Public Horticulture

Current Status of Children's Gardens Within Public Gardens in the United States

Min Hyeong Kwon¹, Changwan Seo², Jongyun Kim³,
Moonil Kim⁴, Chun Ho Pak¹, and Woo-Kyun Lee^{4,5}

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SUMMARY. The purpose of this study was to identify the current status and future development of children's gardens within public gardens in the United States and to examine their roles as places for children to explore natural environments. This study identified 776 public gardens and examined 163 of those gardens using a comprehensive online survey. The sampled public gardens were widely distributed throughout the United States, although they were located primarily in the eastern and western regions of the United States. We found that 55% of the 163 public gardens that we investigated included a children's garden at the time of data collection, and 26.4% planned to add a children's garden in the near future. Children's gardens found within public gardens were typically in a botanical garden and were added after the public gardens were formed. Most of the children's gardens had a stated purpose of providing children with environmental education by allowing them to experience the natural environment through play. Most children's gardens occupied a small proportion, less than 1 acre, of the overall size of a public garden. We also found that demographic and socioeconomic factors influenced the development of children's gardens within public gardens and public gardens in general.

Most people around the world today live in urban areas and spend most of their time in urban spaces. The urban population in the United States was approximately 10.8% before the Industrial Revolution began in 1840, but it increased to 80.7% by 2010 (U.S. Census Bureau, 1990, 2010). The United Nations reports that 54% of the world's population now lives in urban areas, and this number is expected to increase (United Nations, 2014).

Rapid industrialization and urbanization have produced a phenomenon in which contemporary citizens are living increasingly farther from nature (Nabhan and Trimble, 1994).

This phenomenon is referred to as "nature deficit," and the related disorder has resulted not only in mental problems such as depression or stress and physical health problems such as cardio-cerebrovascular disease, heart disease, diabetes, colorectal cancer, and osteoporosis but also in environmental pollution and climatic change in urban areas (Halverson et al., 2008; Lee and Maheswaran, 2011; Louv, 2008; McMichael, 2001).

As the issue of nature deficiency in urban areas has become more prominent, people have become interested in green spaces and access to natural environments. Urban public gardens provide environmental benefits to the natural ecosystem that bridge the natural environment with urban areas to reduce stress and produce a restorative effect on people (Cooper-Marcus and Barnes, 1995; Kaplan and Kaplan, 1989; Lewis, 1996; Rakow, 2011; Ulrich, 1999). Moreover, urban public gardens resolve social problems in urban society by offering a variety of educational opportunities and social gathering spots (Goddard et al., 2010; Lewis, 1992; Robertson, 1996; Sherer, 2006; Waliczek et al., 2000).

Public gardens are considered leisure destinations like museums, parks, or zoos. According to a 2011 report about the leisure market in the United States, gardening was included among the top 10 leisure activities (Falk, 1998; Leisure Market Research Handbook, 2012), and the increase of gardening as a leisure activity has been associated with the increased numbers of visitors to public gardens (Connell, 2004, 2005). According to research on children's preferences for leisure activities, however, children tend to prefer indoor activities, such as watching TV, reading, using a computer, playing video games or using other modern media (Cherney and London, 2006; Moore and Wong, 1997; Stenvall, 2009). The phenomenon in which children have more time to adapt to indoor lifestyles that are distant from natural environments has exacerbated health problems such as childhood obesity, asthma, attention deficit/hyperactivity disorder, and atopic dermatitis resulting from vitamin D deficiency (Mithal et al., 2009; Moore and Wong, 1997; Perrin et al., 2007; Taylor et al., 2001; Taylor and Kuo, 2009).

Because greater numbers of problems are arising for children who have less time to experience natural environments, environmental education researchers in the United States have been studying children's gardens as places where children can improve

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711
1.6093	mile(s)	km	0.6214

Fig. 1. (A) Density of public gardens and (B) density of county population in the United States; 1 mile = 1.6093 km.

their physical and mental health and sociability through the pleasure and play they experience in a natural environment encountered within a city (Halverson et al., 2008; Miller, 2005; Tai, 2006; Taylor, 1994).

