Introduction

Brown County has a land area of 529 square miles with a population of 245,018, 84 percent of whom live in the Green Bay metropolitan area (U.S. Census, 2007). The county has a true mix of urban and natural landscape settings. It has over 160 municipal, county and state owned parks, 18 natural reserves, Cofrin Arboretum, Brown County Reforestation Camp, and Bay Beach Wildlife Sanctuary (Brown County Open Space and Outdoor Recreation Plan, 2001). The Green Bay Botanical Garden, another great asset in the county, has about 17,250 permanent plants of almost 1,800 species and cultivars, and attracted 60,000 visitors in 2009 (Green Bay Botanical Garden Annual Report, 2009). In addition, the county has 12 garden club organizations, nine farmers markets, and a local technical college offering an associate degree program in Landscape Horticulture. Given the county's population and its rich natural resources, there is significant consumer interest in urban horticulture.

The horticulture industry consists of production, distribution, and services associated with ornamental plants, lawns, vegetables, landscape maintenance, and garden supplies. This diverse industry encompasses various business segments, including wholesale nursery growers, landscape contractors, lawn service providers, sod producers, greenhouse growers, and retail garden centers. The horticulture industry plays a major role in Brown County's economic and environmental prosperity. It serves and assists urban residents and generates a total of $45 million in economic activity, providing 1,012 full-time positions and many seasonal job opportunities (Deller, 2002). The county has 15 nursery farm operations utilizing 441 acres in production of trees, shrubs and perennial plants (National Agriculture Statistics Service, 2007). The Green Bay Chapter of the Wisconsin Landscape Contractor Association (WLCA) is the second largest chapter in the state (Wisconsin Green Industry Federation, 2007). Brown County has more than 28 retail garden centers, four commercial greenhouse operators, and many lawn service businesses (National Agriculture Statistics Service, 2007). In addition to its economic benefit, the horticulture industry contributes to the environmental, aesthetic, and social well-being of its residents. It mitigates the stress effect of urban living by adding green space to the landscape (Journal of Environmental Psychology, 1998).

In fall 2006, a needs assessment (n=21) was conducted at a monthly Green Bay chapter of the WLCA business meeting. One year later, I conducted face-to-face interviews with nursery growers (n=3) utilizing the same needs assessment. The needs assessment identified the following top four educational priorities: cultural information regarding planting techniques, current pest problems, new cultivar information, and invasive species (**Exhibit 1**).

A similar needs assessment was conducted with consumers and Master Gardener Volunteers (MGVs) from fall 2006 through spring 2007. A written survey (n=52) was distributed to the current MGV mailing list, to consumer walk-ins at the University of Wisconsin Extension (UWEX) office, and at various garden club meetings. Issues and concerns identified were: variety/cultivar information, pest and disease management, general establishment and care of trees and shrubs, lawn weed management, and invasive species management (**Exhibit 2**). I conducted a discussion with the MGVs at their annual meeting in fall 2006 regarding their educational needs and challenges associated with outreach programs in the community. Their top needs were: community projects, specialized training programs, diagnostic updates, and a newsletter.

These needs assessments provided me the basic foundation for developing educational programs in commercial horticulture, consumer horticulture, and invasive plant species management.

Commercial Horticulture Education

Every year, thousands of dollars are spent on landscape design, implementation, and maintenance. The educational programs developed for horticulture professionals primarily focused on proper tree planting techniques and other sustainable landscape maintenance.

Proper Tree Planting Techniques

Research (Watson et al., 1990) and field practitioner surveys (Hauer and Johnson, 1997) conducted across the United States and Canada led to a discovery that conventional tree planting techniques are the primary cause of stem girdling roots. It may shorten a tree's life span by 20 to 30 years. Economic losses due to improper tree planting involve tree removal, clean-up, and replacement, costing the property owner an estimated $1,500-$2,500 for a 30-foot-tall tree (Personal communication, Certified Arborist, 2010). Losses can be quite substantial when such high-risk trees fall on

Commercial Horticulture Education (continued)

buildings, vehicles, or pedestrians. I observed a high prevalence of this root dysfunction issue on landscape trees within the county. Nearly one-third of UWEX plant diagnostic inquiries from consumers and commercial landscapers were associated with improper tree planting.

