



Environmental Management Practices for Golf Courses

Since its inception in 1991, the Audubon Cooperative Sanctuary Program for Golf Courses (ACSP) has been assisting golf courses in their efforts to implement environmentally responsible maintenance practices into day-to-day golf course operations. Drawing upon the expertise and experience of golf course superintendents, golf industry experts, university researchers, and environmental professionals from diverse backgrounds, Audubon International has developed Standard Environmental Management Practices that are generally applicable to all golf courses. These practices form the basis for the ACSP's certification guidelines.

Environmental Planning

Evaluation and planning helps course managers to balance the demands of golf with their responsibility to the natural environment. An initial site assessment and environmental plan, followed by yearly review and goal setting, helps golf course superintendents and others to responsibly care for the land, water, wildlife, and natural resources upon which the course is sustained.

- Conduct a site assessment to identify the physical characteristics of the property, evaluate current environmental management practices, and identify strengths and liabilities.
- Develop a map of the course that highlights wildlife habitats, water resources, and management zones to use for planning and project implementation.
- Set goals and priorities and assign responsibilities to staff.
- Evaluate progress toward goals and objectives at least once per year.
- Train employees regarding the importance of environmental sustainability and specific techniques for ensuring environmental quality.
- Communicate regularly to employees, customers, stakeholders, and community members about environmental goals, issues, project implementation, and progress.
- Document environmental activities and results to assist with planning and to track progress.



"Regardless of how well a property is managed, going through the Audubon certification process makes the operation better. The process requires a Superintendent to evaluate all their practices and programs which in some cases results in a better way to manage. The process can seem daunting at first. Tackle certification by setting mini-goals that can be tracked. It doesn't take as long as most think."

- David H. Robinson, CGCS, CGIA Senior Director, Golf Grounds, Global Golf Division, Marriott International

Wildlife and Habitat Management

Implementing environmental management practices enhances existing natural habitats and landscaping on the golf course to promote wildlife and biodiversity conservation. The great variation in golf course location, size, and layout, as well as special wildlife species and habitat considerations, must be accounted for when planning and implementing appropriate practices.

General Knowledge

- Identify core habitats, such as mature woodlands, wetlands, or stream corridors, and special habitat concerns, such as endangered or threatened species, on the property.
- Train staff to understand that management practices may positively enhance or adversely impact wildlife species and habitats on the property.
- Identify the dominant native plant community and ecological region in which the golf course is located.
- Maintain an on-going written inventory of at least bird and mammal species to document and track wildlife use of the property.



Wildlife Habitat Enhancements

- Maintain natural wildlife habitat in at least 50% of all minimally used portions of the property.
- Connect small and large natural areas as much as possible to improve wildlife movement throughout the golf course and from the course to neighboring natural areas. For instance, connect woods, meadows, stream corridors, and ponds with corridors of natural vegetation.
- Maintain or plant varying heights and types of plants, from ground cover to shrub and tree layers in habitat areas such as woods, desert, or prairie (e.g., leave understory in woodlands; maintain grasses and herbaceous plants in tall grass areas).
- Leave dead trees standing when they do not pose a safety hazard.
- Maintain a water source for wildlife with aquatic plants and shrubbery or native landscaping along the shoreline (i.e., not turfgrass). This could be a pond, stream, wetland, or river corridor. On smaller properties, this may also include a birdbath or created “backyard” pool.
- Naturalize at least 50% of out-of-play shorelines with emergent aquatic and shoreline plants. Give special attention to shallow water areas (<2ft. deep) since wildlife is most abundant when shallow water includes emergent aquatic vegetation.
- Choose flowers for gardens or container plants that will provide nectar for hummingbirds or butterflies.
- Maintain nesting boxes or other structures, when appropriate, to enhance nesting sites for birds or bats.

