

golf and the environment

U.S. Naval Academy Golf Course
Annapolis, Maryland



**Legacy
Resource Management
Program**

golf and the environment

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The workbook and video *“Golf and the Environment”* produced by the Native Seed Trade Association, are the result of funding by the Legacy Resource Management Program in an effort to **demonstrate** and **apply** the environmental principles set out by the Center for Resource Management. The intention was to provide Golf Course Superintendents with a program of cost-effective managements strategies that will improve the environmental effects of golf courses by working within the local ecosystem. The strategies developed through this initiative provide DoD golf course superintendents with the information they need to become leaders in the use of environmentally sound golf course management principles on courses worldwide.

The golf course industry, in general, suffers from the negative public perception that it is “environmentally destructive.” This is due to the heavy use of pesticides and fertilizers and water that traditional management practices require. Conventional course design and management make these problems almost inevitable. For example, golf course architects rarely take into account the ecosystem

where the course will be situated, and do not typically design courses to fit within the existing ecological framework. In addition, golf course superintendents are trained in turf management and agronomy and manage their courses for playability and aesthetics. Because the courses are designed “for the game” rather than to naturally fit into the environment, golf course superintendents find themselves spending time and money battling elements that are not part of the ecosystem and therefore need to be managed constantly. This is one of the primary reasons why inordinate amounts of water, pesticide, and herbicides are often used on golf courses every year. In recent years, though, many golf course architects and superintendents have demonstrated (on private courses) that course siting, design, and management can work with the native ecosystem to take advantage of the natural checks and balances that help keep turf healthy and the course beautiful.

NSTA has developed a program that focuses specifically on designing practical strategies that incorporate an ecosystem approach into golf course

management. This program puts a special emphasis on naturalized landscaping, integrated pest management, and constructed wetland technology. During the course of this project, we learned and have demonstrated that increasing native plant populations reduces irrigation needs and helps decrease the use of chemical pollutants. This often results in a change to ongoing management practices.

This workbook is a companion to the NSTA produced video *“Golf and the Environment”* and is intended to be both a reference and a resource guide for all DoD superintendents. You will find that the workbook is composed of five sections: Habitat Enhancement Plans, Public Outreach & Education, Integrated Pest Management, Constructed Wetlands, and Acquiring Native Plant Material. In each section you will find an overview, practical management strategies, and resources to help you get started. This workbook, used in conjunction with the video, can help superintendents incorporate environmentally friendly techniques into their management regime.



OVERVIEW

Before initiating any type of new practices into your management program, we must first take a critical look at what you are doing right already, and where you can make improvements. First, review the questionnaire [see Appendix], and prepare the course profile and evaluation. These will help you understand how much *does* and *does not* need to be done. Then, talk with your members about the environmental principles of “*Golf and the Environment*” and some of the strategies you might be interested in implementing. This will help you understand which environmental strategies are most appropriate for your course.

Although this program aims to help you use more environmentally friendly management strategies, we understand the importance of managing the golf course for playability and aesthetics. This program strives to provide a balance between managing for the environment and managing for playability and aesthetics.

The Questionnaire

We designed a simple questionnaire that the superintendent should take time and evaluate before reviewing the workbook and video. Then, when the superintendent is going through the workbook and watching the video, he/she could carefully consider the questions asked on the questionnaire. Completion of this questionnaire will take approximately three hours. Please take time to honestly and fully answer this questionnaire. We have found that it is the most effective way to identify areas where small changes can quickly and easily be incorporated into ongoing management strategies. Larger changes can then be made over time, and addressed as the budget allows. [see Appendix]

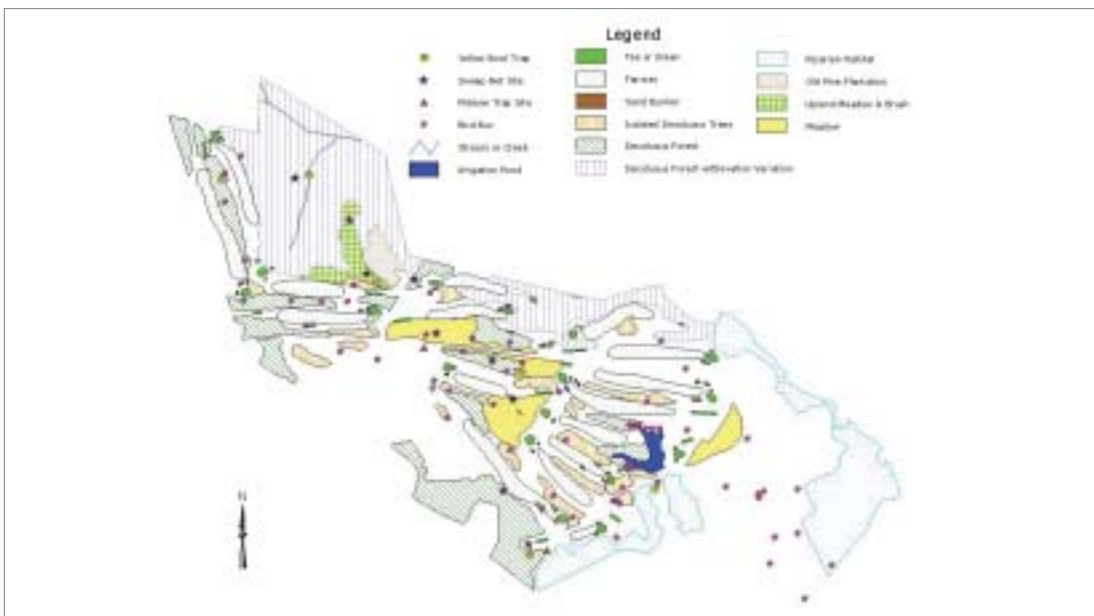
The Course Profile & Evaluation

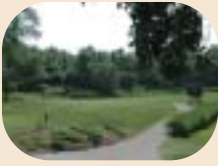
Most DoD installations are mapped using Geographic Information System (GIS) technology. If possible have your course mapped using this technology. You will be able to map your greens, tees, fairways, bunkers, water hazards, irrigation lines and out-of-play areas. These maps (and layers) can be very useful by providing you visual images to help both in planning and in managing many aspects of your course. For example, if you have a problem with Japanese Beetles you might want to outline on