Children's gardens that are within public gardens and are equipped with opportunities for activities such as rest, leisure, and education have now been firmly positioned as alternative spaces that can help children become aware of natural environments. These spaces intrigue children at the appropriate level and aid in relieving various juvenile social problems resulting from nature-deficit disorder. Children's gardens are places that all family members can engage and enjoy regardless of age [American Horticultural Society (AHS), 2005; Maller and Townsend 2006; Taylor, 1994]. Additional research on family leisure activities has

reported that family-oriented leisure activities enhance family bonds and healthy relationships. The selection of leisure activities by young children is influenced by their parents (Hawks, 1991; Holder et al., 2009; Shaw and Dawn, 2001). Therefore, children's gardens within public gardens not only allow for the rest, leisure, and education of children, but they also benefit the families who visit them.

The first children's garden established in a public garden in the United States was the Brooklyn Botanic Garden, which was built in New York in 1914 to help educate children about gardening (Shair, 1999). With this garden as an exemplary case, children's gardens began to gradually spread throughout the United States (Stone, 1984; Trelstad, 1997). In 1993, the Michigan 4-H Children's Garden was established at Michigan State University in East Lansing to teach children about the importance of plants, to induce curiosity, and to provide experiences of aesthetic richness while including many educational elements (Sobaski, 2006).

As the importance and popularity of children's gardens has increased, many studies have emerged about the design elements of children's gardens (DiMare, 2012; Eberbach, 1988; Miller, 2005, 2010; Sobaski, 2006) as well as the importance of spaces for environmental education (Halverson et al., 2008; Hoffman, 2008; Tai, 2006) and spaces for the mental and physical development of children (Maller and Townsend, 2006; Pretty et al., 2005). However, little research

has been conducted using quantitative data or analyses that show the overall distribution and status of children's gardens within public gardens in the United States.

Accordingly, this study was designed to examine the distribution of children's gardens within public gardens, to understand their presence, and to determine the demographic and socioeconomic factors that affect the development of children's gardens with the overall goal of illustrating the status and future development of children's gardens.

Materials and methods

STUDY DESIGN. The study was conducted from Jan. 2010 to Aug. 2014. To examine the distribution and status of children's gardens situated within public gardens in the United States, a list of public gardens in the 50 states and Washington, DC, was compiled using a total of 12 sources, including six official garden-related institutes, two private informational websites, two Internet search engines, and two children's garden-related literature resources. The six official garden-related institutes included the AHS (2010), the American Public Gardens Association (2010), Botanic Gardens Conservation International (BGCI, 2010), the Children's Garden Network (CGN, 2011), The Morton Register of Arboreta (MRA, 2011), and the National Gardening Association (NGA, 2010). The two private informational websites included The Garden and Landscape Guide, Nightingale Garden Company Limited

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¹Department of Biosystems and Biotechnology, Korea University, Seoul 136-713, South Korea

²Department of Climate and Ecology, National Institute of Ecology, Seocheon-gun, 325-813, South Korea

³Division of Biotechnology, Korea University, Seoul 136-713, South Korea

⁴Department of Environmental Science and Ecological Engineering, Korea University, Seoul 136-713, South Korea

⁵Corresponding author. E-mail: leewk@korea.ac.kr.

Table 1. Distribution of children's gardens by state, as compiled from online surveys and lists of U.S. public gardens from 12 sources.

