

## Symposium 7 (S07): Expanding Roles for Horticulture in Improving Human Well-Being and Life Quality

Thursday · August 15

Location: Crowne Plaza Hotel, Caledon Room

1100-1140

S07-0-1

### WHITE COATS AND GREEN PLANTS: CLINICAL EPIDEMIOLOGY MEETS HORTICULTURE

Howard Frumkin

Dept. of Env. & Occup. Health, Rollins SPH, Emory Univ., 1518 Clifton Road, Atlanta, GA, USA, 30322

There is evidence that some kinds of environmental exposures, including contact with plants, contact with animals, views of landscapes, and wilderness experiences, may have positive health effects. Indeed, this link is the basis for such clinical practices as horticultural therapy. However, the available evidence falls short of what is routinely required of a new medication or surgical procedure. Physicians, health policy experts, and regulators require rigorous evidence of the efficacy and safety of clinical practices. This presentation will introduce the paradigm of clinical epidemiology, the field of medical research that evaluates clinical practices. It will review methods such as the randomized clinical trial, and concepts such as the safety and efficacy of clinical practices. Finally, it will propose a marriage of clinical epidemiology and horticulture, identifying key research needs and opportunities at the intersection of horticulture and human health, and suggesting ways that sound science can help evaluate and advance horticultural therapies.

1140-1200

S07-0-2

### EFFECTS OF INTERIOR HORTICULTURAL ACTIVITIES WITH POTTED PLANTS ON HUMAN PHYSIOLOGICAL AND EMOTIONAL STATUS

Kenji Yamane\*, Momo Kawashima, Nobuaki Fujishige, Masao Yoshida

Faculty of Agriculture, Utsunomiya Univ., Mine-machi 350, Utsunomiya, Tochigi, Japan, 321-8505

In order to elucidate benefits of horticultural activities, a study was performed to examine effects of handling and seeing potted pansy plants with or without flowers on human physiological and emotional parameters. Subjects (119 persons) participated individually, being randomly treated in one of three groups. Filling pots with soils (control), transplanting non-flowering pansy plants (NF-P) or transplanting flowering plants (F-P) was performed for 10 minutes for each group respectively. Potted pansy plants cv. 'Sakura sakura' with pink or reddish purple petals were used. Before and after the horticultural activities, brain waves and electromyogram (EMG) at forehead positions, eye blink rates and Profile of Mood States (POMS, Japanese version, 65 questionnaires) were measured. EMG of the subjects significantly decreased through the activities in NF-P ( $P < 0.001$ ) and F-P ( $P < 0.05$ ) group but not in control group. Eye blink rates significantly ( $P < 0.05$ ) declined only in F-P group. The ratio of alpha wave to beta wave with eyes closed significantly ( $P < 0.001$ ) increased in NF-P and F-P group but not in control. Beta wave with eyes opened significantly ( $P < 0.01$ ) decreased in F-P group but not in the other groups. A significant correlation ( $P < 0.002$ ) was found between decrements of EMG and that of beta wave through the activities. In regards to emotional status after the activities, F-P group showed the lowest T scores in all negative POMS items such as "Tension-Anxiety", "Depression-Dejection" and "Fatigue". "Fatigue" score in F-P group was significantly ( $P < 0.05$ ) lowered compared with the other groups through the activities. It was suggested that the horticultural activities with plants promoted physiological relaxation and the activity with flowering plants had more positive effects on human emotions.

1200-1220

S07-0-3

### RELATIONSHIPS AMONG POSITIVE EMOTION, GROUP COHESION, AND HEALTH BEHAVIOR IN HORTICULTURAL ACTIVITIES

Hyejin Cho\*, Richard H. Mattson

2021 Throckmorton, HFRR, Kansas State Univ., Manhattan, KS 66506 USA

During a 3-month study, 14 female Univ. students from a horticultural activity class (Hort group) and 10 from a landscape lecture class (LA group) were asked to provide information on demographics, self-rated group cohesion, affective responses, health behaviors, and allergic or fatigue-like symptoms. Group cohesion was assessed using the Group Environment Questionnaire (GEQ) modified for horticultural activities. GEQ measures attractions to the group-social (six items), attractions to the group-task (three items), group integration-social (three items), and group integration-task (three items). The Hort group showed significantly increased positive emotion after horticultural activities while the LA group did not change. In the beginning of the study, attraction to task (plants) involvement was significantly higher in the Hort group, as compared to the LA group. At the end of the three months, group integration-social increased in both groups. Group integration-social perception was significantly correlated to increased positive emotion ( $r = 0.7$ ,  $P < 0.02$ ) and was negatively correlated with allergic or fatigue-like symptoms ( $r = -0.18$ ,  $P < 0.02$ ). During the study, 50% of the students in the Hort group reported various indoor and outdoor gardening experiences and 90% experienced making floral arrangements. Eighty percent in the Hort group had regular physical exercise such as walking in the park, whereas 17% in the LA group had regular exercise. The Hort group reported significantly fewer numbers of and less severity of fatigue-like symptoms, including allergic symptoms than the LA group. Emotional cohesiveness to the horticultural environment (activities) resulted in increasing positive emotion related to effective adaptation to stress. This study suggests that group interaction combined with horticultural activity facilitates human health.

1220-1240

S07-0-4

### A GARDEN TO LIVE AND LEARN FOR ADOLESCENTS WITH SPECIAL NEEDS

Birgit Hotwagner\*

Hackhofergasse 16, 1190 Vienna, Vienna, Austria, 1190

Horticulture may improve the quality of human life, throughout all age groups. The Sozialpädagogische Jugendwohn und Ausbildungszentrum (Socialeducational Boarding School and Vocational Training Center) in Korneuburg (A) provides the opportunity for socially deprived adolescents with special needs to develop personal skills and to receive vocational training, within cared housing. This paper documents impacts on social skills, self-determination and self-affirmation through psychological and therapeutic advice as well horticultural activities. The garden covers an area of 3000 m<sup>2</sup> and is situated within the school grounds. It was built and is managed by the students of the landscape gardening school. The garden was designed to meet five different aims: 1) vocational training: basic skills of landscape gardening including variation of plant use, building a pond, building walls, woodwork, earthwork, to cobble; 2) ecological and sustainable gardening: no use of peat or chemical fertilizers, creating a habitat for local flora and fauna; 3) communication with other schools: other school classes are invited to learn about nature and gardening taught by the students, this improves their self-esteem, social skills and raises the reputation of the institution within the town; 4) therapeutic value: the garden is accessible for everybody, some areas are specifically designated for psychotherapy and art therapy, for social events, sports and creativity; 5) identification with the school: within the schoolground the garden is a refuge of beauty and relaxation. The garden includes the following elements: orchard, vineyard, wildflower meadow, raised beds to present texture, color, taste and smell, pond, natural brick wall with barbecue pit, gravel pile, seating area, berry hedge, flowering shrubs, and perennials.

1340-1440

S07-P-5

### FROM THE GARDEN TO THE TABLE: EVALUATION OF A DEMENTIA-SPECIFIC HT PROGRAM

Shannon E. Jarrott\*, Christina M. Gigliotti

Dept. Human Development (0416), Virginia Polytechnic Institute, and State Univ., Blacksburg, VA 24061-0416 USA

Horticulture therapy is employed across the lifespan with individuals possessing varied physical, emotional, and psychological abilities. Implementation of HT programs in institutional dementia care programs is growing but research remains limited. A challenge to care providers at such programs is implementa-

tion of appropriate activities given participants' wide range of impairments. Research by the first author indicated benefits of HT on the activity and affect of persons with dementia attending an adult day service (ADS) program. The present study considers whether planting, cooking, or craft HT activities engender differential responses from ADS participants with dementia. Two trained HT students led 5–10 participants in three activities each week over a 10-week period alternating planting, cooking, and craft activities. Each participant was assessed for ability to complete the activities and benefits experienced. Additionally, leaders indicated whether accommodations were made to suit individual abilities. Most participants required some physical and/or verbal help with each activity, regardless of the category, although variability existed within each category. The most common benefits were: interaction, initiation, concentration, and activity completion. Special accommodations were rarely used, but activities were composed of steps requiring different abilities. Thus, individuals experienced success by performing at least one step in the activity. Preliminary analysis indicates that the categories of HT activities promoted cognitive, psychosocial, and physical benefits equally. This study advances HT literature by indicating important benefits for persons with dementia. Activities are developmentally appropriate, interesting, purposeful, and effectively engage participants. Future research might consider what characteristics contribute to variability of success completing different activities in a single category.

**1340–1440**

**S07–P–6**

**THE RELATIONSHIP BETWEEN LEVELS OF FUNCTIONAL INDEPENDENCE AND SUBJECTS' SELF-REPORTED REASONS FOR THE USE OF A GARDEN IN AN ELDERLY POPULATION**

Johanna G. Leos\*

121 Clay Ridge Way, Holly Springs, NC 27540 USA

In a marketing research survey conducted of a stratified random sample of the entire population of elderly persons in Wake County, North Carolina, United States confidential data were collected by personal telephone interviews with the investigator for measuring the relationship between levels of functional independence and subjects' self-reported reasons for the use of a garden chosen from a series of unlabeled scaled-response questions. Open-ended responses in the form of simple "stick figure" self-portrait drawings were analyzed for commonality of features as supplemental data to the study. The population of 45,821 were split into two age groups, one consisting of ages 65 to 74 (29,043) and the other of ages 75 to 84 (16,778), using North Carolina Office of State Planning and Census Bureau and Wake County Voter Registration 2001 information for initial contact purposes. The sample size was computed at a 3% sampling error, variability at .5, and risk at 5% ( $t = 1.96$ ), resulting in a survey of 1,040 subjects. The telephone interview questionnaire served to collect data concerning: a) self-perceived reasons for using the garden, as either therapeutic or task oriented; b) amount and type of garden use; c) health history and hospitalizations; d) perception of health status; and, e) other exercise/leisure activities. Therapeutic-oriented reasons included personal fulfillment as a hobby, social contact, relief from depression and stress, physical exercise to manage disease or disability, and a general wellness plan of disease prevention. Task-oriented reasons included necessary household landscape maintenance and the growing of household staple food crops. The survey's resulting descriptive statistics together with the Pearson product-moment correlation coefficient indicate a positive relationship between therapeutic gardening and wellness. The study suggests further research to be conducted in order to compare wellness outcomes of formal horticultural therapy program participants with those derived from the informal use of residential gardens for personal self-defined therapeutic purposes.

**1340–1440**

**S07–P–7**

**CONTRIBUTION OF PLANTS TO THE WELL-BEING OF RETIREMENT HOME RESIDENTS**

Wilmien Brascamp\*, Judith Kidd

Institute of Natural Resources, Massey Univ., Private Bag 11-222, Palmerston North, Manawatu, New Zealand, 5331

It is well acknowledged that for people of all ages, well-being can be enhanced by contact with nature. However, little is known about how opportunities for people-plant interactions can be incorporated into the design of retirement homes to enhance the quality of life for their residents who currently represent a

fast growing segment of the population. The objectives of this study were to determine past and present attitudes of retirement home residents toward the use of plants in the indoor and outdoor environment, and to correlate these to residents' perceived sense of well-being and quality of life. Sixty one residents from six retirement homes in and around Palmerston North, New Zealand, were interviewed. Retirement homes were selected to represent a range of environments that vary in available opportunities for interaction with nature. Results show the importance of both indoor and outdoor plant environments to retirement home residents and reveal ways in which they like to be involved with plants. Discrepancies exist between their actual and ideal level of interaction with plants. Over a third of respondents would like to do more gardening than they currently do. The main reasons residents like to garden are associated with the therapeutic value of gardening, the satisfaction of seeing the results and being able to share this enjoyment with other residents. Health reasons are a limiting factor for less than a quarter of the sample. Passive outdoor recreation is valued mainly for enjoyment of observing nature rather than socializing with other residents. Most respondents perceive an attractive common indoor plant environment as important to their sense of well-being. Results also include residents' suggestions for creating a more enjoyable outdoor and indoor plant environment. The outcome of the study provides a framework for utilizing plants in retirement home settings for maximum human benefit.

**1340–1440**

**S07–P–8**

**HORTICULTURAL THERAPY IN DEMENTIA CARE: A MANUAL DESIGNED FOR COOPERATIVE EXTENSION MASTER GARDENERS AND ACTIVITY THERAPIST**

Christina Giglotti\*, Peg Pecora, Bridget Gaines, Casey Cook, Mary Predny, Shannon Jarrott, Diane Relf

Dept. of Human Development, Virginia Tech, Univ., Blacksburg, VA, USA, 24061-0416

Based on research over a two year period, the authors developed a handbook with over 50 activities specifically designed and tested at the Virginia Tech Adult Day Center for use with dementia-care clients. Activities focused on growing and using herbs at nursing care facilities in the categories of 1) plant cultivation, 2) cooking, 3) crafts, and 4) sensory experiences. Each activity contains very specific information on the design and implementation of the activity as well as ways to enhance its therapeutic value. The handbook was field tested by Master Gardeners and activity and recreational therapist in the mid-Atlantic region. The participants reported on the clarity of instructions, the applicability of the activity to their specific clientele and modifications that need to be made.

**1340–1440**

**S07–P–9**

**EFFECT OF HORTICULTURAL THERAPY ON THE COMMUNITY CONSCIOUSNESS AND LIFE SATISFACTION OF THE ELDERLY LIVING ALONE**

Hong-Yul Kim<sup>1</sup>, Mi-Kyung Cho<sup>1</sup>, In-Ja Han<sup>1</sup>, Ji-Sook Kim<sup>2</sup>

<sup>1</sup>Dept. of Floriculture, Catholic Univ. of Daegu, Kyungsan 712-702, Korea, Kyungsan, Kyungbuk, Korea, 712-702; <sup>2</sup>Buddhist Social Welfare Association, Nam-gu Daegu 712-010, Korea

This study was conducted to clarify the effect of horticultural therapy on the community consciousness and life satisfaction of the elderly living alone. The horticultural therapy program (HTP) was applied once a week—total 23 times (Apr. 14, 2001–Sep. 27, 2001) to 8 elderly who lived in a group home for the elderly living alone which belonged to Buddhist social welfare association located in Daegu. To evaluate the effect of horticultural therapy, the opinion of staff who work in welfare association were measured and analysed regarding: the changes in Wellness, Life Satisfaction, Character Evaluation, Horticultural Apprehension Evaluation at pre- and post-HTP and Horticultural Activity Evaluation at every HTP. According to the results, HTP was found to be effective in increasing the community consciousness and life satisfaction of the elderly living alone. After HTP, score of Wellness, Life Satisfaction, Horticultural Apprehension Evaluation, Horticultural Activity Evaluation was increased compare to before HTP but score of Character Evaluation was little change. All items rated by Horticultural Activity Evaluation have been improved generally by HTP. Especially score of participation, interest and assistance, self-concept and identity, need-drive adaptation, cognition and problem solving among items of Horticultural Activity Evaluation

were raised. The elderly's reaction to the plant materials used in this experiment showed variability. They preferred fragrant materials such as lily, chrysanthemum, and flower color of orange and violet. When these were used in HTP, the elderly's concentration in activity and satisfaction after activity was improved. With these results, it is considered that the HTP is effective in increasing the community consciousness and life satisfaction of the elderly living alone and it is necessary to develop more effective HTPs which are suitable for the elderly living alone.