the map where your problem is and then look at the types of plants used for landscaping, or that are in the surrounding out-of-play areas. Often, golf courses use ornamental plants for landscaping that are from Asia or other exotic locations. In addition, the surrounding area could be infested with Japanese honeysuckle or Multiflora rose, both plants from Japan that possess invasive characteristics and that often attract pests. If your golf course is mapped with GIS you will be able to see areas where plants and pests overlap, which can help you determine if management changes are needed.

Member Communication

The best way to implement changes is to have support among a broad range of people, including your members. There are numerous ways to communicate with your members about the effects the course has on the surrounding environment. It is important that you learn and try to understand what their attitudes and concerns are because this will help you improve your golf course. Effective communication devices like simple interactive displays and surveys in the pro-shop, posters near the game board, and mailings and brochures, are all easy ways to get your message out and encourage their feedback. A simple chat is very effective in finding out what the members think and want.





OVERVIEW

The creation of habitat enhancement plans is the easiest place to begin implementing environmentally friendly management practices. Habitat enhancement will not only help promote wildlife on your course—it can also minimize pest outbreaks, reduce chemical usage, mowing frequency, and other expenses associated with landscaping. These plans can be developed for many different parts of the golf course, and can be implemented at a pace your budget allows.



Golf Course Ecology

Surrounding Ecology: Before we can create habitat enhancement plans we must determine the ecoregion in which the golf course is situated. The initial step is to learn what the surrounding ecological components are and how these are being impacted by current management practices.

Inventory & Mapping: An ecological inventory would provide an invaluable resource of baseline information about the flora and fauna that currently resides on your golf course. A plant inventory that generates a list of all the trees, bushes, flowers and grasses on your course will supply important information about how these species work with or against the surrounding ecosystem. An insect inventory will not only tell you which beneficial and pest insect species are on your course, but where on the course they are. All of this information could be generated and used as input into GIS as layers to generate a map of the ecological components on the golf course. You could use the map to help you visualize how the course could be managed to fit better into the surrounding environment. In addition, these maps will allow you to track insect pest movement on your course, which could influence your pest control strategies. These maps can be used in a number of different ways to help you manage the ecological components of your golf course.

For this part of the program we would advise you to seek the help of your base natural resource manager. Much of the information you will need for this section can be obtained from your natural resource manager and from the Integrated Natural Resource Management Plan prepared for your installation.

Location Selection

Site selection for habitat enhancement will involve careful consideration—especially if you want to minimize disruption to play. If you want to begin by creating habitat in unmaintained or low maintenance areas, then you should consider areas that are completely out of play, or perhaps in out-of-play rough areas. You might decide to choose the landscaped area around a signature hole or around a water hazard. The location will depend on how naturalized you want the area to be. Naturalized areas can be maintained and appear groomed yet still provide habitat as easily as areas with little or no maintenance. Site selection will depend on what your goals are, and what levels of maintenance you want to obligate to that area.

Plan Design

To create a habitat enhancement plan you will need the GIS map of the golf course, and the inventories of plants, insects and turf. These are vital to the overall design of the plan. Once the locations have been chosen we must also look at the soil properties and whether the site is a dry upland site or a wet and shady spot. These considerations will affect the plant palette you use.

Plant Palette Design: The next step in the habitat enhancement plan process is creating the plant palette. This is a list of plant species [e.g., flowers, trees, shrubs, and grasses] that will be used to create habitat in the location(s) you have selected. We recommend using native plants as much as possible in your palette. We also strongly urge that the plants chosen provide a bloom wave throughout the year. This way there will be both color to enhance the golf course aesthetic, and there will be food for wildlife—especially butterflies—throughout the year. In addition to those considerations, you will want to choose plants that fit into the ecology of the golf course community.

ECOREGIONS OF THE UNITED STATES

Polar Domain

Tundra Division

Arctic Tundra Province
 Bering Tundra (Northern) Province
 Bering Tundra (Southern) Province

Mountain Provinces

Brooks Range Tundra—Polar Desert Province
 Seward Peninsula Tundra—Meadow Province
 Ahklun Mountain Tundra—Meadow Province
 Aleutian Oceanic Meadow—Heath Province

Subarctic Division

Yukon Intermontane Plateaus Tayga Province
 Coastal Trough Humid Tayga Province
 Upper Yukon Tayga Province

Mountain Provinces

Yukon Intermontane Plateaus Tayga—Meadow Province
 Alaska Range Humid Tayga—Tundra—Meadow Province
 Upper Yukon Tayga—Meadow Province

Humid Temperate Domain

Warm Continental Division

Laurentian Mixed Forest Province

Mountain Provinces

Adirondack—New England Mixed Forest—Coniferous Forest—Alpine Meadow Province

Hot Continental Division

Eastern Broadleaf Forest (Oceanic) Province
 Eastern Broadleaf Forest (Continental) Province