State	Sampled public garden ^a				Public gardens	State	Sampled public garden				Public gardens
	CG	CGUC	CGP	Without CG			CG	CGUC	CGP	Without CG	
New York	7	1	0	1	48	Idaho	1	0	0	0	4
Virginia	7	0	2	3	20	Kansas	1	0	2	0	8
Illinois	6	0	0	0	29	Kentucky	1	0	0	1	10
California	5	1	3	2	66	Massachusetts	1	0	0	0	16
Michigan	5	0	1	0	19	New Mexico	1	0	1	0	4
North Carolina	5	1	3	0	32	Oregon	1	0	0	1	15
Pennsylvania	5	0	1	2	44	South Carolina	1	0	0	0	10
Hawaii	4	0	2	1	27	Tennessee	1	0	0	1	20
Wisconsin	4	0	0	0	17	Connecticut	0	0	0	1	6
Colorado	3	0	0	0	13	Indiana	0	0	1	0	13
Florida	3	0	2	1	43	Louisiana	0	0	1	1	11
Georgia	3	0	4	1	25	Minnesota	0	0	0	1	18
Iowa	3	0	1	0	14	Missouri	0	0	0	0	9
Ohio	3	1	1	1	25	Mississippi	0	0	0	0	6
Oklahoma	3	0	1	0	12	Montana	0	0	0	0	3
Maine	2	0	1	2	11	North Dakota	0	0	0	0	3
Maryland	2	0	0	1	10	Nebraska	0	0	0	1	9
New Jersey	2	0	0	1	27	New Hampshire	0	0	0	0	5
Texas	2	0	3	1	28	Nevada	0	0	0	1	5
Utah	2	0	0	0	7	Rhode Island	0	0	0	0	4
Alaska	1	0	1	1	4	South Dakota	0	0	1	0	5
Alabama	1	0	2	2	12	Vermont	0	0	0	0	2
Arkansas	1	0	0	0	4	Washington	0	0	2	2	24
Arizona	1	1	1	0	13	West Virginia	0	0	1	0	3
Delaware	1	0	0	0	3	Wyoming	0	0	0	0	1
District of Columbia	1	0	0	0	9	Total	90	5	38	30	776

^aCG = children's garden; CGUC = children's garden under construction; CGP = children's garden planned.

(1998) and Groundspeak (2010). The two Internet search engines used were Google (1998b) and Wikipedia (2001). The two children's garden-related literature resources included the book *Designing Outdoor Environments for Children* (Tai, 2006) and the thesis entitled *An Investigation of Interactivity at the Michigan 4-H Children's Garden* (Sobaski, 2006).

A list was compiled from the 12 sources and included a total of 776 places that met Rakow's (2011) definition of a public garden (Fig. 1; Table 1), which states that "a public garden is a mission-based institution that maintains collections of plants for the purposes of education, research, conservation, and/or public display. It must have a system for maintaining plant records and professional staff, be open to the public and provide accommodations for access to all people." The public gardens contained in the list were categorized into six different types, as defined by Rakow (2011):

Table 2. Number of U.S. public gardens (PGs) and children's gardens (CGs) within the six categories of PGs.

Garden category	PGs [no. (%)]	CGs [no. (%)]	Proportion of CG (CG/PG)
Botanical gardens	118 (72.4)	71 (78.9)	60.2
Arboreta	29 (17.8)	11 (12.2)	37.9
Display gardens	7 (4.3)	3 (3.3)	42.9
Historic landscapes	6 (3.7)	3 (3.3)	50.0
Conservatories	2 (1.2)	2 (2.2)	100.0
Zoos	1 (0.6)	0 (0.0)	0.0
Total	163 (100)	90 (100)	

arboreta, botanic gardens, conservatories, display gardens, historic landscapes, and zoos.

To investigate the presence of children's gardens within the 776 listed public gardens, an online survey was conducted using Survey Monkey (2011) between July 2011 and Jan. 2012 by sending questionnaires to the education coordinators and horticulture directors at each of the 776 public gardens. In addition, the type of public garden represented by each garden was researched on each garden's website (Table 2). The survey included questions regarding the

presence of children's gardens (Fig. 2; Table 1), their purpose (Table 3), their year of establishment (Fig. 3), and their size (Fig. 4) (see Supporting File). The size of each public garden and the year of its establishment were verified using each garden's website (Figs. 3 and 4). The number of news articles published about children's gardens during 1990 and 2014 was determined by searching the term "children's gardens" in Google (1998a) (Fig. 5). One hundred and sixty responses were collected from public gardens in 43 states. During July and Aug. 2014, a phone survey

Fig. 2. Map showing the (A) distribution of the public gardens and (B) density of public gardens in the United States; 1 mile = 1.6093 km.

Table 3. Purposes of establishing children's gardens within U.S. public gardens [multiple responses ($n = 72$)].

