Turfgrass and Golf Course Benefits — A Scientific Assessment

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HUMANS have used turfgrasses to enhance their environment for over 10 centuries. Golf has been played on turfgrass for five centuries, or one-half that time. Thus, humans have had an interest and willingness to invest time in maintaining turfgrasses for the enhancement of their environment for many centuries. Point in fact, turfgrasses may be one of the oldest techniques humans have used to enhance their external living environment. Thomas Jefferson, one of the foremost statesmen in the United States, once wrote that communities "should be planned with an eye to the effect upon the human spirit by being continually surrounded by a maximum of beauty."

Over 7,500 species of grasses, grouped in 600 genera, are widely distributed throughout the world. While turfgrasses can be identified as to their origin in specific regions of the world, many of the major turfgrasses used in the United States have been naturalized in North America for over 400 years. If humans should disappear from this continent, these turfgrasses would continue to persist and thrive.

Turfgrasses are one of the principal vegetations used on golf courses. While there are certain intensively maintained turfed areas on the golf course in terms of closely mowed putting greens, tees, and fairways, more than 70% of the golf course is devoted to areas consisting of a naturalized ecosystem (Table 1). These areas provide rich habitat for trees, shrubs, flowers, birds, fish, and other wildlife. Unfortunately, there is a tendency for golf courses not to be recognized for their valuable contribution in preserving a naturalized ecosystem in and near urban areas. If golf courses did not exist, these areas probably would be used for either urban residential and industrial development or for intensive agriculture.

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Turfs have numerous important functions as well as being both aesthetically attractive and important outdoor recreational surfaces. These important beneficial characteristics, which are summarized in Figure 1, contribute to our quality of life and are too often overlooked. In addition to these important benefits, the maintenance of our turfgrasses contributes $45 billion annually to the United States economy, representing a substantial number of jobs.

Soil Erosion and Dust Stabilization. Turfgrasses are one of the more inexpensive, durable ground covers. They offer a cost-effective method to control wind and water erosion of soil, thereby protecting a valuable, non-renewable soil resource. For example, studies have shown the comparative soil sediment loss from a very intense 3-inch-per-hour rainfall to be 199 lbs./acre from bare cropland, whereas the loss from a turfgrass cover was only 15% as much (Gross et al., 1991). Note that rains of this intensity are rare. Most rains in the more normal range of 1 inch or less are characterized by negligible sediment loss from turfgrass areas.

Water Entrapment, Groundwater Recharge, and Flood Control. Mowed turfgrass typically ranges from 30 million to greater than 8 billion shoots per acre (Beard, 1973); a shoot density of over 26 billion is found on closely mowed putting greens. The closer the mowing height, the higher the shoot density. This dense plant canopy of mowed turf is one of the most effective systems in the entrapment of water and water-borne particulate matter and chemicals. The large amount of water runoff that occurs from impervious surfaces, such as asphalt, concrete, and roofs in urban areas, carries many pollutants in the runoff water that are trapped in the turf canopy, thereby protecting the quality of surface waters.

The dense turfgrass canopy that acts essentially as a sponge also greatly reduces the intensity of runoff water shortly after rains, thereby holding water in place to increase the rate of groundwater recharge and reducing the rate and amount of runoff water, thereby decreasing the need to invest in expensive man-made flood-control structures.

Carbon Storage. A grassland ecosystem is well known for its high soil organic matter levels in comparison to woodland areas. A

Table 1
Comparative Turf Utilization by Area for a Representative Golf Course

Turf Use	Area (acres)	Percentage of Area
Rough / water / woodland	130.0	72.2
Fairways	40.0	22.2
Building / parking lots	5.2	2.9
Putting greens	2.5	1.4
Tees	2.3	1.3
Total area	180.0	100.0