Mountain Provinces

Central Appalachian Broadleaf Forest—Coniferous Forest—Meadow Province
 Ozark Broadleaf Forest—Meadow Province

Subtropical Division

Southeastern Mixed Forest Province
 Outer Coastal Plain Mixed Forest Province
 Lower Mississippi Riverine Forest Province

Mountain Provinces

Ouachita Mixed Forest—Meadow Province

Marine Division

Pacific Lowland Mixed Forest Province

Mountain Provinces

Cascade Mixed Forest—Coniferous Forest—Alpine Meadow Province
 Pacific Coastal Mountains Forest—Meadow Province
 Pacific Gulf Coastal Forest—Meadow Province

Prairie Division

Prairie Parkland (Temperate) Province
 Prairie Parkland (Subtropical) Province

Mediterranean Division

California Coastal Chaparral Forest and Shrub Province
 California Dry Steppe Province
 California Coastal Steppe, Mixed Forest, and Redwood Forest Province

Mountain Provinces

Sierran Steppe—Mixed Forest—Coniferous Forest—Alpine Meadow Province
 California Coastal Range Open Woodland—Shrub—Coniferous Forest—Meadow Province

Dry Domain

Tropical/Subtropical Steppe Division

Great Plains Steppe and Shrub Province
 Colorado Plateau Semidesert Province
 Southwest Plateau and Plains Dry Steppe and Shrub Province

Mountain Provinces

Arizona—New Mexico Mountains Semidesert—Open Woodland—Coniferous Forest—Alpine Meadow Province

Tropical/Subtropical Desert Division

Chihuahuan Desert Province
 American Semidesert and Desert Province

Temperate Steppe Division

Great Plains—Palouse Dry Steppe Province
 Great Plains Steppe Province

Mountain Provinces

Southern Rocky Mountain Steppe—Open Woodland—Coniferous Forest—Alpine Meadow Province
 Middle Rocky Mountain Steppe—Coniferous Forest—Alpine Meadow Province
 Northern Rocky Mountain Forest Steppe—Coniferous Forest—Alpine Meadow Province

Temperate Desert Division

Intermountain Semidesert and Desert Province
 Intermountain Semidesert Province

Mountain Provinces

Nevada—Utah Mountains Semidesert—Coniferous Forest—Alpine Meadow Province

Humid Tropical Domain

Savanna Division

Everglades Province

Mountain Provinces

Puerto Rico Province

Rainforest Division

Mountain Provinces

Hawaiian Islands Province

One of the benefits of choosing native plants for your palette is that you can choose species that represent different stages of the local ecology. Some plants are going to be early successional, which means that in the beginning of the project they will do very well but eventually will die out and be replaced by mid and late successional species. It is important to choose the plants for your palette that will represent all aspects of the local ecology and that are adapted to your ecoregion. This way you are not just planting plants; you are creating a plant community that will be part of the local ecology. The benefits of designing your plant palette with these considerations are that the plant community will require less maintenance once it has become established, and these will not be areas that harbor pests. You will also create habitat and corridors for wildlife, which will enhance the environmental benefits of your course.

A sure way to satisfy yourself and your golf community about the appropriateness of your plant palette and its affect on the landscape aesthetic is to have a graphic designer help you create composite images showing how the different plant species would look in the setting of your golf course. These images can be printed and used as a display for members to view as a way to get them involved with the impending changes on the course. Composite images are a useful tool not only to help you visualize what the plant palette will look like over time, but are also a useful tool for generating dialogue with your members. Any graphic designer can be hired to help you create composite images for your course.

Once you have created your plant palette you will need to create a schedule of work. If you are going to be creating a meadow or prairie in a large out-of-play area you will need to determine how best to prepare the site. Site preparation can involve mowing, bush hogging, and burning—it depends on how disturbed the site is and what type of plants are there. Often, in the out of play areas on a golf course, these areas are filled with errant turf grass species, a few invasive species, and some small woody plants. The level of site preparation will vary depending on the ecology of the site. You will need to look at your chosen location and figure out a schedule of work so as not to interfere with golf course play. This can be tricky but many golf courses have “no play” days when the more intrusive site preparation activities could be scheduled.

Your habitat design will vary depending where on the golf course you choose to site your habitat enhancement plan. If you start with large out-of-play areas, you will probably be going for an effect that is less groomed and more natural in its overall appearance. If you choose an area that is quite visible on the course (like the landscaping around a hole or a water hazard) then you will need to balance your plant palette to include plants that are aesthetically pleasing to the golf course community. There is no one way to develop your plan, it will take careful attention to detail, and there are many considerations to take into account if you want to balance the environmental affect with the golf course aesthetic and playability issues. This part of the project is one of the most rewarding because the end result brings numerous desirable effects [e.g. aesthetic diversity and increased wildlife activity].

RESOURCES

Publications

Bailey, R.G. 1995. Descriptions of the ecoregions of the United States. 2nd edition. Misc. Publ. No. 1391, Washington, D.C. USDA Forest Service with map.

Balogh, J.C. & Walker, W.J. 1992. Golf Course Management & Construction: Environmental Issues. Boca Raton, Florida. Lewis Publishers.

Dodson, R.G. 2000. Managing Wildlife Habitat on Golf Courses. Europe. J. Wiley Publishers.

Gillihan, S.W. 2000. Bird Conservation on Golf Courses: A Design and Management Manual. Chelsea, Michigan. Sleeping Bear Press.