Categories	Responses (no.)
To provide an environmental education with the experience of nature through play in a garden	22
To provide an engaging place for children and families to enjoy	20
To provide an educational program with hands-on activities	14
To introduce various plants to children and demonstrate where food comes from	11
To attract children and families for garden visits	10
Others	11

was performed to reconfirm the information received from the 163 public gardens that had responded to the online survey and to learn whether they were planning to build a children's garden or were currently constructing one. The data were also examined through discussions, interviews and reviews with 17 colleagues across the academic (professor), public (garden director and director of institution), and private (landscape designer, and environmental educator) sectors of public gardening (Table 4).

DATA ANALYSIS. Pearson's correlation test was conducted using the overall number of public gardens and the public gardens surveyed in each state to determine the relationship between those surveyed and the total number of public gardens. Using news articles published between 1990 and 2014 retrieved from Google (1998a), a frequency analysis was performed to investigate the presence of children's gardens within public gardens (Table 1),

the differences among the six different types of public gardens (Table 2), the number of established public gardens and children's gardens (Fig. 3), the sizes of public gardens and children's gardens according to their ground area (Fig. 4), and the relationship between social interest in children's gardens and their establishment (Fig. 5). In addition, a multiple-response analysis was conducted to determine the purposes of establishing children's gardens within public gardens (Table 3).

A *t* test was performed using data from the 2000 census to determine the factors that influenced the presence of children's gardens within public gardens (Table 5) and the presence of public gardens (Table 6), including local populations, number of children (under 5 years old and 5 to 17 years old), education level (number of people with university degrees or higher), and economic level (per capita income), in the surveyed counties. All statistical analyses were conducted

using SPSS (20.0 for Windows; IBM, Armonk, NY).

A spatial analysis technique based on geographic information system (GIS) was employed to analyze the density (Figs. 1A–B and 2B), geographical distribution (Fig. 2A) and area ratio of children's gardens to public gardens in the United States (Fig. 4A). This study projected the location data of public gardens using Albers equal area conic projections after identifying their longitudes and latitudes using addresses. We used the spatial data to analyze the density of public gardens and to map county population density. All of the GIS analyses were conducted using ESRI ArcGIS 10.0 (ESRI, Redlands, CA).

Results and discussion

DISTRIBUTION OF PUBLIC GARDENS. Data on all 776 public gardens collected from the 12 sources described in the "Materials and methods" were used to analyze the density of public gardens and the distribution of county population in the United States. Most public gardens are located in states on the east and west coasts of the United States, including New York (48), Pennsylvania (44), Florida (43), California (66), and Hawaii (27) (Fig. 1; Table 1). The counties in the eastern and western states with high population densities have more public gardens at higher densities than do other counties. Counties with relatively low accessibility to public gardens

Fig. 3. (A) The number of established public gardens with children's gardens in the United States and of newly established children's gardens in the United States in each time period before 1900 and after 1900 until 2014. **(B)** The number of years between the opening of the public gardens and the establishment of the associated children's gardens.

were primarily located in the less-densely populated central United States (Fig. 1). A previous study demonstrated that greater population densities lowered the costs of providing services and resulted in increased public-sector spending (Ladd, 1992).

CURRENT STATUS OF CHILDREN'S GARDENS. The 163 surveyed public gardens were primarily located in the

eastern and western regions of the country and had similar distribution and densities as the entire list of 776 public gardens (Fig. 2). A Pearson's correlation test that was conducted to verify whether the distribution of the surveyed public gardens correlated to the total distribution of public gardens in the United States showed a statistically significant correlation ($r = 0.723$, $P < 0.01$). Therefore, the conclusions

drawn from our study may be considered relevant to public gardens across the United States. Among the 163 public gardens that completed the questionnaire, 90 (55.2%) had a children's garden as of 2014. Of the remaining respondents, 5 (3.1%) were currently in the process of building a children's garden, and 38 (23.3%) were planning to open a children's garden within a few years. The 30 remaining respondents (18.4%) had no children's gardens (Fig. 2). Taking into account children's gardens under construction and those in the planning phase, the number of public gardens with a children's garden will likely increase in the near future. In addition, the states with the most children's gardens are in the eastern United States, such as New York (7) and Virginia (7), followed by those in the central region, such as Illinois (6) and Michigan (5), and those in the western part of the country, such as California (5) and Hawaii (4) (Table 1).