To help educate the landscapers regarding potential urban tree stress issues related to stem girdling roots caused by improper planting, I created and presented "Impact of Stem Girdling Roots in Urban Forestry" at the 2007 Professional Landscaper's Conference in Green Bay (**Exhibit 3**). Post survey results (n=39) indicated 72 percent of the respondents' attitudes changed about tree planting techniques, and 79 percent agreed they were likely to change their conventional tree planting practice (**Exhibit 4**).

Calculating proper planting hole depth and exposing the root collar of a tree at the time of planting can prevent the formation of stem girdling roots. To demonstrate this concept, I conducted three onsite programs at individual landscape business firms in spring 2007 to train the landscape crew members and supervisors (n=21). Follow-up evaluations through personal interviews with the grounds supervisors (n=3) and on-site assessments were conducted in summer through fall 2007 to determine if crew members planted trees correctly (**Exhibit 5**). Table 1 summarizes the number of trees properly planted by landscape crews at various sites.

Table 1: On-site assessment of properly planted trees by the individual landscape business firms at their clientele sites in 2007

Landscape business firm	Total number (no.) of sites assessed	Total no. trees planted at the sites	No. of trees with exposed root collar	No. of trees with buried root collar	Average percent of trees properly planted
A	3	16	16	0	100%
B	2	9	8	1	84%
C	3	9	0	9	0%
Total Impact		34	24	10	71%

As part of the interview, I asked "What was your clientele reaction to this change in landscape practice?" One supervisor indicated it was a good way to build clients' trust by adapting science-based practices. The interviews gave insight into challenges supervisors saw in adopting proper tree planting techniques. Supervisors shared they have several Hispanic employees on their crews. Because of the language barrier, it was hard for supervisors to explain the technical concept and for employees to realize the significance of proper tree planting. Another challenge was the lack of time to train employees during the growing season.

To address these challenges, I obtained a $2,800 (UWEX Eastern District Resource Management Innovative Grant, 2008) grant to develop and publish a bilingual DVD on "Proper Tree Planting Techniques" (**Exhibit 6**). I also developed a pictorial bilingual brochure in English and Spanish to be used as a separate factsheet or as an on-site reference for individuals (**Exhibit 7**). At the 2008 fall landscape contractors business meeting, I trained 33 landscapers on how to utilize the teaching tools to train their employees. Each participant received a DVD and multiple copies of the bilingual brochure. A post-meeting survey (n=26) completed by landscapers showed an increase in the understanding of the proper planting depth. Prior knowledge of how to calculate root collar depth was rated at an average 2.37 (Likert Scale 1 to 5, 1 being lowest and 5 being highest) and post knowledge was rated at an average 4.37 (**Exhibit 8**). When asked if they planned to train their employees or colleagues using this publication in the next couple of years, 19 respondents indicated they would use the materials.

One year later, a follow-up survey of the 33 participants was conducted. Sixteen of the 22 respondents utilized the teaching tools to train their employees (**Exhibit 9**). One hundred thirty-six employees, including 48 Hispanic employees, were trained. Thirteen landscapers felt their Hispanic employees better understood the overall concept of the tree planting techniques. Eighteen respondents indicated they changed tree planting techniques in pruning

Commercial Horticulture Education (continued)

adventitious roots, exposing root collar above the ground, and mulching to a depth of two to three inches. Sixteen respondents indicated their employees each planted more than 21 trees using new tree planting practices as a result of my materials.