Harker, D. et al. 1999. Landscape Restoration Handbook Second Edition. U.S.G.A. & Audubon International. Boca Raton, Florida. Lewis Publishers.

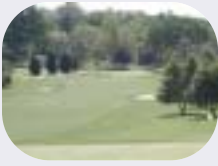
Mackay, J. 1996. A Guide to Environmental Stewardship on the Golf Course. U.S.G.A. & Audubon International.

Internet Sites

<http://www.worldwildlife.org/ecoregions/>

<http://www.nwf.org/backyardwildlifehabitat/>

<http://turf.lib.msu.edu/tero/v01/n02.pdf>



OVERVIEW

A golf course superintendent can address the public relations aspect of environmentalism by developing an outreach and education program. A successful outreach and education program can help you gain recognition and support for your environmental management program. For this type of program to be effective you should target the golf course community [e.g. membership and staff] and local groups. Much of the success of any program relies on buy-in from the people who work, live and play on or near your golf course. If those around you feel like the superintendent and his/her staff have implemented sound environmental strategies then the public perception of your golf course as having a negative impact on the surrounding area will be minimized. This can go a long way towards improving your environmental image in the public relations arena. A heightened public perception and awareness of what goes into golf course management might also go along way in helping you implement changes that might otherwise be ignored.

Community & Volunteer Organizations

If we begin our outreach program by coordinating with the base natural resource manager we can bring in the expertise we need to help put a program together that is both educational and informative. Since the golf course membership and staff are the community most impacted by a change in course management, they should be your area of initial focus. Once you have begun the process of understanding both the ecology and the ecological components on your golf course you can begin an informational campaign. You might want to prepare a poster or interactive display for the clubhouse that tells your membership and staff about the environment in which your golf course resides. You might highlight certain bird or butterfly species of importance and talk about how you plan to incorporate different management techniques aimed to help those species survive. Remember, the goal is to increase golfer understanding of wildlife and environmental quality on the golf course. A brief survey can help in the design of your plant palette. You can generate simulated views of the proposed new landscapes by using composite imagery as described above. Your membership and staff can vote on the palette they like the best. The goal is to get the local golf community involved and to help generate support for your effort.

Often, there are local bird clubs or native plant societies that would love nothing more than to help you implement your new management strategies. Involving such groups in the process allows you to educate the local community about how the golf course environment can be a valuable resource for local conservation efforts. Again, all of these efforts can be coordinated through your base natural resource manager, who can help organize a program that will not only benefit your course but also stimulate the

interest of outside organizations. If you find that your course has not been inventoried for birds, the local bird club could be invited in for a bird count or monitoring program. Every year on the 4th of July there is a national butterfly count with volunteers always looking for a place to go. These are just a few of the ways you can bring in the expertise of outside organizations to help you in your environmental program. In addition, you will be perceived as a leader in your community when it comes to environmental management.

Many superintendents might think that generating more input about management of the course will only cause them more trouble. In truth, golfers and the local community can help you get your environmental program in place. You may not be able to open up your course to the surrounding neighbors, but you can encourage them to help you in your effort to bring environmental stewardship efforts onto your golf course. You might find that some of your golfers would like to build bird boxes or bat houses. In fact, it is often the case that the nine-hole ladies golf group has a gardening interest too. These are the types of expertise you want to bring to bear on your program. If you take it one step at a time, and start slowly you can bring in the community to help lead the effort towards bringing your course more in line with the local ecology.

RESOURCES

Internet Sites

North American Butterfly Association—
Butterfly counts
www.naba.org/chapters.html

National Audubon Society—Christmas Bird Count
www.audubon.org/bird/cbc/index.html

Frog Watch USA
[www.nwf.org/keepthewildalive/frogwatch-app/
index.htm](http://www.nwf.org/keepthewildalive/frogwatch-app/index.htm)

Monarch Watch
www.monarchwatch.org

North American Pollinator Protection Campaign
www.nappc.org

Bat Conservation International
www.batcon.org

National Wildlife Federation—
Habitat Stewards Program
www.nwf.org

Organizations

Master Gardeners Program—check with your
local cooperative extension service

Native Plant Societies—check the Internet for
your local chapter

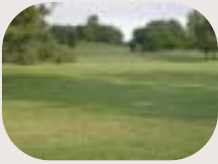
Boy Scouts of America

Girl Scouts of America

Future Farmers of America

4-H Club

Local High School and University Biology
Departments



OVERVIEW

Integrated Pest Management [IPM] is a systematic method of pest management that reduces the reliance on chemicals and strives to work with the ecosystem to take advantage of the natural checks and balances. The principals of IPM have evolved as we have learned that attempts to eliminate pests are futile because they are an integral part of the ecosystem. What has changed about IPM is the breadth of the program and its movement towards a holistic environmental management approach that incorporates all the ecological components found in a system. The basic IPM program consists of six elements: 1) Site Assessment; 2) Monitoring; 3) Setting Thresholds; 4) Stress Management; 5) Identifying & Optimizing Management Options; and, 6) Evaluation. It is important to have an evaluation component so you can determine the successes and failures, and learn what works and what needs to be changed.

There are several advantages that can be realized by the superintendent who utilizes an IPM program. **Economic:** a cost-benefit analysis can help determine the most economical way to manage pests. **Environmental:** by reducing the use of pesticides there is an overall improvement in their long-term effectiveness. Because IPM works with the ecosystem there is less negative ecological impact. **Public Relations:** IPM provides scientific documentation that the management of turf and insects is done in an environmentally responsible manner, which help improve public perception of how your course is being managed.