Habitat Protection and Biodiversity Conservation

- Complete any mitigation projects required by permit.
- Protect wildlife habitats, and any endangered or threatened wildlife or plant species, from disturbance by golfers and maintenance activities. Use buffers, mounted signs, fencing, or designated “environmentally sensitive zones” (per USGA rules) as needed.
- Establish and maintain at least 80% of the landscaped trees, shrubs, and flowers, excluding turfgrass, with plants that are indigenous to the native plant community of the ecological region of the property.
- Purchase landscape plants from locally-grown sources, whenever possible, to support the genetic integrity of local native plant communities.
- Avoid disturbing known bird nests or den sites until after young have dispersed. Stake or flag such areas when needed (e.g., rope killdeer nests; avoid removing shrubs or trees during bird nesting season if nests are present; do not mow fields until after bird nesting season).
- Restore degraded habitats, such as eroded slopes, compacted soils, polluted water sources, or areas overrun with invasive exotic species.
- Clean up trash from habitat areas when necessary.
- Confine roads, cart paths, trails, and necessary vegetation removal to the edges of existing habitats to minimize habitat disturbance and fragmentation.

Chemical Use Reduction and Safety

Golf courses must employ Best Management Practices and Integrated Pest Management techniques to ensure safe storage, application, and handling of chemicals and reduce actual and potential environmental contamination associated with chemical use.

General Knowledge

- Meet applicable state/provincial and federal regulations for chemical storage, handling, application, and disposal.
- Train maintenance staff in the basic tenets of integrated pest management.
- Educate maintenance staff about the risks to human health and the environment associated with chemical manufacturing, use, storage, and disposal, including: acute and chronic health problems, degraded water quality and soil health, and negative impacts to wildlife and habitats.



Cultural Practices and IPM Techniques

- Maintain green, tee, and fairway mowing heights at levels that can be reasonably maintained on a day-to-day basis without continually stressing turf or maximizing chemical inputs.
- Inventory soil types for all playing surfaces and assess conditions such as soil structure, nutrient levels, organic content, compaction, and water infiltration.
- Regularly work to improve soil health. This may include: amending organic content, aerating, and improving water infiltration to cultivate a diverse, living biotic soil community.
- Base fertilizer applications upon soil test information.
- Maximize turf health and minimize resource inputs by improving turf conditions.
- Plant pest-resistant or stress-tolerant cultivars on playing surfaces and in landscaping. Select plant species/cultivars best suited for climate, soils, and growing conditions.
- Designate and train key staff to monitor plant health and pest populations as part of the IPM program.
- Identify and record turf “hot spots” where disease or insect outbreaks first occur. Identify other areas where poor growing conditions often lead to problems.
- Use scouting forms to record the type, severity, location, and treatment of pest problems.
- Establish aesthetic and functional thresholds for *insects, fungal diseases, and weeds* for all managed areas.
- Evaluate potential control measures, including alterations in cultural management, biological, physical, and mechanical controls, and chemical methods.
- Consider the environmental impact of pest control measures, e.g. leaching and runoff potential, toxicity to non-target organisms, soil absorption capacity, pesticide persistence, water solubility, effects on soil microorganisms.
- Actively work to reduce turf stresses and change cultural practices or other conditions to prevent or discourage recurrence of problems.
- Maintain records of treatments employed and their effectiveness and use them to guide future pest control decisions.



Best Management Practices for Chemical Use

- Pesticides are applied by a trained, licensed applicator or as directed by law.
- Maintain a current Material Safety Data Sheet (MSDS) for each chemical at the facility.
- Read and follow label directions when using chemical products.
- Apply pesticides only when and where scouting indicates that pest threshold levels have been exceeded.
- Treat problems at the proper time and under the proper weather conditions to maximize effectiveness and minimize harmful environmental impacts.
- Employ practices and use products that reduce the potential for contamination of ground and surface water, e.g., curtains on application equipment, spoon-feeding, slow-release products, selected natural organic products.
- Eliminate potential chemical runoff and drift by avoiding applications during high winds or prior to heavy rains.
- Establish “no spray zones” and buffer areas, particularly around water features and other environmentally sensitive areas.