Changing their tree planting practices was difficult for many landscapers. I made efforts to understand why landscapers did not adopt these new techniques. I sought solutions to the challenge of educating Spanish-speaking employees. Because no Spanish UWEX materials existed on proper tree planting techniques, I developed a bilingual DVD and brochure. A total of 53 copies of the DVD were distributed to the landscapers and horticulture Extension educators in the state. My programming efforts changed the tree planting practices of 16 landscapers who were able to correctly plant more than 336 trees thus far. Two Extension educators have used the DVD and brochure, one in training the MGVs and the other during a community tree planting program. These properly planted trees may have a longer life span in the urban environment and may increase the property value up to 10 percent (USDA Forest Service, 1993). Programming efforts must continue to change the traditional planting practice of not only landscapers but also consumers. Future outreach education needs to address the nursery growers regarding the necessity of changing the planting depth of the liners in nursery production practices and removing the excess soil over the root ball during the harvest.

Other Sustainable Landscape Maintenance

During the growing season, landscape contractors contend with a wide variety of plants and associated pest problems. To help landscapers and other horticulture professionals to properly diagnose landscape pest problems and adopt sustainable landscape management practices, I developed, wrote and edited a bimonthly horticulture newsletter, which has been in distribution since 2007 (**Exhibit 10**). I distributed the newsletter electronically to 220 horticulture professionals, including lawn service providers, landscapers, nursery growers, and educators. It is also distributed by other county Extension educators, the Wisconsin Green Industry Federation, Wisconsin Urban Forestry, and Northeast Wisconsin (NEW) Urban Forestry, reaching an additional 2,500 individuals in Wisconsin and surrounding regions. Subject matter addressed in the newsletter included nursery and landscape cultural practices, landscape pest and disease management, lawn maintenance, and new plant varieties.

A web based post-evaluation was conducted in 2009 for individuals on my newsletter list. Seventy percent of the respondents (n=60) agreed the newsletter provided “significant” or “very significant” information on commercial landscape practices (**Exhibit 11**). Eighty-four percent of the respondents indicated they tried something new, changed a practice, or changed their thinking as a result of the information obtained through the newsletter. Ninety-three percent of the respondents indicated they applied the ideas from the newsletter. Regarding “nurseries and landscape practices” and “landscape pest and disease management”, 81 and 80 percent of the respondents, respectively, indicated they increased their knowledge “a great deal” or “somewhat”. In addition, I received the following unsolicited comments pertaining to the newsletter:

- *“I learned I don't have to prune back transplanted trees and shrubs from your newsletter, a practice I will adopt in my business. Please continue to send future issues!” - Landscaper*
- *“For the first time I will be doing a mailing using parts of your NEW newsletter. It will be mailed to 350 professional landscape small businesses and municipal managers in St. Croix, Pierce, and some in Polk and Dunn. Thanks for compiling and sharing your scholarly work!” - Extension Educator*

During my first four months in Brown County, I received 18 requests from horticulture professionals on plant problem diagnosis and onsite consultation. In order to help meet this demand, I provide diagnostic updates at the Green Bay Chapter of the WLCA’s monthly meeting. Annually I answer an average of ten commercial diagnostic questions and provide an average of 15 onsite consultations to commercial clients. In spring 2008, at the request of a landscape contractor, I investigated the reason for plants dying on his client’s landscape. I determined the cause to be over watering and improper planting. The contractor later approached me to share his client’s satisfaction and success in the establishment of newly planted shrubs at the site (**Exhibit 12**). Per personal communication, the landscaper indicated he decided to change the timer on the subsoil irrigation system to avoid over watering at 14 other properties. He stated he had saved approximately $5,000 worth of replacement plant materials and the reputation of his company. It helped him to gain trust with UWEX, and he subsequently sought my professional help on many occasions.