Categorization of the public gardens into six types shows that the 163 public gardens that were investigated include 118 botanical gardens (72.4%), 29 arboreta (17.8%), 7 display gardens (4.3%), 6 historic landscapes (3.7%), 2 conservatories (1.2%), and 1 zoo (0.6%). Most of the public gardens with a children's garden are botanical gardens (78.9%) and arboreta (12.2%) (Table 2). This result is similar to that found by Purcell (2010), who showed that botanical gardens accounted for the largest proportion (50.8%) of public gardens with adolescent involvement. Although all of the zoos and conservatories investigated through the online survey had children's gardens, these findings were mostly because of a paucity of survey respondents (two or fewer respondents for each). However, 60.2% of the botanical gardens had children's gardens. As Vergou (2012) notes, historically, managers and developers of botanical gardens have not closely considered the needs of children or adolescents. However, among the factors that encourage botanical garden development, greater attention has been paid in the last 20 years to the value and importance of children and adolescents. This trend implies that among types of public gardens, botanical gardens in particular have developed an interest in establishing children's gardens. According to the definitions of botanical gardens and arboreta (Rakow, 2011), both

Fig. 4. Geographic distribution of children's gardens in the United States according to the proportion of space they occupy within the public gardens (A). The ground areas of the public gardens {B [public gardens (%) = (number of public gardens of X acres/total number of public gardens) × 100] (inset = details of public gardens that are ≤ 100 acres)} and of the children's gardens {C [children's gardens (%) = (number of children's gardens of X acres/total number of children's gardens) × 100] (inset = details of public gardens that are ≤ 1 acre)}. The proportion of children's gardens according to their ground area within the public {D [children's gardens (%) = (number of children's gardens/number of public gardens) × 100] (inset = details of children's gardens that make up ≤ 5% of the public garden)}; 1 mile = 1.6093 km, 1 acre = 0.4047 ha.

Fig. 5. The number of newly established children's gardens in the United States and the number of children's garden-related news articles published since 1990 in each 5-year time period. The news articles about children's gardens were found via Google (1998a).

provide the same public education function, but woody plants are the attraction in arboreta, whereas botanical gardens harbor botanical diversity with both herbaceous and woody plants. Thus, it is implied that the latter provides more diverse educational materials.

Among the surveyed public gardens, the ones with children's gardens report that their main purposes are to provide children with an experience of the natural environment through play as an educational place (25.0%), to be an engaging place for families (22.7%), and to provide educational programs through experiential

Table 4. List of respondents from U.S. academic, public, and private sectors of public gardening examined through discussions, interviews, and reviews.

No.	Affiliation	City and state	Name	Position	Information provided (by discussions, interviews, reviews)
1	Michigan State University	East Lansing, MI	J.L. Taylor	Creator and Former Curator of the Michigan State University 4-H Children's Garden	Children's garden and confirmation of public garden and children's garden lists
2	AECOM Technology Corp.	Los Angeles, CA	H. Schaal	Principal Landscape Architect	Children's garden design
3	American Public Gardens Association	Kennett Square, PA	C. Sclar	Executive Director	Confirmation of public garden list
4	Brooklyn Botanic Garden	Brooklyn, NY	M. Smith	Director of Children's Education and Family Programs	Children's garden and children's education program
5	Franklin Park Conservatory and Botanical Gardens	Columbus, OH	M.A. Miller	Community Outreach and Education Manager	Reviews and feedback
6	The Gardens on Spring Creek	Fort Collins, CO	M. Provaznik	Executive Director	Children's garden
7	Huntington Botanical Gardens	San Marino, CA	J. Folsom	Director of the Botanical Gardens	Children's garden and education program
8	Longwood Gardens	Kennett Square, PA	K. Trzaskos	School and Youth Programs Coordinator	Children's education system and program
9	Meadowlark Botanical Gardens	Vienna, VA	K.P. Tomlinson	Manager and Interpretive Naturalist	Children's garden and function
10	The Morton arboretum	Lisle, IL	A. Phelps	Public Relations Coordinator	Children's garden and children's education program
11	North Dakota State University	Fargo, ND	C.W. Lee	Professor in the Department of Plant Sciences	Confirmed public garden lists and reviews
12	Phipps Conservatory and Botanical Gardens	Pittsburgh, PA	C. Lawry	Environmental Educator and Outreach Coordinator	Children's garden and management
13	San Diego Botanic Gardens	Encinitas, CA	L. Davis	Hamilton Children's Garden Program Manager	Children's garden and children's education program
14	San Diego Botanic Gardens	Encinitas, CA	S. Brueckner	Seeds of Wonder Children's Garden Program Manager	Children's garden and children's education program
15	Temple University	Philadelphia, PA	L. Tai	Professor of Landscape Architecture	Children's garden and function
16	Terra Design Studio	Pittsburgh, PA	C. Tyler	Principal Landscape Designer	Children's garden design and function
17	The New York Botanical Garden	Bronx, NY	A. Haight	Director of the Everett Children's Adventure Garden	Children's garden and children's education program

