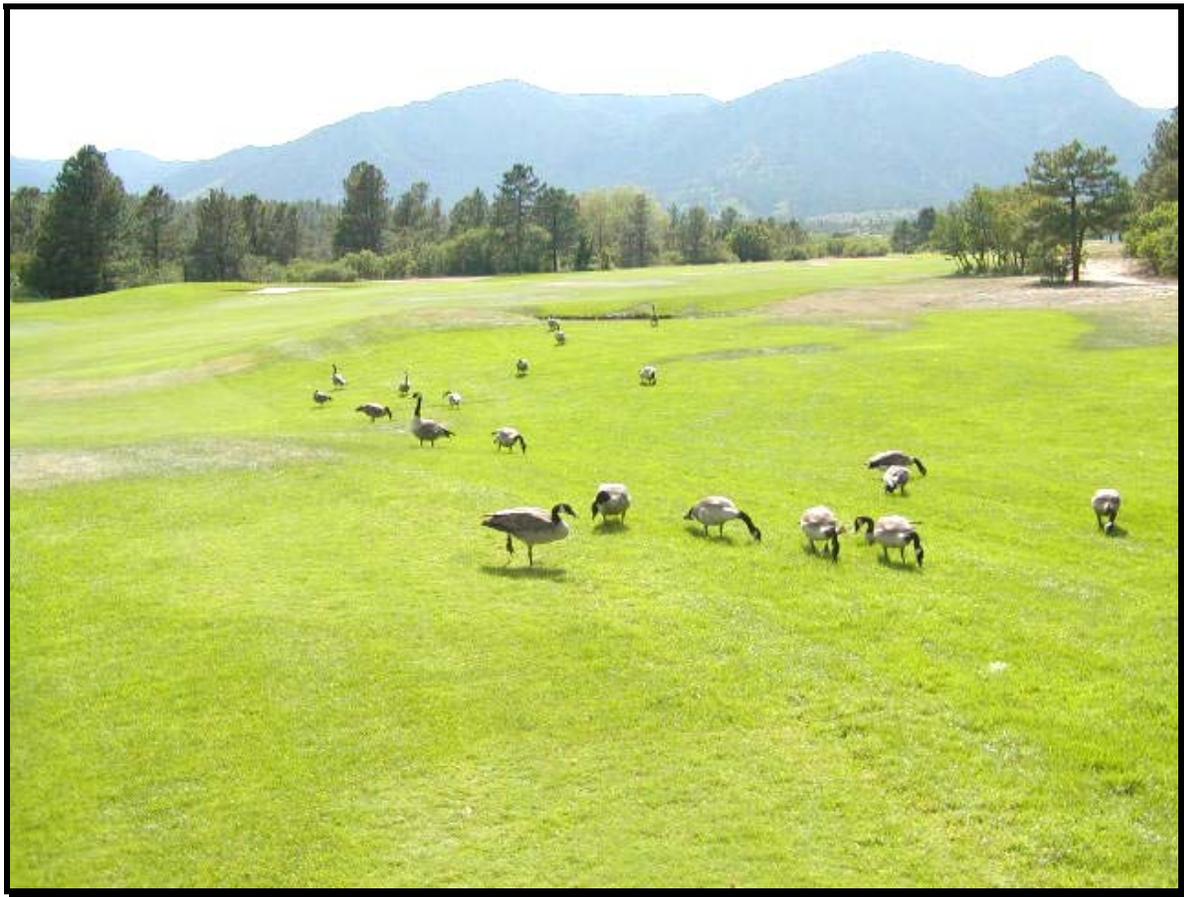
The Endangered Species Act of 1973 (7 U.S.C. § 136 & 16 U.S.C. § 460) adds impetus and motivation, as it is one of the most pervasive and liability driven laws of the age. It is imperative that golf course managers understand what wildlife occurs on their courses and what they can do to improve the populations of the desirable species. Wildlife has specific needs that include space, food, water, and cover that, taken together, define the habitat. Naturally occurring, diverse landscapes obviously satisfy more species' needs and are more valuable as habitat resources on the course grounds and contiguous properties. Audubon International (Mackay, 2002) identifies these as core habitats and suggests that "they should be protected from disturbance by players and employees."

"As urban areas continue to expand into places once used as wildlife habitats, golf courses are becoming increasingly critical to the preservation of natural habitats in urban and suburban environments. There are a surprising number of wildlife species that inhabit golf courses. Not only do golf courses provide a habitat for wildlife reproduction, they serve as critical overwintering areas for migratory and nonmigratory species" (Balough and Walker, 1992).

The Migratory Bird Treaty Act of 1918 provides an additional environmental challenge to golf course managers. Basically it prohibits, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship,

cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, or any part, nest, or egg of any such bird” (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755 as amended).