**1340-1440**

**S07-P-10**

**EVALUATING THE EFFECTS OF A HORTICULTURE THERAPY PROGRAM ON THE PSYCHOLOGICAL WELL-BEING OF OLDER PERSONS IN A LONG-TERM FACILITY**

Karen Stoelzle Midden\*, Tom Barnicle

Plant, Soil and General Agriculture, Southern Illinois Univ., 1205 Lincoln Drive, Carbondale, IL 62901-4415 USA

The purpose of this study was to test the widespread belief that people-plant interactions enhance psychological well-being. The effects of a horticulture therapy program on the psychological well-being of older persons in a long-term facility was investigated over a seven week period. Participants for this study came from two long-term facilities; one being the experimental group and the other was the control group. Participants in both facilities continued with their normal daily routines, except the experimental group had a 1-hour horticulture therapy program once a week conducted by the researchers over the 7-week period. The Affect Balance Scale (ABS) was administered to participants at both facilities before and after the 7-week study (pretest/posttest) to measure psychological well-being. To increase variance, the ABS was measured on a five-point scale. A two-way ANOVA with time as a repeated measure was used to determine if there was a significant difference in pretest/posttest changes in the mean ABS scale between the groups. The control group and the experimental group were not significantly different in psychological well-being prior to the program. After the 7-week period, the experimental group had a significant increase in psychological well-being, whereas the control group had a decrease in psychological well-being. The results of this study indicate that horticulture therapy may have a beneficial effect on the current psychological well-being of older persons in a long-term facility.

**1340-1440**

**S07-P-11**

**THE PROFESSION OF HORTICULTURAL THERAPY: PAST, PRESENT, FUTURE**

Candice Shoemaker\*

Dept. of Horticulture, 2021 Throckmorton, Kansas State Univ., Manhattan, KS 66506 USA

The concepts upon which horticultural therapy are based can be found as far back as ancient Egypt when court physicians prescribed walks in palace gardens for royalty who were mentally disturbed. By the late 1700s and early 1800s examples of the use of horticulture as an accepted treatment approach in mental institutions can be found. Throughout the early 1900s, the use of horticulture for therapy expanded to other populations such as the mentally handicapped, at-risk youth, and war veterans. The 1950s and 1960s saw the beginnings of defining horticultural therapy as a profession and the need for formally trained horticultural therapists. Historically, horticulture was used as an activity or diversion for hospital patients, for vocational training, and in occupational therapy. Horticultural therapy continues to be closely affiliated with these allied therapies such as occupational therapy, recreational therapy, and activity therapy. Comparisons between these allied therapies can be a useful tool in understanding the past and defining or identifying strategies for the growth and development of the profession into the future. This presentation will provide a brief history of the profession and an in-depth comparison of the evolution of horticultural therapy to the other allied therapies. In addition, results of two surveys, one of all current registered horticultural therapists, and one of all graduates of the Kansas State Univ. Horticultural Therapy Program will be presented. These surveys were conducted to obtain information on where the profession stands at its highest level of professionalism at this time—the registered horticultural therapist, and what the career path is of those individuals who have graduated from the only university that offers a degree (rather than option) in horticultural therapy.

**1340-1440**

**S07-P-12**

**THE ECONOMICS OF HORTICULTURAL THERAPY: A EUROPEAN PERSPECTIVE**

Silvio Franco<sup>1</sup>, Eric Monke<sup>2</sup>, Saverio Senni<sup>3</sup>

<sup>1</sup>Dept. of Agroforestry Economics Tuscia Univ. Via San Camillo De Lellis, s.n.c. 01100 Viterbo, VT Italy; <sup>2</sup>Dept. of Agricultural and Resources Economics m Univ. of Arizona; <sup>3</sup>Dept. of Agroforestry Economics Tuscia Univ. Via San Camillo De Lellis, s.n.c. 01100 Viterbo VT Italy

Among the various services that agricultural is recognized to provide in developed countries the healing and therapeutic benefits are very often neglected. In many European experiences to rehabilitate and to socially integrate people with disabilities, in particular those with limited mental and psychological capacities, horticulture has been found as one of the most appropriate activities. The paper discusses, from an economic and social perspective, the role of horticultural, floricultural and nursery production activities in rehabilitating people with intellectual and psychological disabilities. It analyzes the justifications for addressing specific policy measures to therapeutic farming programs that could foster the work integration of disabled people. Qualitative considerations based on Italian case studies are presented. They suggest that these kind of programs have a positive impact on the public assistance expenditure, reduce social exclusion and contribute to the quality of life in rural areas of the European Union.

**1340-1440**

**S07-P-13**

**EFFECT OF HORTICULTURAL THERAPY ON THE CHANGES OF SELF-ESTEEM AND SOCIALITY OF THE CHRONIC SCHIZOPHRENIA**

Ki-Cheol Son<sup>\*1</sup>, Su-Jin Um<sup>1</sup>, Jong-Eun Song<sup>1</sup>, Soo-Yun Kim<sup>1</sup>, Hye-Ran Kwack<sup>2</sup>

<sup>1</sup>Dept. of Horticultural Science, Konkuk Univ., 1 Hwayang-dong, Kwangjin-gu, Seoul, South Korea, 143-701; <sup>2</sup>Dept. of Horticultural Science, Seoul Women's Univ., Seoul 139-770, Korea

Recently, various social treatments have been provided for schizophrenic patients as alternative medicine but limited research has been reported about the application of horticultural therapy (HT). Therefore, this study was conducted to evaluate the effect of HT activities on self-esteem and sociality in cases of chronic schizophrenia in a social welfare center. For this study, 50 patients with comparable levels of symptoms were selected by the hospital psychiatrist as participants. These were divided into two groups to match by gender, 25 patients participated in the HT program as the activity or research group, while another 20 patients were a control group without any structured activities. The activity group attended a one hour HT program twice a week for 6 months. For evaluation, various numeric scales which were associated with self-esteem, relationship change, sociality, and symptom checklist-90-revision (SCL-90 R) were adapted. A checklist for HT activities was also used to evaluate the horticultural performance of participants. Measurements were conducted at 3 time periods: before, at the midpoint, and immediately after the 6 month HT program. According to the results, self-esteem and relationship change were not altered meaningfully in the control group, whereas those were improved significantly in the activity group. On the social behavior scale, the degree of non-verbal and substance of conversation were significantly improved in activity group. According to the SCL-90R test, the degree of interpersonal sensitivity, depression, and anxiety took a significant favorable turn. Somatization, paranoid ideation, phobic anxiety, obsession, and hostility were improved in the activity group but without statistical significance. Finally, the participation, self-concept, and identity of patients among the items of HT activities' evaluation were significantly improved after HT programs. Therefore, it could be concluded that HT programs were effective as one of the alternative medicines in improving of psychological, emotional, and social problems of chronic schizophrenia and more research should be conducted in this area.

**1340-1440**

**S07-P-14**

**EFFECTS OF VISUAL RECOGNITION OF GREEN PLANTS ON THE CHANGES OF EEG IN PATIENTS WITH SCHIZOPHRENIA**

Ki-Cheol Son<sup>\*1</sup>, Jong-Eun Song<sup>1</sup>, Su-Jin Um<sup>1</sup>, Jong-Sub Lee<sup>2</sup>, Hye-Ran Kwack<sup>3</sup>

<sup>1</sup>Dept. of Horticultural Science, Konkuk Univ., 1 Hwayang-dong, Kwangjin-gu, Seoul, none, South Korea (ROK), 143-701; <sup>2</sup>Dept. of Psychiatry, College of Medicine, Konyang Univ., Deajeon Chungnam, 320-711, Korea; <sup>3</sup>Dept. of Horticultural

tural Science, Seoul Women's Univ., Seoul 139-770, Korea

In order to validate the therapeutic aspects of green plants, we have examined the changes of electroencephalography (EEG) of schizophrenic patients by recording EEG during 4 minutes period when they stared meaninglessly at either the plants (*Ficus benjamina* L.) placed in front of wall or ivory-white wall only. EEG measurements were taken from 24 male and female patients with schizophrenia in social welfare center, Khotongnae. The result showed that no significant differences in the delta, theta, alpha and beta activities, regardless of the existence of plants when their eyes were closed immediately after measurement had been started. On the other hand, it showed significant differences in delta activity in the locations of FP1, F3, FZ, F4, FTC2 and TCP1 when their eyes were opened during measurement. In this case, their visual recognition of plants decreased delta activity significantly as compared to that of wall ( $P < 0.05$ ). However, there were no significant differences in the activities of theta, alpha, and beta between treatments. Additionally, in the measurements of hyperventilation brain waves, the delta activity in the location of FP1, F7, F3, FZ, F4 and T3 also decreased significantly and alpha activity increased slightly in the occipital region without statistical significance when they stared at plants. Their systolic blood pressure and heart rate when they stared at plants instead of wall also showed a significant decrease from 129.3 to 117.7 ( $P < 0.01$ ) and from 71.7 to 69.8 ( $P < 0.05$ ), respectively. Considering that it was well known that schizophrenic patients have more delta activity in the frontal region and less alpha activity especially in the parieto-occipital region, this data indicates that various activities with green plants in horticultural therapy could be an effective alternative medicine for schizophrenic patients and should deserves more research.

**1340-1440**

**S07-P-15**

**BIBLIOGRAPHICAL STUDY ON THE DEVELOPMENT OF HORTICULTURAL THERAPY IN JAPAN**

Eisuke Matsuo\*, Akihiro Kawahara, Hyojung Kweon, Hiroyuki Takafuji, Jiyong Choi

Graduate School of Agriculture, Kyushu Univ., 6-10-1 Hakozaki, Fukuoka, Fukuoka, Japan, 812-8581

Horticultural therapy in Japan has only 10 years of history. During these 10 years it has expanded and developed tremendously. This paper deals with the developmental change of horticultural therapy through analysis of the documents published in Japanese. Horticultural therapy was introduced in Japan in 1978 as ENGEI-NI-YORU-CHIRYOU Therapy through horticulture in a book of horticulture and in 1981-1982 as ENGEI-RYOHO Horticultural therapy in a newspaper and a horticultural magazine, but they did not induce Japanese interests in horticultural "therapy". In 1991 it was reintroduced in documents, and in 1993 a Japanese and an American specialist presented a lecture on horticultural therapy in Kobe and in Tokyo, respectively, triggering in part the Japanese interest in it. After these events, documents on horticultural therapy increased dramatically year by year, many study groups were organized, many parties left for overseas countries on a study tour of horticultural therapy, many short term courses for study and training in horticultural therapy were opened by study groups, practical trials in horticultural therapy were begun, and some colleges and/or professional schools opened subjects on horticultural therapy. These movements on horticultural therapy in Japan changed the contents of horticultural therapy documents. The authors compiled the database of Japanese documents on horticultural therapy published from 1991 to 2000. These documents traced clearly the developmental changes of horticultural therapy in Japan. In the introductory stage of horticultural therapy about 1991-95, most of the documents were news and introductory statements, gradually followed by interpretative records for enlightening. Around 1997 some practice records were published. During these few years, research notes increased remarkably, which may indicate that horticultural therapy is taking roots in Japan.

**1340-1440**

**S07-P-16**

**THERAPEUTIC HORTICULTURE IN THE UK: A DETAILED ANALYSIS OF THE CURRENT SETTINGS**

L. Finnis, T. Spurgeon, B. Simpson\*

The Geoffrey Udall Centre, Beech Hill Reading, UK, RG7 2AT

Established in 1978, Thrive is the UK wide charity promoting the use of hor-

ticulture and gardening for training, employment, therapy and health. It runs four demonstration gardens, a range of services for older and disabled gardeners and supports over 1500 individual projects providing services for 60,000 disadvantaged people a year. This paper provides detailed analysis of the projects following extensive research into the range and types of services offered. It includes a description of the needs and demands of clients and reports on such aspects as social inclusion, research into the involvement of ethnic minority groups and therapeutic horticulture in secure settings. It goes on to examine the challenges and issues that have arisen during regular informal contact and at the 85 network meetings held around the UK in the past 4 years. The paper goes on to highlight the trends in therapeutic horticulture in the UK based on wide-ranging information gathered from clients, staff and volunteers.

**1340-1440**

**S07-P-17**

**EFFECTS OF HORTICULTURAL ACTIVITIES ON ENVIRONMENTAL AWARENESS AND BEHAVIOR IN YOUTH WITH DISABILITIES**

Y. Yamaya\*, R. Mattson

Kansas State Univ., 2021 Throckmorton, Plant Science Center, Manhattan, KS 66506-5506 USA

A 9-month case study was conducted to examine cognitive and affective changes in six high school students with disabilities who participated in a science class. The six students were classified as having learning disabilities or emotional/behavioral disorders. The students participated in the study during the 2000-01 school year, and they participated in classroom and lab utilizing horticultural activities in a greenhouse from Monday to Friday. Prior to the study, students were asked to fill out demographic questionnaires to provide information on previous horticultural or outdoor experiences. Data were collected using participant observation, individual interviews, and the Zuckerman Inventory of Personal Reactions (ZIPERS), measuring the change of self-rated emotional responses. The Children's Environmental Response Inventory (CERI) measured students' environmental dispositions using a pre and post-test design. Results revealed both positive and negative changes in student's attitudes toward the environment. Students favorably and unfavorably judged their own performances based on their work efficiency, skill, working attitude, and social interaction with others. Improved cognitive skills and positive social interaction with teachers, peers, school staff, and parents were observed. Students were able to enjoy the activities with or without previous experiences in horticultural or outdoor activities. The result of individual interviews and participant observation indicated that multidimensional aspects of horticultural activities met students' needs and encouraged their interests. The data suggest the importance of careful planning involving teachers, students, assistants, school counselors, parents, and a horticultural therapist. Simple communication between teachers and students, repeating the communication to all class participants, and positive reinforcement played an important role in students understanding the meaning of the class.

