An Update of the Literature Supporting the Well-Being Benefits of Plants: Part 3 - Social Benefits[1]

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Abstract

This paper provides evidence from the literature regarding the social benefits associated with plants and how they influence the physiological, psychological, and cognitive well-being constructs affecting quality of life. These benefits are segmented and discussed using the following categories: place or community attachment, reduced crime, disaster resilience, access to locally-produced foods, socialization of children and their school performance, and community therapeutic impacts. The equitable distribution of these green space benefits among local populations is also discussed. This research should be strategically incorporated into both industry-wide and firm-specific marketing messages that highlight the quality of life value proposition in order to maintain the industry's sense of value and relevance to residential landscape consumers of the future. These findings also present evidence that municipal leaders and policymakers can use in justifying green infrastructure-related funding decisions, as well as grounds for the construction industry using biophilic design principles in ensuring the built environment offers opportunities for green space interactions. The green industry can play a pivotal role not only in providing plants of high quality for these applications but educating stakeholders regarding the benefits discussed herein.

Index words: benefits of plants, community, social benefits.

Significance to the Horticulture Industry

This paper is the third of a four-part series that provides a review of the substantial body of peer-reviewed research that has been conducted regarding the economic, environmental, and health and well-being benefits of green industry products and services. While the first article focused on the emotional and mental health benefits that plants provide, the second article focused specifically on the physiological health benefits provided by plants. This article provides an overview of the benefits that plants provide to society at large and the role they play in addressing critical societal issues. This research should be strategically incorporated into both industry-wide and firm-specific marketing messages that highlight how quality of life dimensions are affected in order to enhance the perceived value and relevance of green industry products for gardening and landscaping consumers in the future.

Introduction

In 2011, Hall and Dickson published a forum article in the Journal of Environmental Horticulture (JEH) that summarized the economic, environmental, and health and well-being benefits associated with people-plant interactions. The proposition put forth in that article was that green industry firms needed to focus on these types of functional benefits in their marketing messages to consumers rather than simply base their value proposition on the features and benefits of the plants themselves (e.g. aesthetic characteristics, insect and/or disease resistance, cold or heat tolerance, salt tolerance, drought resistance, etc.). By doing so, the end consumer would better understand the inherent ways in which plants improve the quality of their lives and begin perceiving plants to be a necessity in their lives rather than a mere luxury they could cast aside during economic downturns, as they did during the "Great Recession" of 2008-2009.

Since 2011, there has been a plethora of additional research studies conducted regarding these functional plant benefits. A total of 1,348 citations have been compiled in total and about two-thirds of those have been conducted since 2011. Thus, this new series of forum articles attempts to update the findings summarized in the original article by Hall and Dickson by focusing on the research on plant benefits that has been conducted since 2011. By doing so, this new information provides the basis for even more innovative green industry marketing efforts, which, in turn, may positively influence the price elasticity of demand for plants in general.

The third topic in the four-part series, social benefits of plants, is one that has been shown to resonate with consumers of all demographic segments (Hall and Dickson 2011). These social benefits are segmented and discussed according to the following categories: place (community) attachment, reduced crime, disaster resilience, access to locally-produced foods, socialization of children and their school performance, and therapeutic impacts affecting communities at large. The equitable distribution of these green space benefits among local populations is also discussed.

The reason these social benefits of plants are so important is that when social bonds are severed, or simply absent, society suffers. At a time when the polarization and fragmentation of society is of growing concern, we need to actively seek ways to strengthen human connections among us and build stronger communities. Green spaces provide opportunities for community residents to connect and collectively find healing. In addition, many people no longer live near immediate or extended family members and subsequently become disengaged from traditional institutions and networks such as churches, labor unions,

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and civic organizations that used to form the basis for their social lives (Putnam 2000).

Generally, research has shown a positive relationship between social ties and cohesion and green space (de Vries et al. 2013, Francis et al. 2012). Of course, the type and condition of green spaces matter in that the variety of plants in a green space, the level to which it is maintained, its orderly arrangement, the absence of litter, and the general impression by local residents have been found to be as important as the quantity of green space in promoting social cohesion in the neighborhood (de Vries et al. 2013).