To say the least, the interpretation and enforcement of this particular law is still quite murky. Fines for violations can be up to \$100,000 for individuals and \$200,000 for organizations. It is probably a good idea to consult with local natural resources manager, United States Department of Agriculture representative, or your friendly Fish & Wildlife Service agent if there are any situations where migratory birds could possibly be harmed by golf course management activities.



Superintendents need to be aware of laws that protect geese and other migratory species that may call their course “home” for a few days or weeks during the year.



Superintendents may need special assistance if cultural resources are discovered or are known to exist on their golf course property.

Cultural resources

Archaeological remains or Native American cultural items are just a few of the environmental challenges under the heading of cultural resources. Golf course managers must ensure that they comply with the National Historic Preservation Act (36 CFR § 800), the Native American Graves Protection and Repatriation Act (43 CFR §10), and the Archaeological Resources Protection Act (32 CFR § 229). Legal complications arise when cultural resources are discovered and not handled per these complicated laws. In case of encountering historical resources, one should immediately cease construction activities in the vicinity of the discovery, immediately notify the nearest National Park Service cultural resources manager, do not further disturb or remove any cultural or natural items or remains from buried contexts, and protect those items or remains exposed or brought up. There are additional requirements that also must be satisfied prior to resuming the construction activity.

Conservation action items

- Use natural resources efficiently while respecting their long-term value to the local community
- Continue building relationships with community regulators, educators, and natural resource consultants and other environmental professionals
- Utilize native or indigenous plant materials whenever possible
- Consider every aspect of the golf course facility as a positive contributor to the overall satisfaction of the customer
- Enlist local consultants to determine how the golf course staff can assist in the removal of invasive exotics that may occur
- Increase number and variety of native plant materials
- Eliminate damage or disturbance of threatened or endangered species and their habitats in accordance with the Endangered Species Act
- Minimize excess air emissions from maintenance equipment in a non-attainment or poor air quality region

Conservation Environmental Compatibility Quotient Checklist

Conservation				
#	Environmental Compatibility Indicator	Yes	Partial	No
1	Is all motorized golf course equipment checked regularly for excessive air polluting emissions?			
2	Has the entire golf course property been examined for critical habitats, state species of concern, and threatened or endangered species?			
3	Have all potentially significant wildlife habitats and their maintenance practices been coordinated with local natural resource manager, the Fish & Wildlife Service, or other appropriate local or regional regulatory agency?			
4	Are employees encouraged to minimize their trips around the course to conserve on the use of fossil fuels?			
5	Have efforts been made to connect natural areas to facilitate wildlife movement through the course property?			
6	If applicable, have all necessary permits been updated and their requirements satisfied in a timely manner?			
7	Are recycling containers conveniently provided for customer and employee use throughout the golf course facility?			
8	Has there been a study to determine the presence of invasive exotic species on or near the course?			
9	Is there a readily available Drought Management Plan for the entire golf course facility?			
10	Are there projects planned and funded that may minimize or eliminate the course's potential negative environmental impacts?			

Conservation Checklist (continued).

#	Environmental Compatibility Indicator	Yes	Partial	No
11	Is stormwater collected for supplementing irrigation water supplies for use on the course or golf course facility grounds?			
12	Are at least 85% of plants used in landscaped areas drought-tolerant native trees, shrubs, groundcovers, or their cultivars?			
13	Have local wildlife species and their habitats been documented and mapped?			
14	Does the course have a Tree Management Plan complete with planting plan and maintenance schedule?			
15	Are all employees trained to understand that poor management practices may adversely impact worker and environmental health and welfare?			
16	Is there an inventory of bird and mammal species documented, maintained, and readily available?			
17	Are food, shelter, and nesting attributes of plant species for landscape development considered during the design/selection process?			
18	Have all degraded habitats due to construction or maintenance of the course been fully restored or improved?			
19	Has the entire property been examined for archaeological, cultural, or historical resources?			
20	Are customers and employees regularly informed/trained on the golf course's conservation practices?			
Totals				

Environmental Compatibility Quotient Summary & Scoring Scale

ENVIRONMENTAL COMPATIBILITY QUOTIENT SUMMARY			
Environmental Compatibility Category	Yes	Partial	No
Planning & Compliance			
Operations & Maintenance			
Water Resource Management			
Conservation			
Pesticides & Pollution Prevention			
Totals			

- Key to checklist responses

- **Yes** = Practice is complete or ongoing and can be verified
- **Partial** = Practice has been initiated but needs improvement or completion
- **No** = Practice is not in place

ENVIRONMENTAL COMPATIBILITY QUOTIENT SCORING SCALE	
Total Yes or Partial Responses	Environmental Compatibility Level
86-100%	Advanced (Green)
70-85%	Showing progress (Yellow)
69% or less	Just started (Red)



**Air Force Center for Engineering & the Environment
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Please visit our Golf course Environmental Management (GEM) Program website:
<http://www.afcee.brooks.af.mil/ec/golf/>.