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Short communication

Artificial lawns: Environmental and societal considerations of an ecological simulacrum

Robert A. Francis

Department of Geography, King's College London, Strand, London, WC2R 2LS, United Kingdom

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ABSTRACT

The replacement of living lawns with synthetic (plastic) grass seems to be on the increase in cities. This paper presents some environmental and societal considerations relating to the installation of artificial lawns to encourage research of the phenomenon at this early stage of emergence. After first discussing the development of 'third generation' synthetic grasses that have made artificial lawns more appealing, it then considers how the replacement of living lawns with plastic grass represents a potentially concerning step towards ecological simulation, or the replacement of real ecosystems with simulacra that address cultural desires but remove nature altogether. The paper then examines some of the possible environmental and societal impacts that may result from the replacement of living lawns with their artificial counterparts, and concludes with the presentation of a research framework for investigation of the emerging artificial urban lawnscape.

1. Introduction

Lawns are common throughout cities in the Global North, particularly in North America, Europe and Australasia. They are part of western culture, embedded in the fabric of settlements large and small and central to everyday domestic space (Trudgill et al., 2010; Robbins, 2012). Residences, places of work, public venues and facilities, sports and recreational grounds and schools around the world maintain lawns. They have not appeared by chance; like buildings, they have been intentionally constructed, propagated, and replicated globally. Particularly prevalent in cities, lawns comprise a substantial proportion of residential gardens (or 'yards'), and are extensive in both area and distribution. Robbins and Birkenholtz (2003) estimated that the 'lawnscape' of Franklin County (OH) covered around 23% of the land cover, while Ignatieva et al. (2015) suggest that lawns typically represent 70–75% of urban green space. In Sweden, Hedblom et al. (2017a,b) found an average of 22.5% lawn cover across three cities, with an estimated 2589 km^2 of urban lawns for the country. Meyer et al. (2001) estimated over 3500 km^2 of lawns in Minnesota, or about 1.5% of the entire state. In the UK, the totality of lawn area exceeds that of London (Davies et al., 2009), while in the US, estimates of lawn area were around 102,000 km^2 in 1993 (Bormann et al., 2001) and c.164,000 km^2 in 2005 (Milesi et al., 2005). Despite their everyday mundanity, they are an important and largely overlooked element of modern life for millions of people.

The replacement of grass lawns with artificial lawns constructed from synthetic polymers (plastics) appears to be on the rise; trends remain unquantified but there are over 100 companies that sell artificial grass online in the UK alone, and it is available to purchase at many hardware stores; Artificial-lawn.co.uk (2017) lists 28 artificial lawn suppliers for the UK and Ireland, and 65 globally. The product is diversifying, with one company listing nine different types of artificial grass, varying in materials, length and colour (Trulawn, 2017). This is indicative of a significant and developing market for artificial lawns. The environmental and societal implications of this remain unknown at the present time, as little published research is available on plastic grass and synthetic turf. This paper summarises the development of the latest 'third generation' of artificial turf before briefly exploring two important elements of the installation of artificial lawn in place of grass lawns in cities: (1) the act as a representation of the ultimate replacement of nature with ecological simulacra, which satisfy cultural expectations of an ecosystem but act in opposition to ecology; and (2) the potential environmental and societal impacts of artificial lawns that need to be explored, particularly in an urban context. It concludes with a suggested framework for further research on artificial lawns in cities.

2. Plastic grass and artificial lawns

Plastic grass (often termed 'artificial' or 'synthetic' turf) was originally developed in the 1960s for recreational purposes, as a reliable and easy to manage alternative to grass playing fields that could be installed both indoors and outdoors. Early forms (first generation) were scratchy and unattractive, formed primarily of short, stiff nylon or polypropylene (PP) fibres (Stanitski et al., 1974) and with a reflective

E-mail address: robert.francis@kcl.ac.uk.

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surface that advertised artificiality. Second generation synthetic turfs held longer fibres interspersed with filler materials such as sand, and looked more like 'natural' playing fields, but were still relatively unrealistic terms of softness and overall aesthetic; their use was primarily confined to sports pitches and playing fields, as for the first generation plastic grasses. Most scientific evaluations of these media have focused on human health implications, either from chemicals contained in the synthetic lawn materials (Zhang et al., 2008), or in relation to sports injuries (Stanitski et al., 1974; Meyers and Barnhill, 2004).

Recent technological developments and the emergence of the 'third generation' of synthetic grasses have meant that artificial turfs are now more frequently manufactured from polyethylene (PE) strands surrounded by infill of sand and rubber grains. This sits atop an expanded polypropylene (PP) thatch, with a latex underside. These materials are softer and closer in feel to natural grass, as well as looking more realistic when appropriately manufactured. This has increased the appeal beyond the primary use for sports facilities to more widespread residential and commercial use, in particular for the replacement of lawns. The technology is designed specifically to appeal to the cultural norms associated with lawns: Smith (2016) notes that the lawn realises its 'highest level of ornamental perfection as a height-managed grass monoculture; a construct that requires frequent mowing and considerable ongoing maintenance if it is to be kept verdant and both weed- and pest-free' (p. 108). Weigert (1994) presents a 'status theory' of lawns wherein 'good' lawns are associated with particular characteristics (Weigert, 1994), including the dominance of grasses and an absence of herbaceous species ('weeds'), softness of the grass (tactility), rich green colour (suggesting health, rather than an 'unhealthy' brown), density of sward, intensive management (a good lawn takes effort and investment), neatness (short, manicured grasses are best) and consistency (uniformity of appearance, based on the above, is good; heterogeneity is bad). A plastic lawn is designed specifically to satisfy the cultural demands of a 'good' lawn, addressing the 'semiotics of appearances' (Weigert, 1994, p. 83) in exemplary fashion, meeting the desired criteria whilst removing the requirement for intensive management. The potential appeal of such constructs is clear.