Many of these social benefits experienced during exposure to plants have been documented in both the built environment and the natural environment. The built environment includes all human-made spaces in which people live, work, and play, including buildings, gray infrastructure (e.g. utilities, transportation networks, etc.), and improved landscapes (outdoor landscape spaces that have been "improved" aesthetically). The term "green spaces" has been used extensively to refer to areas of urban vegetation, including public and private parks and gardens, residential landscapes, and urban forests and other municipal landscapes. However, with urbanization and global migration into urban centers, exposure to outdoor green spaces is becoming less frequent in people's everyday life, prompting the use of biophilic design principles to offer exposure to the elements of natural environments within the built environment. For example, "green buildings" often incorporate green walls, green roofs, water features, natural lighting, and natural materials that emulate nature.

Place/Community Attachment

The term "plant blindness" is used to describe the "inability to see or notice the plants in one's own environment, leading to the inability to recognize the importance of plants in the biosphere and in human affairs" (Warner 2012). On a social level, plants can help create a comfortable environment where people come to find solace. An example of this is community gardening, which is defined by its shared nature, where community residents work collectively to manage a garden for shared benefit. Participation in gardening activities may improve well-being through increased social contact, culturally-valued activities, and mitigation of food poverty. This is especially true in cases where food deserts exist, or urban areas in which it is difficult to buy affordable or good-quality fresh food (Lovell et al. 2014). The benefits of community gardening are argued to extend beyond the participants themselves through more coherent and cohesive communities, improved physical environments, and the sharing of the products of the labor (Draper and Freedman 2010, Goodall 2010, Guitart et al. 2012, Lovell et al. 2014). Community gardening is a promising method of furthering well-being and resilience on multiple levels: individual, social group, and natural environment (Okvat and Zautra 2011).

Urban parks are also sites where different ethnic groups mingle and where informal, cursory interactions can stimulate social cohesion. Further, being involved and concerned with parks can facilitate attachment to these places. The design of a park, its location and people's image of the park in combination with the cultural characteristics of various ethnic groups inform the opportunities for intercultural interactions leading to social cohesion (Peters et al. 2010).

The Knight Foundation developed a study (Gallup 2010) to determine the factors that emotionally attach people to a community (i.e. place attachment). In other words, what makes them want to put down roots and build a life there. The study provided empirical evidence that the drivers that create emotional bonds between people and their community are consistent in virtually every city and can be classified to just a few categories. Not surprising, study participants consistently give higher ratings for elements that relate directly to their daily quality of life, including an area's physical beauty, opportunities for socializing, and a community's openness to all people (Gallup 2010).

The study also showed that the communities with the highest levels of attachment had the highest rates of gross domestic product (GDP) growth (Gallup 2010). At the individual level, household involvement in community gardening and beautification activities and in neighborhood meetings were associated with residents' perceptions of social capital (the value of social networks) and neighborhood norms and values (Alaimo et al. 2010). Household involvement in gardening and beautification efforts yielded stronger perceptions of social capital than did neighborhood-level involvement measures such as resident participation in community organizations (Alaimo et al. 2010). A key cultural component of areas and neighborhoods is the level of social cohesion, which measures the degree to which members of a community cooperate with one another. Differentiated green space access between subgroups of the local population affects the level of social cohesion (Seaman et al. 2010).

Social contacts among neighbors are also influenced by the availability of trees and turfgrass and the perceived level of green space (vegetation) in the neighborhood (Detwiler 2012, Kemperman and Timmermans, 2014 Kweon et al. 2010). However, the safety and level of maintenance of the green spaces are also important in that high quality (well-maintained) green spaces support social contacts between neighbors and encourages outdoor activities among aging populations (Kemperman and Timmermans 2014). Connection with nature is similar to other environmental worldview measures in predicting sustainable attitudes and behaviors, yet is unique in predicting levels of happiness (Zelenski and Nisbet 2014). In other words, access to nature is a significant predictor of several happiness indicators, even after controlling for other connections (Zelenski and Nisbet 2014). Results support the notion that nature relatedness could be a path to human happiness and environmental sustainability (Despard 2016, Glover et al. 2005).

