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COMMENTARY

A justification for continued management of turfgrass during economic contraction

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Abstract

A novel coronavirus, termed COVID-19, spread worldwide and become a global pandemic in 2020. Forecasts show that COVID-19 will cause substantial economic contraction affecting almost every industry. Managed turfgrass, particularly in urban settings, has many positive societal and environmental benefits. In a contracted economy, will resources be available to manage turfgrass to achieve these benefits? In this paper, we outline the benefits of managed turfgrass on golf courses, playing fields, recreational parks, and urban landscapes to assist decision makers with resource allocation in the COVID-19 era.

1 | INTRODUCTION

A novel coronavirus, termed COVID-19 by the World Health Organization, rapidly spread worldwide and become a global pandemic (Sohrabi et al., 2020). By

4 Aug. 2020, there were nearly 18.1 million confirmed cases worldwide, including 4.6 million in the United States leading to more than 154,000 deaths (WHO 2020). Travel bans, enforced quarantines, school closures, and social distancing practices were implemented to limit spread of COVID-19 (Parmet and Sinha, 2020; Sohrabi et al., 2020). The National Bureau of Economics Research estimates that COVID-19 will lead to a 20% contraction of the U.S. economy by the end of the fiscal year, with effects continuing into the future as businesses reduce expenditures related to innovation, training, and general management (Baker, Bloom, Davis, & Terry, 2020).

Nearly every industry, including turfgrass management, has been affected by COVID-19. In addition to the cancellation or delay of professional and collegiate sports played on turfgrass surfaces (PGA Tour, Major League Baseball, Major League Soccer, and National Collegiate Athletic Association), COVID-19 led to the temporary closure of all golf courses in 19 states (NGF, 2020) as well as municipal parks and recreational fields across the United States. In some states, lawn care and outdoor activities were restricted or prohibited (State of Michigan, 2020; State of Oregon, 2020). Many facilities have furloughed staff, and it remains uncertain if financial resources will be available to fill these positions in the future. A federal order facilitated the landscape industry to maintain normal staffing during the pandemic (Krebs, 2020), but this may change with the predicted downturn of the economy.

COVID-19-induced economic uncertainty will have a major effect on all facets of agriculture for the foreseeable future (Lusk et al., 2020). It is well established that managed turfgrass, particularly in urban settings, offers many societal and environmental benefits. In a contracted economy, will resources be available to manage turfgrass to achieve these benefits? Our objective here is to outline the benefits of managed turfgrass on golf courses, playing fields, recreational parks, and urban landscapes to assist decision makers with resource allocation in the COVID-19 era.

Core Ideas

- Managed turfgrass confers many positive societal and environmental benefits.
- These ecosystem services are predicated on sites receiving appropriate management resources.
- Resource allocation in the COVID-19 era should be structured to achieve these benefits.

2 | BENEFITS OF TURFGRASS

Turfgrasses ameliorate the impacts of urban sprawl in today's rapidly urbanizing global society. The many environmental benefits offered have been documented by several authors and summarized by Beard and Green (1994), Stier et al. (2013), and Christians, Patton, and Law (2017). Benefits include temperature moderation through evaporative cooling resulting in dissipation of radiant heat and mitigation of the heat island effect in cities (Amani-Beni, Zhang, Gao-di, & Jie, 2018; Jenerette, Harlan, Stefanov, & Martin, 2011; Wang et al., 2016b). Maximum daily canopy temperature of a green, growing turfgrass was found to be 21 °C cooler than a brown, dormant, sward and 39 °C cooler than synthetic turf (Beard & Johns, 1985). The transpirational cooling effect of green turfgrass can reduce energy input and costs required for indoor cooling (Beard & Beard, 1985). Turfgrasses also play an important role in stabilizing soils in urban centers, on underutilized and abandoned properties (Montgomery, et al, 2016); reducing surface water runoff, thereby recharging groundwater and reducing soil and water erosion (Bouwer, 2002; Dai, Puyang, & Han, 2016); absorbing atmospheric pollutants (greenhouse gases) produced through anthropogenic activities, especially in densely populated regions (Thwaites et al., 2006), sequestering carbon (Braun & Bremer, 2019; Hamido, Guertal, & Wood, 2016; Law and Patton, 2017; Qian and Follett, 2002), producing oxygen, and improving air quality (Monteiro, 2017); reducing noise pollution (Van Renterghem et al., 2015); and decontaminating soils through phytoremediation and associated plant–microbe interactions (Crouch, Carter, Ismaiel, & Roberts, 2017; Grant, Campbell, & Charnock, 2002; Krishnan et al., 2000; Lin et al., 2004; Shahandeh and Hossner, 2000; Thompson et al., 2008; Tordoff, 2000).

