

Wondering About Golf Course Ecology



Editor's Report

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Now that the 33rd Ryder Cup is in the books as one of the great comebacks in golf history, I am filled with a sense of how relationships are formed among players, fans, a golf course, and a game. Important parallels can be drawn from what occurred at The Country Club to the ecology of a golf course. Ecology is defined as the relationship or the response of an organism to the environment. Clearly, the players responded to Ben Crenshaw's leadership, followed by fan reaction to the player's success and it was clear that for a moment in time, fates converged and left us in awe.

While golf seems like a singular challenge (human against course), in my mind it is in fact the player's ability to work with, or manage their game in accordance with the course, that brings success. "It's the little things", as is often said by golf purists that allow the great things to occur. The same is true for the plants, the soil and the environment in and around a golf course. Yet, while we seem to know much about the mechanics of playing successful golf, we know precious little about the golf course ecosystem.

This curiosity about biological relationships on a golf course and the broader relationship of the golf course to an increasingly developing world, may prove to be the inspiration that saves the game as natural resources become limited, (e.g., remember the energy crisis of the 1970's and the regular droughts of 1990's?).

The Context

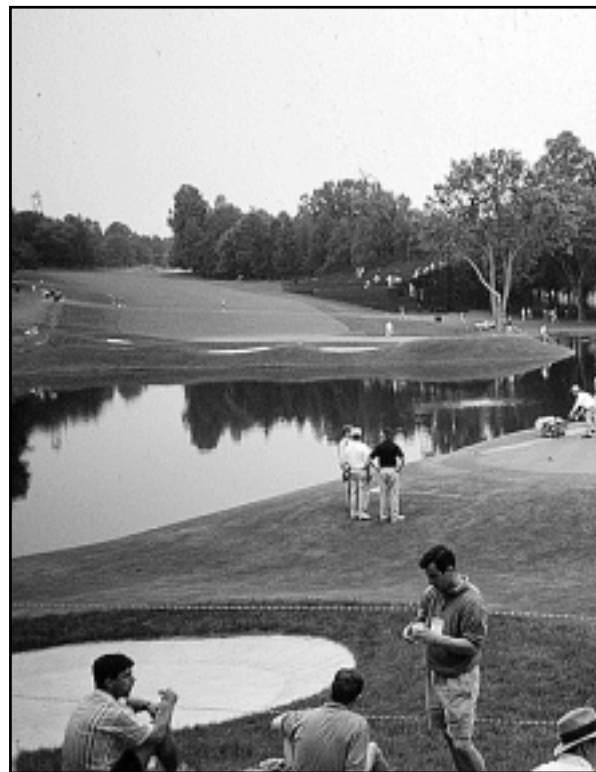
From an ecological perspective, an individual is the foundation of the system, followed by the species (group of individuals), then a population (group of species), community (groups of populations), and finally at the top of the pyramid is the ecosystem (a group of communities). Within this context, there is the plant-soil dimension that we manage, the water and wildlife that is impacted and finally the human dimension that includes the 12% of the US population that plays golf and the remaining 88% that care about the open space, the water and wildlife, not the game.

For many years, advances in turfgrass research have developed management techniques and systems that have increased course performance to meet an increased demand for golf. The increased demand is both from participation and from visual and performance expectations for championship conditions. Therefore, it is impossible to discuss the golf course ecosystem without recognizing the human dimension, however, it all begins with the soil-plant continuum.

Talking Plants?

One of the great ecological challenges that plants face, is their inability to move, i.e. they are immobile. Of course from a reproductive sense, plants are mobile in that the seed or other vegetative organs can be transported by wind, water or wildlife. However, once a plant is established in an area, it does not have the ability to move itself. Therefore, it is in the best interest of the plant to develop a relationship with its immediate surroundings. This would include, neighboring plants, microorganisms in the soil and the soil solution that contains nutrients.

Aboveground, to a certain extent, grass plants are in regular competition for space. If an individual plant can colonize a space (whether purposely seeded or invasively), it will be able to harvest light energy to manufacture food for growth. This competition can be within a species (bermudagrass) or between species (bentgrass and annual bluegrass). Research has shown that grass plants have the ability to sense the proximity of each other through alteration in radiance from nearby green leaves. We have seen this recently in our research with bentgrass seed rates that significantly alter plant density and morphology (leaf width, rooting, etc.).



Broadcasting golf on television has significantly influenced nonrenewable

What about underground communication? There is a substantial body of plant biological research that has shown how roots exude chemicals that effect the growth of other plants (allelopathy), signal microorganisms (some of which cause disease) in the soil and alter the chemical properties of the rootzone (rhizosphere) to make nutrients more available for uptake.

Stealth Technology

One of the more interesting examples of this “underground chatter” was demonstrated recently by Dr. Eric Nelson, here at Cornell University. Eric has been studying seedling *Pythium* diseases for more than a decade. He was able to elucidate the relationship between chemicals released from a germinating seedling and *Pythium* spores. As a seed takes in water and begins to germinate, chemicals are released around the seed. This chemical sphere around the seed is sensed by *Pythium* spores, causing them to germinate and attempt to infect the seedling. Eric used this information to discover how yet another microbe would use the chemical released from the seed as a food source, thereby reducing the chemical sphere and making the seed more “stealth” to the *Pythium*.



golf course maintenance and increased the consumption of energy sources.