Commercial Horticulture Education (continued)

The demand for sustainable landscape education and programming is increasing among landscapers as they find significant economic and environmental benefits in their business and community. Providing landscapers with research based information has been a high priority. The landscapers often refer their employees and clientele to UWEX pertaining to plant health problems. This has increased the value of the relationship they have with UWEX. The NEW Horticulture newsletter is unique as there is no other commercial landscape newsletter available through UWEX that provides regular research-based information on sustainable lawn care practices and woody ornamental management. In addition to 2,500 subscribers, at least eight Extension educators in the state are now sharing the newsletter with their commercial clientele and MGVs in their counties. My outreach efforts also played a key role in building new partnerships with the Green Bay and Fox Valley Chapters of the WLCA that were previously underserved before my arrival. One of the significant outcomes of this partnership was my ability to secure funding for UWEX research on viburnum borer, hosta variety performance, and outreach education programs like the annual landscape and grounds maintenance short course. It is my hope that programming efforts with the landscapers will ultimately benefit consumers and the community.

Consumer Horticulture Education

Gardening is the favorite hobby for many Americans (National Gardening Association, 2010). The average Wisconsin resident invests approximately $650 per year on flowers, trees and shrubs, hired services, equipment, and miscellaneous landscape products (Wisconsin Green Industry Survey, 2002). As an urban county, there is a strong educational demand for reliable gardening information. The number of consumer horticulture questions answered in the Brown County Extension office in 2008 and 2009 was 2,312 and 2,457, respectively. In addition, the public is interested in sustainability of the urban landscape, which requires minimal inputs of labor, water, fertilizer and pesticides. According to the National Gardenening Association's 2008 Environmental Lawn and Garden Survey report, nine out of ten households said it is important to manage their lawns and gardens in an environmentally friendly way. However, 33 percent of households admit they are "not at all" or "not very knowledgeable" about how to care for their landscape in a way that benefits the environment. As a result, I determined a need existed to develop various educational outreach programs in the community that promote gardening and sustainable landscape practices.

Harvesting rain water using rain barrels and rain gardens are sustainable landscape practices that help minimize storm water runoff and provide a supplemental water source to irrigate plants. In 2007 I organized a demonstration workshop in partnership with the Sustainable Greater Green Bay Task Force to educate consumers on how to build a rain barrel. More than 125 people participated in this workshop. I designed and co-developed a brochure entitled "Rain Barrel – The Gardener's Partner", which was distributed at the workshop (**Exhibit 13**). In a post session survey, 53 respondents (n =112) rated the usefulness of the brochure as "a great deal", and 106 respondents said they planned to construct a rain barrel. As a result of the program, six MGVs constructed rain barrels that were used as part of an educational display at the Green Bay Botanical Garden, Village Hall of Suamico, and Brown County UWEX office. In winter 2008, the Community Development Director for the Village of Suamico sought my help in educating residents about the value of rain gardens in residential areas. In partnership with MGVs, I developed and installed a demonstration rain garden at the Suamico Village Hall in 2008. Nine local residents and three village officials participated in the educational demonstration at the garden, and I taught the participants the functionality and installation procedures involved in building a rain garden. During the Village of Suamico's centennial celebration in summer 2008, I organized a field trip to the demonstration rain garden and taught approximately 50 participants about the benefits of rain gardens in the community. The Community Development Director of Suamico stated the importance of the demonstration garden to his community and its impact on the local residents (**Exhibit 14**).

During summer 2008, I was summoned by five homeowners in the Village of Suamico to diagnose the declining pine trees on their property. Upon field diagnosis at three homeowners' properties, I found the decline of the pine trees was caused by a wood boring insect called pine root collar weevil. In response to potential pine tree loss from root collar weevil, I developed a UWEX Garden fact sheet, "Pine Root Collar Weevil" (**Exhibit 15**). The fact sheet was co-authored by Phil Pellitteri, UWEX Entomology Specialist. The fact sheet was mailed to the five Suamico residents who called in 2008 regarding their declining pine trees. Further, a display, along with 100 copies of the fact sheet was set up at the Village community hall in 2009. In follow-up phone calls in fall 2009, the five clients who had received the UWEX fact sheet on pine root collar weevil stated the fact sheet was helpful in identifying the symptoms of the pine

Consumer Horticulture Education (continued)

root collar weevil. Four clients who adapted the integrated pest management practices successfully prevented infestation in young pine trees. A Village of Suamico resident, who lost many pine trees to the root collar weevil, stated he was able to save at least eight pine trees using information provided in the fact sheet.

