A CASE STUDY: THE IMPLEMENTATION OF A WATER CONSERVATION PLAN BY GEORGIA GOLF COURSE SUPERINTENDENTS

F.C. Waltz, Jr.[1], R.N. Carrow[2], Mark Esoda[3] and F.T. Siple[4]

AUTHORS: [1] Assistant Professor and corresponding author, Department of Crop and Soil Science, The University of Georgia, Griffin, GA 30223-1797, [2] Professor, Crop and Soil Science, The University of Georgia, Griffin, GA 30223-1797, [3] Certified Golf Course Superintendent, Atlanta Golf Club, Marietta, GA 30067 and, [4] Certified Golf Course Superintendent, Lanier Golf Club, Cumming, GA 30040.
REFERENCE: *Proceedings of the 2005 Georgia Water Resources Conference*, held April 25-27, 2005, at the University of Georgia, Athens, Georgia.

Abstract. How do water conservation and turfgrass water use become critical issues in a state, like Georgia, which receives 50- to 60-inches of rainfall per year? To begin to answer this question, which is more complex than it appears. The uses of water must first be defined and prioritized. Then where Georgia's water resources are derived and stored must be understood. Lastly, how turfgrass systems integrate into the environmental, economic, and sociological fabric must be realized. By studying how Georgia golf course superintendents were impacted by a four year drought and their decision to voluntarily implement water conservation plans and practices into their daily maintenance programs, other water users can learn water conservation techniques, understand the golf course superintendents' commitment to environmental stewardship, and realize the benefits of working cooperatively with state regulatory agencies. This case study documents past events, which led to current policy and rules and how a proactive attitude looking at future water use will aid in protecting natural resources and encourage economic development while maintaining high turfgrass standards.

INTRODUCTION

Regulatory and legislative bodies, like the Department of Natural Resources (DNR) and local municipalities, have the responsibility to balance water resources for the protection of public health and natural systems, to support the economy, and enhance the quality of life for Georgia's citizens. The highest priority is to protect water quantity and quality for human health and welfare purposes. Compared to bare soil, woody ornamentals and row crops, research has shown the use of turfgrass can increase water quantity by improving ground water recharge, reduce sediment flow to water features, reduce wind and water erosion and, contribute to water quality protection remediating stormwater (Beard and Green, 1994). When discussing water conservation, regulatory bodies often do not consider these environmental services of turfgrass as beneficial in regards to water and human health and safety.

Healthy grass is an aesthetic asset, and a growing body of scientific evidence points to positive environmental and health contributions made by lawns and other grassed areas. While turfgrasses are typically thought of for recreation and aesthetic value, they also provide a valuable environmental service by preventing soil erosion from wind and rain (Cathey, 2003), reducing runoff from rainfall, improving soil absorption and infiltration of water (Beard and Green, 1994), remediation of contaminated or polluted water (Deletic, 2004; Muckel, 2004), and serving as a fire abatement (Firewise, 2004). Furthermore, recent research has shown that turfgrass systems, like golf courses, homelawns, athletic fields, and other grassed areas, help rid the atmosphere of greenhouse gases, like carbon dioxide (Bandaranayake et al., 2003; Elstein, 2003). Additionally, turfgrasses are an integral component of the landscape that positively influences human behavior characteristics like improved ability to concentrate and self-discipline (Taylor et al., 2001).

SITUATION

Providing water resources for continued economic development and growth is a consideration when managing Georgia's water. The population of Atlanta Metropolitan Statistical Area (MSA), which was home to 52% of the State's residents in 2002, grew from 2.8 million in 1990 to 4.3 million in 2002 (U.S. Census Bureau). To maintain economic stability jobs are necessary for these citizens and most all industries need water resources, limited water means no new industry which translates into no new jobs. In south Georgia, water is needed to sustain the agriculture industry which is focused around the production of food and fiber commodities.

To balance all needs, an understanding of where Georgia's water originates is critical. Twelve of

Georgia's fourteen major watersheds or major river basins originate within the state. This is important because water which flows from these basins provide the water for the State's residents and is used by surrounding states for human consumption, interstate commerce, and maintenance of ecosystems. The headwaters of the Chattahoochee comprise the smallest watershed which provides a significant portion of the water supply for any metropolitan area in the United States. If north Georgia continues to experience the growth of the 1990's - there are indications that growth has continued - mere population growth will further tax the static water supply. This translates into regulatory officials needing to make difficult decisions on how to allocate water resources, and, as discussed previously, water for basic human health will predominate.