Figure 1
Summary of Benefits Derived from Turfs

Functional Benefits	Recreational Benefits	Aesthetic Benefits
Soil erosion control	Low-cost surfaces	Beauty
Dust prevention	Physical health	Quality of life
Groundwater recharge	Mental health	Mental health
Flood control	Safety	Social harmony
Carbon storage	Spectator entertainment	Community pride
Organic chemical degradation		Increased property values
Heat dissipation		Complements trees and shrubs in landscape
Noise abatement		
Glare reduction		
Air pollution control		
Nuisance animal reduction		
Allergic pollen control		
Fire hazard reduction		
Wildlife habitat		

(from J. B. Beard, 1989)

Table 2
Representative Microbial Biomass of Soils Under Three Types of Plant Utilization

Type of Utilization	Microbial Biomass (kg C/ha)
Grassland	1,200
Forest	850
Cropland	700

(from Smith and Paul, 1990)

Over 24 million golfers play 500 million rounds of golf on more than 15,000 golf courses, representing 2.4 billion hours of healthful recreation (Pebble Beach Golf Links, California).

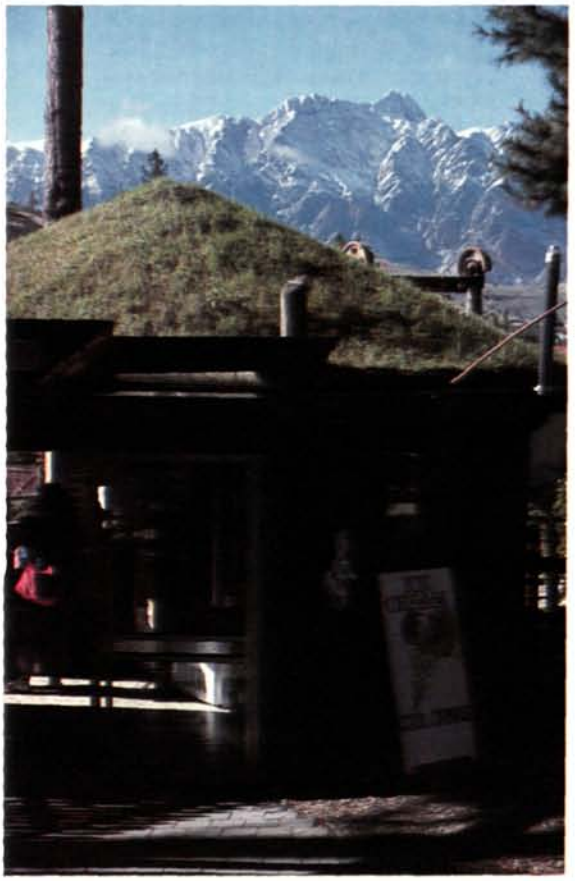
high proportion of the world's most fertile soil was formed under a grass ecosystem. The very unique extensive, fibrous root system of turfgrasses contributes substantially to soil improvement through organic matter additions from decomposing roots and underground stems, which have an estimated turnover rate of 42%. For turfgrass, 66% of the annual net productivity of plant biomass is below ground (Falk, 1967). Thus, turfs function in carbon storage via conversion of carbon dioxide emissions to soil organic matter. They also serve a vital function in restoration of environmentally damaged lands.

Organic Chemical and Pesticide Degradation. Turfgrasses have a unique, fibrous root system that is continually being replaced. This dynamic decomposition process supports a large, diverse population of soil microflora and microfauna. Compared to grassland, the average microbial biomass is 42% less for cropland and 29% less for forests (Table 2). These measurements were made on unirrigated glasslands; thus, many irrigated turfgrass areas would have microbial populations that are even larger. The turfgrass-soil ecosystem with its large microorganism population offers one of the most active biological systems for degradation of trapped organic chemicals and pesticides, thereby functioning in the protection of groundwater quality.

Enhanced Heat Dissipation. The transpirational cooling capabilities of turfs have a significant cooling impact on the microenvironment. Urban areas tend to be 10 to 12°F warmer than adjacent rural areas. Thus, the higher the percentage of turfgrass areas in urban communities relative to impermeable surfaces, the less the heat island effect. The temperature differentials that occur are dramatically illustrated on a typical August day in College Station, Texas (Table 3). These transpirational cooling effects on the microenvironment strongly buffer the potential heat stress effects on humans participating in sports and recreation on turfed surfaces when compared to the alternatives.

