Pre and Post Perceptions of Sustainable Landscape Demonstration Garden

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Significance to Industry: The Sustainable Landscape Demonstration Garden was created to address both consumer perception and the resulting green industry marketing challenge related to environmental gardens and native plants. Consumer perception of native plant gardens is often negative due to perceptions of garden untidiness or lack of maintenance (4). These perceptions result in reduced commercial viability of native plant species. This project is intended to increase the potential for environmental stewardship through the installation of a sustainable landscape demonstration garden. This garden contains native plants and is well-tended (mulched, weeded and watered) yet low-maintenance (no fertilizer or pest control applications). Environmental benefits are communicated in a variety of ways to passersby including both participatory (such as in-person surveys) and passive (such as educational signage and QR codes) mechanisms to enhance access to garden information.

Nature of Work; Environmental education demonstration gardens are typically located in botanical gardens or edges of public parks. These discrete sites may be chosen due to the experimental nature of the installation and/or the assumption that the gardens are not as aesthetically pleasing as traditional landscape beds. Our project takes a different approach acknowledging that 1) environmental educational displays are needed in the busiest, hectic urban environments in order to reach and influence greater numbers and diverse people; 2) the display should be aesthetically pleasing as well as educational so as to generate sales and production of these less common, but environmentally beneficial plants; and 3) the experimental nature of the garden should include a participatory role for passersby to share their opinion and judgment of the display. Participation is engaged learning and often results in greater knowledge retention and continued involvement.

People tend to consider attractive landscapes as ones that appear visually cared for or those that are relatively neat and tidy in appearance (4). Therefore, to enhance acceptance and appreciation of educational display gardens, the garden needs to be professionally maintained, just as any ornamental display garden would be. By locating the environmental display garden in a busy intersection and by partnering with the Clemson University Landscape Services Department to provide installation and

maintenance supervision, we are addressing this need for aesthetic tending.

Hester (2) suggested that by "championing everyday beauty" (p. 109) in an urban environment, knowledge, pride, and pleasure may result. By surveying passersby for their preference ratings of the site before and after installation and by surveying people's preference for native plants, we are inviting passersby and the community at large to actively participate in the project. This engaged learning has the potential to result in increased interest in native plants as well as a stimulus for "ambassador" acts (when people offer positive explanations concerning the project to others).

Changing behaviors, even to protect the environment for future generations, is never easy. Employers who hire college students frequently do so to capture new knowledge and practices. Strategies being learned by the students include how to design and install a native plant demonstration garden; how to successfully work in interdisciplinary teams; and how to measure environmental and perceptual effects of the installation. These are skills needed to create sustainable solutions to the environmental problems in the world today.

Efforts to promote environmental stewardship through the installation of a sustainable garden on the Clemson campus began in 2011. Two adjacent garden locations were identified in a public space bordered by sidewalks. Each location was in a relative stage of decline. One 1,800 square foot area contained weeds, Bermudagrass, liriope, and juniper and was bordered on two sides by sidewalks and one side by the wall of a brick building (Figure 1A). The other 1,400 square foot bed did not have any ornamental plants and was bordered on all sides by sidewalk (Figure 1C). This latter spot had housed a pecan tree, which had been removed from the space due to a combination of decline and high target pedestrian population. All that remained were the roots of the pecan and a vegetative mulch layer on top of the soil.

Clemson University's Landscape Services Director served as the client for students in the sustainable landscape design class offered by the horticulture department. Her criteria for the proposed landscape were that the landscape plantings be low-maintenance, well tended, and aesthetically pleasing to passersby. Class criteria were that the landscape would promote environmental sustainability through biodiversity and include native plants. Horticulture students from three separate classes (Horticulture Inquiry and Discovery, Hort 408; Sustainable Landscape Design, Hort 308/309; and Landscapes and Health, Hort 400) collected human preference and behavior survey data; created landscape designs of the existing space; or submitted soil samples for laboratory analysis.

The concept of sustainability stems from the historical definition developed by The World Commission on Environmental and Development Report to the United Nations, *Our Common Future*, also known as The Brundtland Report. Sustainable development, according to the Brundtland Report, meets the needs of the present without compromising the ability of future generations to meet their own needs (8). The

Brundtland Report identifies healthy environment, economic development, and social justice as the three issue areas that must be present in order for sustainable development to occur. Current perspectives and practices conveyed to students are inspired by EPA GreenScapes materials (7), the Sustainable Sites Initiative Benchmarks and Guidelines (6), and the publication *Cradle to Cradle: Remaking the Way We Make Things* (3).