**1340-1440**

**S07-P-18**

**HEALING SPACES: CREATING AREAS FOR PATIENT REHABILITATION ACTIVITIES WITHIN A HOSPITAL GARDEN**

Patricia Owen\*<sup>1</sup>, Pamela Gill<sup>2</sup>

<sup>1</sup>Cleveland Botanical Garden, 11030 East Boulevard, 1, Cleveland, OH 44106;

<sup>2</sup>Euclid Hospital Cleveland Clinic Health System 18901 Lake Shore Boulevard Euclid, OH 44119

Research documents the potential of time spent in garden environments to improve the health of humans by decreasing blood pressure. Building upon that work, garden areas that serve as rehabilitation sites for patients in health care facilities should aid in the recuperation process. In order for gardens in health care facilities to be used successfully as sites for rehabilitation programs, health care staff must be included in the design process. When Euclid Hospital began the design process for a garden, the first author, a horticultural therapist, was invited to participate. After a landscape design firm was selected, a survey was developed for the hospital's physical, occupational and recreation therapists. The objective was to help these health care professionals define the modalities they wished to implement within the garden for patients' rehabilitation. Based upon the survey and communications with rehabilitation department staff and the landscape architects, the garden area was developed. This paper explains how this collaborative effort improved their hospital's garden design and provided reha-

bilitation opportunities for patients within the garden. Suggestions for future collaborations of health care professionals with landscape designers and horticultural therapists will be offered.

**1340-1440**

**S07-P-19**

**IMPROVING QUALITY OF LIFE THROUGH THE ADAPTIVE GARDEN PROJECT**

Kerrie B. Badertscher\*

Colorado State Univ. Coop. Ext., Boulder County, 9595 Nelson Road, Box B, Longmont, CO, USA, 80501

The goal of this project was to provide an accessible garden to Boulder County residents. In order to create this green space, a collaborative effort by the Center for People With Disabilities (CPWD), Colorado State Univ. Cooperative Extension (CE) and Growing Gardens of Boulder County was formed in August 2000. Collaborative work led groups, businesses and organizations to create a new sense of community in this urban, industrial park setting. More than \$80,000 has been donated to date with 2/3 of the 3/4 acre garden construction completed. The 3 partnering agencies held a series of committee meetings, in-house forums and public meetings to assure input from potential users. Criteria and rationale for each area of the garden were established. Accessible gardens were incorporated: outdoor food preparation area, vegetable, sensory (Braille), gazebo/water feature, theme (where clients choose a yearly idea), art, wildlife, fruit crops, utility area, vertical grow wall, herb, cut flower and perennial/specimen garden. The construction process will be reviewed. A survey of needs was completed. An interview schedule was established for the participants in the program. Pre and post testing was initially submitted in the study but the majority of participants who entered the garden program were physically unable to complete them, due to their disabilities. Verbal testimonials plus CPWD staff input about their consumers continues. Programs were jointly taught by Growing Gardens and CE with CE providing Master Gardener (MG) curriculum and Earth Garden curriculum to Growing Gardens. CE provided MG's mentors for 28 weeks during 2001. The evaluation processes will be reviewed. The Adaptive Garden has provided people with an opportunity to meet others, share ideas and solve problems together. This project cuts across economic, social, cultural, racial and physical barriers, bringing people together from varied backgrounds.

**1340-1440**

**S07-P-20**

**IDENTIFYING THE IMAGE OF A HEALING LANDSCAPE: A DESCRIPTIVE STUDY**

F.A. Miyake\*

SEN, Inc., 4-11 Tsuruno-cho, Suite 1106, Kita-ku, Osaka 530-0014, Japan

The purpose of this research is to add clarity to the evidence of people's need for a healing landscape by focusing on the healing effect of the plants existing in the landscape and to examine how people perceive a healing effect from such places and plants. This study attempts to identify the image of a "healing" landscape (as one that brings relief or peace) through written descriptions provided by 488 people in Japan: 252 people aged 10 to 29, 127 people aged 30 to 59, and 109 people aged over sixty. Each was asked to describe the scene(s) in which they feel relief and/or peace, and the descriptions were carefully categorized and analyzed. The predominate images were able to be categorized as "Nature Abundant Landscape" which 94% of the respondents described to be preferable and only 1% described "Artificial Landscape" with no natural elements. Characteristics within these descriptions and comparisons between the age groups will be given.

**1340-1440**

**S07-P-21**

**DOES PLANT COLOR AFFECT EMOTIONAL AND PHYSIOLOGICAL RESPONSES TO LANDSCAPES?**

Andrew J. Kaufman\*, Virginia I. Lohr

Dept. of Horticulture and, Landscape Architecture, Washington State Univ., Pullman, WA 99164 USA

Plants are a vital component of the social and economic health of our cities. The practical benefits of plants, such as their ability to improve air quality, control erosion, aid in cooling, and increase property values, are widely appreciated by

urban residents and businesses. Recent research has shown that the aesthetic and emotional values associated with trees and shrubs are of equal, or even greater, importance to people than the practical benefits. Research has begun to document human responses to vegetation including habitats and tree forms. Research has also documented that positive benefits accrue from plants both indoors and outdoors. Color has been studied since ancient times in many cultures. Surprisingly, few studies have addressed plant color and its influence on people. Extending research to investigate whether different plant color contributes to exciting or calming landscapes could have tremendous economic and social impacts. This paper discusses Phase I of a two phase research study addressing what effect plant color has on people's emotional and physiological states. Phase I focuses on general plant color preference: what do people think of trees in different colors, such as purple, red, yellow, blue, and green. Phase 2 will incorporate recording emotional and physiological responses, such as blood pressure, pulse, and emotional states, while respondents are viewing slides of different vegetation color.

**1340-1440**

**S07-P-22**

**THE RESTORATIVE EFFECTS OF RECREATIONAL SETTING: A STUDY**

Chia-Chun Hung\*, Chun-Yen Chang

Dept. of Horticulture, National Chung Hsing Univ., 250 Kuokuang Road, Taichung, Taiwan, Taiwan, 40227

This study based on the Attention Restoration Theory, ART, explores the relationships between different types of recreation settings and respondents' psychological and physical responses (EEG, EMG, BVP). Many studies have depicted the benefits of recreation settings on human psychological and physical effects. However, the effect of various characteristics of the recreation settings is still little understood. Therefore, this study proposed the following three research purposes: to realize the effect of different characteristics of the recreation settings on respondents' psychological responses; to realize the effect of different characteristics of the recreation settings on respondents' physical responses, and to realize the relationship between respondents' psychological responses and physical responses induced by different characteristics of the recreation settings. The testing items were adapted from the Restorative Scale (RS). The testing slides included the recreation settings of park, city, forest, mountain, and water body and the restorative effects are ones of the "psycho-physiological response". The result shows that respondents' psychological responses are highly related to the recreation settings. The recreation settings also influenced respondents' physical responses. For the relationship between respondents' psychological and physical responses, the characteristic of Being Away had effect on the alpha wave of right side of brain.

**1340-1440**

**S07-P-23**

**PAIN TOLERANCE AND RECOVERY EFFECTS OF ORNAMENTAL INDOOR PLANTS IN A SIMULATED HOSPITAL PATIENT ROOM**

Seong-Hyun Park\*, Richard H. Mattson, Eunhee Kim

2021 Throckmorton Hall, HFRR, Kansas State Univ., Manhattan, KS 66506 USA

To document the beneficial influence of plant environments on human health, this research conducted bio-monitoring, experimental sessions on pain tolerance and recovery effects of ornamental indoor plants in a simulated hospital patient room. Ninety female university students were randomly assigned to one of the three treatments: 1) presence of foliage plants only, 2) presence of foliage plants with flowering plants, and 3) absence of plants. An experimental session consisted of a 5-minute baseline, a Cold Pressor Test to induce pain by placing a hand in ice water, and a 5-minute recovery period. Each student observed an assigned treatment during the Cold Pressor Test and the recovery period. Psychological responses of brainwave activities (EEG alpha: 8-12 Hz, EEG beta: 21-27 Hz), electrodermal activities, and finger skin temperatures were recorded simultaneously and continuously. Self-rated responses were taken immediately after the baseline and after the recovery period by using the Bi-polar Form of the Profile of Mood States (POMS-BI) and the modified Environmental Quality Rating Scale (EQRS). Comparisons of the three treatments based on pain tolerances, psycho-biological changes, and self-rated responses will be presented. Discussion will emphasize how plant environments affect pain tolerance and recovery of hospital patients.

**1340-1440**

**S07-P-24**

**EFFECTS OF INTERIOR HORTICULTURAL ACTIVITY USING POTTED HERBS ON HUMAN PHYSIOLOGICAL STATES AND EMOTION**

Hideo Kakuta\*, Etsuko Yano, Tomoo Maeda, Tomoaki Yoshida

Plant Ecochemicals Research Center Kita 3-1-1 Megumino Eniwa-shi Hokkaido, Japan 061-1374

Potted herbs have been produced for interior kitchen gardening since 1999 on our experimental farm to improve life quality, amenity and living environments in a house. We studied the effects of interior kitchen gardening in the model room and the green house, using the potted herbs on human physiological and psychological states by means of electroencephalogram (EEG) and electrocardiogram (ECG). The mean alpha and beta power values were calculated and features of EEG associated with emotional states were extracted to the four elemental emotions according to emotion spectrum analysis method (ESAM). Relaxation and pleasantness scores were determined from Mood Check List (MCL-S1) before and after horticultural activity. Results of the comparison between mean alpha power and relaxation spectrum suggest that interior horticultural activity increased relaxation.

**1340-1440**

**S07-P-25**

**EFFECTS OF HORTICULTURAL ACTIVITIES ON ANXIETY REDUCTION OF FEMALE HIGH SCHOOL STUDENTS**

Young-Hyun Lee<sup>1</sup>, Myoung-Rai Ro<sup>1</sup>, Yong-Seon Lee\*<sup>2</sup>

<sup>1</sup>Dept. of Life Science 336-600, Soonchunhyang Univ., Asan City, Chung-nam, South Korea, 336-600; <sup>2</sup>Mokchon, High School, Chunan Cith, South Korea

The physical attributes and psychological factors associated with a person's activities of daily living are important components of an individual's life quality. As horticulture as a therapeutic tool has been increasing in recent years, the present study was undertaken to examine potential impacts of horticultural participation on anxiety reduction of female high school students. STAI-KYZ (Spielberger State-Trait Anxiety Inventory YZ) was determined using a validated self-report questionnaire as a testing instrument, with words and structures paraphrased suitably for high school student level so that they could react STAI-KYZ directly. Participants were 74 students 39 in the experimental group, 35 in the control group. The experimental group participated in 12 horticultural programs, while the control group did not take part in any horticultural programs. The results were as follows, Group X Time (Pre/Post) two-way interactions were statistically significant. Within the experimental group: 1) horticultural program was reduced 48.46% pre-test to 42.69% post-test in state anxiety level [F (1,72) = 21.23, P = 0.00]; 2) horticultural program was reduced 45.79% pre-test to 42.69% post-test in trait anxiety level [F (1,72) = 16.02, P = 0.00]; and 3) social anxiety level was reduced 18.89% pre-test to 21.33% after practicing horticultural program, but was not significant statistically. The control group demonstrated less change in anxiety during the course of the experiment. While there were differences in pre and post test, the means of the control group increased less and was not statistically significant. It was determined that a significant reduction effect was shown on state anxiety and trait anxiety and a trend on social anxiety. These findings indicate a favorable interpretation of effectiveness of the horticultural programs. Using these results as a starting point, further assessment will identify connections to existing people-plant research, as well as horticultural activities and design of children's gardens, educational gardens and home gardens. Moreover, various programs have to be developed and applied positively.

**1340-1440**

**S07-P-26**

**BIOMONITORING HUMAN ENERGY EXPENDITURE RESPONSES TO HORTICULTURAL ACTIVITIES**

Mitsukimi Sugimoto\*, Hyejin Cho, Richard H. Mattson<sup>2</sup>

Faculty of Agriculture, Food Production Science, Shinshu Univ., 8304, Minami, Minowa-mura, Kamiina-gun, Nagano Pref., Japan, 399-4598; <sup>2</sup>Dept. of Horticulture, Forestry and Recreation Resources, Kansas State Univ.

Physical energy expenditures of 36 university students were measured while doing horticultural or non-horticultural activities. Six students were randomly assigned to each of six treatments without replication. These treatments were: 1) sitting activity with plants making a dish garden; 2) sitting activity without plants moving in a wheelchair; 3) standing activity with plants making a dish garden; 4) standing activity without plants walking in a corridor; 5) resting while watching a plant

videotape; and 6) resting while watching an action movie. Starting with a 10 minute orientation, the total student activity time of 20 minutes was followed by a 10 minute recovery period. Pre- and post-measurements were recorded of body weight, body fat, and emotional state (ZIPRES). Heart rate was recorded every five seconds. Energy expenditure was recorded continually throughout the final 30 minutes. Calculated variables were maximum heart rate, recovery time, and average heart rate. A two-factor analysis of variance was adapted to compare "with plants" and "without plants" treatments, and among the sitting, standing, resting activities. If main effects were significant, means were analyzed using a multiple comparison test (Fisher's PLSD). The significance level was set at  $P < 0.05$ . The following results were found from pre- and post-measurements: 1) body weight reduction occurred in all activities, but may have been caused by dehydration; 2) body fat changes could not be measured in the short time span of this experiment; and 3) ZIPERS scores indicated significant increases in "affectionate" and decreases in "fearful" emotions. Result from continual heart and energy expenditure data analysis indicate the following: 1) horticultural activities resulted in decreased heart rate and smoother heart waves as compared to non-horticultural activities; and 2) with horticultural activities, student heart rate recovery occurred in a shorter period of time than it did for students assigned to non-horticultural activities. Further studies need to focus on relationship between heart rate, energy expenditure, and stress level of people having various types of disabilities and include a large sample size.