Wouldn't it be great if we did not need to spray an herbicide again for weed control? How about being able to short circuit the chemical signals sent from stressed plants to microbes that initiate infection? Finally, what if we bred grasses that released chemicals that increase the efficiency of nutrient uptake from the soil and reduced the need for synthetic fertilizers?

Energy for Living

One of the common threads for all life is the need for energy. From an ecological perspective, plants are self-sufficient, requiring only what is provided naturally (light, water) to produce their own energy. Comparatively, we produce energy internally by eating a balanced diet that relies on taking from nature and not always giving back (nonrenewable). Also, when we manage turfgrass plants we utilize energy in nonrenewable forms from petroleum based products or coal-burning power plants that produce electricity. How long can we keep this up without recognizing energy consumption and striving for conservation?

Studies have been conducted that investigated energy consumption for turfgrass management. It is important to view this discussion from a cost/benefit perspective. There are some well documented environmental, economic and social benefits of turfgrass areas, therefore, eliminating golf courses to conserve energy is not a viable option. Nevertheless, mowing, watering and fertilizing accounts for 75% of all the energy consumed for turf management. Mowing alone accounts for 50% of the energy! Interestingly about mowing, only 2-14% of the energy is used for cutting the blade, the remainder goes to throwing the blade and engine inefficiency. Electric mowers use half the energy of gas powered mowers. Dull mowers use 22% more energy than a well sharpened mower. And, a reel mower is three times more efficient than a rotary mower.

From an ecosystem perspective, there are some “hidden costs” regarding air and noise quality issues that must be accounted for at some point, as well as any other alterations of environmental quality. The place to start might be to simply reduce mowed areas on courses, reduce mowing frequency by letting certain areas grow taller or reducing obstacles in the landscape that require intensive edging or sophisticated mowing equipment.

Flowing Downhill

One of the more controversial aspects of golf course ecology is the use of potable water.

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As discussed in previous articles, very little of the water on the planet is available for human consumption. In addition, taken in an energy context, irrigation systems require substantial amounts of nonrenewable energy for effective distribution from pumps to wiring of heads. In fact a study in California found that 69% of all energy used for turfgrass management was used to irrigate turf areas.

There is no question in my mind that we have become less efficient in our water use habits since it has become easier to apply. I know that this might ruffle some feathers and I do not mean to criticize those who strive for efficiency or for all the wonderful advancements in irrigation technology that have improved application efficiency. Yet, I know there are “closet irrigators” out there who apply water when they are not sure they need it. It is too easy to set the percentage of ET, or too easy to hit a button. Why don't we view watering as “how much the plant can do without,” rather than “how much a plant needs?”



The human dimension of the golf course ecosystem has been softened with the increased use of plastic spikes.

Clearly, the golf turf industry will be facing increasing scrutiny over water use, even in the humid climates as our population continues to grow. One of the options will be non-potable, gray or effluent water. While this brings with it many new challenges, it also highlights a key ecosystem benefit that a golf course can provide for water purification. It is a clear example of how a recreational greenspace, such as a golf course could benefit the ecological health of a community.

Sustainable Development

Finally, as we move up the pyramid to the ecosystem level, we must recognize that we are an increasingly populated world with diminishing open spaces. In fact, the concept of sprawling communities has been raised to the national consciousness in the political process. I expect this to continue.

For existing facilities there will be regular examination of the benefits that are provided from having a golf course in a community, that might be easy to address. Yet, for new facility development, there are many questions from an ecological and environmental perspective that are more difficult to answer. I am regularly appalled when I hear that a community blocked a golf course and approved a shopping center with acres of impervious pavement that will negatively impact water quality and wildlife. There may not be much the golf turf industry can do about ignorance, however, there is much the industry can do to espouse the “real” benefits when development is done in a sustainable fashion.

Sustainable development is a term used often but often misunderstood. It's almost



oxymoronic. Yet, unless our society is willing to address the population growth issue, we will have more people, who need more things and development is inevitable. How can development be sustainable, i.e., done in a fashion that minimizes impact and maximizes benefits? One answer is addressed regularly in Audubon International's (AI) Signature Program.

The Signature Program is focused on sustainable development, working with golf course and community developers who want to "tread lightly" and need some guidance. The AI team has the ability to identify siting issues, land and water issues, and an impressive array of "green building" issues that can be cost effective and environmentally sustainable. As the golf turf industry grows, the housing industry and other corporate priorities will become associated with the growth in golf. These relationships must be

structured in a way that makes sense for the 12% who want to play as well as the 88% in the community that have a different agenda.

When looked at from the ecosystem perspective relationships among the individual plant in the soil, to the energy and water needed for maintenance and finally the community issues of land use and housing, I am in awe as to how little we know. There is much to wonder about regarding the ecology of golf courses. I find joy in exploring the minutia of biology and I know how the golf turf manager relishes his or her morning tour of the course. When we recognize how we are all connected, we will experience the same joy as the US Ryder Cup Team did when they saw Justin Leonard's putt drop in the hole on 17. At that moment, we were all in this together!

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Audubon International's Signature Program is focused on sustainable development, working with golf course and community developers who want to "tread lightly" and need some guidance.

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