activities (15.9%). Other reported purposes include providing activities for summer camps to serve children of all physical and mental abilities and encouraging children to eat more vegetables (Table 3). This result is similar to the results of previous studies, which reported that the main purpose of establishing children's gardens was to create a space for children to enhance their imagination and dreams by experiencing the natural environment while having fun (DiMare, 2012; Miller, 2005; Sobaski, 2006). The

main purpose of children's gardens has not changed; they have focused on providing natural experiences to children for the past decade.

An analysis of the establishment of public gardens and children's gardens considered in this study indicates that the establishment of public gardens largely remained steady until the 1940s, at which time there was a dramatic decrease. After this period, new establishments again stabilized until the 1990s, when there was an increase in the number of new public

gardens. In contrast, the increase in the establishment of children's gardens only became widespread from the 1990s to 2000 and occurred alongside a surge in the establishment of public gardens during the same period.

Although fewer public gardens have been established since 2000 compared with the 1991 to 2000 period, our results show that the number of new children's gardens continued to increase during the same period (Fig. 3A). This result is in accordance with previous research (Halverson et al.,

Table 5. Relationship between the presence of children's gardens (CGs) within U.S. public gardens at the county level and demographic and socioeconomic factors.

Variables	County	N	Mean	SD	t test	P
Population	With CG	82	697,089.21	1,255,401.72	1.422	0.157
	Without CG	62	462,852.84	699,916.35		
Population under age 5 years	With CG	82	49,202.67	95,403.51	1.321	0.189
	Without CG	62	32,592.55	54,086.72		
Population age 5 to 17 years	With CG	82	108,176.43	230,726.77	1.167	0.246
	Without CG	62	73,609.42	119,131.51		
Bachelor's degree	With CG	82	98,843.02	167,966.76	1.779	0.078
	Without CG	62	59,554.27	94,401.50		
Per capita income (\$)	With CG	82	28,761.01	6,419.53	2.683	0.008**
	Without CG	62	25,418.63	8,064.86		

Significant at $P < 0.01$.Table 6. Relationship between the presence of U.S. public gardens (PGs) at the county level and demographic and socioeconomic factors based.**

Variables	County	N	Mean	SD	t test	P
Population	With PG	451	370,779.40	679,246.05	10.251	0.000***
	Without PG	2,689	42,469.13	84,781.24		
Population under age 5 years	With PG	451	25,651.19	50,989.41	9.494	0.000***
	Without PG	2,689	2,828.86	6,008.11		
Population age 5 to 17 years	With PG	451	58,829.46	119,673.14	9.132	0.000***
	Without PG	2,689	7,306.77	14,120.42		
Bachelor's degree	With PG	451	49,139.78	93,019.24	10.340	0.000***
	Without PG	2,689	3,773.81	13,234.50		
Per capita income (\$)	With PG	451	26,147.11	6,569.09	18.298	0.000***
	Without PG	2,689	20,132.99	4,859.61		

***Significant at $P < 0.001$.

2008), which found that the timing of children's development was unsurprising as it coincided with increased attention to children's environmental education and physical and cognitive development. In addition, most of the children's gardens located within a public garden were established less than 20 years after the corresponding public garden was established (Fig. 3B).