While a substantial amount of Georgia's water reserves are from surface sources (i.e. rivers), south Georgia and coastal areas have access to ground water supplies. These areas of the state overlay one of the most productive aquifers in the world, the Floridan Aquifer. However, the aquifer is replenished by watersheds which extend into north Georgia.

Although authorities and elected officials are sympathetic to providing the highest quality of life to Georgia's residents, this is an aspect which ranks below safety and economic development. Quality of life is where turfgrass has been considered to influence people, and this is the primary reason that under drought periods water restrictions are imposed on grassed areas (e.g. home lawns, golf courses, sports field, etc.) first. Furthermore, when laws, policy, regulations, and rules are developed by the state or local municipalities, turfgrass is often singled-out in the planning process and at times listed as "nonessential". This philosophy is contrary to research and serves to potentially harm an industry which contributes \$6.4 billion to the State's economy (Hubbard et al., 1990; Florkowski and Landry, 2000; Florkowski and Landry, 2002; Florkowski et al., 2002; Cooter et al., 2003). The real issue then becomes how to maximize water conservation on turfgrass areas while maintaining economic, environmental, recreational viability, and acceptable aesthetics. Currently the most important environmental issue confronting the turfgrass industry is water conservation.

RESOLUTION

Over the past few years, water regulators have been collaborating with researchers and golf course superintendents to develop water conservation measures for irrigation water used to maintain golf courses. By fostering communication, regulatory authorities, state turfgrass scientists, and golf course superintendents have agreed that applying best management practices (BMPs) to turfgrass management can serve as a primary water conservation practice (Table 1). The BMPs approach has been used to address many other environmental issues on golf courses (e.g. pesticide and nutrient fate, protection of water quality, sediment abatement, etc.) and holds the key for bringing regulators and water users together to develop scientifically-based water conservation practices.

The BMPs approach should be the basis for new planning which uses science-based information to maximize water conservation. The tenets of this approach begin with plant selection and adaptation and conclude with making irrigation adjustments according to the whole soil-plant-atmospheric system. In between selection and irrigation is the education and proper turfgrass management practices. There is no single factor that will achieve maximum water conservation on a site; rather it is adjustments within the whole system that are the basis of BMPs. The BMPs approach recognizes that each site is different, and adjustments must, therefore, be site-specific.

In May 2004, the DNR-Environmental Protection Division (EPD) and the Georgia Golf Course Superintendents Association (GGCSA) joined together to develop consensus and plans for ensuring responsible stewardship of the state water resources. These organizations entered into a Memorandum of Agreement (MOA) to work toward having 75% of GGCSA member golf courses with water conservation BMPs in place in three years. At the conclusion of the three year period, the DNR-EPD and GGCSA will evaluate the program. At which time the DNR could make changes in existing outdoor water rules for golf courses (Table 2), giving golf course superintendents more flexibility to manage irrigation water.

Arising from the water conservation program developed for the Golf Course Superintendents Association of America, turfgrass scientists at The University of Georgia provided a detailed BMPs template for water conservation (see article by Waltz and Carrow, 2005 in this issue). This template is the most comprehensive document developed to-date on BMPs for water conservation on golf courses and was beneficial in demonstrating to both superintendents and the DNR the depth and extent of options available for a BMPs program. Additionally, the educational aspects of the program are available for assisting any turfgrass manager on development of their site-specific plan.

The golf course industry has the opportunity to demonstrate how employing a BMPs approach to water conservation can effectively decrease water use and maintain high standards of turfgrass quality. Moreover, golf course adoption of a BMPs approach has the potential to transcend into other segments of the turfgrass industry, further improving water conservation. BMPs are the best means to address water conservation on a long-term, sustainable basis. Additionally, they encourage professionalism, and such science-based approaches stimulate entrepreneurship for development of new technology and approaches to enhance future water use-efficiency.

Table 1. BMPs for golf course water conservation.

I. Site Assessment
   1. Area – Acreage of components such as green, fairway, tee, landscape, rough, natural native vegetation, etc.
   2. Plants – Includes basic characteristics such as drought tolerance, cool-season, warm-season, native species, and height of cut.
   3. General factors affecting water use – mature trees, natural areas, elevation and soils.
   4. Irrigation audit – overall condition, controls, design characteristics, drip systems, metering, evaluating overall distribution efficiency.