**1340-1440**

**S07-P-27**

**EXERCISE INTENSITY OF HORTICULTURE AS PHYSICAL ACTIVITY**

Hyojung Kweon\*<sup>1</sup>, Kenichi Shibuya<sup>2</sup>, Eisuke Matsuo<sup>1</sup>, Tetsuro Ogaki<sup>2</sup>, Jiyong Choi<sup>1</sup>

<sup>1</sup>Graduate School of Bioresource and Bioenvironmental Science Kyushu Univ. 6-10-1 Hakozaki Fukuoka 812-8581 Japan; <sup>2</sup>Institute of Health Science Kyushu Univ. 6-1-11 Kasuga-koen Kasuga 816-8580 Japan

Horticulture is applied to not only supplement lack of exercise for the healthy people but also health improvement for the aged and rehabilitation for the disabled. Horticultural activities are applied to vocational rehabilitation in US and in Japan rehabilitative facilities and mental hospitals are introducing horticultural activities as occupational therapy. According to previous research in which horticultural activities were compared with daily physical activities, exercise intensities of horticultural activities varied from strong (e.g., jogging or going up/down the stairs) to weak (e.g., work in kitchen). This fact indicates that an individual can select moderate activities appropriate to oneself for exercise and rehabilitation without distinction of age and sex. In this paper, the exercise intensity of the general horticultural task was estimated and intensities of each horticultural activity were determined in order to offer the basic data for selecting suitable horticultural activities for each individual. In order to investigate the exercise intensity of horticulture, the rate of oxygen uptake ( $VO_2$ ) and the heart rate (HR) were measured in a horticultural task (i.e., making a flower bed for 20 min). Horticultural tasks were then subdivided into activities such as seeding, watering, and fertilizing, to measure  $VO_2$  and HR of each activity. As a result, there were various activities in horticultural tasks and those exercise intensities ranged widely. Intensity of the task (making a flower bed) were 2-8 Metabolic Equivalent (METs). These values come under intensities of non-game basketball playing (3-9 METs). Despite the same activity, there was difference between exercise intensity of an activity in the tasks and intensity of the activity measured separately, because the activity was affected by the prior activity in the horticultural task.

**1340-1440**

**S07-P-28**

**AN EXTENSION EDUCATION PROGRAM TO ADDRESS GARDENING AND YOUR HEALTH**

Diane Relf\*, Mary Predny

Dept. of Horticulture, Virginia Tech, Univ., Blacksburg, VA, USA, 24061-0327

Gardening is highly preferred and enjoyed as a way of relaxation, especially among older adults. Gardening can offer opportunities to enhance or improve health by allowing for moderately strenuous exercise; encouraging healthy eating habits; increasing interaction with nature, plants, and the environment; reducing stress; and promoting physical, social, and mental stimulation. However, unless managed properly, gardening can also create or aggravate health issues dealing with skin care and cancer, carpal tunnel syndrome, arthritis, cardiovascular health, back/knee problems, heat stress, and many other problems. A program was developed to include printed and web based information, Power Point and slide presentations and

Master Gardener training to address gardening techniques to prevent potentially damaging situations, avoid aggravating existing conditions, and improve health and safety in the following areas: 1) Carpal Tunnel Syndrome, 2) Protecting Hands and Feet, 3) Arthritis, 4) Sunburn and Skin Cancer, 5) Summer Heat, 6) Ticks, 7) Heart, 8) Knees and Back, 9) Plant Allergies, and 10) Power Tool Safety. Additional topic areas will be added.

**1340-1440**

**S07-P-29**

**CAROTENOID CONTENTS IN LEAVES AND TUBERS OF YELLOW-FLESHED DIPLOID POTATOES**

W. Lu, K. Haynes\*, E. Wiley, B. Clevidence

USDA-ARS, Vegetable Laboratory, Plant Sciences Institute, Beltsville, MD 20705 USA

In plants, the xanthophyll cycle components present in leaves serve a photoprotective role in dissipating excess excitation energy during peak irradiance. In humans, carotenoids may protect against a variety of chronic diseases, including cardiovascular disease, certain cancers, and macular eye degeneration. Enhancing carotenoid levels in more frequently consumed vegetables, such as potato, is one of the strategies to improve human health and quality of life. Large variations of tuber carotenoids exist in a hybrid population of *Solanum phureja*-*S. stenotomum*. This research was carried out to determine if there is a relationship between carotenoid levels in leaves and tubers of some yellow-fleshed diploid potatoes. Four clones, two high and two low in total tuber carotenoids, were planted on 25 Apr. 2001 in Beltsville, MD. Five leaf discs of known area (0.28 cm<sup>2</sup>) were sampled at a 2-hour interval from 6 AM to 6 PM on 19 June, frozen immediately in liquid nitrogen, and kept at -80 °C until analysis. Carotenoids were extracted with acetone. Chromatography was performed using the HP 1100 LC system with Chemstation software (Agilent Technologies) on a reverse phase C30 column, 250 x 4.6 mm, (YMC) at 20 °C with diode array detection at 450 nm. Both carotenes and xanthophylls were found in leaves, but only xanthophylls were detected in tubers. No correlations between the individual xanthophyll or total xanthophyll concentrations in leaves and tubers were found. These results suggest that clones high in total tuber carotenoids synthesize more carotenoids in leaves, and also translocate these carotenoids into tubers efficiently. No more carotenoids are accumulated in leaves than are needed for their normal metabolism.

**1340-1440**

**S07-P-30**

**ASCORBIC ACID, FOLIC ACID, AND POTASSIUM CONTENT—HUMAN WELLNESS COMPOUNDS—IN GREEN-FLESH MUSKMELON FRUIT; PREHARVEST EFFECTS OF CULTIVAR, FRUIT SIZE, SOIL TYPE AND YEAR**

Gene Lester\*<sup>1</sup>, Kevin Crosby<sup>2</sup>

<sup>1</sup>USDA-ARS, Kika de la Graza SARC, 2413 E. Bus. Hwy. 83. Weslaco, TX 78596 USA; <sup>2</sup>Texas Agricultural Experiment Station, 2415 E. Bus. Hwy. 83. Weslaco, TX 78596 USA

Three important phytonutrients essential for human health and well-being are: ascorbic acid, 5-methyl-tetrahydrofolic acid (folic acid) and potassium. The influence of cultivar, fruit size, soil type and year on these phytonutrients in [*Cucumis melo* L (Inodorous Group)] was determined. Fully abscised (mature) commercial size fruit: 4, 5, 6, 8, and 9 (fruit/0.031 M3 shipping box) from 3 commercial hybrid cultivars: Mega Brew, Morning Ice, and TAM Dew Improved (TDI); and one experimental hybrid 'TDI' x 'Green Ice' were grown on both clay loam and sandy loam soils. Total ascorbic acid and folic acid content increased with an increase in fruit size up to a maximum (size 5 or 6), then decreased with further fruit size increase. Total ascorbic acid and folic acid content regardless of fruit size was higher when grown on clay versus sandy soils. The experimental hybrid compared to the commercial hybrids contained generally higher total ascorbic acid levels and significantly higher folic acid levels regardless of fruit size or soil type. Free ascorbic acid and dihydroascorbic acid contents were generally higher from clay versus sandy soils and in the experimental line versus the commercial cultivars. However, free ascorbic acid content was high in small fruit and remained unchanged with an increase in fruit size until size 5 or 6 then significantly decreased, while dihydroascorbic acid content linearly increased with an increase in fruit size. Potassium content averaged 17 mg/g dry weight for each line and did not differ due to fruit size, soil type or year

**1340-1440**

**S07-P-31**

**GREEN ROOF DRAINAGE SYSTEM AND PLANT SPECIES INFLUENCE WATER QUALITY OF RUNOFF**

Michael A. Monterusso, D. Bradley Rowe\*, Clayton L. Rugh

Michigan State Univ., Dept. of Horticulture, A212 Plant and Soil Sciences Bldg., East Lansing, MI 48824-1325 USA

Green roof systems offer numerous environmental benefits. Besides the aesthetic value that plants provide, green roofs can potentially offer reduced energy consumption for heating and cooling buildings, a reduction in the heat island effect within urban areas, and reduced runoff into municipal stormwater systems. To test the water quality of effluent draining from green roofs, 24 model roofs measuring 5.95 square meters, were constructed on raised platforms utilizing three commercially available green roof drainage systems (Sarnafil, Siplast, and Xeroflor). Vegetation consisted of nine species of Sedum and 18 species of Michigan native forbs and grasses. Water runoff was periodically collected and analyzed for nitrate and P. Initial nitrate and P levels were significantly greater in effluent from Sarnafil and Siplast platforms compared to Xeroflor (nitrate at 47, 50, and 4 ppm and P at 0.94, 0.75, and 0.14 ppm), respectively. After six weeks, nitrate levels had decreased and stabilized (0.6, 0.8, and 0.9 ppm), but P levels were similar to initial values (0.81, 0.77, and 0.14 ppm). Regardless of sample time, effluent from platforms planted with native plants contained less nitrate and P, compared to those planted with Sedum.

**1340-1440**

**S07-P-32**

**THE USE OF THE STUDENT VOLUNTEERS FOR DEVELOPMENT OF BIO-DIVERSITY PARK ADOPTING INTEGRATED CONSERVATION STRATEGY IN THE BANGALORE UNIV. CAMPUS**

Santhe Narayana Swamy\*, A.N. Yellappa Reddy, K. Siddappa

Garden Dept., Jnanabharathi Campus, Bangalore Univ. Bangalore-560 056 Karnataka 560056 India

The National Service Scheme (NSS) was launched in the year 1969 by the Government of India with the objective of personality development of the college students through community service. The college student volunteers, through NSS, are deployed for community development works such as Health Improvement, Sanitation, Environmental Awareness, Ecology Improvement etc. The NSS is optional hence the students enrolled are called volunteers. The colleges affiliated with the university normally conduct the NSS camps as per suggestions and directions of the later. During the camp period the volunteers are provided with boarding and lodging on site by the concerned colleges and universities. The Bangalore Univ. (BU), during the year 2001, had deployed 1725 NSS volunteers at the rate of 100 to 200 at a time for a period of 10 to 15 days for developing the I phase of the Bio-diversity park (BDP). The BU, through its Garden Superintendent, had facilitated the volunteers in carrying out the works of BDP such as digging pits, manuring, planting saplings, watering and wild fire prevention. The practical works were carried out during the morning hours (8.00 am to 12 noon) and theoretical lectures and training on the works to be attended next day were given during the evening hours. The volunteers were thoroughly trained about the skills of nurturing plants, their utility to the society, their contribution to ecology and environment, and thus they were exposed to nature. The strategy adopted was integrated conservation involving the students, the ex-situ and in-situ conservation. Hence it is very unique in its approach. Now the BDP is demonstration centre for not only students but for farmers also. The student volunteers could be deployed for the next phase of BDP as well for other projects of the university in future.

**1340-1440**

**S07-P-33**

**STUDY OF PESTICIDE RESIDUES IN THE GREENHOUSE ENVIRONMENT DURING HYDROPONIC CULTIVATION OF GERBERA**

S.P. Hatzilazarou, M. Harizopoulos, E. Papadopoulou-Mourkidou, A.S. Economou\*  
Dept. of Horticulture, School of Agriculture, Aristotle Univ., Thessaloniki, a, Greece, 54006

In this work, the residues of the pesticides methamidophos and clorothalonil in the air of the greenhouse, in the liquid nutrient medium of a closed system, and in the drain water of an open system of gerbera hydroponic cultivation were in-

vestigated. Also, the exposure of the personnel to these pesticides during spraying was examined by using absorbent paper on the head and the chest. The sampling of the air began immediately after the sprays and continued for a 6-day period. The sampling of the liquid nutrient medium of the closed system and the drain water of the open system began right after the spray and continued for 3 more days. The samples of the air were collected with the utilization of chromosorb as an absorbent agent and with the use of a vacuum pump. The assay of the extracts was made with EC-MS. It was found that the concentration of the pesticides in the air of the greenhouse was related to their physical and chemical properties and their dose of application. Methamidophos had the highest concentration in the air 2 hours after application ( $27.5 \mu\text{g}/\text{m}^3$ ), due to its high volatility, while afterwards (up to 12 hours after spraying) a rapid decrease in the concentration was noticed and finally 6 days from the spray the concentration was decreased to  $0.45 \mu\text{g}/\text{m}^3$ . Chlorothalonil had the same trend in the air of the greenhouse and its concentration from  $4.9 \mu\text{g}/\text{m}^3$  was decreased to  $0.15 \mu\text{g}/\text{m}^3$  6 days after the spray. The concentration of both pesticides in the drain water of the open system was high right after the spray and was decreased rapidly during the next 3 days. In the closed system both pesticides were accumulated in the nutrient medium in the first 24 hours and began to decrease slowly in the next 3 days. The personnel who conducted the sprays were exposed to a higher concentration of chlorothalonil and to a lower concentration of methamidophos during the sprays of these pesticides. SPTF recommendation : S19-Elegant Science in Floriculture

**1440–1500**

**S07–0–34**

### **THE PSYCHOPHYSIOLOGICAL RESPONSES OF DIFFERENT LANDSCAPE SETTINGS**

Chun-Yen Chang\*

Dept. of Horticulture, National Chung Hsing Univ., 250 Kuokuang Road, Taichung, Taiwan, Taiwan, 40227

Based on the theories of psychophysiology and biofeedback, this study explores the relationships between different types of landscape settings and respondents psychological (landscape experiences) and physical responses (Electroencephalograph, EEG; Electromyography, EMG; Blood Volume Pulse, BVP). Many studies have depicted the benefits of landscape environments on human psychological and physical effects based on the theory of landscape benefit on stress release. However, the effect of various characteristics of the landscape settings is still unknown. Therefore, this study proposed the following three research purposes: to identify the effect of different characteristics of the landscape settings on respondents psychological responses; to identify the effect of different characteristics of the landscape settings on respondents physical responses; and, to identify the relationship between respondents psychological responses and physical responses induced by different landscape settings. Biofeedback instruments (Procomp+ /Biograph V2.0 biofeedback System, Thought Technology Ltd.) were used to record respondents physical responses. The Likert attitude scale adopted from the recreational experience theories was applied to collect the information of respondents' psychological responses of different landscape settings. The testing items were adapted from the anxiety scale developed by Spielberger (1983). One hundred and sixty students were tested with the images of different landscape settings of urban landscapes and rural landscapes, which is based on the theory of place attachment. The information of gender, culture background, and personal health conditions were collected and compared during the analysis. The result shows that respondents' psychological responses are highly related to the characteristics of landscape settings. The different characteristics of landscape settings affect respondents' physical responses. The natural characteristic of the landscape has increased the alpha wave of the EEG. The resort landscape settings have relaxed the EMG's and lower the BVP's responses.