Turfgrasses also positively affect people by improving their physical and mental health and social well-being. Greenspace, which includes healthy lawns and landscapes, is inversely related to the incidence of crime, especially in urban neighborhoods (Kuo and Sullivan, 2001; Kuo et al., 1998). A well-managed lawn with healthy turfgrass, trees, and ornamental plants increases property value by improving perceptions of residential communities, businesses, and schools (Laverne and Winsin-Geideman, 2003; Stier et al., 2013). Greenspace will provide communities with accessible and safe environments to exercise, socialize, and overcome activity restriction in the COVID-19 era. Turfgrass and associated greenspace enhance the creative, intellectual, and cognitive skills of children (Frumkin, 2001; Heerwagen & Orians, 2002; Kahn & Kellert, 2002) and provide safe playing surfaces for athletes (Mack et al., 2019). According to the Centers for Disease Control and Prevention, people with close access to parks and trails are

more likely to lead a more physically active lifestyle and therefore have reduced risk of chronic diseases (Barrett, Miller, & Frumkin, 2014; CDC, 2014) and lower body mass index (BMI) (Bell, Wilson, & Liu, 2008; Liu et al., 2007). Decreased mortality rates have been documented among those living in areas with increased greenspace (James, Hart, Banay, & Laden, 2016). In addition to physical health benefits, turfgrasses also offer many mental health benefits (Moore, 1981). Proximity to greenspace and connection with nature provides a sense of tranquility (Frumkin, 2001) and has been associated with reducing stress and symptoms of depression (Barrett et al., 2014; Beyer et al., 2014), conditions likely to rise in response to COVID-19 (Gao et al., 2020). Increased participation in outdoor activities has been documented in the COVID-19 era (Venter et al., 2020), in part because exposure risks are lower outdoors (Ratnesar-Shumate et al., 2020). Turfgrasses also provide a sense of communal space for neighborhood gatherings and community events, which helps improve social ties, community pride, and overall quality of life (Hartig, Mitchell, de Vries, & Frumkin, 2014).

2.1 | Golf courses

Environmental benefits of golf courses include flood control and groundwater recharge of filtered water when absorbing surface flows from residential areas (Bouwer, 2002; Dai et al., 2016). Biodiversity and abundance of wildlife and insects are maintained as many golf courses provide the minimum size necessary for multiple species, which is critical as populations decline globally (Beninde, Veith, & Hochkirch, 2015; Tanner and Gange, 2005; van Klink et al., 2020). Golf course rough and non-play areas make up 60–70% of most golf courses and often consist of conservatively managed grasses, trees, and shrubs. When combined with the open areas of fairways and greens, this greenspace creates viable wildlife habitat (Cohn, 2008). Golf courses, like parks and forests, reduce the urban heat island effect; in Los Angeles, CA, temperatures on the golf course were ~4 °C cooler than the urban surroundings (Davis, Jung, Pijanowski, & Minor, 2016; Dousset & Gourmelon, 2003). In Colorado, well-managed golf courses fairways were found to have twice as much soil carbon, up to about 80 Mg ha^{-1}, as the native prairie (Bandaranayake, Qian, Parton, Ojima, & Follett, 2003). Golf courses can be built on reclaimed landfills, providing positive environmental and social benefits (Deegan, 2017; Sharma et al. 2007).