Site Assessment

This is the first component of the IPM program and, if you have been following our sequence in the workbook, you will have completed most of this section already. The most important element of the site assessment is a map with the course profile. Again, using GIS can help.

A quick checklist of what should go on your map for a complete golf course profile includes:

- Irrigation system
- Drainage lines & patterns
- Surface water: streams, ponds, lakes
- Soil profiles
- Topographic elevation variations
- Landscaping
- Areas of insect outbreaks & injury
- Weed infestation areas
- Greens
- Tees
- Bunkers
- Sprinkler heads
- Trees and shrubs
- Other markers

If you are using GIS for your mapping system, then each of these features can be designed as a layer on the map, and can be turned on and off when needed. If changes are made to the course then a feature on a layer can be quickly modified without having to revise the entire map.

Not only is site assessment important as regards the profile of the golf course, it is also important for assessing past pest damage. Profiles for most pests are readily available on the Internet or from your local Extension Service. Profiles should not be limited to insects, as weeds and disease are also pests. You should look at the historical pest occurrences on the course and develop profiles about each pest. These profiles should include, but not be limited to:

- Pest name
- Symptoms
- Favorable Environmental Conditions [Ecology]
- Biology
- Threshold levels
- Cultural Control Practices
- Biological Control Options
- Chemical Control Options
- References & Resources

Scouting & Monitoring

The fundamental element of a good IPM program is scouting. Scouting can provide you with information about pest presence, development and damage throughout the season. By continually observing turf condition and damage, you can make intelligent decisions about what pest control strategies to use. The key to efficient scouting is good record keeping. The scout needs to record which areas are stressed or damaged so that, as patterns develop, they can be easily detected. Documentation of pest presence, activity and damage goes a long way towards helping the superintendent determine what types of pest control management is needed.

The scout should make records of the following:

- A detailed description of what the damage looks like
- Where the damage occurs
- Determine when the damage occurred
- What are the general environmental conditions at the time of the damage

The more information the scout can record, the more knowledgeable you will be when it comes time to determine what pest management strategy needs to be employed. Encourage your scout to be as thorough in his/her note taking as possible.

To understand the actual pest problem, monitoring is required. Monitoring is the process by which the pest is sampled and evaluated. There are numerous types of sampling protocols and each is unique to pest type. Often there are very simple monitoring protocols that can be carried out by a superintendent without any special equipment. Monitoring is important because it helps identify what the pests are and how successful past management strategies have been in controlling them.

Threshold Levels

Part of scouting and monitoring is determining threshold levels. A threshold determination is made based on the amount of damage that the superintendent is willing to tolerate. There can be aesthetic thresholds and tolerance thresholds. These levels will vary across the golf course terrain, and will be based on the individual superintendent's preference and experience. In addition, historical pest records can help determine when damage will begin to occur, which can help determine a threshold level for a specific pest.

Stress Management

Stress management refers to cultural control practices that help improve growing conditions of turfgrass to help make it less susceptible to attack by pests, pathogens and weed invasions. There are a number of ways to minimize plant stress and subsequent turf damage that could provide a hospitable environment for pest and pathogen development.

- Mowing practices
- Water Management
- Turfgrass Species Selection
- Fertilization practices
- Soil considerations
- Management of Traffic Patterns

Attention to each of these elements can help minimize the amount of stress on turf and help create an environment where pest, pathogens and weeds cannot take hold and create damage.

Management Options

Every program has multiple options and IPM has many alternative management strategies that can help minimize and control pests. Two of the most effective pest management options a golf course superintendent has are *Biological* and *Chemical control* strategies.

Biological control is when living organisms or their by-products are used to suppress pest or pathogen populations. Often, turfgrass pests are from another part of the world and therefore do not have the suite of organisms here that control their populations in their native habitat. For example, Japanese Beetles are not a pest in Japan because there are plenty of beneficial organisms that control them. They are part of the local ecology. In the U.S., Japanese Beetles, which are not native, have no natural controls to keep their populations in check. There are a number of biological control options that can be purchased to help control these pests. Check with your local extension office for more information.

RESOURCES

Publications

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Ignacimuthu, S. et al. 2000. Biotechnological applications for integrated pest management. Enfield, New Hampshire. Science Publishers.

Leslie, A.R. 1994. Handbook of integrated pest management for turf and ornamentals. Boca Raton, Florida. Lewis Publishers.

Norris, R.F. et al. 2003. Concepts in Integrated Pest Management. Upper Saddle River, New Jersey. Prentice Hall.

Schumann, G.L. et al. 1998. IPM: Handbook for Golf Courses. Chelsea, Michigan. Ann Arbor Press.

Internet Sites

The National Integrated Pest Management Network
<http://www.reeusda.gov/nipmn/>

Center for Integrated Pest Management
http://ipmwww.ncsu.edu/cipm/Virtual_Center.html

Radcliffe's IPM World Textbook
<http://ipmworld.umn.edu/>



OVERVIEW

Constructed wetland technology can be used on a golf course to improve existing water hazards or features, and to filter nutrients from polluted runoff. Nutrient loading of water bodies greatly accelerates plant growth, speeds up natural succession, and creates an unhealthy aquatic ecosystem. With simple changes to existing course water features managers can realize improved water quality benefits.

One of the biggest criticisms about golf courses is their negative impact to local watersheds. Media reports suggest that the average golf course uses 100+ pounds of chemicals per acre to manage turfgrass. Environmental groups report that golf courses rate second behind agriculture in the amount of nutrients in runoff that kill our bays, rivers, and streams. Constructed wetland technology affords an opportunity to change this negative perception by creating a natural system to filter the nutrients in runoff so that the impact to the surrounding watershed is minimized.