To assess people's preferences, a survey was designed using the Dillman Tailored Design Method (1). After obtaining Institutional Review Board (IRB) approval for the survey, identical preference and demographic questions were administered by student interviewers to passersby in the garden area. Pre-installation surveys were conducted in spring 2012 (n = 171) prior to any disturbance of the space. The demonstration garden was installed in June 2012; and post installation surveys (n = 86) were conducted 4-5 months later in the autumn of 2012 after the first growing season. Quantitative survey responses evaluating garden aesthetics and perception of maintenance pre and post-installation were analyzed using a Least Squares analysis of fit, and means were separated using the Student's t test in JMP v 10.0 (SAS Institute, Cary NC).

Soil samples were submitted for analysis both pre installation in November 2011 and three months after installation in September 2012. Garden installation occurred in June of 2012 with a student working alongside the Landscape Services crew. The existing plants were physically removed from the larger space and the roots were removed from the smaller area; the spaces were tilled with a rototiller and 6" of leaf compost, obtained from the South Carolina Botanical Garden, was incorporated into the soil to a depth of 8". Twenty different native plant species and cultivars were installed. A three-inch layer of double ground vegetative mulch was applied to the soil surface immediately after planting. Plants were watered deeply by hand whenever the soil felt dry to the touch 1-2" below the soil surface.

Signs (4" x 6") with the plant botanical and common names were installed in the garden at time of planting, and a larger sign introducing "Sustainable Landscape Demonstration" (Figure 2) that contained a QR code link to the garden's website (5) was installed during the summer. The garden website (5) went live in late April of 2013, and contains information about the Garden's purpose; the designs; the planning, design, installation and maintenance team; and the plants. Each plant is featured on a plant profile sheet that contains descriptive details about its mature size, environmental preferences, and environmental benefits. All plant profile information is cited to source and the sources are listed in the profile.

Results and Discussion: Results from the pre and post surveys of passersby on campus indicate that aesthetics and maintenance of the installed gardens were significantly higher. The survey enabled participants to rate the pre- and post-installation space on a scale of 1 to 10, with 1 being the poorest and 10 being the best. Pre-installation respondents rated the space as a 4.3 in aesthetic appearance, while post-installation respondents rated the Sustainable Landscape Demonstration Garden

as a 6.9 in aesthetic appearance ($P < 0.0001$). Respondents in the pre-installation survey perceived the quality of maintenance as a 4.8, while respondents in the post installation survey rated the quality of maintenance as a 6.8 ($P < 0.0001$). These positive changes in perception of aesthetics and the quality of maintenance are encouraging, considering that perennial plants generally require two complete growing seasons to reach peak performance and the post-installation survey was conducted after only one growing season.

The pre-installation soil test (analyzed at Clemson University Agricultural Service Laboratory) for the larger garden that is bordered by sidewalks and a building documented in 2011 that phosphorus (P) was high, calcium (Ca) and magnesium (Mg) were sufficient to high, and potassium (K), zinc (Zn), manganese (Mn), and boron (B) were medium to sufficient. Cation exchange capacity was 7.2 meq per 100 g soil^{-1} with 3.3% organic matter. With the exception of less P (medium), and more B (sufficient), the 2012 soil test was very similar to pre-planting soil conditions. The initial soil test for the smaller garden documented that Ca was excessive, K and B were high, and P, Mg, Zn, and Mn were sufficient. Cation exchange capacity was 15.8 meq per 100 g soil^{-1} with 5.6% organic matter. With the exception of less P (medium), and B (sufficient to high), the 2012 soil test was very similar to pre-planting soil conditions. To date, no fertilizers have been applied to either garden since the removal of the original existing vegetation and roots. This pattern of minimal change in minerals, organic matter, and CEC suggest that although plants were establishing, which is thought to be a period of elevated nutrient requirement, a depletion of most minerals did not occur.
Locating the demonstration garden in a busy thoroughfare has resulted in high sample sizes for surveys, increased time spent in the area, and increased interactions between student garden workers and passersby.

Our next steps include invitations to green industry professionals, Master Gardeners, and Master Naturalists to visit the Sustainable Landscape Demonstration Garden to rate the individual plants. These plant preference ratings will be posted on the website as indicators of potential promise for native plants and will hopefully be used by producers and retailers when considering introduction of native plants into their production line or garden center stock. During fall 2013, preference surveys of passersby will be administered by students, and additional soil samples will be collected and analyzed.

Literature Cited

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Fig. 1. Pre-installation (A) and post-installation (B) perspective of 1,800 ft^2 bed bordered by sidewalks and brick building. Pre-installation (C) and post-installation (D) perspective of 1,400 ft^2 bed bordered by sidewalks. Post-installation (E) view of both gardens.

Fig. 2. Signage installed within the Sustainable Landscape Demonstration Garden to increase awareness of the gardens' purpose and components, and to enhance educational opportunities for passersby who interact with the garden.