Social benefits include the physical and mental health accrued through both playing the game of golf and the relaxation provided by being in nature, which has been shown to increase life expectancy (Barton, Hine, & Pretty, 2009; Farahmand, Broman, De Faire, Vågerö, & Ahlbom, 2009; Stenner et al., 2016). Two-thirds of U.S. states deemed golf courses as "essential services" during the COVID-19 pandemic (Kelleher, 2020). Golf courses add ≥25% property value to homes depending on proximity (Nicholls and Crompton, 2007). The golf industry employs approximately 2 million people, with an economic impact of nearly $180 billion (SRI, 2012). Golf courses consistently serve as fundraising venues, raising about $4 million annually in the United States (NGF, 2017).

2.2 | Playing fields

As the majority of turfgrass playing surfaces exist in urban environments, the World Health Organization suggested that the availability, accessibility, quality, and security of public green spaces is an indicator of a healthy city (WHO, 2012). The provision, regulating, and supporting ecosystem services provided by turfgrass playing surfaces are consistent with large managed natural vegetative surfaces in urban environments (Thompson and Kao-Kniffen, 2017). Therefore, the ecosystem services provided by turfgrass playing surfaces could be explained by the preference of humans for turfgrass environments and the restorative value of organized play.

Running in a park is associated with a more restorative experience when compared to the same exercise in an urban environment (Bodin & Hartig, 2003). Bagot, Louise Allen, and Toukhsati (2015) reported that turfgrass playing fields were preferred over synthetic surfaces. Findlay and Copeland (2008) found that organized play was positively related to indices of positive adjustment and has a unique protective role for shy children by reducing anxiety. Flouri, Midouhas, and Joshi (2014) found that economically disadvantaged children in urban areas with more turfgrass playing fields had fewer emotional problems from 3 to 5 years old than their counterparts in areas with fewer turfgrass fields. To maximize ecosystem services, turfgrass playing fields should be managed to meet safety standards outlined in ASTM F-2269 and ASTM F-2060 (ASTM, 2018a, 2018b). Safety standards ensure proper care and management of turfgrass playing surfaces. Pest management is of particular concern on sports fields as failure to control infestations reduces safety to end users (Bartholomew, Campbell, & Wallace, 2015; Brosnan, Dickson, Sorochan, Thoms, & Stier, 2014).

2.3 | Parks and recreation

Parks and recreational areas are dominated by turfgrass (Ignatieva, Eriksson, Eriksson, Berg, & Hedblom, 2017;

Wheeler et al., 2017). These areas provide a variety of social, economic, and environmental benefits. The social benefits of these public areas include improved health and safer environments (Barnes et al., 2018; Demuzere et al., 2014; Dyment & Bell, 2008; Monteiro, 2017; Sadler et al., 2017). Managed turfgrass in parks serve some of the largest user groups, employ a significant number of people, and have a substantial economic impact (Diemer, 2004; English, Menard, Jensen, Brosnan, & Boyer, 2015; Hodges, Haydu, van Blokland, & Bell, 1994; Kane & Wolfe, 2012). Municipal turfgrass areas typically receive less-intensive cultural inputs and are managed with little or no pesticides (Barnes et al., 2018; Dernoeden, Carroll, & Krouse, 1994; Diesburg et al., 1997; Kowalewski et al., 2016; Kowalewski, Schwartz, Grimshaw, McCrimmon, & Layton, 2014; Patton et al., 2017; Watkins et al., 2014). Municipal turfgrass areas also serve as disposal sites for municipal waste. For example, effluent wastewater is used as an effective alternative to potable water to maintain turfgrass (Alshammary & Qian, 2008; Hayes, Mancino, & Pepper, 1990; Hyde, 1937; Mancino and Pepper, 1992; Miyamoto and Chacon, 2004; Riper and Geselbracht, 2020; Wang et al., 2014). Several cities actively promote mulching tree leaves and redistributing leaf mulch as a soil amendment that improves turfgrass health (City of Irving, 2020; City of Madison, 2020; City of Raleigh, 2020; Kowalewski et al., 2010). These waste products offer low-cost irrigation and fertilizer alternatives that are readily available to public municipalities (Heckman & Kluchinski, 1996; Riper and Geselbracht, 2020).