Definitions

What is a constructed wetland? It is a man-made complex of saturated substrates, emergent and submerged vegetation, animal life, and water that simulate natural wetlands. A wetland has several legal and regulatory definitions but generally it is a naturally occurring area that is saturated with water during all or part of the year. Some examples of naturally occurring wetlands include swamps, bogs, and marshy areas. Natural water features on your course will not need to be altered, although you may consider designing and planting buffer zones to protect them.

Benefits

The most important benefit of creating a constructed wetland on your course is the overall improvement of water quality. When pesticides, fertilizers and other chemicals are used properly, the turfgrass actually traps most of the nutrients in its root mass acting as a filter for water runoff. However, some golf course situations drain more than just the golf course and there are often nutrients associated with those off-course contributions. A constructed wetland will act as a filter for nutrients, with plants absorbing many nutrients into their biomass which cleans the water.

The main benefits of a constructed wetland will include:

- Improved course aesthetic
- Improved water quality
- Increased high-value wildlife area

How to Create a Constructed Wetland

A constructed wetland can be created in any environment. The first step is to create an impermeable substrate that can hold water over a long period. You can use an existing man-made water feature, like a pond, or create a new one. It is important to make sure your water feature has the proper hydrology that can support the soils, plants and animals that will move in and form a community. The final step is bringing in the plant material that will make the constructed wetland work. In most situations the plants will establish quite rapidly.

One thing you want to avoid is nutrient overloading of your wetland. This can be done by making sure you apply chemicals carefully. For example, using a slow-release fertilizer will help considerably in avoiding nutrient overloading, which is something you want to be careful of, especially during the early stages of your constructed wetland development.

RESOURCES

Publications

Cronk, J. K., M. S. Fennessy. 2001. Wetland plants: biology and ecology. Boca Raton, Florida. Lewis Publishers.

Hammer, D.A., ed. 1989. Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural. Chelsea, Michigan. Lewis Publishers, Inc.

Olson, R.K. 1993. Created and natural wetlands for controlling nonpoint source pollution. Boca Raton, Florida. C.K. Smoley.

Internet Sites

Purdue News: Golf Course Wetlands Prove Valuable Environmental Tool
<http://www.purdue.edu/UNS/html4ever/020708.Reicher.wetlands.html>

Association of State Wetland Managers
<http://www.aswm.org/>

Constructed Wetlands Page
<http://www.usouthal.edu/usa/civileng/wetlands.htm>

Society of Wetland Scientists
<http://www.sws.org/>

USGA: Seasonal wetlands and golf courses
<http://www.usga.org/green/archive/record/02/nov-dec/seasonal.html>

National Audubon Wetlands Campaign
<http://www.audubon.org/campaign/wetland/>

Environmental Protection Agency—Wetlands
<http://www.epa.gov/owow/wetlands/>



OVERVIEW

One of the most important aspects of managing your golf course in an environmentally friendly manner is to use plant species that are native to your ecoregion. This not only includes plants for landscaping, but also for out-of-play areas and even turf. There are turf varieties that have been bred for specific ecoregions and are adapted to that climate and hydrology. Using native plants will bring your golf course into synchrony with the surrounding environment; the course will actually become part of the local ecology. This will make your job easier because now you will be working *with* the environment rather than *against* it.



Definitions

What are native plants? These are species that naturally and historically occur in a specific region, and were not imported from someplace else. With that said, there are many different types of native plant species available. Some native plants have been cultivated to perform better in landscape settings; others are 'straight' native species where no traits or characteristics have been changed through breeding. The main purpose of choosing native over non-native is that it will help bring the ecology of the golf course in step with the local ecology thereby reducing maintenance needs. Whether you choose to use cultivars or straight native species depends on the area you will be planting and what the goals are for that area. Most often, in small-scale landscape settings, cultivars are more aesthetically appealing and have been bred to display certain characteristics, such as resistance to mold. For large-scale naturalized plantings, straight native species will perform better and will provide more appropriate habitat for wildlife.

Non-native species are ones that do not naturally occur in an area. For example, Japanese cherry trees originate in Japan and are not native to the United States. These species don't provide the same quality of habitat and cannot be a functional part of the local ecosystem. Because non-natives often require more care and attract more pests, they usually add to the superintendent's pest and management headaches.

Benefits

The benefits of choosing native plants are numerous. Because these species are ecological components of the natural environment they will easily adapt to the local climate and soil conditions. Native plants will not be impacted by most pests, and will not need the same level of care and maintenance that non-native species need. Adaptation is the key feature that will save the superintendent time and money by choosing native over non-native species.

Finally, using native species will help restore native plant communities, which is an important consideration, especially when the goal is to provide quality habitat for wildlife. Wildlife corridors of regenerative native plants communities will be self-sustaining, requiring little maintenance or resources. Anyone who flies over cities can see that golf courses are often the only 'green' areas in an urban environment (outside of baseball or soccer fields). This simple fact demonstrates the important role a golf course can play in creating a haven for wildlife.

RESOURCES

Publications

Diekelmann, J. 2002. Natural landscaping: designing with native plant communities. Madison, Wisconsin. University of Wisconsin Press.

Hightshoe, G.L. 1988. Native Trees, Shrubs, and Vines for Urban and Rural America. New York, New York. John Wiley & Sons, Inc.

Mielke, J. 1993. Native plants for Southwestern landscapes. Austin, Texas. University of Texas Press.