The Master Gardener organization found that a major reason that volunteers continue to stay involved in the community gardening programs is to learn about gardening and horticulture (Takle et al. 2016). In addition, while altruism is important to these volunteers, they do not

recognize the full impact their projects have on their local community (Takle et al. 2016). To them, it is more about practicing sustainability and beautifying the community than about their own interests.

Neighborhood aesthetics, social involvement, and community garden participation are significantly associated with fruit and vegetable intake (Litt et al. 2011). Community gardeners consumed fruits and vegetables 5.7 times per day compared with home gardeners (4.6 times per day) and non-gardeners (3.9 times per day) (Litt et al. 2011). Moreover, 56% of community gardeners met national recommendations to consume fruits and vegetables at least 5 times per day compared with 37% of home gardeners and 25% of non-gardeners (Litt et al. 2011).

An important initiative for developing the future place attachment of adolescents is the Come Alive Outside Design Challenge (2015), a program designed to reconnect children with nature and attract more young people into meaningful careers in the landscape profession. The program creates the opportunity for college, high school, elementary, and pre-school students to work together with green industry professionals to design and build engaging outdoor learning environments. Helping the public gain a deeper appreciation of why maintained landscapes are essential to healthy communities is central to recruiting more young people into the green industry.

In a study concerning ethnocentrism, community service programs were found to be successful not because of individual efforts, but because of group efforts working cooperatively towards a single goal. The community service work helped participants to look beyond their superficial differences (that is, ethnicity or socioeconomic status) and identify their common interests. An example of this are beautification programs that improve community landscapes through the planting and tending of flowers, vegetables and shrubs (Hoffman et al. 2010).

Reduced Community Crime

A total of 92% of Americans surveyed felt that community safety was the number one characteristic most desired of their neighborhoods (Americas 2012). Those neighborhoods struggling with physical decline and high crime often become safer simply when local residents work together to beautify their neighborhood through programs such as America in Bloom (Bloom 2012, Spector 2016).

Research from cities across the country shows how small changes to urban environments (like planting flowers or adding benches) reduce violence and many neighborhoods have taken the initiative to clean up and maintain their own city streets (Zimmerman 2018). University Avenue Corridor Coalition in Flint, Michigan is an example of this. Residents started holding frequent neighborhood cleanup days to fix up vacant lots and abandoned buildings, symbolically "owning" them by adding lighting, sidewalk repair, benches, and plantings of flowers, shrubs, and trees (Zimmerman 2018). A liquor store was transformed into a fast food restaurant and the public drinking spot across the street became a public park. Over time community members reported fewer mental health problems, had been victims of crime less often, and felt less afraid. According to the coalition's latest report, assaults decreased 54%, robberies decreased 83%, and burglaries decreased 76% between 2013 and 2018. Places where empty lots were being maintained by the community had nearly 40% fewer assaults and violent crimes than untouched vacant lots. This finding is similar to data from other cities such as Philadelphia, where greening of public spaces was significantly associated with lower rates of assault, robbery, burglary, narcotic possession, and offensive graffiti (Branas et al. 2011, Kondo et al. 2015, Sadler et al. 2017, Wolfe and Mennis 2012). Residents in the intervention areas reported participating more in neighborhood watches, block associations, and community events than in the areas where residents did not undertake beautification, clean-up, and other improvement projects (Zimmerman 2018).

One model, spatially adjusted, indicated that a 10% increase in tree canopy was associated with a roughly 12% decrease in crime (Troy et al. 2012). When breaking down tree cover by public and private ownership, it was found that the inverse relationship continued in both contexts, but the magnitude was 40% greater for public than for private lands (Troy et al. 2012). In Philadelphia, remediation (restoration) of abandoned buildings significantly reduced firearm violence –39%; as did vacant lot remediation –4.6% (Branas et al. 2018). Respectively, taxpayer and societal returns on investment for the prevention of firearm violence were $5 and $79 for every dollar spent on abandoned building remediation, and $26 and $333 for every dollar spent on vacant lot remediation (Branas et al. 2018). Traffic-related risks for people involved in the traffic flow in areas near vacant lot remediation are also reduced (Kocur-Bera and Dudzinska 2015).