Communication and Education

- Train and encourage continuing education for maintenance staff, including state/provincial licensing, professional association training, and IPM certification. If applicable, provide non-English speaking employees with training in their native languages.
- Communicate with employees and clientele regarding the IPM program to maintain a dialogue regarding thresholds, epidemics, and control measures in relation to environmental quality.
- Communicate with the green committee, club manager, and club pro, as appropriate, to coordinate and assure support for needed golf maintenance activities.

Maintenance Facility and Equipment

- Chemical storage structure should be secure, well ventilated, and allow limited personnel access.
- Organize maintenance facility for efficient and proper storage of equipment and supplies.
- Properly calibrate all equipment used to apply materials.
- Prevent gasoline, motor oil, brake and transmission fluid, solvents, and other chemicals used to operate and maintain equipment and vehicles from contaminating soils, surface waters, or ground water.
- Clean and maintain equipment in ways that prevent wash water from draining directly into surface waters (e.g., lake, pond, stream).
- Properly store all chemicals. Pesticides and fertilizers are stored on plastic or metal shelving to keep them off the floor.
- Store liquid products below dry materials.
- Handle all pesticides over an impermeable surface.
- Keep a spill containment kit readily available and follow spill containment procedures.
- Triple rinse, puncture, and properly dispose of empty chemical containers.



Additional Maintenance Facility Standards

NOTE: The following maintenance facility specifications are considered standard for environmentally-responsible chemical storage and handling. Because they involve *infrastructure* standards, we strongly recommend them, but do not require them for certification in the ACSP for Golf Courses.

- Fuel is stored on an impervious surface that has spill containment and a roof.
- Chemical storage structure is fire proof.
- Explosion-proof lights are used in chemical storage and maintenance areas.
- Chemical storage area has a sealed metal or concrete floor, and spills are contained by a sump located near the middle of the floor, and a lip along the edges.
- Grass clippings are blown off equipment with compressed air instead of, or prior to, washing with water.
- A catch basin to collect grass clippings, grease, and oils is installed and maintained.

Water Conservation

Water conservation on the golf course involves maintaining irrigation equipment to maximize efficiency and minimize waste, as well as employing water conserving irrigation practices.

General Knowledge

- Prioritize water conservation and train employees to employ conservation techniques.
- Identify water sources used for irrigation and drinking water.
- Train key staff to operate and manage the irrigation system correctly.

Proper Installation and Maintenance of Irrigation Equipment, Retention Structures, and Plumbing Fixtures

- Eliminate uncontrolled releases of water out of water retention structures.
- Design, install, and test the performance of the irrigation system to maximize the efficient use of water.
- Inspect the irrigation system for proper water distribution in all irrigated areas at least once per year.
- Adjust rotation speed and operating pressure to match sprinkler spacing to nozzle performance.
- Check all irrigation equipment daily and maintain the system on a regular schedule.
- Fix leaks in a timely manner.
- Eliminate non-target watering (e.g., sidewalks, ponds, habitats).
- Maintain the pump station regularly to ensure efficient operation.
- Install part-circle irrigation heads where possible, to save water.
- Upgrade the irrigation system, or components of system (e.g., valves, sprinkler heads, nozzles, computer software), to reduce inefficiency and malfunction and reduce water use.



Proper Watering Practices and Turf Care

- Incorporate evapotranspiration rates or weather data into daily irrigation decisions.
- Utilize moisture meters to help identify when irrigation is required.
- Avoid running the irrigation system at peak evapotranspiration times.
- Water “hot spots” to target needed areas only, rather than running the entire irrigation system during the peak of the day.
- Maintain soils and turfgrass to maximize water absorption and reduce runoff and evaporation, including: maintain soil cover, improve soil structure, add or maintain natural organic matter in the soil, and improve drainage).
- Reduce or eliminate irrigation on all unused or minimally used portions of the property.
- Monitor daily water use, tally monthly usage, and set targets for yearly improvement.
- Use turfgrass on greens, tees, and fairways that is appropriate for the local climate and growing conditions.

Water Quality Management

The use of best management practices helps golf courses to protect the health and integrity of water resources. Water quality monitoring provides a valuable tool for evaluating whether management practices are working.