Organizations

Native plant societies—contact your local state society

Local Master Gardener programs—contact your local agricultural extension office

Habitat Consulting Organizations

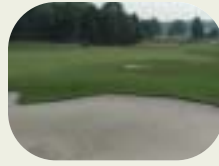
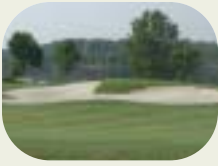
Internet Sites

Lady Bird Johnson Wildflower Center
www.wildflower.org

Nursery Associations

www.nurseryman.com—great list of local groups

<http://www.pottedliners.com/associations.htm>



OVERVIEW

This program, which is designed to help you manage your golf course in a more environmentally friendly way, is composed of overlapping elements, any one of which will bring you immediate benefits. The program's main purpose is to help you work within the existing course budget and ecology to promote eco-friendly course practices. Habitat Enhancement, Integrated Pest Management, and Constructed Wetland Technology all follow the same fundamental principles of using regionally specific ecological components in a way that helps your golf course become part of the local environment. Using locally available native plant species will minimize the amount of pest damage and maintenance you currently experience, it will also help you create habitat for wildlife. Small incremental changes can go a long way towards improving the environmental footing of course management practices.

Environmental Management Strategies

Incorporating small changes, like using native plant material in all plantings, will bring the most immediate environmental benefits. This step will not only be the most obvious aesthetically, but will save money and valuable time and resources over the long term. Again, the goal is to make your golf course fit into the existing ecology of the region. The first step in that process is to incorporate ecological components into daily management practices.

Each of your daily management routines can be fine-tuned and modified to work *with* the local ecology rather than against it. Understanding the ecology of your course, mapping, scouting, and monitoring can provide the information you need to employ management strategies that work within the environmental framework of your golf course.

Water Usage & Quality

As mentioned above, one of the biggest complaints leveled at golf courses is their negative impact to the local watershed. Even if this is a misconception, it is a popular view widely shared by those not familiar with golf courses and their management. The surest way to improve public perception is to demonstrate an improvement in water quality both on and off your course.

Constructed wetland technology and the creation of buffer zones, coupled with water quality monitoring stations will go a long way towards changing the public perception that your golf course is negatively impacting the environment. For example, the Robert Trent Jones Golf Club, home to the President's Cup, was built adjacent to Lake Manassas, Virginia, the local drinking water reservoir. Rather than negatively impacting it, RTJ's use of constructed wetland technology and buffer zones actually resulted in improved overall water quality. This type of effort improves public perception of the course, and can improve your image as a superintendent who is a leader in environmental management. These techniques do not have to become big costly projects; they can be incorporated at a small scale over time.



putting it all together

Turf

For most superintendents the type of turf used in their greens, tees, and fairways is the result of the initial design. Changing the type of turfgrass used on your course can be costly, time consuming, and labor intensive. We do not advocate a wholesale change of your turf unless it is within your budget and management goals to do so. A few superintendents we worked with changed over to a more locally adapted variety by inter-seeding over time. This has both positive and negative impacts on the course, but it is one way of converting your course to a more appropriate turfgrass variety over the long term.

The main considerations for turfgrass management are playability and the overall aesthetic. If you are unable to use a variety specifically bred for your region, the next best option is to try and manage the turfgrass in ways that minimize negative impacts to the surrounding environment while still keeping the turf in good condition. This will prove challenging but can be done within the context of this program.

Playability & Aesthetics

The golf course aesthetic is important to members and staff. Often the only aesthetic that is acceptable is that of Augusta, which is completely an unnatural situation. Although it takes time, educating members about the importance of a naturalized landscape and the environmental benefits that go along with it are important to the success of your efforts. We cannot stress enough the importance of using native plant species for your landscaping. With a little footwork you can find appropriate species that will still provide you with the meticulously groomed Augusta look, and yet be part of the local ecology.

We recognize that the overriding concerns in the management of your golf course involve playability and aesthetics. A golf course with no members is not going to be acceptable or successful. Therefore, we have tried to design a program that incorporates these elements into all management recommendations. The golf course can become part of the local ecology without having to give up the crucial elements of beauty and playability. It is all a matter of balance. This balance can be achieved by doing your homework, and by undertaking this program with the support and help of course members and staff. Outreach and education will play a large role in helping you muster the support you will need to make the changes we recommend. You can be sure that none of your members or staff wants to suffer from a negative public image about the damage your course contributes to the local environment. Communication will be the key asset in helping your members and staff understand the important benefits that will accrue from managing your course with an eye towards the environment.

Proper turfgrass management is the most important element when it comes to maintaining superior playability on your course. Using turf varieties that are adapted to your region will go a long way towards helping you manage your turf within the existing ecology. Incorporating a successful IPM program will also help improve overall course playability. These are just two management strategies that can help you improve your environmental impact while maintaining satisfactory playability.

The golf course aesthetic has been addressed repeatedly throughout this workbook. We understand the importance of the overall aesthetic to your members, and we have taken that into consideration with our recommendations. Again, you will need to do your homework but using native plants and creating habitat and naturalized areas into your planting will improve both the aesthetics and the environmental benefits of the course.

You will need to walk a fine line during the initial stages of this program. The key will be to balance the import elements of playability and aesthetics with sound environmental management strategies, and good communication with both staff and members. It takes effort and time but it can be accomplished. The initial costs will be repaid many times over through reduced maintenance, the use of fewer resources, and the reduction of pests. The long-term benefits are enormous.