Research studies have shown gardening activities can help children with special needs enhance their motor skills, sensory exploration, and creative skills, as well as heighten their inquisitiveness (Blair, Journal of Environmental Education 2009; Hussein, Support for Learning, 2010). In January 2008, a local volunteer from a Brown County school for children with disabilities asked for assistance in developing a gardening program for a class. With the help of three MGVs, and in consultation with the lead homeroom teacher and the school volunteer, I developed a series of hands-on gardening activities for nine cognitively disabled youth aged 12 to 16. An unsanitized greenhouse, insufficient artificial lighting, and lack of a plant stand made start-up challenging. I raised monetary support through the NEW Master Gardener Association and sought in-kind donations from Schroeder's Greenhouse. The two-month program began in April 2008, and I co-taught the students in planting bulbs and seeds, watering, transplanting vegetable seedlings, and recording weekly growth and other morphological characteristics of the plants. Table 2 summarizes the total number of plants grown successfully by students in the greenhouse:

Table 2: Evaluation results of the greenhouse plants grown by nine special needs children

Crop	Total number of plants planted	Total number of plants that survived	Percent success in plant production
Tulip	36	27	75%
Hyacinth	36	36	100%
Shamrock	64	40	56%
Peas	90	90	100%
Tomato seedlings	108	85	79%

Successfully grown tulip, hyacinth and shamrock plants in the greenhouse were gifted to their parents by the students. At the school's year-end event, I assisted the students in distributing the tomato seedlings to the public. A post-evaluation survey (n=17) distributed to the students, parents, and teachers at the end of the school year revealed six students liked learning about plants, and seven students took care of the plants in their homes (**Exhibit 16**). An observatory evaluation report by the local school volunteer indicated the project encouraged development of motor skills and enhanced the students' inquisitiveness in observing and recording the morphological characteristics of the plants. Seven parents indicated their children discussed the gardening experience with them, and five parents reported a change in their child's attitude as a result of the gardening project. One of the parents commented the experience created awareness of plant life. Despite the difficulties posed by time constraints, lack of volunteers, and liability, the volunteer who initiated the program has integrated the gardening project into the classroom curriculum so it can continue to benefit special-needs children.

Many urbanites lack the space and time to grow vegetables in traditional row gardens. In 2008, in collaboration with the MGVs at the Green Bay Botanical Garden, I installed a square foot garden demonstration that showed how to grow vegetables in small backyards with minimal maintenance. The MGVs and I created a brochure on square foot gardening that was distributed to the visitors at the demonstration garden (**Exhibit 17**). More than 700 of these brochures were distributed in the past two years. I led five field tours in the demonstration garden, created a presentation titled "Square Foot Gardening 101", given three times reaching more than 75 individuals (**Exhibit 18**). Fifteen participants filled-out a post-evaluation survey in the spring of 2009 following a presentation and a field tour on square foot gardening. Thirteen respondents "strongly agreed" they had a better understanding of the concept and 11 respondents stated they were likely to build a square foot garden in their backyard. In fall 2009, one participant stated the demonstration garden inspired him to establish a square foot garden in his backyard. The square foot demonstration garden provided hands-on experience in growing vegetables for the ten Master Gardener trainees as part of their general Master Gardener training program in 2009. Post-training evaluation results indicated six out of ten Master Gardener trainees found the demonstration project increased their gardening skills "a great deal" (**Exhibit 19**).
All ten Master Gardener trainees felt the demonstration project increased their confidence level in performing future community projects.