General Knowledge

- Prioritize the protection of water quality, both on and off the golf course, and train staff to use BMPs to prevent pollution.
- Identify the specific watershed in which the property is located, including where wastewater and runoff go after leaving the property.

Best Management Practices (BMP) and Structural Controls

- Eliminate/mitigate erosion to water bodies, such as streams, lakes, and ponds.
- Employ environmentally-sensitive plant management techniques within 25 feet of all water bodies and well heads to minimize nutrient and chemical inputs.
- Eliminate potential chemical runoff and drift near water bodies by designating “no spray” zones, using spot treatments, increasing thresholds for pest problems, using covered booms, and taking the weather into account prior to application.
- Raise mowing heights along in-play shorelines to slow and filter runoff. (Research has shown that, on a slight slope, a 25- foot buffer of 3-inch turf provides filtering benefits.)
- Reduce the potential for nutrient loading to water bodies by employing BMPs, such as: using slow-release fertilizers, spoonfeeding, and filtering drainage through vegetative or mechanical filters prior to entering water bodies.
- Calibrate and adjust fertilizer and pesticide equipment to prevent misapplication.
- Maintain and clean maintenance equipment in a manner that eliminates the potential for on-site or off-site contamination of water bodies.
- Store all chemicals in a manner that eliminates the potential for onsite or off-site contamination of water bodies.
- Mix and load pesticides in an area that guarantees spill containment.
- Handle and apply fertilizers, pesticides, and other chemicals in a manner that eliminates potential on-site or off-site contamination of water bodies.
- Dispose of all chemical containers and all waste materials in a manner that eliminates the potential for on-site or off-site contamination of water bodies.
- Reduce/eliminate the need for chemical algae control in ponds through proper aeration, nutrient reduction, bio-filters, vegetation management, or bio-controls.
- When aquatic weed management is required, seek a physical solution (*e.g.*, hand removal of plants) first, and then seek the least toxic method of chemical weed control. Address any underlying causes of the problem.



Water Quality Management: Monitoring

- Visually monitor water bodies for water quality problems, such as erosion, algae, aquatic “weed” growth, fish kills, sediment buildup, *etc.*, as part of regular IPM scouting activities.
- Report water quality problems immediately to supervisors and, if required, regulatory agencies for appropriate action.
- Establish baseline data for representative water bodies and water sources that may be adversely affected by golf course operations. Testing practices may include:
 - ❖ If there is a creek/stream/river that flows through the golf course, water is tested where water enters and exits the property
 - ❖ Physical characteristics: dissolved oxygen, pH, temperature, and specific conductivity
 - ❖ Nutrients- nitrogen (nitrate and ammonia) and total phosphorus
 - ❖ Macroinvertebrates- surveys for aquatic organisms to determine water quality in streams
 - ❖ Baseline tests conducted 4x/year for at least a year
 - ❖ Re-test water sources at least one time per year, or sooner if problems occur
- Keep written records of monitoring activities, results, and control measures taken if needed.

Outreach and Education

Golfer support for the environmental management program is essential to its long-term success. A variety of education and outreach activities assist golf course maintenance staff in communicating with patrons and community members and invite participation where appropriate. The ACSP for Golf Courses requires that golf courses form a *Resource Advisory Group* to help plan and implement environmental projects and educational efforts. Representatives from the golf course, as well as the local community, often participate to offer advice or volunteer assistance.

Communication, Education, and Involvement

- Communicate environmental goals, objectives, and projects to patrons, staff, and company decision makers.
- Provide regular updates about progress and accomplishments. Activities may include: one-on-one communication, presentations to the board and committees, environmental display board, newsletter articles, special brochures, signage, posters, scorecard information, course tours, and workshops.
- Invite employees, patrons, and community members to help with stewardship projects, as appropriate. For instance, monitoring nest boxes, inventorying wildlife species, hosting workshops or tours.
- Communicate with neighboring property owners, homeowners' associations, and community groups to inform them of the course's involvement in the various environmental stewardship projects (e.g., letters to neighbors; press releases; presentations at workshops, seminars, committee meetings).