3. Artificial lawns as ecological simulacra

Artificial lawns meet the cultural requirements of 'good' lawns. Yet they do so at the expense of any remaining 'naturalness' and embodiment of life. They present a *simulacrum* (*sensu* Baudrillard, 1994) of the desired ecosystem, a stylised representation of an ecosystem that people can utilise while bypassing the need to acknowledge or interact with other species entirely. The ecosystem has been exchanged for its simulated 'form', and the ecological foundation is merely illusory. Artificial lawns support no birds, no bees, no ants, release no pollen; contain no life, other than perhaps microorganisms that need to be cleaned off. In this sense, the artificial lawn is a true simulacrum in all nuances of the term; as a representation of something (immediately, a lawn, and at further remove an open grassland or forest glade) and an unsatisfactory or specious imitation (OED, 2017); and in Baudrillard's (1994) terms, an embodiment of a simulation, an attempt to 'feign what one doesn't have' (p. 3). Contrary to appearances, one has dead, sterile turf, not a living lawn.

Indeed, the synthetic lawn meets the cultural expectations of a 'good' lawn more effectively than a real lawn ever could, and therefore in essence may be, or may become, what Baudrillard (1994) terms a 'pure simulacrum' (p. 6), having no basis in reality – plastic grass is really not grass at all – and ultimately leading to the 'reversion and death sentence of [the] reference' [in this case a living lawn] (p. 6), should synthetic lawns ultimately replace real lawn ecosystems. It may therefore be that artificial lawns are an example of ecological hyperreality, and thereby demonstrate the 'disappearance of objects [living lawns] in their very representation' (Baudrillard, 1994, p. 45).

The emergence of ecological simulacra is not necessarily tied to artificial lawns alone, and technological developments have created possibilities in other areas. Certainly there are synthetic plastic trees and wall coverings available from some of the same companies that manufacture artificial turf, and which may be adopted for similar reasons in domestic space. Yet it is not just plants that lend themselves to simulation. Rault (2015) has suggested that simulacra of domestic pets, in the form of robotic or virtual animals, may become increasingly common. In this case, as for lawns, the cultural values of the species, or at least its domesticated form, are simulated and reinforced whilst removing the species entirely. As children have been observed to treat robotic pets in the same ways as living dogs (Melson et al., 2009) and given that such simulacra 'can without doubt trigger human emotions' (Rault, 2015, p. 3), cultural propagation of artificial pets also seems an intriguing possibility. As technology advances and the simulacra become more realistic it is likely to become more appealing and hence more common, raising further possibilities for hyperreality (Baudrillard, 1994) in human-nonhuman interactions. Nonetheless, artificial lawns represent an intriguing case study that has the potential to become common in cities and therefore deserves the attention of urban ecologists in particular.

Perhaps such lawn replacement is not of immediate concern; artificial lawns must currently represent only a tiny proportion of private green space. Yet there are important implications to be considered if replacement becomes increasingly popular and widespread, ranging from environmental to social. These are now explored in more detail.

4. Environmental considerations of artificial lawns

The environmental limitations of *real* lawns have become increasingly apparent in recent decades, and have been discussed elsewhere (e.g. Ignatieva et al., 2015). Key detrimental aspects of lawns include sustained addition of chemicals such as herbicides, pesticides and fertilisers (e.g. Robbins and Birkenholtz, 2003), generally (though not universally) low biodiversity due to poor-quality habitat and dominance of a few grass species (Thompson et al., 2004), abundance of non-native and potentially invasive species (Stewart et al., 2009) and release of nitrous oxide (N_2O) and methane (CH_4) if irrigated and fertilised (Livesley et al., 2010). Factors such as area and management are important for determining many of these impacts (Cameron et al., 2012). For example, lawns are one of the few ecosystems that in some cases may display a negative species-area relationship, meaning that as lawn area increases, the number of species found may decline, rather than increasing as is the almost universal trend (Stewart et al., 2009). This is because management of larger lawns favours more intense mowing and weeding that restricts spontaneous herbaceous growth, and is particularly the case for large public (e.g. park) lawns, as opposed to private lawns, which maintain more usual (positive) species-area relationships and more variable management practices (Thompson et al., 2004).

Lawns do provide some useful ecosystem services however, as reviewed by Beard and Green (1994); particularly in urban areas, where the alternatives are often impermeable surfaces such as concrete. Alongside the more obvious cultural services of recreation, aesthetics and wellbeing, lawns may provide regulating services such as allowing rain infiltration, thereby limiting surface runoff associated with flash floods (Ignatieva et al., 2015) as well as sequestering carbon (Qian and Follett, 2002) and helping to moderate urban heat island effects (Beard and Green, 1994). Supporting services such as species habitat and providing resources for pollinators may also be associated with lawns (Thompson et al., 2004), though of course the quality and level of provision is relative.

Advocates of artificial (synthetic) lawns often cite their environmental benefits in comparison to traditional lawns, with plastic grass needing no watering, no mowing (thereby saving energy), no application of fertilisers and pesticides, and reduced allergenic health and lifestyle impacts, as no pollen is released (Cheng et al., 2014). In effect,