Reduction in Noise and Glare. Significant noise abatement can be achieved through the use of turfgrasses. For example, a 4-inch-high turfgrass area along a road reduces vehicle noise levels by 40% in a distance of 70 feet (Cook et al., 1971). This noise abatement is further accentuated by a combination of turfs, trees, and shrubs. By the same token, the multidirectional reflection of turfgrasses significantly reduces the discomfort of visual glare effects on the human eye.

Decreased Noxious Pests and Allergy-Related Pollens. Mowed turfgrass areas surrounding residences and buildings reduce the natural habitat for certain undesirable



(Above) Turfgrasses provide many functional, recreational, and aesthetic benefits (Queenstown, New Zealand).

(Top right) Turfs provide a resilient cushion that minimizes injuries (Aukland, New Zealand).

(Right) Maintenance of turfgrasses contributes $45 billion annually to the U.S. economy.

animals, such as snakes, rats, and mice, as well as insects such as mosquitos, chiggers, and ticks (Clopton and Gold, 1992). The latter are particularly significant in the spread of Lyme disease. Finally, the numerous allergy-related pollens produced by dicotyledonous plants are significantly reduced in mowed turf areas.

Reduced Fire Hazard and Enhanced Security. The living green space of irrigated turf, parks, golf courses, and residential lawns provides a significant green space of low fuel value that is vital as a fire break,

Table 3
Comparative Temperatures of Four Surfaces Assessed in August in College Station, Texas

Type of Surface	Maximum Temperature (°F)	Percent Increase Over Green Turf
Green, growing turf	88	—
Dry, bare soil	102	16
Brown, dormant turf	126	43
Synthetic turf	158	80

(from Johns and Beard, 1985)

The clean, cool green of turf provides a pleasant environment in which to live, work, and play (Park Country Club of Buffalo, Williamsville, New York).

particularly in areas that experience extended summer droughts (Youngner, 1970). Also, mowed turfs provide a high-visibility zone that restricts the activities of unwanted intruders.

Wildlife Habitat. A diverse range and a large number of wildlife are supported by the integrated landscape of grasses, trees, shrubs, and water features commonly found on over 66% of a typical golf course area. Studies by scientists conducted on the municipal golf courses in the Cincinnati area led to the conclusion that golf courses may be described as bird sanctuaries, especially when compared to the surrounding urban and agricultural uses (Andrew, 1987).

Recreational Benefits. Turfgrasses enhance the physical health of sports and recreational participants. Over 24 million golfers play 500 million rounds of golf on more than 15,000 golf courses in the United States, representing 2.4 billion hours of healthy outdoor recreation (Balogh and Walker, 1992). Turfs also provide a resilient cushion that minimizes injuries. As golf courses represent less than 4% of the turf facilities, the total recreational activities provided by turfed areas is many times greater.

Ornamental Benefits. Grasses provide beauty and aesthetic benefits that are difficult to quantitatively measure. In a 1971 Harris-Life survey, 95% of the respondents reported one of the things they wanted most around them was "green grass and trees." Golf courses satisfy this human need. There also are the benefits derived from improved

(Top) More than 70% of a golf course can be devoted to area consisting of a naturalized ecosystem (National Golf Links of America, New York).

(Above) Golf courses attract a diverse range of wildlife. Wood ducks have made a home at the Jupiter Island Club, Hobe Sound, Florida.

mental health, social harmony, and work productivity (Ulrich, 1984). How we use vegetation in our surroundings is basic to social stability and harmony, particularly in urban areas. Ugliness is costly! Cities can be dismal without green turf in parks, beside boulevards, surrounding homes, and on golf courses. If we fail to provide representative amounts of turf in urban communities, there tends to be a loss of productivity and greater susceptibility to anxiety, and that may lead to mental illness. The clean, cool, green of turf provides a pleasant environment in which to live, work, and play. Such aesthetic values are increasingly important to the dignity of the human spirit and to the mental health of urban residents.

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