The Questionnaire

We designed a simple questionnaire that the superintendent should take time and evaluate before reviewing the workbook and video. Then, when the superintendent is going through the workbook and watching the video, he/she could carefully consider the questions asked on the questionnaire. Completion of this questionnaire will take approximately

three hours. Please take time to honestly and fully answer this questionnaire. We have found that it is the most effective way to identify areas where small changes can quickly and easily be incorporated into ongoing management strategies. Larger changes can then be made over time, and addressed as the budget allows.

1. What is the playing season at the golf course?

2. What is the total course acreage?

a. Of the total, how much is considered in-play acreage?

b. Of the total, how much is considered out-of-play acreage?

3. Who designed the course?

4. When was the course built?

5. What ecoregion is the course located in? [see page 8]

6. What is your mowing regime?

a. How often [every day? Is there a day of rest for the turf?] (this will probably vary depending on if it is the fairway, green or tee)

b. Blade height

c. In-play versus out-of-play

d. Mowing regimes of fairways, greens and tees—are they different for each in-play area?
Do you mow for green speed?

e. What about the direction of the cut?

f. Equipment used—what kind of mowers?



g. How is that equipment maintained?

h. Who is responsible for the bulk of the mowing?

i. Is there supervision or accountability?

j. How long does it take to mow all the tees? Fairways? Greens?

k. How many people does it take?

l. What happens to the clippings?

m. Do you remove dew? If not—have you heard that it results in a better quality of cut AND could reduce the number of pesticide applications AND can reduce disease?

n. How are the aprons and approaches handled from a mowing standpoint?

o. What about the intermediate areas?

p. How many acres in rough? How many acres in play?

q. What about divot repair—what do you use, how often is it done?

r. Do you verticut the greens? If so, how often? If not, why?

s. Do you fertilize—if so what do you use and how often is it applied?

t. Hole placement—how often do you change it, do you use the whole green?

7. Types of turf used:

a. Fairways

b. Greens

c. Tees

d. In-play rough

e. Out-of-play rough

8. Bunker Maintenance

a. How are the bunkers maintained?

b. What is the maintenance schedule?

c. How do you decide what kind of sand to use?

d. What kind of sand do you use (treated vs. non-treated)?

9. Pest Control & Pesticide Usage

a. Who are your most destructive pests?

b. Where are the outbreaks on the course?

c. How do you currently manage for pests?

d. Do you spot treat, or do broad based treatments?

e. How much pesticide is used per golfing season? [Do pesticide usages fluctuate throughout the year?]

f. What are the most commonly used pesticides on the course?

g. Do you have some sort of pest monitoring protocol?

h. How often do you make blanket pesticide applications?

i. How do you document this information?

10. Weed Control

a. What is your management strategy for weeds in your in-play area?

b. For your out-of-play areas?

c. How do you monitor for weeds?

d. What are the most common weeds you deal with?

e. What chemical(s) do you use for the most common weeds?

11. Herbicide Usage

a. What are the most commonly used herbicides?

b. How much is used?

c. What are the most common and significant problems?

d. Where on the course are these problems occurring?

e. How do you document this information?

f. How often do you make blanket herbicide applications?

12. Disease Control

a. What kinds of turf diseases do you have trouble with?

b. Where are they located?

c. What is your management strategy for dealing with disease?

d. Do you have some kind of monitoring plan for tracking disease outbreaks?

13. Fungicide Usage

a. What is the most commonly used fungicides?

b. How much is used?

c. What are the most common and significant problems?

d. Where on the course are these problems occurring?

e. How is the information currently documented?

f. How often do you make blanket fungicide applications?

14. Chemical Disposal & Storage

a. Do you have a different disposal system for each type of chemical?

b. Can you give a brief description of your disposal system(s)?

c. Where do you wash down your chemical application equipment?

d. What kind of safety and emergency equipment do you have for a chemical spill or personal emergency?

e. How do you store your chemicals?

f. What type of training do you require of the employees who apply chemicals?

g. For those who use chemicals do they have access to the appropriate protective gear?

15. Watering Regime

a. On average, what is the water usage per day/per season?

b. What time of day do you do most of your watering?

c. What is the current watering strategy—watering to the driest part of the course or the wettest part?

d. Explain current irrigation system.

e. How do you monitor?

f. Can you generate reports?

g. Where does the water come from?

16. Seeding

a. How do you choose your turf?

b. For your fairways?

c. For your greens?

d. For your tee boxes?

e. What kind of seeder do you use?

f. Who does the seeding?

g. How many times per year do you seed?

17. Do you Topdress? If so when and how often and what do you use?

18. Aerifying—do you do it? How often do you do the greens? Tees? Fairways?

19. How do you approach the concept of “playability” on your golf course?

a. What management practices help you achieve optimum “playability”?

20. Landscaping

a. Who designs and implements the landscaping for your course?

b. What is the basis for the choice of trees, shrubs, and flowers used on the course?

c. Do you ever base your landscaping decisions on wildlife value, or ecological appropriateness?

d. How important is the overall aesthetic to you and your members?

21. Out-of-Play Management

a. Explain your out-of-play rough management strategy.

b. Briefly describe your out-of-play management practices.

c. How much money and time is spent maintaining your out-of-play areas?

22. Education of Personnel

a. Briefly describe the minimum education requirements for your grounds crew.

b. Does the superintendent pursue continuing education courses?

23. How beneficial do you think it would be to participate in continuing education courses?

24. What kind of outreach and education programs take place at the golf course?

25. In terms of the environment, can you list the top ten things you do as a superintendent that you feel contribute to your being a good environmental steward?

26. What kind of environmental concerns do you have about the golf course in general?

