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Native Landscaping vs. Exotic Landscaping: What Should We Recommend?

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Abstract: In Extension, many questions are fielded concerning the installation and maintenance of turfgrass and ornamental plants. However, it is becoming increasingly apparent that the cumulative impacts of replacing native habitat with non-native turfgrass and ornamental plants is contributing significantly to the decline of biodiversity in both urban areas and surrounding natural areas. Given the state of our natural environment, perhaps Extension programs should present alternative landscaping approaches to help conserve urban biodiversity.

Introduction

Currently, Extension urban clientele outnumber rural clientele nationwide (Christianson & Warner, 1985), and this has caused a shift in Extension, with more and more Extension faculty hired to address urban issues (Fehlis, 1992), U.S. urban populations increased from 39% in 1900 to 75% in 1990 (U.S. Census Bureau, 1995), and many county faculty primarily address urban horticulture issues, particularly in Master Gardener programs (Rohs, 2002).

In such urban horticulture programs, outreach efforts involve recommendations on how to plant and maintain lawns and ornamentals, with little consideration regarding the cumulative effects on native biodiversity. The threats to biodiversity are many, but habitat loss is widely recognized as the most important threat, and the spread of non-native species is considered the second (Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998). In urban areas, this situation is particularly acute because built areas tend to be dominated by exotic turfgrass and ornamentals, In this article, we discuss 1) how turfgrass lawns and non-native plants impact urban biodiversity and 2) how using such exotic plants can affect biodiversity in surrounding natural landscapes,

Simply explained, biological diversity or "biodiversity" refers to the variety of life and its processes, Biodiversity includes species diversity, habitat diversity, and genetic diversity, For the purposes of this

article, we will focus on *native* species biodiversity, Native species are plants and animals present within a given area prior to European contact (e.g., Florida Native Plant Society, 2003), Non-native (or exotic) plants or animals are defined as those species that were not present before European contact, *Endemic* species are native organisms only found in a region and do not occur elsewhere in the world, As explained below, the impacts of exotics on biodiversity may warrant altering conventional urban Extension recommendations to emphasize native landscaping.

The Impact of Turfgrass Lawns and Ornamental Plants on Biodiversity

The conventional approach of landscaping with turf and ornamentals affects biodiversity in two ways: 1) it limits the diversity of native species in areas dominated by turf and ornamentals, and 2) it can affect surrounding natural environments, altering habitats in ways that exclude native plants and animals.

Turfgrass Lawns & Non-Native Ornamentals

Let's first look within the city limits. How do turfgrass lawns and non-native ornamental plants affect urban biodiversity? Simply put, landscapes dominated by turfgrass and non-native ornamental plants create an artificial environment that offers very little opportunity for most native species to thrive. A monoculture of turfgrass infused with non-native ornamentals excludes native plants and provides little to no habitat for most wildlife. Think about the vast amount of land devoted to turf, both for growing the sod and the amount of sod that occurs on the landscape as urban lawns. One estimate indicates that four million acres of managed turfgrass occurs in Florida, with 75% of these as residential lawns (Nagata, 2003). Such acreage limits the amount of natural habitat, thus decreasing urban habitat diversity and ultimately native species diversity.

With animals, studies show that many wildlife species are not found or are in low abundance in turfgrass/non-native, dominated habitats, particularly our most sensitive and endemic species. Bird species that were normally found in more natural areas gradually drop out along a gradient of urbanization (Blair, 2008). Native insect and spider diversity declines in urban areas dominated by turf (McIntyre & Hostetler, 2001), As areas become more urban, native plant species disappear and non-natives increase in number (Kowarik, 2008). In general, biodiversity indices decrease as one goes towards urban centers (Faggi, Krellenberg, Castro, Arriaga, & Endlicher, 2008).

However, biodiversity measures improve with the use of native plants. For example, native urban bird diversity increases with native vegetation (Mills, Dunning, & Bates, 1989; MacGregor-Fors, 2008); more native plants serve as host plants for butterfly larvae (Daniels, Schaefer, Huegel, & Mazzotti, 2008; Collinge, Prudic, Oliver, 2003); and native bee diversity increases with the occurrence of native plants (McIntyre & Hostetler, 2001). Although some exotic plants, particularly trees and shrubs, can provide food and shelter for some animals (e.g., butterfly bush, *Cassia bicapsularis*), it is fair to say that the negatives of a landscape dominated by non-native plants far outweigh the positives for wildlife. First, the exclusive use of non-native plants would ultimately decrease native plant diversity because of the simple fact that native plants are absent from the area. Second, native animal diversity, in general, is correlated to native vegetation diversity (e.g., Burghardt, Tallamy, & Shriver, 2009), Overall, the diversity of native plants improves urban biodiversity by simultaneously creating wildlife habitat and increasing the presence of native plants,