The proportional area of children's gardens ranged widely, from less than 0.1% to more than 10.0%, with an average of 4.3% (SD = 13.9%). The children's gardens with the greatest proportional area were primarily located in eastern states, although some were located in central states (Fig. 4A). There were no statistically significant correlations between the sizes of public gardens and children's gardens. A more detailed distribution analysis via a histogram showed that most public gardens were less than 100 acres in size. Of these, most were at the smaller end of the range and were between 0 and 20 acres (Fig. 4B). An analysis of the sizes of children's garden

showed a similar trend in that the data were skewed toward the lower end of the range, with a majority of children's gardens being less than 1 acre (Fig. 4C). A histogram of the proportional areas of children's gardens within their public garden (Fig. 4D) showed that these data were also heavily skewed to the smaller end of the range, with most below 5%. Within that range, as the proportional area grew smaller, the number of children's gardens increased, with the majority of children's gardens being less than 1% of the proportional area of public gardens.

According to the research, children's gardens within botanical gardens are maintained as important spaces (AHS, 2005; Mattern, 1999; Taylor, 1994; Willison and Vergou, 2012). However, because there are large variations in the size of children's gardens and the proportions of children's gardens within public gardens, the area of a children's garden does not seem to indicate its importance to the public garden. Thus, a better measure of the "importance" of the

children's garden to the public garden may be each public garden's investment, both financial and programmatic, in its children's garden. Therefore, further related studies are needed.

To investigate the social interest in children's gardens over time, the number of news articles published about children's gardens was compared with the number of newly established children's gardens by year. Yearly data were collected beginning in the early 1990s because the number of children's gardens within public gardens began to increase in popularity at that time. The number of newly established children's gardens increased between the years of 1996 and 2005 and then decreased. Interestingly, the number of news articles about children's gardens dramatically increased between 2006 and 2010 (Fig. 5). This increase in the number of published articles about children's gardens would have been an effective way to inform the public about these new gardens and possibly to increase public interest.

The results of *t* tests in analyses relating demographic and socioeconomic factors to children's gardens showed that only per capita income ($P < 0.01$) had positive correlations with children's gardens; correlations with other factors did not reach statistical significance. This result is in accordance with previous reports that personal income influences the use of public services, such as park and recreation services (Scott and Jackson, 1996; Scott and Munson, 1994). On average, counties with children's gardens showed larger populations, more preschoolers and school children, and higher levels of education and personal income than counties without children's gardens did (Table 5). Similar results were found for 776 public gardens, which were significantly correlated with all of the examined demographic and socioeconomic factors (Table 6). It was found that the population, education level, and personal income level of each county affected the development of children's gardens and public gardens. There is a perception that gardens are primarily enjoyed by elite, middle-class people (Dodd and Jones, 2010). This perception may reflect the more common presence of children's gardens and public gardens in

counties related to socioeconomic perspective.

Conclusions

The current status of public gardens and children's gardens in the United States was investigated in this study. Information obtained from online surveys and census data were used to characterize the distribution and development of children's gardens using spatial analysis and mapping methods. Our results indicate that children's gardens are nearly evenly distributed among public gardens, but the density is greater on the east and west coasts. Most children's gardens were planned and established after the associated public garden was created. It is expected that the number of children's gardens within public gardens in the United States will increase in the near future. However, based on the trends observed in this study, it is expected that fewer public gardens will be built in the United States. It is anticipated that children's gardens will continue to be built in the private sector and in public places, such as community gardens, hospitals, and schools, to meet the rising demand for them (Birky, 2009; Waliczek et al., 2000; Whitehouse et al., 2001). From a demographic and socioeconomic perspective, counties with larger populations, higher educational levels and higher income will contain more children's gardens.

According to the results of the online survey, children's gardens serve as multifunctional places for urban children. They are spaces where children may visit with their families, enjoy and rest in a natural setting, or find an educational place to experience and explore nature as urbanization increases. The findings of this study may not represent the true status of children's and public gardens because the data collection was primarily conducted using Internet searches and online surveys, which may have missed vital information. Further studies are needed to incorporate possible missing information and to better describe the status of children's gardens, which are influenced by various socioeconomic and environmental factors.

With renewed public interest, the growth of children's gardens in public areas is likely to continue. Further investigation is needed to

characterize the changing status and role of children's gardens and related activities at various public horticulture establishments in the United States.

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