Some people explicitly state that they volunteer in their respective communities because they find neighborhood greening to be correlated with community safety (Locke et al. 2017). For example, many volunteers of the Community Greenspace program of the Urban Resources Initiative in New Haven, Connecticut believe that there is a reduction in crime from community greening activities, even though it is not an explicit goal of the program (Locke et al. 2017). Or, in places like Portland, Oregon, large shade trees in the public right of way are associated with lower crime rates (Donovan and Prestemon 2010). It is hypothesized that trees may be a signal to potential criminals that a home is better cared for and therefore subject to more effective security than a comparable house with fewer trees.

For adolescents, access to neighborhood greenspace is more crucial. When assessing the level of aggressive behavior in young adolescence, both short-term (1 to 6 month) and long-term (1- to 3-year) exposures to greenspace within 1,000 meters (3,280 ft) surrounding residences were associated with reduced aggressive behaviors (Younan et al. 2016). The benefit of increasing vegetation above the levels commonly seen in urban environments was equivalent to approximately 2 to 2.5 years of behavioral maturation (Younan et al. 2016).

Disaster Resilience

Green, nature-based infrastructure enhances the resilience of the physical surroundings in a community and is vital when mitigating natural disasters. Urban forestry programs and active environmental stewardship networks can provide the leadership to respond to and recover from natural disasters (Tidball et al. 2014). Research at the U.S. Forest Service New York City Field Station examined and confirmed the positive relationship between environmental stewardship, healing, and community resilience in the aftermath of disasters (Svendsen 2009, Tidball 2014). They also documented how communities in New York City that created "living memorials" or green spaces dedicated to memorializing the lives lost in the 9/11 attacks seemed to recover from the trauma more quickly.

The same authors looked at the role of nature in the rebuilding effort that took place in Joplin, MO after the devastating 2011 tornado that completely destroyed much of the town and killed 161 people (Tidball 2014). They found that as volunteers and community groups become actively involved in the stewardship of the natural resources, their communities showed increased civic engagement and ecological literacy. Additionally, communities that work together to create green infrastructure designed to be resilient to storms and other disasters also generate and nurture social connections in these shared places. The role of community-based natural resources management in the form of "greening" after large-scale system shocks (hurricanes, tornados) or community-wide trauma is argued to provide multiple benefits via engagement with living elements of social-ecological systems and subsequent enhanced resilience (recovery) at multiple scales, individually or community-wide (Tidball et al. 2014).

Examples of the power of trees as symbols of resilience begin to emerge soon after disaster events (Tidball 2014). Tidball also alluded to this idea in his earlier work on community-based ecological restoration and community/social-ecological disaster resilience (Tidball 2012), which suggests that individuals (or communities) seek engagement with nature to summon resilience in the face of a crisis. In doing so, they exemplify an urgent biophilia, representing an important set of human-nature interactions in social-ecological systems characterized by hazard, disaster, or vulnerability (Tidball 2012).

Improved access to healthy, affordable food

Horticultural crops not only beautify our neighborhoods, decorate our gardens, and provide ambience but also provide valuable nutrition used to feed the world. Food-producing horticultural enterprises range in size from the subsistence micro-gardens of villages to huge commercial enterprises with large holdings of greenhouse and field crops and extensive orchards (McCaffrey 2012).

A food revolution is emerging out of growing concerns about obesity and other diet-related health problems (Foley 2014). The revolution is most visible today in the form of the local food movement, a continuation of the organic food movement, which, in turn, had its roots in the natural food movement of the 1960s (Ikerd 2011, McFadden 2015) with varying levels of intensification (ecological, sustainable, durable, etc.) in both rural and urban environments (Park 2011, Tittonell 2014).

Urban farming (the practice of cultivating, processing and distributing food in or around urban areas) brings a multitude of benefits to struggling communities: improved access to healthy food, workforce training and job development, and neighborhood revitalization. These innovative programs are facilitated by the creation of urban agriculture-friendly municipal policies to support them (Hagey 2012).