**1500–1520**

**S07–0–35**

### **THE MEANING OF GARDENS AND GARDENING IN DAILY LIFE: A COMPARISON BETWEEN GARDENERS WITH SERIOUS HEALTH PROBLEMS AND HEALTHY PARTICIPANTS**

Anita Unruh\*

5869 Univ. Ave., School of Occupational Therapy, Dalhousie Univ., Halifax, Nova Scotia, Canada, B3H 3J5

This paper will present the outcomes of a 3-year qualitative study in which 40

women and men were interviewed about the meaning of gardening in daily life. The interviews were face-to-face and 1 to-3 hours in length. The questions were semi-structured and used as conversational prompt to explore interest in gardening, relationship between gardening, health and well-being, and frustrations with gardening. Most participants were interviewed once in each season, that is, four times per year. The gardens were located throughout Nova Scotia, 2/3 in rural locations. About half of the participants were diagnosed with cancer or other serious health condition. Comparisons were drawn between the meaning of gardening for people with serious health problems VS healthy participants. The data analysis used a constant comparative approach based on a construction of emergent sets of themes from the interview transcripts. This study revealed the important benefits of gardening on emotional, physical, spiritual and social well-being. The Social Sciences and Humanities Research Council of Canada 1998–2001 funded the project.

**1520–1540**

**S07–0–36**

### **PLANTS IN HEALTH CARE ENVIRONMENTS: EXPERIENCES OF THE NURSING PERSONNEL IN HOMES FOR PEOPLE WITH DEMENTIA**

Erja Rappe\*, Leena Lindén

Dept. of Applied Biology, P.O. Box 27, C-house, Helsinki, Univ. of Helsinki, Finland, FIN-00014

This study documents nursing personnel's observations regarding plants in homes for people with dementia. Based on a survey of 65 nursing staff from ten homes it could be concluded that both indoor and outdoor plants were used as tools in the care work and had a beneficial impact on the environment of the homes. Plants created a lush, homelike atmosphere and improved the quality of indoor air, according to the survey respondents. They reported that the contribution of the plants to the psychological and social well-being of the residents was prominent. Their reported observations included plants stimulated residents' senses, created positive emotions, and offered rewarding activities. The main problems identified were residents' eating of plants and soil and tearing of plants. The residents were interested especially in colorful plants and berries. Although the nursing personnel considered plants and gardening to be therapeutic to the residents, they often disapproved of residents' actions regarding the plants. Staff might regard it as negative if the residents moved plants from place to place, picked flowers, or watered plants. The nursing personnel interested in gardening reported using horticulture in care work more than those not interested in gardening. Education about plants and growing methods adapted for the elderly was felt to be necessary for the personnel. This study provides evidence that plants do not cause any major problems in care environment but can contribute significantly to the well-being of individuals with dementia.

**1540–1600**

**S07–0–37**

### **CARRY ON GARDENING: AN INTERNATIONAL RESOURCE FOR LIFE QUALITY OF OLDER AND DISABLED GARDENERS**

T. Spurgeon, Bill Simpson\*

Thrive The Geoffrey Udall Centre, Beech Hill Reading, Beech Hill Reading, UK, RG7 2AT

Thrive is the UK national charity promoting the use of horticulture and gardening for training and employment, therapy and health. Thrive has been working for 24 years and now runs a range of services to older and disabled gardeners and to the 1500 therapeutic horticulture projects. This paper examines the needs and challenges faced by older and disabled gardeners in the UK and looks at ways in which supporting their gardening needs allows them to live lives of choice. There are more than 6 million disabled people in the UK and 16% of the population is 65 years of age and over. Private gardens make up around 3% of England and Wales—about 1 million acres. Despite all this, the most commonly quoted reason that older people move into residential care is their inability to cope with their garden. When people do move, gardening activity reduces massively. The health benefits of gardening are well chronicled—even at Government level. The solutions to enable people to remain in their own homes include providing them with the information and support to manage their gardens. CarryonGardening is a scheme that harnesses the use of the Internet and allies it to practical support at the local level that results in improvements in life quality and well-being of many older and disabled people in the UK.



**1600-1620****S07-O-38****AN ANALYSIS OF THE FIRST TEN YEARS OF THE PEOPLE-PLANT COUNCIL**

Diane Relf\*, Candice A. Shoemaker, Eisuke Matsuo

Dept. of Horticulture, 410 Saunder Hall, Virginia Tech Blacksburg, VA 24061-0327 USA

The People-Plant Council (PPC) was formed as a result of the interdisciplinary symposium "The role of Horticulture in Human Well-being and Social Development," held in 1990 in Washington, D.C. Since then a biennial multi-day symposium hosted by a university or botanic garden has been held to provide a forum on people-plant topics for researchers and practitioners in this interdisciplinary science. The mission of the PPC is to encourage and facilitate scientific research to document and communicate the effect that plants and horticulture have on human well-being and improved life-quality and to facilitate the integration of this type of research into the mission of other professional associations. Its goal is to increase among all professional horticultural associations the inclusion of human issues in horticultural research as a segment of their mission. The PPC is not a membership organization, rather a link or affiliation between organizations, which facilitates and promotes communication, research, and public awareness on the psychological, sociological, physiological, economic, and environmental effects of plants on people. How effective has the PPC, the biennial people plant symposia, and the efforts of linked professional in this area been toward achieving these goals in their first ten years? This paper will review the past ten years of the PPC and assess its impact on the field of people-plant interactions nationally and internationally.

**1620-1640****S07-O-38-A****TO BE ANNOUNCED****1640-1700****S07-O-38-B****TO BE ANNOUNCED****Friday · August 16****0800-0900****S07-P-39****THE RELATIVE INFLUENCE OF CHILDHOOD ACTIVITIES AND DEMOGRAPHICS ON ADULT APPRECIATION FOR THE ROLE OF TREES IN HUMAN WELL-BEING**

Virginia I. Lohr\*, Caroline H. Pearson-Mims

Dept. of Hort. and Lands. Arch., Box 6414, Washington State Univ., Pullman, WA 99164-6414 USA

Research has documented a strong relationship between childhood experiences and adult attitudes. Positive experiences with nature during childhood are strongly associated with sensitivity of and awareness toward nature in adults. We have previously reported a number of these interactions, such as the positive association of caring for plants as a child with the adult perception that trees should be planted in cities to reduce smog and dust. Many variables, including demographics, childhood activities, and childhood surroundings, influence adults' appreciation for trees. In this presentation, we will compare the relative importance of such variables. A nationwide survey of 2,000 adults in major metropolitan areas in the United States was conducted. Participants were surveyed to assess the scope of their childhood experiences with nature, their current attitudes toward trees in urban areas, and their demographic backgrounds. They also were asked about their understanding and appreciation of urban trees. They were asked specifically about the role of trees in improving well-being by helping people in cities feel calmer. Most respondents expressed positive attitudes toward trees in cities, regardless of childhood exposure to plants or demographic background. While a large majority agreed or strongly agreed, for example, that trees in cities helped people feel calmer, their responses were influenced by demographic factors, such as age, and childhood influences, such as picking flowers, fruits, or vegetables. The relative influence of a range of these demographic and childhood variables on adult attitudes was examined. Among

the most influential were childhood activities. Information gained from this research may be applied in educational strategies to help increase the efficiency of programs designed to teach children about trees, gardening, and nature, and may allow us to tailor these programs to foster greater appreciation for trees and plants in adults.

**0800-0900****S07-P-40****THE INFLUENCES OF LANDSCAPE ECOLOGY STRUCTURE ON RESIDENCE'S PERCEPTION**

Chun-Yen Chang\*

Dept. of Horticulture, National Chung Hsing Univ., 250 Kuokuang Road, Taichung, Taiwan, Taiwan, 40227

This study explores the relationship between residences' perceptions of their living environment and the landscape ecology structures. Residences' satisfaction with their living environment has been popularly used to represent an index of the quality of the planning and design of a community. The purpose of this survey-study is to test the theory of landscape structure of landscape ecology that relates the landscape structures to the environmental quality from an ecological perspective. The Aero-photography Map (1/5000) were used to digitize the landscape structures of the testing sites into GIS systems. For each kind of land use, the indexes of the landscape structures like the patch density, patch shape, size of patches, the arrangement of the corridors, edge effects, and the networks were defined as the independent variables. The software FRAGSTATS was used to quantify the indexes of the landscape structures. The dependent variables were defined generally as residences' perceptions toward their living environment, which includes the perception of nature, perception of crowding, perception of air quality, safety, and the perception of the relationships among residences. The result shows that the landscape ecology structure factors have significant relationships with residences' perception. The edge and shape effect of vegetated areas have significant relationship with residences' perception of natural and air quality. Further studies related to the urban and the rural areas of the various kinds of land use patterns, especially in the suburban areas of Taiwan are suggested.

**0800-0900****S07-P-41****THE ESSENCE OF A GARDENER: MOTIVATIONS AND CONSTRAINTS INVOLVED IN GARDENING**

Tammy Kohlleppe\*, Dennis McConnell, Steve Jacob

Univ. of Florida, Environmental Horticulture Dept., P.O. Box 110670, Gainesville, FL 32611-0670 USA

Gardening is America's number one hobby and the horticulture industry benefits as more people pursue gardening as a leisure activity. Gardening has long been thought to enhance a person's quality of life especially health and well-being. Little research within horticulture or other disciplines has focused on determining a basic understanding of the gardener and the motivations and constraints that bring people to and take people away from gardening, respectively. Past research indicates that the general populace can be segmented into gardeners and non-gardeners while gardeners can be segmented into discrete categories along a specialization continuum reflecting differing levels of participation in gardening from beginner to expert. This study explores the motivations, physiological and psychological factors that direct an individual to act a certain way, and constraints, factors that limit or inhibit participation in an activity, associated with participation and specialization in gardening. Motivations and constraints play a role in a person's decision to garden. A survey was administered to Florida residents to assess motivations and constraints to gardening and specializing in gardening. Findings from this study provide insight into why people do and do not garden and why gardeners do and do not specialize in gardening.

**0800-0900****S07-P-42****HOME GARDENERS VALUE STRESS REDUCTION AND INTERACTION WITH NATURE**

Chris Catanzaro\*, Enefiok Ekanem

Cooperative Agric. Research Program, Tennessee State Univ., 3500 John Merritt Blvd., Nashville, TN 37209 USA

A written survey instrument was developed in 2001 to collect information from home gardeners on the types of plants they grow, their purchasing habits,

the types of gardening activities in which they participate and enjoy, and their perceptions of how important various aspects of gardening are to them. The survey was conducted at two events during late summer: the Tennessee Green Industries Field Day (McMinnville), and the Tennessee State Fair (Nashville). Eighty nine percent of respondents grew flowering annuals in their home gardens, while 69%–74% reported growing herbaceous perennials, shrubs, trees, and edible crop plants. Among those who reported purchases during the previous year, average expenditures were highest for trees (\$95), with about half that amount spent for each of the following: annuals, perennials, and shrubs. With regard to specific activities, 86% or more of home gardeners did: planting, watering, weed control, pruning, mulching/composting, and mowing. Fewer than one-half participated in water gardening or hardscaping. Gardeners reported weed control and planting as the most time consuming activities, and planting was chosen most frequently as the most enjoyable activity. The statement "Home gardens provide a reduction in feelings of stress" was rated as very important by respondents. Respondents also indicated that home gardens provide interaction with nature rather than control of nature, and provide physical and physiological benefits, restorative experiences, and an opportunity for self-expression. Less important to home gardeners surveyed were aspects of cultural or ethnic representation, symbolism, and economic benefits. Results suggest that although gardeners select from a wide range of plant materials and activities in an individualistic manner, the interaction with nature in a nurturing environment provides a number of benefits important to them including mental well-being.

**0800-0900**

**S07-P-43**

**EXPLORING THE IMPACT OF OUTDOOR ENVIRONMENTAL ACTIVITIES ON CHILDREN'S ATTITUDES TOWARD SCIENCE AND MATH USING COMPUTER-AIDED ANALYSIS OF QUALITATIVE TEXT DATA**

T.M. Waliczek\*<sup>1</sup>, J.M. Zajicek<sup>2</sup>

<sup>1</sup>Dept. of Agriculture, Southwest Texas State Univ., San Marcos, TX 78666; <sup>2</sup>Dept. of Horticultural Sciences, Texas A&M Univ., College Station, TX 77843-2133

An understanding of math and science is critical in today's society, which is increasingly technology driven. Much attention has been given to increasing science and math literacy in youth, yet it remains low, and research indicates that students consider these subjects boring and disconnected from their daily lives. Active, hands-on learning opportunities, available through gardening experiences, enable students to experience science and math and construct meaning for themselves, rather than just reading and memorizing it. The main objective of this research was to investigate the impact of an outdoor environmental program, Math and Science in the Outdoor Classroom, an off-campus nature program, on children's attitudes and perceptions toward math and science. Students participated in 1-day programs focusing on topics such as "water", "insects", "soil" and "weather". Teachers from five schools volunteered about 175 second through sixth graders to participate in the program and study. Surveys were administered to students, teachers and volunteers after completion of the program. Interview data was analyzed using QSR NUD\*IST computer-assisted qualitative data analysis system to look for trends and/or differences between groups that participated in different exercises. The interview data was evaluated using Bloom's taxonomy of learning as a theoretical framework. According to Bloom, students progress in learning along a hierarchy from the lowest level of competence, knowledge, to the highest levels of evaluation and synthesis. Interview answers indicated that students participating in Math and Science in the Outdoor Classroom were learning on all levels within Bloom's taxonomy. Responses also indicated that students enjoyed learning the subject matter in this type of experiential learning situation.

