Carbon Sequestration of Turf

By Jon Trappe, Postdoctoral Research Associate, Department of Horticulture

Carbon is a fundamental component of all living things and environmental systems. It has risen in the public's awareness in recent years because of increased concentrations of carbon-based greenhouse gases such as carbon dioxide and methane. These greenhouse gases have been associated with climate change and play an in important role in the growth and maintenance of turfgrasses in urban environments (lawns, parks, athletic fields, golf courses, roadsides).

Carbon sequestration occurs when more carbon is entering a system than leaving. With respect to turfgrass systems, when we are talking about carbon sequestration we are generally talking about the accumulation of organic matter. This is because approximately 50% of organic matter is carbon. In most growing systems, agronomists attempt to increase or prevent the decrease in soil organic matter. Turfgrass systems are particularly efficient at accumulating high amounts of organic matter due to their high maintenance levels and their tendency to produce a thatch-mat layer. Some groups of professionals in the turf industry want to actively maintain their organic matter in thatch produced from many species of turfgrasses.

Organic matter refers to a pool of plant matter that is in various states of decay by soil microorganisms. When turf leaves or other plant parts enter the soil, they are almost immediately acted upon by soil microorganisms. Soil microorganisms transform the plant residues into biopolymers, followed by smaller molecules, and eventually to chemical constituents such as sugars, amino acids, proteins, cellulose, hemicellulose, fats, starches and waxes, and lignins and tanins. More complex chemical structures such as cellulose and lignin are more difficult for microorganisms to break down and result in more stable forms of organic

matter that contribute to long-term OM accumulation. Many factors contribute to OM accumulation including: plant species, plant growth rate and subsequent decay, biological activity, soil chemical and physical properties, environmental conditions, and cultural practices.

In general, most turfgrass systems have a high capacity for storing carbon in the soil. This is because turf systems are typically a perennial stand, are often established on C depleted soils, and are often maintained to produce an ideal growing environment for the plant. Whether or not turfgrass systems are effectively keeping the carbon in the soil long-term is dependent on many things such as soil type or environmental conditions. Other factors such as turf species or cultivar selection, soil cultivation practices, and fertilization, pesticide, and irrigation applications are all decisions made by the turfgrass professional that can affect a turf's ability to sequester carbon.

Research is currently being conducted by turfgrass scientists in conjunction with climate scientists on ways to enhance carbon sequestration potential of turfgrass systems while reducing the emission of greenhouse gases in their maintenance. Ultimately, this research will result in turfgrasses that can be actively growing throughout the year and require minimal inputs (mowing, fertilizer, irrigation, cultivation).