Consumer Horticulture Education (continued)

Landscapers and MGVs often request information on new ornamental cultivars. During the past two years, in partnership with the Green Bay Chapter of the WLCA and the NEW Master Gardener Associations, I conducted a cultivar evaluation program/demonstration on sun tolerant hostas at the Green Bay Botanical Garden. Preliminary performance results were shared with landscapers, hosta gardeners, and MGVs in the NEW Horticulture Newsletter, NEW Master Gardener Newsletter and in the Green and Gold Hosta Society Newsletter (**Exhibit 20**). Conversation with the hosta gardeners during their annual plant sale event indicated the evaluations influenced their hosta purchase in 2010.

With the recent discovery of emerald ash borer (EAB) in Green Bay (2009), I co-organized a community work group comprised of 12 local urban foresters, along with a representative from Wisconsin Public Service and University of Wisconsin-Green Bay. We developed a Community EAB guide on how county residents, local officials, and municipal governments may respond to EAB and ash loss. My role in the work group was to help develop the management guide and execute the educational outreach programs on EAB identification and treatment strategies. I have given seven presentations to approximately 150 individuals on the status, biology and management of EAB. In addition, I gave the EAB presentation and shared the Community EAB Guide with the Brown County's Planning, Development and Transportation Committee. A meeting participant used the information on identification of ash trees from my presentation and shared an unsolicited comment:

> *"I enjoyed your presentation last night at the Planning & Development Meeting. It turns out I do have an Ash tree in my front yard – not a Mountain Ash. It is the most beautiful tree and I sure would hate to lose it. Thanks for the wonderful information. I plan to share it with the Brown County (Government) Management Team tomorrow at our bi-weekly meeting."*

At the 2010 "Learning in Retirement" Study Course sponsored by University of Wisconsin–Green Bay, I presented the topic of EAB biology, status and management in Brown County to 15 residents. In the post program evaluation (n=14), 13 respondents "strongly agreed" their knowledge was increased as a result of the presentation (**Exhibit 21**). When asked to identify what they were going to do differently as a result of the program, three individuals indicated they would observe the ash trees for signs of EAB infestation and four individuals to treat ash trees.

One of the most common consumer calls I receive is related to lawn care, as many homeowners take pride in maintaining a healthy green lawn. I presented a session on "Lawn Care 101" to homeowners in spring 2010 (**Exhibit 22**). Thirty-one participants attended the session and in the post program evaluation, 22 out of 27 respondents "strongly agreed" their knowledge was increased as a result of my presentation (**Exhibit 23**). Respondents also indicated they would change their lawn care practices.

Master Gardeners are trained volunteers of Extension who educate and serve the community utilizing the university's horticulture research-based information. In 2007 and 2009, I conducted a general Master Gardener training program, teaching various gardening subjects, and provided opportunity for volunteer activities in the community. Based on the evaluation of my 2009 general Master Gardener training class, six participants used the information gained in the training class "a lot" towards community projects, and eight participants were "very satisfied" with the volunteer project in the community (**Exhibit 19**). When asked if they intend to perform any more community service as a result of the training program, eight participants stated "Definitely will". Of the 2009 class, 12 out of 14 participants fulfilled the requirements to become a certified MGV by donating over 386 hours of community service valued at over $8000 (http://www.independentsector.org/volunteer_time). A follow-up survey was sent to 38 participants who became certified MGVs in 2007 and 2009 (**Exhibit 24**). When asked in the survey "what have you learned through the Master Gardener program that has most impacted your life", one MGV stated *"A deepening commitment and interest in horticulture as it applies to my practice of growing plants and sharing this knowledge and enthusiasm with the NE (Northeast) Wisconsin community"*. When asked how their contribution as a MGV has changed the community, one MGV indicated "*Made lives richer, easier and more beautiful. Teaching simple ways to raise good food to feed yourself and family."*

In my 2009 general Master Gardener training program, I developed a tree identification field guide for the class and led a tree identification field walk at the Green Bay Botanical Garden (**Exhibit 25**). In the post program evaluation survey

Consumer Horticulture Education (continued)

(n=10), post knowledge on tree identification was rated at 3.38 (Likert scale from one to five, 1= very little and 5= A lot), while prior knowledge was rated at 2.41 (**Exhibit 19**). Eight Master Gardener trainees indicated the field guide was very valuable.