Looking beyond the boundaries of cities, the use of turf and some ornamental plants can affect biodiversity of surrounding habitat. Non-native species that invade and impact natural areas are called "invasive exotics." An invasive exotic plant often "alters native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives" (Florida Exotic Pest Plant

Council, 2007). Areas dominated by invasive exotic plants can limit native animal populations; for example, fewer small mammals were found in forests dominated by Melaleuca, *Melaleuca quinquenervia,* when compared to native hammock forests and pine flatwoods in Florida (Mazzotti, Ostrenko, & Smith, 1981; Sowder & Woodall, 1985). Most invasive, non-native plants in the United States were originally introduced as ornamentals in urban areas and then escaped and became established in surrounding natural areas (Reichard & White, 2001). We are not saying that all non-native plants are necessarily bad, but today's non-listed exotic could become tomorrow's invasive species.

Maintenance of Lawns & Exotic Plants

Both within and beyond city boundaries, the maintenance of lawns and exotic plants with an array of insecticides, fertilizers, and herbicides can also affect biodiversity. With insecticides and herbicides, most people use these chemicals to keep other plants out and to keep turf and ornamentals healthy and alive. The end result is usually the eradication of native plants and insects. For example, many insecticides are not specific to the pest insect and kill many of our native pollinators such as bees, beetles, wasps, and butterflies (Kunkel, Held, & Potter, 2001; Gels, Held, & Potter, 2002).

Applying herbicides to get rid of "weeds" reduces biodiversity simply because the weeds can be native plants embedded within landscaped and turf areas, For example, many herbicide applications are used for the removal of Florida Betony, *Stachys floridana*, which is a native plant (Unruh, Partridge-Telenko, & Brecke, 2009). Roundup, and its active ingredient isopropylamine, was found to be toxic to native freshwater mussels (Bringolf, Cope, Mosher, Barnhart, & Shea, 2007) and lethal to both aquatic and terrestrial amphibians (Relyea, 2005a). The end result is a net native biodiversity loss as local native plants and animals can be eradicated from a yard or neighborhood, a nearby waterbody (Relyea, 2005b), and even surrounding natural habitat.

How do fertilizers affect biodiversity? Excess fertilizers (e.g., phosphate and nitrate that is not taken up by yard plants) end up in local wetlands and waterbodies when nutrients run off the landscape after a storm event. In one study on the Florida Wekiva River Basin, it was estimated that 20% of the nitrate load was from residential properties <http://www.dep.state.fl.us/water/wekiva/>. Rivers, streams, and lakes that have high levels of nitrates and phosphates cause algal blooms (Lin, He, Yang, Stoffella, Phlips, & Powell, 2008), fish kills (Gannon et al., 2009), and the growth of invasive exotic plants (e.g., Sutton, Van, & Portier, 1992). Near major population centers, even the disturbing appearances of "dead zones" in our coastal waters have been linked to nutrient runoff from the land (Diaz & Rosenberg, 2008).

Biodiversity loss can even affect important ecosystem services, such as removal of carbon dioxide (CO2) and pollination services. More biodiverse ecosystems can uptake more CO2, a greenhouse gas, than ecosystems with less species diversity (Reich et al., 2001). Furthermore, the maintenance of turf and ornamentals can actually cause a net increase in CO2 and other greenhouse gases (Townsend-Small & Czimczik, 2010). This is due to the use of fertilizers and mowing of a manicured landscape, which takes fossil fuels, thus releasing CO2 into the atmosphere. Greenhouse gas emissions from fertilizers, mowing, leaf blowing, and other lawn management practices are four times greater than the amount of carbon stored by lawns (Townsend-Small & Czimczik, 2010).

The Precautionary Principle

Some will argue that evidence of impacts by exotics is not conclusive and exceptions occur. Further, they argue that if homeowners and the landscaping industry managed lawns and ornamentals appropriately, we could minimize our impact on natural environments. However, the risk is great, and thus the precautionary principle may be most appropriate here. Essentially the precautionary principle states that "where there are

threats of serious or irreversible damage, the absence of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation" (Untaru, Gu, & Ramanitrarivo, 2008).

Certainly, non-natives do have their place (e.g., vegetable gardens, turfgrass for recreation, and exotic flowers for show), but the dominance of exotic vegetation is at the expense of our natural heritage. Alternatives do exist (Hostetler & Main, 2010), and people are increasingly interested in sustainable options (Moravec, 2006). The challenge is not only to switch our thinking in Extension but to develop unique outreach programs to engage city dwellers in adopting more practices that benefit biodiversity.

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