Irrigation Water, Science and Emotion, Is EPA a Friend or Foe of Turf?

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(Authors Note: This article was written based on testimony given at a hearing to construction code officials on the benefits of turf in the environment).

I am a board member of the National Turfgrass Federation and an active participant in many national debates about turfgrass and the environment. This is an example of one such debate by the turfgrass industry and regulators.

When EPA started their Water Sense program (www.epa.gov/watersense), their intention was to bring national attention to potable water demands and to reward those that implemented a comprehensive water conservation program. Water Sense is an EPA partnership program whereby retailers, builders and landscapers subscribe to the water saving techniques and EPA rewards them with the use of Water Sense labels for marketing purposes. Products listed on their website as Water Sense certified include urinals, showerheads, toilets, faucet fixtures, and landscape irrigation controllers.

The program is analogous to the Energy Star Program designed to conserve energy.

Jumping ahead to "outdoor" criteria for a certified Water Sense home, EPA originally intended for builders/landscapers to have two options for landscape water conservation; (1) no more than 40% of the landscapable area can be turf or (2) utilize a water budget tool to direct irrigation.

The turfgrass industry from the very beginning did not see value in restricting turf to 40% of the landscape area. Assuming the goal is to conserve all sources of water, one cannot infer that a generalized turf limitation of 40% or less will reduce water consumption of the landscape when the remainder of the landscape has not been specified.

In fact, we pointed out that restricting turf to 40% of the vegetated area connotes a negative environmental value to turfgrass and completely discounts the positive social, economic and environmental attributes. In a study evaluating the effect of three landscape types on residential energy and water use in AZ, McPherson et al. (1989) found that energy consumed for air-conditioning a home with a rock landscape was 20-30% more than for the turf and shade landscape. This was due to a 4°C depression in landscape temperature attributed to eva porative cooling from the turf. Even wher accounting for CO2 and N2O emissions from inputs required to maintain turfgra ss in the urban landscape, Townsend-Smal and Czimczik (2010) found turfgrass s a net sequester of carbon when apply ing up to 8 lbs N / 1000 ft2 yr-1. Milesi et al. (2005) used satellite imagery and modeling and estimates total potential C sequestration of turf in the continental U.S. to range from -0.2 to 16.7 Tg C yr-1 depending on management. The CENTURY model has identified intensive-

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ly managed turf can sequester approximately 1 t C ha-1 yr-1 (Qian and Follett, 2002). This rate of sequestration is similar to perennial grasslands following cultivation (1.1 t ha-1 yr-1) (Gebhart et al., 1994), is much higher than unmanaged grasslands (0.33 t ha-1 yr-1) (Post and Kwon, 2000), and is twice as much soil C stored compared to native prairie (Bandaranayake et al., 2003).

Alternative landscapes are sometimes touted for their putative ability to reduce urban runoff and enhance groundwater recharge but such outcomes are not necessarily realized. Erickson et al. (2001) found no significant differences in runoff water quantity when comparing a native Florida woody perennial landscape to a St. Augustinegrass landscape. However, significantly greater amounts of P were leached from the native perennial landscape compared to the turfgrass landscape (Erickson et al., 2005). The thatch-forming capabilities of turfgrass in combination with a permanent and dense plant structure yields a less channelized pathway for water movement, which increases resistance, horizontal spread, and infiltration of surface runoff (Linde et al., 1995). This effect was demonstrated by Krenitsky et al. (1998) who observed turfgrass sod to be more effective than synthetic erosion control materials in reducing both runoff and sediment losses through the delay of runoff initiation. This combination of factors may be enough to reduce runoff water volumes and therefore nutrient loading, regardless of soil nutrient concentrations. Steinke et al. (2007) showed managed Kentucky bluegrass turf was as effective as a buffer for runoff from paved surfaces as a planting of native prairie and yielded no more nutrient or sediment pollution despite fertilization. Kentucky bluegrass turf had similar water infiltration capacity as the native prairie plantings (Steinke et al., 2009).

This is where the debate got interesting. One of EPA's arguments was the Water Sense program was voluntary. No one was forced to participate. The turfgrass industry argued that once EPA published their guidelines, communities and municipalities would adopt them as tools to conserve water and this is exactly what happened. In fact, Code Officials when writing their new International Green Construction Code (IGCC) adopted the entire EPA Water Sense program as a starting point and made it even more restrictive.

The IGCC stated, "Water used for outdoor landscape irrigation shall be nonpotable." We stated that significant challenges exist as to why water source should not be dictated and left as a jurisdictional option. Although a long-term outcome from the IGCC may be greater access to alternative sources of water, the current distribution system is not capable of meeting large increases in volume and landscape irrigation may not be possible due to the random distribution of the demand (Tchobanolglous et al., 2011).

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Based on 2004 numbers, the EPA estimates 1.7 billion gallons per day of wastewater were reused (U.S. EPA, 2004). This is only slightly more than the 1.5 billion gallons that may be applied for landscape irrigation each day in the U.S. (U.S. EPA, 2011). Florida is the leading producer of recycled water followed by California. Together these two states produce nearly 30% of the total recycled water. The most recent analysis shows that Florida uses 56% of the 243 billion gallons of reclaimed water produced annually for irrigation of golf courses, landscape, or other public access areas (Parsons et al., 2010). However, in 2009 California allocated just 18% of it's 235.86 billion gallons for landscape irrigation (California EPA, 2009). A 2005 inventory in California determined that 1.5 billion gallons of wastewater are discharged into the ocean each day (Hauser, 2005). These numbers indicate that current infrastructure in California is capable of treating just 30% of it's wastewater for reuse. These statistics, from the two states most advanced at recycling and reusing water, demonstrate significant challenges as to why water source should not be dictated in the proposed IGCC and left as a jurisdictional option.

Our primary argument was a sensible approach to water conservation is based on a water budget that is regionally based and calculates ET using specific crop coefficients for various turfgrasses. The water budget should account for all plants in the landscape as Park et al. (2005) documented that irrigation requirements for an ornamental mixed-species landscape increased over time and used more water than St. Augustinegrass. Ranked ET rates of four turfgrasses under field conditions in a semi-arid region were: tall fescue (6.8 mm d-1) > zoysiagrass (5.6 mm d-1) > buffalograss (5.1 mm d-1) = bermudagrass (5.0 mm d-1)(Qian et al., 1996) and intraspecies ET rates can vary up to 60% among 61 Kentucky bluegrass cultivars (Ebdon et al., 1998). Most regions of the U.S. have specific crop coefficients for turfgrass; however when lacking 80% replacement ET will be effective at maintaining turfgrass and conserving water (Sass and Horgan, 2006). In addition, smart irrigation controllers should account for diurnal variability in crop coefficients, which range 0.2-0.8. Fu et al., (2004) found tall fescue and bermudagrass could be irrigated at 40-60% replacement ET while maintaining acceptable quality and function.

In the end, Code Officials voted not to include the 40% turf restriction at the same time that EPA decided to pull it from Water Sense.

I certainly learned from this process. I learned that:

1) One must advocate and participate in the process to affect change

2) EPA and other regulators in government can be reasonable. Some offices are better than others.

3) This process took years with involvement from many people in industry.

4) Spending time in DC will either make you sick or invigorate your passions in life.

5) I am proud of the turf industry for advocating for change with EPA and using science as their primary mechanism for defense. We are now engaged in a positive discussion with EPA's office of water about the best water budget tool to conserve water recognizing that we can do better with the water we apply to our landscape.