In summer 2007, I answered approximately 1,500 consumer questions by phone and through walk-in visits to the office. Some of the consumer gardening questions are repetitive in nature and can be answered by trained MGVs. During eight weeks in winter 2008, I trained six MGVs in plant diagnostics for horticulture crops to enable them to answer consumer gardening questions. In summer 2008, 1,342 horticulture inquiries were recorded at the Brown County UWEX office, of which 12 percent were answered by the six MGVs. The six MGV's contributed a total of 175 hours of service on plant diagnostics at the UWEX office (Wisconsin Master Gardener Program Accomplishment Report, 2008). As a result of this help, my time spent in answering some of the common consumer gardening questions was reduced, allowing me to focus on other educational efforts.

In addition to responding to specific information requests, I proactively educate the public about timely horticultural topics of interest. My weekly garden column, in the past four years for the *Green Bay Press-Gazette* reaches an audience of approximately 80,000 subscribers (**Exhibit 26**). Unsolicited comments from readers include:

- *"Thanks for writing an article on lawn moss in your column. I did find the iron sulfate at Steins and successfully controlled the moss in my lawn. Keep up the informative articles."*
- *"I just wanted to say thank you for forwarding Vijai's column to us. Most of the Manitowoc County Master Gardeners have email and really enjoy receiving the articles. Since the topics are always timely, they are also very helpful to our plant clinic.*"

My experiences in building local consumer horticulture education programs have been highly diverse and demanding. I have provided horticulture outreach programs on numerous levels in collaboration with local communities, MGVs, other non-profit organizations, and media. The development of the rain garden demonstration project is an example of a successful partnership that increased awareness of the rain garden in the community. I have trained MGVs who played a significant role in various UWEX community projects and impacted consumers by promoting square foot gardens, rain gardens, rain barrels, hosta varieties and other sustainable landscape practices through plant clinics. One MGV stated *"His (Vijai Pandian) help has been invaluable with his support and expertise. It gives me confidence to start and lead community projects, which I always wanted to do but never felt I had the knowledge or ability to find answers to my questions."* As the number of MGVs increases, more community projects will be generated to meet consumer needs. This will strengthen the relationship and build trust between the community and UWEX. One unique opportunity I experienced as an educator is working with the special needs children in 2008. I fostered gardening interest and helped in integrating gardening into their class curriculum. On a personal level, I gained an appreciation for their daily challenges and was inspired by their enthusiasm towards gardening. Based on comments and feedback from Brown County residents, timely information I provided through media outlets has proved to be an effective educational method and enhanced the visibility of our county Extension office. The consumer horticulture program has great potential for further expansion into the community. However, lack of volunteers and funding to sustain ongoing horticulture projects are major challenges in this endeavor. Future efforts will include training more MGVs and expanding my program for people with limited resources.

Invasive Plant Species

Horticulture professionals and consumers identified "invasive plant species" as one of the major educational opportunities in my needs assessment. According to the 2009 Brown County Invasive Species Report, there are 55 sites in Brown County infested with garlic mustard, more than 600 acres of phragmites along the Bay of Green Bay shoreline, and an increase in new invasive species like perennial pepperweed, poison hemlock, and Japanese hedge parsley. Based on conversations with landscapers, woodland owners, and consumers, managing garlic mustard in urban landscape settings is very difficult. In 2007, the Bay Beach Wildlife Sanctuary manager asked for suggestions to control the invasion of garlic mustard at the Wildlife Sanctuary in Green Bay. Garlic mustard has replaced native vegetation and degraded the forest quality in the sanctuary. I investigated the infested sites and evaluated the sanctuary's existing garlic mustard management strategies. I observed that traditional fall treatment application with

Invasive Plant Species (continued)

glyphosate did not achieve any control over the next generation of garlic mustard plants. Because of the lack of control, more than $8,000 was spent annually to manage the garlic mustard invasion. Likewise, traditional fall treatment at Lost Dauphin Park in De Pere has not been able to achieve an acceptable level of control.

