turfgrass
COLUMN

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BENEFITS OF TURF TO THE ENVIRONMENT

Turfgrass has been used to enhance the environment for centuries. It plays an important role in people's everyday life, adding beauty to the environment and providing the foundation for many recreational activities.

Turf provides many benefits to the environment and society. Lawns can add to the value or sale price of houses. Even for renters, a green lawn is an important factor that affects their choice of residential location (Duble, 1996). Many recreational facilities depend on a uniform, flat and well-maintained turf as the medium for playing, such as golf courses, athletic fields, picnic areas and parks, etc. The United States Congress (2003) has acknowledged positive benefits of turfgrass to our environment: "turfgrass sod in urban areas and communities can aid in the reduction of CO_2 emissions, mitigating the heat island effect, reducing energy consumption and contributing to efforts to reduce global warming trends". The many environmental benefits of turf are discussed below.

1. Turfgrass protects topsoil from wind and water erosion and improves soil quality

Soil is the basis of terrestrial ecosystems. Turfgrass can protect the non-renewable soil resource from erosion caused by wind and water. The dense leaves, thatch mat and roots of turfgrass provide an excellent cover that reduces soil erosion, even on severe slopes. With well established and well maintained turfgrass, almost no soil will be lost even in heavy rainstorms. To the surrounding ambient, this means less mud and dust. On a larger scale, it means conservation of topsoil and less sediment pollution to rivers and lakes. A study showed that a 30-minutes storm producing a 76 mm/h rainfall could cause a soil loss of 223 Kg/ha from bare ground with 8% slope, but with healthy turfgrass cover, the loss were reduced to 10 to 60 Kg/ha (Gross et al., 1991).

Turfgrass is effective in reducing soil erosion for several reasons. First, it stabilizes the soil surface with large number of plant shoots: 185 million to over 49 billion shoots per acre. Routine mowing of turfgrass can increase shoots compared to ungrazed grassland. Putting and bowling greens mowed at a 4 mm height possess up to 27 billion shoot per acre (Beard and Green, 1994). Second, the turfgrass root system promotes "soil building" by increasing organic matter that is effective for binding and decomposing many compounds. A healthy root system can add up to 3 tons of biomass per acre each year. Also, within the turfgrass ecosystem, there is continuous growth and death of roots and other plants tissues. This process provides organic matter to improve the physical condition and the fertility of the soil. Gross et al. (1991) concluded that even low-density turf stands could effectively reduce soil erosion. Therefore, the lateral flow of water is slowed and fewer soil particles are carried away. For these

reasons, turfgrass offers a cost-efficient method to reduce wind and water erosion of soil and is thus sometimes called the "bandage for the earth".

2. Turfgrass absorbs and filters rain and runoff water

Humans depend on clean water for daily life, food supply and many industrial processes. Turfgrass system can efficiently reduce groundwater and surface contamination by capturing, filtering and even utilizing polluting chemicals. Mowed turfgrass have dense biomass (canopies) of fine-textured stems and narrow leaves, whose biomass can range from 400 to 12,000 Kg/acre (Lush, 1990). The leaves over the soil surface intercept and absorb raindrop impact and provide a hydraulic resistance to runoff (Krenitsky et al., 1998). In addition, there are on average 300 earthworms per square yard turfgrass soil, whose activities create additional macropore space and improves the tilth and structure of the soil (Beard and Green, 1994). The thatch layer of turf also acts to filter pollutants and chemicals from water. As a result, filtered and clean water enters the underground water system through the turfgrass and the soil profile. After comparing two natural and four man-made materials, Krenitsky et al. (1998) reported that turfgrass sod is the most effective one among the six materials tested (wood excelsior, jute fabric, coconut fiber blanket, coconut strand mat, straw, and turfgrass sod) in terms of runoff control ability, reducing runoff by 54 to 59 percent when compared with others. Another study showed that turfgrass was very effective in reducing sediment transport, even after vertical mowing down the slope of plots (Linde and Watschke, 1997). Studies also suggest that turf system could trap and filter water better than crops and forest because it supports more active organisms. Therefore, when properly managed, turfgrass is an effective filter that can improve water quality, and it is thus sometimes called "natural filter". In practice, some golf courses are now already utilizing municipal wastewater for irrigation.

3. Turfgrass contributes to carbon sequestration and O2 creation

Because of the low initial soil organic carbon, high productivity and lack of heavy physical soil disturbance such as tillage, turf system has the capacity to sequester atmospheric carbon. A study by Qian and Follett (2002) revealed that turfgrass could store atmospheric carbon at a rate of approximately 1 ton of carbon per hectare per year for up to 25 to 30 years after it is established. This result is similar to a previous carbon sequestration estimation, which is 1.1 ton/ha per year (Gebhart et al., 1994). Consequently, the total carbon sequestered by all turf areas in the U.S., which is about 20 million tons of carbon per year, is an amount comparable to the carbon estimated to be sequestered by conservation reserve program lands in the United States (Qian and Follett, 2002). In addition to the ability to sequester carbon from the atmosphere, turfgrass creates oxygen as other plants do. A landscape area or yard that is about 40 feet by 50 feet large can generate the oxygen required by one person for an entire year.

4. Turfgrass moderates temperature in urban environment

Turfgrass reduces high levels of radiant heat found in urban areas. Urban areas may be 5 to 8 °F warmer than nearby rural areas where trees and turfgrass cover most of the surface (Duble, 1996). Evapotranspiration is the cooling process of plants, including turfgrass. Grasses transpire at a rate that, in energy terms, exceeds the local radiant energy supply (Aldous, 1999). As a result, turfgrass reduces ground surface temperatures. It has been reported that the front lawns of eight houses have the cooling effect of about 70 tons of air conditioning, while the average home has an air-conditioner with only three or four tons capacity. A few degrees difference in temperatures around houses will save significant energy and thus reduce cost. In addition, a study has shown that actively growing bermudagrass is a better cooling surface during summer daytime than other surfaces, including dry soil and a synthetic surface (Table 1).

5. Turfgrass reduces noise, glare and visual pollution

Turfgrass surfaces absorb harsh sounds much better than common surfaces in urban landscape such as gravel, pavement or bare ground (Beard and Green, 1994). Undesirable noise levels may be reduced by 20 to 30 percent. Studies have shown that bluegrass absorbs sound even better than a heavy carpet on a felt pad (Potter, 1998). Also, turfgrass reduces glare. Buildings, concrete walks, and glass reflect significantly more light than turfgrass does. This reflection can cause glare and on sunny days can be visually uncomfortable. Turfgrass surface reflects light to all directions and thus diffuses its intensity.

6. Turfgrass creates valuable wildlife habitats

Turfgrass has dense biomass, which can support many organisms. Together with shrubs, flowers, and trees, turfgrass surfaces are good habitats for a diverse wildlife population. A study of golf courses and parks in Cincinnati, Ohio indicates that passerine birds benefit from golf courses, even to the extent that some golf courses may be regarded as bird sanctuaries (reviewed in Beard and Green, 1994). Therefore, properly designed and managed turfgrass areas such as golf courses and parks can maintain and promote animal and plant diversity and natural habitats.

Table 1. Temperature comparisons of four types of surfaces in College Station, TX. (after Beard and Green, 1994)

Type of Surface	Maximum daytime surface temperature (°C)	Percent temperature increase over active turfgrass
Actively growing bermudagrass	31	—
Dry bare soil	39	26%
Brown summer-dormant bermudagrass	52	68%
Dry synthetic turf	70	126%

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