**0800-0900**

**S07-P-44**

**EXPANDING VIRGINIA COOPERATIVE EXTENSION'S 4-H HORTICULTURE PROGRAMMING**

Elizabeth Phibbs\*, Diane Relf, Joe Hunnings, Kathleen Jamison

Virginia Tech, Dept. of Horticulture, 407 Saunders Hall, Blacksburg, VA, USA, 24061-0327

In order to ensure the long-term growth and development of Virginia Cooperative Extension's 4-H youth horticulture projects, a needs assessment was completed. 4-H agents, Environmental Horticulture agents, and Master Gardener Coordinators were surveyed to determine the current status of 4-H pro-

grams and projects, target areas for new programming, and identify available resources and resource needs. Special attention was placed on the ability of programs and projects to fulfill SOL's, develop life skills, and build character. Interviews were conducted with Virginia Cooperative Extension specialists, teachers, and arboreta and botanic garden staff to establish new directions for partnership in programming. A web search investigated 4-H gardening programs and projects across the country.

**0800-0900**

**S07-P-45**

**PLANTING THE SEEDS OF CHANGE: THE IMPACT OF A YOUTH GARDENING PROGRAM ON TEACHERS, PARENTS, AND STUDENTS**

Sonja Skelly<sup>1</sup>, Lelia Scott Kelly\*<sup>2</sup>

<sup>1</sup>Mississippi State Univ. Dept. Plant and Soil Sciences Mississippi State, MS 39762; <sup>2</sup>Mississippi State Univ. Northeast District Office Verona, MS 38879

Teachers and researchers have found youth gardening to be an effective way to positively impact youth, parents, teachers, and communities. In a pilot study conducted by the Mississippi State Univ. Extension Service, researchers surveyed teachers, parents, and students participating in the 4-H Junior Master Gardener(SM) (JMG) youth gardening program. Findings show that teachers believe the JMG program can improve student leadership, responsibility, cooperation, communication, environmental awareness, interest in plants and gardening and academic achievement. Analyses of parent surveys shows that parents believe the JMG program can increase students' interest in plants and gardening, increase students' consumption of fruits and vegetables, encourage students to garden at home, and increase the amount of money parents spend on gardening products. Analyses of student survey responses indicate that students participating in the JMG program have positive attitudes toward the environment, science, and fruits and vegetables. The JMG program is offered statewide and a more extensive study is being conducted. This presentation will cover the methods used to implement the program statewide including: recruiting and using volunteers, working with schools and 4-H groups, and using the Cooperative Extension Service. Additionally, evaluation methods will be addressed. The results and implications of the pilot and expanded study will also be discussed.

**0800-0900**

**S07-P-46**

**FIELD TRIPS TO PUBLIC GARDENS: THE IMPACT OF PRE- AND POST-VISIT ACTIVITIES ON ELEMENTARY STUDENT LEARNING**

Sarah Jane Gross\*, Cynthia Haynes

Iowa State Univ., 4026 Adams Street, Sioux City, IA 51108 USA

Many public gardens offer tours to schoolchildren. Informal educators argue that preparing students for a field trip by providing pre- and post-visit activities can positively impact learning. However, there is little research that supports the efficacy of pre- and post-visit activities on learning at public gardens. Therefore, the objective of this research was to determine the impact of pre- and post-visit activities on learning after a field trip to a public garden. This quasi-experimental study's population included four fifth grade classrooms assigned to one of two treatments: 1) a field trip only (control); and 2) a field trip with pre- and post-visit activities (treatment). A post-trip assessment consisted of open-ended questions and was scored quantitatively. Differences between treatment groups were analyzed using a *t* test. There were no significant differences in post-test scores between treatment groups. Although pre- and post-visit activities have been found to prepare students for a field trip and to tie the field trip to classroom learning, this case study did not show an increase in learning outcomes. A limitation of this research was the small number of students involved thus it should be conducted again with a larger population. However, the use of an open-ended questionnaire may have implications for assessing student learning as opposed to close-ended questionnaires. Open-ended questionnaires allow researchers, teachers, and garden staff to assess what students learn while on field trips to informal settings such as public gardens. This research has implications for informal education settings such as public gardens, botanical centers and arboreta that seek to measure visitor learning.

**0800-0900****S07-P-47****COSTS AND BENEFITS OF VOLUNTEERING AT A UNIVERSITY-AFFILIATED PUBLIC GARDEN**

Cynthia Haynes\*, Cary Trexler

Dept. of Horticulture, Iowa State Univ., Rm. 106 Horticulture Hall, Ames, IA 50011 USA

University-affiliated gardens are important institutions that enhance teaching, research, and outreach missions of the university. Attracting and retaining volunteers, a serious concern for many institutions, is important for the success of any public garden, including those associated with universities. The objective of this study was to determine the perceptions and needs of volunteers at a university-affiliated public garden. Using a focus group format, participant responses were analyzed for costs and benefits to the volunteers and the university. Benefits were categorized into three groups; material, purposive and solidarity. Material benefits are tangible rewards that can be equated with monetary or resource gain. Purposive benefits are rewards derived from achieving a goal or mission. Solidarity benefits are social rewards that net recognition from being a part of a group. Findings indicate that volunteer motivation shifted from purposive to solidarity benefits as the garden grew and expanded. Concomitantly, the goals of the university-affiliated garden shifted from purposive to material benefits. The results of this study confirmed findings by researchers working with other groups of volunteers that: 1) people volunteer at university gardens to garner specific benefits for their participation; and 2) the needs of volunteers may fluctuate over time, thereby necessitating that the public garden adjust reward systems accordingly. The university garden management must develop and maintain an efficient support system to help volunteers meet their desire for helping the organization. More specifically, the university garden needs better training programs, a more flexible volunteer work schedule, and more recognition ceremonies to retain volunteers. This study has implications for any institution that utilizes volunteer support to accomplish its mission.

**0800-0900****S07-P-48****EVALUATION OF MASTER GARDENER TRAINING IN IOWA**

Cynthia Haynes\*, Donald Lewis, James Romer

Dept. of Horticulture, Iowa State Univ., Rm. 106 Horticulture Hall, Ames, IA 50011 USA

Universities spend many hours training and educating Master Gardener interns to assist the outreach functions of the university. These interns go on to assist consumers of all ages in their communities through a variety of tasks. The purpose of this research was to improve the training program by determining the perceptions and prior horticulture knowledge of Master Gardener interns at Iowa State Univ. (ISU). A computer graded multiple-choice questionnaire was given to interns prior to and after completing the forty hours of training conducted by ISU Extension staff. Analysis of learning styles, gardening experience, expectations, and satisfaction with the program were evaluated. Findings indicate that the majority of Master Gardener interns were experienced in at least one area of gardening, were highly motivated to learn in a variety of styles, and were at least somewhat satisfied with the training program. The information gathered from this study can be used by extension staff to more effectively train, coordinate, and supervise the expertise of Master Gardeners in their community.

**0800-0900****S07-P-49****FRESH PRODUCE FOOD SAFETY TRAINING PROGRAM FOR THE SOUTHEASTERN US**Dennis J. Osborne<sup>1</sup>, Douglas C. Sanders\*<sup>2</sup>, Donn R. Ward<sup>3</sup>, James R. Rushing<sup>4</sup>, William Hurst<sup>5</sup>

<sup>1</sup>Horticultural Science Dept., NCSU Room 112 Kilgore Hall Campus Box 7609 Raleigh, NC 27695-7609 USA; <sup>2</sup>Horticultural Science Dept., NCSU Room 230, Kilgore Hall Campus Box 7609 Raleigh, NC 27695-7609 USA; <sup>3</sup>Food Science Dept., NCSU Room 100 Schaub Hall Campus Box 7624 Raleigh, NC 27695-7624 USA; <sup>4</sup>Clemson Univ. REC 2865 Savannah Highway Charleston, SC 29414-5333 USA; <sup>5</sup>125 Food Science Building Extension Food Science Univ. of Georgia Athens, GA 38062 USA

In 2000-01, a consortium of SE states cooperated to introduce Good Agri-

cultural Practices (GAP) to southern produce growers, packers and consumers. The group's focus on potential food handling problems uncovered a heretofore unknown, high level of regional interest in developing a food safety assurance program for the region's fresh produce. The southern US produce industry operates differently than the large produce industries of the west, midwestern and northeastern US. Except for some notable exceptions in Florida and Texas, southern producers are typically grower-packers. These entities usually are seasonal, have their own packinghouse operation, are small-scale in that they pick what they grow and pack and often use migrant and seasonal labor. In the southern produce industry, modern worker training, sanitary practice and facilities and supervisory expertise are either somewhat limited or completely lacking. Also, the use of seasonal and migrant labor dictates the use of Spanish language interpreters and training—in the face of a marked shortage of either. Until very recently, no specific training documents or training programs addressing this need have been prepared. While following US Food and Drug Administration's Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables and other existing related materials, the consortium produced materials and a training program specifically directed to the conditions and the commodities in the southeastern US. Consortium materials have been widely adopted. The consortium will continue to pool expertise and training as it evolves other training materials based on its current effort. That current effort will be reviewed in this paper.

**0800-0900****S07-P-50****IMPROVING THE HORTICULTURAL WORKPLACE: FRINGE BENEFIT OPTIONS IN GERMANY**V. Bitsch\*<sup>1</sup>, U. Bromm<sup>2</sup>, C. Schalich<sup>2</sup>

<sup>1</sup>Dept. of Agricultural Economics, Michigan State Univ., Agriculture Hall, East Lansing, MI 48824-1039 USA; <sup>2</sup>Rehsenerstr. 3, Hohnhorst, D-31559, Germany

Difficulties in attracting, motivating, and retaining qualified employees call for improvement of workplaces in horticulture. Rising input costs combined with stagnating output prices constrain these endeavors. Therefore, cost neutral measures are preferential. One solution, that has been discussed by the project group 'Horticulture 2000' in Germany (Bitsch/Ludwig, 1992), were more flexible fringe benefit plans, such as have been introduced by some industrial enterprises. The objective of the study was to explore the possibilities for and interest in these innovative arrangements by both employers and employees. Structured face-to-face interviews and on-site simulations of fringe benefit choices were undertaken in 39 ornamental enterprises in Lower Saxony in Germany. As innovative work-time and benefit systems are more common in retail than in producing industries and the objective of the study was to explore their chances for expansion, only enterprises with a minimum of 50% production, and at least two fulltime non-family member employees in ornamental production were included. 38 employers and 67 employees participated in the study. Results confirm the hypothesis that there is a large potential and demand for change in horticultural workplaces. Surprisingly few employees are well informed about the fringe benefits they receive. But even the employers are not fully aware of all the benefits they offer their employees, and in most cases are not able to estimate the respective costs. More than 60% of the employees showed interest in different benefits than they actually received, even more made a different choice in the simulation. Nearly all the employers are also open to change, and more than half of them will consider offering optional benefit plans. Hence, individualized fringe benefits can be considered as an opportunity for low cost improvement of horticultural workplaces.

**0800-0900****S07-P-51****RESEARCH ON THE DROUGHT-RESISTANT CAPABILITIES OF 47 LIANES FOR QUARRY RECLAMATION**Yiyang Xu\*<sup>1</sup>, Jiangli Lei<sup>2</sup>, Liangsheng Xie<sup>3</sup>, Ruiying Liu<sup>1</sup>

<sup>1</sup>Shenzhen Landscape Science Research Center (Dongmen north road No. 42), Shenzhen, Guangdong, China 518003; <sup>2</sup>ShenZhen Donghu Park, Shenzhen, Guangdong, China 518003; <sup>3</sup>ShenZhen Four Season Flowers Co. Ltd, Shangbu north road No.2006 Shenzhen, Guangdong, China 518029

In order to apply liane to greening abandoned quarry slopes, the drought-resistant capabilities of the selected liane varieties were tested as the scientific foundation of sound deployment. This research uses water physiological indexes of liane, including temporary wilting ratio, permanent wilting ratio, leaflet water-holding ratio, so that the drought-resistant capabilities of the test varieties can be

understood. The results show that the hundred-mark system synthetic evaluation method at the base of temporary wilting ratio and leaflet water-holding ratio can accurately reflect the drought-resistant capabilities of the lianes, because of the results coinciding with that of the observation. The following lianes were identified as drought tolerant and thus useful in land reclamation efforts: *Pereskia aculeata* Mill., *Parthenocissus heterophylla* (Bl.) Merr., *Macfadyena unguis-cati* (L.) A., *Bauhinia corymbosa* Roxb., *Ficus pumila* L., *Thunbergia grandiflora* Roxb., *Cryptolepis sinensis* Merr., *Ficus tikoua* Bureau, *Tetrastigma obtectum* pl., *Tetrastigma jinxiuense* C.L.Li., *Tetrastigma caudatum* Merr.-et chun, *Ampelopsis cantoniensis* PL., *Ampelopsisheterophylla* var. *kulingensis* C.L.Li., *Pueraria montana* Merr.

0800-0900

S07-P-52

#### USING WILD AND CULTIVATED PLANTS TO REMOVE POLLUTANTS IN SOILS CONTAMINATED BY THE TOXIC SPILL OF THE AZNALCÓLLAR MINE (SEVILLE, SOUTHERN SPAIN)

Antonio De Haro<sup>\*1</sup>, Deni Velez<sup>2</sup>, Rosa Montoro<sup>2</sup>, Rafael Font<sup>1</sup>, Mercedes Del Rio<sup>1</sup>  
<sup>1</sup>Instituto de Agricultura Sostenible, C.S.I.C. Alameda del Obispo s/n 14080 Córdoba, Spain; <sup>2</sup>Instituto de Tecnología de Alimentos, C.S.I.C. Burjassot, Valencia, Spain

In the proximity of a main wildlife reserve known as the Doñana National Park (southern Spain), the collapse of a dam in a pool containing pyritic slurry and waste toxic water from the mine activities, led to the contamination of the Guadiamar river and thousand of hectares of adjacent agricultural exploitations. The sludge was removed with machine tools but the soils of some areas have remained polluted with heavy metals such as Pb, Cu, Zn, Cd, Tl, Sb, and metalloids as As. In order to recuperate these affected areas by using plants (phytoremediation) as an alternative to the engineering based methods, different approaches are being used: The results obtained in the following experiments will be discussed. 1) Periodical surveys of the wild plants able to grow in the contaminated soils, and identification of the metal tolerant and metal accumulator species, with special attention to arsenic accumulator plants. 2) Field trials of cultivated plants such as Indian mustard (*Brassica juncea*) and Ethiopian mustard (*Brassica carinata*) performed on the polluted soils. These species have been selected because they are well adapted to mediterranean climate, produce high biomass, and can accumulate moderate levels of heavy metals. 3) Experiments with selected genotypes of wild and cultivated plants carried out to study the response to different levels of heavy metals and arsenic.