II. Determine overall water needs
   1. Metering
   2. Record keeping and accounting
   3. Water testing
   4. Reservoirs/ponds
   5. Determine future needs
   6. Consideration for alternative water sources

III. Best Management Practices and current water conservation measures
   1. Current irrigation controls and hard costs (parts, power)
   2. Staffing in irrigation control and irrigation maintenance
   3. Scouting – costs
   4. Hand watering – hours and costs
   5. Night watering capability
   6. Rain, leak, etc. loss controls and costs
   7. Traffic controls and costs
   8. Metering – installation and ongoing calibration and replacement
   9. Management for water conservation
      a. Height of cut
      b. Soil cultivation to promote root depth
      c. Evapotranspiration utilization
      d. Selection of landscape plants
      e. Natural vegetation areas
      f. Fertilization
      g. Pest management – early morning or late evening applications to reduce water loss. Consideration of Integrated Pest Management protocols.
      h. Wetting agent usage.
   10. Record keeping and costs
   11. Possible irrigation methods (plant based, soil based, budget approach, deficit, atmosphere based)
   12. Goal setting regarding water use efficiency
   13. Education – List benefits of golf courses and turfgrass areas; publish water conservation plans; engage stakeholders (members, patrons, neighbors, general public) with the benefits of water conservation

Table 2. Georgia DNR-EPD outdoor water use rules pertaining to golf courses: Approved May 2004.

I. Non-drought periods
   1. No restrictions

II. Drought Response Level 1
   1. No restrictions

III. Drought Response Level 2
   1. Golf Course Fairway irrigation on Monday, Wednesday, and Friday
   2. Irrigation allowed between 12:00 a.m. and 10:00 a.m.

IV. Response Level 3
   1. Golf Course Fairway irrigation on Saturday
   2. Irrigation allowed between 12:00 a.m. and 10:00 a.m.

V. Response Level 4
   1. No outdoor water use, except
      a. When using reclaimed wastewater permitted by EPD
      b. Irrigation of greens
      c. First 30-days of new installations when supervised by a certified golf course superintendent or contractor
      d. Watering-in of pesticides

LITERATURE CITED

Bandaranayake, W., R. Follett, and Y. Qian. Assessing soil carbon sequestration in turfgrass systems using long-term soil testing and the CENTURY simulation model. Agronomy Abstracts.

Beard, J. B. and R. L. Green. 1994. The role of turfgrasses in environmental protection and their benefits to humans. *J. Environ. Quality* 23: 452-460.

Cathy, H.M. 2003. Water right—conserving our water, preserving our environment. Inter. Turf Producers Foundation. www.TurfGrassSod.org.

Cooter, R., D. Papendick, and N. Washington. 2003. An economic impact study of the golf industry on the state of Georgia. Office of Sports Business Research, Georgia State University.

Deletic, A. 2004. Modeling of water and sediment transport over grassed areas. *J. of Hydrology* 248: 168-192.

Elstein, D. 2003. Are golf courses holding the carbon? Turfgrass as a "sink" for CO_2. Agriculture Research June, page 10.

Firewise. 2004. Firewise landscaping. www.firewise.org/pubs.

Florkowski, W. J. and G. Landry. 2000. An economic profile of the professional turfgrass and landscape industry in Georgia. The Georgia Agricultural Experiment Station. Research Report 672.

Florkowski, W. J. and G. Landry. 2002. An economic profile of golf courses in Georgia: Course and landscape maintenance. The Georgia Agricultural Experiment Station. Research Report 681.

Florkowski, W. J., G. Landry, and C. Waltz. 2002. Revenue profile of golf courses in Georgia. The Georgia Agricultural Experiment Station. Research Report 687.

Hubbard, E. E., J. C. Purcell, G. W. Landry, and T. R. Murphy. 1990. An economic profile of the lawn-care industry in the metropolitan Atlanta area. The Georgia Agricultural Experiment Station. Special Publication 65.

Muckel, G. B. 2004. Understanding soil risks and hazards. USDA on-line publication. http://soils.usda.gov/use/risks.htm.

Taylor, A. F., F. E. Kuo, and W. C. Sullivan. 2001. Views of nature and self-discipline: Evidence from inter city children. Journal of Environmental Psychology 21: available online at http://www.idealibary.com.

Tucker, C. 2002. Ignoring water crisis won't wash. The Atlanta Journal-Constitution. May 29.

U.S. Census Bureau. http://www.census.gov.