Green activism and guerrilla gardening (gardening on land that the gardeners do not have the legal rights to cultivate, such as abandoned sites or other areas that are not being cared for) lie at the more informal end of the urban food growing movement, but little is known about the extent of this practice or the future of such unplanned activities (Hardman et al. 2018). Previous research reveals the ability of these informal movements to regenerate 'forgotten' spaces and bring communities together (Hardman et al. 2018). Ultimately, more research is required to better understand the actions of those who pursue a more informal approach to urban gardening.

Some consumers are becoming increasingly interested in purchasing plants that are locally-grown and/or ecologically friendly for them to use in home gardening and food-scaping activities. Food-scaping is the practice of including edible plants in the ornamental landscape. Behe et al. (2013) found that participants who purchased different food-producing plants had distinct preferences for various environmental attributes of plants and profiled nine distinct consumer segments, identifying their plant purchases and preferences for local and sustainably grown plants. Results provide plant producers and retailers with market segments that can be identified and targeted and provide a basis for customizable marketing communications to enhance profits (Behe et al. 2013).

Socialization of Children

Early childhood is a critical time for establishing a strong foundation of healthy habits that will shape children's physical and psychological well-being both in the present and future (Park and Riley 2015). Opportunities to engage with new people in new situations also enhances children's cognitive development (Seltenrich 2015). Playing outdoors is essential not only for children's health but also for their learning, and their level of engagement during instruction might increase through greater nature-induced "shots of serotonin" (Park and Riley 2015).

The progressive disengagement of humans from the natural world has been viewed both as a key public health issue and one of the most fundamental obstacles to halting global environmental degradation (Soga et al. 2018). However, childhood experiences with neighborhood plants are positively related to age; older participants, compared to younger ones, report higher frequencies of childhood experiences with neighborhood flowering plants. Participants' age and childhood environment (urban vs. rural settings) also had significant effects on their levels of

childhood nature experiences. Results suggest that as children's direct connection to neighborhood biodiversity progressively declines, it can have serious implications for public health and biodiversity conservation at the community level.

School Performance

While some teachers may feel pressure to have children spend more time indoors on academically-oriented tasks, research suggests that outdoor time in the midst of plants is beneficial to children's academic success. Young children's outdoor play serves important and diverse purposes, including physical exercise and opportunities for growth in all developmental areas (Kemple et al., 2016). Outdoor play in nature may contribute to improved self-control and more focused attention. For example, research has shown that having recess significantly lowers the level of children's inappropriate in-class behaviors; when recess was not offered, children engaged in higher levels of inappropriate behaviors. The rich multi-sensory experience of being outdoors appears to encourage children to be more observant of, and curious about, their surroundings, leading to a desire to explore, investigate, and make sense of their observations. Symbolic play, in which children allow one thing to represent another or in which they take on roles and allow themselves to represent another persona, is considered an important element in the development of abstract thinking (Kemple et al. 2016).

Given these benefits, teachers need to provide children with the opportunity for high-quality outdoor play, especially outdoor play in more naturalized environments in the midst of plants. Teachers' knowledge and beliefs about the importance of nature interactions and about their own roles during children's outdoor play can contribute to the efficacy of these child and plant interactions (Kemple et al. 2016).

Community-wide Therapeutic Impacts

In general, as people age, they are less mobile and have more limited activity spaces. At the same time, they are faced with smaller social networks due to social and health-related changes. Results show that social contacts among neighbors are mainly influenced by the availability of trees and turfgrass and the perceived level of green, thus green spaces are important factors affecting health during aging (Kemperman and Timmermans 2014).

Noise pollution is one of the top four types of pollution in the world (Önder and Akay 2015) and noise pollution can have significant negative effects on human health. Dzhambov and Dimitrova (2014) found evidence that the presence of vegetation can generally reduce the negative perception of noise, while others found vegetation to be effective noise barriers (Önder and Akay 2015). Other research has also confirmed the positive correlation between plants being in the cityscape and perceptions of acoustic comfort and loudness (Jeon et al. 2010). Water sounds were also determined to be one of the best sounds to use for enhancing the urban soundscape by masking the surrounding noise pollution (Jeon et al. 2010).