0800-0900

S07-P-53

#### REMOVAL EFFICIENCY OF INDOOR AIR POLLUTANT GASES BY ORIENTAL ORCHIDS

S.W. Han\*, J.S. Lee

Dept. of Horticultural Science, Seoul Women's Univ., Nowon-Gu Gongreung-Dong, Seoul, Seoul, Korea, 139-774

Oriental orchids are the representative plants grown by Koreans in daily surroundings. Moreover they are one of the most popular plants in Eastern Asia due to attractive leaves and fragrant, showy flowers. We conducted laboratory tests with 4 species of Oriental orchids to validate their ability to remove various air pollutants, which were connected with carbon dioxide (CO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ammonia (NH<sub>3</sub>), formaldehyde (HCHO), benzene (C<sub>6</sub>H<sub>6</sub>), and trichloroethylene (TCE; C<sub>2</sub>HCl<sub>3</sub>) from indoor environment. Oriental orchids were identified as effective plants to remove certain indoor pollutant gases. *Cymbidium rubrigemmum* was a useful plant in removing wide range of pollutant gases including 2.66 mg·cm<sup>-2</sup>·min<sup>-1</sup> of CO<sub>2</sub>, 155.07 mg·cm<sup>-2</sup> of NO<sub>2</sub>, 86.90 mg·cm<sup>-2</sup> of HCHO, and 230.84 mg·cm<sup>-2</sup> of C<sub>6</sub>H<sub>6</sub>. Ammonia was removed from air environment by Oriental orchids especially *C. vivesence*. *Cymbidium sinense* presented significantly greater ability to remove TCE compared with other kinds of orchids. Gases trapped in soil are more rapidly biodegraded by microorganisms when in the presence of plant root. Experiments conducted to compare the amount of removal of air pollutants in sealed and unsealed pot condition indicated that the Oriental orchids had higher ability to remove ammonia and benzene in unsealed pot compared with sealed one. It was also founded that the gas removal rate showed significantly high correlation with physiological

variables such as photosynthetic rate, stomatal conductance, transpiration, and intercellular CO<sub>2</sub> concentration.

0800-0900

S07-P-54

#### HONEYBEES AS AN AID IN IMPROVING LABOUR CONDITIONS IN SWEET PEPPER GREENHOUSES: REDUCTION OF POLLEN ALLERGY

Sjef van der Steen<sup>1</sup>, Tjeerd Blacquire<sup>1</sup>, Rien van der Maas<sup>\*2</sup>, Nicolette de Jong, Hans de Groot

<sup>1</sup>Applied Plant Research, Bee Research Unit, Ambrosiusweg 1, 5081 NV Hilvarenbeek The Netherlands; <sup>2</sup>Applied Plant Research, Fruit Research Unit, P.O. Box 200, 6670 AE Zetten, The Netherlands

Sweet pepper is the most important greenhouse vegetable crop nowadays in the Netherlands. It is grown on an area of 10,000 hectares, and about 8,000 people are working in these greenhouses. One third of these workers sooner or later develops an allergy to the sweet pepper pollen. The symptoms range from itching, blocking of the nose as well as a snivelling nose, to asthma. The pollen falls from the flowers when the plants are shaken, which occurs when people are cutting fruits or when they prune or twine the plants. In a pilot study, financed by the Product Board for Horticulture (PT), a number of greenhouses in which honeybee colonies were introduced were compared with greenhouses without honeybees. In the greenhouses with honeybees hardly any pollen was present on the anthers of the flowers, since it was collected by the honeybees as a food for their larvae. In flowers of plants in greenhouses without honeybees, pollen was present most of the time. The symptoms of allergic workers in the greenhouses were significantly reduced by the presence of honeybees, as was deduced from questionnaires in which the workers were asked to mark the intensity of the symptoms during the past week on a Visual Analogue Scale. The possible additional beneficial impacts of the application of honeybees on a larger scale needs research, as well as answering the question of a possible prevention by honeybees of this occupational allergy of horticulturists working with sweet bell pepper. The required or optimal number of bee colonies per area greenhouse will be studied this year.

0800-0900

S07-P-55

#### AN EVALUATION OF FLOATING DUSTS AND MOLDS IN COMMERCIAL GREENHOUSES

Limi Okushima<sup>\*1</sup>, Masahisa Ishii<sup>1</sup>, Sadanori Sase<sup>1</sup>, Atsuo Ikeguchi<sup>2</sup>, Kenichi Komaba<sup>3</sup>

<sup>1</sup>National Institute for Rural Engineering, 2-1-6 Kannondai, Tsukuba, Ibaraki, Japan, 305-8609; <sup>2</sup>National Agricultural Research Organization 3-1-1 Kannondai, Tsukuba, Ibaraki 305-8517, Japan; <sup>3</sup>Haga-Tochigi Agriculture Promotion Office 1568 Tamachi, Mooka, Tochigi 321-4325, Japan

Air quality in greenhouse impacts growers' health. Floating dusts and molds, which are important negative factors for air quality in greenhouses, were investigated in actual conditions. Air was sampled from 10:00 through 14:00 from August 2000 to July 2001 in three types of tomato production greenhouses: a Venlo-type and two wider multi-span greenhouses, one of which was hydroponic culture and the other soil culture. Using an optical particle counter, 2 L of air was drawn for 2 min and the number of dust particles greater than 0.3 μm in diameter was counted. Then 420 L of air was drawn in 30 min and the molds in the air were cultivated at 30 C for 48 h. The number of mold colonies was counted. The number of dust particles with more than 1 micro m in diameter was stable at about 1,000 particles per L. The colony number of floating mold was about 200 particles per m<sup>3</sup>. The order of the number of dust particles and molds was almost same as in the open field around the greenhouses. The order of dust particles with more than 0.3 μm in diameter in greenhouses was 100,000 particles per L. The number was significantly affected by the airflow through the ventilator openings. It suggests that air quality in greenhouse was affected strongly by the outside air quality. In the Venlo greenhouse in the winter, the number of mold species was less than in open field, although the number of mold colonies was almost same as open field. It is considered that the mode of molds living in the greenhouse was different from that in the open field. In the multi-span greenhouses in the summer, the mold species were not different from in open field. The crop condition in the greenhouses and the weather

condition in the surroundings also affected the species of mold.

**0800-0900**

**S07-P-56**

**ROLE OF PEEPAL TREE IN DIFFERENT CULTURES THROUGHOUT HISTORY INCLUDING ART, LANGUAGE AND RELIGION**

H.P. Mohan<sup>1</sup>, S. Narayanaswamy<sup>2</sup>, S. Sridhar<sup>3</sup>

<sup>1</sup>Hassan District Co-operation Central Bank, Hassan, Karnataka, India; <sup>2</sup>Garden Dept., Bangalore Univ., Bangalore, Karnataka, India; <sup>3</sup>Institute for Natural Resources Conversation, Education, Research and Training (INCERT), Seshadripuram, Bangalore, India

This study confirmed the Peepal (*Ficus religiosa*) as an important social or cultural tree. The Peepal tree has tremendous impact on social life of people of all castes, creeds, communities, cultures and religions. The tree itself evokes history as it lives for long periods within which two to three generations of people pass. The tree is interwoven in the social web of people. It signifies culture as people of Bangalore worship it, adore it and revere it. The Peepal is the sacred tree of "Hindus" from time immemorial, where as the Buddhists worship it as a tree of enlightenment as Buddha received enlightenment under a Peepal tree in 6th Century B.C. The Peepal tree is a "tree of friendship" as a branch of it was carried as a good will gift to Sri Lanka by Prince Mahendra and Princess Sangamitra, son and daughter of King Ashoka (300 B.C.). Since the spread of Buddhism, the peepal tree has been called Bodivriksha. The Peepal tree is grown with utmost care and reverence. For its better maintenance and health, a mound or platform is normally built around it. Such a mound with a peepal tree at its center is called Aralikkatte. The Peepal is called "Arali" in canarese, a local language. The Peepal tree is equated to god in South India as stone idols of god are consecrated around Aralikkattes. Hence, Aralikkatte is considered auspicious. In South India, the marriage of the Peepal tree is celebrated with pomp and festivities. To the accompaniment of music, the Peepal tree is married to the neem (*Melia azadiracta*) by Hindus with all their might and pleasure. The marriage ritual is very unique and classical event in and around Bangalore.

**0800-0900**

**S07-P-57**

**RECOGNITION OF COLOR NAMES DERIVED FROM PLANT NAMES BY UNDERGRADUATE STUDENTS IN JAPAN**

Kinuko Masuda<sup>\*1</sup>, Matsuo Eisuke<sup>2</sup>

<sup>1</sup>Laboratory of Environmental Planting Design, Division of Materials Diversity Science, Dept. of Diversity and Fractal Science, Chiba Univ., Chiba 271-8510; <sup>2</sup>Laboratory of Applied Plant Science, Division of Applied Plant Science, Dept. of Plant Resources, Faculty of Agriculture, Kyushu Univ., Fukuoka 812-8581

Color is closely related to our life, and we have expressed colors by names of minerals, animals, plants and so on. Since plants have a close relation to our life as foods, drinks, medicines, clothes, dyes, etc., there are so many color names derived from the plant names. Thus, colors derived from plant names are important considerations in People-Plant Relationships. At present, there are 176 color names originated from plant species, comprising of 83 Japanese names and 93 European names in Japan. Most of the original plants are ornamentals, or species used for foods or drinks, and their color names have been mostly adopted from flower or fruit colors. This research was conducted to investigate what colors derived from plant names were recognized by undergraduate students (79 boys and 173 girls). Students consisted of agriculture, education, computer, art and nursing majors. Participants were asked to describe the color names derived from plant names. Only 13 colors, i.e., momo-iro (peach), orenji (orange), sakura (cherry blossom), remon (lemon), bara (rose), sumire (violet), yamabuki (Japanese rose), fuji (wisteria), kuri (chestnut), ai (Japanese indigo plant), daidai (bitter orange), cha (Japanese tea) and mikan (mandarin orange) were described by over 10% of the informants. On the other hand, informants were asked the part of plants from what color names were derived. Students often misunderstood the part of plants from what color names were derived. For example, 83.8% of the participants answered that momo-iro was derived from the fruit color. But the truth is that momo-iro is derived from the flower color in Japan. These results suggested that the colors named after plants species are not always learned in relation to the part of plants, although these plants are very popular in our daily life.

**0800-0900**

**S07-P-58**

**THE MINERAL SPRINGS OF VIRGINIA: VIRGINIA'S LOST HEALING LANDSCAPE**

Brian Katen\*

210 Architecture Annex, Virginia Tech, Blacksburg, Virginia, USA, 24061

In his essay "The 19th Century Rural Landscape: the Courthouse, the Small College, the Mineral Springs, and the Country Store", John Brinkerhoff Jackson stated: "one final southern landscape feature deserves much more study than it has so far received: the watering place or spa or mineral springs." This paper, using period source material including travel accounts, diaries, letters, artist's representations, photographs, and plans, along with analysis of existing springs, presents the nineteenth century mineral springs as a particularly significant yet long neglected "Virginia" landscape that extended far beyond the state's Tidewater towns, and plantations. The mineral springs will be revealed as one of America's earliest healing landscapes, places of convergence and interest to landscape historians, historical landscape architects, preservationists, and contemporary designers. In addition to the spring's waters, the landscape of the mineral springs was central to the spring's restorative and healing qualities. Their distinctive landscape compositions included a modest hotel flanked by cottages or "rows" enclosing a central park-like green space. The larger landscape included channelized streams, spring houses, bath houses, gazebos, bowling alleys, ballrooms, pavilions, ponds, icehouses, privies, walks and gardens. Circuits through the landscape and other outdoors physical activities were an important part of daily regimens prescribed by doctors. Over 80 Virginia mineral springs have been identified. The defining features of a significant number of springs landscapes are intact. Today, in a time of increased interest in heritage landscapes, healing landscapes, and tourism, they are an extraordinary resource for interpretation and rehabilitation.

**0800-0900**

**S07-P-59**

**HORTICULTURE IN THE MEXICAN CULTURE**

Helena Leszczyska-Borys\*

Universidad Popular Autónoma del Estado de Puebla, Escuela de Agronomía, 21 Sur 1103, Col. Santiago, 72160 Puebla, Pue., México

The present customs of adorning the temples with plants have their origin in the cultural development of the ancestors. The ancient inhabitants of Mexico, 62 ethnic groups, have kept their agricultural knowledge along with their beliefs and religious practices. To understand the deep importance of flora in the life of contemporary native communities, it is necessary to go back to the past and thus enrich our vision with the information on the privileged place that flora occupied in prehispanic and colonial Mexico. A variety of codices documents a Mexican history and plant knowledge. Also in the colonial times the elements of flora were widely used in all kinds of artistic creations. In religious art the artist have expressed in different manner their admiration for God. Several temples, churches, open chapels and posa chapels were richly decorated with floral elements. Currently the cultural richness of towns is also manifested through the fiestas. This study documents the use of ornamental plants, fruits, vegetables and seeds in the States of Puebla (Pue.) and Guerrero (Gro.).

**0900-0940**

**S07-O-60**

**HORTICULTURE, WELL-BEING, AND MENTAL HEALTH: FROM INTUITIONS TO EVIDENCE**

Frances E. Kuo\*

Human-Environment Research Lab Univ. of Illinois, 1103 South Dorner Drive Urbana, IL 61801

Can horticulture contribute significantly to human well-being and mental health? Increasing evidence suggests it can. These findings come from scientific studies with diverse populations, including residents of poor inner city neighborhoods, ecological restoration volunteers, and children with Attention Deficit/Hyperactivity Disorder. Moreover, the findings come from studies of diverse outcomes, including lower rates of violent and property crime, lower incidence of aggression, greater ability to cope with poverty, better life functioning, greater life satisfaction, reduced attention deficit symptoms, greater strength of community, and others. This presentation gives an overview of the evidence for horticultural

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contributions to human mental health and well-being, with a particular focus on its implications for children, the poor, and other vulnerable populations.