Based on the ineffectiveness of traditional control measures, I initiated a field research trial in collaboration with UWEX Weed Science Specialist Mark Renz. The objective of the research trial was to evaluate the effectiveness of various herbicide treatments and application timings to reduce the population of existing mature plants and next generation garlic mustard seedlings. I designed, executed and evaluated the research plots at two northeast Wisconsin locations.

I organized a field day in 2009 to present the outcome of our garlic mustard field research study to woodland owners, landscapers and the general public. As a result of the field day, a post program evaluation (n=26) indicated 88 percent of respondents felt the field day was highly beneficial to them, and 24 respondents intend to try one of the treatment strategies (**Exhibit 27**). Regarding garlic mustard management strategies, prior knowledge was rated at 3.34 (Likert scale from 1 to 5, 1= low and 5= high) and post knowledge was rated at 4.07. One of the respondents wrote *"I didn't have a good knowledge of garlic mustard. I now feel that I can identify and treat the outbreaks on my land."* In spring 2010, the Wildlife Sanctuary Manager reported the new management strategies recommended by the UWEX were highly successful in controlling garlic mustard in 14 acres of their property. I developed and presented a poster at various national and regional conferences in 2008 and 2009 pertaining to the research study (**Exhibit 28**). A research article on "Treatment Timing for Garlic Mustard Management" was published in the Invasive Plants Association of Wisconsin newsletter, which is distributed to more than 200 subscribers.

For the past three years, I taught invasive plant management to approximately 60 landscape students at Northeast Wisconsin Technical College (**Exhibit 29**). To promote public awareness of invasive species, I wrote numerous articles in my weekly column for the *Green Bay Press-Gazette* (**Exhibit 30**). After reading my news articles on threats posed by invasive species in 2007, four teachers and 50 students from Valley View Elementary School took action by hand-pulling garlic mustard at the Wildlife Sanctuary. In fall 2009, I presented a five-minute live television segment for WLUK's "Good Day Wisconsin" show on garlic mustard control (14,000 viewership). Since 2007, a display on invasive plants and related publications has been set up at the Green Bay Botanical Garden during every growing season. According to the botanical garden staff, approximately 50 people visit the display booth every week during the growing season.

Invasive species are a constant threat to our natural environment and human health. Public awareness and support are essential for early detection, control, and minimal spread of invasive species. My partnership with news media and other organizations helped in faster dissemination of the information to local communities and created awareness of invasive species in the community. I feel, I have made a significant contribution to the body of scholarly material through my field research trial for better garlic mustard management. This research trial produced a new tool for Wildlife Sanctuary management in scheduling a timely application of treatments and reduced the garlic mustard population and its seed bank on the Sanctuary's property. This management practice has not only saved thousands of dollars in controlling garlic mustard, but also helped the Wildlife Sanctuary manager to focus for the first time on restoration of native vegetation in the previously infested sites. Research of successful garlic mustard management at the sanctuary will encourage other land managers in the area to adopt new management practices on their properties. Public education on invasive species, including the garlic mustard management practices, will remain a major part of my programming to help preserve our native vegetation and wildlife habitat in the community.

Horticulture is becoming more popular among urbanites as they find rewarding experiences in growing plants. My contributions thus far fostered community interest in home gardening, promoted healthy urban trees, supported sustainable landscape maintenance, empowered MGV's to serve and outreach on community garden projects, and increased environmental awareness. I also reached out to underserved audiences in establishing a gardening program. My work has shown both social and environmental value. I have initiated new partnerships and contributed to the economic growth for Brown County communities and individuals. Based on my past programming efforts, I feel confident in meeting the educational needs of landscapers and consumers in the years to come.