Portland, Oregon was used as a case study in an interpretive study to assess the effect of increased air quality in relation to human health (Rao et al. 2014). The research team estimated that the NO_2 reduction associated with trees in Portland could result in significantly fewer incidences of respiratory problems, providing a $7 million USD benefit annually for residents in the city (Rao et al. 2014), thus leading to significant health cost savings for the community.

Incorporating the principles of biophilia into architectural design for buildings and hardscapes (also known as biophilic design) has numerous unanticipated benefits. For example, green walls, natural lighting, water sounds, and other biophilic elements can lessen absenteeism (missing work altogether) and presenteeism (being at work, but not productive). Numerous studies have also quantified the benefit of views and/or natural daylight in increasing productivity at work, greater time spent at the desk, and increased quality and quantity of work output (Clark and Chatto 2014).

Distribution of Green Space Benefits

There is growing evidence that across North American cities, underprivileged populations have disproportionally less access to vegetation than affluent groups, raising concerns of environmental inequity resulting from these variations in urban vegetation for low-income citizens and visible minorities (persons of skin color that are underrepresented in a given region) (Pham et al. 2012). Disparities are also more pronounced on public land than on private land (Pham et al. 2012). Differences in income is a major factor, but does not fully explain inequities among visible minorities.

To address this issue, Reddon and Durante (2018) provided historic and current evidence for the importance of nature exposure (NE) and introduced the Nature Exposure Sufficiency (NES) and Insufficiency (NEI) continuum. Insufficiency includes impoverished environments (e.g. slums and prisons) where nature exposure is sometimes very limited (Reddon and Durante, 2018). Nature Exposure Sufficiency (NES) is an optimal amount of exposure to nature where the many benefits from exposure to plants can be experienced by everyone, but particularly for individuals with various health conditions such as arthritis, dementia, or depression. The benefits of NE are not just derivable from parks, forests, and other natural settings, but the interiors of buildings and homes can be enhanced with plants and even pictures or objects from nature in order to provide some level of NE. Additionally, there is evidence indicating that virtual and artificial environments depicting nature can also provide substantial NE and therefore contribute to general well-being. Nature Exposure Sufficiency and Insufficiency are correlated with the level of environmental sustainability of the community and its long-term planning efforts to deal with future environmental externalities (side effects that could be harmful to either the general public or the environment) (Reddon and Durante 2018).

Another German study investigated whether families with lower-level socioeconomic status (SES) reside in less

green neighborhoods in four areas in Germany (Markevych et al. 2017). In the Munich and Leipzig areas, families in the low/medium income resided in neighborhoods with lower tree canopy coverage compared to those in the high-income areas. Although there are exceptions, these results are suggestive that lower income areas may have less tree coverage.

The distribution of heat risk–related land cover (HRRLC) characteristics across racial and ethnic groups and degrees of residential segregation has also been examined. After adjusting for ecoregion and precipitation and holding segregation level constant, non-Hispanic blacks were 52% more likely, non-Hispanic Asians 32% more likely, and Hispanics 21% more likely to live in HRRLC conditions compared with non-Hispanic whites (Jesdale et al. 2013). Within each racial/ethnic group, HRRLC conditions increased with increasing degrees of metropolitan area-level segregation. Further adjustment for home ownership and poverty did not substantially alter these results (Jesdale et al. 2013).

The U.S. EPA recommends both increased tree canopy and changes in roof and pavement characteristics to reduce urban heat intensity (EPA 2017, Hair and Kramer 2016). Many cities have developed plans to mitigate future heat risks, largely through adopting strategies that promote tree planting and high albedo roofs and pavements (EPA 2017, Hair and Kramer 2016). Results of this analysis highlight the idea that urban planning in regard to greenspaces to mitigate future extreme heat should proactively incorporate an environmental justice perspective and address racial/ethnic disparities in land cover characteristics.

While the creation of new green spaces to address environmental justice problems can make neighborhoods healthier and more aesthetically attractive, they can also increase housing costs and property values (Wolch et al. 2014). Ultimately, this can lead to gentrification and a displacement of the very residents the greenspace strategies were designed to benefit. Urban planners, designers, and ecologists, therefore, need to focus on urban greenspace strategies that protect social as well as ecological sustainability (Wolch et al. 2014).

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