2.4 | Lawn and landscape

Urban vegetation and greenspaces play a crucial role in creating a comfortable living environment, particularly in semi-arid and arid climates. A study conducted in Phoenix, AZ, documented nearly 25 °C surface cooling on turfgrass compared with bare soil (Jenerette et al., 2011). Cooling from urban lawns via evapotranspiration plays a significant role in lowering surrounding surface temperatures, thereby positively affecting human thermal comfort and reducing energy consumption associated with air conditioning (Wang et al., 2016b). Amani-Beni et al. (2018) suggested increasing turfgrass coverage grown in conjunction with trees and focusing on irrigation management in order to maximize the cooling effect of urban parks.

Numerous authors have established a positive relationship between greenspaces and the well-being of residents. The restorative effect of greenspaces on humans and associated impacts on human health have been documented (Akpinar, 2016; Wells and Rollings, 2012). Akpinar, Barbosa-Leiker, and Brooks (2016) reported that more urban greenspace was associated with fewer days of mental health complaints in urban areas. Studies also demonstrated that greenspaces in schoolyards had a higher positive restorative effect on children (Bagot et al., 2015, Kelz, Evans, & Röderer, 2015). Ward et al. (2016) and Benjamin-Neelon et al. (2019) confirmed that greenspace exposure was positively associated with physical activity in children aged 3–14 years. Significant associations between childhood obesity and the distance between the child's residence and greenspace have been reported (Manandhar et al., 2019; Shradda et al., 2019), with expansion of green areas thought to prevent weight gain at early ages.

Elam and Stigarll (2012) estimated a 17% increase in residential house pricing when landscape quality is improved. Conway, Li, Wolch, Kahle, and Jerrett (2010) documented a significant impact on house prices if homes are near a greenspace. They calculated that a 1% increase in greenspace within 200–300 ft of the residence would result in an approximate increase of 0.07% in the expected sales price. They further suggested that greening of urban areas could provide a valuable policy instrument for elevating depressed housing markets.

Studies have shown that lawns act as a net carbon sink (Braun & Bremer, 2019; Hamido et al., 2016; Law and Patton, 2017) and sequester carbon into the organic pool at similar levels to other grassland soils (Braun & Bremer, 2019). Wang et al. (2016a) documented that organic carbon sharply increased in desert soils after desert shrubs were converted to irrigated lawn. Similarly, soil inorganic carbon doubled in 6 yr in the turfgrass soil after conversion from desert shrubs.

3 | CONCLUSION

The ecosystem services provided by greenspaces containing turfgrass (i.e., golf courses, playing fields, parks and recreation, and lawn and landscapes) are predicated on the sites receiving appropriate resources for management. In the absence of allocable resources, these greenspaces will deteriorate, leading to concomitant reductions in aesthetics, function, and recreational quality. Turfgrass management encompasses a range of activities, including cultural practices (e.g., mowing, fertilization, irrigation, cultivation, and pest management), for establishing and sustaining sites at a desired level of quality.

Although budget reductions are a likely reality of the COVID-19 era, prioritization of expenditures is necessary, and essential minimums should focus on the three primary cultural practices: mowing, fertilization, and irrigation (Soldat et al., 2020). Mowing is the most basic practice needed to provide desirable turfgrass. Second, turfgrasses, like all living organisms, require nutrition. Nutrition for greenspaces primarily comes in the form of fertilizer and

other practices such as cultivation and liming to maintain soil health. Third, all plants, including turfgrasses, require water to sustain life. Irrigation resources should supplement natural rainfall, allowing these greenspaces to remain productive.

In an era of COVID-19-related budget constraints, decision makers should work with facility managers and stakeholders to identify essential minimums to ensure that realistic expectations for greenspaces are achieved while mitigating negative impacts on ecosystem services. For example, nonprioritized reductions in spending on golf course management will result in poor playing conditions, further resulting in potential revenue loss as golfers seek other venues. The cascading effect can lead to the demise of a golf course and resultant loss of valuable greenspace nestled into urban and suburban development. Similarly, insufficient resource allocation to playing fields, parks, and recreational areas can yield unsafe conditions, exposing municipalities to increased liability. Unkept and neglected landscapes are associated with higher rates of crime (Troy et al., 2016). Neglect of these greenspaces, or eliminating their inputs altogether, is not advisable.

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