**0940-1000**

**S07-0-61**

**URBAN HORTICULTURAL ECOLOGY: INTERACTIONS BETWEEN PLANTS, PEOPLE AND THE PHYSICAL ENVIRONMENT**

A. Martin\*, L.B. Stabler

Dept. of Plant Biology, Arizona State Univ., P.O. Box 85287-1601, Tempe, AZ 85287-1601 USA

Growing interest in the ecology of cities is providing a unique opportunity for horticultural scientists to study plant processes in an environmental setting that is foreign to most ecologists. Past studies in urban plant ecology have been limited to inventories and distribution of the plants present or have focused on areas of remnant native vegetation and impacts of urbanization on those remnant patches. Classic ecological pedagogy depicts exotic species as invaders, and human manipulations of the geosurface as disturbance events. The real essence of urban vegetation as a system that has been carefully designed and is intensively managed to serve human interests has been overlooked. While the concepts of human/plant interactions are common and inherent to horticultural research, they may present a difficult obstacle to be overcome for those trained in conventional ecological circles. In conjunction with the Central Arizona Phoenix Long Term Ecological Research initiative, we have approached plant ecological studies in an arid urban system as an interacting triad of plants, people, and the physical environment. People arrange and manage plants in cities for aesthetic as well as practical purposes. Plant viability is predicated on horticultural practices, and the anthropogenic environment in which landscape plants grow can be physiologically stressful. At the same time, the arrangement of plants affects the biophysical environment of the city and the quality of life of the people living there. We propose that a better understanding of urban plant ecology is attained using a landscape horticultural perspective, one that is familiar with the interactions between plants, people, and the physical environment. Understanding the ecology of urban plants might lead to design and management strategies that maximize benefits associated with plants in cities and improve human well being and quality of life.

**1000-1020**

**S07-0-62**

**BENEFITS OF GARDENING TO THE WELL-BEING OF NEW ZEALAND GARDENERS**

Kidd, Judith, Wilmién Brascamp\*

Institute of Natural Resources, Massey Univ., Private Bag 11-222, Palmerston North, Manawatu, New Zealand, 5331

To date limited research has been conducted regarding the benefits of gardening to human well-being other than the long-term health benefits of the physical exercise involved in gardening. The aim of this study is to determine the essential personal characteristics, if any, and the necessary conditions that enable adult New Zealand gardeners to reap the non-physical benefits of the gardening experience that may contribute to enhanced well-being. The study specifically focuses on the factors that influence a person to become involved with gardening, their reasons for gardening, and the conditions necessary in order to experience the joys and benefits of gardening. Additionally we examine the correlation between gardeners' personal qualities and perceived benefits of gardening, and we assess and quantify their self-perceived state of well-being using the Psychological Well-being Index (PWI). Results are based on 376 responses to a countrywide mail-out survey sent to self-selected gardeners who responded to media advertising and publicity. Quantitative analysis and qualitative evaluation of responses was used to construct a set of multidimensional profiles that reflect the range of qualitative determinants necessary for realising the positive effects of gardening. Results reinforce findings of an earlier investigation of New Zealand mid-aged women gardeners that gardening serves a wide range of needs and benefits on many levels, including psychological, emotional, social, and spiritual. The data also provide an understanding of the type of person who engages in gardening and give an overall picture of their motivations for gardening. Finally, the study offers recommendations on how gardening can best be promoted to non-gardeners and to people who have little or no experience with plants or the outdoors, and identifies which indicators are apparent prerequisites in order for someone to find satisfaction and a sense of well-being from gardening.

**1020-1040**

**S07-0-62-A**

**TO BE ANNOUNCED**

**1400-1420**

**S07-0-63**

**SACRED GROVES OF THE CITY: A LOOK AT CONTEMPLATIVE GARDENS IN AUSTRALIA AND NEW ZEALAND**

Ingrid Ennis\*, Judith Kidd

School of Landscape and Plant Scien, UNITEC, Private Bag 92 025, Auckland, n/a, New Zealand, Institute of Natural Resources, Massey Univ., Private Bag 11-222, Palmerston North, Manawatu, New Zealand, 5331

Historically people have maintained many associations with plants in a number of ways including through food provision, rituals, aesthetics, landmarks, memorials, and as seasonal cues. Now increasingly urbanised, many people also use planted and natural environments as a refuge from the stresses of city life. Research and experience from the Northern hemisphere indicate that people associate contemplative or meditative gardens, parks and green spaces in cities with 'better' environments for working and living, and hold the view that work to cultivate this urban vegetation as innately 'healthful' (Ulrich, 1986). This paper describes the range of contemplative or meditative garden projects in New Zealand and Australia, which are an expression of the belief that urban vegetation improves city environments for those that work and live in them. These projects are implemented through local bodies, corporate entities, government agencies (e.g. schools), community groups and individuals. Data were gathered through archive and website searches, site visits, images and interviews with project personnel. Using images, narratives and social history this work documents these projects and their significance to regional cultures and human well-being. Comparisons with work in this field in other countries reveals the unique nature of the connection between plants and people held in this area of the South Pacific.

**1420-1440**

**S07-0-64**

**HORTICULTURAL PRODUCTION IN DEVELOPING CITIES AND PUBLIC HEALTH**

Gebhard B. Lulilo, Edith F. Mwijage\*

Chemistry Dept., Univ. of Dar es salaam, P.O. Box 35061, Dar es salaam, Tanzania

Rapid rural-urban migration and lack of formal employment, especially in developing countries, has forced urban dwellers to engage into horticultural production. City residents make use of available open spaces to grow vegetables as a full or part time activity. Despite economic and social benefits accrued from vegetable production, it is also associated with health and environmental risks. Vegetables are cultivated in soils along roadsides, near industries, etc, where pollution risks is high. Since piped water is inadequate farmers resort to river waters whose quality is uncertain. This paper highlights heavy metal contamination status of the most commonly grown vegetable, *Amaranthus hybridus*, in Dar es Salaam City. Results show that soils of the open spaces had mean metal levels (ppm) as follows: Pb (150-2.71), Cd (0.04-0.46) and Zn (3.70-51.45) and metal levels (ppb) in river waters were: Pb (34.1-285.0), Cd (10.6-209.0) and Zn (19.7-483.3). The vegetable, *Amaranthus hybridus*, was found contaminated with such heavy metals and the extent differed from one location to another. However, mean heavy metal levels in the edible part of the vegetable ranged from 0.52-2.81 ppm for Pb, 0.20-0.34 ppm for Cd and 3.27-3.70 ppm for Zn. The levels of some heavy metals in the vegetables were above the FAO/WHO maximum levels of contaminants in some locations. It seems that soil and water pollution are likely to pose health risks to consumers of vegetables grown within the city limits depending on one's age, eating habit and the amount consumed per day. Therefore, vegetable cultivation in open spaces in Dar es Salaam City should be practiced with health risk consideration for the sake of public health.

**1440-1500**

**S07-0-65**

**URBAN AGRICULTURE IN KIVU: HOW ROOTS HELP POPULATION WITH LOW INCOME IN AFRICAN GREAT LAKES CITIES**

Sylvain Mapatano\*

P.O. Box 274 Cyangu Rwanda, P.O. Box 1914 Bukavu DR Congo

Built in 1900, the town of Bukavu is located in the province of South Kivu, in the East of Democratic Republic of Congo. At the start, it counted about 10,000 inhabitants. For the moment, its population is estimated to be more or less 600,000 inhabitants. From the 1980s, former open spaces, outlying areas and lower lands of the town started being exploited to fill in the food deficit in families and palliate the lack of salary payment and the fall of the purchasing power. The advent of the two successive wars in DRC since 1996, left insecurity pockets in rural areas which used to provide food to urban ones: more than 80% of households with low income get part of their food from agricultural activities in town and in its periphery and more than 75% of the crops sowed are races (roots) and tubers, essentially cassava and sweet potatoes, completed by seasonal sowing of beans. For all these crops, leaves and roots are highly consumed. Women are particularly active in that sector (more than 86%) Unfortunately, farming practices are likely to favour the degradation of the urban environment if no urgent measure is foreseen. That is why thanks to close collaboration with the WFP office in Bukavu, we have undertaken a number of activities which aim at helping cultivators increase their productive capacity (of those crops) on small spaces. The feebleness of spaces available to each household and the high number of family dependants (average of 9 persons per family) justifies the preference given to races (roots) and tubers, of which tuber leaves harvest is often spread over a long period in a year. Today, our efforts aim at :1) facilitating partnership relation between farmers and other social actors; 2) enlightening farmers on the decisions of the administrative authority in terms of protection of the environment and the management of waste; 3) popularising farming techniques in a participative approach; 4) valorising plants with multiple properties in urban gardens; and 5) Developing a network gathering actors of the Eastern Congo towns as well as those in similar context in the neighbouring countries (Rwanda and Uganda).

**1500-1520**

**S07-O-66**

**ORGANIC VEGETABLE GROWING-ATTITUDE OF THE CROATIAN FARMERS (FIELD STUDY RESULTS FOR BJELOVARSKO-BILOGORSKA COUNTY IN CROATIA)**

Zutinic, Djurdica\*, Miroslav Tratnik

Faculty of Agriculture, Institute of Agricultural Economics, Svetosimunska 25, Zagreb, Zagreb, Croatia, 10000

Croatian organic agriculture is lagging considerably behind that in West European countries, although the conditions for this type of production are favorable. Favorable conditions are confirmed by the fact that the mineral fertilizer consumption in Croatian agriculture during the last ten years has been the lowest in Europe, available unpolluted agricultural land is ample, waterstreams are clean, and the like. This year, the Organic Agriculture Act was passed to encourage organic agriculture and production, particularly on the family farms. The last decade in Croatia was a period of considerable increase in rate of the vegetable growing in the open. This production presently occupies 12% of total arable land. The projection from 1998 anticipates that this production will increase by 3 or 4 times until 2010 (Imbrek et al., 1998). However, organic vegetable growing is negligible, so this segment of the Croatian agricultural development policy is only declarative. This paper is based on a survey conducted among the family farms in the NE region of Croatia (Bjelovarsko-Bilogorska County). The survey focused on the organic agriculture perception of the Croatian farmers, particularly their attitude towards the organic vegetable growing, and their willingness to start with this type of production in the future. The paper intends to highlight a need for wider scientific research with family farmers, the results of which would be used for raising awareness and promotion of organic agriculture among the prospective producers (family farms). The authors have presumed that the family farms, namely the farmers who are to a larger or smaller degree involved in vegetable growing (conventional for the time being) is as a group more sensitive to the rational application of agrochemicals and other indirect pollutants than the groups not involved in this production. The fundamental results of the survey confirm this presumption.

**1520-1540**

**S07-O-67**

**HORTICULTURAL BIOFILTRATION SYSTEMS TO IMPROVE INDOOR AIR QUALITY**

Alan Darlington\*, David Llewellyn, Jeff Mallany, Michael Dixon

Division of Horticultural Science, Dept. of Plant Agriculture, Univ. of Guelph, Guelph, Ontario, Canada, N1G 2W1

North Americans spend in excess of 90% of their time indoors, making the quality of the indoor environment a key public health issue. In order to provide an adequate indoor environment in terms of temperature, buildings are increasingly air-tight. This feature has the negative impact of allowing air borne contaminants such as volatile organic compounds (VOCs) to accumulate potentially to the point of influencing the well-being of occupants. Traditionally, this is avoided through the use of ventilation. However, conditioning this additional air in terms of its temperature and humidity can represent a considerable expense. An alternative means of air quality control may be biofiltration. Here, air is forced through a wet biomass. Contaminants move from the air and into the water where they are broken down to their benign constituents by beneficial microbes. Biofiltration is a relatively old technology that has been modified for the indoor setting. One of the key modifications is the integration of green plants. The low concentrations of indoor VOCs suggest that it may be difficult to establish and maintain the highly specialized microbial populations active in traditional biofilters. To counter this, we have utilized phytoremediation approaches developed for contaminated soils, where green plants can facilitate contaminant degradation. A developed system integrates living green plants as packing material directly into a high surface area, low volume biofilter that can remove significant amounts of VOCs and CO<sub>2</sub> (a major indoor contaminant) from the indoor space and does not lower air quality through the generation of other VOCs or microbial spores. The use of horticultural plant species has the added advantage of increasing the aesthetic appeal of the system. This can increase the acceptance of the system by occupants and has the added advantages associated with greening space such as reduced absenteeism.

**1540-1600**

**S07-O-68**

**BALANCING LANDSCAPE CHOICES AND WATER USE IN A DESERT ENVIRONMENT**

Jane E. Spinti, Rolston St. Hilaire\*

Dept. of Agronomy and Horticulture, New Mexico State Univ., Box 30003, Las Cruces, NM, USA, 88003

Municipalities in the arid southwestern United States have initiated landscape water conservation programs because of increasing demands on water resources. The goal of this research was to examine the factors that affect consumers' decisions to adopt managed landscapes that might conserve water in an urban desert environment. Using a survey that consisted of dichotomous items, scaled items, multiple-choice questions, and open-ended questions, respondents in Las Cruces, a desert city in New Mexico were questioned about their landscape preferences. Other questions in the survey were used to identify factors that might impact landscape choices. Respondents had a favorable attitude toward a landscape that might conserve water but their actual landscape choice may be mitigated by several factors. For example, when asked about the use of indigenous plants in managed landscapes, 81% of respondents agreed they would be willing to use desert plants in their front yards, but only 41% reported that they had desert landscaping in their front yard. While only 10% percent of respondents chose a lawn as their favorite landscape element, 71% reported that they had a lawn. Furthermore, 95% of respondents preferred landscapes that had unique and interesting features regardless of how much water the landscape consumed. All the respondents had trees in their landscapes. Of these, 55% reported that trees were the most important landscape element. We conclude that consumers will be willing to try a desert landscape if it contains trees and is well planned.